MANAGING THE IMPACT ON BIODIVERSITY OF SUPPLY CHAIN COMPANIES

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SUMMARY

Industrial development has had a major role in creating the situation where bio-diverse materials and services essential for sustaining business are under threat. A key contributory factor to biodiversity decline comes from the cumulative impacts of extended supply chain business operations. In order to contribute to stopping this decline, the industrial world needs to form a better understanding of the way it utilizes the business and biodiversity agenda in its wider operations.

This thesis investigates the perceptions and attitudes to biodiversity from government, society and a wide cross-section of industry. The research includes the extent of corporate attention to and use of environmental business tools and guidelines in reporting on biodiversity issues.

A case study of three companies from different industrial sectors is undertaken to observe procurement and related environmental management of their supply chains. The use of accredited and non-accredited environmental management systems (EMS) are analysed as frameworks for introducing biodiversity aspects into supply chain management. The outcome is a methodology, which can be used either as a bespoke in-house biodiversity management system or within an accredited ISO 14001 EMS, for incorporating the assessment and management of the potential risks and opportunities involving environmental impacts on biodiversity of supply chain companies.

KEY WORDS: Biodiversity; Business; Management; Supply Chain.

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ACRONYMS

AZ	AstraZeneca (UK)
API	Active Pharmaceutical Ingredients
BAA	British Airport Authority (Heathrow)
BAP	Biodiversity Action Plan
BAOB	Biodiversity and Opportunity to Business
BARB	Biodiversity and Risk to Business
BAT	Best Available Technique
BB	Business and Biodiversity
BBOP	Business and Biodiversity Offset Program
BD	Biodiversity
BESW	Biodiversity and Ecosystem Services Work-stream
BIFS	Biodiversity and Business Information File on Suppliers
BitC	Business in the Community
BitE	Business in the Environment
BMS	Biodiversity Management System
BROSCAT	Biodiversity Risks and Opportunities in Supply Chain Operations, Assessment Tool
BSI	British Standards Institute
CAA	Civil Aviation Authority
CBD	Convention on Biodiversity
CCBA	Climate, Community and Biodiversity Alliance
CEH	Centre for Ecology and Hydrology
CEQS	Covalence Ethical Quotation System
CFA	Conservation Financial Alliance

CI Conservation International

CIPS Chartered Institute of Purchasing and Supply

CITES Convention on International Trade in Endangered Species

COP Conference of the Parties

CP Center Parcs

CRiSPS Centre for Research in Strategic Purchasing and Supply

CRITERION To locate cases of given criterion

CSI Cement Sustainability Initiative

CSD Commission on Sustainable Development

CSR Corporate Social Responsibility

CMS Convention on Migratory Species

Defra Department for the Environment, Food and Rural Affairs

DNA Deoxyribonucleic Acid

EA Environment Agency (UK)

EBI Energy and Biodiversity Initiative

EC European Commission

EcIA Ecological Impact Assessment

ECOSOC Economic and Social Council (UN)

EDD Environmental Due Diligence

EEA European Environment Agency

EF Ecologic Finance

EICC Electronic Industry-wide Code of Conduct

ES Environmental Statement

EMS Environmental Management System

EMAS Eco-Management and Audit Scheme

ENGOs Environmental Non-Governmental Organisations

EPA Environmental Protection Agency (US)

ERM Enterprise Risk Management

ESA Ecological Society of America

ESIA Environmental and Social Impact Assessment

ES Environmental Statement

EUEB European Union Eco-Labelling Board

EUSS Electric Utility sector GRI G3 Supplement

EVA Economic Value Added

FAO Food and Agriculture Organization

FEAP Federation of European Aquaculture Producers

FFI Fauna and Flora International

FIEC Furniture Industry Environment Committee

FoE Friends of the Earth

FSC Forestry Stewardship Council

FWAG Farmers and Wildlife Advisory Group

GC Global Compact

GCM Global Climate Model

GEMI Global Environmental Management Initiative

GHG Green House Gas

GMO Genetically Modified Organisms

GSCM General Supply Chain Management

gtz Deutsche Gesellschaft fur Technische Zusammenarbeit GmbH

GRI Global Reporting Initiative

HSEMS Health and Safety Environmental Management Systems

ICMM International Council on Minerals and Mining

IEEM Institute of Ecology and Environmental Management

IEMA Institute of Environmental Management and Assessment

IFC International Finance Corporation

IFOAM International Federation of Organic Agriculture Movements

IGOs Intergovernmental Organisations

IIGCC Institutional Investors Group on Climate Change

INF International Monetary Fund

IPCC Intergovernmental Panel on Climate Change

IPSERA International Purchasing and Supply Education and Research Association

IRM Integrated Risk Management

ISEP Integrated Supplier Evaluation Protocol

ISO International Organisation for Standardisation

ISM Institute for Supply Management (US)

ITTO International Tropical Timber Organisation

IUCN International Union for Conservation of Nature

JPOI Johannesburg Plan of Implementation

KPI Key Performance Indicator

LBAP Local Biodiversity Action Plan

LCA Life Cycle Assessment

LCM Life Cycle Management

MA Millennium Ecosystem Assessment

MDG Millennium Development Goals

Me-THF Methyl - Tetrahydrafuran

MNC Multi-National Companies

MTBE Methyl tertiary-butyl ether

MTCC	Malaysian Timber Certification Council
NCF	National Contractor Framework
NERC	Natural Environment and Rural Communities Act
NGO	Non Government Organisation
NONS	Notification of New Substances
NTFP	Non-timber forest products
NVI	Natural Value Initiative
OECD	Organisation for Economic Cooperation and Development
OFR	Operating and Financial Review
OGP	Oil and Gas Producers Association
PEFC	Pan European Forest Council
PENSA	Program for Eastern Indonesia SME Assistance
PMD	Product Management and Development
PQQ	Pre-Qualification Questionnaire
PRI	Principles for Responsible Investment
PWC	Price Waterhouse Coopers
QMS	Quality Management System
RAG	Red, Amber, Green
REACH	Registration, Evaluation and Authorisation of Chemicals
REAP	Responsible Entrepreneurs Achievement Programme
RMS	Responsibility Management Systems
RSPO	Roundtable on Sustainable Palm Oil
SAI	The Sustainable Agriculture Initiative
SAW	Solvent and Aqueous Waste
SCM	Supply Chain Management
SCOPE	Scientific Committee on Problems of the Environment

SDF Sustainable Development Framework

SEA Solvent Environmental Assessment

SEDEX Supplier Ethical Data Exchange

SER Society for Ecological Restoration International

SFI Sustainable Forest Initiative

SHE Global Safety, Health and Environment

SIG Special-Interest Groups

SME Small and Medium Sized Enterprise

Spp Species

STSC Sustainable Tourism Stewardship Council

TBL Triple Bottom Line

TIES The International Ecotourism Society

TNC The Nature Conservancy (Enterprise Fund)

TQM Total Quality Management

TREES Rainforest Alliance Training Research, Extension, Education and Systems Program

TOI Tour Operators Initiative

UK United Kingdom

UKBAP United Kingdom Biodiversity Action Plan

UNCBD United Nations Convention on Biodiversity

UNCCD United Nations Convention to Combat Desertification

UNEP United Nations Environmental programme

UNFCCC United Nations Framework Convention on Climate Change

UNEP FI United Nations Environmental Programme Financial Initiative

VISIT Voluntary Initiatives for Sustainability in Tourism

WEEE Waste Electrical and Electronic Equipment

WEHAB Water, Energy, Health, Food and Agriculture and Biodiversity

WBCSD World Business Council for Sustainable Development

WRI World Resources Institute

WSSD World Summit on Sustainable Development

WT Wildlife Trusts

WTO World Trade Organisation

WWF World Wide Fund for Nature

CHAPTER 1

RESEARCH AIM AND OBJECTIVES

1.1 INTRODUCTION

The opening chapter introduces the origins, reasons and drivers for undertaking this research project. The aim and objectives are given along with the outline and scope of the project. Biodiversity presently occupies a relatively low profile in supply chain management and potential cumulative impacts related to a single product line are not being considered. In order to find the reasons behind this, and explore the barriers and attitudes to what is one of the key components of sustainable development, the project has investigated the key stakeholder influences on the business and biodiversity discussion.

The business and biodiversity debate covers a wide subject area, and consequently not every area and initiative, in the constantly changing and rapidly developing corporate world, will have been appraised. The project has concentrated on what it considered the most representative of the business and biodiversity situation to date, and with particular relevance to the supply chain.

1.2 ORIGIN OF RESEARCH

This research project is a consequence of previous work investigating the integration of biodiversity issues/aspects into the international accredited Environmental Management System (EMS) ISO 14001. Earlier studies by Calow (2003) and Hildreth (2007) had concentrated respectively on companies with landholdings, where internal company influence on biodiversity management could be directly assessed, and in methodologies for using biodiversity indicators in assessing business impacts. As a result of these investigations it was recognised that a significant area of an organisations overall biodiversity impact was being ignored, and that the neglected area was in external procurement operations, an area where a company generally has less management influence, that is, in its supply chain.

The industrial partner for the above projects, Middlemarch Environmental Ltd, saw the commercial opportunity of research into managing supply chain biodiversity impact. There was a need to respond to a business call for a consultancy service for companies struggling to assess and incorporate these impacts into the supplier element of their environmental management systems (EMS).

1.3 NEED FOR THE RESEARCH

The materials derived from organisms, such as, the lotus blossom, shark, penguin, and the gecko have inspired new technologies like self-cleaning surfaces, new aerodynamic coatings for airplanes, cars with low-drag coefficients, better engines, and reusable adhesives. These and other animals, plants, fungi, and microorganisms have not only given humans the opportunity to create higher performance technologies, but they have provided services that clean the air, supply potable water and contribute to creating fertile soil and a stable climate. In addition, global economies and society have benefited from biodiversity in terms of *inter alia* providing food, preserving health, and catalyzing innovation. But nature suffers from an alarming worldwide loss of biodiversity which is endangering the livelihood of mankind at a global level (gtz, 2008) and ultimately, its very existence.

Business continues to contribute to this decline in its sourcing and use of materials from world markets (MA, 2005). Organisations, whether from the private or public sectors, invariably form part of not just one product type supply chain, but interact with a wide variety of suppliers, often forming cross-sector relationships. A company, therefore, whether it provides a service, manufactures a product often derived from raw materials extracted from the earth, can be characterized within the context of its supply chain (Handfield and Nichols, 1999). As work by Goba *et al* (2008) found, with increasing awareness of the situation within the corporate world there is a need to develop more sustainable business operations. Industry needs to extend its increasing awareness to the way it utilizes biodiversity-business and form a better understanding of the cumulative impacts in its wider operations. A new business model is needed in order to value the potential contribution the business community can make to stopping biodiversity decline.

One solution is for biodiversity to become part of mainstream accredited EMSs, such as ISO 14001 or alternatively part of in-house designed systems, and to apply those systems to existing supply chain management processes, backed up by access to relevant information on biodiversity aspects. Consequently research is needed to ascertain the level and extent of current biodiversity consideration within industry and to find the restraints and drivers surrounding the issue. The findings will make clear the scope of information needed by industry to effectively extend their management of business related biodiversity risks and opportunities to the supply chain. The culmination of this will be an assessment method or model that allows business value to be added to biodiversity aspects and sums the cumulative risks and opportunities in a product supply chain. The research will therefore:

- Investigate the environmental management options and choices available to organisations for considering biodiversity in supply chain management.
- Determine the extent to which companies are currently publicising thier considerations of biodiversity, both generally and in a supply chain context. This will be established by conducting a survey of cross-sectorial corporate responsibility reports.
- Find out current supply chain environmental management methods used in industry by performing case studies with participating companies.
- Make available a biodiversity information data-base for procurement managers.
- Inform the design of a supply chain biodiversity impact assessment method and industry tool for determining the related risks and opportunities to business.

The discussion on the above issues should start by investigating the general societal understanding of biodiversity. Often providing an obstacle to the understanding of the importance of biodiversity to industry are the numerous definitions offered. The following section discusses biodiversity definitions in a natural science context.

1.3.1 BIODIVERSITY – a natural-science based definition

This section discusses specific definitions relating to the science of biodiversity. The proposal that the services ecosystems provide to industry depend on ecosystem function and interrelationships between components and levels of biodiversity has been the subject for discussion in the scientific community for many years (for example, Ehrlich and Ehrlich, 1981; Wilson, 1992a; Shultze and Mooney, 1993). The debate has produced numerous definitions of biodiversity many of which included ecological, organismal, and genetic components (Figure 3.1), for example, Wilcox, 1984; OTA, 1987; Harper and Hawksworth, 1995; Haywood and Baste, 1995, and genetic, population/species, and community/ ecosystem elements offered, for example, by Redford and Richter (1999).

The levels and elements of biodiversity mentioned above are reflected and documented in the definition of biodiversity presented by the 1992 United Nations Convention on Biological Diversity (UNCBD) in Rio de Janeiro, that is:

'*the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems*' (UNCBD, 1992:Article 2).

Other research and work on these interconnected and variable relationships has generally supported this definition, for example, McGrady-Steed *et al* (1997); Naeem and Shibin (1997); Magurran (1999); Magurran and May (1999); Naeem *et al* (2002); and Foley *et al* (2005). The above CBD definition and others with similar content are good explanations if the reader has an understanding of ecological complexes, species, and ecosystems. The non-specialist reader however may not see the relevance of the human species and activity that influence the ecological complexes cited in the definition. There is the possibility that the definition would seem to imply organisms and species which may be separate from humans - that ecosystems are detached from humans. Perhaps the inclusion of the human position within ecosystems would help connect biodiversity to anthropogenic activities and thus business to biodiversity, for example by adding:

'..*the variability among living organisms, together with humans, from all sources..* '.

Despite the omissions, the above CBD (natural science centric) definition is the one which is referred to when *explaining* and discussing biodiversity throughout the opening chapters.

1.3.2 Biodiversity – a definition for business

The scientific explanation of what biodiversity is can often be different from the business view of its use and value. A discussion concerning the science of biodiversity is introduced separately in section 3.2. One other example where a quick, uncomplicated and business orientated, understanding of biodiversity was given at an Environment Round Table organised by the French Government in November 2007 (Section 4.5). The introduction, in this explanation, of time, environmental change and the link with climate change, widens the scope for considering biodiversity in business.

'..biodiversity is a pool of responses by the living world to changes in the environment, which have been tested throughout history. By diminishing this evolution potential, we are also reducing our ability to adapt to the variability of the environment, and particularly of the climate' (LGE, 2007, p10).

For a working clarification of the ideal position of biodiversity within the business context, the project has chosen the definition by Bishop *et al* (2008, p10), which is a:

'*Commercial enterprise that generates profits via activities which conserve biodiversity, use biological resources sustainably, and share the benefits arising from this use equitably'.*

Bishop's definition implies a necessary consideration of biodiversity in the successful business of continual development and profit. The author of this project proposes the following justification to Bishop's definition in order to add at the end a more obvious time element, that is: *..in order to preserve the market and secure trading in the longer-term.*

Biodiversity is essentially a word to describe the variety and interactions of the living contents within an ecosystem or ecosystems. It may be analogous to the contents and index sections of a book. With a better understanding and consistent idea of biodiversity, business can get an appreciation of the potential risks and opportunities concerning their individual product lines, presented to them as a result of their supply chain operations. An obstacle to this is the absence of a management method or tool to assess cumulative biodiversity impacts in product supply chains.

1.3.3 Business Demands on Biodiversity - overview

The availability and accessibility of natural materials in the modern global economy has enabled company marketing machines to offer a greater choice of cheap consumable products which has fueled consumer expectations. As the UK professional services firm, Price Waterhouse Coopers (PWC, 2006, p 4) put it:

'*We are looking at a singular juncture in the history of business—a time when technology, content, and distribution are converging at a speed never before seen, and where innovations have fueled a power shift toward consumers that verges on social revolution'*.

The situation has placed greater demands on raw material supply and on essential service industries, for example energy and water, utilities which enable the manufacture of products. Demands on biological systems are, as a consequence, increasingly difficult to sustain and are compromising ecosystems ability to recover, and provide the services and goods that facilitate business development (Suhkdev, 2008).

The way industry feeds and responds to consumer demand necessarily means natural resource exploitation and consequently, influence on biodiversity. The influence could be through direct means such as habitat change, over-exploitation, or indirectly through rapid climate change (covered in Section 3.5), introduction of alien invasive species, or nutrient overloading of soils (MA, 2005 and 2006). In reality, there is not a business organisation that does not use some form of ecosystem service, '*either directly through their activities or indirectly through supply chain partners*' (GRI, 2007, p 7). Yet despite knowing this, to date the majority of economic players have not systematically acknowledged the importance of biological diversity for their own companies, and have not developed or implemented strategies and action plans for its preservation or sustainable use.

The business situation is slowly changing however, as other pressures apart from the complexities of security of supply, enter the mix. Principle among these are the powerful and influential pressures and problems industry will have to face from a growing number of more responsible consumers with changing attitudes towards what they are buying. Consumers are shifting their priorities to include not just the price of the product but the associated ethical and environmental cost, as leading industrialist

Rose (2007, p1) said, '*environmental considerations… increasingly influence [*customers*] purchasing decisions.'* If these changes in customer attitudes are not addressed, Rose further commented, '.. *customer trust will be lost and that can only be bad for sales and bad for the company brand in future*'.

Industrial development is threatening raw material supply by the invariable contribution to biodiversity loss through its supply chain, and this remains a neglected component of a business operation, which is not fully appreciated or understood. These environmental issues should have equal consideration alongside what are seen as integral parts of company management and the fundamental drivers for development, that is, the economic and social components of business, see Elkington, (2004) for further discussion in this area.

One of the key components of the idea of sustainable development is biodiversity, and for any assessment of a company's impact on biodiversity (positive and/or negative) to be meaningful, it should include all its operational activities. Assessments of more obvious direct impacts on biodiversity of its landholdings constitute only a part of the solution. The wider environmental footprint has to be considered, where the buying of raw materials and goods may go beyond local and regional areas and extend nationally and internationally, with direct, indirect, or cumulative implications for biodiversity.

There is a growing appreciation of the general magnitude of the problem, as highlighted by the Millennium Ecosystem Assessment in 2005, and finding solutions to the continued worldwide degradation of biodiversity are of increasing concern in the political and business arena. For example, the UK Government is taking a lead and requiring all public sector bodies to consider biodiversity in their business functions. The new duty comes under section 40 of the Natural Environment and Rural Communities Act 2006 (NERC). The aim is to raise the profile of biodiversity in England and Wales, eventually to a point where biodiversity issues become second nature to everyone making decisions in the public sector (Defra, 2006c).

Further to this, the Department of the Environment, Food and Rural Affairs (Defra, 2003) strategy for biodiversity in England has stated that it expects the business community to contribute to biodiversity conservation. Other drivers for better biodiversity consideration by business and demonstrations of environmental due diligence include, the EU Environmental Liabilities Directive (Dir 2004/35/EC), The Equator Principles (2003, revised 2006) in the financial sector, the Convention on Biological Diversity (CBD), the Killarney Declaration (2004) and the Message from Malahide (2004).

The importance of supply chain influence on biodiversity has also been recognized with an increasing number of drivers for research in this area. In the UK, for example, English Nature (now Natural England) has realized the implications regarding biodiversity impact in supply chains and their overall environmental position in the business community. It has indicated that it expects companies who have large supply chains to have assessed those companies for their impact on biodiversity as part of their management processes. Natural England has suggested integrating Environmental Management Systems (EMS) into their overall approach, for example, ISO 14001 or the Eco-Management and Audit Scheme (EMAS) (English Nature, 2004), Chapter 5 discusses this in further detail.

The UK Government Position Statement on EMSs (2005) is that supply chain environmental and financial performance should be improved by a robust, effective and externally certified EMS. As a result Defra (2003, p 80) has called for all business sectors to:

'Engage in reporting on biodiversity as an integral part of its processes and activities.' And: '*To manage supply chain and investment decisions to reduce the risks of indirect adverse impacts and to enhance biodiversity'*.

This project conducted a biodiversity and business literature search focusing upon biodiversity impact assessment in relation to company supply chains. The search found, with a few notable exceptions, an overall lack of information relating to biodiversity consideration and in particular its application in supply chain environmental management. The exceptions are sector specific and generally constitute in-house management systems that, if audited, are audited within the company.

This research project has confirmed the earlier uncertainties and anxiety in this neglected area of business operations *vis-à-vis* the consequences of non-consideration of biodiversity impact. Project investigations to date have demonstrated the need for the research and that the projects aim and objectives are still relevant.

1.4 AIM AND OBJECTIVES

The overall aim of the project is to design a research programme specifically to answer the questions posed by business on how to consider, assess and manage impacts on biodiversity in the supply chain. The outcome will be a practical business tool and methodology/model for determining a dedicated product supply chain's cumulative impact on biodiversity and the related risks and opportunities to business as a result.

With respect to this the project compared and analysed the choices available to buying (focal) companies for the management of biodiversity aspects within the supply chain which are summarised in a mapping diagram in chapter 12. In addition, it was considered important to the project to obtain a sense for the overall position and importance currently attached to biodiversity within industry. Therefore a survey of corporate social responsibility (CSR) reports was undertaken (Chapter 7) to find the extent of biodiversity consideration and type of related environmental management in the supply chain across a wide range of industrial sectors.

The end result will be a methodology/model for incorporating the assessment and management of risks and opportunities involving environmental impacts on biodiversity and related effects on business operations of supply chain companies. The model will be flexible enough to be used in a non-accredited in-house designed company Environmental Management Systems (EMS) or as part of an accredited management system such as ISO 14001. The methodology is not intended to provide any detailed or technical method for directly surveying biodiversity, but to give companies a process for introducing awareness of the risks and opportunities and to integrate biodiversity into their supply chain management systems. In addition the methodology is incorporate into a practical business tool - the Biodiversity Risks and Opportunities in Supply Chain Assessment Tool or model.

In summary the contributions to knowledge are:

- The corporate social responsibility survey results presented in Chapter 7.
- The summary diagram in Chapter 12 of choices available in managing biodiversity in the product supply chain.
- The methodology for Biodiversity Risks and Opportunities in Supply Chains Assessment Tool (BROSCaT) (Chapter 14).

The overall aim of the project will be achieved by meeting a series of distinct objectives.

Stage 1.

i. Conduct a literature review and business and biodiversity appraisal to a) gain a knowledge and understanding of work undertaken to date relating to the management by organizations of biodiversity within their supply chains and b) to gain a wider view of the overall business and biodiversity debate and any schemes and initiatives that may relate to achieving the project aim;

ii. Undertake a series of interviews to assess the current attitudes of businesses to biodiversity within their supply chain and where relevant explore their biodiversity management practices;

iii. Determine the drivers motivating organisations to engage with biodiversity issues within their supply chains;

iv. Identify a small number of businesses covering a range of activities where biodiversity plays a significant role within their supply chains, and establish their willingness to collaborate in the research;

Stage 2.

v. Undertake pilot studies of at least two businesses to inform the research procedure;

vi. Evaluate the practices and procedures adopted by organizations for assessing and managing the impacts on biodiversity of their supply chain, using the case study approach;

Stage 3.

vii Construct a methodology, that employs an EMS framework, for assessing and managing biodiversity impacts within a supply chain;

viii Construct a methodology/model that can be used without a formal EMS framework for assessing and managing biodiversity impacts within a supply chain;

ix Undertake trials of the proposed methodology and evaluate its viability.

1.5 COVERAGE AND SCOPE OF THE RESEARCH

The purpose of this part of the research project was to discover the extent to which biodiversity has been discussed by the significant players within the context of business and the perspective of the supply chain. The overview does not aim to be exhaustive, since the literature is extensive, diverse and ever changing.

A holistic approach has been sought, throughout all the Chapters, to give the viewpoints of stakeholders from, *inter alia,* business, government, and society, in tackling biodiversity degradation on a national, European and wider global scale. Relevant instruments used by the above are examined, for example, command and control regulation, economic, self-regulation, voluntarism, and information strategies. As information is limited on biodiversity impact management mechanisms in the supply chain, other areas of business operations, business culture and organisational behaviour, with a connection to biodiversity loss, are examined in context, throughout the following Chapters.

1.6 THESIS STRUCTURE

Chapter 2 outlines the main literature review findings, looking at published work from a range of academic journals, business journals/reports, none government organisations (NGOs), professional bodies, political spheres and industrial sector approaches, the focus being on biodiversity and related environmental issues within supply chains and evidence for methods for assessing cumulative impacts. Other biodiversity related schemes are discussed, including eco-labelling and logos. The use and availability of environmental guidelines as frameworks for biodiversity management, is explored along with life cycle management.

Business operational impacts on biodiversity are considered through the company relationship with corporate social responsibility reporting, sustainable development, sustainability, general environmental issues, and social attitudes. These related components, with relevance to biodiversity loss, already constitute part of economic instruments like corporate reporting and open accountability, and these areas are explored in Chapters 6 and 7, which shows how effective companies report and act in regard to their biodiversity responsibility.

Chapter 3 has the aim of clarification and covers the science of biodiversity. Biodiversity is discussed in relation to the stability of ecosystems and the services and material supply they make available for industry. Also discussed is an overview of biodiversity regulatory instruments, along with industry's response and attitude to biodiversity in the wider environmental context. This will provide the reader with a rationale and perspective to the importance of considering biodiversity loss and gains, due to wider company operations.

Global biodiversity loss is discussed and the implications for industry, along with the drivers of biodiversity change, linking society and business to biodiversity. The commitments made by the United Nations to halting biodiversity loss are outlined, adding the sense of urgency organisations should be ascribing to the situation. The concept of dangerous climate change is examined in line with international, national, and local country biodiversity policy. The idea of sustainable development is introduced in terms of its relevance to biodiversity and industry.

Chapter 4 discusses so-called 'green procurement' in the context of environmental management of supply chains, bringing the idea of sustainable procurement into the debate, which considers procurement both from the buyer and the supplier viewpoints. Other areas of supply chain management are appraised, with definitions, the business of supply chains, and the potential contribution the supply chain can make to halting biodiversity decline. Types and significance of impact associated with the supply chain are investigated along with the attitudes of companies and suppliers to biodiversity, and its value to business. The drivers that are influencing potential change in attitudes to biodiversity are also discussed. An introduction to the environmental management system framework is made.

Chapter 5 covers the ISO 14001 environmental management system (EMS) framework. The aspects used in the environmental management of companies are explained. This will provide the context for chapter 9 where such systems are used as a framework for introducing supply chain biodiversity issues.

Chapter 6 discusses the corporate social responsibility (CSR) report and its role in taking forward biodiversity considerations. In addition, stakeholder influences, voluntary codes, the frequency and quality of CSR reporting on biodiversity issues, including guidelines for CSR frameworks, are examined. The discussion extends to the links between biodiversity and climate change and the relationship and relevance to business. The education of stakeholders in an integral element for contributing informed influences to business leaders. The lack of accurate knowledge on biodiversity issues in a business context is holding back its position as a main player in boardroom discussions. This element of business and biodiversity operations is investigated.

Chapter 7 introduces biodiversity and its material value to industry, the role of EMSs in CSR, and biodiversity impact in the supply chain are investigated by means of a survey focusing on the biodiversity content of current CSR reports. The idea of CSR reporting as a mechanism and driver for incorporating management of biodiversity into supply chains, as part of a company's overall environmental image will be tested.

Chapter 8 covers the research case study method. Case study company selection and experiences are discussed in this chapter. Alongside researching reasons and attitudes for business exclusion of biodiversity in the supply chain, a multiple case study of three cooperating companies will be undertaken to evaluate their supply chain management procedures and seek ways of incorporating biodiversity. Organisational culture and again the importance of effective education and training extending from the business school to the business is discussed.

Chapters 9; 10; and 11 introduce the case study companies used in the project. The findings of the studies are given, along with the information and data used in the construction of the final methodology.

Chapter 12 deals with the integration of biodiversity aspects into accredited EMS. The standard ISO 14001 framework, discussed in chapter 5, is adapted for biodiversity consideration within a supply chain context.

Chapter 13, carries on from Chapters 5 and 12, and takes the results of the case studies in chapters 9; 10; and 11, the survey in Chapter 6, and previous chapter findings and covers the integration and construction of the methodology into non accredited EMSs as a bespoke management tool.

Chapter 14 takes the principles and framework of the model in chapter 13 and incorporates it into an Excel format for easy use within procurement departments. The Excel tool has been given the working acronym BROSCaT (Biodiversity Risks and Opportunities in Supply Chains Assessment Tool).

Chapter 15 is a discussion of the findings of the project and ties together the preceding chapters by remarking on the present biodiversity and business situation. The outcome of a presentation and demonstration of BROSCaT to one of the case study companies is given along with a comment on the future directions for further research. within industry.

Chapter 16 ties the project together and concludes with a discussion of the projects effectiveness in meeting the aim and objectives. Included is an evaluation and final summation of the project with concluding remarks on the future of biodiversity in business.

1.7 DISCUSSION

At the outset of the project a good grounding of the situation has been sought. In order to fulfil the project objectives the research has concentrated on obtaining a wide understanding of the biodiversity situation within a practical business context. This approach aims to strengthen the acceptance by business of the final methodology, by presenting effective answers to management questions, and providing fast access to relevant supporting information.

The coverage and scope of the research has included the position of business and society in relation to biodiversity loss. This is thought to be an integral part of the research as society ultimately has to understand the way science explains the importance of biodiversity. The power shift (mentioned in Section 1.3.3) towards consumers has, largely, driven business to conduct itself with the same utilitarian purpose ascribed to society's general short-term attitude to life, and the disregard for sustainable living standards. This is exemplified with the corporate business world, as it moves rapidly in modern market situations, and the management and ownership of organisations regularly changes at a similar pace. Company horizon thinking, on survival in the market place, often results in short-term environmental solutions. Biodiversity is a long-term business consideration; and as such the subject occupies a low priority on management agendas, and in bottom line objectives. In order to indicate the importance of long-term thinking if market-led business is to survive the author has suggested the definitions of biodiversity should include clear references to human time influenced impacts on natural ecosystems.

The project review of published material, and the further research, has found that the general situation in industry, and particularly in small and medium sized companies, is that the importance and position of biodiversity issues are either not understood or are misunderstood, and as such largely disregarded within a supply chain context. With a better understanding and consistent idea of biodiversity businesses can get an appreciation of the potential risks and opportunities concerning their individual product lines, presented to them as a result of their supply chain operations. An obstacle to this is the absence of a management method or tool to assess cumulative biodiversity impacts in the product supply chain. The grounding gained from the wide research approach adopted by this project will add to the operational acceptance of the final method and practical BROSCaT tool. The findings of the research will also highlight the environmental management choices available to business with respect to the supply chain. By providing business managers with an understanding of the issues and giving the information needed to turn risks into opportunities the whole product supply chain is able to realise its potential for reducing biodiversity loss and maximising business advantage.

Chapter 2 now reviews the published material on the subject and investigates the influences that have shaped current attitudes and the enabling frameworks that may encourage change.

CHAPTER 2

A Review of biodiversity and the Business of the environment

This chapter covers Stage 1, Sections (i) and (ii) of the objectives stated in Chapter 1, Section 1.3, and reviews published material available on biodiversity related business and supply chain issues.

2.1 INTRODUCTION

The level of risk or opportunity and the relationship which individual companies have with biodiversity is influenced, *inter alia* by the products or services it provides, stakeholder interest, and the geographical extent of its supply chain. The perception of the level of potential risk/impact also affects the scope of an individual company's environmental policy and any biodiversity content, e.g. corporate, local, global, legislative compliance. These criteria will determine the extent to which biodiversity risk/opportunity assessment methods are used, and the knowledge and financial resources needed to implement them.

The responsible conduct expected of suppliers is commonly conveyed through procurement processes which determine their buyer-supplier environmental management relationship. These same suppliers may also supply goods and services to a number of companies operating across a wide range of industrial sectors. This complicates the isolation of specific impacts and influences on biodiversity across the supply network and highlights the limitations of applying 'broad-brush' environmental guidelines and reporting initiatives commonly used throughout industry that are expected to determine any set of circumstances.

The scope of this literature review chapter has therefore been extended to include a wider view of business and the influences forcing biodiversity related management change. This has included reviewing business attitudes to managing biodiversity, legislative enabling frameworks, and the current knowledge, materials, schemes and initiatives available to aid management. The review aims to search for the extent of reporting on supply chain biodiversity impacts and to find any current methods in use for its assessment. Perhaps more importantly the review looks to develop, as Yin (2007, p9) say's, not answers but more '*insightful questions about the topic',* questions that will inform the direction of the research.

The large amount of published material relating to environmental management has forced this review to be selective towards publications of most relevance. The review has looked for information that is directly relevant to the project aim and objectives and taken examples from a small number of industrial sectors with potentially high impact on biodiversity through their supply chains. The literature is reviewed particularly for any evidence of current use and choices of environmental management methods available for assessing biodiversity related risks and opportunities within supply chains.

2.2 A REVIEW OF THE LITERATURE

A literature review was undertaken to explore historic and current work on biodiversity consideration management in company supply chains. The review has supported and confirmed the initial need for the research. The review has not found any published work in the wide range of available academic literature in this subject area that relates directly to biodiversity consideration in any detail. This is also the case in terms of management methodologies for cumulative biodiversity impact assessment in the context of the supply chain, that is, the use of accredited or non-accredited environmental management systems.

The review examines existing and emerging issues regarding the science of biodiversity and how they relate to business operations. The review was also extended to include published work from the wider environmental, political, and societal scene. This was done in order to gain an understanding of the motivations driving or constricting the pervading attitudes of business to biodiversity. In addition, the research investigated existing mechanisms that may assist biodiversity and supply chain integration methodology. The review is divided into academic and business related literature sections to present a clearer delineation between the two.

2.3 REVIEW OF ACADEMIC LITERATURE

The review of academic literature did not find any specific work in academia on descriptions or methods for integrating direct biodiversity issues into accredited or non-accredited environmental management systems (EMS). Work by Darnall *et al* (2006), although not mentioning biodiversity, investigated whether sustainability could be complemented by EMSs and green supply management. They concluded that integrating EMS and general supply chain management (GSCM) could improve environmental sustainability beyond organisational boundaries, into a company's network of buyers and suppliers (see Section 6.6.2 for a discussion on integrating other management systems).

Also discussed in the literature were related issues with implications for biodiversity, such as, sustainable development (see Chapter 4), sustainability, green supply, general supply chain management, or sustainable procurement, but with either no mention or little detail on biodiversity impact management. Examples are given below of academic publications in the area of supply chain management dealing with environmental purchasing/procurement, management and sourcing of materials.

Academic literature dealing with environmental issues use a variety of terms related to, but not often specifically using the term, sustainable procurement. These are general environmental issues which are connected to biodiversity but with no direct reference made in the reviewed text. A literature review undertaken by Walker and Phillips (2006) found a number of these biodiversity related terms, such as:

- green supply (Bowen and Cousins *et al* 2001a, 2001b);
- green purchasing (Chen, 2005; Min and Galle, 2001; Ochoa *et al*, 2003);
- green purchasing strategies (Min and Galle, 1997);
- green purchasing and supply policies (Green, Morton and New, 1998);
- environmental purchasing, (Carter and Carter, 1998; Carter, Ellram and Ready, 1998; Carter, Kale, and Grimm, 2000; Legarth, 2001; Murray and Cupples, 2001; Zsidisin and Siferd, 2001);
- green supply chains (Vachon and Klassen, 2006; Rao and Holt, 2005; Walton, Handfield, and Melnyk, 1998);
- green supply chain management (Sarkis, 2003; Zhu, Sarkis and Geng, 2005);

- environmental supplier performance (Humphreys, Melvor and Chan, 2003; Noci, 1997).

None of these publications deal with biodiversity specifically in the supply chain or in any detail, but concentrate on areas such as waste, recycling/reuse, energy efficiency and sourcing, transport, logistics and local and alternative sourcing. Further examples from academic publications not covered here are discussed within context in later chapters.

2.4 REVIEW OF BUSINESS LITERATURE

2.4.1 Overview

The literature search found a productive output of information and schemes from business related sources to support company biodiversity commitments. Numerous schemes came from the literature published in both the private and public sector business world. There is also a prolific output of associated information, guidelines and directives from government departments, non-government organisations (NGO), inter-governmental organisations (IGO), and professional bodies on the related area of sustainable procurement. Examples of the above are discussed in the following chapters.

Although little mention is made of biodiversity in procurement processes, related environmental aspects mentioned in the context of sustainability, have implications for biodiversity and business, and therefore should not be overlooked, for example, security of the raw material supply. Included in the review are several references from Bishop *et al* (2006) of The World Conservation Union (IUCN) Scoping Study for Building Biodiversity Business. This publication highlights many of the business and biodiversity issues currently under discussion.

The escalating problem of maintaining security of supply is moving the related management process of sustainable procurement up the business agenda. For example, Fanning (2007, p14) observed, when looking at increasing raw material prices, that businesses '*need to follow the money*', a reference to scarcity affecting price and a link to resource sustainability and economics. Fanning (2007, p14) further commented on the changing situation with:

‘*It is difficult to get excited about sustainability when resources appear plentiful, but constraints are making it a real deal within* [procurement] *departments’.* (Parentheses added)

The business literature review found that with regard to biodiversity management in the supply chain, direct inclusion or consideration is uncommon across industry sectors. However, where mentioned it tends to be specific, but not exclusive, to large companies within sectors with a tangible direct impact on biodiversity, for example, utilities, mining, energy, eco-tourism, organic agriculture, and air transport. Literature from academia, government, NGOs, professional bodies and industry often relates to specific sectors, management systems, bespoke company systems or materials, and is reviewed in context within relevant chapters.

Business publications predominantly relate to general environmental issues with climate change, energy and waste management predominating. However, a group of seven leading oil energy companies and two conservation organisations have jointly published recommendations/guidelines (EBI, 2007) on best practice for integrating biodiversity conservation into oil and gas developments. The process developed by the joint programme is the Energy and Biodiversity Initiative (EBI). The oil and gas sector is clearly seen to have a range of impacts on biodiversity due to exploration, distribution (transport, pipelines) and refinement. As a result companies in this sector place a high significance, in terms of risk and benefit value, on biodiversity issues and the potential to influence the industry’s reputation. The accredited framework is not focused on the supply chain but primarily used to assess and manage their existing and new developments for biodiversity impact on landholdings.

The review found a widening stakeholder demand for greater transparency on environmental performance and product sustainability (Marshal *et al*, 2007). In response companies with the resources to do so, have looked to non-financial reporting and certification schemes as a way of communicating their corporate responsibility commitments (Worldwatch, 2006). In addition, businesses have used social responsible investment indices, environmental standard stamps of approval, eco-labels, or benchmarks, often in sector partnerships, to publicise good environmental practice. To aid this move towards better business transparency, the business and related stakeholder communities produce a continuous output of initiatives, schemes, guidelines, and sustainability indicators aiming to help companies deal with and report on their common environmental responsibilities.

However, these and other initiatives are in the main aimed at cross-sectorial industry and are therefore applied in a wide range of business types and sizes (Insight, 2006). As such, they are less likely to include biodiversity consideration as part of their management plans. These broad-brush guidelines emphasise those environmental issues commonly cited in industry, such as carbon emissions, waste and energy. Where biodiversity is included, these schemes and guidelines also have a tendency to concentrate on only one component, that is, the conservation/environmental dimension, with references to, for example, reducing impact, protecting, or to enhance and improve conservation opportunities (Insight, 2006). In addition, the literature review found similar results to the UK Environment Agency study of environmental reporting (EA, 2006) where the key indicators of biodiversity used in guidelines and schemes refer only to endangered species, protected areas, habitats and high conservation value areas (Section 6.5).

The sustainable use/economic dimension of biodiversity and the economic related, equitable sharing/social dimension, which deals with socio-economic impacts, local communities and indigenous peoples, and the cultural values of biodiversity, are not widely referred to in these environmental guidelines (IUCN, 2007). The consequence is a reduced incentive and stakeholder pressure for individual, and particularly small, businesses to try to understand the importance of biodiversity and consider potential impacts due to their operations (IUCN, 2007).

Although cross-sectorial guidelines and responsibility initiatives and schemes focus on general environmental principles, and not supply chain biodiversity issues specifically, they do provide, as the IUCN (2007) point out, a potential platform and leverage point for incorporating biodiversity issues and generally raising awareness. This is because of the guidelines high profile position as a component of a media platform, as they form part of corporate social responsibility (CSR) reports. These reports are answerable to stakeholder expectations and require a response to environmental issues of the day, and if sufficient pressure is exerted then it is likely that biodiversity consideration in supply chains would be included.

The situation in sector-specific industries is somewhat different. In this case initiatives are often driven by direct business incentives (Section 2.5) to incorporate biodiversity into their corporate responsibility principles. However, the degree and interpretation of biodiversity consideration varies according to the sector (Section 6.4.2), with some companies including it in their core principles and others as part of general guideline procedure (IUCN, 2007).

The advantages of spreading the importance of biodiversity are that influential organisations within sectors that incorporate a biodiversity element also influence and apply competitive pressure on other sector member organisations to do the same, or to even go one better and improve consideration. The business community, alongside organisations such as Earthwatch and the EU conservation union (IUCN) Business and Biodiversity initiatives, have included biodiversity into overall sustainability aspects of their recommended environmental management processes. They identify 4 levels whereby a company can address biodiversity (IUCN, 2007, p62).

- ***'Compliance** – when a business focuses its efforts to comply with local and national legislation;*
- ***Philanthropy** – when a business responds to the challenges to biodiversity by making donations to external conservation organisations;*
- ***Management** – when corporate strategies, policies and operational responses are developed, based on biodiversity assessments to reduce, control and mitigate impacts;*
- ***Value creation** – when a company fully integrates biodiversity into its business model and develops new opportunities linked to biodiversity conservation.'*

There are also project oriented biodiversity business tools, although they have sometimes been seen to focus on complying in order to aid, for example, the permitting process (planning) (Bishop *et al*, 2007) or to placate stakeholders. There are a large number of guidelines in this area of biodiversity management including:
(The URL is given for links to papers and articles lists, or specific web-sites where reports can be found)

- Biodiversity Impact Assessment (http://www.wii.gov.in/eianew/eia/articles.htm).
- Integrating biodiversity into management systems. Example, the EBI, (http://www.theebi.org/products.html).
- Integrating biodiversity into oil and gas lifecycle (http://www.ipieca.org/activities/biodiversity/bio_publications.php).
- Biodiversity Action Plans (http://www.ipieca.org/activities/biodiversity/bio_publications.php).

- Biodiversity indicators for business (http://www.theebi.org/products.html).

The general call from stakeholders for a more responsible approach to biodiversity management has seen the adoption of non-legally (voluntary) binding responsibility schemes within the context of environmental sustainability and its three main components – environment, social, and economic (IUCN, 2007). The processes, targets and results are usually articulated by means of a corporate responsibility report (CSR) wherein companies utilise different aspects of the above levels of involvement. An illustration of how CSR reporting has been used to publicise and market good biodiversity practice can be seen from sector specific examples in industry where companies have large landholdings and/or undertake extensive developments, and direct impacts on biodiversity are evident. The CSR report is covered in section 6.1.

Such private sector specific companies commit to improve environmental performance by adoption of voluntary schemes allowing membership of an initiative, roundtable or business association. Examples taken from Bishop *et al* (2006) are given below. They give industrial sectors where environmental schemes have been used to aid general biodiversity management and responsibility reporting. Included are examples from the financial industry, where risk perceptions due to biodiversity aspects associated with industry are increasing (BESW, 2007). In addition, the ability to manage biodiversity is increasingly being recognised as a way of securing continued access to resources. Financial institutions have the financial 'leverage' to influence the biodiversity policy of the companies they invest in (FFI, 2008). The problem remains as Bayon (2008) points out, is that ecosystems are often external to economic systems and are therefore not taken into account when economic decisions are made.

The European Commission has produced an environmental procurement guide for the public sector called 'Buying Green!' (EC, 2004). The handbook deals with green purchasing principles across a range of general environmental issues and suggests criteria for selecting and awarding company contracts. Supply chains are covered, but there is no specific mention of biodiversity. In the UK, the governments 'Sustainable Procurement Task Force', compiled a document called 'Procuring the Future' (Simms, 2006), after an intensive study of the public sector (Section 6.6.3). The document advocates a risk-based approach to sustainable procurement in the supply chain, as did the case study participating companies discussed in chapters 9; 10; and 11. The document claimed that more than 50% of the environmental impact of the public sector came from its supply chain.

Although there is no detailed mention of biodiversity impact in the supply chain, the document recommends the use of EMSs in the supply chain, and the use of a staged approach (Section 5.1) to achieving an accredited EMS by suppliers (Defra, 2006b). This would be taken into account in section 12.2 when considering the choices of supply chain environmental management available to focal (buying) companies.

2.5 CERTIFICATION SCHEMES

Some industries such as arable and livestock agriculture, are considering sustainable/biodiversity management of their landholdings or products and some seek to legitimise and publicise their efforts with some sort of 'official stamp' of approval. Certification schemes are increasingly being used as a means of gaining market share and managing and communicating CSR commitments.

Certified logos, for example, inform consumers and customers on the sustainability of goods and services. Examples of these are the Forest and Marine Stewardship Councils (FSC and MSC). The number of such logos can be confusing, however, and there are an increasingly wide range of certification schemes across Europe, with the agriculture sector having the most with, as of 2007, some 380 (Theuvsen and Plumeyer, 2007). Apart from being confusing due to the sheer number of these schemes they do not offer an assessment of the cumulative impacts on biodiversity associated with a product throughout the supply chain.

In the tourist industry the Voluntary Initiatives for Sustainability in Tourism (VISIT) is a European initiative promoting Ecolables and sustainable tourism development. Cooperation with 10 leading ecolables in Europe is leading to common environmental standards being established throughout the industry. There is no specific mention of biodiversity in their 21 Principles; however, 8 of the Principles refer to life cycle analysis, environmental legislation, local and regional environmental impacts and environmental management systems (VISIT, 2007).

The European Union eco-label scheme – EUFlower (under revision) is one example of assigning an environmental quality stamp for promoting sustainable consumption and production for a range of products and services. The European Union Eco-Labelling Board (EUEB) develops ecological criteria for product groups and can qualify to be labelled as environmentally friendly. The relevant ecological issues and corresponding criteria are based on comprehensive studies of the environmental aspects related to the entire life cycle of the product (EUEB, 2007), although biodiversity is not referred to specifically and no cumulative impact assessment is made of the whole supply chain.

Taking the environmental quality stamp a stage further and providing official approval in the UK for recognising biodiversity on company landholdings comes from the Royal Society of Wildlife Trusts. The Wildlife Trusts Biodiversity Benchmark follows the framework and process of ISO 14001 and requires organisations with landholdings to meet a set of biodiversity management criteria (Wildlife Trusts, 2007). Using the ISO 14001 framework for the assessment and management of biodiversity on company landholdings makes the exercise part of the standard accredited environmental management process.

The criteria set by the Wildlife Trust Benchmark, however, demand only the minimum biodiversity consideration, the main emphasis being on regulatory compliance. It therefore offers no further protection or consideration, in excess of the standard ISO 14001 EMS, to biodiversity. As the same biodiversity criteria could be part of a standard EMS, the main difference or advantage to companies going for the award is the use of the Wildlife Trusts Biodiversity Benchmark logo as an add-on, for publicity purposes. This may further illustrate the driving necessity for companies to show a demanding stakeholder audience that they are 'doing the right thing'. The supply chain is not considered by the Benchmark criteria as it concentrates on landholdings only.

Other schemes also include the Business and Biodiversity Offset Program (BBOP) which is a partnership between companies, governments and conservation experts to explore biodiversity offsets. They aim to action conservation schemes to compensate for residual, unavoidable harm to biodiversity caused by development projects, and thereby ensure no net loss of biodiversity (BBOP, 2007). Conservation organisations and others have identified some potential risks of the scheme. For example, biodiversity offsets could be used by developers and government authorities to allow for developments which are too damaging to the environment to be considered appropriate. Also the idea of no net loss to biodiversity is questioned and the current lack of biodiversity standards act as a barrier to its success (BBOP, 2007). Further, ecosystems are difficult to create, enhance or restore and so may be less valuable in terms of biodiversity than the original and the new site may still be subject to future development (Bayon , 2008).

In the insurance sector initiatives such as ClimateWise (2007) have involved over 40 leading companies in taking action to reduce risks concerning climate change and to report publicly on their performance Biodiversity is mentioned in a farming context but not in general industry or the supply chain. Additionally products such as Environmental Impairment Liability (EIL) insurance has started to explore damages to natural resources and loss of biodiversity. There is also a move towards 'sustainable insurance' with the UNEP Financial Initiative Insurance Working Group (IWG). The IWG along with academic institutions from America and Europe, are investigating the better understanding and integration of environmental, social and governance (ESG) factors in insurance underwriting and product development (UNEPFI, 2007_2). Now the EU's Environmental Liability Directive (ELD) (Section 6.4.3) has come into force in England with aims to make the 'polluter pay' for environmental damage. There are criticisms, however, from within the insurance industry, with White and Pohl (2009, *pers comm*) commenting that the ELD has few teeth and, coupled with weak punitive fines and little concerted pressure from governments, there is no financial incentive to insure.

2.5.1 Life Cycle Management and Assessment

Life cycle management (LCM) is a scheme that incorporates elements of both impact assessment and environmental management. The scheme was developed to manage the total life cycle of products and services towards more sustainable consumption and product patterns (UNEP, 2007 and EC, 2003). The underlying analytical tool for LCM is Life Cycle Assessment (LCA). This is an environmental methodology that assesses the environmental aspects and potential impacts across the life cycle of products (UNEP, 2003b). The International Organisation for Standardisation (ISO) has standardised the LCA framework in its 14000 environment series, with ISO14040.

Other initiatives include UNEPs Life Cycle Initiative (UNEP, 2007_3) where biodiversity is identified as a high priority, particularly in a non-Organisation for Economic Co-Operation and Development (OECD) context (IUCN, 2007). As this scheme is geared for whole life cycles of a product, it is not suited to assessment of individual local biodiversity impacts.

Despite the potential for improving environmental operations, LCA has not always been viewed in business as practical and the guidance material available for LCA, although informative, only offers part of the help required. Small businesses for example, often do not have the adequate in-house expertise or resources for the required assessments and the practicalities of achieving targets within the time scales demanded (Jonson, 1996). LCA is only a method for improving general environmental performance (Curran, 1996) and is not specifically designed to assess or manage impacts, risks or opportunities with respect to biodiversity in a supply chain context. In addition, LCA does not require communication or partnership working between supply companies on biodiversity issues. Future research was recommended by Jonson (1996, p173) into developing methods for the assessment and evaluation of environmental impacts.

2.5.2 Supply Chain Partnerships

By forming working partnerships large companies can cooperate on non-sensitive and non-financial operations in the supply chain, and formulate common sector biodiversity criteria in their supply selection. Advice and practical help on biodiversity issues could be extended to their smaller suppliers, with the knock-on cumulative impacts on biodiversity assessed, and conservation and sustainable use contributions made towards reducing biodiversity decline. One platform for doing this comes from the International Union for the Conservation of Nature (IUCN) who has introduced the business sector supply partnerships initiative, as part of the IUCN Business and Biodiversity Initiative (IUCN, 2007). For more information on partnerships see the Biodiversity in Good Company Initiative (gtz, 2008). There is also the Industrial Symbiosis Programme which brings together companies from all sectors with the aim of improving cross industry resource efficiency (NISP, 2008). The programme has the potential to combine expertise and resources for considering biodiversity issues. Care would have to be taken if forming partnerships that are organised within specific sectors, and they would have to be achieved with due regard to the EU legislation on monopolies.

Combining purchasing power and sharing best practice and expert opinion, whilst preventing duplication of effort, could also create additional leverage to drive improvements and reduce biodiversity impact on the part of the first tier supplier as well as further down the supply chain. This all sounds challenging but the concept is not entirely without precedent as the following examples illustrate.

The home improvement company B&Q use a life cycle environmental approach to their products. The company operates a partnership programme with its suppliers and as part of the organisations vendor assessment process (QUEST) programme it operates Critical Failure Points (CFP) which must be met as a condition of supply. Their specific environmental assessment question is CFP Number 8 which covers a range of environmental aspects but does not mention biodiversity, with the overall focus on compliance. B&Q is part of the Kingfisher Group who demand active engagement with suppliers and set environmental improvement targets for suppliers, focusing on timber and chemical products (KF, 2008).

The chemical industry uses an information exchange system operated through the REACH Regulation – Substance Information Exchange Forum (SIEF). SIEFs is a communication requirement whereby suppliers have the information they need to use chemicals safely. Registrants are required to share information to prevent duplication of existing data (EC, 2007).

2.6 DISCUSSION

The literature review has given the project an holistic view of the historical and present situation regarding the relationship business has with biodiversity. It has also provided the foundation for further investigation into the reasons surrounding the reluctance of wider industry to consider biodiversity in its extended operations in the supply chain. The regulatory frameworks are largely in-place for considering biodiversity issues but any voluntary additions supporting legislation are commonly ignored by smaller business organisations in the supply chain. The review found that it is predominantly large companies with a more publicly obvious impact on biodiversity that have a greater opportunity to benefit from exploiting increasing concerns over its degradation. This can be achieved by being able to go beyond compliance, donate to conservation, reduce, control or mitigate impacts, or lead management sector innovation. The EBI Initiative mentioned in section 2.4.1, is an example of going beyond compliance. This partly explains why the bulk of the literature comes from leading business publications with numerous schemes, initiatives and targets on how to conserve or consider and exploit biodiversity for company good.

Another large input of literature comes from *inter alia* government, inter-government - NGOs and IGOs, perhaps the result of inter-lobbying activities. Likewise, the use of eco-label schemes, framework guidelines, and associated corporate social responsibility reporting in order to publicise company environmental objectives, are utilised by large companies with the resources to produce such expensive documents.

This relatively comfortable situation of having both the resources and the business imperative to concentrate and manage only direct biodiversity aspects of company operations (largely enjoyed by the top 1% of EU companies), is beginning to change. Principle stakeholder demand has historically been centred on (capitalist) continual economic bottom line development with the objective of satisfying only the shareholder. It has been suggested in the literature that pressure to conduct business development sustainably does not always mean the business is operating in a sustainable manner in terms of ecosystem service use. These issues are discussed in the following chapters.

More recently, increasingly pressure from a wider group of well informed institutional and private interested parties is changing company environmental policy, and areas such as biodiversity are moving up boardroom agendas. The next stage in this gradual paradigm shift in business attitude is to introduce biodiversity risk and opportunity issues into the wider company operation of its supply chain. This will include new pressure on the wider company supplier network and organisations that may be small or medium sized, which often do not have the resources or inclination for introducing yet more administration hurdles on what are seen as difficult and esoteric subjects, such as biodiversity.

Although the literature review did not find any specific detail on supply chain biodiversity management methodology, the overall findings did conclude that the regulatory and guidance frameworks already in place (also refer to Section 6.5) have the potential to include biodiversity consideration. In addition, organisations who may see difficulties in demanding an accredited EMS of their suppliers can now suggest a number of alternative choices. Procurement managers can recommend the staged approach to certification or the certification stamp where a formal EMS may not be required. The life cycle assessment (LCA) method could be adapted to include biodiversity, however, a criticism of LCA from industry is that it is often too costly to implement over a wide supply network (Tickle, *pers comm*, 2009), which is a barrier to its wider acceptance within industry. Whichever choice is most suitable a culture of working partnerships would help to ensure an efficient use of available resources with respect to a single product line.

Before this can be achieved, however, a significant obstacle which is blocking biodiversity consideration within industry has to be overcome, that is, a lack of understanding on the subject of biodiversity. The importance of education on biodiversity issues is relevant here and is discussed further in section 8.9 and in section 6.5.3 where company in-house training is discussed. For example, business schools could include a biodiversity and business element to their syllabus whereby new entrants into industry would have an informed understanding of the issues. The questions arising out of the literature review have guided the direction of the research and informed the authors understanding of organisational cultures, an area which id discussed in section 8.9.

The following Chapter (3) discusses the science of biodiversity and its connections and relevance to business operations.

CHAPTER 3

BIODIVERSITY AND BUSINESS CONTEXT

This chapter investigates further, Stage 1, Sections (i), (ii) and covers Section (iii) as set out in the objectives of Chapter 1, Section 1.3.

3.1 INTRODUCTION

Recurrent questions which have been asked by business and procurement managers throughout the project are 'what is biodiversity' and 'what is its connection to other environmental issues and its importance and relevance to business development' and 'where can information be found on business and biodiversity'. In response to these questions, this chapter recommends, to business practitioners with some knowledge of the subject, a working definition and explanation of biodiversity, in the context of the position and importance of biodiversity to ecosystem function and the provision of goods and services needed by industry. Biodiversity is also discussed in the context of the ideas of sustainability and sustainable development and the business links to biodiversity loss. In addition, the enabling frameworks which allow business to structure their environmental/biodiversity commitments, along with guidelines offering advice, are explored. The question on finding information on the subject is covered in subsequent chapters.

3.2 THE COMPONENTS OF BIODIVERSITY

The definition preferred by this project is outlined in section 1.3. Having decided on a working definition, the components of biodiversity are now discussed. The interrelationships between key elements of biological components are now generally considered in 3 groups or levels of diversity, that is, ecological, organismal, and genetic, and how cultural diversity influences the groups (Harper and Hawksworth, 1995; Heywood and Baste, 1995; O'Riordan, 2000).

Figure 3.1 shows each component having its own interlinked elements and, although in reality they are not so clearly defined, the levels and components illustrate their use as an important tool for 'thinking about and studying biodiversity' (Gaston and Spicer, 2004).

Figure 3.1 The Components and Levels of Biodiversity
(Source: Heywood and Baste, 1995, p19)

Aston University

Illustration removed for copyright restrictions

The 3 levels of biodiversity, as presented in Figure 3.1, are used as a visual aid to explain the complexities of biodiversity. Biodiversity can be seen as an organised hierarchical structure ranging from ecosystem and landscape level, through community level, down to the population and genetic level.

It is important to emphasise that the three levels of biodiversity, Ecological, Genetic, and Organismal, are not mutually exclusive or independent, therefore disturbance at any level impacts upon the other levels of the three hierarchies (Gaston and Spicer, 2004). For example, populations are common to all 3 levels. It is useful therefore to give an explanation of all three levels as one may be more apparent than the others to a company, but they should also be aware of possible cumulative impacts. The chemical or pharmaceutical industries may, for example, need to be aware of the genetic impacts of product exploration. The three hierarchical levels of biodiversity along with the impacts of human cultural diversity are described in section 3.2.1.

3.2.1 Ecological Diversity

Ecological diversity is used to describe collectively the number of species in a given area, the variation in biological communities within which species live, and the ecosystems in which communities exist, together with the processes and interactions that take place between these systems. Organisms do not occur in isolation, but exist in a wide range of ecological groups (Gaston and Spicer, 2004). The focus is on the scale of ecological differences (i.e. from populations, communities, niches and habitats to biomes) and the interaction with the physical environment (i.e. an ecosystem). The risk to businesses associated with poor ecological diversity management/consideration, is the loss of ecosystem services, see section 3.3.

3.2.2 Genetic Diversity

The focus of genetic diversity is on genetic processes, patterns and variation driving evolution and adaptation. The resulting gene flow is the consequence of cross fertilisation between members of species across boundaries between populations, or within populations (Treweek, 1999). Genetic variation within a species will be reduced as population size is lowered, with minimum viable population implications, leading to genetic problems from which the species cannot recover (Primack, 2000). It is important to maintain a healthy gene pool in order for ecosystems to adapt to and survive environmental change, and to maintain ecosystem services. Environmental issues that impact on genetic diversity (and all levels of biodiversity, both terrestrial and aquatic origin) include: habitat fragmentation, connective corridors, movement and migration of species into and out of ecosystems.

An example of the impact on business due to poor genetic diversity management/consideration would be interruption or risk to the security of raw material supply. Genetic resource is directly relevant to the biotech-industry, pharmaceuticals, agriculture, cosmetics, food, cleaning agents and paper, for example. Combining Article 2 of the CBD definitions of 'genetic resource' and 'genetic material' gives, 'any material of plant, animal, microbial or other origin containing functional units of hereditary of actual or potential value'.

In order for a company to create value from a genetic resource it removes the genetic material directly *in-situ* from the ecosystem of the country of origin. However, *in-situ* access occurs rarely in practice. In the German biotech-industry, for example, it is common practice for genetic resources to be obtained indirectly (compliant with local laws) *ex-situ* from databases, gene-banks and certified collections in biological resource facilities often located in the country of origin (Kohts, 2007). For further information, refer to the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) and its supplementary Standard Material Transfer Agreement (sMTA) 2008.

Genetic diversity is not normally considered in general environmental management except when specific genetic modifications, resources, mono-cropping or isolated habitats, for example, are discussed. It is generally accepted that it is the ecological level, expressed as ecosystems and species richness, which are most widely used and recognised when discussing business and biodiversity (Section 3.2.6).

3.2.3 Organismal Diversity

Organismal diversity has been the most popular idea behind biodiversity conservation and serves as a convenient human construct for grouping evolutionary related sets of individuals (Gaston and Spicer, 2004). Within this construct, the theory and practice of describing the diversity of organisms (of whatever species) and the arrangement of these organisms (taxa) into classifications is known as Taxonomy. The top levels in the taxonomic (organismal) hierarchy are intended to identify the major branches in evolution, and each holds a group of species sharing basic patterns of form and function with each other, (Gaston and Spicer, 1998,. Groombridge and Jenkins, 2000) refer to Figure 3.1.

3.2.4 Linking the 3 Levels of Biodiversity

These interlinked elements of biological diversity are not then, as Treweek (1999, p188) pointed out, a 'static property'. This is the case whether the disturbance is from natural and/or human cultural/business origins.

In addition to the species level method of assessing biodiversity, work by Magurran (1999) suggested current conservation practice recognises that competition within species is also important, therefore intraspecific diversity needs preserving as part of the dynamic ecosystem process. Also important in the understanding of how biodiversity and the stability of ecosystem function are related, such as, nutrient cycles, is the interaction between species (competition, facilitation, mutualism, disease, predation) (Hughes *et al*, 2002).

3.2.5 Species Diversity

To select any one of the components within the 3 levels of biodiversity as fundamental to ecosystem sustainability is a contentious issue (Gaston and Spicer, 2004). The scientific context and/or business context in which biodiversity is discussed will often decide whether, for example, it is genes or the number of species which are key to finding solutions. In the context of the 3 levels of biodiversity, it has been the practice that the species level within Organismal Diversity (Section 3.2.3) has been widely considered in conservation. In biodiversity consultancy terms it is species that are used to convey to business managers the fundamental elements of biodiversity health. Species adapt and evolve; they occupy ecological space, and become extinct (Groombridge and Jenkins, 2000).

This focus on species as the fundamental element or indicator of biodiversity has been questioned, for example, Bibby (1998, p176) had pointed out that, '*…there is growing evidence that such a strategy is not adequate'*. Species diversity is also inadequate, according to Tilman and Lehman (2002), in determining the potential effects on diversity and ecosystem processes, as differences in species diversity can be confounded with differences in species composition. Tilman and Lehman include a second component of functional diversity which uses the range of species traits in a habitat or region. More recently Gaston and Spicer (2004) discussed whether the species richness approach was useful or even correct. Gaston and Spicer (2004, p14-15) point out two limitations associated with using species richness in the measurement of biodiversity:1) '*definition of species – the inexact science of defining a species'* 2) '*different kinds of diversity – the example of a small number of closely related species verses an equivalent number of more distantly related species – in terms of species richness they are equally diverse'*. The work by Gaston and Spicer (p13) points out 4 reasons why species richness is commonly used as an indicator of biodiversity health:

1) 'Practical application – agreement on species richness in a given area from different studies.
2) Existing information - on species patterns is available from literature and data-bases.
3) Surrogacy – species richness acts as a surrogate or indicator for many other kinds of variation in biodiversity. Greater numbers of species tend to demonstrate more genetic diversity: i.e. More Organismal Diversity with greater numbers of individuals

through to higher taxa; more ecological diversity with more niches, habitats, and biomes.
4) Wide application – species number is commonly seen as the unit of practical management, legislation, political language, and tradition. People tend to associate with variation in species richness with variation in biodiversity'.

In summary, species richness is widely used in biodiversity study as a manageable (organised) method of assessment, although it is only one of a number of methods and is recognised as having limitations. In terms of impacting on business, species degradation is a potential material risk to business as it is related to ecosystem service loss (impact on genetic and ecological diversity) and hence to security of supply.

3.2.6 Species Diversity, Ecosystems and Practical Application

Biodiversity and ecosystem functioning, what Rhodes and Chester (1994) referred to as functional biodiversity, has become, as Naeem *et al* (2002) noted as an important aspect of modern ecological thinking. Functional (bio)diversity, according to work by Hooper *et al* (2005), is the contribution that individual species interactions with other species make to the operation of an ecosystem. An example of this is plant species reducing erosion or improving soil fertility through nitrogen fixation.

Ecological surveys in general have tended to focus on a traditional species approach (Byron, 2000), treating species in isolation and not part of an interactive system. This approach has come into question as stated above and with other concurrent thinking as, Coyne and Orr (1999, p1) observed:

'… *that species are real entities in nature, not subjective human divisions of what is really a continuum among organisms*.'

The debate continues on species value to ecosystem function, with Hooper *et al* (2005) also arguing that species richness is perhaps less important than species characteristics and composition. There are situations where local functional extinction and reduction of key populations to the point where they no longer effectively contribute to the ecosystem, can impact heavily on ecosystem service provision. On the other hand, richness or numbers can equip a system with a range of species that can react differently to perturbations and stabilise disturbance (resilience, see Section 3.4). For example, Kettunen and ten Brink (2006) cite species richness as being good for resisting alien invasive species.

Current understanding of ecosystem functioning and biodiversity relationships is uncertain however (Mooney, 2002), due to an inadequate underpinning of scientific knowledge of habitat and species synergy in varying ecosystem types (Dolman, 2000). Chapman and Reise (1999, p8) found that,

'*Ecology is a science of averages and possibilities ... although there are underlying rules that can be found, there are also many exceptions to general rules'*.

This makes ecosystems and biodiversity to which any assessment is applied, complex and unpredictable with Purvis and Hector (2000, p212) affirming that: '*there is no single feasible way of measuring or valuing biodiversity overall.*' Uncertainty is an integral part of impact prediction in ecological surveys (Morgan, 1998), introducing a high degree of subjectivity. For example, Therivel *et al* (1992) found that even habitat descriptions and definitions can be disputed. Work by Kettunen and ten Brink (2006) found this situation still exists and that defining direct, theoretical or practical connections between biodiversity and ecosystem processes, still remains unclear. They also point out that this has implications for policy decision makers.

In considering the wider assessment of biodiversity in the context of an ecologically connected landscape, it is ecosystem and habitat conservation which are regarded now as a better way to conserving many species simultaneously (Dolman, 2000). In practice it is a combination of species richness within an ecosystem context that determines the biodiversity assessment (Sections 3.2.3 and 3.2.5). Perhaps of most immediate and important danger threatening biodiversity service provision for industry, as the Millennium Ecosystem Assessment (MA, 2005) concluded, is the rapid environmental disturbance to ecosystems, caused by human cultural and industrial development.

3.2.7 **Cultural Diversity -** Linking Society and Business to Biodiversity

It is only comparatively recently that the scientific community has considered biodiversity component relationships in any depth and relatively little work on the causes of biodiversity change and effects on ecosystem function, and the possible effects on human society (Leemans, 2001). According to Leemans in 1996, no broad discussions were found in the literature on socioeconomic forces driving biodiversity loss. Leemans (1996) found that the literature on global biodiversity change had thus far tended to focus on genetic and population level diversity within species, regional species and community diversity, habitat loss and alien species.

There were exceptions to this however with, for example, The Scientific Committee On Problems of the Environment (SCOPE) who in 1991, in response to increasing biodiversity loss, investigated the relationships between ecological complexity and ecosystem function. This ongoing work into future changes in biodiversity and ecosystem processes included research into cultural diversity and the likely effects on society as a result of continued over-background (that is, the addition of anthropogenic influence) biodiversity loss (SCOPE, 2007).

It is cultural diversity and the area of the social sciences that interprets and determines human interactions with all three biodiversity levels (Section, 3.2). If business and the wider community, in general, have little understanding of biodiversity, it is perhaps the ecosystem ecologist fraternity that has been partly responsible for the situation. Holling *et al* (2002b, p8), argue that traditionally ecologists have limited their research into understanding ecosystem function and not considering enough '*human influence, social organisational structures, and institutional arrangements'*, i.e. the cultural constructs that link humans with nature. It is also the social element that business often uses to relate to biodiversity, in terms of understanding its value and how environmental impacts can degrade it. As Dilthey (1892, p278) pointed out, *'we explain in the natural sciences, we understand in the social sciences'*.

In considering company supply chains this project will have to include supply companies operating in a variety of cultural situations. This makes a strong case for biodiversity assessment/management methods, whether ISO 14001 or in-house systems, to be tailored to specific product chains, as opposed to applying a 'one method fits all'. This area of cultural diversity is explored further in section 8.9 where the organisation is faced with a variety of cultural influences and chapters 6 and 7 where industry's social responsibility are linked to cultural diversity.

3.3 ECOSYSTEM SERVICES AND INDUSTRY

As biodiversity contributes to the maintenance of ecosystem functions (Tacconi, 2000., Chapin *et al*, 2000) it is therefore the source of many ecosystem services and goods that provide the environment and the natural resources essential for business to operate and survive. Examples of ecosystem services are, climate regulation (discussed in Section 3.5), maintenance of hydrological cycles, flood and drought mitigation, erosion protection, air and water purification, cultural heritage, food, crop pollination, timber, fiber, genetic resources, extractive resources, and fresh water. As this review is on business and biodiversity, the focus is on biodiversity loss affecting the services needed by business. It is recognised that ecosystems provide other services related to characteristics other than biodiversity. This would include navigation or natural flood prevention where biodiversity loss only comes into play when it is linked to direct physical ecosystem loss.

The above services are generally classified as follows (summary by the author of MA, 2005 findings):

- *'provisioning services such as food, fiber, fuel and water;*
- *Regulating services i.e. benefits obtained from the regulation of ecosystem processes such as, climate, floods, disease, wastes, water quality;*
- *cultural services such as recreation, aesthetic enjoyment, tourism; and*
- *supporting services i.e. production of all the other ecosystem services, such as soil formation, photosynthesis, and nutrient cycling'.*

As industry requires increasing supplies of the materials provided by ecosystem services, then greater pressure on ecosystems is compromising their ability to deliver. A study on European Union (EU) ecosystems by Kettunen and ten Brink (2006) demonstrated that a wide variety of biodiversity-related services provided by a wide variety of ecosystems have been lost or degraded. Also the way ecosystem services are exploited and used has difficulties, as Kettunen and ten Brink (2006) point out. It is often the case that a trade-off will result through the modification of one ecosystem to provide one service (e.g. agriculture, business development, energy production) at the expense of others.

The 2005 Millennium Ecosystem Assessment (MA) examined 24 ecosystem service types and found that only 4 had become enhanced through anthropogenic influence, these were; crops, livestock provision, aquaculture, and carbon sequestration. In contrast, 15 other services including; fishing, timber production, water supply and quality, waste treatment, natural hazard protection, regulation of air quality, climate, erosion, and a wide range of cultural services, had become degraded (MA, 2005).

The impacts of trade-offs on inter-service provision will present differing levels of importance to different stakeholders. For example, enhancing agricultural production, through wetland drainage, artificial fertilisers and irrigation, can have detrimental effects on connected water and aquatic ecosystems (Kettunen and ten Brink, 2006).

Any diminishing of the natural supply chain as a result of non-sustainable use or trade-off effects will have the potential for profound impacts on business with economic bottom lines suffering from increasing costs, scarcity of materials, stakeholder pressure, and increased regulation (MA, 2005). The World Business Council for Sustainable Development (WBCSD, 2005) supported the 2005 MA report by pointing out that business cannot function if ecosystems and the services they provide are degraded or out of balance.

The uncomfortable realisation has to be then, in a modern global business climate, as Chapin *et al* (2001, p4) and Leemans (2001, p23) concluded, that resource management thus ultimately defines the fate of biodiversity. For an estimation of lost monetary value due to biodiversity-related ecosystem service loss see Appendix 1, and The Living Planet Report (WWF, 2008). Another term used in industry to describe natural systems in the context of environmental management is *integrity* [of biological systems]. For example, in the Energy and Biodiversity Initiative (EBI) Report (2005) (Section 2.4.1) the term 'biological integrity' is substituted for 'diversity' in order to describe a pre-development site's natural baseline. The definition of Biological Integrity (biointegrity) given in the report (Glossary,p1) is:

'*The capacity to support and maintain an integrated, adaptive community with a biological composition and functional organisation comparable to those of the natural systems of the region and also it is the measure of a system's wholeness, including presence of all appropriate elements and occurrence of all processes at appropriate rates. Integrity refers to conditions under little or no influence from human actions; a biota with high integrity reflects natural evolutionary and biogeographic processes'*.

Whatever the terms used, and despite the underlying science explaining the risks associated with resource management, business continues generally to ignore the situation. Rather than diminishing ecosystems ability to maintain long-term productivity, business should be looking to sustainably exploit and expand renewable resources. Economic projects need to look at the underpinning resources enabling them to operate. Yet as Hindmarch *et al* (2006) argue, at present they are rarely factored into development plans, giving an indication that the projects are not able to comply or deliver environmentally sustainable products. Reducing the natural capital that ecosystem services provide has longer-term collateral effects, for example, soil degradation (Bellamy *et al*, 2005), increases in atmospheric carbon dioxide, and loss of local biodiversity due to unsustainable land management (Hindmarch and Pienkowski, 2000).

Hindmarch *et al* (2006, p142) point out the difficulties associated with integrating economic systems and ecosystem services, with long-term values of underpinning growth, into accounting processes and state '*they are structurally unable to do so'*. Although work on ecological economics by Costanza *et al* (1997), Turner *et al* (2001), de Groot *et al* (2002), and the related work by Figge and Hahn (2005) for example, have offered economic values to natural systems, they are largely ignored in national economic policy and individual projects at strategic level (Hindmarch *et al*, 2006).

Hindmarch *et al* (2006, p137) cite Jacobs (1997) who makes the case that 'acceptable change' to the environment and to development is decided 'socially' (see Section 3.2.7). Jacobs contends that environmental health indicators like the carbon cycle, or ecosystem services are ignored because they do not have local social constituency, whereas charismatic species which do, such as the great crested newt, can influence policy. It can be taken from this that biodiversity indicators are also ignored.

The Millennium Ecosystem Assessment (MA) asserted that industry could not function without natural resources and services provided by ecosystems (MA, 2005, 2006). Unfortunately human use of biological systems nearly always means they are degraded as a result (WCED, 1987; Robinson, 1993; Vitousek *et al*, 1997). It should come as no surprise then that unsustainable use, as businesses utilize these services, contributes to ecosystem change. This was supported by the 2005 MA report (p23) on ecosystem change and human well being when it concluded that:

'If current trends continue, ecosystem services that are freely available today will cease to be available or become more costly in the near future...'.

Since the MA and other reports, it is now more generally recognised and accepted that biodiversity is experiencing unprecedented changes in distribution and abundance through anthropogenic activity. Modifications of natural systems directly related to human activities, such as increasing human population and material consumption (Primack, 2000), has contributed considerably to the decline in biodiversity (Heywood, 1995; Lawton and May, 1995). Yet despite more recent initiatives for conservation and sustainability (for example, UNESCOs Man and the Biosphere [MAB] programme and programmes such as Diversitas), biodiversity, what Wilson (1992) called the key to the maintenance of the world, has continued to decline with natural habitats being destroyed at a rapid rate (Dobson, 1996; Purvis and Hector, 2000; MA, 2005) resulting in species extinction across the world reaching their highest levels (Dolman, 2000; Paris, 2005).

This decline should convey some value on biodiversity, however, scientific, social, or economic value assigned to biodiversity will vary according to the level of risk, or opportunity, associated with industrial sector and individual company operations, product manufacture or services provided. Also companies are influenced by the level of stakeholder interest (Sections 6.1 and 6.2) in a product or service. Whatever the level of impact, companies depend on the ability of biological systems, to sustain material supply.

3.4 BIODIVERSITY LOSS

Current research on biodiversity loss has been driven by the increasing anthropogenic pressure on ecosystems (Kinzig *et al*, 2002; Gaston and Spicer, 2004), rekindling interest in the function of diversity-stability relationships (May, 1972; May, 2000) influenced by environmental disturbance (Hughes *et al*, 2002). The EU study by Kettunen and ten-Brink (2006) revealed different levels and underlying causes of biodiversity loss, including loss/degradation/alteration (the most common direct impacts) of ecosystems and habitats, over-extraction of resources, pollution and eutrophication, changes in species population levels, numbers, and species composition (introduction of invasive alien species). The extent human-use-demand disturbs these different components of biodiversity will vary depending on ecosystem type (Redford and Richter, 1999). Studies related to this into the effectiveness of ecosystems in reorganising after disturbance or a destructive event, have pointed to biodiversity as a key measure of ecosystem resilience (Perrings *et al*, 1995). A detailed discussion on the various conceptual components of ecosystems is beyond the focus of this project. In terms of resilience however, the definition (of which there are a number) used in this project refers to ecosystem resilience, and is offered by Holling and Gunderson (2002, p28) as:

'*Resilience as measured by the magnitude of disturbance that can be absorbed before the system (eco) changes its structure by changing the variables and processes that control behaviour*'.

The argument here is that sustainable relationships between people and nature are necessary for stability or maintaining existence of ecosystem function. Resilience is linked to the interplay between stabilising and de-stabilising impacts, and the idea of sustainable development, ecosystem restoration, environmental change, and biodiversity loss. The arguments are controversial, however, and have stimulated heated debate over the years on how biodiversity would affect ecosystem function (Kinsig, 2002). May (1973), and Holling *et al* (1995), for example, suggesting that a general connection between species diversity and the idea of ecosystem resilience was not yet certain. What has emerged from research studies is the clear situation that if conditions causing sustained stress or shock arise and a certain level of biodiversity loss is reached, the result often creates opportunities for diverse ecosystems to fundamentally stabilise and reorganise (Perrings *et al*, 1995) in response to change. Ecological stability, or the capacity of systems to recover from perturbations in species abundances, linked to food webs and energy flow is the focus of recent research. Although the theoretical debate is complex environmental management practitioners need to be aware, in order to be accepted by business that environmental decision methods have to be practical, in terms of evaluation methods and techniques, supported by good science.

Table 3.1 has been compiled by the author to illustrate the national and global situation by showing the UK as an example of general habitat loss and decline since 1945, and farm bird species decline mainly as a consequence of agricultural intensification. Table 3.1 also shows examples of species (IUCN) at risk worldwide, taken from the Millennium Ecosystem Assessment (MA) 2005, of degrading systems and services and industries economically dependent on those services.

Table 3.1 Examples of Habitat/Species (spp) Loss/Decline and at Risk in the UK and Worldwide with Industry Ecosystem Services Dependence

(Adapted from: Hill *et al*. (2005). IUCN, 2004., MA, 2005)

Habitat Type (UK)	Loss – last 60 yrs	Farmland birds lost in last 30 years (UK)	% Loss
Ancient lowland woodlands	Over 50 %	Song Thrushes	40 %
Hedgerows	150 k Miles	Yellowhammers	54 %
Hay meadows	95 %	Starlings	84 %
Chalk downland	80 %	Corn Buntings	90 %
Wetland fens and mires	80 %	**IUCN Spp @ risk Worldwide**	**% Risk**
Habitats in unfavourable condition (UK)	**Percentage**		
SSSIs (from total 1 mil hectares. est.)	42 %	Mammals	20 %
Rivers and Streams	69 %	Birds	12 %
Uplands Grasslands and Heaths	c. 65 %	Reptiles	4 %
Fen Marsh and Swamp	35 %	Amphibians	31 %
Lowland Broadleaved Woodlands	33 %	Fish	3 %
Millennium Ecosystem Assessment (MA) (world)	**Degraded**	**Industries based on ecosystem services (MA) (world)**	**Billion $ per year**
Review of 24 different ecosystem Services indicators (15 of 24)	60 %	Food production	$980
Human induced spp extinction rate over background (medium certainty)	>1K times	Timber industry	$400
Commercially exploited marine fish stocks (medium certainty)	25% over-harvested	Marine fisheries: per year Marine aquaculture: per year	$80 $57
Demand for ecosystem services from 1960 to 2000	World population doubled to 6 billion Global economy increased > sixfold	Recreational hunting and fishing: per year in the United States alone	>$75

Can the main drivers causing environmental change and impacts on these biological 'end users' be categorised? Sala *et al* (2000) cite five main drivers having a global effect on biodiversity which are, land use, nitrogen (N) deposition, biotic exchange, atmospheric carbon dioxide (CO_2) and climate. Figure 3.2 (adapted from Sala *et al*, 2000, p359) represents the results of a global climate (impacts) model (GCM) of the expected reaction to change in the environment (in 10 terrestrial and freshwater ecosystems) for the year 2100, using five major environmental drivers that influence change on biodiversity. Relative (average) rankings of these are shown and are based on the understanding at the time (work published in 2000) of biome sensitivity to change (Sala *et al*, 2000).

Figure 3.2 Major Drivers of Biodiversity Change
(Adapted from: Sala *et al*, 2000, p359)

Aston University

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In Figure 3.3 biotic exchange (*) refers to the deliberate or accidental introduction of species into an ecosystem. Values on the Y- axis represent the average across the 10 biomes and they are made relative to the maximum possible change, which resulted from change in land use. The thin bars are standard errors and represent variability among biomes. The 10 biomes used were: Arctic and Alpine Tundra; Boreal Forest; Temperate Grasslands; Tropical Savannah; Mediterranean-Climate Ecosystems; Deserts; Temperate Forests of North and South America; Tropical Forests; Lakes; Fish Diversity in Streams and Rivers.

The conclusion drawn from these model scenario studies are, according to Sala *et al* (2000, p366), that any required change to impacts on biodiversity should include '*those actions that decrease the rate of change of global change drivers*'. That is, reducing land-take and changing land use, or reducing rapid climate change, would have a consequential effect on reducing the rate of change of biodiversity loss (Sala *et al*, 2000). Regional fine-tuning and differences would be taken into account in management plans based on the understanding of ecological, social characteristics, and economic conditions (ibid). For fine-tuning methods see Vliet and Leemans (2006). The evolving debate on the causes of biodiversity loss, supported by the Millennium Ecosystem Assessment (MA, 2005) conclusions, and the scientific and business basis for halting its decline, has resulted in the IUCN concluding that biodiversity faces multiple challenges. In Europe for example, habitat loss, fragmentation, intensive agricultural practices, urban expansion, increased transport and road networks, the illegal harvesting of flora and fauna, are all cited as being the primary threats (IUCN, 2005). In response European governments have committed to a series of global and regional agreements aimed at halting biodiversity loss. The UK along with other European Union member states (see Table 3.2 for examples) has committed to halt biodiversity loss by 2010 (UN, 2002).

Table 3.2 Halting Biodiversity Loss 2010 Commitments.
(Sources: UN (2002, 2003). Malahide (2004). Rabey (*pers com.* DEFRA, 2005)

2010 COMMITMENT	LEVEL	WHEN IT WAS MADE	WHAT WAS SAID
WSSD-World Summit on Sustainable development	International	2002	"The achievement by 2010 of a significant reduction in the current rate of loss of biodiversity"
CBD-Convention on Biological Diversity	International	2002	"To achieve by 2010 a significant reduction of the current rate of biodiversity loss at the global, regional and national level"
Kiev Resolution on Biodiversity	Pan European	2003	"To halt the loss of biodiversity by 2010"
Malahide Conference	Pan European	2004	Halting the decline of biodiversity priority objectives and targets for 2010
EU Sustainable Development Strategy	EU	2002	"To protect and restore the structure and functioning of natural systems and halt the loss of biodiversity both in the European Union and on a global scale"
Gothenburg Agreement	EU	2001	"To halt the loss of biodiversity by 2010"
Public Service Agreement 3-	UK	Public Service Agreement 2005-2008	"Bringing into favourable condition by 2010 95 per cent of all nationally important wildlife sites"
DEFRA Target: UK to be amongst leaders in sustainable procurement	UK	2000	UK Government to be recognised as amongst the leaders in sustainable procurement (public sector) across EU member states by 2009. Development of KPIs.

The 2010 objective was seemingly assessed for appropriateness, effectiveness and implementation, at conferences in Killarney (2004) and Malahide (2004), although it has since been argued that the practicalities of achieving this target are, as Mace

(2005, p33) commented, '*demonstrably omitted*'. The sceptic camp meanwhile wonder if sustainable development can live alongside, often destructive, market-based methods, as a basis for conservation (Kiss, 2004), and that a '*persisting industrial revolution mindset'* (Brady, 2005, p10) necessarily degrades ecosystem integrity. Stern (2006) linked the threat to human wellbeing with industrial development, by stating that there are severe economic risks with continuing the present business-as-usual situation.

It is worth noting at this point that the term 'ecosystem' is increasingly being used in an unqualified way as being synonymous with large-scale landscapes (Kirby, 2005). Although laudable, as Kirby (2005, p3) points out, single woods and small areas of grassland, for example, are ecosystems too. On this theme, intensively managed arable fields, although often of low biodiversity interest, are nevertheless functional ecosystems. As work by Turner *et al*, 2001 pointed out, the scale and nature of the ecosystem have to be defined in the same way biodiversity is considered and measured from different hierarchical, spatial and temporal scales. Otherwise, Kirby (2005, p3) goes on to say, the term ecosystem is a 'meaningless exhortation'.

3.5 CLIMATE AND BIODIVERSITY LOSS

An overwhelming body of scientific evidence now clearly indicates that climate change is a serious and urgent issue, and the main cause is increases in, so called, green house gases (GHG) caused by human activities (Willows and Connell, 2003; IPCC, 2001a; Stern Review, 2006). An international workshop, held at the Royal Society in London (2008, p49), on biodiversity – climate interaction, adaptation, mitigation and human livelihoods, concluded that '*Observations of marine and terrestrial systems confirm that climate change impacts biodiversity'*. The workshop also concluded that, climate, biodiversity and human wellbeing are inexorably linked.

The most immediately vulnerable natural systems to rapid climate change are: glaciers, coral reefs, low-lying islands, polar and alpine ecosystems, cloud forests, mangroves, coastal wetlands and grasslands. While some species, including agricultural pests, may increase in abundance or range, climate change will increase existing risks of extinction of many threatened species and lead to further loss of biodiversity. The pressure of human development is causing a faster and greater rate of climate change, and consequently more damage to ecosystems and the societies that depend on them (IUCN, 2007).

In the early 1990s the scientific community looked to be attempting to halt the effects of biodiversity loss by considering general concerns for biological conservation and the extinction of species, by the political apparatus of treaties like the Convention on Biodiversity (CBD), see section 3.6.1. There were however, other environmental concerns that were largely overlooked under the fledgling CBD. For example, there were parallel discussions about the physical elements of terrestrial and oceanic environments, atmospheric chemistry, and climate, with the disquiet in these areas leading to other separate treaties, see section 3.6.1. These areas dealing with the more pure environmental science of physical elements, and involving the methods of ecosystem ecologists, were regarded as largely separate issues from the work presented by conservation biologists and community ecologists, on biodiversity loss.

The respective conventions resulting from both camps are now regarded as interrelated and mutually dependent (Chapin *et al*, 2000). The outcome of this merging of convention aims is that impacts on biodiversity, such as habitat fragmentation, species introduction, land take, and ecosystem function, are now seen as inter-reacting. The environmental stresses of human induced changes to land use, global carbon stores in the biosphere, the altering of gaseous cycling, and climate (Chapin *et al*, 2000), are now all part of the CBD thinking on the causes of biodiversity loss.

An example of the above can be seen in the climate debate which is now in full-flow and includes biodiversity loss as a key factor. The climate debate has escalated, as highlighted by the work of van Vliet and Leemans (2006), who found that there were, to that date, over 1000 papers published on this subject. Compare this figure to the 21 papers available to the Intergovernmental Panel on Climate Change (IPCC) Third Assessment Report (TAR) in 2001. There cannot be a discussion, therefore, on biodiversity loss without including climate change, as it is one of the main effects of anthropogenic interference with natural systems. This area of related biodiversity loss can not therefore be ignored and will be included as part of the considerations of impacts options in the final methodology. As work by Sukhdev *et al* (2009) indicated, carbon dioxide or so called ‘brown carbon’ is equally interchangeable with ‘green’ or ‘blue’ carbon, that is, terrestrial and marine ecosystems. In support of this, the Society for Ecological Restoration International (SER) issued a position statement on global climate change during its joint conference with the Ecological Society of America (ESA) “Ecological Restoration in a Changing World” held recently (2007) in San Jose, California. The position statement calls attention to the vital role played by terrestrial and aquatic ecosystems in supporting humanity, and the need to protect and restore these habitats in order to mitigate global climate change and its effects. The overwhelming scientific consensus is that climate change is a real threat that requires immediate action. Changes in land use and the subsequent loss of biodiversity are a significant contributing factor to global climate change. The outgoing chair of SER (Bowers, 2007, p1) illustrated the situation with:

‘The loss of vital ecosystem functions and services reduces biological resilience and adaptability, further increasing our vulnerability to the adverse impacts of global climate change.’

This area of environmental drivers with seemingly indirect but related consequences of human induced ecosystem service stress is affecting the Earth’s systems and compounding impacts on biodiversity. The natural regulation of climate is an example of this, as it is both a consequence and a cause of biodiversity loss. The Royal Society (2008, p49) workshop stated that in relation to climate change:

‘*The loss of biodiversity presents an insidious threat, but one that is no less important in terms of the long-term wellbeing of the planet. The loss of biodiversity and the degradation of ecosystems should therefore be of major concern to decision-makers around the world’.*

Global Climate Models (GCM) have indicated that since the industrial revolution human activities have contributed to Earth surface warming by changing the radiative balance of the atmosphere (Houghton *et al*, 1995; Knutson, *et al*, 1998; Raynor, *et al*, 2003; IPCC, 2007). One example of anthropogenic forcing of global fundamental changes in climate is the weakening of the Tropical Pacific Atmospheric Circulation or the Walker Circulation (McIlveen, 1997). This is due to increasing greenhouse gas concentrations and subsequent surface warming (Vecchi *et al*, 2006) which has implications for global climate and biodiversity decline.

The changeable nature of climate has to be considered not only in the part of the atmosphere where biota function, that is, the troposphere, but also the function of molecular species in other parts of the atmospheric column, for example, in the stratosphere (c.15 to 50 Km above surface). This is because gas molecules in the stratosphere absorb and moderate the transmission of solar radiation to the troposphere, and their qualitative and quantitative concentrations are an important determining factor with respect to ecosystem processes (Vanloon and Duffy, 2000). Conversely, the activities of life in the troposphere have altering effects on the way gases in the stratosphere interact with incoming solar radiation (ibid).

The Intergovernmental Panel on Climate Change (IPCC) confirm there is new and stronger evidence of observed impacts of climate change on unique and vulnerable systems (such as polar and high mountain communities and ecosystems), with increasing levels of adverse impacts as temperatures increase further. An increasing risk of species extinction (above pre-industrial) poses significant risks to many unique and threatened systems including many biodiversity hotspots (IPCC, 2007). For examples of climatic change impacts on ecosystems refer to IPCC (2007) and Schellnhuber *et al* 2006.

3.5.1 Dangerous Climate Change and Business

The term 'dangerous climate change' was legally introduced at the 1992 United Nations Framework Convention on Climate Change (UNFCCC). The convention called for the stabilisation of greenhouse gases (GHG) to 'prevent dangerous anthropogenic interference with the climate system' (UNFCCC, 1992). There is also a suggestion in Article 2 of the convention, that the stabilisation levels of atmospheric GHGs should be achieved within a recommended timeframe (with defined targets and timescales) that is sufficient to allow ecosystems to adapt naturally to climate change; ensure that food production is not threatened; and enable economic development to proceed in a sustainable manner (Schneider and Lane, 2006).

The monetary costs as a result of dangerous climate change were highlighted by the Stern Review (2006). The total economic cost of dangerous climate change was estimated to be equivalent to a one-off, permanent 5-20% loss in global mean per-capita consumption. Stern (2006) concluded that there are severe economic risks with continuing the present business-as-usual situation. Although Stern's approach to uncertainty and cost benefit analysis, and hence his results, have been criticised (see for example, Dietz *et al*, 2007), work by Dietz *et al* (p311) did however agree that climate change could deplete and degrade so-called 'critical' natural capital. The latter is essential for human development and:

'*the loss of which can neither be reversed nor be compensated by increasing production and consumption of other goods and services'*.

An example of innovative schemes available to help business deal with issues like climate change comes from the Business in the Communities May Day Network scheme. This scheme, which has the endorsement of HRH the Prince of Wales, consists of groups of companies who have committed to taking action on climate change. Although biodiversity is not mentioned, it does provide a hub and enabling framework for businesses to share their experiences in tackling the issue and to engage suppliers, customers and sector partners to do the same (BitC, 2007).

In order for the relationship between the environmental pressures on biodiversity and the associated pressures on business to be constructively developed, there has to the political will and direction, working within political enabling frameworks. The enabling framework would require direction to make it more profitable to conserve biodiversity, rather than to destroy it (Bishop *et al*, 2006).

3.6 ENABLING FRAMEWORK FOR BIODIVERSITY AND BUSINESS

All businesses operate within a framework of legal liabilities and socially required standards. Both the private and public business climate is influenced by government taxes, subsidies, regulations and voluntary commitments. These enabling conditions reflect the responsibilities and role of business in society. However, business-enabling frameworks with regard to biodiversity issues are often poorly developed. As Bishop *et al* (2006, p85) point out biodiversity is generally treated as a public good with governments and charities taking the lead in being responsible for its consideration. As for business and private investors, they have generally regarded biodiversity as a resource to be exploited or as an environmental liability, not as an asset to be considered sustainably in terms of industrial development.

3.6.1 International Biodiversity Policy

There are an increasing number of international laws and regulations on biodiversity related issues. More than 500 general environmental protection treaties and other agreements from the past 30 years were identified by UNEP in 2002 (UNEP, 2002). Examples summarised from UNEP (2002) of international environmental policies with significant impacts on biodiversity include:

- *the Cartagena Protocol on Biosafety, under the Convention on Biodiversity (CBD), which regulates international transfers of genetically modified organisms;*
- *the Bonn Guidelines on Access to Genetic Resources and Fair and Equitable Sharing of the Benefits Arising Out of Their Utilization, a voluntary agreement under the CBD;*
- *the International Treaty on Plant Genetic Resources, negotiated under the auspices of the Food and Agriculture Organization (FAO);*
- *the Kyoto Protocol, under the Framework Convention on Climate Change, which includes provisions for mitigating climate change through forestry and land use activities that affect biodiversity.*

The Kyoto Protocol is directly linked to business and biodiversity due to the rapid demand for climate mitigation services (Bishop *et al*, 2008). For example, industrial scale destruction of Green House Gases (GHG), capture and use of methane from landfill, energy efficiency and renewable energy supply. Also, forestry and other land use activities that sequester atmospheric carbon in biomass.

Most policies relate to the marine environment with terrestrial biodiversity featuring on a smaller scale, but also include the World Heritage Convention (1972), the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in 1973, the Convention on Migratory Species (CMS) in 1979, and the Convention on Biological Diversity (CBD) in 1992.

The idea that economic development would have to grow in a sustainable manner (UN, 1992) underpinned the fundamental principles of the Rio Earth Summit in 1992. The Rio Earth Summit placed the issue of biodiversity, as Byron (2000, p3) noted, '*firmly on the international agenda'*, with the development of the CBD. The CBD has a primary aim to conserve biological species, genetic resources, habitats, and ecosystems (Rao, 2000). Other European Community Directives in related areas strengthened the legislative framework, for example, the environmental impact assessment (EIA) Directive 85/337/EC (CBD, 2001.14 (1)), implemented in the United Kingdom in 1988 (EC, 1985). Article 14 (1, a and b) of the CBD suggests that an EIA be used for 'potential projects likely to have significant adverse effects on biodiversity' (CBD, 2001). While Article 6 (b) requires that the conservation and sustainable use of biodiversity be integrated into relevant sectorial and cross-sectorial plans, programs and policies. It also required signatories, in accordance with the CBD, to implement a national biodiversity strategy to protect biodiversity and use biodiversity resources sustainably (Treweek, 1999; Dolman, 2000; Defra, 2001). This gave the issues of sustainability and the relationship between economic development and the environment an international and national legislative foundation (Glasson *et al*, 1999). It also helped open up possibilities for more public participation in decision making with more environmental information made available, for example, environmental statements, environmental appraisals of development sites and eventually, as discussed in chapter 6, corporate environmental reports (IEMA, 2002).

3.6.2 Local and National Policy

In answer to these international policy commitments, conservation organisations in the UK, such as, The Wildlife Trusts, The Royal Society for the Protection of Birds (RSPB), Butterfly Conservation, Friends of the Earth (FoE), Plantlife, and the Worldwide Fund for Nature (WWF) proposed a biodiversity-planning programme for government – Biodiversity Challenge (Regan, 2004). This document led, in 1994, to the UK Biodiversity Action Plan (UKBAP) being adopted (UKBAP, 1994), resulting in Local Biodiversity Action Plans (LBAP) being put into practice throughout the UK (Defra, 2003). This has been strengthened and given legal recognition in the CROW (2000) Act (s.74) where government is required to have regard to the purpose of biodiversity conservation in accordance with the CBD provisions (Bell and McGillivray, 2006). The requirement is for the Secretary of State to list species and habitats important to biodiversity conservation, although this, as Bell and McGillivray (2006) point out, does not convey (under section 74 (2)) statutory status on the action plans.

Ten years after the Rio summit, the 2002 World Summit on Sustainable Development (WSSD) in Johannesburg gave an opportunity to, as Deutz (2005, p186) said, '*review* *progress on the ambitious blueprint spelled out in Agenda 21'*. Initially four key issues were proposed by the United Nations (UN) for the conference – Water, Energy, Health, Food and Agriculture (WEHA), issues in line with the Millennium Development Goals (MDGs) (2000) and the Kyoto Protocol (adopted, 1997., entered into force 2005). Biodiversity was only included with the intervention of the UN Secretary General (2002) when he added it to the initial four issues, giving the acronym WEHAB (Deutz, 2005).

At the Johannesburg summit, governments were called upon to change unsustainable patterns of consumption and production (refer to Chapter 3 of the Johannesburg Plan of Implementation (JPOI)). In order to accelerate the shift towards sustainable consumption and production (SCP), the Plan called for them to promote the development of a 10-year framework of programmes on SCP (10YFP). The international collective effort to develop the 10YFP is named the "Marrakech Process" as the First International Expert Meeting on the 10YFP took place in Morocco in 2003. The proposition for the 10YFP will be presented and reviewed at the 2010-2011 cycle of the Commission on Sustainable Development (CSD).

Biodiversity also entered the WSSD process at the Conference of the Parties (COP-6) of the CBD in The Hague in 2002, with the target set by the JPOI of achieving a significant reduction in the rate of biodiversity loss by 2010. Deutz (2005) also makes the point that the JPOI did not expand the ecosystem approach to conservation beyond the CBD, except for marine systems.

The implications for biodiversity after the WSSD may be more defined at the governance level but the real problem remains, as Le Prestre (2002) maintains, not in governance *per se* but rather ensuring that governance systems in other sectors that impact upon biodiversity take biodiversity into account. Policy decisions affect biodiversity, and ensuring consistency and coherence between the interconnected aims of economic development, social advancement, and environmental sustainability, is the main challenge of global governance (Deutz, 2005).

The adoption of a decision by the CBD to engage with the private business sector at the Conference of the Parties in Curitiba Brazil in 2006, has suggested an emerging consensus regarding the need to enlist business in the conservation and sustainable use of biodiversity. International biodiversity policy, however, still relies on voluntary guidelines and reporting, supplemented in a few cases by restriction on trade (Bishop *et al*, 2008). The CBD treaty has changed the emphasis away from just preserving areas with exceptional diversity, to the more holistic view of sustainable development of biological resources (Pearce, 1992).

3.7 DISCUSSION

This chapter has started the project's investigation into the science of biodiversity by explaining the component structure of the term biodiversity. Following this its relationship to business has been explored by an overview of ecosystem services and introducing the cultural element. Subsequent chapters will take the discussion further, but the initial research has indicated the uncertainty regarding the science of ecosystem function. The example given, of the practice of treating individual species only as isolated indicators of ecosystem condition, and not part of an interactive system, may, in many cases, have provided sub-optimal solutions in biodiversity management. The uncertainty surrounding the science has also contributed to hampering any progress in mainstream management improvements by industries already confused with the numerous definitions of biodiversity and sustainable development. Added to this is the danger of industry seeing the conservation of protected areas as doing enough and ignoring often equally important non-designated and less charismatic ecosystems with similar potential to halt biodiversity decline.

The problems stated above have highlighted the historically bad start that the subject has had in terms of explaining its links to business development. The resulting uncertainty within mainstream business communities surrounding the science of biodiversity has clouded its importance and value to longer-term development. The situation is exemplified by biodiversity being widely recognised as significant in providing sustainable material sourcing for sector specific industry but widely ignored in its role as a vital climate regulating and adaptive constituent of ecosystem function.
This ambiguity has had the broad effect of distancing the subject of biodiversity from other environmentally related issues, such as, energy, waste, and its inexorable links to dangerous climate change. In addition, the business community has generally not accepted responsibility, or understood the potential cumulative impacts, both positive

and negative, cascading across other levels or components of biodiversity, due to their wider external operations. The outcome is that biodiversity has become a significant area of secondary concern within mainstream business. This attitude prevails despite the extent of biodiversity degradation presenting a high risk potential in threatening raw material supply to industry.

In attempts to control the deteriorating biodiversity situation, governments and conservation bodies have introduced an enabling political environment where businesses can assess their responsibilities, and change embedded attitudes towards external material sourcing. However, despite political commitment, Europe has struggled to halt the loss of biodiversity by the set target of 2010. The CBD is the most important of a number of political instruments that deal with the increasing threat of biodiversity loss. The operation of the CBD is not, however, without its critics. Laikre *et al* (2008) have spoken of the scientific board of the convention – the Subsidiary Body of Scientific, Technical and Technological Advice (SBSTTA) as politically influenced which effectively constitutes a barrier to scientific discussion and progress. They claim the CBD is increasingly being dominated by politicians and professional negotiators, with some parties aiming to steer the process away from science towards decisions that do not interfere with national issues of trade and economic growth. Stocking (2008, p115) agrees, saying the nomination of delegates to convention meetings is: '*the core of the problem, they tend to be government nominees ... not scientists who are up to date with the literature'*.

On the upside of down, however, there are areas where, in spite of these problems, the wider business world is seeing the potential advantages of biodiversity consideration. The drivers for change come from sectors more likely to be at risk from potentially large direct impacts, and where the business incentive is more apparent for biodiversity to gradually become a better-understood concept. Individual private sector businesses are driving consideration by linking biodiversity to sustainable development and the economic interest of protecting security of supply of materials. An example of this comes from the EBI initiative of the oil and gas sector, described in section 2.4. These companies see the advantages of reducing biodiversity impact risk, such as, operating licence, while at the same time publicising their actions and strengthening shareholder value. An obstacle to carrying on this momentum to the supply chain is the lack of a practical business model for assessing the cumulative impacts both to biodiversity and business. This information on the need for a cumulative assessment of impacts will inform the direction of the research aim.. This chapter has highlighted an area which is a concurrent theme throughout the following chapters, that is, the need for more accessible information on biodiversity in terms of definition and impact types with respect to a business context. In addition, where can industry find information on how biodiversity affects business operations, for example, how is it connected to climate change, where can information be sought on *inter alia* international, national and local policy, sector specific impacts, guidelines, ecosystem services and so on. An integral part of the research aim and final methodology therefore will include the provision and access to relevant information. The areas of biodiversity loss illustrated in Table 3.1 will also guide the research with respect to the impact types and ecological entities that the final model needs to consider. The areas of biodiversity enabling frameworks described in this chapter will also guide the type of compliance and legislative information needed by the model.

It has also been the historical case that economic considerations have acted as a constraint to progress on biodiversity issues, but recent cultural attitudes are starting to change the wider business view in this area. The degree in which these influences are assimilated into business practice will depend on the varying degree of value attached to biodiversity within the cultural context in which large company supply chains operate. A large influence on attitudes to biodiversity will also depend on the organisational culture of the company and the degree it is willing to listen to a wide range of stakeholders and this is investigated further in section 8.9 and Chapter 6. The following chapter will take the debate further and review the associated literature in relation to the company supply chain and discuss the potential contribution that supply chain management can make to reducing biodiversity decline.

Chapter 4 now carries the discussion onto the environmental management of the supply chain. The contribution to halting biodiversity decline that supply chains can make is covered along with criteria for assessing the risks and opportunities biodiversity presents to wider business operations.

CHAPTER 4

BUSINESS, SUPPLIERS, AND THE SUPPLY CHAIN

This chapter discusses the relative positions of the buyer and supplier in relation to biodiversity management. The potential contribution supply chain management can make to slowing the decline in global biodiversity is investigated. In addition, examples of standard criteria for assessing conservation values and the significance of risk associated with the type of biodiversity impact are explored. This covers Stage 1, Sections (i), (ii) and (iii) of the objectives set out in Chapter 1, Section 1.3.

4.1 SUPPLY CHAIN MANAGEMENT – A DEFINITION

Supply chain management (SCM) has a number of definitions, and as work by Seuring (2005) pointed out, there are recurring themes in the majority of contributions. That is, supply chains deal with material and information flows which have to be managed in a cooperative way by all partners involved. Two definitions have been selected that come close to defining the whole situation. First the definition offered by Stevens (1989, p3):

'*A system whose constituent parts include material suppliers, production facilities, distribution services and customers linked together via the feed forward flow of materials and the feedback flow of information'*.

And the second from Cooper and Ellram (1993, p13): *'An integrative philosophy to manage the total flow of a distribution channel from the supplier to the ultimate user'*.

The above definitions are perhaps good for pure supply chain management processes, but are rejected for this project as they do not allow for including any environmental element to management. The definition that would allow a connection to biodiversity (raw material extraction) and its sustainable use comes from one of the most cited definitions of a supply chain and its management by Handfield and Nichols (1999, p2): *'The supply chain encompasses all activities associated with the flow and transformation of goods from raw materials stage (extraction), through to the end user, as well as the associated information flows. Material and information flow both up and down the supply chain. Supply chain management (SCM) is the integration of these activities through improved supply chain relationships, to achieve a sustainable competitive advantage.'*

This is the definition selected and referred to when discussing supply chains throughout this thesis. The definition mentions the material and information flow both up and down a sustainable chain of supply. It includes the supplier's viewpoint and business relationship with his customer which must not be overlooked when discussing management processes. There is the potential for close partner relationships throughout the supply chain which could harness inter-company resources and add value to a product or service by increasing wide stakeholder awareness of their collective supply chain impact, risk or opportunity, on biodiversity. These factors will inform the research aim and the design of the final methodology.

Throughout this project the company which is the focus of the discussion, and is acting as a buyer of the service or product/material from a supplier, is referred to as the focal company. The term 'impact' is used throughout the project as a general term for either a positive (benefit/opportunity) or a negative (risk) impact.

4.2 SUPPLY CHAIN MANAGEMENT RESEARCH

It has been widely reported and accepted and, according to Hojung *et al* (2000), the management of company supply chains has had a positive impact on industry performance. In recent years there has been increasing interest in both practical and academic research in SCM. However, according to the work by Seuring and Goldback (2006), there are few research methodologies in this area, so far developed. Further to this, research (mainly surveys) has concentrated on first and second tier suppliers from up or down the supply chain and few studies beyond these stages have been found (Seuring, 2005).

This project conducts a number of case studies to observe the environmental management of their supply chains and decide if there is any room for including biodiversity consideration within existing systems (see Chapters 8 to 11). In terms of supply chain management research, Stuart *et al* (2002, p419) highlight the: '*powerful, influential, and useful contribution to both management practice and theory development'* that the case study approach can have.

4.3 SUPPLY CHAIN BUSINESS OVERVIEW

Recent business practice has seen many companies reducing business costs and expanding their product lines though an aggressive supply chain strategy, in attempts to strengthen their competitive performance. This has entailed sourcing low-cost materials in the world market and the forming of multi-tiered supplier networks (sometimes referred to as value chains or webs) and business processes (PWC, 2006). This outsourcing stratagem is a supply chain initiative that companies both large and small, have employed. The benefits of these initiatives are apparent, as Price-Waterhouse Cooper (2006) says, in that companies can reduce costs and enter new markets.

However, these benefits are often accompanied by greater supply chain complexity and increasing exposure to new risks, particularly in an environment where consumers are seeking more certainty over the integrity of the products and services they are buying. Businesses are, as a result of these risks, placing more effort on demonstrating that their products are 'responsibly sourced'. In order to effectively manage this situation companies need to understand the potential environmental and associated biodiversity risks which may exist within their supply chains.

It has been the larger companies which have been, on the whole, proactive throughout industry in driving biodiversity risk consideration as part of their operational management plans. This has however been, for the most part, restricted to managing their land-holdings (Section 2.4) and any wider company operations concerning the supply of raw materials or services, has been neglected. Business climates, as with biodiversity, do not remain static and old paradigms are put into question as traditional concepts of linear supply chains are giving way to more complex webs requiring dynamic relationships (PWC, 2006).

The modern business climate has evolved alongside market changes such as; liberalisation of trade; wider access to information; faster communication technologies; outsourcing prices; and more efficient transportation of goods. This has inevitably meant that many companies, in order to compete in international markets, have had to extend their activities beyond national borders. Globalisation of trade has widened procurement sourcing where individual products requiring large numbers of components can be derived from large numbers of producers, widely dispersed around the world. This situation has led to product or supply chains and any connections they may have to consumers becoming more '*complex, long and international*' (Moltke *et al*, 1998). As a result there is now a greater potential to cumulatively contribute to ecosystem stress (Chapter 2) and biodiversity loss with each additional societal and geographic link in the supply chain.

The new procurement situation has also meant that many smaller enterprises have been merged into a growing number of trans-national companies (TNCs), increasing those companies in size and influence (PWC, 2006). With influence comes the ability to affect global economic, political, environmental and social development (Kuhndt *et al*, 2004). Accordingly, as Moltke *et al* (1998, p11) found:

'*The balance between private actors and government agencies in international products chains has undergone dramatic shifts …*'

As a result, this has fogged the boundaries between the environmental and social responsibilities of government and business. It is companies, not just governments, which now are seen to have a responsibility to contribute to environmental, social and economic development of a region (Korten, 2001). Also with a wider range of stakeholders, with better access to information, taking a more active interest in company operations, along with other market pressures, (Section 6.2) drive informed, responsible, internal and external influences. These changing relationships between stakeholders, the state, society and economies have fostered new political activities (Hughes and Demetrious, 2006). This includes a broad range of diverse individuals, groups and organisations that influence business policy and corporate responsibility thinking.

For example, pressures from outside the organisation i.e. secondary stakeholders or external stakeholders (Section 6.2) are now major drivers for accountability and responsible business operations and are part of the new activist influence. The issues raised by these secondary external new activist stakeholder organisations are extending company responsibilities, away from just internal economic bottom lines, and widening their range to include suppliers, as part of the overall company (environmental) footprint (Freeman, 2007).

4.4 THE POTENTIAL CONTRIBUTION THE SUPPLY CHAIN CAN MAKE TO HALTING BIODIVERSITY LOSS

The project research has found that, any direct biodiversity impact that a company feels responsible for, is mainly concerning owned landholdings (Sections 2.4, and 7.4.1). The focal (buying) company normally regards external supplier organisations as a separate business and consequently any responsibility they attach to biodiversity impact is regarded as indirect. Although suppliers are mostly independent of the focal company they do have links through product/service related partnerships, for example, in finance, and project management. There are also non-financial collaborations associated with the product or service where environmental consideration is factored into for example, product or service design.

Focal company environmental management links with suppliers are normally required as a result of the nature of the product, level of risk, and industry regulations. For example, the chemical industry has the Registration, Evaluation and Authorisation of Chemicals (REACH, 2006), the IT industry has the Waste Electrical and Electronic Equipment (WEEE, 2002) Regulations and related electronic industry-wide Code of Conduct (EICC, 2005). This type of product or service related enforcement ensures that every supplier follows a set of audited industry criteria in order to operate within that industry. This could, but not necessarily, include an accredited environmental management system (EMS), see Chapter 5.

The changing business climate (Section 1.3.3) is forcing other areas, where business has an impact on the environment, into a new spirit of openness and transparency. A buying (or focal) company has now to be more aware of the environmental consequences of its operations. In terms of sourcing raw materials, when a company orders materials or a service from a supplier(s) there is pressure from stakeholders to demonstrate ethical responsibility and to consider any impacts which are wholly or partly associated with, and happen as a result of, the product or service being bought or supplied. For example, risks associated with the manufacturing process, the location of the supplier or raw material source.

With each organisational section of a product or service supply chain there is the potential for that company to have an impact on biodiversity. These potential impacts can be considered cumulative if they are associated with a single focal company or single product line. In practice, however, apportioning an impact to a focal company or product is difficult, when the supplier may be supplying the same materials to a number of other companies.

The potential indirect impacts, both on biodiversity and the associated company, may also be cumulative and of a greater collective significance than direct impacts, therefore assuming a greater risk and higher material value. Responsibility by shared association with a supplier (Section 4.4.1) is a material risk and in order to minimise the risk, an understanding of significant indirect causal factors and methods to reduce or avoid them, is necessary. The contribution to halting biodiversity loss through tracing a products cumulative impact in the supply chain is potentially significant, given the geographical extent of these extended company operations. Indirect as well as direct impacts will therefore be a consideration when designing the final methodology in line with the project aim.

In addition, the process of contributing to halting biodiversity loss within supply chains could form the basis of profitable new business models. These include the supply of commodities and services according to emerging standards of biodiversity-friendly production, supported by independent certification or assurance mechanisms, as well as the supply of ecosystem restoration and management services to both public and private customers.

4.4.1 Direct and Indirect Biodiversity Impact in the Supply Chain

The project author has found through experience within industry that, direct and indirect impacts, positive or negative, often have different causes and time scales, but both have the effect of changing biodiversity. Negative impacts include: habitat loss or fragmentation; stresses on fauna and flora due to pollution events or incorrect waste disposal; and genetic degradation of ecosystems and their function. Positive impacts include, habitat creation or enhancement; prevention of pollution; protecting species; development mitigation, and having regard to the genetic resource of an area.

The difference in the positive and negative impact types, from a company management point of view, is in the causal chain of events leading to impact. These include the type and scale of impact; knowledge of local ecosystems; the time scale involved; and the degree of company influence on suppliers linking to the limitations of responsibility for any impacts.

Direct impacts on biodiversity can be assessed in internal management systems and attributed to company activities. For example, protecting sites on company landholdings and reducing or avoiding potential impacts due to activities or processes. These impacts can be avoided or mitigated by environmental management system processes, demanding biodiversity protection and conservation with, for example, biodiversity action plans (BAPs), or changing high level management practice and principles.

Often less tangible indirect biodiversity impacts due to company operations may result from: design of a product; the geographical area of material extraction; supplier ethical and environmental practice; manufacture; distribution; packaging or end of life fate, and economic factors. In addition, a supplier may cause adverse biodiversity impact in its manufacture of other products which are not directly supplied to a focal company or by outsourcing to non approved companies. An example of this comes from trading between Europe and the Far East, which has brought in issues of supply chain visibility (Ridgewick, 2008). This is where a supplier may outsource components to other sub-contractors and even sub-contractors of their sub-contractors, which are unknown to the focal company. Ridgewick highlights this industrial fragmentation as an accepted business practice in many Asian industries. Further, while managing social and environmental compliance is possible with suppliers that buyers know, it fails for those that are hidden. Ridgewick (2008, p22) highlights the risks of inadequate due diligence auditing of the wider supply chain, which are:

'*In relying on the trading entity to conduct this due diligence the risk increases exponentially. In a world with powerful global brands, consumer expectations do not differentiate between products produced domestically or overseas; to them the entire supply chain is all one brand*'.

Table 4.1 gives examples put into tabular form by the author, from impacts cited by Treweek (1999) and Mulder (2007), of criteria used for the assessment of impact types. For a discussion on assessing the significance of impact types see section 4.4.2. Poor supply chain visibility emphasises a significant risk to product quality (Section 6.6.1) and corporate brand equity (Section 4.10).

Table 4.1 Criteria for Direct, Indirect and Cumulative Impact
Adapted from Treweek (1999). Mulder (2007)

IMPACT		
Direct or Primary	**Indirect or Secondary**	**Cumulative**
Habitat loss/change (incl. temporary loss)	Reduction in habitat area	Habitat 'nibbling' progressive loss and fragmentation
Habitat fragmentation /barriers	Changes in resource (food) availability. Increasing competition.	Reduced habitat diversity at landscape level (associated with reduced biodiversity at other levels)
Non-sustainable resource over-exploitation e.g. marine fishing – mono-cropping	Reduced gene flow due to Species reduction	Ongoing habitat loss at or fragmentation over time, resulting in progressive isolation and reduced gene flow. Reduced genetic diversity can result in loss of resilience to environmental change
Pollution	Habitat isolation	Irreversible loss of biodiversity through destruction of populations
Eutrophication (water bodies)	Delayed effects of above and Predator/prey relationships	Exceeding viability thresholds e.g. falling below regional carrying capacity due to progressive habitat loss
Enhancement	Cultural factors	Accumulation of all levels of significance impacts
Increase/decrease	Nutrient loading - farming	-
Mitigate	Cross-sector impacts	Long supply chains
Temporary loss	Unsustainable business Practice – supply chain logistics – non-local buying	Unsustainable business Practice – supply chain logistics – non-local buying.
Invasive species	**Associated**	**Synergistic**
Ecosystem loss	Combined effects of operations e.g. similar impacts over company group operations	Toxic effects of cocktails of pollutants reducing viability of individuals or affect breeding success of whole populations
Soil erosion / compaction	Climate change resilience local, wider regulation	-
Disturbance		

It is not only adverse risk but the potential lost opportunity through poor supplier visibility that could entail a cumulative positive effect throughout the supply chain and help strengthen the industries reputation and, offer potential for organisations to differentiate within sector. This situation further exemplifies the need for a business model which allows managers to assess their impacts on biodiversity and associated risks to a company's long-term trading operations. Table 4.1 will inform the final list of these impact types within the final methodology.

4.4.2 Significance of Risk or Opportunity

In section 2.4.1 Simms (2006) advocated a risk based approach to sustainable procurement and work by Whitelaw (2004) had also mentioned the concept of significance of risk as a fundamental part of an environmental management system. The level of risk or opportunity attached to a product and its suppliers will be a essential consideration in the final methodology. The Institute of Risk Management definition of risk is taken from ISO/IEC Guide 73, that is, '*the combination of probability of an event and its consequences*' (IRM, 2002, p2). Assessments of significance of the risk or opportunity that issues of biodiversity impact may pose to a focal company through its supply chain take into account impact magnitude and the sensitivity and value of receptors (Morris *et al*, 2000, p235) and the industrial sector(s), and therefore, the product, service or material being sourced. These business operating criteria will influence the scope and degree of impact with respect to the components and levels of biodiversity, as outlined in section 3.2. The ISO 14001 standard (Whitelaw, 2004, p5) defines an environmental impact as: '*any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's activities, products or services'*.

Examples (summarised from this research project) of significance of risk in the supply chain are based on the level of:

a) Sensitivity of ecosystem and biodiversity elements to material sourcing and supply in extended (external) company operations
    - Direct, indirect, permanent, temporary, or cumulative impact
b) Negative or positive impact
    - Risk or opportunity
c) Transport logistics from geographical location of material source (distance from focal company and sensitivity of biodiversity both within material sourcing area and throughout transport).
d) Associated material business risk to company reputation, brand image or security of supply

In assessing significance of risk to both biodiversity and business at the strategic management stage accurate information is needed in order to trace the product supply chain cycle. In the case of an accredited environmental management system process, the initial environmental review (IER), at the planning stage, would identify any significant biodiversity aspects associated with the product supply chain (Chapter 5).
With precise information on potential biodiversity impacts at each stage in the procurement process, the likely significant impacts on biodiversity aspects can be estimated and appropriate management of the impact made. The level of significance and the risk attached to products will vary and so need to be assessed in context. In addition to the above basic criterion of significance, other criteria would also be

considered within all product procurement processes, for example (summarised from various sources):

e) *Legislative compliance - Regulations and Directives attached to the product or service, location, or industrial sector.*
f) *Environmental standards attached to the product, service or industrial sector.*
g) *Availability (rarity) of material being sourced.*
h) *Impact on local/indigenous communities.*
i) *Supplier's geographical distance from or location within, a protected area of conservation, protected species or habitats.*
j) *Local country regulations and compliance.*
k) *Consultation with local biodiversity related groups.*
l) *Consultation with other relevant stakeholder groups.*

There are a number of methods for assessing significance of risk, such as the 4 key stage approach used by the US Environmental Protection Agency (EPA, 2007). The EPA method is essentially the same as the one advocated by the British Standards Institute (BSi) (Smith and Green, 2006) where they also use a 4 stage process. Both methods can be adapted for biodiversity consideration by substituting the word 'environmental' with the word biodiversity. The BSi 4 stages (if adapted for biodiversity) are: (Adapted from Smith and Green (2005) p 48)

1. *'Selecting an activity, a product or service.*
2. *Identifying any* biodiversity *aspects associated with the selected activity, product or service.*
3. *Identifying any actual and potential, positive and negative,* biodiversity *impacts associated with each identified* biodiversity *aspect.*
4. *Evaluating the significance of each identified* biodiversity *aspect'.*

As the BSi states, the ISO 14001 Standard does not describe any method for identifying environmental (or biodiversity) aspects, or for assessing the associated significance of risk(s) or impact(s). It is left to the organisation in question to select or devise their standard or bespoke method. The significance of risk is often relative to organisations and locations.

A significant impact on biodiversity to one company can be of less importance to another. In general terms, the evaluation of significance is a judgment which involves the consideration of both biodiversity and business issues (Smith and Green, 2006). Examples given by Smith and Green (p59) of environmental impact significance are summarised as:

- *'the likely scale of the impact;*
- *the likely severity of impact;*
- *the probability of occurrence;*
- *the likely duration of the impact'.*

In addition, the business significance assessment should include (Smith and Green, 2006, pp59-60):

- *'potential regulatory and legal exposure;*
- *degree of difficulty in changing the impact;*
- *the likely cost of changing the impact;*
- *the effect of change on other activities or processes;*
- *the concerns of interested parties;*
- *the effect on the public image of the organisation'.*

An assessment of significance is given by Roberts and Robinson (1998), who have designed a severity rating list, shown in Table 4.2. The list can be adapted for biodiversity issues.

Table 4.2 Severity Rating List
(Roberts and Robinson, 1998, p91)

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The method forms part of an environmental impact and significance matrix. The matrix process describes the environmental aspect and identifies the impact type (e.g. direct, indirect). An impact value is ascribed to each environmental aspect identified by answering a list of 5 questions and giving a value of 1 for a yes, and 0 for a no answer. The 5 questions are (from Roberts and Robinson, 1998, p91):

1. *'Is the aspect associated with any legislation, regulations, authorisations or industry codes of practice? Or the use of hazardous, restricted or special substances?*
2. *Is the aspect of concern to stakeholders?*

3. *Is the aspect or impact clearly associated with any serious global environmental issues? (e.g. Loss of biodiversity, climate)*
4. *If the aspect is quantifiable, is the amount of use significant?*
5. *Is the amount or frequency of use significant?'.*

The next stage classifies an environmental aspect by assigning a perceived severity rating value (1 – 5) to the impact. The rating value should reflect the effect that the aspect has or could have if uncontrolled. Half values can be assigned to an impact severity value, e.g. 3.5 when an impact is more than a moderate concern but less than a serious impact. An indication of the level of significance of the aspect is then calculated by multiplying the impact and severity values. For example, if an environmental aspect answered 'yes' to questions 1, 2, and 3, and 'no' to questions 4 and 5, the impact value is 3. The severity of the impact is rated at 4, therefore, the significance level of the impact is (3 x 4) 12 (Roberts and Robinson, 1998).

The simplest form of risk assessment is a matrix where the level of risk is determined by combining the results of hazard and consequence analysis, as shown in the example from Morris and Therival (2001) given in Table 4.3.

Table 4.3 Potential Risk Level and Likelihood of Occurrence
(Morris and Therival, 2001, p357)

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Matrices can be designed to be simple or complex depending on the level of assessment required. One approach to assessing significance, which offers a more direct link to biodiversity aspects in general, are the Institute of Ecology and Environmental Management (IEEM) 'Guidelines for Ecological Impact in the United Kingdom' IEEM (2006). The IEEM Guidelines are geared to assessing company or project landholdings in the form of an ecological impact assessment (EcIA), but there is scope for adapting the guidelines to supply chain biodiversity impact. Levels of significance can be tailored to specific company operations and products, and therefore the IEEM guidelines serve as an example framework to illustrate a possible generic route to determining significance of risk.

The 2006 IEEM Guidelines define a significant impact as *'an impact on the integrity of a defined site or ecosystem and/or the conservation status of habitats or species within a given geographical area'* (IEEM, 206, p8, item1.23}. A typical biodiversity assessment of a company site will involve a field survey which entails collecting ecological data for the site and the adjacent habitats. The ecological features are evaluated in terms of their nature conservation value using the criteria set out in the 2006 IEEM Guidelines.

The value of an ecological resource can be determined, by the UK Department of the Environment, Transport and Regions (DETR) guidelines, within a defined geographical context. The following frame of reference is used: International; National; Regional; County; District; Local; and, Within Zone of Influence (e.g. company site or immediate area). Using this geographical context the value of habitats or species can be assessed using the criteria outlined and adapted in tabular form (Table 4.4). Once the value of an ecological resource has been determined the significance of the effect on the resource can be assessed.

Table 4.4 Guidance on Determining the Nature Conservation Value of Features
(Adapted from DETR, 1998, Ch 6., DETR, 2004, p4)

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With respect to the assignment of a value for habitats and species within the company site, the IEEM guidelines state that tabulated (fixed indications) boundaries between different habitats become difficult to define with precision (IEEM, 2006, p20, item 3.5). This is due to the range of factors influencing the definition of value e.g. habitat quality, geographic location, size of species populations etc. Thus the guidelines suggest an approach involving professional judgement based on available guidance and information and expert advice. The above generic criteria is used in ecological impact assessment (EcIA) where, following collation of the ecological baseline information, the likely effects of a proposed development are assessed, based on the existing knowledge of the design and against the criteria provided in Table 4.6.

The significance of an adverse effect (or a beneficial result) is the product of the magnitude of the effect and the value (Table 4.4) or sensitivity of the ecological feature affected (IEEM, 2006). High levels of significance are generally ascribed to large effects on features of high nature conservation value. Low levels of significance are ascribed to small effects (impact) on features of high nature conservation value or large effects on features of lower nature conservation value as shown in the significance matrix in Table 4.5.

Table 4.5 Significance Matrix (Adapted from IEEM, 2006, p30)

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The assessment of the potential effects of a proposed development takes into account both on-site and off-site effects, such as those that may occur on adjacent areas of ecological value. Effects can be permanent or temporary and can include direct loss of wildlife habitats, fragmentation and isolations of habitats, disturbance to species, changes to key features and changes to the local hydrology and/or water quality (IEEM, 2006). The effects can be either beneficial, where there is an advantageous or positive effect on the environmental resource or receptor, or adverse, where there is a detrimental or negative effect on the environmental resource or receptor. Using the magnitude of effect terms outlined above and in Table 4.5, the criteria adapted and presented in Table 4.6 is used to assess the significance of adverse and beneficial effects on ecological resources or receptors.

Table 4.6 Likely Significant Effects Criteria
(Adapted from: DETR, 2004, p5)

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.The IEEM and DETR Guidelines are based on an understanding of the legal requirements of the relevant legislation. As such, they concentrate on legal compliance of development projects affecting designated sites of conservation interest. The guidelines recognise that there are various criteria used for determining significance and decisions are often subjective (IEEM, 2006). The aim of the guidelines is to present a level playing field for assessors in determining whether an impact is significant and to minimise any subjectivity.

The guidelines, as presented by the IEEM, are best utilised for company landholdings. The guidelines could be adapted and tailored to specific company requirements and extended to be used in each company in a product supply chain. The emphasis here is to provide a level business playing field for all suppliers in a chain or network. The correlated results, using the existing guidelines, would give an indication of the cumulative biodiversity impact of company landholdings in a supply chain, if they were associated with sites of national or international importance.

An example is given in tabular form designed by the author (Table 4.7) where individual supplier effects (marked and selected at random with an 'X') on conservation status areas, using Table 4.6 for significance ratings, can be examined in the context of the whole product chain, and an assessment of the cumulative supply chain impact on biodiversity made, with an additional assessment of the associated corporate responsibility risk.

Table 4.7 Method for Assessing the Cumulative Impact of Conservation Status Areas in the Supply Chain

Effect	Supplier												Cumulative impact score	Potential CR Risk /Benefit
	1	2	3	4	5	6	7	8	9	10	11	12		
Major adverse	x								x				2	High
Moderate adverse			x						x				2	Medium
Minor adverse	x	x				x					x	x	5	Low
Negligible (adverse)					x		x	x		x			4	Low
Major beneficial				x	x						x		3	High
Moderate beneficial		x				x							2	Medium
Minor beneficial	x				x						x		3	Low
Total cumulative impact over 12 suppliers													9 adverse	
(Maximum score for each effect is 12)													8 beneficial	
Target - zero adverse													3 negligible	

In the example shown in Table 4.7, the Major Adverse category would require immediate combined management action from the buyer and supply company in question. Following this the next significant impact (Moderate Adverse) would be targeted for action. The overall aim would be to reduce the cumulative impact of the product supply chain to zero and increase the beneficial impacts to the number of suppliers in a chain (in this case 12). Potential CR risk and business risk categories are also shown, using the AstraZeneca (AZ) model in Table 10.5.

In many cases within industry, the assessment of risk both to biodiversity and to the business can be entirely subjective and depend on a manager(s) interpretation of the situation. For example, the red, amber, green (RAG) rating used by AZ (Section 10.5.2) is not specifically used to assess the risk to or from biodiversity impact. The RAG evaluation is largely subjective in that it relies on the value judgement of the buyer. In terms of assigning risk or opportunity to biodiversity issues some sort of criteria is needed to make the results more objective, make predictions with more confidence, and to present a level playing field to all suppliers. The degree of confidence in assessing impact significance and the limitations to certainty should be made clear (IEEM, 2006, p32).

However, as discussed in section 3.4, biodiversity is not only about areas of significant conservation status. The cumulative impacts (often indirect) associated with areas affected by a company that are deemed 'less significant', are often not accounted for. Conservation status areas are used as an example for illustrating the significance level of impact, in practice any rationale or scoring method would be tailored to the situation and also allow for non-designated areas (refer to Kirby, 2005, in section 3.4). Nonetheless, the potential impacts on conservation status areas through company landholdings should be taken into account within the overall supply chain biodiversity assessment. Therefore all natural ecosystems will be accommodated in the final model although it is accepted that designated areas have more tangible value to business.

The IEEM state in their guidelines chapter 4, item 4.12, that a qualitative description of an impact on ecological structure may be adequate, but an '*objectively defined scale according to a stated convention is more helpful'*. Further, a defined scale can be used '*even if the decision as to confidence level is only based on expert judgement, rather than frequency data, as long as this limitation is stated'* (p32). The IEEM, as an example which could be used, cite a confidence scale for ecological impact assessment of *Certain, Probable*, and *Unlikely* (p32). Another example of scales that could be used is, as the IEEM Guidelines state (IEEM, 2006, p32), '*based on the 5% confidence level conventionally used as the lowest limit for acceptable statistical significance in common scientific practice, a four-point scale that could be usefully employed is'*:

- *'Certain/near-certain: probability estimated at 95% chance or higher.*
- *Probable: probability estimated above 50% but below 95%.*
- *Unlikely: probability estimated above 5% but less than 50%.*
- *Extremely Unlikely: probability estimated at less than 5%'.*

With respect to the supply chain the confidence scale used as examples in the IEEM guidelines are now included with the rationale and risk levels and given a significance of risk score. This is done in order to quantify the level of risk assigned to individual suppliers (rather than just assigning an X to a supplier as in Table 4.7) and to sum the cumulative risk throughout a product supply chain. The scores (Table 4.8) given the range (after Saaty, 1980, p127) from 0 to 9: 0 – to signify a percentage level of significance confidence (IEEM, 2006, permission given, Tasker, 2009, *pers comm*) below 5% level; 3 – to signify a level between 5 and 50%; 5 – for a level between 50 and 95% and; 9 – for a level above 95% probability/certainty.

Table 4.8 Evidence of Environmental Impact - Scoring Method
(After Saaty (1980, p127) and adapted from IEEM, 2006, p32)

SCORE	RATIONALE	RISK
9	Systematic evidence of environmental impact – Certain/near-Certain	Estimated at 95% chance or higher - Significant
5	Good evidence of environmental impact - Probable	Probability estimated above 50% but below 95% - High
3	Some evidence of environmental impact – Unlikely	Probability estimated above 5% but less than 50% - Low/Medium Risk
0	No evidence of environmental impact – Extremely Unlikely	Probability estimated at less than 5% - Low Risk

The scores assigned to the rationale and level of risk given in Table 4.8 are now further adapted (by this project) specifically for business and biodiversity aspects. The modified Table 4.9 uses the same rationale, but in addition to scoring risk, the table gives a business opportunity score assigned to each level of biodiversity impact, based on the evidence obtained. Now termed the 'business and biodiversity (BB) risk score' any adverse impacts are now assigned a minus (-) number. The minus number has been chosen in order to differentiate the adverse impacts from the beneficial impacts.

This risk based approach was designed for road schemes by the then Department for Transport and Regions (DTR) (now the Department of the Environment, Transport and the Regions (DETR)) but can be adapted for use in other projects (Morris *et al*, 2000, p237).

Table 4.9 Business and Biodiversity (BB) Opportunity and Risk
(Adapted from IEEM, 2006, p32., DETR, 2000, Ch 6.57)

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The minus number has the additional advantage of conveying a negative or adverse impact to business managers. Any beneficial impacts are given a positive number which this time conveys a beneficial impact to the reader. An additional 'N' row has been added in order to account for the situation where no information is available or can be obtained from the supplier, as found during the AstraZeneca case study (chapter 10). The uncertainty attached to this 'N' score should attract a similar management response to the major adverse impact, until more information is obtained from the supply company in question.

The management objectives when using Table 4.9 would be to reduce the minus numbers to zero/positive both for an individual supply company and for the cumulative effects of a number of suppliers. Conversely managers would aim to increase the positive beneficial score according to the number of suppliers in a chain. The research into significance of risk assessment levels has determined that the BB risk scoring method outlined in Table 4.9 will now be used to demonstrate the degree of potential single and cumulative impacts in the supply chain, and as such will inform the final methodology.

4.5 ATTITUDES OF COMPANIES AND SUPPLIERS TO BIODIVERSITY

The literature research found that biodiversity consideration varies between industrial sectors. As would be expected, companies with a direct business interest in natural resource supply or industries listed in the F&C Asset Management high and medium biodiversity impact risk by sector list (F&C, 2004, see Section 7.3), such as, food (farming), timber products, and the retail sector involving pharmaceuticals, have been more pro-active in this area.

Most companies are themselves part of a supply chain and every company will have an impact on the environment and hence biodiversity to some extent. It follows that companies should consider methods of managing and reporting the opportunities available in understanding these impacts. However, the reality is that despite the urgency surrounding the situation (Section 1.3), as McCarthy (2007, *pers comm*) say's:

'*Biodiversity is a compliance issue and generally not a priority for business management'*.

One explanation that contributes to this attitude is the confusing nature of the idea of biodiversity as it is presented to business, by science, as discussed in section 1.3.1. The language of ecologists and conservationists used in definitions of biodiversity does not always convey an understanding to a wider business audience.

The Convention on Biodiversity (CBD), for example, offers a rather esoteric definition (Section 1.3.1). The CBD definition satisfies a target audience where direct biodiversity risk and opportunity forms part of its landholding and management operations, such as the utilities, mineral extraction, oil and gas sectors and the leisure industry. Such definitions elicit a confusing response, however, if offered to a non-specialist from a sector with no apparent impact on biodiversity, or to procurement department managers, whose 'horizon thinking' does not perhaps extend beyond a good (short-term) performance related bonus package.

The question often asked during this project, by business managers, is 'what is biodiversity'? The answer to the question, given in this business situation, would depend on how the question is likely to be understood by the questioner. It is the social context in which the enquiry is made that will guide the understanding of the description. The answer expected from most business managers to the question 'what is biodiversity', is not science based, but commercial based. The real question they are asking is 'what risk or opportunity does biodiversity present to my business'.

One business orientated answer to the above question is given by LGE (2007, p1) where they state that biodiversity can be considered as the life insurance for our changing world, and further, biodiversity is an option value for the future.

LGE (2007, p1) back up their statement with: '*Biodiversity deserves to be considered and protected to enable, ecosystems and their capacity to develop in their own sustainable way, to provide humans with the products and services which enable its own development'*.

The introduction of the human involvement and the link to long-term business survival provides business with a basis for understanding the commercial reasons for considering biodiversity.

4.5.1 Smaller Enterprises

Counter to the need to understand the situation, companies that do not see biodiversity as a business risk cite that their main priority is to stay in business. This ignoring of biodiversity degradation has been experienced within the project case studies and meetings with company managers, who's reluctance to change is allied to feelings of job or market uncertainty, particularly within top management. This position is particularly prevalent in the majority of small companies who see no incentive to consider their environmental responsibility (Thankappen *et al*, 2004) or have such a small impact they see voluntary environmental reporting as a low priority (Defra, 2006). This view is reinforced by Preuss (2005) as he found the tendency was for SMEs to be less active in environmental matters than larger companies.

The ignorance surrounding biodiversity is an obstacle, as outsourcing becomes more common, which companies with large supply chains will have to address as their potential impact on biodiversity goes beyond immediate suppliers, and often influences more distant ones in the global theatre. Lack of environmental knowledge, and often a poor understanding of biodiversity loss in relation to risks to the business, leads to biodiversity impacts in supply chains being ignored, despite evidence that ecosystem degradation may severely affect long-term shareholder value (F&C, 2004). The risk of taking this stance is not realizing their possible vulnerability to reputation from invisible resource impacts (Ends, 2004). Lack of knowledge of the subject is the area where education will play an important part in changing attitudes and this is discussed further in section 6.5.4.

The smaller the enterprise often means that fewer resources are available for dealing with environmental responsibilities and in reducing the cumulative biodiversity impact potential risk to their business. Supply chain companies are invariably small to medium sized enterprises (SMEs), for example, these companies make up 99% of the three million businesses in the UK, of these '94% do not believe they have an impact on the environment' (EA, 2004). Thankappen *et al* (2004, p2) found it is often the litigation threat posed from non-compliance to legislative and regulatory regimes that is likely to drive environmental initiatives and although concern by management on environmental issues may be voiced, the majority of SMEs '*do relatively little in practice*'.

Perhaps part of the reason for this situation is the high degree of skepticism within industry and a lack of suitable business models that fuels the disinclination to be pro-active on environmental sustainable development issues (Ethical Performance, 2005). An increasing number of companies, however, are investigating various management methods that will enable them to anticipate surprises and identify potential events that may affect earnings, for example, the Enterprise Risk Management (ERM) Framework (Scott, 2005). Negative attitudes are becoming more of a risk to business than in the past however, with environmental regulation compliance having to be demonstrated, as the UK Environment Agency indicated as early as 2005, with their chief executive announcing that SMEs should '*expect special attention this year*' (Mills, 2005, p32). The project has found, through the case studies (Chapters 9 to 11) and discussions with business managers, that it is often lack of easily available information on biodiversity issues that holds back its consideration. There is guidance material available but specific information tailored to organisation operations is difficult to find particularly for biodiversity related issues. These findings support the need in the final methodology for a biodiversity information file for suppliers, found in previous chapters.

4.6 EXAMPLES OF GENERAL GUIDANCE MATERIAL OFFERED TO SMEs

The following examples of guidance material (also refer to Section 6.5.2) available to organisations include, to varying degrees, a reference to biodiversity aspects, but not specifically in the supply chain. They have been included to illustrate the current available frameworks that could potentially introduce more detailed biodiversity issues in the supply chain as part of the existing guidelines in the future.

Williamson and Lynch–Wood (2005) refer to work by Hutchinson and Hutchinson (1997) and Murphy and Bendell (1997) which indicated that there is a choice of guidance material developed to assist SMEs in making environmental improvements. According to their research however, they generally do not offer help or support in how to apply the information in, for example, such areas as environmental legislative compliance, or where to get financial support (two areas of prime concern for SMEs).

For a more specific guide to supply chains and sustainable procurement the NGO Forum for the Future (FtF, 2007) has produced a toolkit to help business. The toolkit is in Excel system format and first examines the need for the product, and then the selected product's likely current impacts are listed. An action plan is proposed where biodiversity is covered with the heading – protecting habitats and biodiversity. Current impacts are given criteria of magnitude; probability and; significance. Under these criteria there are ratings of high; moderate; and low. The criteria for supplier selection pose the questions on details of the approach to ensuring that products are not sourced from protected natural areas e.g. legally logged timber; organic farmed food; chain of custody and; reward suppliers for extra conservation measures (FtF, 2007). General examples of biodiversity impact are given but no specific guidance on significance of the risks to biodiversity or to business. Links to guidelines will form part of the information file for suppliers in the final methodology.

4.7 DRIVERS INFLUENCING CHANGE IN SUPPLY CHAIN MANAGEMENT

The criteria that are the main drivers for any move to consider a company's environmental impact seem not to be primarily legislative or voluntary standards, as has been suggested in section 4.5.1, but more directly related to the economic area of the bottom line. This argument seems counter to the adoption of standards being a result of regulatory pressures, as Khanna and Anton (2002) propose, but holds with the potential of competitive advantage and pacifying stakeholders being the drivers for quality environmental management and reporting (see Chapter 7 for more discussion in this area).

The above arguments also apply to supply chain management where the same internal barriers need to be overcome to get management to buy into sustainable procurement. Research by Morton (2004) outlined the main obstacles, which were: senior management, finance directors, budget holders, internal customers/specifiers, users of products and services and, interestingly enough, the environmental manager, if appointed. See section 8.9 for further discussion in this area.

Work by Morton (2004) has found that the majority of owners, directors, and managers, particularly in smaller supply chain enterprises, will look to general environmental issues concerning their companies only if it affects corporate objectives. It could be taken from this that protecting biodiversity would be off their radar altogether. The latter attitude is invariably related to the difficulty business managers have in finding relevant information on biodiversity, which has been a recurrent question by business managers throughout this project.

The general attitude stated above also seems true in the wider geographical context with, for example, the new EU accession countries of Eastern Europe, where a study by Hewlett-Packard (2008) found a low awareness of social and environmental responsibility. SMEs were found to have little or no proactive engagement with social and environmental initiatives, did not go beyond compliance or have strategic environmental plans (Andersen and Skovgaard, 2008). A study by Holt (2005) of a cross-sectorial sample of UK businesses identified internal environmental attitude as a key driver, and again there was some indication the size of the company was an influence in considering environmental issues with legislative drivers a close second. Company size, as a factor, is supported by a MORI poll (2004) which found that Employees of large companies (500 + employees) are more likely to think companies should consider environmental issues across the board, compared to those working in small companies (less than 20 employees). See Holt *et al* (2005) for further reference to work regarding attitude and performance in the supply chain.

Work by Crotty (*pers comm*, 2005), in the automotive industry, further confused the issue by suggesting that managers view environmental regulation as either something:

'*that does not impact them, or that requires no effort on their part to determine its impact, or is the responsibility of others such as government or customers – to communicate to them.'*

The Hewlett-Packard study (2008) emphasised the importance of key personnel in multi-national companies (MNC) being committed to the environmental performance of their first tier suppliers. For example, if the first tier account manager does not attach much importance to environmental issues they will not encourage his SME suppliers on these issues. The study found it was crucial therefore for the 'first' company in the chain to send the right signals to its direct suppliers (Andersen and Skovgaard, 2008).

The Business community however does have champions with clear values and commitment who are looking to lead their companies in a long-term sustainable direction (Ethical Performance, 2005). Champions who will lead business away from an undercurrent often circulating in industry of, as Orr (2005, p1321) put it, that 'human kind cannot *afford* to survive', relating to short-term costs of sustainable development.

It is worth noting that from April 2006 it was proposed by the EU that stock market listed companies be required to disclose, alongside a business review, important environmental issues affecting their businesses (EA, 2005). However, due to successful lobbying by the CBI and others (Cobbett, 2006), from 12 January 2006 the requirement to produce a statutory Operating and Financial Review (OFR) will be removed by the Companies Act 1985 (Repeal) Regulations 2005 [S.I. 2005/3442] - a triumph for short-termism and a disappointment for corporate social responsibility {CSR}advocates (ibid). The new requirement to include a business review in the Directors' Report remains. The Government believes that the central requirements of the business review are largely the same as those of the statutory OFR, and has therefore decided to recalibrate reporting requirements and remove the obligation to produce a mandatory OFR (Directors' Report, 2005). This is a blow to transparent CSR reporting and the need to audit supply chains or give assurance, and in demonstrating as Cobbett (2006, p16) say's: '*..they* [companies] *do not damage ecosystems and for everything* [raw materials] *taken out there is a compensating input',* that is, sustainable business practice.

Despite set-backs the interrelationship of company objectives with social and environmental ones, the idea of corporate social responsibility (CSR), is gaining momentum with business recognising it has a responsibility to a wide group (Section 6.2) of stakeholders (Mylrea, 2005., MEA, 2005). This is also the area of socio economic/political/ethical issues to do with globalisation, north/south, rich/poor divides (Ehrenfeld, 2005), all with fundamental links to biodiversity. The aim should be to make industry sensible of the distinctions, as Pearce and Moran (1994, p18) pointed out, between proximate causes of biodiversity loss, that is, habitat loss or pollution events, and the fundamental causes behind them such as economic, institutional and social factors, as mentioned in section 1.3.3.

This is the neighbourhood of the *social bottom line* where a wider stakeholder influence, away from just the shareholder, is considered. CSR has its critics however, with Porritt (2005, p32) warning of the dangers that it could be utilised as: '*…profitable business as usual, plus as much of the green and social 'stuff' that does not conflict with that priority'.* Companies often miss the mark though, as CSR can add economic assets through social value in seemingly contradictory ways, for example, through supply chain procurement policy, staff training, employment practices acting beyond mandated employment law, investment in innovation and so on (Porritt, 2005). CSR (see Chapter 6) is undoubtedly another business marketing tool to control environmental agendas, however, these intangible assets could be the ‘soft underbelly’ of business management, allowing biodiversity issues a foot in the boardroom door.

Attitudes of companies are beginning, and are having, to change with the focus not just on the economic *raison d’etre* but expanding into areas concerning the environmental and social implications of business. On this theme, Henriques and Richardson (2004, p150) maintain there are two kinds of approach to sustainability, that is, a top-down and an inside-out approach. The top-down approach emphasises management and control through measurement, where the system knows what has been done but it may not be enough, and the system may not allow more to be done. Environmental management systems, operating within the current paradigm, that do not do enough for the environment but do it with the ‘utmost care’, fall into this category.

Henriques and Richardson (2004) advocate the inside-out approach, which looks beyond current paradigms and considers partnerships with outside suppliers and other stakeholders, promoting innovations, new systems and methods. They point out however that creative processes come with risk and uncertainty as companies move out of the comfort zone of the old paradigms, this area is discussed further in section 8.9. The area of this innovative sustainable business climate gave Elkington (1994) the motive to articulate new social and environmental pressures and agendas on business, when he coined the term ‘the triple bottom line’ (TBL) and later the 3 Ps of ‘People, Planet and Profits’.

4.8 ECONOMIC VALUE OF ECOSYSTEMS AND BIODIVERSITY

The problem facing business is the difficulty of placing an economic value on public goods that have no price, such as biodiversity. The value of nature, as Suhkdev (2008, p4) states,

‘*..bypasses markets, escapes pricing and defies valuation. This lack of valuation is, we are discovering, an underlying cause for the observed degradation of ecosystems and the loss of biodiversity’*.

The human perspective valuation of biodiversity is a 'work in progress', with the European Commission (Environment) and the Federal German Government (Environment) initiating a study on The Economics of Ecosystems and Biodiversity.(TEEB). Coming out of discussions at the G8+5 environment meeting in Potsdam in 2007, and inspired by the momentum for early action and policy change created by the *Stern Review of the Economics of Climate Change* (Stern, 2006), the need was expressed to explore a similar project on the economics of the loss of ecosystems and biodiversity. The resulting joint initiative aimed to draw attention to the global economic benefits of biodiversity and the costs of biodiversity loss and ecosystem degradation (Dimas and Gabriel, 2008).

Phase 1 of the initiative, presented at COP9 (2008), has looked at different approaches to solving this problem, such as, policies to reward preservation of the flow of these public goods, and encouraging compliance markets which attach tradable values to the use of ecosystem services. Payments for ecosystem services (PES) can create demand and correct imbalances which harm biodiversity and impede sustainable development (Demas and Gabriel, 2008).

Phase II, currently in progress, will examine the investment case for PES, but also for other new and innovative instruments. The initiative will aim to encourage more new markets for supporting and rewarding the sustainable use of biodiversity and ecosystem services. It will re-examine the past exclusive responsibility placed on the state for managing ecosystems and exploit the new paradigm of market led involvement and the contribution from business. Dimas and Gabriel (2008, p10) pointed out the need for:

'Countries, companies and individuals to understand the real costs of using the Earth's natural capital and the consequences that policies and actions, individual or collective, have on the resilience and sustainability of natural ecosystems'.

Phase 11 of this initiate will drive change in biodiversity management by publicising organisations efforts in redefining company environmental performance metrics and reporting standards. The intention is to evolve valuation guidance on organisations use of natural capital. Including the cumulative impacts and assessing the risks and opportunities throughout supply chains would be a powerful aid to both halting biodiversity loss and maintaining individual company reputation. A paper was submitted (call for contributions) to the TEEB Report Phase II Outline D3 – Report for Business and Industry by the author and the biodiversity project manager at AstraZeneca (UK) to add emphasis to the value of the supply chain in halting biodiversity loss (Whatling *et al*, 2009).

For additional information on valuing ecosystem services see Defra (2007) – An introductory guide to valuing ecosystem services; a review on the economics of biodiversity loss – phase 1 (scoping) economic analysis and synthesis, final draft report (Markandya *et al* (2006); Defra (2006) Valuing our natural environment – final report. Refer to Appendix 1 for selected information taken from the above references.

4.9 THE BUSINESS VIEW

A cross-section of the business community comprising of large international and national companies as well as SMEs (reflecting varying requirements and impacts on ecosystem services) responded to the Millennium Ecosystem Assessment (MA) (2005) - on the present position and state of ecosystem services. The following common themes relating to moves towards more sustainable operations emerged from the MA meeting.

Major companies realise that survival in the long-term depends on considering a wide range of stakeholder interest and involvement and competitive advantage can be gained through differentiation within a sector (MA, 2005, p1). It was thought important to develop strong mutual relationships, with external operations encouraging voluntary commitment to processes and actions, verified externally, that help deliver better environmental and social outcomes. In addition, companies committed to voluntary action could work strategically with stakeholders and influence public policy development, thereby improving industry performance, and finally commitment to transparency and accountability (MA, 2005, p1).

The cross-sectorial businesses represented in the MA study included the agri-business, mining, oil and gas, energy/utilities, forestry, and tourism. From this list agri-business is taken as an example of common business concerns and also because the nature of agri-business has resulted in major impacts on ecosystems globally. Intensive methods have degraded marginal and fragile ecosystems in particular. This situation remains with, projected demands on ecosystem services set to double in coming years (MA, 2005).

A summary given by the MA (2005, p3) of the business environmental/biodiversity impact on agri-business includes (in no particular order):

- *'Licence to operate – public driven concern over ecosystem damage instigates new national/international law and regulations;*
- *Reputation and brand-risk – consumer concerns increasing pressure for less intensive and less toxic chemical methods;*
- *Cost of capital and perceived investor risk – confidence in the long-term viability of companies;*
- *Access to raw materials – access to ecosystem services could be restricted, for example, fishery restrictions due to fishing (catch) overtake;*
- *Operational impacts and efficiencies – reduction of impact footprint by business and customers by reducing, for example, waste or recycling'.*

The other industries represented cited the following common themes for a sustainable approach to business MA, 2005, pp7 – 9):

- *'Reputation and brand risk;*
- *Access to raw materials;*
- *New business opportunities and partnerships;*
- *Operational impacts and efficiencies'.*

These results from the MA 2005 report are now compared with the general business case for sustainable procurement. The findings are taken from the author attending a sustainable procurement workshop (Who's pulling your supply chain) held in London in May 2005 by Business in the Environment (BitE, 2005), Manchester University Business School and The Chartered Institute of Purchasing and Supply (CIPS). The aim was to explore what criteria influence environmental and procurement managers to consider their environmental responsibilities. The delegates from a large cross section of industry from insurance to defence gave a number of reasons to apply sustainable procurement practices which are summarised below by the author from written notes from the BitE, 2005 event:

- *'Reputation – enhancing and protecting reputation which then links to share price and as a marketing tool – potential to build areas of brand around achievements. However they recognised the potential risk of 'sticking your head above the parapet';*

- *cost savings – packaging, waste not going to land-fill and a reduction in energy and remediation costs;*
- *legislation – reduction of risk and the ability to pre-empt legislation;*
- *finite resources – protecting the long-term value of the business;*
- *consumers – raising awareness;*
- *employees – attracting and retaining staff;*
- *borrowing money – improved status;*
- *increased sales opportunities and the ability to differentiate from competitors.*
    - *In response to the questions concerning biodiversity, the lack of available information on the business effects of biodiversity issues was cited as a main obstacle to consideration'.*

The lack of information on biodiversity has informed the research and a platform for easy access to relevant information will form part of the final methodology process. Information to provide well informed management decisions is part of the overall education process of industry and its employees. The issue of educating employees on the subject area is discussed in section 6.5.3.

Reasons concerning employee satisfaction tie in with a MORI poll undertaken in 2004. The Mori poll concluded that responsibility issues are important to employees, and initiatives can have a positive impact, and employees are seen as influential by other stakeholders. In addition, employees generally want to hear about their company's activities (MORI, 2004). However, there was no direct mention of biodiversity in the poll. The above business cases for sustainable procurement were similar to the general business case for incorporating sustainable procurement into corporate management compiled by the Strategic Supply Chain Group (SSCF, 2005) and endorsed by Business in the Environment (BitE, 2005).

The author attended a sustainable supply workshop held in Bath University in November 2005 by the Bath University School of Management; the Centre for Research in Strategic Purchasing and Supply (CRiSPS); the International Purchasing and Supply Education and Research Association (IPSERA) and; the NHS Purchasing and Supply Agency (PASA) concluded with a number of stated 'burning issues', summarised from the author's notes below:

- '*Competing objectives* between – value for money, competition, corporate and economic performance, efficiency agenda, incentivisation, manage and measure.
- *Public vs. private sector* – duplicity of concerns, differing pressures and approaches, can the public sector learn from the private sector?

- *Sustainability transcending party politics* – three party collaboration, exchange, a shared approach, opportunity to leapfrog the political agenda.
- *Harnessing the potential of individuals* – personal vs. corporate attitudes and values, empowerment, personal responsibility, creating a learning framework, engaging champions at wider level'.

These were considered to be the main challenges to sustainable procurement with the main emphasis on management and policy obstacles. However, there was no mention of biodiversity and no one at the workshop could or did discuss in any detail biodiversity issues.

The common themes from all the above findings are that company and brand reputation are the primary drivers for environmental consideration with license to operate and the links to regulatory factors also a key factor. The general underlying arguments found throughout the above investigations are for economic, short-term, reasons to operate a business, and not necessarily ones concerning sustainable development.

These studies/workshops also highlighted gaps between management and staff and company and government policy, along with private and public disparity. Any commitment to improving environmental performance or acting beyond compliance is mainly voluntary and certainly not connected to the biodiversity crisis facing the planet. These findings tie in with the literature research, which has found that industry does not generally mention biodiversity specifically as a driver, and that company environmental policy statements in general do not mention biodiversity.

4.9.1 The Environmental Management System

One of the frameworks available to business managers for evaluating and managing risk within the supply chain is the environmental management system (EMS). The use of EMSs is not mandatory and accredited systems are not required by purchasing departments on any regular basis (see Chapter 5). Their effectiveness versus non-accredited (in-house) systems, in terms of including adequate processes, has been questioned (Andersen and Skovgaard, 2008). The Hewlett-Packard (HP, 2008) study into SME use of EMSs in their Eastern European supply chain, found that organisations with accredited systems fared no better in environmental management solutions than those with an in-house system. HP emphasises to their suppliers that a well-functioning EMS, tailored to the size of the company, is more important than having a certification. For HP the processes in SMEs do not necessarily have to be as comprehensive as those in larger companies (Andersen and Skovgaard, 2008). The environmental management system is discussed in the following chapter.

4.10 DISCUSSION

The complex nature of supply chains makes it necessary to manage them in a structured and efficient manner. This is true both for the procurement process in terms of product or service pricing and for maintaining security of supply. For many industrial sectors the mechanisms are already there for managing environmental issues of suppliers through sector specific legally-binding regulations such as WEEE and REACH. There is also guidance information available, but this is often difficult and time consuming, particularly for SMEs to implement. In addition, specific information on biodiversity risk and opportunity is not easily available to managers who invariably do not have specialist knowledge in this area.

The industries that do have to adhere to specific regulations assess the risk based on the product or service's potential impact on the environment, and the consequential risk to reputation. The interest in biodiversity is largely dictated by the level of risk, and the level of risk is likely to be greater with increasing company size and wider supply networks. There are internal management obstacles to change throughout industry, as discussed in section 8.9, but the situation is being challenged by stakeholder pressure, and decision makers are looking to management frameworks to guide them and advise on compliance. The potential importance of environmental, and more specifically biodiversity issues, for adding worth to economic bottom lines and consequently shareholder value, has been discussed. The suggestion is made that biodiversity consideration is an under exploited component of business operations.

The amount of cumulative risk to biodiversity in the supply network is likely to depend on the product or service being supplied and the geographical extent of the supply chain. How that risk or potential impact on biodiversity is managed starts with the company biodiversity policy, the policy criteria are then cascaded down to the next supplier and so on down the network. This can not work however unless there is cross-managerial 'buy-in' of the subject area. As supply chains become increasingly international and complicated and are subject to rapid change in line with business trends, supply chain managers will have to be better informed and their attitudes changed on an increasing list of emerging issues. The issue of biodiversity consideration will also have to be managed in supply chains and in networks that may operate in cross-sectorial and across cultural boundaries. The attitude and awareness of supply chain managers to forecast emerging environmental issues will provide opportunities for differentiation and competitive advantage, giving a greater material value to biodiversity, thereby gaining economic added value to product or service brands.

Indeed, business value is added to the product brand, and by association to biodiversity, with each supplier that is assessed for their consideration - with greater cumulative risk there is the potential for greater cumulative opportunity. By giving a significance score to both individual and the collective supply chain the products biodiversity footprint can be appraised and the adverse risks (minus score) highlighted for urgent management input. This will have to be driven by companies with the resources to force change and with influence over smaller organisations to extend the limitation of responsibility. With respect to the lack of available information of the subject area a programme of education and training will be necessary and be attached to the product or brand. The model will therefore incorporate the BB risk/opportunity score and provide a product supply chain biodiversity impact 'map' with links to information on biodiversity and business related to a product and/or sector.

The EMS, whether accredited or a tailored in-house business system, provides the framework for communicating the biodiversity policy down the supply chain. These strategic policy commitments should form part of other seemingly intangible elements of supply chain management such as partnerships, communication, information exchange and other collaborative initiatives. The following chapter discusses the EMS as a framework for integrating and managing biodiversity aspects within the supply company network.

CHAPTER 5

ENVIRONMENTAL MANAGEMENT SYSTEMS

This chapter discusses the structure, role and effectiveness of the Environmental Management System (EMS) process as a framework and guide for continually improving company operations. This will give additional information and investigate further Stage 1, Sections (i), (ii) and (iii) of the objectives set out in Chapter 1, Section 1.3.

The aim of this chapter is to provide base-line information for use when discussing EMSs and biodiversity aspects in Chapter 12. The potential contribution an EMS framework can make to managing biodiversity issues in the company supply chain is explored.

5.1 INTRODUCTION

Efforts to demonstrate self-regulation, such as company departments dealing specifically with environmental issues, are often accepted as part of overall corporate management strategy (Section 6.7). These departments invariably examine their in-house systems and internal environmental policies and consider integrating with voluntary accredited standards such as ISO 14001 and EMAS. One way of achieving this is to go via the staged approach to these standards, for example, the Institute of Environmental Management and Auditing (IEMA) Acorn Project and the British Standard Institute BS8555 processes, which are being implemented as guides to compliance throughout industry (Sections 4.9.4 and 7.5.1). For a definition of EMS see section 5.4.

The management of external company operations are generally given less priority however (Section 5.2) by environment and procurement departments, with supply chain managers often regarding these standards only as a means of ticking the right boxes for supplier assessment criteria (Preuss, 2005). Supply chain management has entailed the traditional integration of key business processes through information exchange, which has added value to the product or service for the customer and other stakeholders (Lambert *et al*, 1998). One method of potential information exchange on environmental and biodiversity issues is the structured and standardised framework of the accredited environmental management system (EMS). This route to achieving better environmental performance has been questioned however, as discussed in section 4.9.4.

Sheldon (1996) noted that a management standard is only an aid to management and it is how management systems are used that determines their effectiveness. It is often the case, as Sheldon goes on to say, that for both focal companies (the buyer) and their suppliers, these systems alone are not sufficient drivers for environmental consideration, particularly further down the supply chain, and are often seen as holding back economic development.

There is also a question of what type of subculture a standard brings with it – is it put in place to placate demands from stakeholders or is it a serious attempt to improve environmental performance? (Welford, 1997). Sheldon (1996) also maintains that as these standards are essentially minimum criteria for structured environmental consideration they are generally seen as short-term problem solving mechanisms and very different from the longer-term principles of sustainable development (Section 3.7). This is also the area of organizational culture where internal management structure can often be regarded as separate to the people who operate it and certainly not operated in the spirit of continual improvement; see section 8.9 for further discussion. In such cases the process of internal training and education on biodiversity and business issues would help enlighten the company and encourage more transparent dialogue with external stakeholders. See section 6.2 for further discussion on stakeholder influence.

EMSs are, having said that, part of the process of contributing to, as Welford (2000, p1) put it: '*Businesses acting in ways that are consistent with sustainable development*', as Porritt (2004, p69) says: '*Awareness always precedes action*.' However, guidance applies only passive pressure on business to comply and this has proved true for specific biodiversity consideration in whole company operations. For example, calls from the Department for Environment Food and Rural Affairs (Defra, 2003, p80), for all sectors to, '*engage in managing and reporting on biodiversity as an integral part of its processes and activities*' and further to: '*manage supply chain and* *investment decisions to reduce the risks of indirect adverse impacts and to enhance biodiversity opportunities*', often being ignored.

In the case of general biodiversity policy in business, the situation remains that despite regulatory and stakeholder pressure on industry and the abundance of guidance information available, statements of intent promising biodiversity impact measures in company environmental policies have proved largely empty, and as Calow (2003) found at the time, actually adopting biodiversity impact into a structured EMS, is exceptional.

There is nonetheless, a real need for structured management process tools for managing environmental issues in industry and the accredited EMS framework has the potential to deliver. However, the way the system has been used in some practical situations has come into scrutiny. Work by Haverkamp *et al* (2005) for example, highlights the limitations of these process orientated environmental management systems with results from the farming sector. Giving pollution prevention from chemical fertilisers as an example, they found that the focus of EMSs in practice was on the general manufacturing/production process, rather than individual product impacts further down the supply line. If the EMS had a product focus it should work with all suppliers connected with that product and not separately as the survey in section 7.5.1 found. Working with suppliers in this way would encourage openness and partnership working, as discussed in section 12.1, and better traceability of impacts attached to a product, as mentioned in section 12.3. The aim of the final methodology would be more effectively delivered if it were a product focused management process and this will therefore be incorporated within its design..

5.2 THE WIDER BUSINESS OPERATION

The ultimate effectiveness of an EMS depends on how comprehensive the application of the process is throughout internal and external company operations. The big advantage of accredited environmental management systems, particularly if integrated with other management activity within the company (e.g. ISO 9000 series, see Smith and Green, 2006) is that they do give a structured and auditable account of demonstrating due diligence in for example, environmental legislative compliance and company policy objectives. This is only true however if they are applied comprehensively to whole company operations and influences down the supply chain (Section 12.1).

In section 3.3 (also Section 2.1) the discussion put forward the idea that the sector, product or service, required of the supplier, by the buyer, was instrumental in determining the level of biodiversity impact. The buyer therefore should consider the risk implications of the items being bought before the procurement (sourcing) stage. This area of environmental management is covered in the case study research in Chapters 9, 10 and 11 and the methods discussed in Chapters 12 and 13, where case study companies were all risk averse on environmental issues. This area of the research has informed design of the methodology which emphasizes the risk approach to biodiversity consideration and associated business operations.

5.2.1 Environmental Supply Chain Management Guides

There are management guides, tools and assistance documents available to companies that provide an alternative approach or complement to accredited environmental system frameworks. Refer to the general EMS guidelines ISO 2004:2004 which cover the elements of an EMS and its implementation. Links to these guidelines could form part of any information provided by the final methodology.

5.3 ENVIRONMENTAL MANAGEMENT SYSTEMS (EMS)

An outline description of ISO 14001 is given in this section. For a detailed guidance for use refer to International Standard ISO 14001:2004. The definition of an EMS adopted by this project is taken from Roberts and Robinson (1998, p2) as,

'*A system by which a company controls the activities, products and processes that cause, or could cause, environmental impacts and in doing so minimise the environmental impacts of its operations'*.

An EMS can be an in-house designed system for example, managing waste, energy use or regulating emissions, or a standardised formal and accredited (certified) system such as the International Standardisation Organisation (ISO) 14001:2004 (IEMA, 2008). It also applies to the European Union (EU) Council Regulation 761/2001, Environmental Management and Audit Scheme {EMAS}. EMAS allows EU member states to comply, on a voluntary basis, with their obligations under the Maastricht Treaty (1992) to develop, '*policy and action in relation to the environment and sustainable development'* (EC, 2007). Both EMAS and the ISO standard were originally designed to reduce industrial pollution.

These voluntary standards are intended to provide a framework and guidance for any type of organisation who wishes to operate a management system for concentrating on what may be considered significant impacts (positive and negative) in relation to environmental issues. Environmental management systems are intended to integrate with other related management systems such as quality management systems (QMS) and their related standard ISO 9000 series.

They provide a structured, systematic and cyclical process of monitoring a stated policy commitment to continual improvement and an accredited demonstration of environmental due diligence. The system itself does not detail environmental performance requirements but provides a framework for doing so (ISO, 2009). The standard also provides a common reference for communicating with stakeholders. The system provides assurance to management employees that a company is in control of its environmental impacts.

The ISO 14001:2004 process suggests four stages of continual improvement in a cyclic system beginning with a *plan* for environmental improvement, carrying out or *doing* the plan and placing *checks* for performance effectiveness of the plan and finally *acting* on any recommendations to improve the original plan (ISO, 2009).

ISO 14001:2004 EMS process provides a generic and flexible framework for integrating environmental performance issues with other existing related company management systems. Further, the ISO 14001 EMS process, being presented as a framework or template, can be manipulated or designed to incorporate (as long as the ISO 14001 requirements are met) any facet of an organisations operational environmental impact. Biodiversity can therefore be incorporated into each of the standard's 17 clauses.

5.4 EXTENDING THE EMS PROCESS TO THE SUPPLY CHAIN

Any novel methodology designed for integrating biodiversity consideration into an accredited EMS, such as ISO 14001, is necessarily bound by the framework to work within the stipulated 17 requirements and clauses of the standard. By adopting this approach, unnecessarily complicated requirements are not added to the existing framework process. The Biodiversity Benchmark of the UK Wildlife Trusts is an example of using the ISO 14001 framework for considering biodiversity aspects (Section 2.5) of company landholdings.

For the purposes of continuity, ideally the same EMS process adopted by the focal company should therefore be applied by all individual organisations in a supply chain or network. Individual companies that have an EMS in place will tailor their system, using the guidelines, according to their assessment of biodiversity risk, as a result of company activities. Any new or existing biodiversity criteria requested by a customer can be integrated into existing company procedure. The initial management process involved in doing this is guided by the company environmental planning stage and articulated through the company environmental policy. The policy should include a requirement for suppliers to consider biodiversity in the same way as the focal company plan or code of conduct dictates. How easily company policy can be integrated will depend on existing supply chain management processes and relationships, and how sophisticated and effective they are. The application of an accredited EMS gives some assurance to external stakeholders and can demonstrate conformity throughout the supply chain. .

The consideration of biodiversity within industry coupled with the use of EMSs is explored in the survey in Chapter 7, and the incorporation of biodiversity aspects into accredited EMSs is discussed further in Chapter 12.

5.5 DISCUSSION

The integration of an environmental management system into other established management systems within a company can be seen in some organisations as a means of satisfying the standards body issuing the certificate, and as a route to gaining new or maintaining old contracts.

There are arguments for and against this type of voluntary organisation and disclosure system, where the level of 'environmental good' is governed by varying external stakeholder influence, and the intensity of that pressure is dependant on the potential business risk associated with a product or to an industrial sector. The survey of a sample of cross-sector companies described in chapter 7 suggests that in the case of direct biodiversity consideration the use of EMSs (or related biodiversity management system (BMS)) is not widely used in industry and hardly used in indirect supply chain situations (Section 7.7).

There are 'bolt-on' mechanisms for tailoring an EMS to specific product needs, such as the LCA technique. The technique is already used in assessing the indirect impacts on biodiversity from general environmental issues, such as, waste and pollution, and this has the potential to be extended to add direct biodiversity impacts associated with the cyclic life of the product.

Whether an organisation chooses to use its own in-house system or an accredited system seems to have little difference on the quality of environmental management. An EMS, as with any management system, is a framework offering a suggested operational process which offers guidance on how to manage, in this case, environmental aspects associated with company operations. As Waller (2006) points out, management systems or processes should be regarded as tools, and the practical management of the operations they are applied to, as a separate task. In-house systems are used in all industrial sectors regardless of company size. However, largely because of the constraints generally imposed in terms of resources (Section 4.4.1), in-house designed environmental systems are more likely to be the preferred method for small and medium sized enterprises (SMEs).

The main difference and possible advantage with an accredited system is that the suggested structure is a common guide and a potential common 'playing field' for all industry to work to and be audited against. The accredited systems are especially useful for evaluating individual company industrial sector environmental performance in for example, legislative and ethical compliance. In addition, they also serve to present an independently assured (audited) demonstration where a company has considered environmental issues, beyond compliance, and actively introduced for whatever reasons improvements to performance.

Whichever methodological system is utilised, the marketing medium which is becoming more popular for publicising an organisations environmental credentials, is the Corporate Social Responsibility (CSR) Report. It is perhaps in this area of marketing a brand or company to the wider stakeholder audience that biodiversity issues can gain a higher profile within wider company supply operations.

The current situation regarding the potential paradigm changing influences on biodiversity and business thinking, exerted from a widening range of stakeholders, coupled to the use of in-house and accredited EMSs, is discussed in Chapter 6.

CHAPTER 6

CSR REPORTING AS A MEDIUM FOR PROMOTING BIODIVERSITY ISSUES

This chapter investigates the role and drivers of Corporate Social Responsibility (CSR) reporting on managing and publicising company biodiversity issues and environmental procedures and operations. The position of the company supply chain is examined in the context of sustainable development and procurement. There is also a discussion on the driving influences that internal and external stakeholders exert and how their collective pressure can often change company policy. This exercise helps in forming the direction of the research and with the scoping of information content required for the final methodology. It also provides additional support for CSR reporting as a useful medium in driving biodiversity up the environmental business agenda. This covers Stage 1, Sections (i), (ii) and (iii) of the objectives set out in Section 1.3.

6.1 INTRODUCTION

Changing social attitudes towards the way companies operate their internal and external organisation beyond the purely financial, are forcing industry to revisit the way they report on their responsibilities to society (Kuhndt, *et al*, 2004; Idowu and Taylor, 2004; Jonker *et al*, 2007, Marshall, *et al*, 2007). The subject of biodiversity though is often seen as a responsibility for conservation organisations or NGOs and as a compliance issue and therefore not something the business community should get involved in beyond that (Bishop *et al*, 2007). As Bishop *et al* pointed out; biodiversity has not traditionally been a central focus of CSR. However, this situation may be changing with increasing business and public awareness of the issues, notably from the Millennium Ecosystem Assessment in 2005.

A key area of business and social interaction is the relationship companies have with their various stakeholders. It is changing relationships between stakeholders and organisations reflecting changing relationships with the state, society and economies, which have created a new political activism (Hughes and Demetrious, 2006, p94).

This new activism includes individuals, groups and organisations that have the potential to influence business policy and corporate responsibility thinking (Section 2.4.1). See the discussion in section 8.9 on influences on the organisation.

Companies are not only governed by internal management but they also have external parties with an increasing interest and influence on how that company operates. The reputation of an organisation as viewed by external stakeholders (in view of recent blows to Enron and other company reputations) is a key driver for companies in considering and implementing CSR policy and how they report on their wider operations. This new area of business operation has organisations thinking about their corporate citizenship not just incorporating legal and economic needs but the transparency of other ethical and discretionary responsibilities demanded by stakeholders (Maignan and Ferrell, 2000). Maigan and Ferrell (p284) define Corporate Citizenship as:

'*the extent to which businesses meet the economic, legal, ethical and discretionary responsibility imposed on them by their stakeholders'*.

Work by Marshall *et al* (2007) suggests that environmental transparency reporting implies a 'beyond compliance' disclosure of information in such reports. To what extent this is true may depend on whether the company is looking purely to follow accepted guidance principles or more towards achieving skill building continuous improvement targets. What has become apparent during this research is that the quality (Section 6.4.2) of information of environmental issues in available reports is varied and the method a company chooses to disclose information, will affect the quality of that disclosure. Marshall *et al* (2007) further suggest that active engagement with corporate citizenship-orientated stakeholders will induce organisations to disclose better quality environmental information.

6.2 STAKEHOLDERS AND STAKEHOLDER INFLUENCE

Many organisations have taken to engage with external stakeholders in an atmosphere of collaboration with the aim of negotiating solutions to potential environmental problems (Marshall *et al*, 2007). Organisations often make short-term environmental management decisions that affect their reputation in the longer-term, and so developing responsible information systems that reflect wider stakeholder views is a forecasting advantage (Brown *et al*, 2005). A definition of what constitutes a stakeholder is given by Freeman (1984, p84), who has defined stakeholders as groups or individuals:

'*who can affect or [are] affected by the achievement of the firm's objectives*'.

Clarkson (1995), Waddock (2006) and Freeman (2007) give general examples of two types of stakeholders having an affect on a company. That is, primary stakeholders such as investors, customers, employees (Freeman (2007) adds communities into the primary group) and suppliers, and secondary stakeholders such as government and community, competitors, consumer advocate groups, special interest groups, and the media.

The degree of stakeholder influence on corporate strategic direction and policy can vary and often depends on business sector and/or number of employees. In terms of managing impact on the environment, businesses are under mounting pressure from various specific directions, such as, regulators, government, special-interest groups (SIGs), NGOs and consumers (Madsen and ULHØI, 2001). Allenby (2000) suggests that if business is to meet the level of quality of environmental information demanded from stakeholders in the future, then integrating information systems, organisation and environmental initiatives, are a key basis for doing so. This adds support in accommodate the need for better information on business related biodiversity issues linking practitioners to relevant scientific and managerial information.

Pressures exerted from secondary stakeholders or external stakeholders (Sections 4.1; 4.3), often intergovernmental organisations (IGOs), are now a major influence. Some examples of intergovernmental secondary stakeholders are: The United Nations (UN); The Organisation for Economic Cooperation and Development (OECD); The International Monetary Fund (IMF); The World Trade Organisation (WTO); The International Union for Conservation of Nature (IUCN) and; Global Compact (voluntary programme sponsored by the UN).

There are other secondary stakeholders operating as not-for profit organisations or non-governmental organisations (NGOs) (sometimes referred to as third sector or civil society organisations). This includes environmental non-governmental organisations (ENGOs) with a focus on sustainable development, such as: Corporate Watch; Forum for the Future; Friends of the Earth International; Greenpeace International; Oxfam International; Transparency International; World Wide Fund for Nature (WWF) and; The European Centre for Nature Conservation (ECNC).

Stakeholders can affect a company by exerting power, urgency or legitimacy (Mitchell *et al*, 1997). Conversely company policies, processes and procedures affect stakeholders and the natural environment, and so ultimately form a mutual relationship between the two that contributes to the level of a company's success (Waddock and Graves, 2006). The extent and quality of environmental disclosure by organisations however, often depends on the kind of engagement with IGOs and ENGOs i.e. are they used as purely a source of guiding principles or as a source of technical skills, as suggested by Marshall *et al* (2007). Work by Marshall *et al* also suggests that corporate engagement with principles-focused NGOs were significant only at the compliance level of voluntary environmental disclosure. In terms of increasing the awareness of environmental issues to top management the principles focused NGOs may be useful in engaging a wider corporate management audience, regarding the value of transparency (Lazslo *et al*, 2005).

NGOs like the UNs Global Compact, the Coalition for Environmentally Responsible Economies (Ceres) and Business for Social Responsibility tend to promote principles of conduct. These set the objective of adopting principles which 'set in motion changes to business operation' and they invariably entail the strategic commitment from top management (Marshall *et al,* 2007). Whereas, skills building for environmental stewardship NGOs develop knowledge, skills and methods for actively managing company environmental impacts and deal with lower management. Examples of skills building NGOs are The Global Environmental Management Initiative[1] (GEMI), the Corporate Environmental Responsibility Centre of the Earthwatch Institute and The World Business Council for Sustainable Development (WBCSD). These types of NGO are founded on similar principles but the latter focus on knowledge enhancement and skills building in order to improve an organisations environmental stewardship performance. They communicate at the business

[1] See http://www.gemi.org/

operational personnel level and not so much with top management (Marshall *et al,* 2007). In practice Marshall *et al* found that the two NGO stakeholder types can complement each other by engaging the business sector at all management levels, i.e. building an association with top management on the one-hand and capacity building with operational personnel on the other.

6.2.1 Financial Stakeholders

The success of a company has until recently been governed solely by the economic bottom line (Section 4.7) and consequently by stakeholders with a financial bias. However, this body of stakeholder is now finding environmental issues increasingly hard to ignore as environmental topics include more than just internal management processes and products but also encompass the wider external footprint of the whole business operation.

Conflicting stakeholder positions however have often been seen to slow down management initiatives (including environmental initiatives) with economic issues ultimately taking precedence in the general business climate. Top management has often viewed the idea of including all stakeholders in management as only encouraging business to focus on non-business activities. This view is challenged by Freeman (2007, p4) who maintains that:

'*There is really no inherent conflict between the interests of financiers and other stakeholders'*.

Further, Freeman (p5) states that, the successful company has to consider all stakeholder influences, and only focusing on financial stakeholders is '*deeply flawed*' if long-term sustainable and successful business is to be maintained (p5):

'*The idea that shareholders have a special place at the center of the managerial modal is an idea whose time has come and gone'*.

There is also value created by wider stakeholder engagement for customers, employees, suppliers, and communities (Freeman, 2007). These arguments assume that all shareholders are only interested in the economic element whereas, there are shareholder activists that play an external role in monitoring corporate environmental behavior. For example, Waddock (2000) and Graves *et al*, (2001) found that shareholders use the proxy vote to influence shareholder resolutions in such areas as threats to reputation and as levers to start dialogue on company image issues.

6.2.2 Stakeholders and Wider Business Operations

The changing of stakeholder positioning and pressure is forcing a rethink of business behavior and changing the approach business is taking in relation to the wider business operation of suppliers and supply chain performance. Historically, company dealings with suppliers had been considered external to main company management, whereas the present situation sees the supply chain to have a direct influence on the management of sustainable development in a company (Seuring and Goldbach, 2006). There is slow progress but nevertheless progress in the pressure to change consideration to what are often regarded as low level business cases, such as those concerning biodiversity issues.

In line with these external pressures the business climate is continuing to rapidly evolve in terms of its relationship with society and its increasing concern over the management of ecosystem services. The World Business Council for Sustainable Development (WBCSD, 2005) contends that considering risks to ecosystem services is part of responsible business practice. This new shift in business thinking, in response to the new activism, can give a competitive advantage to companies with pioneering strategies that anticipate or respond to ecosystem changes. It also adds weight to the general opinion that biodiversity should be of concern not just to companies with more obvious impacts (for example, resource extraction) but also to relatively lower risk sectors such as financial institutions, consumer goods companies, service organizations and information technology (WBCSD, 2005). See Cooper and Owen (2007) for further discussion on stakeholder influence.

This is leading to, in the face of change to the characterisation of the environmental situation and the idea of sustainable development, to more adaptable methods of environmental regulation and the rise in the use of voluntary approaches to environmental protection (Wood, 2006).

6.3 VOLUNTARY CODES

Berthelot *et al* (2003, p8) offer a definition of voluntary corporate environmental disclosures as:

'The set of information items that relate to a firm's past, current and future environmental management activities and performance…and the past, current and future financial implications resulting from a firm's environmental management decisions or action'.

The definition has a realistic link to the financial bottom line and therefore one that fits into the marketing (Section 6.4.1) exercise of responsibility reporting.

The most influential of these voluntary codes to emerge as an effective way to regulate industry, and at the same time reward business for their level of social responsibility (Wood, 2006), is Corporate Social Responsibility (CSR) – sometimes abbreviated to Corporate Responsibility (CR). CSR reporting should set defined principles of ethical business practice and allow stakeholders an informed and measured insight into company operations. Andriof and Waddock (2002, p95) argue that CSR has two core principles; '*business exists at the pleasure of society*' and that it '*acts as a moral agent with society*'. Birch (2001, p95) proposed the best outcome of CSR is when it: '*Achieves a positive social and environmental impact by integrating profit making with social, economic and environmental responsibility..'*.

There are, perhaps predictably, a number of definitions and explanations of the role of CSR in society. A commonly used definition of CSR is cited by Kraisornsuthasinee and Swierczek (2006, p54) from the World Business Council for Sustainable Development (WBCSD,1999) as: '*…the continuing commitment by business to behave ethically and contribute to economic development while improving the quality of life of the workforce and their families as well as of the local community and society'*.

There is no direct mention of the natural environment in the above definition and there is also plenty of room for manoeuvring towards favourable business use, bearing in mind it is intended for business consumption, under the characteristic spirit of the business idea of sustainable development (Section 6.4.1).

The WBCSD definition needs revisiting as it could appear to conflict with the WBCSD's own statement on ecosystem services, mentioned in section 6.2.2. CSR reporting needs to distance itself from the impression of reluctant responsibility and compliance to one of real effort to improve the environmental footprint of business. A suggested addition to the WBCSD definition could be, '…contribute to economic development while *safeguarding* and improving *the natural environment,* the quality of life…' The CSR definition preferred by this thesis is the one given below by the European Commission.

The European Commission (EU, 2008, Glossary) defines CSR as: '*a concept whereby companies integrate social and environmental concerns in their business operations and in their interaction with their stakeholders on a voluntary basis'*.

The business case for CSR reporting is given by the Commission (EU, 2008) as:

'*Increased employee retention, better productivity, better relations with stakeholders, new commercial opportunities, competitive advantage, better brand image. One of the most important drivers of CSR is the management and prevention of risk, where previous soft issues (such as the environment) are now considered hard and hard to manage, ignore and very hard and costly if you get them wrong, and so influencing a company's licence to operate.'*

The EU Commission also aims to integrate CSR into all EU policies (EU, 2002).

Having found a definition, the CSR structure should be designed at the development stage, and include key elements of management strategy essential in any CSR programme. Examples are given by the 'AccountAbility Rating' (AccountAbility Rating, 2006), which evaluates companies across six key elements, given below (the rating expressed as a percentage) and taken directly (permission given) from the published Association of Chartered Certified Accountancy (ACCA) and FTSE Group report (2007) Improving Climate Change Reporting:

***'Stakeholder engagement**: (20%) Identification of stakeholders, systematic engagement with them and assessment of their views on non-financial (economic, social and environmental) impacts that are material; Demonstration that the company has understood their views and responded to them; Institutionalisation of stakeholders into the company's decision-making*
***Governance**: (15%) Integration of non-financial issues and performance into Board Level decision making; Clear allocation of responsibilities for non-financial matters; Comprehensive global company policies on non-financial issues; Integration of non-financial performance into annual reporting.*

***Performance management**: (15%) Clear lines of management responsibility; Incentives and training to drive performance on non-financial issues; Management systems for non-financial issues, and product and process innovation to improve non-financial performance.*
***Public disclosure**: (15%) Alignment of non-financial reports with the GRI Sustainability Reporting Guidelines; Material information published on the company's non-financial performance within its reporting.*
***Assurance**: (15%) Company's current and future assurance position on non-financial aspects of performance; Scope of assurance of the company's non-financial performance data by an independent third party; Materiality and completeness of the data reported, and responsiveness of the company to stakeholder concerns; Statement of the assuror's independence and competencies.*
***Strategy:** (20%) Alignment of core business strategy to the imperatives of sustainable development, and commitment to key voluntary frameworks and standards; Clear identification of non-financial impacts arising from the company's core operations; Influence of non-financial impacts on strategic business decisions'*

These six key elements are geared for large companies particularly where the requirement for public disclosure has to use the GRI Guidelines. Many SMEs, however, have not the resources to use these guidelines (Section 6.3).

As a means of regulating industry, Kraisornsuthasinee and Swierczek (2006) proposed that voluntary reporting can only be effective at a practical level if CSR is interpreted by management in terms of activities, rather than focusing on responsibilities, with tools and processes the main objectives. To this end, Kraisornsuthansinee and Swierczek (2006, p54) cite Swift and Zadeck (2002) who classify CSR into four stages of development.

1) *'Legal Compliance: this reflects the expectation that CSR is more than an obligation.*
2) *Low-level business case: including publicly visible approaches such as philanthropy, risk management and industry standards.*
3) *Strategic corporate responsibility: emphasizing the integration of corporate responsibility into key aspects of business practice. Examples include implementing product and process innovation, new business and corporate responsibility as a substantial resource base for strategies.*
4) *Remolding competitive advantage: concentrates on multi-stakeholder partnerships, institution building, corporate responsibility-orientated advocacy and public policy'.*

The availability of a CSR report for institution and public scrutiny allows a company the opportunity to demonstrate it is operating or developing sustainably. Therefore, it should include the social, financial, and environmental components of sustainable development. Reporting on these elements should allow a reader from any stakeholder sector to make informed decisions and better and more detailed impressions about the organisation. In terms of accountability to stakeholders, Cooper and Owen (2007, p650) argue that public disclosure in itself can be:

'*instrumental in terms of enhancing accountability in that it creates a new form of visibility, which may not only shape managerial subjectivities but also offer ammunition to influential outside parties, notably NGOs, seeking to bring influence to bear on the organisation'*.

They add the proviso however, that external influences effectiveness in changing company priorities depends on its attitude to routine privileged returns to investors that take precedence over all other economic and social interests.

6.4 CORPORATE RESPONSIBILITY REPORTING

6.4.1 Sustainable Development – Practical Usage

Industry has now found itself in the situation where it is to be made more accountable and responsible (Section 2.4.1) for its environmental and social actions. The origin of this comes from the seemingly opposing ideas of sustainability and development, which has its roots, as Wood (2006, p235) points out, in the '*compatibility of economic development and environmental protection*'.

However, the ideals behind the phrase 'sustainable development' have often been influenced by a business world that many commentators have held: '*…is not committed to the pursuit of sustainable development*' (Moser and Miller, 2001, p215). Korten (2001, p230) pinpointed the situation by saying that companies are historically not designed to function in areas other than servicing the narrow financial interests of shareholders. Earlier Holling *et al* (1995, p44) had exemplified a rather cynical business perspective by explaining sustainable development as a logical partnership where sustainability is the, '*capacity to create, test, and maintain adaptive capability*' and development is the '*process of creating, testing, and maintaining opportunity'.*

There have been other criticisms over business manipulation of the term sustainable development, see the discussion in section 3.7. Welford (1997) observed, companies often seek to control the direction of sustainable development to the benefit of their stakeholders. There is also the inevitable confusion associated with multi-sectorial understanding of ideas like sustainability, which is, like many others, a term coming out of theory, but which finds itself struggling in practical application.

Adding to the confusion are the varying definitions of sustainability (Section 1.3) and the conflict between environmental, social and financial performance (Section 4.7). Work by Aras and Crowther (2007, p abstract) details the roles of corporate culture and organisational behaviour in the use of the concept of sustainability, ranging from sustainable development to a return to the green pre-industrialisation. They argue that organisational behaviour needs to expand corporate culture by incorporating 4 key (equally important) aspects of sustainability:

- ***'Societal influence****, as a measure of the impact that society makes upon the company in terms of the social contact and stakeholder influence;*
- ***Environmental impact****, as the effect on the actions of the company upon the geophysical environment;*
- ***Organisational culture****, as the relationship between the company and its internal stakeholders, particularly employees, and all aspects of that relationship; and*
- ***Finance****, defined in terms of an adequate return for the level of risk undertaken'.*

(Aras and Crowther, 2007, p abstract.)

The idea is to maintain a balance between the 4 dimensions and show sustainability as compatible with financial performance but also highlighting the need for longer time horizons. Further, they argue, that issues around sustainability are not so much concerning value creation as with the distribution of the value created by corporate activity (Aras and Crowther, 2007). These additional areas concerning sustainability are now demanding more space in the public reporting of company activities.

The ideal business context would entail sustainable development linking with the triple bottom line approach (Section 4.8) to the way it is sustainably marketed. Fuller (1999, p4) defined sustainable marketing as:

'*The process of planning, implementing and controlling the development, pricing, promotion and distribution of products in a manner that satisfies the following three criteria: (1) customer needs are met (2) organisational goals are attained, and (3) the process is compatible with ecosystems'*.

The inclusion of ecosystems in the definition gives a clear message as to the importance of natural systems in product design.

6.4.2 The Frequency and Quality of CSR Reporting

Until 1999 non-financial reporting had been predominantly environmental but since then the inclusion of social and economic factors relating to sustainability has become more common (Worldwatch, 2006), and has evolved into CSR. CSR reporting has not escaped criticism, mainly for being just a promotional activity or for being too costly for traditional shareholder values (ibid). CSR reporting is itself evolving, perhaps in response to criticism, and now includes a wider view of business operations, moving away from compliance disclosure with quantitative data to more qualitative material topics tailored to specific organisations, stakeholder, or sector issues (KPMG, 2005).

According to a KPMG (2005) International Survey of Corporate Responsibility Reporting (Corporate Register 2008), corporate responsibility reporting has been rising since the early 1990s (Figure 6.1) and has increased dramatically over the period 2004 towards 2007. On the frequency of CSR reporting, 52% of the top 250 companies of the Fortune 500 issued a report in 2005, compared to 45% in 2002 (KPMG and Amsterdam, 2005). Of companies listed on the FTSE 100, 83 issued reports in 2005 (CorporateRegister, 2006). In the USA, of the Standard and Poor (S&P) 100, 39 companies issued responsibility reports in 2004 (Env News, 2005).

Figure 6.1 Corporate Social and Environmental Reports 1992-2007

Source: CorporateRegister.com. The 2006 / 2007 figures are growing daily.
Figures correct as of March 2008 (McGhee, 2008, *pers comm.*).

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Scott (2006) highlighted, in the 2006 Worldwatch Institute report 'Vital Signs', this increasing trend for social responsibility reporting, with virtually no CSR reports in the early 1990s up to nearly 1800 multinational companies publishing in 2004, and a reported increase forecast up to 2005. Overall Scott (2006) found that European companies publish the most CSR reports with 54% of total produced between 2001 and 2005.

In Central Europe there has been a requirement for related environmental reporting for companies of a certain size since the 1990s. Denmark, for example, was the first Member State in the EU and, arguably, the first country in the world to introduce a law that requires certain (Danish) companies with high environmental impacts to publish annual environmental reports. The law was passed in June 1995 (Danish Environmental Ministry, 1995a) and took effect in January 1996. Until then there had been no specific requirement to publish environmental information except when accounting laws and standards required this in relation to liabilities and the valuation of assets (Price Waterhouse, 1995). From January 2001 in the Netherlands, a number of companies have been obliged to submit environmental annual reports every year to the competent authorities. This obligation has been laid down in the Environmental Reporting (Environmental Management Act, 2001) Decree.

Outside Europe the most prolific producers of CSR reports, on a wider global scale, were Asia and Australia, who published 25%. This was followed by North America with 17%, South America with two percent and Africa and the Middle East producing 2% between them. In major developing economies only 5 Indian and 11 Chinese companies submitted reports in 2004 (Scott, 2006). Scott further points out that the figure of 1800 multinational companies publishing in 2004 still leaves 97.5% of some 70,000 multinationals worldwide not issuing CSR reports.

The KPMG (2005) survey found, perhaps not surprisingly, that companies with relatively high impact on the environment lead the field in CSR reporting. Supply chain issues are increasingly considered with eighty percent of companies including some sort of supply chain responsibility. Biodiversity was not a survey criterion in the KPMG survey but related climate change (Section 3.5.1) impacts were mentioned in 85% of reports.

Whatever the industrial sector there are real incentives to manage and report on company operations. The United Nations Environmental Programme (UNEP FI) Finance Initiative Report (2006) found that mismanagement of environmental, social and governance issues can pose a real threat to company and investor value. The report concluded that potential material effects of these issues could have a real impact on profitability, and recommended investors and asset managers to assess their environmental and social responsibilities and include them in investment decisions. In accountancy terms, the potential book value of any biodiversity assets are linked to brand equity and the general goodwill attached to the organisation, and it is in that organisations interest to avoid the amortisation of this area of shareholder value.

In relation to the quality of reports there seemed to be little sign of improvement up until 2004, according to the UK Environment Agency (EA) environmental reporting survey of that year. This survey gave only 89% of FTSE all-share companies (507 out of 570 companies) reporting on environmental issues in their mandatory annual report and accounts and these showed no significant quantified information (EA, 2004).

Recent poles suggest public attitudes to CSR reporting are moving increasingly towards requesting more detailed disclosure of environmental responsibilities (Ipsos/Mori, 2006), and as a consequence it would be expected that the quality and content of reports should have improved. However, the EA updated report of 2006 found environmental reporting '*still woefully low*', in the first 100 quoted company reports (EA, 2006). The EA report found few comprehensive disclosures to inform shareholders of environmental risks and opportunities.

6.4.3 Incentives and Disincentives for CSR Reporting

Under the umbrella of sustainable development the voluntary CSR report is seen as having overall net benefits for the bottom line. Wood (2006, p250) cites a number of drivers that influence the implementation of voluntary codes - these are listed below:

(i) ***'Cost Savings** with reduction of inputs such as, energy, water and raw materials; waste disposal, lower insurance costs, better credit ratings, profitability, risk reduction, enhanced shareholder value, grants, tax relief.*

(ii) ***Regulatory Gains**; avoiding costly official regulation and some ability to influence and promote desired regulation.*

(iii) ***Higher Revenues****; securing higher prices, larger market share, differentiation, customer demand.*

(iv) ***Reputation Gains****; environmental leadership, trust, brand image, NGO relations, local communities, employees, unions. Other drivers are related to ethics and legal compliance and management commitment to ethical and environmental stewardship'.*

Further commercial advantages linked to CSR reporting are given by Line *et al* (2007, pp4-5) as:

***'Profit** – growth rate and positive financial performance;*
***Access to capital** – indices such as The Dow Jones Sustainability Index, the FTSE4Good Index, the Morley Fund Management Sustainability Index, the Business in the Community Corporate Responsibility Index, and others;*
***Lower operating costs and greater efficiency** – reducing waste, water and energy efficiency;*
***Enhanced reputation** – trust, due diligence.*
***More sales** – consumer confidence.*
***Greater productivity and quality** – employee involvement, increased productivity and reliability.*
***Improved recruitment and retention** – improved working conditions, less environmental impact, ethical and reputable company.*
***Lower risk and effective risk management** – less exposure to risk, reputation, environmental, legal, financial.*
***New commercial opportunities** – dialogue with stakeholders, society expectations, innovation'.*

In addition, Business in the Community's (2003, p3) 'business case' for CSR notes

that it offers: '. . .*a means by which companies can manage and influence the attitudes and perceptions of their stakeholders, building their trust and enabling the benefits of positive relationships to deliver business advantage*.'

In terms of the motivations for disclosing environmental issues Berthelot *et al* (2003) maintain they can be categorised as cost-benefit or legitimacy-based. Bewtey and Li (2000) found evidence to suggest that firm's disclosed less when there is considerable uncertainty about the information that is withheld, or a firm faces serious financial problems or distress. There are criticisms of company agendas regarding legitimacy, where environmental management systems acquire legitimacy to prevent social and government sanctions (Nea *et al*, 1998., Deegan *et al*, 2002). Research by Marshall *et al* (2007) suggested company voluntary environmental disclosure (VED) increased with company size, media exposure and NGO pressure.

As well as a number of clear advantages associated with CSR reporting, there are also constraints and disincentives where companies often see CSR as burden oriented. This is where companies see their economic activity in terms of risk to reputation, by exposing environmental damage, rather than looking to the more positive aspects of risk awareness associated with openness and management improvement (Figge and Hahn, 2004a). There are also economic reasons where companies will only go so far in complying with voluntary codes and will cap reporting if excessive costs are reached (Wood, 2006). A survey by the UK Environment Agency in 2006 suggested that company size was a factor in reporting (Section 4.4.1). The EA (2006) report found that smaller companies gave less clear information than FTSE 100 companies. There are also indications that sensitivity to litigation is affecting the quality of reports. This is especially so in the US, particularly in the utility sector, with, for example, less detail on CO_2 and climate change in recent reports (Figge, *pers comm*, 2006).

Behind the scenes, one driver to present environmental and social issues in transparent and meaningful annual reports is the growing number of mandatory regulatory developments. These include the Sarbanes-Oxley Act (USA) (2002), Government strategies such as *Securing the Future* (2005) in the UK, the Operational Financial Review (OFR) (2006), and related EU Directives such as The Accounts Modernisation Directive (2003/51/EC). Apart from disclosure related drivers there are legal directives such as the European Commission Environmental Liability Directive 2004/35/EC (Defra, 2007). The Directive states that polluters will pay for any environmental damage they cause and define environmental damage as that which has a significant adverse effect on conservation status of EU-protected biodiversity, waters subject to EU legislation and land contamination that poses a significant risk to human health.

The Directive introduces a regime of strict liability for prevention and remedy of environmental damage to "biodiversity", water and land from specified activities, and liability for the remedy of environmental damage to biodiversity from all other activities on the basis of fault or negligence. The operator that causes the damage, or threat of damage, must prevent or remedy it at their own expense (Abbiati, 2007; Defra, 2007). The Environmental Damage Regulations (Prevention and Remediation) are in force from March 2009 and enforced by the Environmental Agency (England and Wales).

There is no lack of incentives and drivers for companies to not only report corporate responsibilities, but also to act beyond straightforward compliance. In support of the above drivers there are guidelines available advising on report content, improving quality and focusing on relevance and materiality. In addition, there are management tools available to help internal environmental 'champions' present a case for environmental and social responsibility issues. The American Institute for Supply Management (ISM) is an example with their 'Call for Action: Developing a Social Responsibility Business Case' initiative. The ISM has created a set of business-case documents designed to develop or enhance a company social responsibility program. The program aims to give operational managers the considerations needed to build a compelling business-case for CSR when presenting the case for executive support (ISM, 2007). There is no mention of specific biodiversity impacts or issues and no connection to the supply chain but the framework is there for including its consideration in the future.

6.5 GUIDELINES ON CSR REPORTING

There are now a number of guidelines, aimed at all sectors in the UK, advising companies on writing and presenting CSR reports. For example, Defra have produced reporting guidelines for UK businesses with their Environmental Key Performance Indicators (KPI) publication (Defra, 2006a). Defra advise that the CSR report should follow the general principles of transparency, accountability and credibility and include the KPI principles of relevance, quantitative assessment and comparability. The KPI indicator list consists of 22 indicators under the main headings of emissions to air, emissions to water, emissions to land, and resource use. These headings suggest companies concentrate on five or less indicators of greatest relevance. It is worth noting that an Environment Agency (UK) report (2006), looking at environmental reporting to that date, found '84% of FTSE all share companies, currently reporting on their social responsibilities, had not yet disclosed their environmental performance in accordance with the Defra Guidelines' (EA, 2006).

There are a number of initiatives in use providing models for companies to report qualitatively on their biodiversity impacts in an attempt at a holistic and integrated methodology. An example is AccountAbilities AA1000 Guidelines, which includes the principle of accountability to all stakeholder groups and states, '…*Stakeholder views are obtained through an engagement process that allows them to be expressed without fear or restriction*' (AccountAbility, 1999). Another prominent example is the Global Reporting Initiative (GRI) (Defra, 2006a).

In addition, the International Standards Organisation (ISO) is due to publish their social responsibility (SR) standard guidelines in 2010 (ISO, 2008). The proposed document, ISO 26000, is at the time of writing still in the consultation stage but it will be a voluntary guide not a standard. The extent of biodiversity guidelines has not been made apparent on the ISO Web-Site information pages, at this stage.

6.5.1 Global Reporting Initiative (GRI)

The GRI is a multi-stakeholder initiative intended to make available best practice guidelines for organisations wishing to report on their progress towards sustainability (Grey, 2006).

The Global Reporting Initiative guidelines (GRI, G3 Guidelines, 2006) provide a framework for CSR reporting which is seen as synonymous with economic impact and sustainability reporting. It is intended for cross sector organisations of any size and location. Also, a key feature of the GRI Guidelines is the degree of importance given to stakeholders, as the GRI (p.9) states, '*A primary goal of reporting is to contribute to an ongoing stakeholder dialogue. Reports alone provide little value if they fail to inform stakeholders or support a dialogue that influences the decisions and behaviour of both the reporting organisation and its stakeholders'* (GRI, 2002).

The GRI Guidelines define economic impact as (p9):

'*A change in the productive potential of the economy that can have an influence on a community's or stakeholder's well-being and longer term prospects for development'.*

In an explanation of the relevance (Section 1 –Relevance) of indirect economic impact the GRI Guidelines state (p9), ‘*Indirect economic impacts are an important part of an organizations economic influence in the context of sustainable development’*.

The focus is away from direct impacts and towards additional impacts as a result of direct economic development. Direct economic impacts are seen as the value and indirect impacts as the results, sometimes non-monitory, of business transactions. The guidelines recognize the relevance of indirect economic impacts although their connection to environmental impacts is not openly stated. An important last paragraph in section 1 on EC9 relates indirect impacts to CSR -

‘*For management purposes, indirect economic impacts are an important indication of where risks to reputation may develop, or where opportunities may emerge to expand market access or a social license to operate’* (GRI Guidelines, 2006, Sec1, EC9).

GRI guidelines have not met with universal approval however. Busby (2006) and Bazley (2006) commented that the criteria demanded are hard to meet, and that companies who have not adopted it, have not done so because deriving the data in the format required is difficult and takes time to obtain. Other criticisms are that the data presented is backward looking and of poor quality and rarely audited (Insight, 2006).

According to a study by Insight Investment (2006) on the GRI and (the biodiversity impact related issue) climate change reporting, data presented in reports could be presented in a format that is more relevant to investors. Investors increasingly see climate change as material and so need relevant information in order to assess risk or opportunity when making investment decisions (ibid). As biodiversity issues are linked to climate, the same information would be needed to asses material risk.

In addition, the Insight Investment report outlines the need to avoid confusing other stakeholders, and for them to be able to easily find specific information of relevance. One size fits all, in terms of generalized reports, may not work in this case, and sector specific frameworks are currently under review (Insight, 2006).

GRI is not yet as widely used as it might be with only (to date), according to Insight Investment, some 1,000 organisations in over 60 countries currently using it as the basis for their environmental and social reporting. For a contextual comparison, in a German Federal Environmental Agency (Umweltbundesamt) survey of 310 listed companies only eleven percent had used the GRI framework

(Peglau, 2006, *pers comm*). Some companies seem to be actively avoiding the GRI and AccountAbility standards and instead using other management methods, with Lloyds TSB (UK) reporting against the European Foundation of Quality Management framework.

The GRI aims to present a broadly-based triple bottom line (TBL) approach (Section 4.7) according to Grey (2007) but only partially achieves this with the social aspects being inadequate. In terms of environmental data the guidelines do not demand the quality for making any judgment on sustainability. In addition, the GRI has been accused in the academic accounting literature of manipulating and managing stakeholder engagement in a process of corporate spin (Owen *et al*, 2001., O'Dwyer, 2003). The specific performance indictors used for biodiversity in the GRI are listed under the environmental performance section (EN, p28) and are:

***'EN11 -** Location and size of land owned, leased, managed in, or adjacent to, protected areas and areas of high bio-diversity value outside protected areas;*

***EN12 -** Description of significant impacts of activities, products, and services on biodiversity in protected areas and areas of high biodiversity value outside protected areas;*

***EN13 -** Habitats protected or restored;*

***EN14 -** Strategies, current actions, and future plans for managing impacts on biodiversity;*

***EN15 -** Number of IUCN Red List species and national conservation list species with habitats in areas affected by operations, by level of extinction risk'.*

These GRI indictors tend to focus on areas of high biodiversity value or protected species with no allowance for what might be considered medium or low quality areas or other species of equal value to an ecosystem. The emphasis is to report on direct impacts with no responsibility for wider indirect impacts, giving the impression of a 'compliance only' attitude in the report.

This situation reflects the relative importance given to biodiversity in business reporting and supports the Environment Agency report (2006), which looked at environmental reporting (Section 6.3 and 6.4.2), where biodiversity came ninth out of a list of 24 environmental topics disclosed and used by companies (Figure 6.2). Discussions on biodiversity related issues in these reports also appear to be exclusively linked to land use and therefore direct impact.

Figure 6.2 UK Environment Agency (2006) List of Environmental Disclosure Levels of Environmental Topics used in Reports

Source: Environmental Agency (2006, web-page public domain).

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Economic indicators in the GRI with relevance to the supply chain are listed in the EC section of the guidelines and relevant items include (p26):

'EC6 *- Policy, practices, and proportion of spending on locally-based suppliers at significant locations of operations'.*

And in section 2 of EC6 (p26):

2.5 'Indicate the factors that influence supplier selection (e.g. costs, environmental and social performance} in addition to their geographic location'..

Another related factor to indirect biodiversity impact in supply chains is the economic impact and this is described in section EC9 as (p28):

'EC9 *– Understanding and describing significant indirect economic impacts, including the extent of impacts'.* Where indirect economic impact is defined as: *'An additional consequence of the direct impact of financial transactions and the flow of money between an organization and its stakeholders'.*

The guidelines point to adopting a more interdisciplinary role for the investment industry in understanding the material value of a wider range of business induced environmental impacts.

6.5.2 CSR Related Guidelines for Biodiversity and the Supply Chain

Companies can obtain information and guidance relating to biodiversity issues which could be used in CSR reports. For example, the European Commission on Sustainable Development (ECSD) has guidelines and methodologies that include lists of indicators of sustainable development, which also include a section on biodiversity management (CSD, 2001).

In the UK, Local Authorities have two sets of guidance relating to the conservation and enhancement of biodiversity in the UK, I - the Natural Environment and Rural Communities Act (2006), which gives specific guidance aimed at the needs and requirements of Local Authorities; and a more generic guidance from central government, aimed at all public bodies affected.

The Defra guidelines (Defra, 2006a) (Section 6.3) list KPIs under various environmental headings, all of which will have direct or indirect impacts on biodiversity (Section 4.3.1) but it is not a specific KPI in these guidelines. Biodiversity is not a KPI in the Defra Guidelines because, as Defra point out, biodiversity presently does not have a single universally accepted quantifiable method of assessing a company's impact. The guidelines do however advise the inclusion of company supply chains in evaluating and reporting environmental performance.

6.5.3 Guidelines for Small and Medium Sized Enterprises (SMEs)

The definition of a SME and common to and widely accepted in the EU, is from the EU Recommendation 2003/361/EC (EU Commission, 2003, p13). An extract from Article 2 of the Recommendation defines SMEs as:

'*the category of micro, small and medium sized enterprises (SMEs) is made up of enterprises which employ fewer than 250 persons and which have an annual turnover not exceeding 50 million euro, and/or an annual balance sheet total not exceeding 43 million euro.'*

One way in which SMEs can help to mitigate their indirect biodiversity impact is by reducing their energy consumption. With the aim of legislative compliance the European Commission has proposed to create the Environmental Compliance Assistance Programme, in order to help SMEs minimise their environmental impact. The main aims of the programme are summarised by this project as:

- minimise the administration burden on companies;
- help SMEs integrate environmental concerns into their businesses;
- supporting regional and national networks;
- building on local know-how;
- improve communication.

There is no direct mention of biodiversity in these guidelines but they represent another possibility for including biodiversity into the existing programme framework.

An example of general guidelines aimed at smaller companies in the supply chain, are the Danish Commerce and Companies Agency and European Commission Guidelines, produced in cooperation with Hewlett-Packard (Andersen and Skovgaard, 2008).

Other programmes that support SME corporate commitment to biodiversity management include the Global Compact (GC) Outreach Programme (UNGC, 2007) and the Organisation for Economic Co-Operation and Development (OECD) Guidelines for Multinational Enterprises (OECD, 2007). The GC is a framework where businesses commit to aligning their operations and strategies with 10 universally accepted principles in the areas of human rights, labour, and the environment.

The 3 GC environmental principles are:

- *'Principle 7 – Business should support a precautionary approach to environmental challenges.*
- *Principle 8 - Undertake initiatives to promote greater environmental responsibility.*
- *Principle 9 – encourage the development and diffusion of environmentally friendly technologies'.*

The Principles are taken from the Rio Earth Summit in 1992 and Agenda 21, a 40 chapter action plan on specific issues relating to sustainable development (UN Global Compact, 2007). One of the 7 key environmental challenges cited by the GC is the loss of biodiversity and long-term damage to ecosystems. The OECD Guidelines are used by the governments of the 39 adhering countries to encourage businesses to develop their own individual codes of conduct, aiming to raise their environmental performance concerning mitigation and precautionary principles. There is no specific mention of biodiversity in the OECD Guidelines, but they are flexible enough to include biodiversity when a company integrates the principles into their own business activities.

The UN Environment Programme (UNEP) also provides business with environmental and legislative advice (UNEP, 2007). There are schemes in place that aim to help SMEs with their corporate responsibility management. The UN Industrial Development Organisation, for example, has a framework known as the Responsible Entrepreneurs Achievement Programme (REAP) and aims to guide SMEs by translating CSR principles into commercially viable practical management.

In order to use guidelines effectively and to understand how business can consider biodiversity, there has to be a common understanding of what biodiversity is and how it relates to business, and why industry should consider it. These and other guidelines have the potential to include biodiversity issues but they come up against an obstacle of little general understanding of the subject (Brady, 2005), and therefore there exists within industry, for all sizes of companies, a need for education on biodiversity issues with respect to business operations and their supply chains.

6.5.4 Educating Ecosystem Services Stakeholders

Numerous definitions have been offered attempting to explain what biodiversity is, refer to section 1.3.1. Discussions on correct definitions are somewhat academic, however, if they do not explain clearly what they are defining and there is confusion conveyed to their business (non-specialist) audience which may lead to a negative reaction. Perhaps this particular confusion hails partly from the science of ecology, which has a high degree of indeterminism as ecological systems are not fully understood, thereby leading to uncertainty. As Morgan (1998, p24) explained:

'*Uncertainty refers to the failure [*of ecologists*] to devise representation of natural systems from which their future behaviour could be predicted with reasonable accuracy'* (parenthesis added).

In order for the business of biodiversity idea to be better accepted within the wider industrial community the misconceptions and uncertainties need to be explained. Any effort to promote market-based approaches to biodiversity consideration must '*start from an assessment of the main obstacles and risks which hamper the realisation of such a vision'* (Bishop *et al* 2006, p120). One of the fundamental obstacles is the lack of knowledge about biodiversity science and how to consider it in business terms and relate it to the wider market. One lead would have to come from industry sectors where there is already experience in managing biodiversity on land holdings and another from academia where research could apply the issue to supply chains. Training and education links should be formed with existing biodiversity business initiatives and involve all external and internal stakeholders, refer to section 8.9.

Conversely biodiversity related organisations such as, NGOs, conservation, and consultancies need to be educated on the business skills and needs with respect to biodiversity. This will help both parties speak the same language when discussing business risks with respect to biodiversity impacts.

The final methodology will be informed by this exercise in researching CSR reporting of biodiversity. The research suggests that easily accessed information is needed which links specific biodiversity and business related questions to detailed and relevant answers. Therefore an electronic link will be provided in the final methodology allowing access to relevant information on business and biodiversity. The information can also be used as an aid to educating stakeholders (Section 8.9) and in training personnel on the methodology.

6.5.5 Biodiversity Indicators for Informing CSR Reports

The European Environment Agency (EEA) have agreed on a global framework to monitor and report progress on meeting the halt biodiversity loss by 2010 target (Section 3.4). The EEA, in response to developing the biodiversity indicators in 2004, have formed a Pan-European Cooperation on 'Streamlining European 2010 biodiversity indicators (SEBI2010)' the aim is to progressively develop biodiversity indicators (EEA Report, 5/2006).

6.6 MATERIALITY AND THE CSR REPORT

UNEP (2006) called for the investment industry to broaden its understanding and analysis of a wider range of global issues that can affect business performance and investment value. Recent investment industry understanding of global environmental issues has seen the content of a CSR report very often based on long-standing values of what issues and information is relevant, material, or of direct economic/investment risk to a company.

As the modern business community evolves however and globalisation, information technology and greater scientific understanding open up a wider range of issues, embedded consensus is becoming outdated. Materially intangible areas of business operations such as corporate responsibility and reputation, plus environmental issues such as ecosystem function and biodiversity (Section 3.5) are now seen as relevant. A wider range of environmental issues are now being considered as material risk to companies and as a result materiality has, since the late 1990s, widened its meaning and entered into responsibility and sustainability reporting (Ashley and Jones, 2007).

The link to sustainability allows a longer-term view of economic materiality, almost a branch of materiality moving away (evolving) from the often short outlook of economic vision. Wider considerations of what is a material risk to companies are being investigated by an increasing number of companies. An example of this comes from the AccountAbility organisation, launched in 1996 as the Institute for Social and Ethical AccountAbility with the purpose then, as it is now, to promote accountability for sustainable development, now includes materiality in its AA1000 CSR reporting assurance framework (AccountAbility, 2006). AccountAbility's working definition of materiality is: *'Material issues are those things that could make a major difference to an organisation's performance. Material information provides the basis for stakeholders and managers to make sound judgements about the things that matter to them, and take actions that influence the organisation's performance'.*

In the past it has been financial indices that have been seen as the public measure of company performance, but now it is increasingly recognised that environmental and social resources can be considered in the same terms as economic resources (Section 6.2.1). The ethical reputation tracking company, Covalence, found that out of 10 indices and rating agencies studied, 8 had included biodiversity in their indicators. There are various formats used in indices for treating biodiversity which could be a single criterion, or incorporated into a sustainability criterion, company profile or stories about leaders as well as general or sector specific indicators (Mach, 2008). Examples of this interdisciplinary move towards corporate responsibility and material value are coming forward. One project which has looked at treating social and environmental resources in economic terms is the EU funded ADVANCE Project (Figge, 2006., Figge and Hahn, 2005., Figge and Hahn, 2004b).

This project applies the Sustainable Value approach to evaluate the environmental performance of sixty-five European companies. In order to evaluate these resources an opportunity cost approach is used. The idea is to give a resource value if it is used more efficiently than through an alternative use of the same resource. The Sustainable Value of environmental and social resources is treated in the same way as financial analysis and therefore considers more stakeholders than just investors. The ideas of environmental sustainability and corporate responsibility are now becoming part of the company's ethical performance. These three bottom line components of economic, environmental and social resources are also linked to company reputation and, through responsibility, associated with the material value and perception of the quality of a company's product.

6.6.1 Quality as Material Value in the Supply Chain

Companies are seeing competitive advantage of linking quality, as a material value, to social, environmental and financial issues and communicating this to stakeholders. In this way quality becomes synonymous with responsibility and sustainable procurement. Environmentally sustainable procurement of quality materials directly relates to sourcing in the supply chain, and links both to the overall environmental responsibility of a company. For example, this approach is used by Marks and Spencer Group Plc, with the aim of connecting their suppliers with quality, and non-retailers, that is, producers, manufacturers, farmers etc in the supply chain, with consumers (Barry, 2006).

The idea is that a more environmentally responsible supplier will deliver a better quality product and by doing so, expand consumer perceptions and expectations of quality and, through better informed demand, educate the consumer to embrace environmental and sustainability aspects, as part of their own responsibility. This link with quality helps to take out any cynicism and provide a more genuine reason for considering environmental issues (Barry, 2006, *pers comm*). The procurement of sustainable materials and goods in the supply chain has to be managed in order to assure quality and protect brand reputation. One way a company can control the associated drivers for protecting reputation is by using an environmental management system (EMS). The company can then utilise voluntary codes to report to stakeholders on proceedings and results within the EMS.

6.6.2 The Role of Environmental Management Systems in Demonstrating Responsibility in CSR Reporting.

The role of Environmental Management Systems (EMS) in applying a process of environmental management and an assurance of regulatory compliance is increasingly seen as essential to company operations (Chapter 5). A recently completed three-year European study (Remas, 2006), of over 300 company sites, investigating the benefits of EMS in the context of regulation, found that having a progressively more robust EMS in place (in particular EMAS), leads to better on site environmental management. There was also a significant link to regulatory performance with sites using EMS performing better, although results varied throughout Europe.

Including information on environmental management systems in CSR reports and highlighting factors within the system that relate to reputation ought to convey a message of responsibility to the reader (Gyomlay and Moser, 2005). Despite this, a FTSE 250 survey by the British Standards Institute (BSI) found a third of UK companies are still not tackling environmental issues (BSI, 2006) and do not have an EMS in place. However, many of the leading companies, according to the BSI, already use an EMS and are recognising its importance for attracting and retaining business. Again for comparison, a similar situation exists in Germany, where thirty eight percent from the Federal Environmental Agency survey of 310 companies do not have an EMS in place (Peglau, 2006).

In terms of company supply chains, the BSI (2006) study also found 48% of companies require suppliers to meet their own criteria for environmental standards and 70% expect suppliers to do so within the next ten years. However, there are areas of an EMS that require significant input in terms of time and expertise. For example, environmental management is becoming more complex in the area of assuring compliance regarding the legal and policy obligations of suppliers (ENDS, 2006). In order to protect company reputations from poor practice in the supply chain, specific sectors of industry are increasingly looking at their mutual suppliers. An attempt to simplify EMS comes from the utility, information and communications sectors, which have pooled resources and set up a supplier database with the aim of easier and faster access to social and environmental policies. The oil and gas sectors are expected to follow suit (ENDS, 2006).

The oil, gas and mining sectors aim for a consensus agreement on policy between business, government and civil society to help to simplify the situation. Work by Warhurst (2001) in these sectors cite the drivers for an agreement as: globalisation, the voice of society, action groups, regulation, conditions of finance, industry peer pressure, internal pressures, supply chain pressures, voluntary codes of conduct and environmental change. Warhurst calls this agreement a multi-sectorial partnership or tri-sector partnership. In order to reduce complexity in management systems it is often necessary to prioritise environmental responsibility to levels of risk, especially where supply chains are involved. An example of business adaptation, in terms of environmental responsibility, is in the area of the relatively new and as yet not widely used responsibility management systems (RMS). These systems emerged with the aim of identifying risk responsibility and engaging with and reporting to stakeholders.

Waddock and Bodwell (2002) used the total quality management (TQM) paradigm when describing the interrelationships and approach to responsibility management (6.3) as Total Responsibility Management (TRM) shown in Figure 6.3. Leigh and Waddock (2006) outline TRM as a systematic approach, mostly voluntary and tailored to specific company situations, to counter external pressures from standards, directives, monitoring and codes of conduct to which a company is subjected.

Figure 6.3 An Integrated Model of Total Responsibility Management (TRM)

(Waddock and Bodwell. 2002, p120)

Aston University

Illustration removed for copyright restrictions

TRM utilizes stakeholder influence, thus bringing in CSR and the links to supply chain and reputation reporting. TRM includes environmental management of suppliers by the focal company by identifying them as primary stakeholders and as such, part of core internal company responsibilities. Secondary stakeholders are regarded as externalities with all players encapsulated under the environmental umbrella. The TRM system then fits neatly in the CSR report format and is a way of demonstrating this acceptance of responsibility to stakeholders.

6.6.3 Biodiversity Impact in the Supply Chain Context

The increasing scarcity of natural resources (MA, 2005), often affecting the availability of material goods in supply chains, is forcing an economic association with external increases in cost due to environmental issues, with profound effects on overall financial bottom lines (MA, 2005.MA, 2007).

Where material goods essential for sustaining business are derived from bio-diverse ecosystems and the services they provide, industrial development has had a major role in creating the situation where these ecosystem materials and services are under threat (section 2. ref in paper MA, 2005). Such are the cumulative impacts of business operations on the natural environment and biodiversity that business development should now be regarded as a related component of ecosystem function.

In researching for this project, however, the overall impression is that there is still a residual cautious and sceptical feeling towards general ‘environmental issues’ within business management, and very little understanding of linking biodiversity to material supply. It is in the context of CSR that fears and scepticism can be confronted with the CSR report exploited as an effective medium for publicising a company’s understanding of responsibility regarding its wider indirect impact on the environment, by including its supply chain. The CSR report also forms part of a demonstration of due diligence in complying with regulatory instruments, for example, the controversial amendment to the Companies Bill (Dti, 2006) which requires an annual review by quoted companies and should include more openness when reporting on relationships with suppliers.

As discussed in Chapter 3, biodiversity is integral to the discussion on impacts on ecosystem function, and as such is linked to the overall public impression of the company. Biodiversity and its relative importance to ecosystem and resilience deserve equal consideration with social and financial issues at boardroom level. Whether this is under the guise of *the environment* or direct mention, and should therefore be included in CSR reports. The situation in relation to the supply chain seems to be vindicated by a Chartered Institute of Purchasing and Supply (CIPS), Supply Management Survey of 100 buyers that highlighted the uncertainty of company purchasers in this area. The survey found that only 17 % of buyers had some understanding of the term ‘sustainable procurement’ (Snell, 2006).

The present critical world environmental situation (MA, 2006) is introducing new drivers (Section 4.2.3) that business has to respond to. As a consequence of changing market pressures and the imperative for more openness and accountability, business is starting to use sustainable development not in contradictory terms, but as an opportunity to improve profitability and strengthen reputation by voluntarily considering and reporting on its environmental performance.

In the UK public sector a key driver for responsibility in relation to supply chain procurement is the government sponsored Sustainable Procurement Task Force. The task force has developed a methodology incorporating a National Action Plan. The aim is to suggest sustainable procurement directions in business, see ‘Procuring the Future’ (Defra, 2006b).

A key issue of this strategy is more efficient consumption and production of non-renewable resources. Biodiversity is mentioned briefly as part of the requirements for future world leaders in the sustainable procurement world to consider. Also from October 2006, all public sector bodies in the UK, from the police to the BBC, will have to consider biodiversity in the work they do. This new duty comes under Section 40 (duty to conserve biodiversity) of the Natural Environment and Rural Communities Act 2006.

Defra, in partnership with the Local Government Association, the Association of Local Government Ecologists, English Nature, the Countryside Council for Wales, Welsh Assembly and Wildlife and Countryside Link are working on developing guidance to assist those affected in fulfilling their responsibilities (Defra, 2006c).

Despite these public sector plans and Legal Acts the message for biodiversity consideration in procurement does not seem to have taken effect. Research by Walker and Brammer (2007) at the Centre for Research in Strategic Purchasing and Supply (CRiSPS) & the Centre for Businesses, Organisations and Society, at the University of Bath School of Management has shown that environmental issues are way down the agenda in terms of sustainable procurement. The centre conducted a worldwide study of sustainable procurement activity in public sectors and compared the findings to UK practices. The study looked for practical examples of sustainable environmental purchasing in line with nationals level commitments to deliver such as, the United Nations' plan of implementation of the World Summit on Sustainable Development.

Within the framework of the Organisation for Economic Co-operation and Development, members agreed to improve the environmental performance of public procurement, whilst in the UK's 2005 Sustainable Development Strategy, the government stated its goal to be among the leaders in the EU on sustainable procurement by 2009 (Walker and Brammer, 2007). The study findings indicated that purchasing criteria was concerned mainly with areas of supplier work force health and safety and general public service department's in local and regional government sourcing from small or local suppliers. Environmental aspects were a lower priority generally but in education (sector) procurement, disproportionately higher (Walker and Brammer, 2007).

6.6.4 Other Environmental Impact Reporting Relating to Biodiversity Impact

One of the main environmental issues covered in CSR reports is climate change and the quantitative data supplied on carbon emission reduction. Regulatory, NGO, and stakeholder pressure forces businesses to improve considerably the reporting on impacts their operations and products have on climate change (ACCA, 2007). Businesses, especially energy-intensive companies, are now expected to disclose how they are mitigating their contributions to climate change in terms of policies, targets, product innovation, risk management and initiatives to reduce CO_2 gas emissions.

In line with the increased interest and urgency of the climate change situation, there have been many different publications, research studies and indices looking at climate change and industries role in dealing with it. These include the *Stern Review*, published in October 2006, which looked at the economic impacts of the 'Business as usual' scenario and the 'Take action' scenario. The Intergovernmental Panel on Climate Change (IPCC) 4th Annual Assessment which confirmed that climate change is a result of human actions, and that temperature increases are likely to be 1.8–4ºC (3.2–7.2ºF) by the end of the century (Section 3.5.1). There is also increasing interest from the investment community, with the Carbon Disclosure Project, the Institutional Investors Group on Climate Change (IIGCC) *Investor Statement on Climate Change* and the FTSE4Good climate change criteria (ACCA, 2007).

In addition, A UK report into the extent and quality of climate change CSR reporting has been undertaken (from a seemingly unlikely source) by the Association of Certified Chartered Accountants (ACCA) and the FTSE Group, The report is one of the first to address the issues of climate change reporting from an accounting perspective. The report, *Improving Climate Change Reporting* assesses the performances of 42 UK companies which are renowned as leading environmental reporters. The 42 companies were those defined as being from high or medium environmental impact sectors (for example, airlines, chemicals, electricity, oil and gas, construction, paper). Of the 42 selected companies, 15 companies were in the high-impact category and 27 in the medium-impact. The report highlights the leading sustainability and CSR reporters do not provide information equally on climate change issues. Individual product impacts are not adequately reported and climate change reporting is limited to a small group of leading companies and within this group, not widely practiced or monitored (Adams, 2007).

In addition, biodiversity is not a considered component of climate change reporting. This is despite the evidence linking biodiversity to climate regulation discussed in section 3.5. This is a missed opportunity for linking biodiversity to the more popular subject of climate change and the immediate effect that would have of placing it on boardroom agendas. Education on these two areas is needed both for business and stakeholders, including consumers.

6.7 Discussion

The subject of reporting responsibly is linked to which issues a company regards as being material. This determination of materiality, often using materiality matrices, is now an important factor in directing corporate strategy (Ashley and Jones, 2007). Sustainable procurement may be cited as a corporate strategy, however, is not possible without regard to raw material supply and the ecosystems that rely on diverse biological components to function (Section 6.6.3). Biodiversity therefore has to be considered as relevant and a potential material risk that could make a meaningful difference to bottom line figures. Biodiversity is a fundamental baseline in any one of the drivers cited in section 6.4.3, and in every aspect of a business operation.

Voluntary codes play an important role in marketing company reputation and brand value, which are major drivers for differentiation in competitive markets. CSR reporting can be used to emphasize and provide overall reassurance on ethical trading as well as giving stakeholders detailed information on key individual products. The CSR report has become a shop window for business to inform external stakeholders of their performance and intentions in operating responsibly and representing environmental, social and governance values. Despite the millennium ecosystem assessment report (2005) companies may also be unaware of the risks and opportunities with respect to supply chain biodiversity issues. This situation could be compounded by lack of communication within industry. This suggestion is supported by a CR survey conducted by IBM of senior cross-sector business executives which found there are significant information (including environmental) gaps between companies and their suppliers. Few of the IBM survey respondents were engaging with their supply chain partners often enough, and as a result missing an opportunity to reduce environmental impact and turn risks into opportunities (Riddleberger and Hittner, 2009).

Engaging stakeholders in the disclosure of biodiversity information within CSR reports is now more common as organisations take on their corporate citizenship obligations to meet ethical and discretionary responsibilities (Marshall, *et al*, 2007). Allenby (2000) suggests that if business is to meet the level of quality of environmental information demanded from stakeholders in the future, then integrating information systems, organisation and environmental initiatives, is a key basis for doing so. The Millennium Ecosystem Assessment (MA, 2005) provides enough evidence of the urgency surrounding biodiversity loss, and related risks to business viability, to suggest that a revolution is needed within business to action partnership working, with the aim of reducing biodiversity loss throughout their product supply chains. There is evidence that this is beginning to happen as Marshal *et al* (2007, p58) found that stakeholders are beginning to engage in '*direct dialogue, knowledge sharing and negotiated solutions'*, in a bid for *'higher quality disclosure of environmental information'*.

The CSR report has many attributes in forwarding the cause of biodiversity consideration in the supply chain as has been demonstrated above. However, as Asken (2009, *pers comm.*) pointed out, a good responsibility report alone is not enough to persuade company's to introduce a supplier biodiversity assessment tool. In order for that to happen it has to be demonstrated that biodiversity management can make a meaningful difference to such operations. The final model will have to provide such assurances by showing an assessment of the risks to supply chain effectiveness and the potential for turning those risks into opportunities. The model will also provide a means of accessing information for educating cross-departmental personnel on biodiversity and business. With such detailed information businesses can communicate their citizenship-based corporate biodiversity policies and actions and demonstrate that a meaningful difference has been achieved via the medium of the CSR report. The following chapter now investigates CSR reporting for the level and category of biodiversity reporting across a wide range of industrial sectors.

CHAPTER 7

BIODIVERSITY CONSIDERATION AND THE USE OF ENVIRONMENTAL MANAGEMENT SYSTEMS IN CORPORATE RESPONSIBILITY REPORTING

Following the overview in chapter 6 of Corporate Social Responsibility (CSR) reporting in general, a survey of published CSR reports from companies across a range of industrial sectors was undertaken. The objects of this survey were to find the extent that organisations considered and reported their responsibilities to biodiversity both within focal companies and their supply chains. The investigation also explored the level of reporting for links to perceptions of sectorial biodiversity risk and the extent and type of environmental management systems (EMS) use within focal company supply chain management. The intention of this exercise was to find out, at an early stage, if suggestions that the industrial sector or type of environmental supply chain management would inform the direction of the research.

7.1 INTRODUCTION - CSR Report Survey

In order to investigate the extent of biodiversity consideration, in CSR reports, a random sample of cross-sector publicly available company CSR reports were reviewed. The survey looked for trends in the level of biodiversity consideration, as reported, both within the focal company (sample (buying) companies selected for the survey) and particularly with respect to its management of their external supply chains. The survey explored any suggestion of a connection between the potential to material risk from biodiversity issues, as reflected in the risk sector an organisation is placed, and the management methods used to convey the quality of reporting on such issues.

One approach to managing biodiversity impact in the supply chain is the use of environmental management systems (EMS), especially when assessing risk, as the UK Government suggests, that properly implemented EMSs will help with managing risks, liabilities and legal compliance (Defra, 2005). From the point of view of smaller organisations in the supply network, or in developing countries where drivers for such systems are not as strong, accredited EMS standards can be too time consuming, complex or expensive to implement (Chapter 5). Therefore, the second part of the survey reviewed the general use of EMS in terms of, whether an accredited EMS, such as ISO 14001, or company in-house non-standard environmental system, was employed, by the focal company (see Appendix 2, for an overview of worldwide uptake of ISO 14001). The quality of environmental disclosure (see Sections 6.4.2 and 6.6.1) in CSR reports is affected by the approach to using accredited EMSs. Often, as work by Preuss (2005) found, they can be used rather cynically (see section 5.1 and the discussion in section 5.8) introducing what Everard (2008) called a tick-box attitude. The temptation for organisations to manipulate notions of sustainability (see Section 6.4.1) and accredited management systems and just use them to tick the right boxes is difficult to assess with this type of web-based survey and without access to audited records. This survey therefore has not taken the possibility of genuine or cynical reporting with respect to EMS or sustainable development into account. Similarly the CSR reports were difficult to search with respect to ascertaining the role of a dedicated person to manage the environmental and biodiversity issues. The dedicated biodiversity role in the sample companies was not a criterion of this survey.

7.2 Objectives

The main objective of the survey was to evaluate publicly available CSR reports for the degree of consideration given to biodiversity issues by the business community in relation to its supply chain. The results are intended to inform the more in-depth research of the single case studies described in (Chapters 9; 10 and 11) in the absence of access to suppliers as a result of low buying company influence. In order to achieve this objective the survey looked at:

1) Company reporting of biodiversity issues not in an environmental management system (EMS) context (standard or non-standard) and not connected to supply chains. This is to see if biodiversity issues are being reported outside any formal EMS;
2) direct mention of biodiversity within any form of EMS and with respect to suppliers. This will indicate if biodiversity is being included within EMSs and extended to suppliers.
3) EMS used in a non-biodiversity context, both internally and externally in the supply chain. This will show the extent of EMS use and if they are mentioned in reports;

4) mention of sustainability in a biodiversity and material supply context. This will show if biodiversity is seen by the organisation as part of their development and sustainable procurement process;
5) a biodiversity link specifically to landholdings of the focal company. This will show that biodiversity is seen only in the context of internal management;
6) the extent of focal company use of ISO 14001 and mandatory ISO 14001 requirement of suppliers. This will indicate if this standard is a requirement within supply chains and part of supplier selection criteria; and,
7) the use of non-standard in-house EMS in both the focal company and mandatory requirement in the supply chain. This will indicate the extent of non-standard EMS use within supply chains.

7.3 Biodiversity Consideration Survey Method

The survey reviewed the website published CSR reports of 120 leading national and multinational companies from various industrial sectors. The reports selected covered the financial years 2003/4 and 2005/6.

The survey sample came from three sources: (i). a company list compiled by Aston University's Environmental Systems and Safety Management Research Group – from an undergraduate assignment to assess environmental policies and statements; (ii) A Business in the Community (2006) top 100 companies list for corporate responsibility; and (iii) from CorporateRegister.com, a web-based directory of corporate non-financial reports. The sample was chosen to include 40 companies in each of three Biodiversity Risk Business Zones, as defined by F&C Asset Management (2004). A list of sample companies can be seen in Appendix 3.

The F&C Asset Management (2004) publication – *is biodiversity a material risk for companies* – considered what risks biodiversity poses for companies across all sectors of the business community and classified the potential material biodiversity risks, that is, risks of financial significance to a company due to its impact on biodiversity. F&C Management Ltd is a UK-based asset manager and considers whether companies that manage their social, ethical and environmental risks effectively are protecting shareholder value. Research for the F&C assessment was undertaken by the Earthwatch Institute (Europe) and ISIS Asset Management, who produced a biodiversity risk by sector table which segregated companies into high (Red), medium (Amber) and low (Green) biodiversity risk by sector zones. The F&C Asset Management Risk by Sector Table was adopted for this research, as it was the most comprehensive and relevant survey found of this kind. It takes into account the proportion of companies in an industrial sector that are likely to be exposed to biodiversity risks, and assesses the significance of risk likely to be faced by companies in each sector. Classifications of risk for the F&C Table were assigned using the results from an F&C workshop of leading company environmental and financial practitioners, and a subsequent email survey of companies. Sectors were identified that had the greatest biodiversity risks and how these risks could affect the value of a company, as a result of both the impact of companies on biodiversity and impact of biodiversity on companies. In addition the participants were asked to rate their industrial sectors by significance into high, medium, low, or non-existent impact zones.

The assessment found evidence of 10 sectors having a significantly high risk from their relationship with biodiversity, and the F&C report categorized them into 'Red' biodiversity risk zones. Further categories of medium risk (11 sectors) and low risk (12 sectors) were categorized into 'Amber' and 'Green' risk zones. Table 7.1 shows the 3 levels of biodiversity risk from the F&C Asset management study together with the sectors assigned to each zone. Within each zone, sectors are presented in alphabetical order. The ordering does not reflect different levels of risk

Table 7.1 Level of Biodiversity Risk by Sector
Source: F&C Asset Management (2004, p13)

In the analysis the of the survey results, section 7.4.1, the F&C risk by sector table is used only as a general guide of industrial sectors most likely to have an impact on biodiversity. It is recognised that sectors in all 3 biodiversity risk zones can have varying impacts on biodiversity and that their position is not fixed to a particular zone. As the F&C report points out, biodiversity can not only be a material high risk to companies in the red zone, but also to companies in the amber and green zones. The industrial sectors listed in the high risk zone are ones where companies are likely to have landholdings or their operations have a significant effect on land (and therefore natural habitats) and often have stronger legislative compliances. For example, utilities invariably own large amounts of land or their distribution channels, e.g. pipelines, run through many hectares of land. The food industry has biodiversity implications in the farming sector. The leisure industry owns or has an influence on large areas of land and is where this projects case-study participant, Center Parcs Ltd, operates. The medium risk zone includes manufacturing and retailers where materials are taken from natural resources, e.g. tobacco, beverages, textiles. The pharmaceutical and transport sectors are represented in this zone and this is where two of this projects case study participants, AstraZeneca and BAA (Heathrow), operate. The lower risk zone represents sectors from the service industries where there is often a less obvious impact on biodiversity.

Work by Ehrenfield (2005) found attitudes to biodiversity varied globally according to north/south, rich/poor divides, although Andersen and Skovgaard (2008) found little difference across Europe (section 4.7). However, in terms of impacts on biodiversity due to any geographical and cultural factors, the survey did not look for any specific influences. The focus was on biodiversity management and extent of company reporting spread over its entire operations and not related to any particular or potential scenarios. These areas of research would have to be the subject of further study. The results are presented in tabular form showing companies scored against specified criteria. The assessment of each CSR report was undertaken against the five-category criterion shown in Table 7.2 with a rationale for their selection shown in italics.

Table 7.2 Survey Categories Used To Evaluate Sample Companies CR Reports

SURVEY CATEGORY	KEY	CRITERIA (DEFINING LEVEL OF BIODIVERSITY CONSIDERATION) AND *RATIONALE (in italics)*
Supply Chain	A	Is biodiversity a consideration when dealing with environmental issues in the supply chain? Is biodiversity consideration part of the supplier selection criteria or code of conduct of the focal company? *The results give an indication of the level of understanding and importance given by the sample companies' indirect biodiversity impacts relating to the supply chain. This category is included as it is the focus of biodiversity issues in this project.*
CR Report	B	Is biodiversity mentioned as part of the general environmental section and in relation to the overall company policy but not specifically in an EMS context? No connection to the wider impact of the supply chain. *Considers the CR Report in general and looks for specific consideration of biodiversity in any context other than the supply chain. These results indicate the overall level of biodiversity consideration and awareness within the focal company.*
Focal Company EMS	C	Are Environmental Management Systems (In-house, ISO 14001, EMAS, 3rd party accredited management systems) in place? Do they directly mention and include biodiversity in an EMS context in the report? *Examines evidence within an organisations structure of Environmental Management System use in a biodiversity context. Is biodiversity issues part of a designated role in EMSs or discussed as part of an EMS framework? These results will show the level of structured management of biodiversity issues in areas such as targets and timeframes.*
Sustainability	D	Is Sustainability mentioned in the context of biodiversity consideration or general environmental issues? *Confirms acknowledgement of the link between biodiversity and sustainability, for example in terms of security of supply, or sustainable management of ecosystem goods or services.*
Landholdings	E	Is biodiversity consideration specific to land owned by the sample focal company? *Identifies companies with landholdings, whether their biodiversity consideration is restricted to a landholding context and how broad this is, ie. land owned and leased by the focal company or used by suppliers.*

With reference to company environmental statements of intent the survey looked for a mention of biodiversity in any statements, see Table 7.2 Category B. In selecting the criteria and categories used for evaluation of the CSR reports, the survey was deliberately not steered by performance indicators used in guidelines, such as the Global Reporting Initiative (GRI) (Section 6.5.1). Such performance indicators generally concentrate on protected land areas and areas of high biodiversity value, whereas the survey was looking for evidence of more wider and general considerations of biodiversity in the reports. Companies selected for the survey may well have publicised other documents in addition to their CSR report, such as environmental or specific biodiversity impact reports, but these were not considered in the survey. However, because EMS categories are not always stated in CSR reports, other related publicly published documents, such as environmental reports, were investigated when evaluating the use of EMS in the supply chain.

These categories were designed to demonstrate a comprehensive coverage of the area of biodiversity consideration and EMS use, in terms of company responsibility, as explained in section 6.1. The main emphasis was to assess the biodiversity consideration of the main published CSR report, as opposed to more disperse information. The 5 survey categories (A to E) cover the main survey objectives outlined in section 7.3 and are designed to give an overall impression of environmental reporting in the 3 Biodiversity Risk Zones as defined by F&C Asset Management (2004). The five survey categories and criteria were developed from the project literature review as the most representative of issues concerning the management of biodiversity in organisations and with respect to this project. The list is designed to focus the survey with respect to the project aim and objectives. The survey did not investigate whether claims made in reports were verified or audited; this would have to be the subject of future studies.

The Supply Chain (A) category is included because of the potential contribution to halting biodiversity loss, as discussed in section 4.4, that supplier partnerships on biodiversity management can make. And as the Handfield and Nichols (1999, p2) definition in section 4.1 says, *'The supply chain encompasses all activities associated with the flow and transformation of goods from raw materials stage (extraction), through to the end user, as well as the associated information flows..'*. The CR Report category (B) is included in order to find the level of importance attached to the CR report as a shop window of a company's biodiversity management performance. As discussed in section 6.6, the survey looked for an example of the longer term values (material consideration) of biodiversity issues, or of direct economic/investment risk to a company.

The Focal Company EMS category (C) looked for evidence of a structured approach to biodiversity management within an EMS. Chapter 5 discussed the lack of any evidence that biodiversity was integrated into EMSs such as ISO 14001; the examination of this category by the survey would indicate the level of EMS use in managing biodiversity within a focal company. The Sustainability category (D) is included as this is another link to materiality (Section 6.6) and the value placed on biodiversity. It is also linked to sustainable use of biodiversity (see Section 3.6.1 on international biodiversity policy) resources by business and the survey looked for evidence of its consideration in sustainable terms. The Landholdings category (E) is included as this is the area of the F&C high risk zone and where companies are more likely to have landholdings. The survey investigated evidence of biodiversity consideration where companies have owned land or their operations effect natural habitats (see Section 2.4.1). This will separate areas where companies concentrate on more obvious direct impacts of their owned landholdings.

7.3.1 Scoring

In reviewing each of the sample company CSR reports with respect to the five evaluation categories set in Table 7.2, a score was assigned by the project author that reflected the level of criteria consideration. The scoring system designed by this project, shown in Table 7.3, ranges from 0 to 3, reflecting - No, Poor, Moderate and Good Consideration, examples of reasoning given in italics.

Table 7.3 Biodiversity Consideration Scores for Survey Category

Level of Biodiversity Consideration in CSR Report	Level of Biodiversity Consideration Examples with Respect to Criteria Set in Table 7.2 shown in italics	Score
No Consideration	Mention of biodiversity in any context not found in report and poor coverage of general environmental issues relating to biodiversity. *No mention of biodiversity shown against any of the criteria set in Table 7.2.*	**0**
Poor Consideration	General environmental issues reported but not in detail. Supply chain mentioned in general environmental terms only. Biodiversity or related issues not mentioned. *Set against each of the 5 criteria in Table 7.2 - Environmental issues reported in general but no detail.*	**1**
Moderate Consideration	Mention of biodiversity related issues, e.g., sourcing of raw materials; security of supply; text eluding to biodiversity related consideration e.g. species or habitat protection or genetic context. *Biodiversity related issues mentioned with respect to the criteria set in Table 7.2.*	**2**
Good Consideration	Specific mention of biodiversity. Good understanding of biodiversity is conveyed in the report. Biodiversity is considered in the wider context of the supply chain. *Biodiversity directly mentioned set against each of the criteria in Table 7.2.*	**3**

Each of the sample CSR reports was electronically word-searched for a direct mention of biodiversity or any related words such as ecosystem(s), ecology, or sustainable, with respect to the supply chain. These words and any sections of the reports explicitly relating to natural environment issues were then assessed in detail directly, by reading the relevant sections. The results are presented in tabular form showing companies scored against the specified criteria.

7.3.2 Segregating Sectors into Biodiversity Risk Zones

Having obtained the review data for the sample (see Appendix 3 for examples of the tables of results), companies were divided into their relevant biodiversity risk zones by industrial sector, as defined by F&C Asset Management (2004) – see Table 7.1. The 120 sample companies had been selected such that there were 40 in each of the three F&C biodiversity risk zones.

7.4 RESULTS

Taking each survey category at a time, a simple frequency analysis was undertaken to determine both the maximum frequency scores within each biodiversity risk zone and the modal frequency scores across all zones, in order to highlight the most common biodiversity consideration. The results are shown in Table 7.4.

Table 7.4 Results by Survey Category and Biodiversity Risk Zone

Survey Category Key	Red Risk Zone BC Score (40) Highest Score **Bold**				Amber Risk Zone BC Score (40) Highest Score **Bold**				Green Risk Zone BC Score (40) Highest Score **Bold**				Total BC Score across all Risk Zones (120)			
	0	**1**	**2**	**3**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
A	10	**14**	10	6	**15**	13	6	6	9	**16**	8	7	34	**43**	24	19
B	3	8	2	**27**	5	12	4	**19**	12	8	5	**15**	20	28	11	**61**
C	**18**	9	6	7	14	**18**	6	2	**17**	12	9	2	**49**	39	21	11
D	3	11	12	**14**	3	**15**	**15**	7	7	**18**	11	4	13	**44**	38	25
E	7	9	1	**23**	**15**	4	8	13	**14**	10	7	9	36	23	16	**45**
Total Score Across All Categories	41	51	31	**77**	52	**62**	39	47	59	**64**	40	37	152	**177**	110	161

Notes: 40 CR reports were considered in each of the three risk zones giving a maximum score of 40 for each survey category, with a total of 120 reports being surveyed. The distribution of Biodiversity Consideration Score (BCS) (0 to 3 - taken from the criteria given in Table 7 3), is shown within each risk zone. Maximum frequency scores are in bold, modal frequency scores are shaded grey.

In each case, apart from survey category E (Landholdings), maximum and modal frequency scores coincided. The exception was due to the disparity between red zone companies with a high consideration for landholdings, and amber and green zone companies, which showed no consideration in this area. Other survey categories were not so polarised across risk zones.

An analysis of Table 7.4 is presented in section 7.4.1 and the results discussed in section 7.4.2.

7.4.1 Analysis of Results

Table 7.5 is a synthesis of the findings from Table 7.4 and summarises the most common levels of consideration in each biodiversity risk zone with respect to the survey categories.

Table 7.5 Most Common Level of Biodiversity Consideration in Survey Reports

Survey Category	Red Risk Zone Level of Biodiversity Consideration	Amber Risk Zone Level of Biodiversity Consideration	Green Risk Zone Level of Biodiversity Consideration	Most common level across risk zones
A (Supply Chain)	Poor	None	Poor	Poor
B (CR Report)	Good	Good	Good	Good
C (F C EMS)	None	Poor	None	None
D (Sustainability)	Good	Poor / Moderate	Poor	Poor
E (Landholdings)	Good	None	None	None
Most common level across all survey categories	Good	None/Poor	None/Poor	None/Poor

Perhaps not surprisingly companies representing high (red) biodiversity risk produced CR reports with greatest consideration for biodiversity and scored highest, with a most frequent score of good (3) for each survey category, whereas amber and green zone companies generally scored poorly (≤1). However all companies, including those in the red zone scored poorly or failed to consider biodiversity impacts in the supply chain or with respect to EMSs. Averaging the biodiversity consideration scores across risk zones (Table 7.5, final column) also highlighted the use of EMSs and the consideration of sustainability and landholdings as being deficient overall (ie poor or no score). It appears that organisations placed in the red zone are more likely to have significant landholdings than companies in other risk zones and therefore they are probably more immediately aware of business risks concerning biodiversity and with respect to the other survey categories, compared to amber and green listed companies. Across all risk zones biodiversity receives the most attention under survey category B (general consideration in CR reports). Companies often mention biodiversity as part of the general company policy, but go no further in publishing detailed information within the report. Although this gives the impression that the report is giving good consideration to biodiversity, the detail is missing concerning how the company manages the risks. It is possible that in some cases more detail on biodiversity issues is published elsewhere. No evidence was found as to a dedicated role for biodiversity within EMS, as part of the survey category C.

7.4.2 Discussion

It is recognised that, although fairly representative of industry overall, the company sample size is relatively small, and that no formalised random sampling method was employed in the survey. The analysis therefore, can only give a suggestion of trends of how business is using CSR reporting as a means of conveying its biodiversity consideration, and any in-depth statistical analysis of the results would have little meaning. However, the survey coincides with the project aim of observing reporting patterns and informing the final project methodology and from the analysis undertaken some general observations can be made.

When each of the survey category scores is collated, it is the red zone (with a score of 77) which has the highest Good Consideration score of 3. This coincides with the F&C Asset Management (F&C) classification of highest material risk to a company. The amber and green risk zones both give a low consideration score (1), reflecting the F&C judgement of a lower biodiversity risk within these industrial sectors. Despite the overall survey results not differentiating between amber and green risk zones, the findings do support the F&C identification of the industrial sectors with the greatest perceived biodiversity risk. However, when results are taken as a whole, the overall consideration for biodiversity across all industrial sectors is poor. This conclusion corresponds with the UK Environment Agency list of disclosure levels of environmental topics used in reports (Figure 6.2), where biodiversity comes in at number 9 on the list and is linked only to land use.

7.5 ENVIRONMENTAL MANAGEMENT OF THE SUPPLY CHAIN

7.5.1 The Use of ISO14001

In addition to the above survey a further review of the 120 sample focal companies was undertaken. This had the objectives to:

1) Find the number of sample companies that required the accredited management system ISO 14001 to be mandatory in the supply chain;

2) investigate the use of in-house (that is, company designed non-accredited systems) environmental management systems by the focal company and;

3) find how frequently used are in-house environmental management systems in the procurement process.

This survey of ISO 14001 use was not scored and biodiversity was not a criteria. The survey examined the number of companies in each of the F&C Biodiversity Risk Zone that used the environmental management options described in the above objectives. Focal companies who accepted a staged approach from suppliers to achieving ISO 14001, such as the British Standards Institute (BSI) 8555 or the Institute of Environmental Management and Assessment (IEMA) Acorn system, were counted as requiring ISO 14001 from that supplier. A number of these leading companies in the survey sample used other leading companies as their main supplier; as a result these companies had ISO 14001 in place. It is also possible that some companies in the supply chain had accredited systems but information on specific suppliers was not available from the CSR reports.

7.5.2 Results of the Survey of ISO 14001 Use

The results of the ISO 14001 survey, given in Table 7.6, show the focal company use of ISO 14001 as evenly spread across the F&C red and green risk zones with 77% and 82% of the 40 companies in each risk zone.

Table 7.6 Use of Environmental Management System Options in the Focal Company and Supply Chain

EMS USE (Biodiversity not a criteria)				
Management System	**Risk Zone**			**Total**
	Red	**Amber**	**Green**	
Focal Company ISO 14001 EMS	31	22	33	86
Focal Company In-House EMS	35	36	36	107
ISO 14001 EMS Requirement In Supply Chain	16	10	23	49
In-House EMS Extended to Supply Chain	27	23	13	63

The amber risk zone gave the lowest overall number, representing only some 55% of the 40 companies in this risk zone. There were however more companies within the amber risk zone using their own in-house environmental management systems. The total of 86 for accredited ISO 14001 systems from a possible 120 companies, shows the standard is not universally employed. Focal company in-house EMS numbers were evenly spread across all risk zones, showing over 87% using these systems.

The findings from reading the published CSR reports concur with the literature review findings discussed in section 2.4.1 in suggesting that companies may often attain and use the ISO 14001 standard and environmental, social and ethical *guidelines and processes* (Section 6.3) as a baseline for environmental management, but it is likely that they use their own bespoke systems alongside these. This combined use ensures and enables companies to be compliant, and the in-house systems, which are already integrated into the company's internal management systems, allow the company to act and report in more detail on specific industrial sector issues. The use of established in-house EMSs would appear to be the most effective way forward for integrating biodiversity issues, given the lack of guidance within the ISO framework for including biodiversity.

The number of companies requiring ISO 14001 of their suppliers is 49 or 41% across all risk zones. The green risk zone had the highest number with 23 or 57% of companies. The amber risk zone numbered only 10, which corresponds to the low number of amber focal companies having the ISO 14001 standard. The use of in-house EMS for managing the supply chain is higher than for the ISO standard. The total number of 63 or 52% of focal companies in the survey using in-house criteria mirrors the higher use of in-house systems by the focal companies themselves.

There is an even spread in the red and amber risk zones, but the green risk zone had a relatively low number – 13 or 32%. For an overview of total worldwide use of ISO 14001 throughout industry see Appendix 2. These results again suggest that a methodology for considering biodiversity within supply chains would have to be flexible enough to be easily used alongside existing industry bespoke systems. The results also support the request from this project's case-study companies for a bespoke method and practical tool which can be easily used alongside their own supplier management processes.

7.6 Investigation of Focal Companies Scoring a Maximum for Management of Biodiversity in the Supply Chain

Out of the survey sample of 120 companies, 19 scored the maximum rating of 3 (Good Consideration) in survey category A - supply chain (Table.7.4). A further 5 categories were selected to review category A. The object was to ascertain the type of environmental management system used by these 19 companies and what type of system they required of their suppliers. The findings would inform the direction of the research as to the choices available to focal companies on EMS with respect to the supply chain. In addition, the findings would suggest whether the final model would concentrate on integration with ISO 14001 or be flexible enough to work as a stand alone bespoke method to work with in-house systems. The rationale therefore was:

Category 1. To find out if the focal company used ISO 14001;
Category 2. to find out if the focal company used its own in-house EMS and if they worked in partnership with their suppliers aiming to work to similar standards;
Category 3. is ISO 14001 required of their strategic suppliers;
Category 4. if a supplier does not have a accredited system does the focal company recommend a staged approach to attaining it.
Category 5. is there any mention that the focal company enquires if their strategic suppliers ask their strategic suppliers to consider biodiversity.

Table 7.7 Review Categories and Results

	FURTHER ANALYSIS OF SURVEY CATEGORY A – BCS (3)	Red Zone (6)	Amber Zone (6)	Green Zone (7)	Total (19)
1	Accredited Environmental Management System used by focal company – ISO 14 001 or EMAS?	5	6	7	18
2	In-house EMS. Own code of conduct; expect suppliers to meet own standards. Own supplier quality partnership system including a biodiversity element?	5	6	6	17
3	ISO 14001 required in supply chain - 1st or 2nd Tier?	2	2	4	8
4	Acorn or BS8555 recommended to suppliers?	2	0	0	2
5	Obligation for a supplier to require biodiversity criteria from their own suppliers?	0	1	2	3

Further analysis of these 19 focal companies (Table 7.7) showed that the companies were spread evenly across the three biodiversity risk zones, and hence the consideration of supply chain biodiversity issues was not dominated by any particular risk zone.

The results also show that with one exception, each of these 19 companies employed an accredited EMS such as ISO14001 or EMAS. Nevertheless the one non-accredited company operated its own in-house system. In fact a total of 17 companies had internal systems, which contained specific biodiversity elements and involved, amongst other things, working in partnership with suppliers. These in-house systems are often based on ISO 14001 and tailored either to the industrial sector the company operates in, or to a type of product.

Strategic suppliers are often expected to comply with the company EMS via a due diligence process. Various titles for such processes are used, for example, Responsible Care Management (ACC, 2007), Electronic Industry Code of Conduct (HP, 2009), Vendor Code of Conduct, Supplier Relationship Management, Responsible Sourcing Standards, Supplier Management and Assessment Systems, Supplier Ethical Data Exchange (SEDEX, 2009) and Global Compact Sustainable Supplier Management System (GC, 2003). However, only 8 of the 19 companies required their first or second tier suppliers to adopt accredited EMS systems. Interestingly four of these eight cases were low risk (green zone) companies. Therefore in the majority of cases, the requirement of focal companies for suppliers to have accredited EMSs may currently be viewed as too restrictive in terms of supplier sourcing. The operation of purchaser-supplier partnerships and contractual agreements or assurances may be more workable solutions in the current business climate.

The results indicated an upward trend in red risk zone focal companies requiring ISO 14001 by a staged approach, through Acorn (IEMA, 2009) or BS8555 (BSi, 2009). Overall the data are too sparse, with a total of only 2 companies reporting across all 3 risk zones, for any meaningful conclusion to be drawn however. The overall (cross-zone) indication is that encouragement to start a staged approach to achieving ISO 14001 is not widely recommended to suppliers.

Only 3 companies reported the extended requirement for their main suppliers to ask for information on biodiversity issues of their own suppliers. None of these companies were from the red risk zone, but two were from the green zone, giving a further indication that biodiversity risk zone boundaries are not strictly defined. With only 3 companies out of the 120 in this category, there is a strong suggestion that focal company influence diminishes with distance down the supply chain. This situation has to change and keep pace with changing business attitudes towards sustainability.

7.7 CONCLUSION

The survey found CR reporting of consideration for biodiversity in the supply chain to be poor over the whole sample size. An average of 16% of companies rated as Good Consideration (GC) for biodiversity. The green risk sector scored higher for supply chain biodiversity consideration (Table 7.4) suggesting companies in this sector are just as aware of their supply chain biodiversity responsibilities. In contrast general biodiversity consideration has a higher profile with an average of 49% consideration across the three risk sectors. In fact the red sector rated higher in all other categories B to E, which might be expected, as it is the high-risk biodiversity sector. Despite the red risk sector having the highest ratings with amber overall second, biodiversity consideration is very low in all three-risk category sections.

Biodiversity is reported for the focal company but poor reference made to biodiversity in an EMS context. Companies in the red risk sector were again coming out on top but still low, with only an average 17% from the total sample size scoring a GC level. EMS is also poorly reported in the context of the supply chain. The suggestion to the reader here is EMSs are not widely used to manage biodiversity either in the focal company or in the context of suppliers. In terms of the supply chain EMS are often an issue of resource availability for SMEs and are therefore not in place for any environmental issue.

Sustainability (D) has a poor mention in relation to biodiversity across sectors. However in the red risk sector sustainability was linked to biodiversity more often than the amber and green sectors. Sustainability is more likely to be mentioned in relation to energy, waste, or emissions. Also the red sector rated higher across the whole cross-sector in biodiversity consideration on land holdings. This reflects the sectors probability for having land owned by companies.

The analysis of the 19 sample companies achieving a rating of Good Consideration showed the red sector achieving higher rating in all categories except the requirement to ask suppliers to place similar criteria on their own suppliers. The greatest difference in ratings was in the EMS (14001 or EMAS) category. Although all 19 companies used an EMS, 50% more companies used an accredited system in the red sector, indicating a greater need to have figures assured with an externally audited report by high-risk companies. Again the red risk sector rated higher in all the other categories that is, 5 to 8. Amber and green were close but green rated higher suggesting a high or higher acceptance of biodiversity responsibility and willingness to publicise in CR reports. With respect to informing the final methodology this element of the research suggests that the final method would have to be designed to function, across all industrial sectors, both within an accredited EMS and as part of a non-accredited system. This would ensure that whether a supply network is working with large companies with an accredited system or a small and medium sized company (SME) in a supply chain the method would work equally well.

7.8 DISCUSSION

The survey findings show that the red risk zone had the highest overall level of consideration for biodiversity (see Table 7.5). This would seem perhaps unsurprising as the survey samples taken from the high red risk zone consisted of companies which are more likely to have a direct and perceived tangible impact on biodiversity (see section 7.3), possibly through their landholdings. These companies as a result have a vested interest to be transparent and are more likely to give biodiversity a higher material value, as the IUCN found (2007), see section 2.4.1 and further discussions in sections 2.5 and 6.4.2. The results support the earlier research where organisations that are more likely to have a direct impact would consider biodiversity at a higher risk level, see sections 1.3.3; 2.4; 4.4; 7.4.1; and EBI (2007), section 2.4.1. However, biodiversity reporting in a non-supply chain context (survey category B) is shown to be good across all risk zones and therefore across a wide range of industrial sectors. This would suggest that the principle of biodiversity consideration has been accepted to a degree within industry but not, as yet, thought as part of an organisations risk assessment in its wider operation. This situation has to change, as Korten (2001) argued in section 4.3, as it is companies that now have to contribute to environmental, social and economic development and not just governments.

In this respect companies are now more mindful of the power shift towards consumers and the influence they are starting to exert on sustainable product sourcing, as work by Price Waterhouse Coopers (PWC, 2006) found in sec 1.3.3. At the same time risk perceptions in industry with respect to biodiversity are increasing, as the example from the United Nations Environmental Programme Financial Initiative showed in section 2.4.1 (BESW, 2007) and the recent report from the Institute of Chartered Accountants and the Environment Agency (UK) stated (ICAEW & EA, 2009). As Fauna and Flora International argued (FFI (2008), section 2.4.1), financial institutions have the leverage to influence biodiversity policy of companies they invest in. In the retail sector environmental considerations are increasingly influencing purchasing decisions as Rose (2007) pointed out in section 1.3.3. Examples from Hughes and Demetrious (2006), in section 4.3, show an increase in interest in these issues from a widening body of stakeholders with the potential to influence organisations. Freeman (2007), sections 4.3 and 6.2.1, suggested that secondary or external stakeholders are extending organisation responsibility to the supply chain in an overall environmental footprint; this is supported by Mylrea (2005) and the MEA (2005), in section 4.7. At the same time, the increasing threat of scarcer resources and to security of supply may be drivers, as Fanning (2007) suggested in section 2.4.1, for companies to view environmental issues with more interest, and this should also hold for biodiversity.

The IUCN (2007) identified 4 levels where companies could address biodiversity, these were: compliance; philanthropy; management and value creation, section 2.4.1. Whichever approach is considered most advantageous to organisations there are obstacles, as Morton (2004) in section 4.7 pointed out. The main examples given are senior management, finance directors, budget holders, and internal customers/specifiers, users of products/ services and environmental managers. The size of a company also influences attitudes to environmental issues as the MORI (2004) pole and work by Holt (2005) found in section 4.7, and as biodiversity is only a fringe element of general environmental aspects, it will only be given value if the issues affect corporate objectives. A constraint to overcoming barriers to change in this area is the lack of specialist knowledge on the subject and way's of delivering relevant information to business on the risks and missed opportunities within supply chain biodiversity management. The area of education and training on biodiversity and business is discussed in the following chapter.

There are incentives for companies to consider biodiversity and examples come from the idea of sustainability, mentioned by Wood (2006), section 6.2.2. Common themes for a sustainable approach to business are cited from the Millennium Assessment (MA, 2005) in section 4.9 as: reputation and brand risk; access to raw materials; new business opportunities; partnerships; operational impacts and efficiencies. Other drivers supporting this come from Business in the Environment (BitE) and The Chartered Institute of Purchasing and Supply (CIPS) (section 4.9) as reputation: cost savings; legislation; finite resources (long term value); consumer awareness and employees; borrowing money; increased sales opportunity and differentiation from competitors.

Moltke *et al* (1998) and Holt (2005) and the MORI poll (2004), section 4.5.1, suggested that the lead for change has to come from large organisations with extensive supply networks, with the influence to affect global economic, political, environmental and social development, a view supported by Preuss (2005) in section 4.5.1. Thankappen *et al* (2004), section 4.5.1, found that smaller companies have little incentive to drive change. This is an area where larger focal companies can work with smaller enterprises in the product supply chain and pool resources for common objectives.

The partnership approach is advocated by Henriques and Richardson (2004), section 4.7, but Andersen and Skovgaard (2008), section 4.7, point out that it is crucial for the first company in the chain to send the right signals and information to its direct suppliers, and they should do the same to their strategic suppliers in order for the process to function efficiently. Partnership working with suppliers is not without precedent, with examples from large organisations where supply chain partnerships pool resources such as the B&Q company, and the model of the Substance Exchange Information Forum (SEIF) from the chemical industry (EC, 2007), section 2.5.2., and the Biodiversity in Good Company (gtz, 2009) initiative from Germany.

The level of understanding and urgency of the situation will perhaps move forward with publications such as The Economics of Ecosystems and Biodiversity (TEEB) report (D3) to business, which is due to be published in 2010 (Dimas and Gabriel, 2008), section 4.8 (a paper by the author *et al* has been submitted to contribute to the report). Also the Institute of Chartered Accountants and the UK Environment Agency (2009) - Environmental Issues and Annual Financial Reporting document, which now includes biodiversity as part of its company annual report recommendations. Another example is The United Nations Environmental Programme Financial Initiative (UNEPFI-Biodiversity and Ecosystem Services, 2008) sets out the business case for biodiversity and outlines associated risk and opportunities for the finance sector. Other examples come from the EU directive and the Habitats Directive (92/43/EEC) aiming to protect biodiversity; and the Environmental Liability Directive (ELD,2009), section 6.4.3, (Defra, 2007). Criticisms of the ELD however mainly from the insurance industry (White and Pohl, 2009), section 2.5; argue that the fines for pollution incidents are too weak.

As Suhkdev (2008), section 4.8, say's the difficulty is placing a value on biodiversity and companies will need to know the financial incentives for its consideration. This is an area where the TEEB initiative from the German Federal Government and the EU Commission can help by reporting on case studies and evaluating biodiversity as an ally of business. Another example is the Payment for Ecosystem Services (PES) programme which promotes the conservation of natural resources in the marketplace (Demas and Gabriel, 2008), section 4.8. After making the decision to consider biodiversity the management of its assessment within the supply chain would have to be considered.

CSR reporting is according to Mylrea (2005) and The Millennium Ecosystem Assessment (MEA, 2005), section 4.7, gaining momentum and business recognizes its responsibility to a widening group of stakeholders. However, according to the survey results the indication is that biodiversity is poorly included within CSR reporting across a wide section of industry, suggesting a lack of transparency is this area. Companies are missing a marketing opportunity if they do not include their full biodiversity management processes or achievements (particularly beyond compliance) in their reports, or they do not provide electronic links to other related CR documents.

A common framework for potentially applying biodiversity aspects to the supply chain is the ISO 14001 EMS. The implication, taken from the survey of company CR reports presented in this chapter, is that where a chain of companies is commercially managing the supply and manufacturing of a common product, and where they have an accredited EMS, they operate them independently. This creates the potential for individual companies to expend precious resources on duplication of EMS objectives and targets, which may be common throughout organisations within a whole product supply chain. The overlap concerns *inter alia,* company in-house expertise, budgets, information, business level playing field and, where outside consultation is needed - negotiation and buying power. Yet pressure from stakeholders, for example Natural England (2004) who suggest that industry should use 14001 in its overall approach to environmental management (section 1.3.3). Work by Darnell *et al* (2006) suggested integration EMS into supply chain section 2.3. An alternative approach is also needed where companies can assess their biodiversity responsibility in the supply chain within their own existing in-house system.

This chapter has studied a random number of cases in order to find any trends in biodiversity consideration across a wide industrial sample. The survey has suggested current causal situations that may explain the extent in which industry deals with the question of biodiversity. The conclusion drawn from the CSR survey concurs with the findings of chapter 6 in that the final methodology would have to work equally well across all industrial sectors and be able to be integrated into accredited and in-house non-accredited EMSs.

In order now to provide more evidence to support these findings and give more insight into the managerial relationship between industry and biodiversity issues the next chapter focuses on a smaller number of selected individual case companies.

CHAPTER 8

RESEARCH METHOD

This chapter describes the qualitative case research method adopted for studying the supply chain management processes of the companies working with the project. General case study theory and application with relevance to the projects aim is also discussed. The short-listing of potential organisations for the case studies and the reasons for the selection of 3 participating companies is explained, along with the difficulties experienced during the project of maintaining case study momentum and communications with the selected companies, in a changing business environment.

This Chapter covers Stage 2, Sections (iv), (v) and (vi) of the objectives set out in Chapter 1, Section 1.3.

8.1 INTRODUCTION - Case Study Definition

The dynamic nature of studying a real life business situation has made finding a definition of 'the case study', which would directly apply to this project, difficult to find. Definitions vary according to the type of 'case' in question and the strategy adopted for study (Ragin and Becker, 2005). The 'case', is the 'object' of the study and the unit of analysis (de Vaus, 2001) and in this instance the object is a qualitative observational study of procurement related environmental management, set within the context of specific business organisations, but forming part of a wider overall project-research strategy.

Through initial communications with the 3 participating companies it is known at the outset of the case study stage that they do not have a biodiversity management strategy within their respective supply chain management processes, refer to section 8.8.6 for details on final case study selection. The case studies for this project have observed qualitative data, in the form of internal management procedures in relation to general environmental issues or aspects, concerning their respective supply chains. The study, within a real life context, investigates the properties of a single phenomenon which in this case is the management procedure adopted by the business organisation, and the context is the company procurement and environmental operations departments.

In answering the question 'what is a case' Becker (Ragin and Becker, 2005, p6) holds that there is no definitive answer, because it '*depends on the specific evidence and issues at hand*'. If for the purposes of methodological clarity a definition is needed then Gerring (2007, p17) describes the study of a single phenomenon, instance or example as the most common understanding of the term 'case-study'. Another example of a definition of 'case study' is offered by George and Bennett (2005, p17) who define a case as '*an instance of a class of events*'. Miles and Huberman (1994, p10) provide a succinct abstract definition of a case, with, '*a case is a phenomenon of some sort occurring in a bounded context'*.

The qualitative case study has helped, as Miles and Huberman (p1) further state, '*to get beyond the initial conceptions'* and to generate research contributions to a new conceptual framework in the form of the final methodology. The Miles and Huberman definition has identifiable boundaries and is the one referred to in this project. The particular case study method adopted for this project is described in section 8.2.

The case study method is not without its critics (see Gerring, 2007). For example, there is a view that such research strategies should be only used in the exploratory phase of a project Shavelson and Townes (2002). Other criticisms of the case study include the idea that it can not be generalized beyond the case in question. To counter this, practitioners of the case study approach argue that it is not the purpose of the case research design to generalize to other cases. The case study approach differs in this respect to survey research strategies as they use random sampling (as used in the cross-case survey in chapter 7) to increase the representative-ness and validity of their general findings (Bryman, 2004).

The arguments as to what is a 'case' continue and are beyond the scope of this thesis, however they serve to illustrate, as Ragin (1996) states the indeterminate and dynamic nature of the term 'case'. Often what a case study exemplifies will only become apparent, as Radley and Chamberlain (2001) said, after the study is completed.

There have been a number of case-study strategies described, for examples see Bryman, (2004, p51) and Yin (2003, p3). Bryman (2004) describes the exemplifying case. This approach provides a situation where case research questions can be answered in context, in order to find a typical example of the particular case or management strategy within a wider study. The exemplifying case would now be the nearest type that would fit the objectives of this project, which is to study supply chain management processes. These more in-depth studies of company procedures provide further grounding information to support the wider cross-case study and provide additional questions which will inform the development of the final methodology, and industry training and education on biodiversity issues (see Section 2.1) as discussed in section 8.9. References to 'sectors' refer to industrial sectors, and where risk sectors are mentioned (from the F&C risk zones in chapter 7) they are described as 'biodiversity risk sectors'. The next stage, after the case studies, is to use this information in order to integrate the findings into a methodology and test it within a real procurement situation.

8.2 SINGLE OR MULTIPLE CASES

There are also other variations within case study strategies to be considered and these include questions such as, 'is the study single or multiple case'? Two or more cases within the same overall study are regarded as a multiple case study (Yin, 2003).

For this project, a single case study in isolation could provide some meaningful results, but would necessarily have to be a focal company case study within a single industrial sector (as opposed to biodiversity risk zones described in Section 7.3) and may therefore introduce a sector bias, even if its supply base has the potential to operate in other sectors. For example, biodiversity in the utilities sector is more directly relevant to a utility organisation with large landholdings. Utilities would also include organisations whose operations are likely to impact on surrounding habitats (with a pipeline installation for example), than in the banking or insurance sectors, whose impacts are less apparent.

Ideally the participating companies would come from different biodiversity risk zones, as described in Table 7.1 but this proved difficult to arrange. In addition, for the overall research project to conclude with an understanding of supply chain management trends, a single case would not be sufficient. By undertaking a multiple case study the individual findings will triangulate the results within the case study, adding further triangulation with the research survey conducted in Chapter 7, and the findings of the wider literature review in the initial chapters.

8.3 PROJECT FOCUS – Case Study Approach

The first objectives in any case study selection is to maximize the time available by avoiding unrealistic or uninformative studies as quickly as possible. There are a number of ways of conducting social science research, such as, by experiment, surveys, histories and the analysis of archival information (Neustadt and Fineberg, 2004), and Table 8.1 gives the relevant situations of the different research strategies. Each has their applications depending on the type of research question, control over behavioral events or time frame focus. The current state of knowledge of the subject area at the time of writing and the nature of the research context will also dictate the appropriate method to be adopted (Yin, 2003).

Table 8.1 Relevant Situations of Different Research Strategies
(Taken from: Yin (2003, p5)

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The stratagems selected for this project are a combination of orientation within the research with respect to the impression of biodiversity within industry, survey and case study. Orientation research in this instance refers to the general literature review which helps in determining the relative position of biodiversity issues within industry and in environmental management of supply chains. The survey element constitutes the CSR report survey outlined in Chapter 7, whose findings give the project a wider 'cross-case' view of the general situation regarding biodiversity consideration in industry. These study methods will keep in-mind the project objectives and attempt to use multiple data sources for triangulation (Section 8.2), as advocated by Bryman (2004, p275) to provide a holistic verification of evidence and key information. The study will therefore use interviews of key personnel, direct observation of company documents, records, and websites to describe events and practices.

The approach taken in studying and working with the case companies is of a detailed observation of the management processes and methods in operation and relating to expected supplier environmental standards. The approach has not taken any prior commitment to any existing theoretical model and has adopted a non-active stance in dealing with information, with no control or altering of events, taking an observation role only.

The case study for this project is focusing on one phenomena or area of company environmental and business management concerning the procurement of goods or services from a range of suppliers, which collectively constitute a supply chain. For this project the aim of the study is to observe how the current supply chain management systems operate and what parameters they work by in deciding the extent of their environmental policies and responsibilities.

In order to provide a substantive contextual element to strengthen the results of the multi-case study, the project has adopted a balanced approach to qualitative 'case' research by observing the wider business and biodiversity/environmental situation (cross-case study), what Coffey and Atkinson (1996, p60) called '*from orientation to complication'*. The object of this part of the study is to introduce an empirical element (see Lincoln and Guba 1985, p316) and see if the findings of both studies are transferable, that is, if there is no consideration of biodiversity both in the wider cross–case study and the in depth multi-case studies.

The orientation consisted of the literature study followed by, and in conjunction with, attending professional conferences, workshops and discussions with procurement practitioners and business managers. This research was further augmented by interviewing managers and owners of small companies, which are both buyers and suppliers, to gain their viewpoint on drivers and constraints to biodiversity consideration. This important phase of the project has given a wide appreciation of the historical and present situation concerning biodiversity and business. The above research gave the project a good grounding for the later more detailed individual case studies.

The individual case studies provided a detailed insight into business thinking on environmental and procurement management content and utilization (the complication or ‘how’ and ‘why’, in Table 8.1), which could not be found by just analyzing the results of a random sample general-survey, as conducted in Chapter 7. The project selected 3 individual companies, each from a different industrial sector, which would present a balanced appraisal of supply chain management practice.

8.4 CASE STUDY CONTEXT

The case study for this project would not be undertaken as an active study which would potentially alter the management practices of the respective companies during the time of the study. The study observed the current supply chain management processes which would inform the design of the methodology, given in chapter 13, for integrating biodiversity issues into the environmental supply chain management (eSCM) system, after the conclusion of the study. Any testing to check the methods validity and feasibility therefore, has been undertaken ‘in parallel’ with the working system and has not been included as a ‘live’ test. This follows the methods outlined in Table 8.1 where the control of behavioral events is not required, and the focus is on contemporary events. Both the survey and case studies used by the project adopt this pattern. Yin (2003, p6) maintains that it is case studies that are generally used when there is little control over events, and questions of ‘how’ or ‘when’ need to be investigated in real time and in real-life context.

It is recognised that a single case, within any of the 3 sectors, can not be representative of that whole sector, and so it would be incorrect to say that the single case findings can be generalized to other case’s within that sector, or to cases in other sectors. The case study will be a descriptive type, as explained by Yin (2003) whereby the current supply chain management procedures of each company will be explored and described from observations (inductive approach). The findings from the 3 detailed case studies can be investigated for any common ground and the results triangulated to give greater confidence.

The point of orientation for this case study is the qualitative research strategy and as such the study looks for external validity from a wide source of information. Although the project scope limits the detailed study to a small number of companies, it is the wider research undertaken in the literature review, discussions and interviews with non-participatory companies, and the CSR survey (Chapter 7) that reinforces the results taken from the single case studies. The findings from these various sources of information, with respect to this projects aim, are that a method for assessing the impacts on biodiversity and business throughout company supply chains is currently not available.

The case study is investigating the strategies used by the participating companies in selecting and managing their supply chains, with the aim of gathering information on supply chain management with a particular focus on general environmental aspects. The study does not attempt to find out the reasons why a company is not considering biodiversity, as these areas are covered in other chapters. Data on the management systems will be obtained throughout the study and this will gradually inform the final methodology. This process follows the grounded theory framework for analyzing qualitative data. Grounded theory was originally expounded by Strauss (1967) and Glaser (1992) and has been defined by Strauss and Corbin (1998, p12) as:

'*..theory that was derived from data, systematically gathered and analyzed through the research process. In this method, data collection, analysis, and eventual theory stand in close relationship to one another'.*

The existence of a research question at the outset of the study is not required by grounded theory. There is however, controversy about what grounded theory is and how it is applied (Charmaz, 2000). For example, there has been doubt cast on the ability of the researcher to suspend their awareness of relevant theories or concepts until a later stage in the study (Bulmer, 1979). It is also claimed that the method sticks to the social phenomenon in question and does not translate to other wider phenomenon (Bryman, 2001). The use of this approach to the case studies in this project aims to stick to the phenomenon and arrive at what Miles and Huberman (1994, p8) call a '*practical understanding'* of their environmental management processes as applied to the supply chain.

The study, as applied to this project, does however have non-influencing underlying questions, i.e. how do companies manage the environmental aspects of their suppliers and, can biodiversity consideration be integrated within these systems? This project does not seek to develop a theory out of the case studies but to use grounded theory only as a strategy for the collection of data, as described by Bryman (2001, p399). The case study is observing management structure within 3 companies which has been continually improved as a result of stakeholder influence. Therefore, the grounded theory method is relevant in that it tends to be objectivist, i.e. it looks for categories and concepts already within the management process data. The studies will follow an iterative process whereby the initial collection and analysis of information will guide the next direction of the information gathering process and so on until all relevant data has been collected. The case study method adopted for this research can therefore be summarised as follows:

- single case study within a single industrial sector forming part of a multi-case study of 3 companies each from different industrial sectors;
- non-active – observation only;
- no pre-theory – Grounded Theory approach to the collection of information – iterative process;

In practical terms, the research process for case studies is similar to those used for other (empirical) research (McClutcheon and Meredith, 1993; Yin, 2003), and the process adopted for explaining the management processes in the 3 selected case companies follows a five stage approach, as suggested by Stuart *et al* (2002), and is outlined in Figure 8.1.

Figure 8.1 Case Study Research Process
(Adapted from Stuart *et al*, 2002, p422)

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8.5 SELECTION OF CASE COMPANIES FOR STUDY

The selection of case companies can be the most difficult step in case study research (Yin 2003; Gerring, 2007). At the selection stage, the characteristic's of the companies from which a selection is to be made has to be aligned with and inform the project objectives. This can be achieved by either searching for companies providing contrasting outcomes, or as is the case for this project, companies which have common instances of the phenomenon being studied (Yin, 2003). This screening stage of the case study should be conducted with as efficient regard to time and resources as possible by examination of what is considered as sufficient data for the purpose. In order to help to focus on project relevant companies, a case selection criterion was designed by this project and is shown in Table 8.2.

Table 8.2 Criteria and Rationale for Selection of Case Study (Focal) Companies

CASE SELECTION (OPERATIONAL) CRITERIA AND *RATIONALE*	
INDUSTRIAL SECTOR	The 3 case studies had to come from different industrial sectors. This would eliminate potential sector specific bias towards biodiversity. Selection would ideally separate the companies into different biodiversity risk sectors (See Section 7.3: Table 7.1) or as many biodiversity risk sectors as the selection situation may allow. *This criterion was selected because the wider literature review and CSR survey in chapter 7 found that different sectors had different impacts and values placed on biodiversity. The biodiversity risk sector was also a factor in the level of considering biodiversity within supply chain management.*
COMPANY WITH EXTENSIVE SUPPLY NETWORKS	The selected company would have to use an extensive supply network. The study would potentially investigate supply chains in other countries in order to introduce varying biodiversity impacts. *The extent of the supply chain would more likely introduce differing impact types and varied attitudes to biodiversity. For example, to legislative, compliance or conservation methods over large or SME companies and to a varied product line.*
SUPPLIER SELECTION CRITERION AND PROCUREMENT MANAGEMENT	Supplier selection and operating policy. Companies would ideally have to already have procurement selection criterion and as a minimum to manage their supply risk according to industry compliance standards. The company would have to be known to integrate their procurement activities with trading partners at some environment related level. This is ascertained through publication research of the proposed focal company activities. *This criterion ensures that a case company has some form of existing environmental management system operating in the supply chain. This provides the basic information for informing the end methodology and its practical inclusion within existing systems. This also serves to support the project findings that there is not currently a method for considering biodiversity within supply chain environmental management.*
ACCREDITED EMS	The focal company would need to have an accredited environmental management system in place in order to investigate the integration of biodiversity aspects into their wider supplier network within such a system. *The methodology described in chapter 13 can be used within an accredited EMS framework or within an in-house designed system. The use of the accredited system provides a level playing field system in which all focal and supply companies can work.*
WILLINGNESS TO WORK WITH THE STUDY	The companies short-listed for selection would have to agree to assist in the study, and this would be a key factor in deciding which company to use. Appendix 3 Illustrates the number of organisations approached against the number actually willing to work with the study. *The total number of suitable organisations for study is narrowed down by which companies would be willing to participate, making the selection a two-way process. This is largely dependent on the organizational ethos within the company and the existence of a 'biodiversity champion' who has the empowerment to drive the development of novel initiatives and department buy-in of additional management methods. See section 8.9 for further discussion in this area.*

The 5 case selection criteria described in Table 8.2 represent what the project considered to be the most relevant in helping the final methodology. The criteria are based on the CSR survey findings in chapter 7 and the experiences of getting potential organisations to agree to participate. The requirement for an extensive supply network would increase the variety of biodiversity risks and opportunities as well as providing more opportunities (probability) for supplier cooperation in any requests for information. To make best use of available time the requirement was included for an established supplier procurement policy and management system which could be observed for potential areas where biodiversity assessment could be integrated. Although it is a requirement criterion that the focal company have an accredited EMS it is not a requirement for their supply companies. As the survey in sections 7.5.2 and 7.5 suggested organisations often use their own in-house EMS alongside an accredited system.

An accredited EMS provides a level playing field which is defined in this case as business management processes that facilitate the building of biodiversity into existing business practices. This may enable the creation of new markets and businesses based on the conservation and sustainable use of biodiversity.

The case study companies for this project were selected for the common instances of the phenomenon being studied, that is environmental management in the supply chain. The first stage was to reduce the number of companies available to those meeting the screening selection criteria. The second stage was to a large extent governed by which organisations were willing to work with the case study. Issues of confidentiality, time, resource, inclination, and need, among others would influence the decision maker's choice in this regard. Table AP 3.2, Appendix 3, shows a breakdown of the number of selected companies approached against the actual number willing to work together in the study.

The selection of case study organisations for this project was initially narrowed down to 4 companies, these had all been utilized in previous MPhil research by Calow (2003). This project was a follow-on development from the Calow study, and the selected companies were: Boots Chemist (retail); Seven Trent Water (utilities); BAA (Heathrow) (airport operator); Centre Parcs UK (leisure).

8.5.1 Companies Originally Selected for the Multi-Case Study

The case study was initially started by choosing 3 companies out of the 4 organisations selected. Center Parcs was not included as they did not have as extensive and varied a supply chain as the other 3 companies. The selected companies were therefore:

- **BAA (Heathrow)** – a leading airport operator and manager.
- **Boots Group (UK) Ltd** - a leading international pharmacy-led health and beauty group which operates in both wholesale and retail.
- **Seven Trent Water Plc** - a member of the Severn Trent Group of companies. The company is an international utility service and environmental solutions company and is the world's fourth largest privately-owned water company

8.6 CASE STUDY INTERVIEW APPROACH

The orientation period (undertaken to find the direction the subject area had taken) at the start of the project, which included the wider literature review, followed by a period of meetings, workshops, seminars, conversations and networking (see Appendix 6 for a list of main proceedings attended), would be ongoing throughout the project to keep up with the changing business scene. This provided a grounding and context to the later detailed case studies and assured that both the project interviewer and the procurement practitioner in any subsequent discussions would be conversing in the same business 'language'.

The case study will gather information on the supply chain management practices within procurement departments and any associated links to environmental departments and company policy. It was anticipated that after stages 1 and 2 (Figure 8.1), that stage 3 of the case study period would take 1 year, followed by a period in the 3rd year for data analysis and testing of the methodology in parallel with existing company systems. The first stage was to gather information on supplier procurement practices with regard to environmental issues. In each of the participating companies a representative expert in this area was sought who could impart and explain the information offered. The interviewees had positions where they had influence over the phenomenon being studied. Initially the interviewees in all cases were primarily experts on environmental issues concerning the industry and brand products. They had a good understanding of supply chain theory and potential environmental impacts but not specifically biodiversity impacts.

The interviewees in all 3 case studies were selected by and included the main contact (champion) for the project as being the most relevant representative of the company within the subject area. The object was to obtain any relevant information on SCM procedure which would allow the author an insight as to where a biodiversity management element could fit into existing processes. As it was already known at the outset of the interviews that biodiversity was not considered in their supply chain management it helped the interviewer in remaining impartial and to concentrate on gathering information only, without any introduced value judgments.

At the time of the first interviews within the first stages of the project it was understood that in the second year further interviews would be arranged in order to ask any further questions that may arise from the projects evolution. This follows the iterative process, mentioned in section 8.4 whereby the initial collection and analysis of information will guide the next direction of the information gathering process, and so on until all relevant data has been collected. This was not possible however due to the reasons described in section 8.7, where contact continuity was interrupted.

In all cases the interviews were unstructured and consisted of information gathering only, the content of the interview was largely dictated as far as possible by the interviewee. This approach allowed the interviewee to talk without feeling constrained by set questions and restricted answers. Therefore, the input from the interviewer was limited to introducing the topic and ensuring that the necessary ground was covered while allowing the interviewee to say what they felt was relevant. The objectives of these first interviews were to obtain documentation on the supplier environmental management process.

The next objective was to conduct further interviews, as necessary, to probe the in-house experts on their existing processes and discuss potential areas where, and to what extent, biodiversity could be incorporated. This series of second interviews was proposed and agreed for the second year of the study but for reasons of broken continuity in communications this was not possible, see section 8.7 for further details. The information obtained from all 3 participants in the first year of the study was however considered enough to make a detailed observation of management processes.

Table 8.3 gives a summary of the information obtained from each of the 3 participating companies in the first year of the case studies.

Table 8.3 Summary of Information Obtained from Participating Companies

Company	Documents Obtained	Interviews	Meetings	Risk Averse Approach
AstraZeneca (UK)	Environmental policy. CR policy. SHE Standard. Buying our future doc. Supplier selection questionnaire. AZ purchasing principles.	First year interviews. AZ Essentials SHE Biodiversity Project Manager. ISEP Manager	2 First year meetings	Yes
BAA (Heathrow)	Environmental policy. Information on Heathrow landholdings. BAP plans for the airport boundaries and surrounding areas. CR report on biodiversity.	Sustainability manager. Sustainable development manager	2 First year meetings	Yes
Center Parcs (UK)	Supplier selection procedure; CP environmental questionnaire and assessment; supplier selection matrix.	Environmental Manager and ecology manager.	3 meetings in first year of study	Yes

8.6.1 Questionnaires

Originally the idea was to interview a number of strategic suppliers from the 3 case studies. In the event this did not transpire due to the break in communications and loss of champions from each company. It was finally decided at the start of the final year of the project to try and ascertain some information from suppliers if not by direct contact then by means of a questionnaire. At this time the project was conducting the AstraZeneca (UK) case study and as a result a total of 5 questionnaires were sent out by land-mail and email (with a covering letter from AstraZeneca explaining the reasons for the questionnaire and a stamped addressed reply envelope) to their strategic suppliers of organic solvents, see section 10.6. In addition the landscape architect at Center Parcs (UK) was asked to complete the questionnaire (see Section 9.2.8). CP (UK) completed the questionnaire which can be seen in Appendix 4. A questionnaire was designed for this purpose and is described in Table 8.4.

Table 8.4 Biodiversity Consideration Supply Chain Questionnaire.

QUESTIONS	RATIONALE
Organisation of the purchasing department	Questions 1 to 2
1) Is there a formal purchasing strategy that includes biodiversity issues? 2) Are purchasing environmental issues considered in the long-term?	*This sections aim is to ascertain the culture of the company. Do they include biodiversity in company supplier policy and do they look to the long term when considering the environment. This is intended to inform the marketing of the methodology in chapters 13 and 14.*
Company and supply chain interaction	Questions 3 to 7
3) Are there criteria set to evaluate a supplier? 4) Are any supplier criteria related to or influenced by the main purchaser's company code of conduct for procurement? 5) Is the environmental or biodiversity performance of a supplier measured against criteria? 6) Are suppliers regarded as partners? 7) What does supplier partnership entail and what do you see as the benefits?	Q. 3) 4) &5) - *This will give an idea of a company's intended relationship with a supplier and does it expect similar standards to its own. If a supplier is selected according to set criteria, then are environmental issues included. The answer will also find out if biodiversity is a consideration.* Q. 6) & 7) - *If suppliers are regarded as partners then there is scope for negotiating a biodiversity element into SCM. This will inform the design of the final methodology and for advocating partnership working.*
Biodiversity/environmental concerns in purchasing and supply	Questions 8 to 19
8) What do you see as the main environmental issues in your supply chain and what implications if any for biodiversity? 9) Has your company an environmental policy and/or a CSR policy? Does it mention biodiversity? 10) Does your company see biodiversity consideration in its supply chain as important to brand or company image? 11) Is there a risk assessment for biodiversity impact in the supply chain? 12) Are you accredited to a formal EMS? Do you have an in-house voluntary environmental management system? Do you require suppliers to have an environmental management system? 13) Does your company see biodiversity/ environmental consideration as a cost or potential benefit or business opportunity? 14) Do you have examples of environmental / biodiversity initiatives already in place within the supply chain? 15) Have you seen any benefits as a result of these initiatives? 16) Have you ever had to deselect a supplier for non-compliance or unsatisfactory environmental performance? What did you see as the main threat to your company/brand/image? 17) Do you offer any environmental training to suppliers in order to meet criteria? Do you use any other incentives to suppliers – investment, benefits etc? 18) How does management at board level regard involving suppliers in environmental/ biodiversity management? 19) Any additional comments?	*These are direct questions on biodiversity and intended to provoke comment on the issues.* Q.8) - 11) *Respondents are invited to think about the subject as a possible risk to business and a 'don't know' response could flag-up a determination to find out more. The answers will further inform the final methodology as to which environmental issues are considered important by business and to what extent they judge biodiversity as an issue. This will add to the information already gained as to the need for education and training on these issues.* Q. 12) *The EMS questions are intended to add support to the findings of the survey in chapter 7.* Q. 13) *Is intended to find out the attitude the company has to biodiversity issues. This will again help in formulating the biodiversity information file on suppliers as part of the final methodology.* Q. 14) 15) *The answer will further inform the general review of the biodiversity and business situation.* Q. 16) *This will give an idea as to the type of risk issues within the supply chain and if they are related to biodiversity impact. And why they deselected in terms of types of risk to business. This will decide if any other types of environmental impact should be considered as linked to biodiversity loss and should be considered in the final methodology. Again this will give an idea of a company's readiness to work in partnership with suppliers.* Q. 19) *Additional comments may add to the compilation of information for the design of the final model.*

However no replies were received from the strategic suppliers of AstraZeneca (UK) supply companies. The questionnaire asked direct questions on biodiversity with the object of obtaining the extent of their biodiversity knowledge, attitudes and consideration through an anonymous reply which might, as May (1991) said, provide an insight into the subject within a business situation. For a questionnaire to be filled however people have to have an incentive to do so, perhaps from an interest in the subject or to fulfill a management process (May, 2001, p97) and it would seem that biodiversity is not on the radar. There is a mixture of open and closed questions depending on the area of the subject the questions are directed. The results were intended to inform the design of the final methodology.

8.6.2 Strengths and Weaknesses of Questionnaires

The advantages of sending out a questionnaire by mail or email is that it is cheaper than arranging interviews and due to time restraints potentially quicker to get results, especially considering the wide geographical areas of the suppliers. The questions were designed to minimise any bias from the responder and offer an anonymous response, particularly in a potentially sensitive sector such as pharmaceuticals. The use of open questions where necessary allows for the respondent to expand and give potentially more information.

The disadvantage is that the questions are fixed and do not allow for exploring wider related issues or who is answering the questions. The researcher also has no control on how the questions are interpreted.

8.7 DIFFICULTIES IN MAINTAINING CASE STUDY MOMENTUM

8.7.1 BAA (Heathrow)

The first links were established with BAA through existing contacts with the project industrial partner, Middlemarch Environmental Ltd. A meeting was arranged with the sustainability manager, and ‘champion’ for the project, early in the first year, to discuss the case scope and what the study required of BAA in terms of information, interviews and access to documents. Further meetings at the Heathrow Headquarter Offices produced information and documentation regarding the management of the supply chain and selection of suppliers.

It was agreed that the case study would start in the second year of the project, after the literature review stage. Communications remained good for over a year after which it gradually became more difficult to obtain information and arrange site visits. Unfortunately the project contact, the Sustainability Manager, was moved to another department, and no other person was assigned to the project, and consequently communication was halted for several months. These events were as a result of BAA being taken-over in June 2006. The company was bought by a consortium led by Ferrovial, a Spanish construction company, and during the transition period BAA management had other more immediate pressures than supply chain biodiversity issues.

Communications were re-established in 2007 with a new contact at the company. This contact was an ecologist dealing with biodiversity issues on company landholdings and not involved with general management, such as, procurement. Consequently, despite renewed communications, further case collaboration was not possible. However, the information obtained up until this point, was enough to inform the research and to ascertain that biodiversity was not considered within supply chain management.

8.7.2 The Boots Company

Contacts were made with the Boots Company representative at an initial steering group meeting and introductions and presentations made. From the start of the study however, further communication with the company became difficult. Meetings were hard to establish and were deferred on a number of occasions, as the contact was not empowered to manage the project case on Boots behalf. Subsequently, the project contact left the company with no successor assigned to oversee the study.

In July 2006 the Boots Company merged with Alliance UniChem and a new company, Alliance Boots was formed. After exhaustive attempts to re-establish communications with the company, their management finally said they could not afford the time to assist with the study, due to the imminent management changes to their organisation.

8.7.3 Seven Trent Water

After the first meetings with the company it was agreed with Seven Trent Water that the case study would start after the first year of the project, as by then the company would be in a better position to work with the project. Before this could occur however, the company underwent extensive restructuring, renewal and re-organisation of its management. The contact for the study retired from the company and communication was broken. Attempts to re-establish communications were unsuccessful and the company was taken off the case study selection list.

8.7.4 Second Case Study Selection Period

The loss of ‘champions’ within the 3 selected case companies left the project at one and a half years-in, with no active partners for the case studies. There was enough information however from BAA to enable a viable assessment of their biodiversity policy in regard to their supply chain. Two other companies therefore had to be sourced that fitted the case operational criteria outlined in Table 8.2.

8.7.5 Center Parcs.

The obvious first choice was Center Parcs (CP), because they had initially agreed to participate in the study. Contact was made with the environmental manager and the company again agreed to work with the study.

These initial management contacts and champions of the project at CP were broken however when the Center Parcs Group was taken over by Blackstone Inc. in 2006. The subsequent management restructure resulted in the environmental manager being made redundant and not replaced. At this point the outgoing environmental manager terminated the CP involvement with the case study. This role within the Operations Department at Head Office, including the EMS, was outsourced by employing an external consultant to review all aspects of the EMS. In addition, the Ecology Manager at Head Office was made redundant and so all project contact and communications with CP lost. This event illustrates the changing nature of business and the effects of incoming top management with a different emphasis on corporate responsibility. When this occurs, existing management structure is often the victim of cost cutting, and the environmental department is prominent on the incoming chief executive officer's (CEO) radar.

Some 10 months later contact was however re-established with the company through the Chartered Landscape Architect for CP UK, who is effectively overseeing the biodiversity aspects of CP (UK). A re-commitment was needed from top management for re-establishing the case study. This was obtained in November 2007 after a presentation to the UK Board, by the Chartered Landscape Architect to review all aspects with regard to biodiversity action targets for all holiday villages. The Commercial Director, who is responsible for the purchasing department is now leading this aspect.

8.7.5.1 Project Champion

The experiences encountered during the selection of suitable companies that would be willing to participate have served to highlight the importance of a person with empowerment to champion the case study. The selection procedure found that middle management, often the environmental manager, is not ideal for a champion as they are potentially subject to being moved or might leave the company. The optimum influencing level to lead new initiatives of this kind, as work by Steger (2006, p435) found, is top management such as the CEO of the company. The CEO can then delegate the everyday management of a project to a relevant person(s), with empowerment to champion the initiative and who would report back with any results, keeping the top management fully aware of the situation. The ideal condition would be for the champion to initiate the introduction of biodiversity risks and opportunities into a management system that operated regardless of management personnel changes. Even so such management systems still need the top management-will to operate effectively. The design of the final methodology will enable the continual assessment of biodiversity risks with clear management targets for completion of objectives, while engaging all relevant departments in the same aim of reducing risk.

8.8 OTHER CASE STUDY COMPANIES

One other company had to be found to complete the planned quota of 3 multi-case studies. Through the use of business contacts the first company contacted was H. J.

Heinz (UK) Company Ltd. Heinz is the most global U.S. based food company, with a world-class portfolio of powerful brands holding number-one and number-two market positions in more than 50 countries (Heinz, 2008).

Heinz does not consider biodiversity directly whether in their landholdings or in their supply chain. They do have a ‘supplier guideline’ but the emphasis is on compliance. The environmental section of the Heinz Supplier Guidelines (2008) state:

Environmental Practices: ‘*Our suppliers will be expected to meet applicable environmental laws and regulations in their operations and to develop and implement plans and programs to correct any non-compliant practices’*. (From Heinz Supplier Guidelines, 2008, p1).

The company was a suitable candidate for a case study and met all the case selection criteria. Communications were established through the projects initial contact who gave the permission to get in touch with their external environmental (UK) advisor.

At this time Heinz UK did not have an in-house environmental manager but used their ex-environmental manager, who is now working as their external advisor on environmental issues. Contact was made at the first meeting the external advisor agreed to approach Heinz further and seek approval for the case study support, and the issue of approval was scheduled to be discussed at Heinz (UK) board level in the following weeks. However, at this time there was uneasiness within Heinz UK management as the parent company in America was in the process of restructuring their European management organisation. The low priority biodiversity issue therefore, was taken off the agenda completely. The company European Risk Manager (Business Development), referring to biodiversity impact in the supply chain, commented that sometimes companies are afraid to be the first to ‘*put their head above the parapet’* and lead new initiatives, in-case unknown risks, with financial and reputation implications, are exposed (Condra, 2005, *pers comm*).

A second company was contacted through a network meeting at a national biodiversity conference. The company was Royal Parks London who manage the Royal Parks within the city, on behalf of the country. The company agreed to work with the project should they be needed. The company operations however were thought to be too similar to Centre Parcs, therefore, not selected as it failed the operational criteria (Table 8.2) by being in the same sector as another selected company.

The third company who was willing to discuss the project was AstraZeneca (AZ, UK). Initial contact was made at an Institute of Environmental Management and Assessment National Conference (IEMA). A telephone conference link was arranged with their Global Safety, Health and Environment (SHE) Manager and the UK Biodiversity Manager. As a result of this discussion AstraZeneca agreed to assist and be used as a case study company. Further on-site meetings were arranged to discuss the scope of the study between the biodiversity manager and their sustainability (CSR) manager. It was agreed that as the type of information required could be sensitive internal management material, a confidentiality agreement between AZ, Aston University and Middlemarch Environmental Ltd (the project industrial partner) would be required.

The negotiations between the legal departments of AZ and the University took from January 2006 to March 2007, and during this time access to, and the release of, information from AZ was not possible. When the case study resumed it was agreed that the supply network for organic solvents should be the focus of the study.

The case study teamwork with AZ was very good up until August 2007 when communications and requested information became increasingly difficult to obtain. The reason for this was that the Global SHE Manager and top management 'champion' of this project moved to another area of operations. Consequently, the biodiversity manager has had difficulty in obtaining authorization for information release and there is no longer the management empowerment to encourage their procurement operations to respond to data requests. The fact remains that some suppliers were not inclined to respond to these requests. This may have been due to several reasons including their preoccupation with other business priorities, their lack of understanding of biodiversity issues and/or relevance to their operations, risk aversion (unwilling to raise their heads above the parapet) etc. The information already acquired is however sufficient to complete the study.

8.8.1 Companies Providing Supporting Information

In order to increase the overall project effectiveness in terms of understanding the business and biodiversity situation, additional information was sought to complement the larger in-depth case studies. This was achieved through contact with a number of other companies, who were interested in the project aim, but were not in a position to offer full assistance, or did not fulfill the project operational criteria outlined in Table 8.2. These companies did, however, provide information on whether they directly considered biodiversity as part of their supply chain environmental management processes.

Four UK based organisations which are considered to be amongst the best, by this project, in their sector for good environmental practice in dealing with their supply chains, are discussed in detail. One example is Chest of Drawers Ltd, an SME from the retailing end of the wood furniture industry who is endeavoring to pilot its own scheme for educating customers and giving them choice through raising awareness on sustainable timber sourcing. The second is Birse Civils Ltd, a civil engineering company who in order to achieve contract status with a statutory body is introducing biodiversity and other general environmental aspects into its own supplier selection criteria. The third and fourth examples are from the farming sector where a consultancy, White Gold Services, is advising a supermarket retailer on sustainable milk production, and Jordan's Cereals Ltd a cereal crop buyer which imposes ecological criteria on farms who wish to supply the company.

8.8.2 Chest of Drawers Ltd

Chest of Drawers Ltd has been an independent retailer of globally sourced solid-wood furniture in London for the past 20 years. The company recognised that the international nature of the industry makes it difficult for customers to easily make an informed environmental choice on furniture products. They also found no relevant independent 'stamps' of approval which encompass both environmental and ethical aspects and with any relevance to customers. To resolve this, Chest of Drawers has pioneered an industry unique labelling rating system (the company does not require their suppliers to have an accredited EMS), with the aim of providing information on the sourcing of sustainable wood products to their customers. The system brings to the industry a transparent process that enables consumers to make a decision on their purchase in a similar way they would in buying food or clothing. The information and rating score is conveyed to the customer in the form of an Environmental Grading Label attached to the product. The rating system consists of 3 main categories: wood source and sustainability; workshop practices and; furniture miles. These criteria are then summarised with a rating out of a possible 10 score and displayed on a label on each piece of furniture in the shop.

The rating system is not independently assessed however the company is working closely with industry and NGOs in developing the system as an industry standard. The labelling and criteria standards of the Forest Stewardship Council (FSC), Greenpeace, and the World Wildlife Fund for Nature (WWF) for example, produce or promote sustainable wood product tracing labels for the industry. This system takes these initiatives a stage further by considering the wider environmental impacts of a wood product and conveying that information to the customer, and so completing the information cycle.

There is at the moment no specific mention of biodiversity and the process relies on the existing labelling procedure of the FSC. The process is flexible enough however, to be able to include a biodiversity question, but this would be more likely to happen if the furniture industry as a collective buying group adopt the rating system. Companies like Marks and Spencer's are seemingly taking the lead in becoming fully sustainable in their wood furniture sourcing and this is forcing other large furniture retailers to reluctantly follow suit. Retailers are all concerned about the consistent supply of certified timber (Corbett, 2008). There is, according to Chest of Drawers Director Kim Corbett (2008, *pers comm*), talk of logo fatigue as retailers try to '*get on the bandwagon*' and offer sustainable credentials.

The Chest of Drawers initiative is in line with the separate principles of the Furniture Industry Environment Committee (FIEC), and the aims of the UK Department of Trade and Industry's (DTI) Sustainable Development Strategy and Sector Sustainability Challenge (2005) (managed through the Business Enterprise and Regulatory Reform (BERR) Department). Again, no direct mention of biodiversity, but the principles aim to raise the profile of sustainability within sectors - its criteria for the furniture industry include: the adoption of EMS; energy and waste management; procurement policies and; sustainable timber purchasing. A certificate is awarded (independently audited) to members who fulfil the required criteria. As an SME, Chest of Drawers is driving the awareness of sustainable timber sourcing.

The information was obtained from the company from 2 site visits to their retail outlet shop in Islington London. The above information came from a discussion with the company director and obtaining a sample rating label from the shop.

8.8.3 Birse Civils Ltd

Birse Civils Ltd is an operating division of Balfour Beatty Regional Civil Engineering Ltd, who provide a range of civil engineering construction services throughout the UK. Birse do not mention biodiversity as part of their supplier relations, but they do have an environmental and CSR policy which mentions sustainability in terms of '*limiting the use of natural resources such as aggregates and timber, and reducing the impact of operations on the natural environment'* (Birsecl, 2007).

In 2007 the UK Environment Agency (EA) included Birse Civils in their National Contractor Framework (NCF). This also included Birse as part of the EAs Sustainable Procurement Strategy and Structured Supplier Development Programme. Adopting a partnership approach, the EAs National Procurement team has, since 2002, led an annual programme of Sustainability Audits to help and support key suppliers to address and deliver improvements in their environmental and ethical Corporate Social Responsibility (CSR) performances (Griffiths, 2007).

The requirements for consideration by EA suppliers, built-into the Sustainability Audit, cover areas of the business operation including:

- General overview of company structure, strategy and environmental management including particular roles and responsibilities and status of ISO 14001 certification;
- Processes used to identify and manage environmental risks within the business
- Plans for improving environmental performance;
- Sustainable procurement, including supplier development, overseas sourcing, etc;
- Corporate Social Responsibility principles/standards.

Birse already considers biodiversity as part of their landfill business and feel the next stage is to extend this management process to their external operations. Although biodiversity is not a specific requirement of the EA audit, Birse thought this would be a good opportunity to include biodiversity aspects into their proposed new Supplier Selection Criteria Questionnaire (Douglas, 2007, *pers comm*).

The nature of the Birse supply chain was discussed at a series of interviews with the national supply chain manager. The focus was integrating biodiversity aspects into their supply chain management process, and presenting the aims and objectives of their sustainable procurement strategy within their corporate social responsibility (CSR) report.

One main requirement of any biodiversity addition to their environmental management system, was that it had to easily integrate with their existing systems and not present yet another administrative burden, either to Birse or their suppliers (Douglas, 2007, *pers comm*).

Based on the information obtained a supplier questionnaire was designed for Birse, by the author, to fit into existing supplier criteria and management system processes. The supplier questionnaire is sector specific and includes a wide range of materials supplied to the civil engineering industry. Set against each material or products supplied are general environmental questions and the addition of a question on biodiversity.

The idea at this pilot stage was to introduce biodiversity as part of the general environmental questions on, for example, waste, packaging or transport. It was envisaged that the biodiversity questions would provoke enquiries from suppliers and Birse could explain the reasoning and rational behind its inclusion. The 2 biodiversity questions asked if biodiversity was part of company environmental policy and part of their own sourcing of materials and if they required its consideration from their own suppliers. The 2 questions were: 'Is biodiversity consideration part of your product sourcing and manufacturing policy?' And 'is biodiversity consideration part of your own suppler selection criteria?' The questionnaire satisfied the EA audit criteria and is currently being piloted by Birse with the aim of permanently integrating the questionnaire into their supplier selection criteria. The original recommendation was to follow up this first 'tick-box' questionnaire with a more detailed one, which would require verification and a site visit. However, Birse management decided that at this stage (in the interests of cost saving) an initial questionnaire was sufficient and the follow up questionnaire is put on hold for the time being.

8.8.3.1 Pre-qualification Questionnaires (PQQ)

The shortfalls in the use of pre-qualification questionnaires (PQQs) is emphasised if the supplier does not respond. Kinsey (2008) points out that if there is little weight or follow up action on PQQs there is a danger they could fall into disrepute and be a tick-box exercise performed as part of the price of doing business. For the construction sector Kinsey advocates the use of follow-up audits and using independent accreditation organisations such as the BuildingConfidence (2008), however, their pre-qualification systems do not directly mention biodiversity risk/impact.

8.8.4 White Gold Service

The White Gold Service was launched in November 1997 as a specialist service providing support and advice to dairy farmers supplying Dairy Crest. The service was originally designed to help farmers achieve the Assured Dairy Farms standards, a requirement of all suppliers of milk to Dairy Crest. The White Gold farm consultancy interfaces with and advises both dairy farmers and Waitrose supermarkets on sustainable milk production and supply. The biodiversity aspects of dairy farming are managed under the WildCare Scheme (see www.wildcare.co.uk). WildCare is designed to focus on what the Waitrose Select Farm Milk farmers are doing on their farms to develop and protect areas that enhance wildlife. The hedge, for example, is a key feature. It has the purpose of providing shelter and containing livestock in fields - yet it also provides shelter, food and resting sites for wildlife.

Under the WildCare Scheme all the Waitrose Select Farm Milk farmers have a Farm Wildlife Action Plan (FWAP) produced for them by a wildlife adviser. The adviser's role is to walk all the fields associated with the dairy operation and measure the wildlife space. The minimum level is 10% dedicated wildlife habitat. This compares to an estimated average UK farm area for wildlife habitat of 5%. Records are made during the farm walks of the wildlife species seen and known to be present on the farm. Where appropriate the Plan will include short, medium and long term action points for the farm to work on. These could be filling gaps in hedges, planting trees, putting up nest boxes, etc. The Scheme has been developed in conjunction with The UK Wildlife Trusts and is linked to the relevant county Biodiversity Action Plans (BAPs). There is not a requirement for suppliers to have an accredited EMS.

In summary (compiled by the author, the WildCare Scheme (2008) provides:

- *'Highlights the positive wildlife impact made by the Waitrose Select Farm Milk farmers involved in the Scheme.*
- *Demonstrates that farmers and conservationists can work together.*
- *Improves the conservation management on the farms.*
- *Enables production of food in an environmentally sensitive manner.*
- *Provides Waitrose and the Select Farm Milk farmers with meaningful 'green credentials'.*

The output from the completed Farm Wildlife Action Plans clearly demonstrate that the Waitrose Select Farm Milk farmers have a keen interest in encouraging wildlife on their farms and the environment in which they live and work. This level of interest is driven by Waitrose and their buying power and influence over their suppliers. Waitrose use these initiatives to differentiate the company within the retail sector and publicise this in their CSR reports.

The information on Wildcare was obtained from a site visit to White Gold Services offices at Leominster and discussing the service with the managing director. The White Gold Service advises on the purchase of environmental products to the farming community and the service has the potential to incorporate the framework methodology for biodiversity consideration in supply chains outlined in chapter 13.

Other farm industry initiatives managed by White Gold include the end-use or disposal of plastic fertiliser or fed bags and nylon twine. The plastic is stored on-farm after use in a large portable container. A plastic waste recycling company then collects the container and takes it to its factory where it is transformed into granules for the injection moulding industry (Beavan, 2007).

8.8.5 Jordans Cereals Ltd

Jordans Cereals are a small family owned business supplying breakfast cereals and cereal bars to the food retail industry. The company recognises that its internal potential impacts on biodiversity are predominantly indirect, but its main product ingredients derived from an arable farm supply base, has a more direct effect. With regard to their main offices and manufacturing base, biodiversity is not a criterion imposed on their suppliers and the company is reluctant to instigate yet more administrative burdens and potential audits in this area. However, in order to mitigate the potential direct impacts of their organic material suppliers, 80% of Jordan's cereals are sourced from Conservation Grade grain and the remainder from Organic Grain from other UK farms. Conservation Grade is a scheme created by owner Bill Jordan in 1985 to help protect wildlife exclusively on the British farms that supply non-organic cereals – wheat, oats and barley. The scheme illustrates the potential influence a buying company can exert on farm companies in terms of direct biodiversity aspects.

In order to become a supplier a company has to conform to the scheme's criteria. The farms in the scheme are paid a premium and the company guarantee to buy their crops. This gives, according to Jordan's, total quality control from seedling to cereal packet. Jordans now has contracts with 79 farmers, representing approximately 60,000 acres of UK farmland[2]. There is no requirement for suppliers to have an accredited EMS. The company recognises that one of the main reasons for the decline in species over the last 50 years has been the loss of their habitats. After the Second World War, farmers had to use every part of their land for food production, so often hedgerows and trees were removed.

According to the Conservation Grade Scheme, the system has proven to dramatically reverse the decline in wildlife on farmland. Independent trials run by the government-funded Centre for Ecology and Hydrology (CEH) have shown the system to increase wildlife by up to five times. The Conservation Grade farmers commit to taking 10% of their land out of food production to create a number of specific wildlife habitats that are designed to work together to increase the overall biodiversity of the farm. They plant wild flower edges around their fields for bees, insects and butterflies to feed on; sow seed growing crops, to provide foods for birds over winter and they provide boxes for owls and bats. The environmentally conscious way the company sources and underpins its ingredients is driven by the support of consumers (customers), as they buy the product (Jordan, 2005, *pers comm*). This in turn supports

[2] For further information go to - www.conservationgrade.co.uk.

their suppliers with an extra premium and enhances the otherwise low biodiversity baseline often associated with mono-cropping.

The information on Jordan's Cereals was obtained through telephone conversations with the Conservation Grade director and with the owner Bill Jordan, with supporting information from their respective web-sites. Table 8.5 gives a summary of the drivers and restraints found with respect to the consideration of biodiversity from supporting but non-participating companies.

Table 8.5 Summary of Non-Participatory Company Findings

Company	Drivers for Biodiversity Consideration		Restraints for Biodiversity Consideration
	Focal Company	Supplier	
Chest of Drawers (CoD)Ltd (No accredited EMS)	Customer driven – sustainability certification labels and CoD Rating System – no direct requirement for biodiversity consideration	Certification labels e.g. FSC compliance. No requirement for accredited EMS	Industry acceptance. Difficulties in monitoring
Birse Civils Ltd (Have ISO 14001)	Contract criteria/preferred supplier list. Industry Compliance. Not a driver - but ISO 14001 is a supplier requirement.	Supplier selection criteria. Accredited EMS requirement.	Voluntary CSR only. Sector acceptance
White Gold Services (No accredited EMS)	Supplier list of major supermarket (Waitrose) - focus on compliance. Brand and reputation.	Supplier selection criteria. No requirement for accredited EMS.	Wider acceptance beyond direct dairy farming impact
Jordan's Cereal Ltd (No accredited EMS)	Manufacturer supplier criteria. Conservation Grade. Customer driven.	Supplier selection criteria. No requirement for accredited EMS.	Wider acceptance beyond direct farming impact

None of the companies currently consider biodiversity directly in their environmental management of suppliers. However biodiversity is alluded to in the farming sectors of White Gold and Jordan's. This finding supports the general literature review findings and the results of the multi-case studies undertaken in the following chapters. Of the companies listed in Table 8.3 only Birse Civils Ltd has ISO 14001 and requires an accredited EMS of their suppliers. This may be due to the fact that the construction industry is heavily regulated and suppliers have to have a formalised and auditable account of their environmental performance. The other SMEs of the non-participating companies do not have an accredited system but use their own management systems in-house. In addition, the non-participating companies do not demand an accredited system of their suppliers but use an industry tailored system, in the case of Jordans and White Gold, and a novel assessment system in the case of Chest of Drawers.

8.8.6 Final Multi-Case Study Selection

A preliminary investigation of the 3 companies finally selected and willing to participate in the study was made to ascertain the extent of biodiversity management in a supply chain context. This entailed a company web-site search of each of these organisations plus initial conversations with the company contacts. The results revealed that within the 3 case study companies described in chapters 9 to 11 biodiversity issues do not form part of environmental management processes with respect to suppliers. These findings also concurred with the results of the survey in section 7.4.2, where overall biodiversity consideration across all industry sectors was poor. This being the situation, the object of conducting an observational study of their supply chain management processes is justified. Therefore the information gathered from the initial meetings was not required to look for direct biodiversity aspects of the supply chain. From the information obtained the study would look for areas in any management process that may inform the research direction.

8.9 THE ORGANISATION AND CULTURAL INFLUENCES

The 3 organisations selected for case study had met the project criteria set in Table 8.2. The selection process was however a two-way exercise with all the potential case study companies deciding internally whether to participate. There are often internal barriers to new initiatives as Morton (2004) found, see section 4.7. Agreeing to partake in a project investigating a little understood area of marginal concern, with seemingly no tangible advantage to business in the short term, and which would involve not only their (focal) company but external organisations in the supply chain, requires a longer term business vision. This is not just a mission statement which often, as Welford (2000, p168) said, '*lays out bland and unbelievable principles*', but a real and genuine affirmation that the company will conduct business in a way that is consistent with sustainable development. The AstraZeneca (UK) project *Buying our*

Future is an example of this stated commitment to drive environmental preferable purchasing, see section 10.4.1. The development of a business vision should include the people that work within it and with empowerment to develop creativity and openness to new ideas (Welford, 2000), as discussed in section 8.7.5.1.

The willingness to involve their company in the project had been influenced by *inter alia* factors such as perceived value of biodiversity, cost, time, and to varying extents the potential disruption to established internal organisational structures and social orders in the face of impending change. This attitude was illustrated by one of the criteria asked by the case study participants, that is, that any methodology would not unduly increase the administrative/management workload and would easily fit in with established procedures, see sections 8.8.3; 8.8.5; 10.8.

Generally speaking, the management structures of an organisation can often tend towards becoming processes that are considered external or separate to the individual people who operate it (Bryman, 2004) and respond to external exposure in a deterministic way (Burrell and Morgan, 2003, p102). This objectivism attitude to management where an organisation requires its employees, to varying degrees, to rigidly stick to organisational procedures is a restraint in allowing management to be influenced by various stakeholders (Section 6.2) to consider, in this case, new environmental initiatives. A culture of objectivism may exist where the organisation has its own social order (limited internal stakeholder influence) in that it expects employees to conform to the requirements of management processes, making the organisation itself a constraining force that inhibits change (Bryman, 2004, p16).

The difficulties of maintaining case study momentum described in section 8.7 illustrated the importance of top management approval in supporting a department and in appointing an individual or individuals who would champion new initiatives. The potential outcome of the case studies was to allow or consider new additions to existing organisational processes. The seemingly established organisational cultures of all 3 participating companies were radically changed however when new top management came in with differing ideas with regard to company mission statements. In the case of Center Parcs (UK) this was a short term phenomenon as in spite of the environmental manager position not being reinstated, the project was eventually re-supported (see Section 8.7.5) by new top management and a new champion, but not before it disrupted the project case study.

The environmental management system has its origins in both organisational management theory of its structure and the scientific objectives it sets. Both these components of organisational processes cannot be understood, as Taylor (1996, p69) asserted, '*without close attention to the social contexts'* applied to the situation. This is the area of cultural diversity and linking society, business and biodiversity discussed in section 3.2.7.

The organisational processes within companies that do take account of both their internal and external stakeholders, often in a stated commitment to revise and improve, are more likely to keep pace with changing relationships with the state, society and economies, as Hughes and Demetrious (2006) affirmed, see section 6.1. This constructivist position allows for management processes to be accessible to the employees that operate it and enable its adaptation potential in dealing with social change, see section 6.2 for a discussion on stakeholder influence. Work by Brown *et al* (2005, p262) found that '*social learning within environmental management is essentially about managing change'*, and about development and a 'letting go' of processes that no longer contribute to sustainable practice. In terms of management Brown *et al* assert, it is at the boundaries to opportunity where new approaches and learning are created, and '*environmental managers are leaders not followers, of change'*.

The organisational culture of a focal company would have to be adaptable to work with other companies within its supply chain or network in order to assess the risks and opportunities associated with a product. If organisational cultural change is needed then both internal and external stakeholders have to be considered and the effective education and training of management on the advantages of, in this case, considering biodiversity issues undertaken.

The development of the final methodology had therefore to take into account the organisational readiness within a company and make allowances for the extent to which management processes interacted with company stakeholders. The final model will be designed as a general management tool which provides for all stakeholder influence on organisational processes and culture within its practical operation and allows the potential for change. As the model is designed to fit the product it will therefore electronically link to stakeholder related information for that product. This information is bespoke to the whole focal company supply network linked by the product and/or its industrial sector and will illustrate the risks and opportunities relating to their particular stakeholder activity.

8.10 DISCUSSION

The concept of multiple case studies is a logical follow-on from the gathering of general information on the business and biodiversity situation in relation to supply chains. The studies enabled the project to focus on individual company processes, and thereby gain a greater and more in-depth perspective on industry practices and any drivers and obstacles to considering biodiversity in supply chain management. The studies provided grounding for the overall research and the next stage is to engage industry in further developing the model and strengthening its implementation into a wide variety of organisational cultures (section 8.9).

Although the selection criteria were drawn up for all potential participating companies, in reality the actual choice has been dictated by which ones were willing to participate. The companies that were finally used, however, fulfilled the operational criteria set and did represent wider industrial management processes currently in use within the subject area.

The continual changing business scene proved to be problematic, when individual project ‘champions’ within a business were replaced or disappeared. Under these circumstances, efforts to maintain relationships used-up a lot of the available research time. However, these events highlighted the difficulty in dealing with the reality of this type of case research, which is dependent on empowerment from the top-down and cross-departmental cooperation to implement the ideal as promoted in the company literature. The severing of management links in a command chain is likely to be analogous to many immature company environmental management systems, where the awareness and perception of significance of these specific issues, in terms of the wider organisations responsibilities, is fragmented. As such, the unfolding situation has proved useful for the overall business orientation and appreciation of the research project and highlighted the difficulties faced within industry management.

The inclusion of information from examples of companies with a non-participatory project role gave further triangulation and replication support to the impression of industry attitudes. The Chest of Drawers Company have taken an industry lead and given the customer sourcing information to enable a buying choice and is using the customer to drive sustainable sourcing. Their initiative drives timber sustainable practice through product end-user awareness but this novel approach is having difficulty in finding large business buy-in and will take time before it becomes part of industry practice. The civil engineering firm Birse have introduced environmental and biodiversity questions into their supplier selection criteria through market pressure from competitors whom already comply with statutory body contract conditions. There are examples of dairy and arable farming enterprises, from White Gold and Jordan's Cereals, which consider biodiversity because it allows them preferred supplier status and increased margins from a large supermarket chain or a small specialised food producer which has found a niche where the consumer is used as a driver for biodiversity consideration.

The difficulty this project research found was in persuading these companies to link and expand these initiatives to their wider product supply chain. When asked to extend their biodiversity responsibilities beyond what they perceive to be direct impacts or compliance issues, companies currently see little incentive. This situation is compounded by a lack of industry methods for assessing potential biodiversity risk, which serves to emphasise the useful contribution of the final methodology/model can make in resolving this restraint to business responsibilities in this area.

The organisational culture of a company should be considered as an aspect when dealing with companies who sometimes concentrate on the issue itself and do not relate it to longer-term business issues, as discussed in section 8.9. Work by Steger (2006, p441) found that organisations generally tend to focus on the issue and issue management than to think about the relationship between issues and business value and therefore set priorities in the design of management systems. This can make organisations stick rigidly to set criteria and so restrict the implementation of new ideas.

As a result of losing the champion within each company to drive the case studies it was not possible to establish any meaningful contact with their respective suppliers.

The study would have benefited from suppliers perspectives on implementing the methodology. Involving a number of strategic suppliers on its practical use would have highlighted any potential implementation changes needed. However, the 3 participating companies themselves are also supply companies to other buyers and as such are representative of supply chain companies. The information and findings from the 3 focal company case studies was considered sufficient to ascertain environmental procurement processes and inform the final methodology. Subsequent 'road testing' of the model would have to take place at a later date which has already been organised through a knowledge transfer programme (KTP) with Cranfield University, Middlemarch Environmental Ltd and the DETR, due to start in December 2009.

The interesting outcome of these studies is the move towards consumer involvement in the retail trade and compliance in the building industry as drivers for change. The following chapter gives the case study data and findings from the 3 participating companies in support of the final methodology.

CHAPTER 9

CASE STUDY – Center Parcs (UK) Ltd

This Chapter deals with the case study of Center Parcs (UK) Ltd. This covers Stage 2, Sections (v) and (vi) of the objectives set out in Chapter 1, Section 1.3.

9.1 INTRODUCTION

The study discussed in this chapter was conducted using the methods outlined in Chapter 8. The general corporate strategy on environmental and any biodiversity aspects of the company is outlined followed by the supply chain processes adopted for considering these issues. The information obtained throughout the study has guided the design of the final methodology and this is outlined in the discussion at the end of the chapter. The company provides a useful addition to the multi-case study because its operations are separate from the other 2 case companies, and it is regarded as a leader within the leisure sector. In addition the companies operations directly use natural ecosystems/habitats as their product and are therefore interested in marketing biodiversity as a consumer attraction.

9.2 CENTER PARCS (CP) UK SUPPLY CHAIN MANAGEMENT

This section covers the case study, within the leisure industrial sector, for Center Parcs (CP) UK. The study was based at the CP UK Head Office in New Overton, Newark. The Head Offices are also located some 3 miles from the oldest of the CP UK Holiday Villages at Sherwood Forest and this was the location referred to in the on-site case study investigation. There are currently 4 operating CP villages in the UK which provide for up to 1.3 million guests per annum and employ over 6000 people. There is also a proposed fifth village in Bedfordshire, which has just been given planning consent. The CP concept is to promote the natural environment surroundings within a leisure context of the Holiday Village. While providing various standard leisure activities associated with holidays, CP also makes biodiversity accessible to its clients.

As a market leader in the short break holiday village concept CP view biodiversity as a fundamental part of their 'shop window' and as such a fundamental part of their marketing strategy. The consideration of biodiversity on their Holiday Village landholdings is well established and the involvement of their clients and customers is a key part of this. As an indicator of their commitment and competence in this regard CP have been awarded the Wildlife Trusts Biodiversity Benchmark for Land Management (Section 2.5). The company also has the accredited environmental management system ISO 14001 in all their UK sites. Having achieved this level of biodiversity consideration for their landholdings, CP is now looking to their wider operational influence in the supply chain. Their commitment to this is endorsed by top management as stated in their Sherwood Forest Ecological Survey Document Opening Policy Statement, they comment, '*it is now time to make sure that the biodiversity initiatives on site are linked to the wider world through initiatives in the supply chain and elsewhere'* (Gibson, 2007p1).

CP also has a stated commitment in their current ISO 14001 Environmental Management System (EMS) for Sherwood Forest Village Biodiversity Action Target No 29, BAP (2007) to:

- *'Develop and implement a strategy to promote biodiversity conservation to relevant suppliers and contracts. With Actions:*
    - *Through liaison with the UK Environmental Manager identify priority suppliers and contractors for contact by the end of 2004 and on-going.*
    - *Develop delivery tools and programmes for implementation over 2005; the goal is to influence 10 key suppliers per annum by a specific supplier programme'.*

CP represents a company within the leisure sector that is sensitive to environmental publicity for its perceived potential direct impacts on biodiversity. Of the 3 participating companies the CP brand is the only one that depends on well managed and diverse ecosystems as a core product in the market place. Having succeeded in a high level of biodiversity management on their landholdings, CP is now keen to promote these achievements to the commercial and wider world. However, since these stated commitments a series of management changes has delayed their implementation.

9.2.1 Opening Contact

After a number of other selected case study companies were deselected from participating in the project (Chapter 8), CP was contacted for the second time and asked if they would become a project case. A project outline and a brief report on the project progress were given to the company for approval. CP agreed to re-participate and initial meetings were arranged to discuss project scoping and the requirements expected of the company during the study. The renewed opening contact was made in June 2005 at a meeting at the company Head Office with the then CP UK Environment Manager.

It was agreed at this first meeting that the on-site case study and subsequent testing of any methodology would commence early in the second year of the project, after the orientation period. This would mean the case study would have by then a better understanding of the overall supply chain management structure throughout industry and that procurement personnel and the case study observer would be speaking the same ‘professional language’.

The Environment Manager was acting as a champion for the project and the implementation of biodiversity management in the supply chain. In addition, an introduction was made with the UK CP Ecology Manager, who is based at the Sherwood Forest Site. These contacts allowed communication with top management and facilitated access to internal management documents, introduction for interviews, and any on-site village observations/surveys, if required. As a result any further information on supply chain procurement systems and operations was obtained directly from the procurement department through interviews and obtaining their procurement methods documentation.

The preliminary meetings with the CP Environmental Management team confirmed that the company recognised the potential of extending their sector best practice landholding (holiday village) biodiversity management and consideration expertise into their wider operations in the supply chain. In addition to the potential contribution that CP can make in reducing biodiversity loss, the company also recognise that raising awareness through existing and potential contact with suppliers and contractors, an opportunity exists to extend this contribution by educating and influencing the mindset of a large number of businesses and their employees on the importance of biodiversity consideration.

Throughout communications with the Environmental Manager one request was emphasised. That was any new biodiversity criteria or methodology in relation to the supply chain would be better received and more likely to be used if it was designed to be part of existing CP environmental and supply chain management operational procedure(s) (Drury, 2005). In addition, the methodology should not be over-complicated or significantly add to administration workloads. It was also emphasised, by the procurement department, that information on typical biodiversity impact types on a wide range of materials used by the company, and their effect on business operations, was difficult to obtain. The buying managers had, therefore, little confidence in discussing biodiversity issues either with colleagues or suppliers.

9.2.2 Study Findings

The evaluation of the baseline supply chain found that Center Parcs Ltd employ the services of approximately 5565 contractors and suppliers. The product and service supplies bought-in to the company cover a wide rage of business sectors. These include products such as, food, equipment, retail consumables, pharmaceutical, construction materials, and services such as, waste collection, energy, cleaning and service. The company strategy for considering environmental issues of the products and services it procures is, in the first instance, to evaluate the product or service itself, rather than investigating the supply company. That is, is the product necessary and can it be sourced with minimum environmental impact. This is achieved through their procurement department by use of their UK Procurement Strategy Process.

The first stage of the Procurement Strategy Process procedure is to:

1. Determine the potential environmental risks concerning the product type;
2. The second stage is to assess the supply company itself on their company environmental aspects.
3. Assess the results of a Supplier Selection Criteria.

At this stage in the supplier selection process there is currently only a direct documented dialogue with suppliers in relation to environmental aspects via a CP Environmental Questionnaire (the Questionnaire is shown in Appendix 4). After the questionnaire phase there is an additional communication with potential and selected suppliers with the development of periodic 'meet the supplier' events, held at Head Office or at supply company venues. At these events CP present their Supplier Environmental Criteria and the general requirements expected of a supplier.

The current CP Environmental Criteria cover aspects such as transport (delivery) efficiency, energy, waste minimisation, packaging and any other specific environmental issues concerning the supplied product(s) or services. This area would cover any legislative aspects or environmental licensing (hazards) or procedures concerning safety or pollution risks associated with a product or service. At the time of the case study CP strategic suppliers were required to have an accredited EMS in place.

A 'meet the supplier's event' with CP and its strategic suppliers was attended in 2005 as part of the case study. Presentations by Envirowise on energy use and CP presentations on waste and packaging management were given by the CP Environment Manager. The main area of discussion at this event was reduction in energy use, reducing packaging, general waste reduction and transport efficiency, i.e. reducing the number of deliveries per week. Biodiversity was not on the agenda but planned objectives were in the pipeline at that time.

9.2.3 Center Parcs (CP) UK Procurement Strategy

Two meetings at the Head Office site in New Ollerton, within the first year of the project, with the procurement manager produced the following information on the strategy employed by the company for managing the environmental risks associated with their supply chain. The information on CP supply chain management strategy was obtained from:

- Two meetings with the single contact at CP, that is, the environment manager.

- Copies of documents obtained from a) the procurement department and b) the environment managers own files.
- Unstructured interviews with the environment manager.

The information obtained from these first meetings gave a comprehensive overview of the CP procedure for managing the environmental aspects of their suppliers. From the point of view of the focal company this information was considered enough to give an objective analysis of company procedure in this area. It was envisaged that further meetings and interviews would be arranged with their strategic suppliers in order to get a perspective from the supplier. This did not transpire however as the environmental manager contact and champion of the project was made redundant and so left the company. Refer to section 8.7.5 for a detailed discussion on this event. The main document and management procedure concerns the potential environmental risk associated with a product or service type and the environmental suitability of suppliers.

In order to assess the likely risk to the company before a suitable supplier is approached, Center Parcs (CP) has developed a UK Environmental Supplier Assessment Manual. The manual consists of a series of Product Environmental Suitability and Supplier Assessment Criteria. The criteria are produced in order to allow the Supply Chain Manager (procurement) to assess the suitability of both the product and supplier to whom he is allowing individual holiday village managers to purchase from. In order to make best use of resources and time the Assessment Manual focuses first on potential high risk product or service suppliers.

The manual takes the form of identifying key high environmental impact products and associated suppliers by the use of a series of 2 Selection Matrices, shown in Figures 8.1 and 8.2 (CP, 2005). The text in the manual often refers to CP internal reference documents and these are given in Table 9.1.

Table 9.1 Internal CP Reference Documents

P-03-07a	Supplier Selection Procedure
F-03-07b	Environmental Questionnaire
F-03-07c	Environmental Questionnaire Assessment
F-03-07a	Supplier Section Matrix

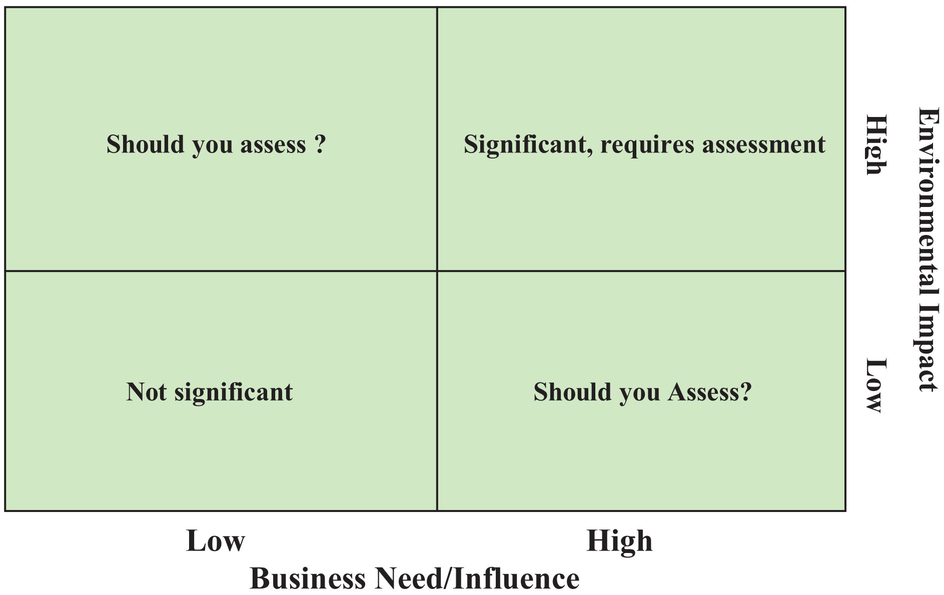
9.2.4 Selection Matrixes

The matrices compare high and low environmental impact probability against the business need for the product and the degree of management influence CP can exert on the supply company. The main purpose of the matrices is first to assess the business need for the product or service being considered for purchase against its potential environmental impact. The supplier is not the main focus at this stage but the emphasis is on the product. The product and supplier are ranked (according to CP documentation) and a decision made on the need for further assessment based on the findings.

The criterion for Matrix 1 is:

- What makes an environmental impact?
    - How damaging to the environment do you believe the manufacturing process is?
    - How significant is the impact?
    - Is environmental legislation likely to apply?
- What are CPs influences?
    - Quality of supplier?
    - How great is CP influence over supplier?
    - Can other supplier's be used?

Figure 9.1 Supplier Assessment Criteria - Selection Matrix 1



Environmental impact criteria for Matrix 1 are defined by CP as:

- How damaging to the environment do you believe the manufacturing process is? I.e. energy use, waste management issues and/or use of environmentally damaging materials.
- How significant is the impact of delivering materials from the supplies? (Frequency, distance and fleet profile, etc).
- Is environmental legislation likely to apply to specific processes of the company? (I.e. waste management licences, hazardous waste, etc.)

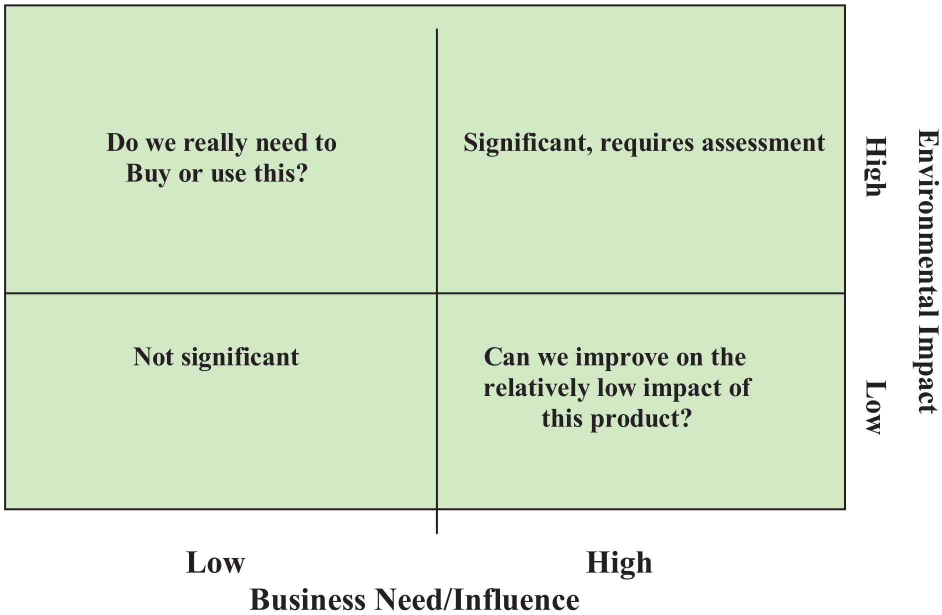
The criteria for Matrix 1 looks at how much influence CP have over the supplier and the level of the partner relationship with a supplier and are defined by CP as:

- The quality and competitiveness of the supplier?
- How great is Center Parcs influence over the supplier?
- Is there a more environmentally friendly and comparable supplier, offering a comparable level of service and price?

These criteria are then expanded upon for the selected suppliers from Matrix 1, and assessed in more detail. The criteria for Matrix 2 (Figure 9.2) have the same headings as criteria one but go into more detail. Matrix 2 is intended to allow individual managers to assess the products that are to be purchased without submitting lengthy questionnaires to the supplier. With this information from managers, products are further, and separately, assessed by Head Office Purchasing. The more detailed criteria are:

- What makes an environmental impact? The criteria of Matrix 1 is assessed in more detail – Plus
  - Does the product have an environmental statement?
  - Is it made from sustainable materials?
  - Waste type
  - Packaging type
  - Environmental labelling?
- What are CPs Influences? The criteria of Matrix 1 is assessed in more detail - Plus
  - How great is the need for the product?
  - Purchasing method – can bulk buying reduce transport?

Figure 9.2 Supplier Assessment Criteria - Selection Matrix 2.



Environmental impact criteria for Matrix 2 are defined by CP as:

- Does the product contain materials hazardous to the environment?
- How damaging is the manufacture of the materials/products?
- Is there specific environmental legislation covering the purchase, use and disposal of the product?
- Does the product have an environmental statement?
- Is it made from sustainable materials?
- Can its waste be disposed of as ‘normal’ waste?
- Is the packaging recyclable and/or made of recycled materials?
- Is the product covered by an environmental product labelling scheme?

The criteria for Matrix 2 influences as defined by CP are:

- Are there any alternative products that are kinder to the environment whilst being of comparable quality?
- Are there any alternative products that are kinder to the environment whilst being of a comparable price?
- How great is the need for this product?
- Is there a more environmentally friendly method of purchasing? I.e. ordering in bulk etc.

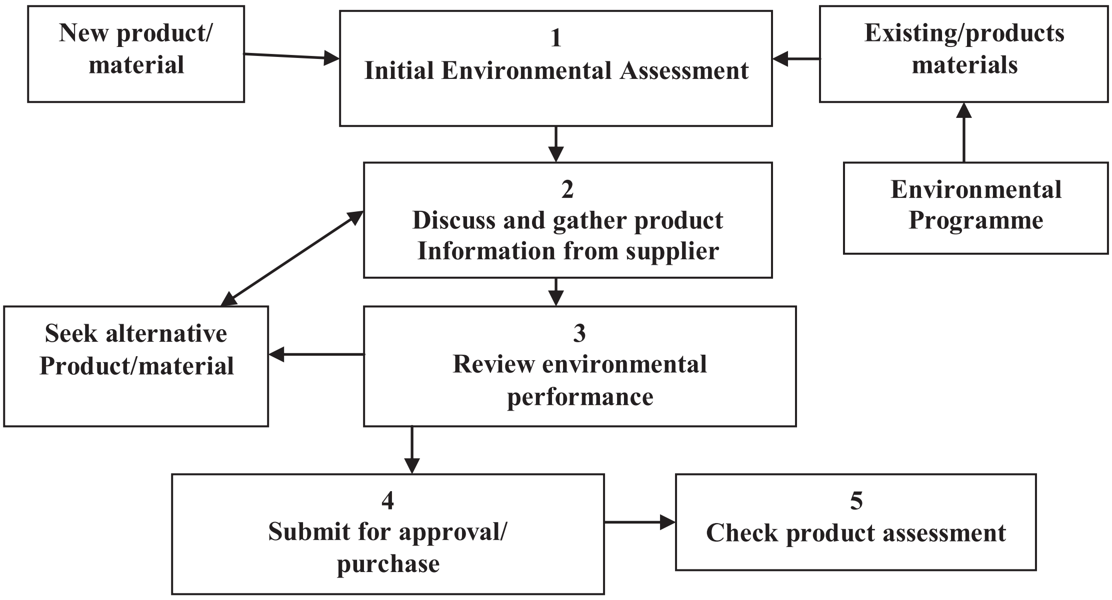
Selected suppliers are then given an assessment appraisal. This covers areas of:

- Environmental policy
- Environmental Aspects
- Environmental Legislation
- Products and Materials
- General comments

9.2.5 Environmental Procedure Plan

CP has a documented Environmental Procedure Plan. The project covers Version 7, May 2003 of the Plan and as far as this can be ascertained, it is still current. The purpose of this procedure is to control the environmental aspects relating to the purchase and provision of products and/or materials from CP approved suppliers. The scope of the procedure is applicable to all CP employees authorised to purchase products and/or material on behalf of CP. It is applicable both to the purchase of all new products and materials and existing products and materials as identified in the annual environmental programme of CP. Figure 9.3 shows the process chart used in the Environmental Procedure Plan.

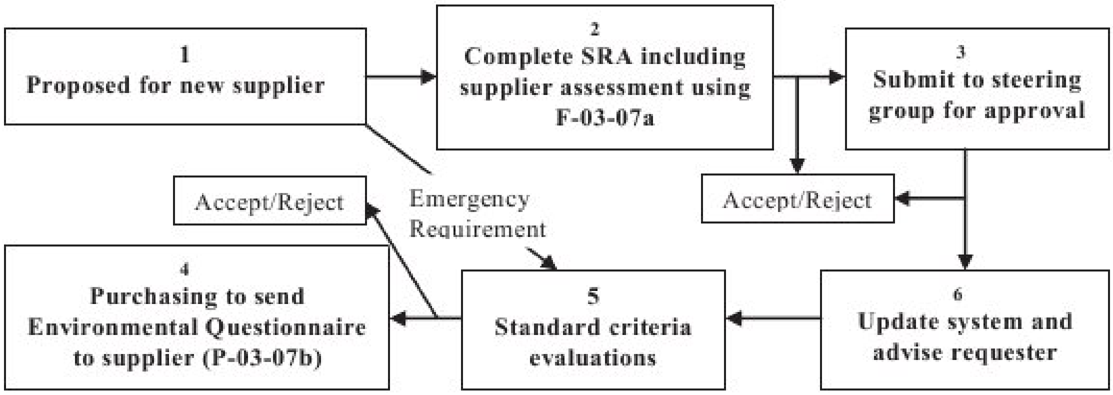
Figure 9.3 Environmental Procedure Plan



9.2.6 Selection of New CP Suppliers – Version 6 (2004)

The purpose of the supplier risk assessment selection procedure is to control the potential environmental impacts of products, goods or services supplied to CP by their approved suppliers. The scope covers all potential suppliers of products, materials, capital items and services. It is the responsibility of all CP employees authorised to recruit suppliers to follow the Supplier Risk Assessment Procedure. The following Figure 9.4 shows the supplier selection chart.

Figure 9.4. Selection of New Suppliers – Process Chart



The selection of new suppliers follows a formal procedure as shown in Figure 8.4. The procedure is summarised in Table 9.2.

Table 9.2 Selection of New Suppliers Procedure

(Source: CP Head Office Internal Document 2004)

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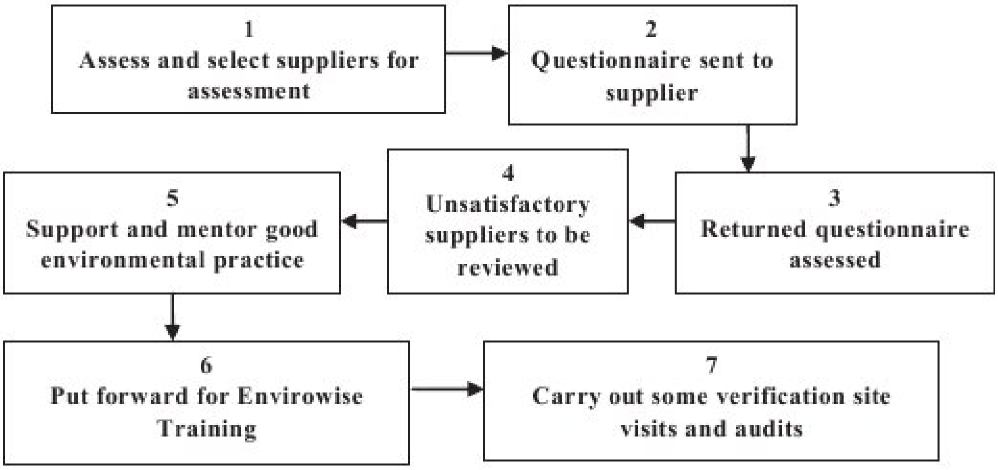
9.2.7 Assessment of Existing Suppliers

The assessment of existing suppliers is to ascertain their environmental performance and how they deal with any potentially significant environmental impact. Figure 8.5 shows the Assessment of Existing Suppliers Process flow-chart.

Figure 9.5 Assessment of Existing Suppliers – Process Flow-Chart



The procedure has also in place the assistance and mentoring facility provided by the UK Governments Envirowise Programme (Envirowise, 2007). The scope of the procedure covers suppliers assessed through internal procedure documents, as requiring further assessment or support in managing their own environmental aspect. The assessment of existing suppliers follows a formal procedure as shown in Figure 8.5 and is summarised in Table 8.5.

Table 9.3 Assessment of Existing Suppliers Procedure
Source: CP Head Office internal document P-03-07b (2004)

Aston University

Illustration removed for copyright restrictions

The above procedures are intended to be used as part of the purchasing process and not as a separate task.

9.2.8 Case Study Questionnaire

The case study general Biodiversity Consideration in the Supply Chain Questionnaire was sent out to the Chartered Landscape Architect at the CP Head Office for completion. The completed CP supplier questionnaire is shown in Appendix 4 (these are sometimes referred to as a Pre-Qualification Questionnaire or PQQ).

The majority of the case study questionnaire was not answered due to the management reorganisation taking place at the time (refer to Section 8.3.2). The new contact in the Landscape Department at CP endeavoured to obtain further cooperation and information from the procurement department but was unsuccessful. Also, any testing of methodologies as a result of the case study was not possible at the present time or within the time scale of the project. However, in the near future arrangements would be made to implement any suggested supply chain biodiversity consideration into present CP systems. A final meeting was arranged for October 2007 in order to analyse data already obtained and conclude the case study. The meeting confirmed that the information already obtained was still relevant and current. It is proposed that a presentation of the final project findings, methodology and practical management tool after completion of the thesis.

9.3 Discussion

The core business of Center Parcs Ltd is to increase shareholder value by offering customers a holiday experience where they can be entertained within the boundaries of a holiday village. The products CP are offering or selling is essentially leisure-time which is spent within the semi-natural ecosystems of their ‘Holiday Villages’. This niche positioning enables their differentiation within sector and an opportunity to market biodiversity as an economic value added and tangible driver for shareholder value. The management of risk to the reputation of the product and therefore the company brand is necessarily linked to good biodiversity consideration and management, and justifies the resources expended in managing the processes involved.

CP is seeking to further strengthen or consolidate their Brand by extending their market lead expertise, in biodiversity consideration of their landholdings, into the wider external company operations of their supply chains. By doing this the opportunity arises to advertise to other sector companies through their Corporate Responsibility Report, that they are leaders in this area of ethical environmental good practice, while adding market and investor confidence in the company. This marketing opportunity also extends to their Holiday Brochures and therefore links the above strategies with the customer and consumer value. The use of this kind of strong brand advertising within the companies own sector adds support to justify the CSR survey undertaken in Chapter 7.

The procurement strategies CP employ for evaluating both the product and service environmental aspects go a long way in promoting awareness of biodiversity issues in the supply chain. The system has been operational now for several years but due to recent management reorganisation and internal uncertainties the system has not evolved from its original design stage. The environmental impacts associated with a product or with a supply company are left to the procurement manager to assess without a detailed environmental impact criterion to refer to. The system depends to a large extent on the ability and knowledge of the procurement managers to asses such potential impacts. This aspect of the strategies would have been overseen by the Environmental Manager but the position no longer exists and therefore the Actions 3, 5 and 7 of the Assessment of Existing Suppliers procedure, are not currently undertaken. Therefore the stated ISO 14001 commitment to extend biodiversity consideration with the Biodiversity Action Target and influence 10 key suppliers a year at the Sherwood Forest Village is not currently being achieved.

As the system stands at the time of writing, the environmental aspects of suppliers are presented by the individual supply company, and no system of auditing is in place to verify such statements. Strategic suppliers are required to have an EMS in place, such as ISO 14001, or be in the process of installing such a system. Therefore if the supplier has an externally and independently audited system the procurement manager will rely on that certification when assessing potential environmental impacts with suppliers. The experience of conducting this case study has highlighted the importance of a champion to both introduce the project and maintain momentum cross-departmental interest. As the discussion in section 8.9 found the organisational culture of a company has to be considered when assessing the probability of acceptance of new initiatives into already busy and often overburdened departments. With the exit of this projects champion the study was effectively stopped for the best part of a year, however, the experience was valuable as an example of ‘real situation’ scenarios and as such contributed to the overall design of the final methodology.

As a result the final model would have to have cross-departmental buy-in in order for it to be accepted by a large group of ‘champions’ with education and training to ensure its continuity regardless of culture or institutional changes. To this end the model would have to be incorporated into CP procurement strategy (Section 9.2.3) and it is suggested into the environmental programme illustrated in Figure 9.3.

Realistically it is not generally reasonable to not accept or indeed to deselect a supplier on biodiversity grounds only although there will be exceptions, for example, in the case of a particularly sensitive product or a significant overt and direct adverse impact. The priority within business generally is to select a supplier on business/economic/suitability grounds where environmental issues are a component of that process. Supplier selection would attract a more rigorous process depending on the sector and product being supplied. CP may be an exception where some products are deemed to be of sufficient risk to biodiversity as highlighted by their selection matrix and other processes. The methodology described in Chapter 13 does include the selection component of supply chain management and describes the biodiversity management of the supply chain from design and policy to selection and continued partnership working relationship. The practical working biodiversity supply chain management (bSCM) tool main focus is intended to be on managing biodiversity risks and opportunities within the supply chain, after the selection of suppliers.

The documents provided by CP have given an insight in the companies supply chain environmental processes. This information has highlighted the need to include the level of business influence over suppliers and this will be a consideration in the final model design. They also raise the idea of significance of risk which coincides with the design of significant risks and opportunities and attributing a score to them discussed in section 4.4.2.

CHAPTER 10

CASE STUDY – AstraZeneca (UK) Ltd

AstraZeneca (AZ) is the second company case study of the project. AZ operate within the pharmaceutical sector and their business is to discover, develop, manufacture and market medicines for important areas of healthcare – cancer, cardiovascular, gastrointestinal, infection, neuroscience, and respiratory and inflammation. The AZ brand is representative of a leading player in this environmentally/biodiversity sensitive health sector and as such is an important study for informing the project objectives.

10.1 Introduction

AstraZeneca Plc is an Anglo-Swedish multi-national company formed in 1999 by the merger of Astra AB of Sweden and the British Zeneca Group Plc. The company employs some 66,000 people worldwide in over 100 countries and they manufacture in 19 countries, with 16 research and development centres in 8 countries. The AZ aim is to enhance human health through the innovation of new medicines. The organisations reputation and long-term success depend on its ability to integrate their financial obligations with social and environmental responsibilities. The company recognises the importance of their wide range of stakeholder influences and incorporating those considerations into their Corporate and Social Responsibility (CSR) initiatives. The publicly stated company core values will ensure that *inter alia* health, safety and environmental issues remain a fundamental company consideration. It is a publicly stated aspiration of the company that these core CSR principles and commitments, including new and emerging issues, are expanded by encouraging their suppliers to embrace similar standards. This is the area of cultural diversity as a component of biodiversity as shown in Figure 3.1 and discussed in section 3.2.7.

The case study base and location of the main contacts for the project are within the AZ Safety, Health and Environment (SHE) Product Support function located at Brixham Environmental Laboratory (BEL), Devon UK. The laboratory works towards a better understanding of the environmental fate of medicines and the potential long-term effects of pharmaceuticals in the environment. The research scientists work both independently and in collaboration with other organisations to advance research in this area and publish in the scientific literature. The BEL facility can perform a range of environmental, physio-chemical and eco-toxicological testing required for regulatory compliance with the Notification of New Substances (NONS) or the Registration, Evaluation and Authorisation of Chemicals (REACH) Directives.

10.2 Industry Overview on Environmental Issues

The pharmaceutical sector is particularly sensitive to natural environment issues which may threaten security of supply or give negative publicity, making this area a material risk to operations, reputation and public image.

A level of biodiversity risk by sector report by F&C Asset Management (2004) (Section 6.7.2) rated pharmaceuticals, from a choice of High, Medium, and Low Risk Sectors, as a Medium Biodiversity Risk Sector, stating some companies may be exposed to significant risks. There is related evidence that throughout the pharmaceutical sector there is recognition of the importance of these potential risks.

For example, the pharmaceutical company Johnson and Johnson (2007) states in its social responsibility web-site, that the environment is the ultimate human health issue, a statement that highlights the interdependence between human health and the health of the planet. The idea that issues of risk to natural (environment) bio-diverse ecosystems are synonymous to human health risk is, in principle, part of pharmaceutical company core business thinking. This accepted view is in sharp contrast to the general ideals of the majority of other industrial sectors in relation to ecosystems and biodiversity decline. Because of this fundamental business ethic, the consideration of biodiversity in the wider company operational field has the potential to add to the perceived quality of the final product (brand) and the public and industry image of both the manufacturer and its suppliers.

10.3 AZ Biodiversity Consideration

AZ recognises the importance of biodiversity in social, environmental, and economic terms. For example, in its major UK business facilities with landholdings greater than 5 Hectares, and within 5 km of protected sites, biodiversity action plans (BAP) are being developed with the aim of protecting and enhancing biodiversity.

This recognition of the material importance of biodiversity to the AZ core values is being considered to be extended, within existing management systems, to include its wider operating influence in its supply chain.

Under the AZ CR Policy and SHE Standard 5 (Section 2.4 of the Standard), sustainability, individual site operations will be managed to eliminate, reduce or mitigate potential impacts arising from activities or processes. So far these environmental management aims have been directed at owned manufacturing or other AZ business facilities with landholdings.

These same management aims are now proposed to be extended initially to strategic suppliers and later to lower tier suppliers. A staged approach will be taken in achieving the above by selecting a single raw material/product for detailed examination in the case study.

10.4 Case Study Overview

The case study would be sponsored by the Global SHE Department at AZ. The first stage of the study investigated the existing management systems and procedures employed by AZ in relation to the company purchasing practices, principles and relationship with suppliers. In order to focus the study and scope the project to fit available time scales, one particular product was chosen for investigation. This exercise established the baseline situation concerning the working management methods employed in supply chain interaction. The baseline information included examples and procedures taken directly from the information supplied by AZ in accordance with the Confidentiality Agreement formulated for conducting the case study. The next stage investigated the supply companies within the selected product chain.

10.4.1 Initial Meeting and Business Case for the Project

The first project meeting took place in the AZ Brixham Laboratory and the main topic for discussion was the scoping of the study and time scales along with the type and extent of the information required from AZ. The meeting was with the Project Manager for Biodiversity and the Environmental Specialist and Project Leader for the in-house AZ Project 'Buying Our Future' (now referred to as the AZ Project). The AZ Project was instigated as part of a wider company investigation into sustainable procurement and supply chain associated risks to security of supply.

At this meeting it was agreed that the testing of any methodology as a result of the case study would take place in the second year of the project. In addition, it was an AZ requirement that any methodology for introducing biodiversity aspects into procurement processes would have to dovetail into existing environmental and procurement frameworks employed by AZ. It was also decided at the meeting that in view of the large number of products and services procured by the company it would be necessary to concentrate on one type of product. This would make optimum use of the available time allotted to the case study. It was also made clear that, outside the relevant environmental departments, the awareness of biodiversity issues, impact types, and business risks, was relatively low. Buying departments found that obtaining any information in this area was difficult to find and time consuming.

In summary, a number of actions plans were agreed at the meeting to be undertaken by May 2007. The action plans were:

1. Familiarise the project with AZ CR, purchasing principles, and management systems in relation to the supply chain
2. Look to where opportunities for linking biodiversity into existing management systems might arise in the context of the selected case study product focus – single chemical solvent.
3. Explore methods of raising biodiversity awareness in AZ and linking biodiversity to health and environment – stakeholders, society.
4. Arrange meeting with the project supervisor to discuss the case study as specified in The Confidentiality Agreement.
5. After familiarisation, arrange meeting with AZ strategic solvent supplier(s).

It was also decided at the meeting to propose the introduction of biodiversity consideration into supply chain procurement on three levels:

1. Raise awareness of biodiversity within AZ managerial teams
2. Achieve 'buy-in' and ownership by introducing biodiversity consideration into and inviting comment from management, study groups, project teams, e.g. purchasing, SHE technical support.
3. Develop tools for considering biodiversity in the solvent supply chain.
4. Consider a biodiversity data-base for information access.

Introducing biodiversity supply chain management to a wide AZ internal audience would be achieved by presenting the case study to relevant management teams, for example, purchase project team, SHE team, engineering team.

10.5 Confidentiality Agreement

The above meeting highlighted the business case for including biodiversity issues into the overall AZ project aim of environmental improvement, minimising risk and sustainable use of natural materials. In order to develop an understanding of the AZ procurement practices, the information required by the case study could call for access to some potentially sensitive material. It was decided therefore that a Confidentiality Agreement between AZ (UK), Aston University, and the Industrial Partner, Middlemarch Environmental Ltd, would be needed to safeguard this internal management information. As mentioned in section 8.8, the legal process of doing this took some time. The result was that the detailed case study and testing of any methodology could not take place until the last year of the project time scale. By this time however, the management situation within AZ had changed and the top management 'Champion' for the project had moved to other areas of the company (Section 8.8). All material relating to AZ within this thesis has been approved by their legal and other relevant departments before publication.

10.6 Case Study Interim Reports to AZ Project Team

As part of the AZ case agreement there was a requirement to present interim reports on the case study progress. A report on progress after the first year of the study, the Report entitled *AstraZeneca Case Study – Biodiversity management in the Supply Chain,* was presented in May 2007. The report outlined the current AZ management processes and integration of the project objectives during the study. The report was presented to the Project Manager for Biodiversity at a progress meeting during a environmental exhibition on sustainable energy at the NEC Birmingham in May 2007. A second report entitled *AstraZeneca UK - Supply Chain and Biodiversity Report Synopsis of Supply Chain Biodiversity Management Case Study* was presented to AZ in July 2007 and represents a synopsis of this chapter.

10.7 Data Collection

The study analysed qualitative data obtained from organisational and managerial processes, for example, documents, records, interviews, existing supplier questionnaire, and direct observation. The case study was conducted by using the iterative grounded theory method (Section 8.4).

The first stage of the case study was to obtain an overview of the AZ Corporate Strategy concerning the group purchasing policies and principles currently employed throughout the organisation. This appreciation of working practices would provide the basis for presenting the business case for biodiversity to the wider internal stakeholders at AZ.

The case sponsors, that is, the Global SHE Director, the Project Manager for Biodiversity, and the Project Leader for the AZ Project had explained the potential difficulties and constraints the case study could potentially encounter within the company. Other relevant departments might adopt a cautious attitude towards introducing another aspect to procurement operations. The objective opinion ranged from; extra administrative burden, economic cost, difficulty in monitoring, knowledge of subject, influence on suppliers too weak, and do not see any advantage in introducing this aspect. The project would therefore have to be 'sold' to departments involved in the procurement process.

10.7.1 AZ Purchasing Principles

AZ also recognises that what they buy, and from whom they buy it, can have significant environmental and business consequences and therefore, risk management should extend to its supply chain. In order to protect the AZ company brand and image they require certain assurances from their extended business operations in the supply chain. To this end the AZ purchasing principles state that suppliers should embrace corporate responsibility (CR) principles similar to their own. This provides the basis for a continual improvement philosophy both in internal and external company operations and contributes to the material added value of biodiversity consideration. The AZ CR focus is on their three main business operations (R&D, Manufacturing Operations and Marketing) where over 80% of suppliers are based, in the USA, UK and Sweden. CR considerations are included in all new contracts and master agreements in these countries.

In a practical approach to implementing CR principles the initial company policy is to prioritise main (strategic) suppliers or high risk suppliers that are important for business continuity. In countries where low supply company standards exist AZ will work with suppliers to improve standards through its CR Principles in Purchasing Practice.

10.7.2 Group Policy Framework

At the time this research was carried out AstraZeneca had eleven Group Policies forming their Group Policy Framework. The framework forms an important part of AZ corporate governance targets. The aim is to bring together group policies, supporting standards, procedures, and guidelines into one common format and structural framework. This will allow all managers and staff to understand the responsibilities for compliance that corporate governance demands under the foundations of the AZ ‘Code of Conduct’.

10.7.3 The AZ Project – Buying our Future

The AZ Project aims to provide AZ purchasing professionals with the tools and knowledge to drive environmentally preferable purchasing. The outcome is intended to form part of AZ Corporate Responsibility (CR) policy and will contribute to the Corporate Safety, Health, and Environment (SHE) policy and objectives. The AZ project was instigated to update the existing company ‘CR in Purchasing Guideline’ document and produce environmental criteria for each purchasing category and deliver purchasing training to increase awareness. The AZ project also aims to engage in discussion with NGOs to ensure work undertaken is in line with stakeholder thinking. Also it will evaluate how to provide ongoing environmental support to purchasing professionals throughout the global company.

AZ corporate responsibility commitments demand that management processes continually work towards reducing the environmental impact of the business. AZ recognises that what it buys and from whom can have significant environmental consequences. The biodiversity project and case study would therefore form part of the AZ Project research with the potential for inclusion into the overall environmental CR commitment of the company. The two projects would build on the existing AZ 'Environmentally Sustainable Purchasing Project' which prioritises purchasing categories based on environmental impact and ability to influence risk. The business case objectives of the Buying Our Future project are to:

- Ensure environmental issues are addressed in the new version 'CR in Purchasing Guidelines';
- develop environmental criteria for all purchasing categories;
- ensure tools, information and advice can be made available to purchasing professionals to drive environmental improvement;
- meet requirements of ISO 14001 within the UK;
- identify appropriate mechanism for environmental support to purchasing globally.

Identified risks and opportunities:

- Risk – low risk of inadequate input being obtained from purchasing due to work pressures.
- Opportunities – high probability that the project will contribute to reduce AZ environmental impact.
    - High probability that some environmental improvements will reduce total cost of ownership.
    - Medium probability that doing 'the right thing' can contribute to improved wellbeing within purchasing professionals (it feels good to save the planet).
    - High probability that this project can enhance our CR image with external stakeholders.
        - Ongoing intangible benefit value

The case for introducing and 'selling' biodiversity consideration to supply chain operations was linked to the Buying Our Future - CR policy of the company, and the publicly stated commitments outlined in CR and Sustainability Reports.

10.7.4 Making the Case for Biodiversity Consideration within AZ (UK)

The Project Manager for Biodiversity and the Global SHE Director had realised that in order for any new and additional process or method, in what may be considered as a 'marginal' area - that of biodiversity consideration, to be effective and meaningful, general management 'buy-in' across all departments was considered essential.

Therefore, the business case for introducing what might be regarded as, ‘yet another environmental issue’ into existing systems would have to be convincing to other, perhaps more directly involved, company departments, such as buying, engineering, and environmental, and auditing.

Whilst this stage of the case study was to primarily investigate present management and procurement systems, a consequence of the investigation would also be to raise awareness of biodiversity within the Buying, Auditing, SHE and CR Departments. It was anticipated that increased awareness of the potential risks of ignoring biodiversity issues would add to the considered material value of biodiversity within these departments. With top management approval and agreement that the cooperation of the various departments involved in the whole procurement process was essential, these departments were invited to work alongside the project. In line with this, at key stages of the case study relevant management personnel would be informed of progress and opinions sought to improve the practical use and final management process concerning biodiversity in the supply chain.

It should be pointed out that no attempt was made to alter or put in-place any changes to existing processes during the case study.

10.7.5 AstraZeneca Corporate Responsibility Policy

AZ recognises that long-term success is linked to reputation and the ability to integrate financial obligations with social and environmental responsibilities. Fundamental to company policy is maintaining and improving standards of responsibility and communicating progress to stakeholders. This recognition of responsibility is part of company core values and is consistent with the AZ Group Policy Framework and publicly declared Code of Conduct. The AZ definition of corporate responsibility is:

The way AZ incorporates economic, social and environmental issues in the operation of its business. CR in AZ includes making sure that; our CR commitments are expanded by encouraging our suppliers to embrace standards similar to our own.

The AZ responsibility standards relevant to the project and case study are:

- Maintaining high ethical standards in research and development of new medicines;
- Making a positive contribution to the communities affected by company operations;
- Meeting national and international regulations;
- Responsibility commitments are expanded by encouraging suppliers to embrace standards similar to own;
- Ensuring new and emerging issues relating to CR are dealt with appropriately and effectively.

10.7.6 CR Principles in Purchasing Practice

An AZ priority in recent years has been to build CR into the new category management processes (Section 10.5.1) that have been developed for the successful integration of CR into purchasing practices. Suppliers are expected to operate with similar standards of CR as AZ. To this end CR principles must be effectively incorporated into the supplier selection process. As part of the selection process suppliers undergo a risk assessment and value judgement process.

This process is governed by the nature of the supply relationship and the level of risk involved. Strategic suppliers are required to at least meet minimum CR Performance Expectations. The necessary information is acquired by using questionnaires, due diligence reviews and other relevant tools. The AZ Integrated Supplier Evaluation Protocol (ISEP) in outsourcing and procurement includes supplier questionnaires and audit templates (Section 10.4.5). Suppliers are required to demonstrate their plans to meet AZ CR expectations if they do not already do so. The minimum CR expectations in relation to environmental issues are outlined in the AZ Purchasing Guidelines – CR Principles in Purchasing Practice (2006, p3). The purchasing guidelines are being reviewed by the environmental purchasing ‘Buying our Future?’ project business case, see section 10.4.1.

There are six CR expectations in the Purchasing Guidelines all of which relate to general environment issues but no specific mention of biodiversity impact. The evaluation of suppliers is based on the minimum CR expectations questionnaire and business review or audit meeting with the supply company.

All six CR expectations relate to indirect impacts on biodiversity but two could be linked to direct impacts, these are:

- You should review your resource consumption;
- If you are handling or producing genetically modified organisms (GMOs), you need to have the appropriate policies and procedures in place for managing the associated risks.
    - For example, in the UK follow the biological safety officer HSE Guidelines.

NB: AZ has a SHE Guideline on biological safety which covers facilities and operations. In addition, all suppliers will have appropriate management systems in place to ensure that CR principles and standards are communicated, understood and applied within the company, and that performance is monitored and measured on an ongoing basis. This would include an environmental management system (EMS), for example, ISO 14001.

AZ also state in the Supplier Performance Expectations and in the CR Policy Statement that: AZ continually monitors its internal and external environment for new and emerging issues that require attention. Any new AZ standards that emerge as part of this process will be communicated to suppliers in an appropriate and timely way.

The Minimum CR Expectations required from suppliers are:

- The minimum CR expectations questionnaire should have a 'yes' response to all questions. Any 'no' responses should be highlighted in a subsequent follow up business meeting within a one-month period;
- The business review/audit should identify gaps, issues and action plans to address opportunities for improvement and mitigate risk;
- Performance deficiencies should be identified and improvement opportunities should be implemented in a timely manner. Strategic suppliers can be offered AZ support to help to mitigate risk.

The items listed in the minimum CR Expectation Questionnaire that have a bearing on the case study are:

Item – Corporate Responsibility

Question 2 - Do you comply with AZ minimum performance expectations for suppliers?

Item - Environmental

Question 4 - Do you endeavour to minimise environmental impacts in design and development of products and services?

10.7.7 Integrated Supplier Evaluation Protocol (ISEP) - Checklists

The ISEP Checklist for first tier suppliers has 62 main items/headings. Of these there are 18 items concerned with the general environment on the checklist that may have a bearing on the case study. Of these 18 general environmental items there are 9 that, at this stage, may have a direct bearing on the case study in terms of management of the supply chain or direct biodiversity impact. The 9 items are shown in Table 10.1.

Table 10.1 SHE Management Checklist Items Relevant to the Case Study

Item	AZ Expectations
SHE policy	There is a written SHE Policy communicated to and understood by staff
	There are clearly defined SHE Roles and Responsibilities communicated to and understood by staff
SHE licenses	The site has license to operate from local/national authorities. The site has no enforcement or prosecution in force or pending
Incident/accident investigations	There is a procedure for investigation. Incidents/accidents are reported, investigated and actioned. Actions are followed up
Audits	There is a procedure for self-inspection. Findings are reported and reviewed/actioned by management
Training	There is a procedure for identifying and delivering SHE, good manufacturing practice (GMP) and task training.
Risk assessment	Reaction, material and process tested on a schedule. On failure, corrective action is taken.
Genetically Modified Organisms (GMOs)	There is a policy in place. The policy as a minimum should cover: compliance with regulatory requirements, review and risk assessment, strict controls, adequate containment, training of staff and ethical welfare considerations of transgenic animals (if applicable).
Change Control	There is a change control procedure in place. Proposed changes are reviewed to consider quality, engineering and SHE aspects. Implemented changes are reviewed and signed off.
Raw Materials	The site has assessed its supply chain and identified risks to raw material suppliers. Contingency plans are in place in case of disruption.
Purchasing	There is a purchasing policy that ensures only approved suppliers are used. There is a supplier audit process to ensure continued compliance.

10.7.8 Supplier Risk Assessment – Tools and Guidance

Purchasing and CR risk should be considered as part of supplier selection and ongoing management process, for example, integrated risk management (IRM). The level of risk will vary depending on the scope and nature of supplier activity, and hence each supplier should be managed on a case-by-case basis. Suppliers are assessed on three scenario criteria and assigned to three risk levels. The 3 Scenario and Risk levels are shown below:

Scenario 1 - Low Risk

- Commodity goods or services
  - No effect on operations if supply disrupted
- Minimum supplier CR performance expectations
  - Supplier given reasonable time to conform to expectations
- Supplier examples: stationery, low risk spare parts, some basic chemicals and consumables.

No direct action required, since Terms and Conditions will incorporate minimum CR requirements.

Scenario 2 – Medium Risk

- Supplier could pose risk to reputation or operations
  - Interruption of supply – critical to operations
- Standard contractual language
- Close examination of the suppliers CR profile
- Tailored questionnaire addressing specific areas of risk
- Business review meetings – actions based on nature of risk and supply relationship
- Supplier should demonstrate reasonable and timely improvement if in breach of expectations
- Supplier examples: contractors, unfamiliar markets, sub-suppliers - sourcing unclear.

The buyer must complete and forward the ‘Accompanying Letter’ and ‘Minimum CR Expectation Questionnaire’ to the suppliers. Refer to the Integrated Supplier Evaluation Protocol (ISEP) (Pre-Audit Questionnaire). See section 10.4.5.

Scenario 3 – High Risk (Strategic Suppliers)

- Clear risk to reputation or operations
  - Interruption of supply risk
- Construct questionnaires to address specific areas of risk and follow up with audits to ensure CR standards are kept up to standard
- Improvements should be implemented in a timely manner
- Suppliers who are unable to conform should not be used

In addition to other unique risks which include: chemical manufacturing; contract laboratories; contractors on site; business travel; promotional items, there are some specific and relevant areas related to biodiversity and the supply chain. These related purchasing activities should be included in the overall management system. They include existing or emerging policy issues relevant to AZ CR performance, and are:

- Biodiversity consideration – some items from suppliers may have potential impacts on biodiversity. Therefore AZ should seek to minimise its use of such materials which, when taken from sensitive ecosystems, could potentially cause long-term damage and threaten the security of supply.
- Climate Change – commit to minimising impact on climate change by being energy efficient and considering the environmental (and specific biodiversity impact) in purchasing decisions.
- Biopharmaceuticals and bio-prospecting – the use of naturally occurring materials removed from complex ecosystems can result in adverse biodiversity impacts or disrupt the lives of local residents. AZ should manage the risks to biodiversity responsibly and the rights of those who inhabit the area of activity.

Supplier examples: suppliers of pharmaceutical intermediates; single source suppliers; suppliers of key raw materials or; outsourcing of services, including manufacture of active pharmaceutical ingredients (API).

The buyer must complete and forward the 'Accompanying Letter' and 'Minimum CR Expectation Questionnaire' to the suppliers. Refer to the Integrated Supplier Evaluation Protocol (ISEP) (Pre-Audit Questionnaire). See section 10.4.5.

10.7.9 Global Purchasing

Corporate Responsibility (CR) Community of Practice – this is a group of AZ CR practitioners who regularly meet to discuss and share best practice in integrating CR into purchasing activities. They are happy to provide advice to interested parties, based on their experience and knowledge in this area.

10.8 SAFETY HEALTH AND ENVIRONMENT (SHE) POLICY

One of the AZ SHE Policy Statements has the aim of: '*continuous improvement in the sustainability of all activities by, amongst other things, economising on the use of natural resources and working to eliminate pollution* …'. There are 8 SHE Standards, and of these there are 5 (Standards 4 to 8) that are relevant to the project, these apply to AZ facilities and business functions and form the basis for the CR Principles in Purchasing. The 5 relevant standards are:

Standard 4 – Risk Management

- There must be a process at all facilities, and within all functions, to identify significant SHE related risks that arise from all activities undertaken. This process must include periodic reviews and account for business and process changes;
- The threats and opportunities associated with identified risks must be assessed in terms of the potential consequences, people, the environment and the business; and the likelihood of them occurring;
- Appropriate procedures and arrangements must be put in place to assess and manage these risks responsibly so that unacceptable risks are avoided;
- The nature and scale of potential emergencies must be separately identified and formal plans put in place to manage them. These plans must be periodically tested. Emergencies must be managed in a manner that places the highest priority on the protection of people and the environment;
- The SHE implications of any planned business acquisition or divestment, including licensing or collaborative agreements, must be evaluated and appropriate responsibilities agreed in a timely and comprehensive manner.

Standard 5 - Sustainability

- All facilities and functions must identify significant opportunities to improve the sustainability of all their activities and produce appropriate implementation plans. These should include the more efficient use of materials and energy, the substitution of hazardous materials where feasible and the optimisation of materials reuse and recycling.
- Sustainability impacts must be considered during the development, acquisition and marketing of new products and services.

Standard 6 - Outsourced Activity

- There must be an exchange of relevant SHE information and requirements between AZ and its contractors. Processes must be in place to ensure that… protection of the environment is being effectively managed.

Standard 7 - Monitoring and Auditing

- Regular monitoring and auditing are fundamental to continuous improvement of the SHE management systems and must be applied at both local and global levels;
- Monitoring and auditing programmes must be able to confirm the existence of effective controls for preventing harm to people and the environment and detect deviations from internal and external SHE requirements.

Standard 8 – Annual Review and Improvement Plans

- Including a formal annual review, examining all aspects of SHE performance, including the results of local audits, compliance with legal and company requirements and progress against objectives.

10.8.1 Identifying the CR Priorities

Formal internal risk assessment processes, together with external benchmarking and stakeholder dialogue, are used to identify opportunities and challenges associated with CR. The AZ CR Priority Action Plan provides a framework for managing risk in line with core values, including defined objectives and key performance indicators (KPIs). One relevant aspect to biodiversity and of concern to SHE as a key focus challenge is climate change.

10.8.2 Priority Action Plan KPIs

The KPIs for the Priority Action Plan are:

- Climate Change - Objective Action Plan KPI, GHG emissions – absolute and referenced to sales (where appropriate).
  Minimise impact worldwide. Focus on greenhouse gas emissions.
- Pharmaceuticals in the Environment – Objective Action Plan (where appropriate). Refine understanding of how products interact with the environment and pursue opportunities to reduce or eliminate potential adverse impacts, particularly with regard to environmental toxicity. At this stage it is too early to establish a meaningful KPI in this area of long-term research.
- Suppliers – Objective Action Plan KPI (where appropriate), see section 8.5. Suppliers are encouraged to adopt CR standards similar to AZ.
- Include CR in global purchasing category management processes. CR referenced in all new contracts and master agreements generated from the countries in the Priority Action Plan. CR included in the roll-out of our new category management process.
- Selection of Suppliers: prioritise suppliers most important to continuity of business. Lead by example. Make supplier aware of policies and principles.

Build CR into existing selection and risk assessment processes, including integrated risk management. Only expect supplier to do what AZ are prepared to do themselves.

As a minimum the following questions should be included in strategic supplier selection.

- Are policies in place covering SHE and other areas of CR?
- Is there a clear management structure, with defined responsibilities for performance and risk management?
- Does the supplier have risk assessment and management processes that include CR and address as a minimum: fire, security, natural hazards, licences to operate and risk in their supply base?
- Have any targets for improvement been established and is progress monitored?
- Has the supplier been subject to any prosecutions?

Where there are additional risks (e.g. chemical manufacture, contract laboratories) consider further risk assessment and auditing. Best practice in supplier auditing where there are high risks can be found in Global External Sourcing Audit Templates. Additional guidance can be found in the AZ Corporate Responsibility Toolkit.

10.8.3 Category Management

Category management is a development of the brand management approach to product development. Essentially similar products are separated into categories and managed as business units and therefore are subject to business reviews to examine, for example, costs, profitability, trends and future opportunities for change or improvement.

A substantial proportion of the AZ budget is spent externally on goods and services to support the business. AZ has adopted Category Management as the approach to manage external spends and maximise value delivery. The procurement representative on the Category Management team has the responsibility of identifying suppliers and buyers related to a category using the buyer supplier search tool, available via the Purchasing Information Gateway. It is also the responsibility of the category management team to categorise suppliers as strategic, collaborative or opportunistic using supplier segmentation methodology. Supplier classification will also be determined by the potential CR risk to the business which will be established by the Category Management team.

The classification of suppliers is determined as:

- Strategic suppliers – Potential High CR risk

- Collaborative suppliers – Potential Medium or High CR risk
- Opportunistic suppliers – low risk (unless there are extenuating circumstances).
    - As an additional filter the category management team must identify any potential CR risk for an individual opportunistic supplier e.g. is the supplier operating in a low cost country? Are there any unique risks associated with the category e.g. animals? Is AZ spend a high proportion of the supplier's turnover? Is the supplier using material, which could potentially cause long-term environmental damage?
    - If a CR risk is identified the opportunistic supplier should be upgraded to potential medium CR risk and the communication to the supplier changed accordingly.
    - Otherwise opportunistic suppliers are classified as low CR risk.

10.8.4 AZ Analysis of Supplier Evaluation Data and Assigning a RAG Rating

The AZ analysis is based on data derived from the minimum CR Expectations Questionnaire and business review meeting or audit meeting. Suppliers are assigned a Red, Amber or Green (RAG) evaluation depending on the buyer interpretation of the supplier data. The RAG rating system criteria is:

RED Rating

A RED rating indicates a supplier who is unable, or unwilling, to operate in a manner consistent with the minimum CR Performance Expectations - Supplier to be monitored quarterly.

AMBER Rating

An AMBER rating indicates that the supplier is meeting many of the CR Performance Expectations - Supplier to be monitored half yearly.

GREEN Rating

A GREEN rating indicates a supplier that is meeting all CR Performance Expectations - The supplier should be reviewed on a yearly basis.

The collected results are shown in a Record Results Table (Table 10.2).

Table 10.2 Record Results Table

Supplier	Business Risk	Potential CR Risk	Min CR Expectations Questionnaire Findings	RAG Rating	Business Review/Audit	Date of Next CR Review
Name	Strategic Collaborative Opportunistic	High Medium Low	Link to p.drive*	RED AMBER GREEN	Link to p.drive*	Next** Review date

* All associated documentation is stored on a central category team p Drive or e-rooms. ** All suppliers must be, as a minimum, evaluated annually. Red rated suppliers to be monitored quarterly. Amber suppliers evaluated half yearly. All documentation must be updated within four weeks of a meeting and incorporated as a link in the buyer's tool.

10.8.5 Overview of AZ Procurement Management Process

Figure 10.1 provides an overview of the current AZ Procurement Management Process.

Figure 10.1 Diagram of Procurement Management Process

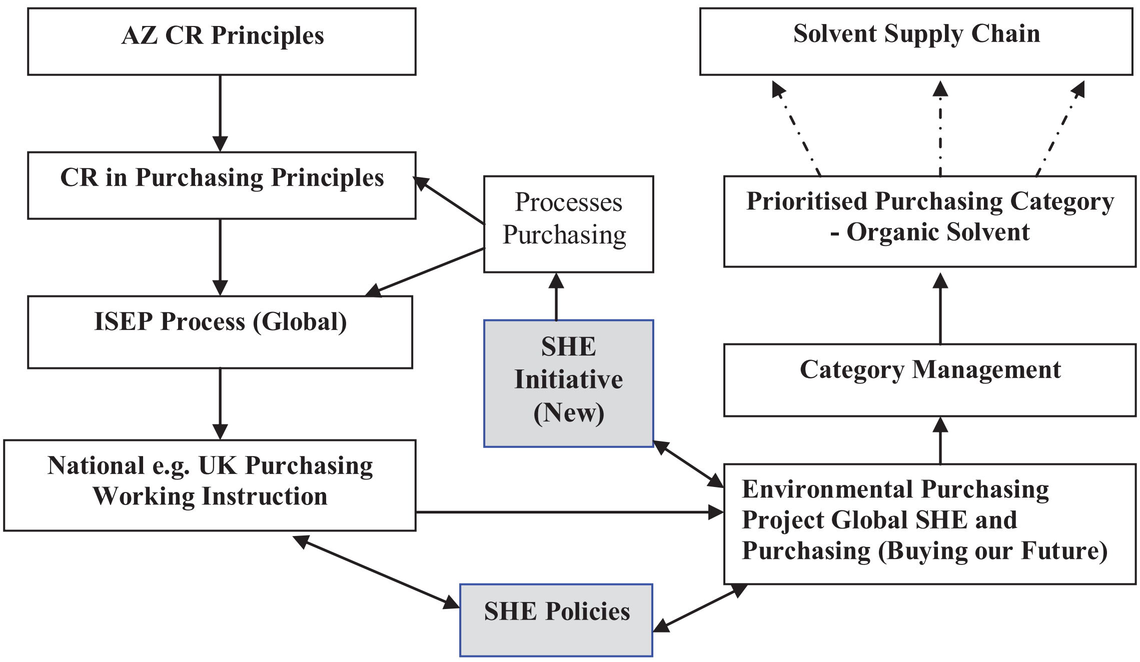
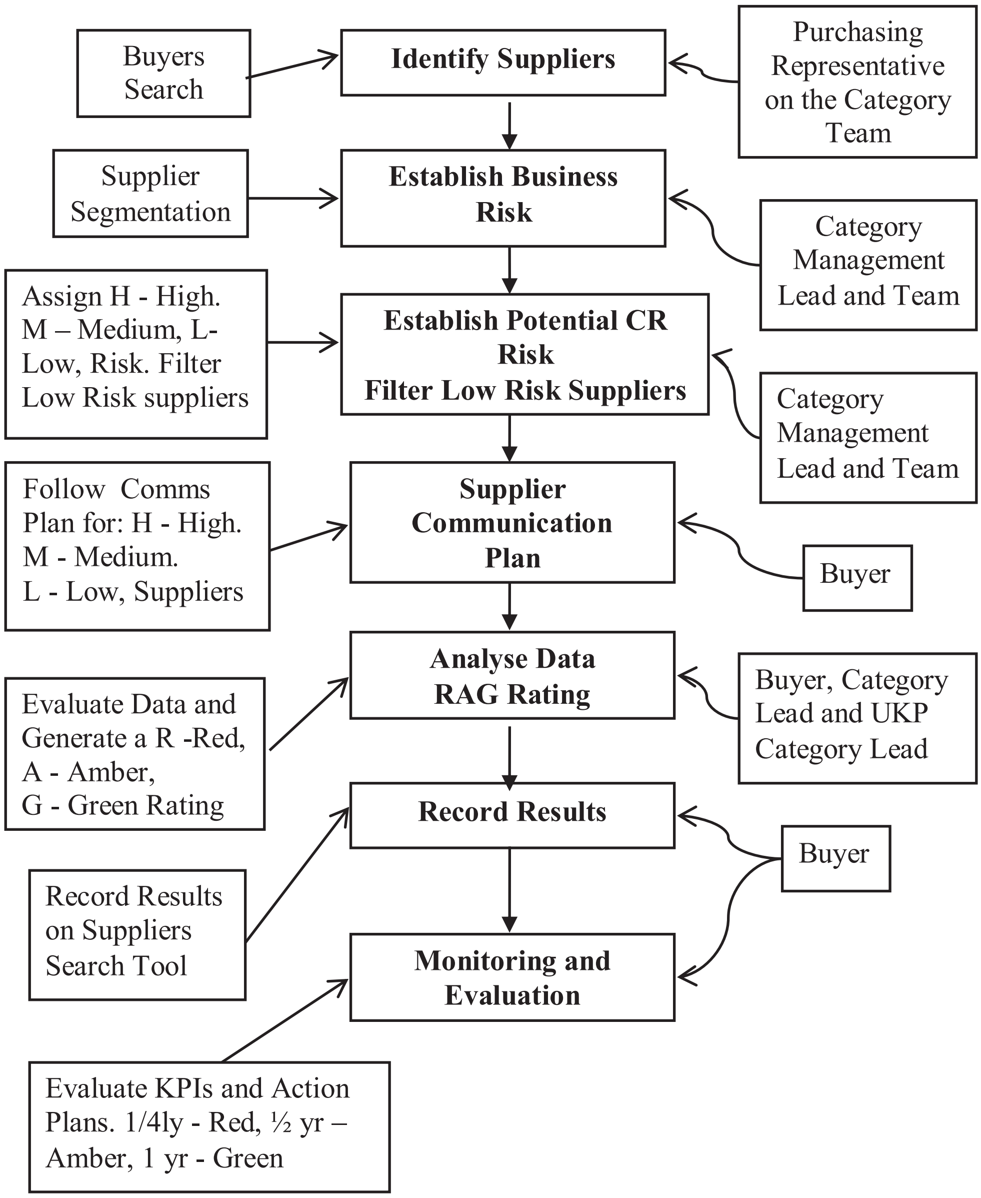


Figure 10.2 gives the overall management process of CR in the supply chain, taken from the Corporate Responsibility UK Purchasing Working Instruction, Version 2, 2007.

Figure 10.2 Management of CR in the Supply Chain



The procurement of products and services follow a management process based on the publicly stated AZ Core Responsibility Principles. The AZ supply chain strategy encompasses the management process, the organisation, and information systems needed by procurement professionals to source products and services responsibly. The above systems are applied to the selected product for the supply chain case study.

10.9 THE CASE FOR THE SELECTED PRODUCT RANGE FOR STUDY

The product selected for in-depth study would have to meet criteria which would be both representative of the AZ supply chain network and fulfil the project objectives. The criteria agreed by AZ and the case study were that the product would have to:

- Have a direct as well as an indirect potential impact on biodiversity;
- Be representative of AZ supply networks;
- Be sourced from the UK;
- Be an AZ Prioritized Purchasing Category, i.e.;
    - Be of fundamental or strategic importance/utilisation to the AZ product line, that is, in the manufacture and development of medicines, and where any interruption in supply would seriously disrupt production;
    - Be used in significant volumes;
- Have the main significant chain of suppliers to be of a manageable length for the time scale of the study;
- Be a product which is currently under environmental scrutiny and economic suitability to AZ.
- Have limited confidentiality issues

The raw material products used by AZ which meet all the above selection criteria are organic chemical solvents. It was decided therefore to focus on the biodiversity impact of solvents and their associated supply chains. It was also decided that the solvent products and procurement methods would be considered within the AZ 'CR Principles in Purchasing Practice'. Furthermore, any new additions to policy should not unduly complicate or be separate from AZ processes. Therefore any new methodology, resulting from the case study, would be designed to integrate into existing AZ management systems, codes of conduct and group policy framework outlined in section 10.4.4.3.

Solvents, on average, account for some 80 to 90% mass utilisation in a typical pharmaceutical manufacturing process. In view of the fact that solvents have physical-chemistry and environmental toxicity profiles, they constitute a major proportion of the environmental footprint associated with pharmaceutical manufacture (Constable *et al*, 2007). A definition of a solvent is given below.

Solvent definition: A solvent is a liquid that has the ability to dissolve, suspend or extract other materials, without chemical change to the material or solvent. Solvents make it possible to process, apply, clean or separate materials. Water, for example, is an inorganic solvent. Organic solvents, that is, solvents derived from a carbon source, include hydrocarbon solvents, oxygenated solvents and chlorinated solvents (Chlorine Industry Review, 2006).

It is the hydrocarbon family of solvents that are the focus of this study. Because of their high risk potential for environmental impact in the industry pharmaceutical companies have developed their own solvent selection guides. These include the Green Chemistry Guide and the Solvent Selection Guide (Curzons *et al*, 1999). The Solvent Selection Guide provides safety, health and environmental information to promote the selection of solvents with the minimum SHE impact (AZ, 2003 -2007).

Table 10.3 shows examples of attributes and hazards considered in the Solvent Selection Guide.

Table 10.3 Solvent Selection Guide Attributes and Hazards
(From Curzons, *et al*, 1999)

Aston University

Illustration removed for copyright restrictions

The Solvent Selection Guide is being further developed for specific AZ use with work by the Solvent Environmental Assessment (SEA) Project, which looks at the 'life cycle environmental impact profile' of a solvent. The SEA Project aims to measure the potential of a solvent to cause environmental impact via climate change, acidification, eutrophication, tropospheric ozone (smog) creation and/or depletion of resources throughout its life cycle.

10.9.1 Solvent Environmental Assessment (SEA) Project

The objectives of the SEA project are to develop:

- Streamlined life cycle assessment (LCA) data for solvent use in AZ;
- An assessment of the economic effects of solvent recovery/reuse;
- The use of information generated to provide specific guidance on best available technique (BAT) for solvent choice and use by Process Research and Development (PR&D).

Life cycle inventory (LCI) profiles have been developed for 45 solvents used by AZ. The LCIs will provide the basis for further work into integrating life cycle information into the solvent selection guide.

This work has followed a 'cradle-to-gate' pattern, where the LCI profiles cover only the production phase of the solvents and not their use by AZ. A full life cycle analysis of solvents would have to include AZ operational impacts resulting from manufacture, transport, storage, and treatment after use, that is, reuse, recycling or disposal. The incentive (environmental and financial) for recycling is high for solvents with higher production phase impacts, but gradually reduces for solvents with lower production phase environmental impacts.

With the aim of improving the AZ Solvent Selection Guide, LCI profiles have been listed by Environmental Impact Category Scores. The scores factor in the business driver of utility, the importance of a solvent (and solvent category) in terms of costs, the number of chemistry production processes and the range of possible solvent alternatives.
The environmental impact categories identified by AZ are:

- Global warming;
- Acidification;
- Eutrophication;
- Photochemical ozone creation;
- Resource scarcity.

AZ emphasise that biodiversity considerations can be divided into the following product life-cycle phases (Brown, 2008):

1) Production – from collection of raw materials, cultivation and/or manufacture – this is essentially a series of site based assessments of biodiversity impact
2) Transport and packaging – use of raw materials, production of CO2, transport of material incl. GMOs etc.
3) Product use – intrinsic hazard of product versus use profile (volume etc.) = risk assessment (Chemical Industry has to consider environmental fate and ecotoxicity – with the aim of protecting biodiversity.
4) Product disposal/recycling.

10.9.2 The Choice of Specific Organic Solvents for the Case Study

Following a discussion with members of the SEA Project team, a shortlist of solvents (Table 10.4) was recommended for further research regarding their biodiversity impact in the supply chain. These solvents have been selected either because they are derived from renewable biogenic sources e.g. bio-ethanol from sugar cane or non-renewable hydrocarbon sources.

Table 10.4 Selected Solvents Recommended by AZ for Further Supply Chain Research

Solvent Category	Solvent	Source
Alcohols	Methanol CH3OH Ethanol (incl. Bio-ethanol) C2H6O. This is a Volatile Organic Compound* (VOC)	Hydrocarbon Sugarcane
Ethers	2 Methyl-THF (produced from naturally derived furfural from waste vegetable matter). C4H8O. VOC.	Corn husk Sugar cane Oat hulls
Ethers	Methyltert-butylether (MTBE). C5H12O. VOC.	Hydrocarbon

All solvents listed above are*Volatile Organic Compound (VOC): substances which may exist in vapour form in the atmosphere, and which are capable of reacting in the presence of sunlight (photo chemically reactive) (National Centre for Manufacturing Sciences, 2006).

The solvent 2 Methyl – tetrahydrafuran (2Me-THF), although currently only used in relatively low sample volumes for research purposes is included in the study because it is derived from organic vegetable waste. Solvents derived from renewable sources (their initial origin/sourcing involves cultivation) will have a direct impact on biodiversity (AZ SEA Project).

Solvents in general selected for use by AZ aim to have the lowest impact whether from source (raw materials) or when released into the environment and have maximum potential for recovery and reuse, as recommended by the Solvent and Aqueous Waste (SAW) project (refer to Copello *et al*, 2006 and Copello, 2006, for more discussion in this area).

Internal AZ stakeholder interest in the SEA project is from product research and development (PR&D), Operations and the national SHE organisations, and QA. The benefits accruing from the SEA project include: ensuring future environmental compliance; reducing environmental impact resulting from AZ manufacturing process; and improving external perception of environmental performance of AZ by stakeholders. There is currently no biodiversity consideration element applied to solvent procurement, however, it is intended that such consideration would be included within the RAG Rating for organic solvents, which is Red.

10.9.3 The Case for Managing Biodiversity Issues in the Supply Chain

The existing principles of managing internal responsibility that AZ assigns to direct impact and the protection of biodiversity should be extended to the wider business operation of the supply chain in order to demonstrate due diligence and mitigate risk of indirect impacts. The priority is first to implement AZ CR principles, to include biodiversity consideration, into the management systems (Sections 10.9) of strategic or high risk suppliers. The consideration of biodiversity in the solvent supply chain should be implicit in the overall AZ 'Code of Conduct' and structural Group Policy Framework.

Biodiversity management should also form part of the CR obligation to communicate progress to stakeholders of new and emerging issues. The principles, methods and processes for including biodiversity management in the solvent supply chain should be flexible enough to extend to any type of material bought in the AZ supply network chains.

Once implemented, biodiversity consideration in the supply chain should be included in the published CR report. Any impact on biodiversity would have to be considered in the Supplier Selection Criteria and evaluated on a case-by-case basis. The level of corporate responsibility assigned to biodiversity and a particular supplier will depend on the significance of impact on biodiversity and consequent material risk to AZ. The significance of biodiversity risk determines the exposure and risk to AZ reputation and therefore the degree of material value assigned to biodiversity, and the level of influence AZ would exert on that supplier.

10.9.4 Organic Solvents, Biodiversity and Material Value

Extending the consideration of biodiversity into the supply chain using existing AZ environmental management systems (EMS) should be based on a systematic risk assessment. The focus of this stage of the study will be on suppliers of solvents and the assessment of significant biodiversity risk or opportunity to AZ.

The assessment of significance is a value judgement and therefore its evaluation is particular to AZ. Influences on significance value may include: stakeholder pressure, type of material and associated biodiversity risk, country of origin or manufacture, environmental (biodiversity) impact potential, and costs. Where risk, as stated by AZ, is equal to the intrinsic biodiversity value multiplied by the probability of loss or damage, or the hazard multiplied by the probability of exposure (Brown, 2008).

The next stage in the case study is to gather information on the solvent supply chain. This would include a:

- look at the solvent life cycle, from design and sourcing, agricultural aspects, and reuse, recycle or disposal phases. This will identify any significant areas to focus on for biodiversity consideration;
- an assessment of the material significance of the solvent to AZ to include;
    - significance to stakeholders and society;
    - importance of solvent class;
    - number of alternatives in solvent class;
    - strategic significance – type of supplier;
    - significance of possible biodiversity impact – scope, type, cumulative.

The case study assigned material CR value criteria to biodiversity in the solvent supply chain. Good biodiversity consideration of the natural environment adds to the quality and thereby the value of the final product. It is proposed that significance matrices focusing on solvents in the supply chain would be used to assign value and significance, for example:

- Business value of positive public reputation on biodiversity issues;
- Level of threat or opportunity to biodiversity – value;
- Risks and benefits to AZ;
- Impact and scope of potential impact;
- Public exposure and awareness;
- Potential impact on AZ delivery of CR/SHE strategy and code of conduct;
- Link biodiversity to quality of product;
- Overall impact on AZ.

The next stage was to study the feasibility, as part of the *Buying Our Future* project, of including biodiversity consideration in the purchasing criteria effectively making biodiversity part of the minimum CR Performance Expectations, as outlined in the AZ Purchasing Guidelines – CR Principles in Purchasing Practice.

The feasibility study also included biodiversity consideration as part of the AZ Integrated Supplier Evaluation Protocol (ISEP) Questionnaire and audit templates. This would involve the addition of a biodiversity question to the six CR expectations expected of suppliers.

10.10 THE SELECTED ORGANIC SOLVENT SUPPLY CHAIN

The 3 organic solvents selected for the study, MTBE, Methanol and 2-Methyl THF, are discussed in this section. The increasingly tight time scales for the supply chain study (Section 8.3.6) necessitated the focusing down of the wider supply chain, therefore the following supply chain diagrams of organic solvent suppliers show the strategic companies only. It was requested by the AZ sponsors of the project that the solvent 2-Methyl THF (2-MeTHF) was given particular attention in the study as the chemical was being suitability tested, and could be a potential replacement for other solvents in future manufacturing processes. The main reason for concentrating on this organic solvent is that it has a direct biodiversity implication as it is derived from vegetable cultivation.

10.10.1 The MTBE Supply Chain

MTBE (methyl tertiary-butyl ether) is a chemical compound that is manufactured by the chemical reaction of methanol and isobutylene. The main general industrial use of the solvent is as a fuel additive in motor gasoline. It is one of a group of chemicals commonly known as "oxygenates" because they raise the oxygen content of gasoline. At room temperature, MTBE is a volatile, flammable and clear liquid that dissolves rather easily in water. The solvent is also used for processes in the pharmaceutical industry. The environmental impact associated with MTBE is that it has the property to dissolve easily in water and as a result it does not "cling" to soil very well and it migrates faster and farther in the ground than other gasoline components, thus making it more likely to contaminate public water systems and private drinking water wells. Also, MTBE does not degrade (breakdown) easily and is difficult and costly to remove from ground water.

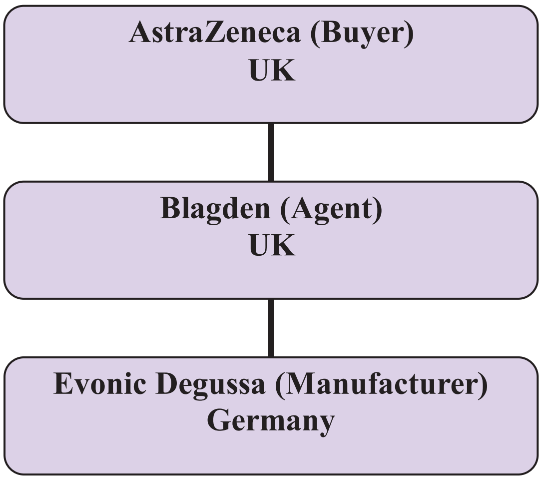
The MTBE component, as supplied to AZ, of Methanol is derived from natural gas, and the component isobutylene is made from crude oil or natural gas, thus MTBE is an unsustainable resource and, when used in motor gasoline, is a fossil fuel. Largely because of the adverse environmental impacts associated with MTBE its production in the USA has declined. This has also been the case in Western Europe but for favorable tax reasons of the alternative ethanol-derived ether ETBE rather than for environmental reasons (Malveda *et al*, 2006).

In isolation, because isobutylene is a gas at ambient temperature and pressure, the environmental impact of isobutylene is associated with atmospheric pollution. Because of the relatively short half-life of isobutylene in the atmosphere and the low environmental concentrations typically found, its contribution to potential global warming can be considered minor. The ozone depletion potential of this substance is negligible (UNEP, 2003).

MTBE is supplied to AZ via its agent Blagden Ltd (UK), who buys the solvent from the manufacturer, Oxeno Degussa GmbH, in Germany. Blagden Ltd is a technically led sales, marketing and logistics (distribution) company dealing in speciality and industry chemicals within the UK and Ireland. They distribute coatings and polymers, consumer products (food, flavours; health care), and industrial and general chemicals (acids; bromines; chlorates; solvents). Their head office is in Westerham Kent and they have a distribution centre in Speak, Liverpool. They employ 53 people with sales around £25 million. The company currently has quality management systems ISO 9001:2000.

Since 2007 Oxeno Degussa (an acronym of **De**utsche **G**old-**U**nd **S**ilber-**S**cheide-**A**nstalt – German Gold and Silver Metals Separating Works) were taken over by Evonic GmbH and is now Evonic Degussa GmbH. Based in Düsseldorf it employs some 45,000 people and is Germany's third largest chemistry company and the world's largest producer of speciality chemicals. Evonic Degussa is owned by RAG (Ruhrkohle Aktiengesellschaft) AG which is the largest German coal mining corporation. Figure 10.3 shows the strategic MTBE supply chain.

Figure 10.3 Primary or Strategic MTBE Supply Chain



10.10.2 Communications with MTBE Supply Companies

Contact was made with the UK agent supplier of MTBE, Blagden Chemical Specialities, by email, letter and telephone. The AZ supply chain organisation Questionnaire was sent by email and hard copy with an AZ covering letter to the purchasing department. Blagden replied they did not see they could fill in the questionnaire as they are only agents for the solvent MTBE. Blagden referred me to the then named German manufacturer Oxeno Degussa (Sydney, *pers comm*., 2007).

Contact was made at Degussa UK office, who referred me to, and gave contact names for, the German Degussa manufacturing facility (Northolt, *pers comm*, 2007). Degussa declined to fill in the questionnaire, again citing the reason as: Degussa does not think it has an impact on biodiversity as MTBE is derived from crude oil refining and natural gas. All of which is supplied to Degussa from German suppliers. The names of these suppliers were not given by Degussa as this information was cited as potentially useful to competitors and therefore, too sensitive. Degussa convert isobutylene to MTBE, using methanol and a C4 processing step (Scholz *et al, pers comm*, 2007).

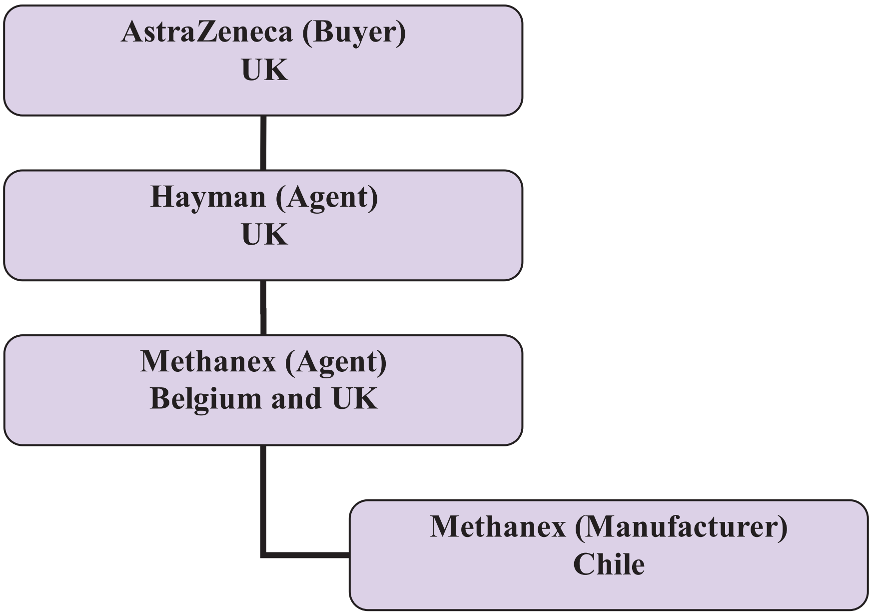
10.10.3 The Methanol Supply Chain

Methanol is a simple one carbon colourless and tasteless alcohol. Other names are Methyl-alcohol and Wood-alcohol. It is produced from natural gas but can also be derived from renewable bio-feed-stocks. Methanol is produced naturally in the anaerobic metabolism of many varieties of bacteria. Methanol is commercially produced synthetically from natural gas and steam which is reformed in a furnace to produce hydrogen and carbon monoxide, which react under pressure in the presence of a catalyst.

In the environment, the main implications are for groundwater and river (surface water) pollution. Methanol can be expected to bio-degrade at a relatively fast rate in a wide range of aerobic and anaerobic groundwater environments. In concentrations of 8k to 10k mg/l, methanol is likely to have significant inhibitory effects on microbial populations. In high concentrations above 50k mg/l it is likely that microbial degradation of methanol will not occur at any significant rate, plus these high concentrations can sterilise a soil (Smith *et al*, 2002). Work by Jamali *et al* (2002) found no long-term toxic effects from methanol release to surface water river environments. Methanol was found not to persist in water due to the rapid rate of dilution and bio-degradation.

Methanol as supplied to AZ is derived from natural gas. Figure 10.4 shows the strategic methanol supply chain. The first contact with AZ is via a UK agent, Hayman Ltd (UK). Hayman is an independent family owned company dating back to 1820. The company is a global supplier of methanol and other solvents to the flavour, fragrance, pharmaceutical, and personal care industries and research laboratories. Hayman buy methanol via a company agent (Methanex Belgium and UK) based in Belgium for the manufacturer Methanex who are based in Chile. Methanex, founded in 1992, is the world's largest supplier of methanol to markets in North America, Asia Pacific, Europe and Latin America. The company has some 800 employees the head office Chilean plant has a production capacity of 3.8 million tonnes of methanol per year. The companies extensive global supply chain and distribution network of terminals and storage facilities have a total storage capacity of some 1.4 million tonnes.

Figure 10.4 Primary or Strategic Methanol Supply Chain



10.10.4 Communications with Methanol Supply Companies

Contact was first made with Hayman Ltd (UK) by email and telephone. A Supplier Questionnaire was subsequently emailed to Hayman. Hayman did not consider it necessary to complete the questionnaire as they felt as agents and therefore only the buyer's, they did not have an impact on biodiversity (Gill, *pers comm*, 2007). Hayman suggested speaking to the manufacturer, Methanex Ltd, whose manufacturing facility is in Chile, South America. It was also suggested that contact was made with the lead auditor for AZ responsible for Hayman Ltd and based in the AZ facility in Macclesfield UK.

Both an emailed and hard copy of the Supplier Questionnaire (both in English and Spanish) were sent to Methanex. The reply from Methanex was similar to the response from Degussa with MTBE, where they did not consider they had an impact on biodiversity as methanol is derived from natural gas taken directly out of the ground at their facility in Chile, so declined to complete the Questionnaire (Vennik, *pers comm.*, 2007).

The lead auditor at AZ was contacted and a meeting arranged at the Macclesfield site (Section 10.6.7).

10.10.5 The 2-Methyl THF (Tetrahydrofuran) Supply Chain

Particular attention was directed towards the organic solvent 2-Methyl THF (2-MeTHF) over the other excipients, MTBE and Methanol, in its supply chain as it is derived from renewable vegetable feed-stocks and therefore has a likely direct biodiversity implication. This makes it a potentially better alternative to the existing THF solvent currently used by AZ, which is partly derived from hydrocarbons. The following description of the organic solvent is taken from Speciality Chemicals Magazine (Comanita, 2006).

2- MeTHF is derived from 2-furaldehyde (also known as furfural), which is produced from naturally occurring pentoses in agricultural waste like corncobs or bagasse (sugar cane), and oat hulls, in a two-step hydrogenation process via 2-methylfuran. By contrast, THF is currently made from 1,4- butanediol (BDO) by intramolecular cyclisation under acidic conditions. BDO, in turn, is a petroleum-derived product that uses acetylene as a key intermediate.

Anastas and Warner (1998) have developed the so called '12 Principles of Green Chemistry', which help to explain the critical decision criteria in designing green chemical processes. In the context of these principles, according to Comanita (2006), 2-MeTHF can make a very compelling case for a greener solvent against THF on at least three of the 12 principles, that is: renewable feed-stocks, waste prevention, and energy efficiency. In summary the main environmental related advantages of 2-MeTHF over THF as stated by Comanita (2007, p7) are:

- *'Derived from a sustainable renewable source, i.e. Corncob or sugar cane;*
- *Less CO_2 emission to atmosphere in processes as the solvent can be recovered and so no requirement for it to be incinerated on site;*
- *Reduced VOC emissions to atmosphere due to higher boiling point (low vapour loss);*

- *Greater re-cycling potential and cost/environmental efficiency as the energy used in the re-cycle process is far less (variable but typical 70%);*
- *Less solvent used in chemical processes – lower manufacturing cost potential;*
- *A wide combination of consecutive reaction can be carried out in the same solution without the accumulation of impurities from solvent degradation;*
- *Has many of the favourable properties of THF'.*

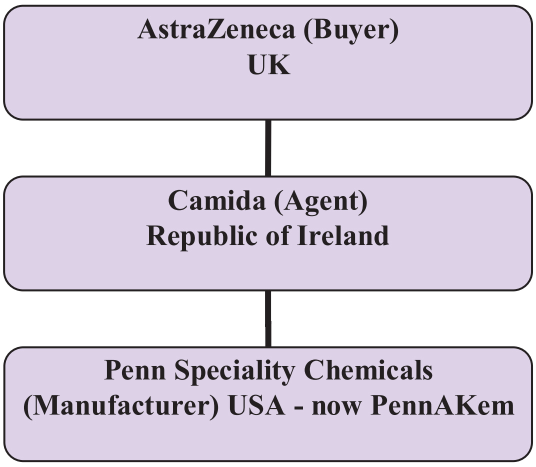
In terms of the raw material costs of 2-MeTHF, they are decoupled from the ever increasing cost of chemicals derived from oil (hydrocarbons). However, despite the solvent source being derived from sugar-cane residues or waste maize (corn) cobs, there could be fluctuating market prices of these commodities as demand for feed - stocks increases. In addition, the sector is seeing competition from fast growing world consumer needs for fossil fuel alternatives; see Defra (2006); Defra (2008); Turley *et al* (2002); EPFL (2006); and Magnus *et al* (2007) for discussions on biofuels.

The 2-MeTHF strategic (and potentially a high CR risk, see Section10.4.1) supply chain is relatively short with only 3 main (strategic) stages in the chain. It is the strategic supplier that AZ, in theory, will have the most direct influence in terms of imposing their CR principles. AZ source 2-MeTHF through Camida, a specialised chemical agency, based in the Republic of Ireland but with offices world-wide. Camida are also agents for Penn Speciality Chemicals (PSC), Memphis, Tennessee, USA, who manufacture 2-MeTHF.

Camida, established in 1988, are a specialised chemical and ingredients sourcing and supply company. Their head office is in Clonmel Ireland and they have offices in Singapore and Pittsburgh, USA. Employing some 25 people they operate a global supply network with some 200 selected suppliers across 25 countries. Penn Speciality Chemicals (PSC), established in 1999 in Memphis USA, was privately held and employs some 500 people and are the world's largest producer of 2-MeTHF. Since July 2008 PSC have been taken over by PennAKem LLC which is a wholly owned subsidiary of the French company Minakem Group. PennAKem is now the global pre-eminent supplier of furfural and furan derivatives and the world's leading producer of methyltetrahydrofuran.

At the time of the case study AZ are purchasing only sample quantities of this solvent, for research purposes. The primary or *strategic* 2-MeTHF supply chain is shown in Figure 10.5.

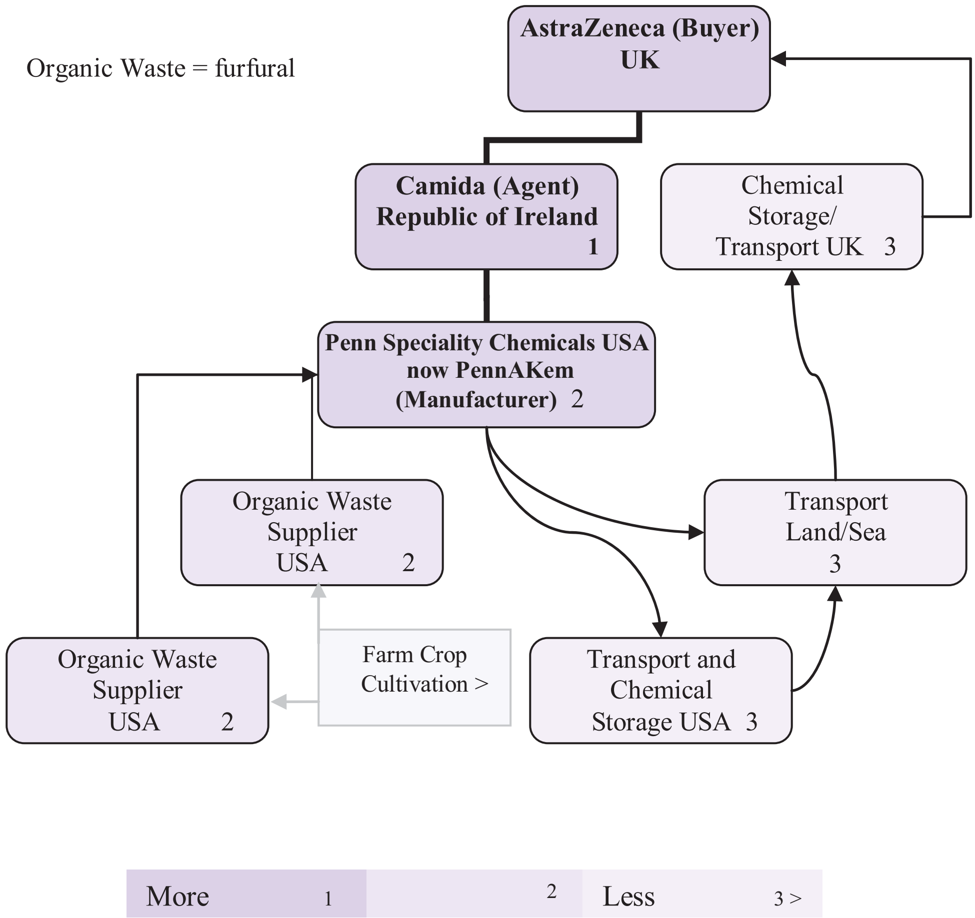
Figure 10.5 Primary or Strategic 2-MeTHF Supply Chain



This is the strategic supply chain for Me THF and if adopted as a solvent in full scale Process R&D and/or manufacturing, would be subject to AZ Category Management, Supplier Evaluation Criteria and RAG Rating processes. The 2-MeTHF supply chain would also include other secondary or collaborative suppliers according to the AZ management process but these secondary suppliers to AZ maybe regarded from the point of view of the manufacturer, in this case PSC, as strategic suppliers. AZ will have less influence on the biodiversity performance of these secondary suppliers.

Therefore it is important for the buying company to audit the manufacturer for their own in-house purchasing standards and criteria in relation to their strategic supply chain. In addition, there are third tier suppliers associated with supplying a service, for example, providing chemical storage and transport from source (manufacture) to the end user, in this case AZ. Third tier suppliers are further removed from the sphere of AZ influence. Figure 10.6 shows the 2-MeTHF supply chain with secondary and third tier suppliers and the diminishing sphere of influence.

Figure 10.6 2-MeTHF Supply Chain



AZ Sphere of Influence

Figure 10.7 gives examples of the biodiversity aspects associated with 2-Me-THF in relation to its supply chain.

Figure 10.7 Supply Chain Biodiversity and Business Aspects of 2-Me-THF

2-Me-THF Supply Chain Biodiversity and Business Aspects		
Common Material Issues	**2-Me-THF Supply Chain**	**Biodiversity Aspects - Examples**
Establish Business Risk	**Consumer**	Waste, packaging, recycle, disposal. Health.
Brand image, Reputation. Company Policy Transparency. CR Reporting. Legal and other Compliance. Risk. Differentiation. Stakeholder influence. Publicity. Marketing. Security of Supply. Quality. Social/Ethical. licence to operate Future legislation and regulatory incentives. Investment - Screening. Accountability. Logistics Cost	**Transport Logistics**	CO2 Miles, Fossil Fuels. Transport company biodiversity aspects.
	AZ Manufacture UK	Energy use, pollution – air, water, land use.
	Chemical Storage UK	Pollution event, Land use
	Transport Logistics (Sea)	CO2 Marine Miles, Fossil Fuels. Transport company biodiversity aspects. Pollution risk.
	Chemical Storage USA	Pollution event, Land use
	Solvent Manufacturer USA	Energy use, pollution – air, water, land use. company biodiversity aspects
	Organic Waste Supplier (corn husk) USA	Energy use, Waste, Land Use company biodiversity aspects
	Transport Logistics USA	CO2 Miles, Fossil Fuels – transport company biodiversity aspects
	Organic Crop Production (corn/maize) USA	Use of Agrochemicals. Mono Cropping. Loss of Biodiversity. Soil Quality. Biodiversity sensitive sites. Climate issues. Ecosystem Services.
	Supply Chain Buying Chain	

10.10.6 Communications with 2-MeTHF Suppliers

Contact was first made with the selling agent for 2-MeTHF, Camida Ltd in the Republic of Ireland. Cameda offers a wide range of chemical products to the industry. Currently Camida have sourced this organic chemical for AZ only in small sample quantities to enable testing for manufacturing applications and suitability.

The manufacturer for the solvent is Penn Speciality Chemicals (PSC) Corp who are based in Memphis USA.

The AZ procurement teams were asked to provide the product chain information along with contact details and relevant personnel dealing with the product via Camida. AZ did not have any direct contact with the manufacturer but gave details and contact names working with them in their Agents (Camida Ltd) offices in Ireland. As part of the case study a site visit was made to Camida Ltd in Ireland to interview the particular agent for the AZ contract. The strategic organisations in the 2-MeTHF supply chain were confirmed and the relevant contact names at PSC obtained.

Communications were then sought with PSC by, in the first instance, e-mail introduction to the project, and later by hard copy and AZ covering letter with the accompanying Project Supplier Consideration Questionnaire, and request to visit the manufacturing site. There was no reply however from PSC to either emails or letter. Further communications with AZ and Camida finally resulted in a response from PSC (PSC email to AZ) who replied: '*Penn has been inundated with these types of questionnaires and our regulatory department who is responsible for completing them is also very busy with other issues. Also the company is going through a change of ownership. Sorry, it has not been completed to date but this is just the reality of the situation. Penn will eventually complete it'*. Further efforts to speed things up have to date not been any more successful.

This situation clearly highlights the need for communications between key (strategic) companies in the supply chain. In this case the sphere of influence was potentially affected by level of spend (AZ only bought samples at this stage) at the time of the study. This level of spend could, however, have the potential to increase considerably should the tests at AZ on the solvent be positive. The real obstacle to obtaining information on biodiversity issues are, in all probability, the United States chemical industry institutions. They would caution against releasing any information to third parties which may reflect on an organisations reputation. The impression is they would rather not know the biodiversity situation, or would prefer to protect their material supply.

10.11 ASTRAZENECA SUPPLIER SELECTION CRITERIA

The objective of the project is to define biodiversity risk in the organic solvent supply chain and incorporate any criteria and methods for assessing biodiversity aspects into existing AZ procurement management systems. For the purpose of this report the following general suggestions are made and summarised in Table 10.5.

Table 10.5 Conceptual Framework for Biodiversity Consideration and Management in the Supply Chain.

Level of Assessment	Internal Assessment	External Assessment
Strategic	Include biodiversity into corporate policies and strategies and CSR criteria in a supply chain context.	Assess potential biodiversity impact as part of business performance, governance and accountability
Operational	Identify biodiversity risk level and opportunities as part of supplier evaluation criteria and assign Biodiversity RAG Rating to material or supplier. Include biodiversity element in supplier selection questionnaire.	Assess biodiversity aspects in terms of baseline status and review opportunities for conserving, protecting or enhancing. Evaluate returned questionnaire.

Strategic level assessment is defined as a process carried out internally to assess overall risks and opportunities associated with biodiversity impact of a material, product or service. The outcome is a policy document or CSR Report identifying key biodiversity commitments, objectives and targets with empowerment from top management. Operational assessment refers to biodiversity assessment management in terms of assigning risk levels and significance of potential impacts associated with a material in the supply chain.

Operational assessment can be biodiversity performance set against established standards, e.g. protected areas, or against commitments and targets or comparing against industry or sector biodiversity consideration. The following Table 10.6 gives a suggested minimal biodiversity element for inclusion into the AZ Supplier Evaluation Questionnaire or pre-qualifying questionnaire (PQQ). The PQQ has its problems as discussed is sections 8.3.2; 8.3.2.1 and 8.8.3.2 and any questionnaire assessment that is too demanding in terms of difficulty or length or needing data collection is unlikely to be successful. The initial questionnaire has to be short and simple, to enable suppliers (many may be SMEs) to at least begin to assess or achieve better awareness and at the same time become conscious of the urgency and need to take account of the biodiversity material asset. The intention of this questionnaire is to initiate dialogue around the subject area for partnership working. If the suppliers level of understanding on biodiversity issues is not known the questionnaire could have, if considered necessary by a focal company, accompanying documentation explaining the rational behind each question and some general information of the subject area with respect to business. At this point there is no intention to deselect or not select a supplier on the basis of the answers to this questionnaire.

Table 10.6 Suggested Biodiversity Consideration Questionnaire (PQQ)

Supplier Biodiversity Aspects Questionnaire.		**Date**			
Biodiversity Management Information :		**Comment Yes**		**Comment No**	
1	Has your company an environmental policy and/or a CSR policy that includes a biodiversity element?				
2	Does the policy include biodiversity aspects of your suppliers?				
3	Does your company see biodiversity/ environmental consideration as a cost or potential benefit or business opportunity?				
4	Do you have examples of environmental/biodiversity initiatives already in place within the supply chain?				
5	Do you review and maintain biodiversity legislative compliance?				
6	Does your company see biodiversity consideration in its supply chain as important to brand or company image?				

The questions have been selected to give an overall impression to the buyer of the level of biodiversity consideration demonstrated by the supply company. The questions also include the suppliers own supply chain in order to ascertain how far biodiversity is considered in the wider supply web. Each question has a direct mention of biodiversity as the intention is to provoke comment and activity where a supplier would actively try and find out if their company could answer yes to any of the questions. This may mean contacting the buyer and asking for more information and thereby establishing communications and discussion on the subject. The rationale behind each question is now explained:

Question 1. This will ascertain if the supplier has a top management commitment and gives an idea of the organisational culture of the company with respect to biodiversity (see discussion Section 4.11). The information will help ascertain if the supplier's environmental policy principles are similar to AZs. The CSR policy will give an idea of the suppliers corporate responsibility thinking, see section 6.1.

Question 2. Provides information on the suppliers beyond compliance attitude to biodiversity; see section 4.3, and taking into account a wider range of stakeholder influences.

Question 3. Provides information about how a supplier views biodiversity issues in relation to risks to business or potential opportunities if biodiversity is not a consideration. See sections 4.3 and 4.7

Question 4. Gives evidence of the extent of biodiversity consideration.

Question 5. Show if the supplier understands the minimum legislative compliances, as discussed in sections 3.6.1 and 3.6.2, with respect to biodiversity as applied to their product or sector.

Question 6. Allows an insight into the suppliers understanding of the links to a product line and how biodiversity issues could affect the value of a product. See sections 6.3, 6.4.2 and 6.4.3

With the information from the biodiversity questionnaire both the focal and supplier companies have a basis where they can work to start including biodiversity aspects. This can be achieved by communicating on the subject, education, training and introducing the biodiversity impact assessment of suppliers methodology discussed in chapter 13. AZ approved the questionnaire in principle but initially they will only include one of the questions into their supplier selection criteria. Question number 1 has been selected by AZ. The aim here is to gradually introduce biodiversity as a selection criterion.

10.11.1 Auditing

An interview with the lead auditor for AZ held at the Macclesfield manufacturing facility gave an insight into current auditing practice and provided the supply chain information for the design of the questionnaire in Figure 10.9. During the interview the likely impacts of organic solvents were discussed along with the auditing process involved with assuring compliance with chemical health and safety regulations.

Essentially, the auditing criteria has determined, that for the purposes of auditing the biodiversity impacts of organic solvents and in particular 2-Me-THF, the impacts are normally likely to be medium, but the solvent could also have the potential to be high if released accidentally in high concentrations into certain biologically sensitive environments. However, the real answer is that we don't know and precautionary principles should apply, as advocated by Webster, 2007. If biodiversity aspects are going to be included in AZ supplier selection criteria then they should also be included in the AZ auditing process. Discussions with the AZ Auditing Team for organic solvents suggest this would not be a problem given that the in-house expertise was there or external specialist consultants were used (Webster, 2007).

10.12 Discussion

The pharmaceutical industry has the potential to attract significant adverse publicity if, as a direct result of their buying conduct, companies in this sector significantly contribute to the loss of biodiversity and ecosystem service provision. There are in place stringent regulations on the manufacture, storage, transportation, and disposal of medicines and their constituent ingredients along with procedures and research if they enter the natural environment in any significant quantities. Therefore, the industry is subject to stringent safety standards and monitoring of its operations. Some examples are, the Control of Major Accident Hazards Regulations 1999 (COMAH); chemicals (Hazard Information and Packaging for Supply) Regulations 2002 (CHIP); Control of Substances Hazardous to Health Regulations 2002 (COSHH); and The Carriage of Dangerous Goods by Road Regulations 2004 (CDGR).

Currently AZ does not have a method for considering biodiversity impact in its supply chain beyond the criteria of these safety standards. It is the potential direct, indirect and cumulative harm to biodiversity by their suppliers that may pose a significant risk to the individual AZ brands and the overall organization's reputation. The case study has highlighted an area of 'unknown' risk largely due to the reluctance of strategic organic solvent suppliers to divulge information or enter into a dialogue in the spirit of continual improvement.

Other organisations within different industrial sectors have experienced a similar unenthusiastic response to new supply chain initiatives for the environment (beyond compliance). The Body Shop, for example, experienced difficulties with their volume of business being too low for chemical suppliers to attempt to influence their own suppliers – emphasizing a financial restraint (Body Shop, 2009). According to Preuss (2005), in the Body Shop case, another control was that the environment carries political overtones and, outside from the direct business with the Body Shop, there is little incentive for chemical suppliers to consider the environment.

In addition, any adverse publicity to one pharmaceutical company will inevitably introduce market risk to the whole industry. With significant risk comes an equal potential benefit in helping to halt the decline in biodiversity by increasing awareness within the industry and improving material supply choice. A high level of biodiversity consideration in the short-term will contribute to future proofing any longer-term risk by demonstrating due diligence and showing an appreciation of the importance of sustaining ecosystems.

Although AZ recognizes the importance and value of biodiversity on its landholdings, it does not include the wider influence of its operations in the supply chain. The case study has shown that the mechanisms within AZ management are already in place for introducing biodiversity consideration in a structured way. AZ emphasized the requirement for a system that is easily integrated with existing management processes. The methodology described in section 13.2 and the management tool in chapter 14 was demonstrated at AZ Brixham and the management team there agreed that it was potentially very useful. The use of category management processes by AZ (Section 10.5.1) presents a potential opportunity to include a biodiversity category based on the level of risk/impact attached to a product. This could be included in the 'Trends and Future Opportunities for Change or Improvements' area of the process. Section 13.2.3 employs this process as part of supply chain management in the final methodology.

CHAPTER 11

CASE STUDY - BAA (Heathrow)

Heathrow Airport is situated some 15 miles from central London and is regarded as a major transport player in the aviation world. Flights from Heathrow go to over 180 destinations in over 90 countries and some 90 airlines have made Heathrow their base. The airport is owned by BAA, who also currently own Gatwick, Stansted, Southampton, Glasgow, Edinburgh and Aberdeen airports. The case study observes the supply chain processes of the airport authority that operates the Heathrow facility, and does not consider the aviation industry or comment on the environmental implications involved in the use of air transport. Of the 3 participating companies the BAA brand represents the processing of passengers and the facilitating operations for air transport and as such covers an environmental/biodiversity sensitive sector with a high public profile. The study will add another dimension to the information required for the final objectives and introduce an area of stakeholder influence on organizational procedures.

11.1 Introduction

Air transport is a sensitive public area and attracts attention from a wide selection of stakeholders. The facility at Heathrow draws particular attention being within the urban environs of London and with publicized future expansion plans for new terminals and runways. The case study was centered at the BAA Head Offices based at Heathrow Airport. The initial contact and project 'champion' was the Sustainability Projects Manager for the group. BAA Heathrow has in-place a comprehensive biodiversity action plan that covers its landholdings at the airport. Their sustainability and environmental responsibility reports advertise their work in this sensitive public relations area. Regarding their wider supplier operations, the direct consideration of biodiversity was not included in their selection criteria or required as an issue in supplier management programs.

11.2 Industry Overview on Environmental Issues

The management of biodiversity at airports is about achieving a balance between optimizing the opportunities for a diverse range of habits and species, whilst minimizing the risk to aircraft. UK Aviation has embraced the need to act responsibly towards the environment by publishing in June 2005, the Sustainable Aviation Strategy, which detailed specific commitments designed to help aviation address its environmental impacts. The strategy is supported by all leading UK airports (including BAA), airlines and aerospace manufacturers, along with National Air Traffic Services (NATS) and the UK Aviation Trade Associations. It has 34 commitments across a variety of environmental, social and economic areas (AOA, 2006). Commitment 25 covers new developments requiring land, and states; avoiding the loss of natural and man-made heritage wherever possible and biodiversity loss should be minimised wherever possible.

The Strategy also states; Sustainable Aviation signatories recognise that, in addition to emissions and noise, aviation has other more general impacts on the UK environment, specifically the consumption of natural resources, land use, and impacts on biodiversity. The industry later published the Airports Environmental Guidance Manual in 2006 (AOA, 2006). The manual provides general environmental guidance for airport authorities.

11.3 BAA (Heathrow) Biodiversity Consideration

The main localized biodiversity related issues surrounding an airport facility are noise and air pollution. Airport construction can also cause loss of habitat for local plant and animal species. These areas of impact also go beyond the immediate environs of the airport and extend to local habitats within the environmental shadow of the facility. In order to help mitigate these impacts BAA work with local communities and organisations to conserve biodiversity on sites near the airport.

The BAA approach is to make the most use of existing land for airport developments and where possible not to build on green spaces. Where there is no viable alternative, BAA work with those affected to mitigate and/or compensate for biodiversity impacts.

The objective is to try to conserve biodiversity on-airport and on-site, with aircraft safety a priority. BAA at Heathrow have developed their biodiversity action plan (BAP) and have achieved the Wildlife Trusts Biodiversity Benchmark Standard (see Section 2.5).

11.4 BAA Environmental Responsibility in the Supply Chain

BAA (Heathrow) consider their supply chain to be part of the overall responsibility of the company in terms of environmental issues. Biodiversity is currently not a direct criterion for supplier selection. As a key player in the aviation industry they recognize the important role they have in supporting the wider economic picture in the UK. The organisation and how they consider their responsibilities is influenced by a wide range of stakeholders including:

- Customers: These are passengers, airlines, retailers and other tenants;
- Employees: The 13,000 staff who work for BAA, World Duty Free, Heathrow Express and other companies;
- Government: Who play an important role in shaping the business through legislation and policy setting;
- Local communities: Those people affected by airport operations but who may also be employed at BAA airports;
- Non-governmental organisations (NGOs): Community groups and national organisations often taking a particular interest in environmental issues;
- Regulators: BAA is regulated by the Civil Aviation Authority (CAA) and the Competition Commission.

BAA spends in excess of £1.5 billion per year with external suppliers. They have extensive dedicated buying teams that procure goods and services including:

- Construction and engineering
- Utilities and fuel
- Consultancy services (training and design services)
- Baggage handling systems
- Facilities support (catering and cleaning)
- Office supplies and services
- IT and telecommunications
- Marketing and communication services
- Travel and transport.

11.5 Case Study Overview

The case study was undertaken from the BAA Head Offices at Heathrow Airport, London. The champion and coordinator for the project was the Sustainability Projects Manager. At the outset of the project a meeting was arranged with the Sustainability Projects Manager. At this meeting it was agreed that the second year of the project would be the best time to start the case study (Section 8.7.1). Chapter 8 explains the difficulties encountered with BAA as a result of the changes to ownership and management restructure at the company.

As a direct result of the company changing ownership the project champion, that is, the Sustainability Projects Manager, was moved to another area of the companies operations. Further communications with BAA management became difficult and eventually stopped. The result was that only the information which had been obtained within the first year of the study would be available to inform the project objectives. In addition, information on the extent of any related environmental considerations, relating to the supply chain, was no longer available to the case study, after the first year of the project.

However, the case study was considered useful in that the unfolding situation highlighted the importance of a champion in driving such initiatives forward within a changing corporate environment. Section 8.7.5.1 discusses the role of a champion and the difficulties in maintaining continuity and momentum of a project see section 8.7. The effective severing of information flow at BAA and the similar experiences at the other 2 case study companies suggested that these occurrences are not uncommon. In addition, the effects of losing a champion are made more apparent if it happens before a management structure or process is implemented and running or, with a situation where no such system is envisaged. If a management process had been in place then the system would have carried on working through personnel changes. As Waller (2006) found, see section 5.8, the Environmental Management System itself is just a tool and any practical operations they are applied to should be regarded as a separate task.

11.6 Discussion

Although the case study at BAA was effectively terminated after the first year of the project, the initial meetings and interviews with the sustainability manager did provide some insight into company intentions in this area. BAA already implement sector leading biodiversity management plans on their airport landholding at Heathrow. The extent of that commitment to good biodiversity management gives some indication of the company's acceptance of its responsibilities towards biodiversity, due to its operations within the airport and environs.

The initial willingness to explore methods for extending those responsibilities towards the supply chain indicates the awareness, within the company, of the potential risks and gains associated with its supply companies. The information that the case study gave with respect to champions of a project suggests that the final methodology should be able to run as an independent tool with its application guided by cross-departmental management. The loss of the project champion mirrors the situation at CP and AZ and therefore serves to strengthen the conclusions from these studies. The final model will be designed to operate independently of a single champion and encourage a group of champions from different departments and through a programme of education and training make sure of the continuity of the process.

The use of a bespoke method for assessing and managing biodiversity risks and opportunities in the supply chain and without an accredited system framework is discussed in chapter 13. Chapter 12 investigates the use of an accredited EMS for including biodiversity as its environmental aspects.

CHAPTER 12

INCORPORATING BIODIVERSITY ASPECTS INTO SUPPLY CHAIN COMPANY ACCREDITED ENVIRONMENTAL MANAGEMENT SYSTEMS

This chapter considers the accredited environmental management system ISO 14001, described in Chapter 5, as a framework for managing the biodiversity aspects of a company's supply chain. The chapter covers Stage 3, Section (vii) of the objectives set out in Chapter 1, Section 1.3.

12.1 INTRODUCTION

An accredited environmental management system (EMS), such as ISO 14001, provides a standard recommended process and framework for applying and implementing a company's environmental principles and responsibilities. In addition, the adopted EMS applies equally in an organisation's dual role both as a buyer and supplier while providing a level business/management playing field for cross sectorial industries to work with (Section 5.6).

The survey in Chapter 7 found that within supply chains and networks the predominant situation is that individual organisations apply their EMSs exclusively within their own company operations. This conclusion was supported by the findings in section 6.6.2, with the suggestion that where companies do manage biodiversity their EMSs are generally geared to consider their own landholdings or land directly affected by their operations (Section 2.4). The survey results indicated that the accredited EMS framework is not always linked to other stakeholder (Section 7.5.1) companies within a product chain. The implication, taken from the survey in Chapter 7, is that the resulting situation is a chain of companies commercially managing the supply and manufacturing of a common product, and where they have an accredited EMS they operate them independently and unconnectedly. This creates the potential for individual companies to expend precious resources on duplication of EMS objectives and targets which may be common throughout organisations within a whole product supply chain. The overlap concerns *inter alia,* company in-house expertise, budgets, information, business level playing field and, where outside consultation is needed - negotiation and buying power.

The success of the mechanism needed to link different company biodiversity aspects together lies essentially with the level of top management determination, communication, partnership working, and the influence that both buyers and suppliers have with each other (for example, see Section 8.6.5). This type of business relationship variable often comes into play when a focal company intends to extend their own ethical environmental standards to supply companies (Section 8.3.9). The extent to which this is achieved can depend on a buyer's influence, which is not always guaranteed to extend beyond strategic suppliers and onto organisations further down a more economically distant supply network (Sections 8.8.4; 8.8.5; 9.2 and 10.8).

With lack of influence it is likely that there is also poor communication and consequently insufficient information exchange along the supply chain (this is a factor when considering significance of risk, see Section 4.4.2) with respect to environmental issues, as was found during the case study described in section 10.6.5. The potential lack of information exchange on environmental aspects associated with a product may contribute to the latent or potential material risks (Section 6.6 and 10.4.2) to the supply network and hence back to the focal company. If the above scenario exists it is contrary to the 'added value' ethos of traditional supply chain management, outlined by Lambert *et al* (1998), and cited in section 5.1.

One approach to assuring environmental credentials through information exchange, throughout the whole supply chain, is by requiring or demanding, in command and control management, that suppliers have in place an accredited EMS (Section 5.1). Where the strategic supplier has their own EMS in place (or aim to do so), it can provide the focal company with independently audited assurance and the opportunity to combine their biodiversity criteria with the suppliers own management system. This opportunity and process can then be cascaded further down the supply chain, with strategic suppliers demanding the same of their main suppliers. Voluntary environmental management systems such as ISO 14001 are not currently used universally across industry, as the example from Peglau (2006, *pers comm.*) suggests, (see Sections 6.6.2 and 7.5.2) and its uptake differs widely from country to country (refer to Appendix 2 for more details). The survey of chapter 7 found that focal companies, particularly the smaller enterprises, often use their own in-house systems, which are normally well established and proven over a number of years. The CSR survey described in section 7.5.2 found that it is likely that any use of accredited systems processes initially run alongside in-house systems with the accredited system used only as a guide. The case study companies in chapters 9; 10; and 11, all had ISO 14001 EMS in place and operational. As these organisations were relatively large their use of accredited systems would add support to the findings of Marshal (2007), discussed in section 6.4.3 and the CSR survey in section 7.3, where larger companies tend to use accredited systems.

12.2 CASE STUDY COMPANY USE OF ACCREDITED EMSs

The participating case study companies all have the accredited ISO 14001 EMS in place and require the same system of their strategic suppliers. Table 12.1 summarises the EMS status of participating companies and what is demanded of their strategic suppliers. These findings can be compared to the Non-Participating company's findings summarised in Table 8.5 to illustrate the differing use of EMS across industry.

Table 12.1 Summary of Participating Company use of EMS

Company	Drivers for Biodiversity Consideration		Restraints for Biodiversity Consideration
	Focal Company	Supplier	
Center Parcs	Customer and sector image. CR and transparency for publicity. Security of supply. ISO 14001 in place. Risk adverse approach.	To retain and win contracts. Requirement for strategic suppliers to have accredited EMS	Acceptance difficult beyond strategic suppliers
AstraZeneca	Industry requirement. Safety high priority. CR image. Compliance. ISO 14001 in place. Risk adverse approach.	Compliance. Requirement for strategic suppliers to have an accredited EMS	No perceived incentive to consider – will biodiversity make a meaningful difference to company image?
BAA (Heathrow)	CR image. Compliance. ISO 14001 in place. Sensitive public image. Future expansion of runways.	To win contracts. Requirement for strategic suppliers to have an accredited EMS	Not a priority for non-strategic suppliers

Table 12.1 shows these larger companies using the accredited ISO 14001 system and demanding the same from their strategic suppliers. The final methodology and management tool would have to be flexible enough to be able to operate both within the framework of an accredited EMS and an in-house designed system. Examples of the choices available with respect to which EMS to adopt are described in section 12.3.

12.3 SUMMARY OF FOCAL COMPANY-SUPPLIER ENVIRONMENTAL MANAGEMENT OPTIONS

Examples of the options or choices available to the buying (focal) company when considering environmental management of their supply chains are shown in Figure 12.1. Choice number1 is the focus of this chapter.

Figure 12.1 Focal Company Supply Chain Environmental Management Choices

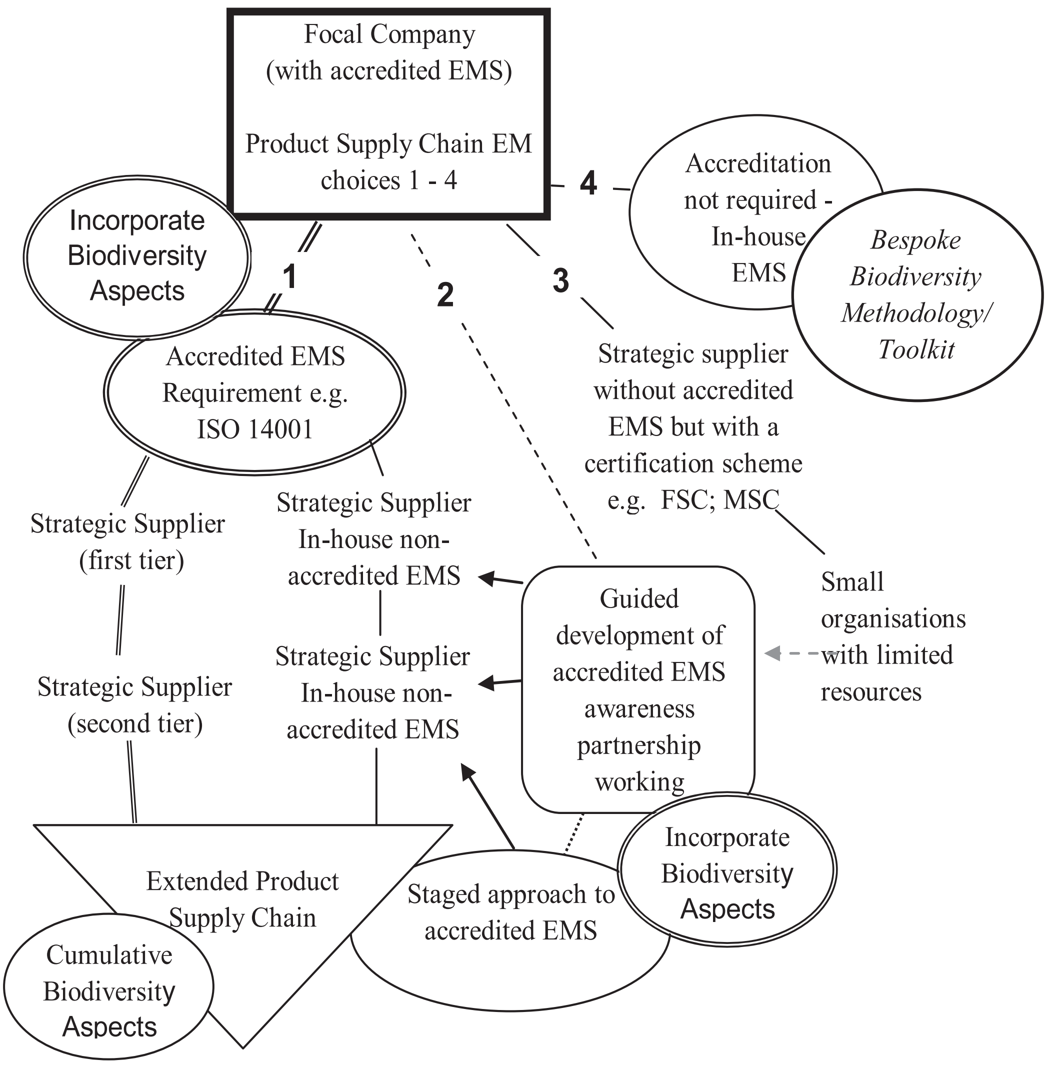


Figure 12.1 shows 4 choices in approaching biodiversity supply chain management for an individual product. Choice 4 is for the focal company to use the final biodiversity management model, which can asses the biodiversity/business risks and opportunities in the supply chain without using a formal EMS framework. This choice is discussed further in chapters 13 and 14.

Choice 3 may be appropriate with a situation where a supplier satisfies the focal company criteria for biodiversity aspects concerning a product by achieving certification stamps such as FSC or MSC (Section 2.5), it may not be necessary in this case to demand that the supplier has an accredited EMS in place. An accreditation such as FSC or MSC provides the information the focal company needs in terms of traceability of the product and any sustainability aspects attached to procurement.

The other 2 choices are where the buying company requires/demands an accredited EMS, such as ISO 14001 (Chapter 5), of their suppliers as part of their supplier selection criteria. Choice 1 is where it is a requirement that a focal company's strategic suppliers have an accredited EMS and consecutively demand an accredited EMS of their own strategic suppliers. If biodiversity is deemed to be a significant aspect this command and control option of choice 1 requires that biodiversity aspects are incorporated into the accredited system.

In some cases the strategic supplier may operate its own in-house EMS or it may be the case that further down the supply chain for example, third tier and beyond, it may be unreasonable to immediately demand an accredited EMS if the company is small and does not have the requisite resources (Section 4.5.1). In this case the focal company could adopt choice 2 and suggest/require a staged approach to ISO 14001, such as Acorn or BS 8555 (Section 5.1) with agreed time frames and objectives for implementation. The focal company may also be in the position to be able to offer a guided programme of assistance towards the development of an accredited system incorporating biodiversity aspects, as shown in Figure 12.1. By incorporating biodiversity aspects into each supply company EMS an assessment of the cumulative impact of the chain can be made.

12.3.1 Implementation Challenges

The implementation of new initiatives into established environmental management systems can come up against a number of obstacles. These may include reluctance for new initiatives and extra work, objectivist organisational culture (as discussed in Section 8.9) and introduction of what is perceived to be the marginal issue of biodiversity. Any new process would therefore have to be presented to various internal stakeholders in a convincing manner in order to achieve essential inter-department 'buy-in', see the discussions in section 10.4.2 on the AstraZeneca experience. Buy-in could be achieved by inviting departments, which may be as disparate as engineering, buying, environmental and auditing, to comment on the content of the methodology and suggest ways of introducing it into current processes.

A project champion is also essential, as was found during the case studies and wider research, to drive forward any suggestions. By giving all relevant departments a chance to work alongside the methodology they are likely to assume ownership and make the process succeed. Internal stakeholders would expand their appreciation of business related biodiversity issues and practical use of the methodology through education and training (Section 6.5.3) and a culture of continuous improvement.

The education and training programme could then be extended to the supply chain and form part of the partnership working ethos as discussed in section 2.5.2.

12.4 INCLUSION OF THE FOCAL COMPANY SUPPLY CHAIN BIODIVERSITY ASPECTS INTO ISO 14001 EMS

If an organisation decides through information provided in its register of aspects that biodiversity issues present a potential business risk or a missed opportunity with respect to the supply chain, the first step will be to incorporate such issues in the ISO 14001 cycle of continual improvement section 5.3 at the planning stage (Clause 4.3.1 of ISO 14001) of the EMS process.

The requirements of the ISO 14001 EMS process could now be modified to include biodiversity in the supply chain as a detailed aspect within the overall environmental commitment of the company. For example, it may be included (but not necessarily) as part of the Environmental Policy (Adapted Clause 4.2 of the ISO 14001:2004 requirements):

- *'Introduce a commitment to extend company environmental principles to the strategic organisations with mutual business interests within the supply chain. As part of the environmental principles and policy of the company the consideration of appropriate biodiversity aspects should be included in the initial environmental review (IER), with respect to supply chain operations'.*

The IER will produce a register of environmental aspects and impacts that are associated with company supply chain operations. Any specific biodiversity issues with respect to the supply chain, which the company regards as being of sufficient importance, are drawn up as likely biodiversity aspects (Section 5.5). The Planning Clause 4.3.1 of the ISO 14001 requirements, which currently do not refer to biodiversity, is now modified to include biodiversity aspects, which is added in non-italics:

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- *'Include within the environmental aspects process of the planning stage the level of significance that will be assigned to any* biodiversity aspects *identified with respect to the supply chain operations. The initial environmental review (IER) will identify significant impacts in terms of the product, sector, and other issues throughout the supply chain operations'* (Section 4.4, and Section 5.5*)*.
    - Aspects – Activities, products and processes that can or do interact with the environment
    - Impacts – Changes to the environment caused by environmental aspects.

Often the level of significance is added alongside the impacts listed in the register of aspects and impacts so that their relative importance in terms of risk to the company as described in section 4.4.2 can be seen at a glance and thus promoting good supplier visibility see section 4.4.1. Included as part of the significant biodiversity aspects registered at the strategic planning phase is a register of environmental legislation and regulation. This register would now include any biodiversity related legislation and regulation issues. With the above information of the baseline situation in place, a programme of environmental and specific biodiversity objectives and targets for supply chain management can be drawn up. With respect to the supply chain and biodiversity, objectives can be seen as a set of broad goals where supply chain biodiversity (environmental) performance will be improved.

If, as a result of the process described above, a need for the company to consider biodiversity within the supply chain is established, and the aspects and impacts relevant to the product have been decided along with the set objectives and targets, a management programme can be designed for biodiversity. The associated risks to business can be included at this point, see section 4.3 for examples of associated business risks. With the information provided by the management programme the next stages in the ISO 14001 process (i.e. implementation and operation, checking and corrective action, and management review) can now be managed. The ISO 14001 focal company audit process can now be extended to include the biodiversity aspects identified with respect to the supply chain. In addition to the register of aspects and impacts there should now be made available to managers a more detailed information file on biodiversity. The information file would provide data for future reference and back-up of the EMS documentation, and continually support the register of aspects and impacts. The addition of this file is now discussed in section 12.4.1.

12.4.1 Biodiversity Information File on Suppliers (BIFS)

How to find information and guidance on biodiversity related issues (Section 4.6) has been a recurring question, asked by procurement professionals, throughout the case studies and wider project research. This is proving to be an obstacle to considering biodiversity impact by decision makers and other managers within organisations. This situation was highlighted by the managers in the case study interviews reported in Chapters 13; 14; and 15. for more details on the wider business community need for easy and quick access to information on environmental issues in general see the results of a survey, 'How mature is the Green Supply Chain', conducted by BearingPoint *et al* (2008). Any methodology that would illustrate the business case for biodiversity consideration in relation to company supply chains, would benefit from explanations and links to information and guidance on biodiversity issues. As part of the implementation and operation stage of the EMS cycle, a Biodiversity Information File on Suppliers (BIFS) is added and compiled containing relevant and detailed information on supply chain environmental and biodiversity aspects. For example, a guideline on environmental reporting formats; biodiversity impact types (Sections 4.4.1, and 4.4.2); industry guidelines (Section 6.5); assurance stamps and logo's e.g. the Forest Stewardship Council (FSC) or Marine Stewardship Council (MSC) (Section

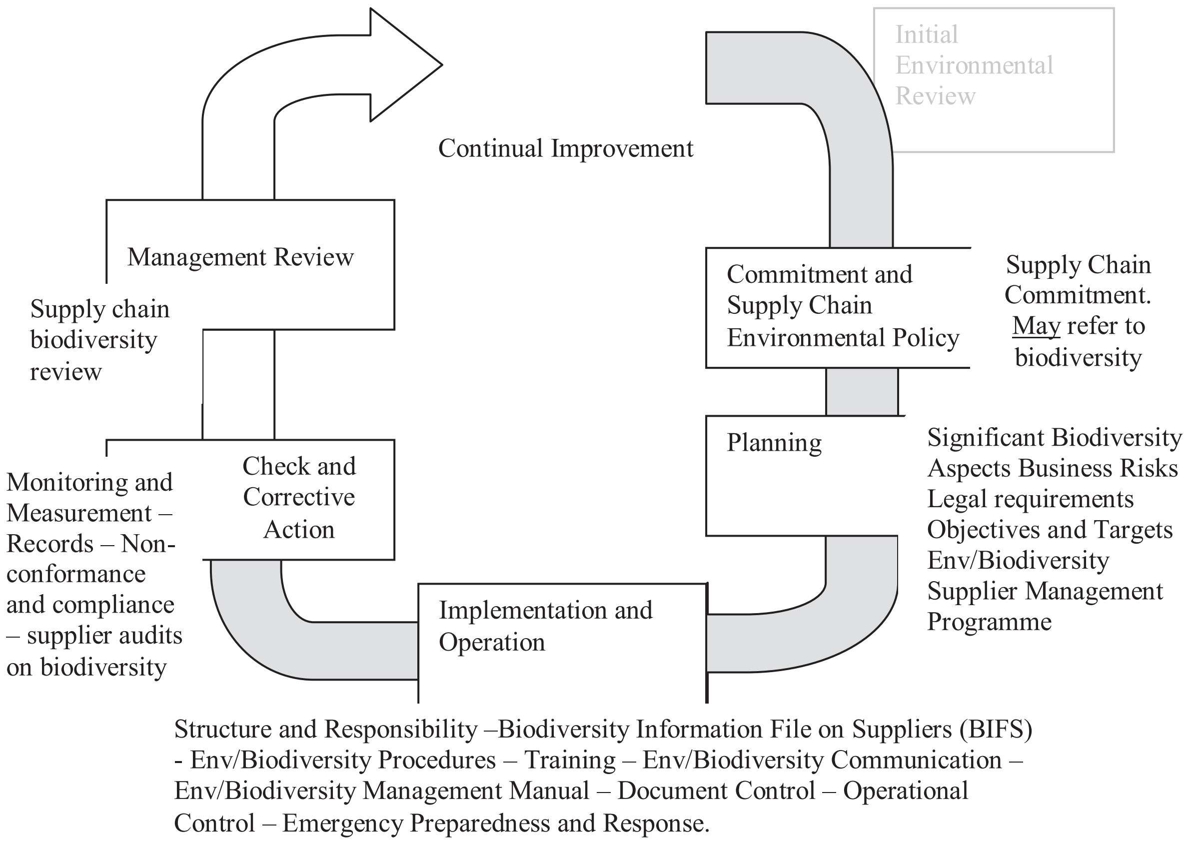
2.5); legislation and regulation (Sections 3.6, 3.6.1, and 3.6.2); and associated business risks (Section 4.9). An example of a BIFS file is given in Appendix 5 and shown in Figure 14.17.

Relevant information is researched and provided either in-house, by supplier partnership agreements, or by external sector specific agencies, institutions, or consultancies. The BIFS would follow a similar principle to the purchasing information gateway database described in section 10.5.1. The BIFS is intended to be made available throughout the supply chain in an information flow process to facilitate good communication and collaboration.

12.4.2 Application of the ISO 14001 EMS within a Supply Chain Partnership

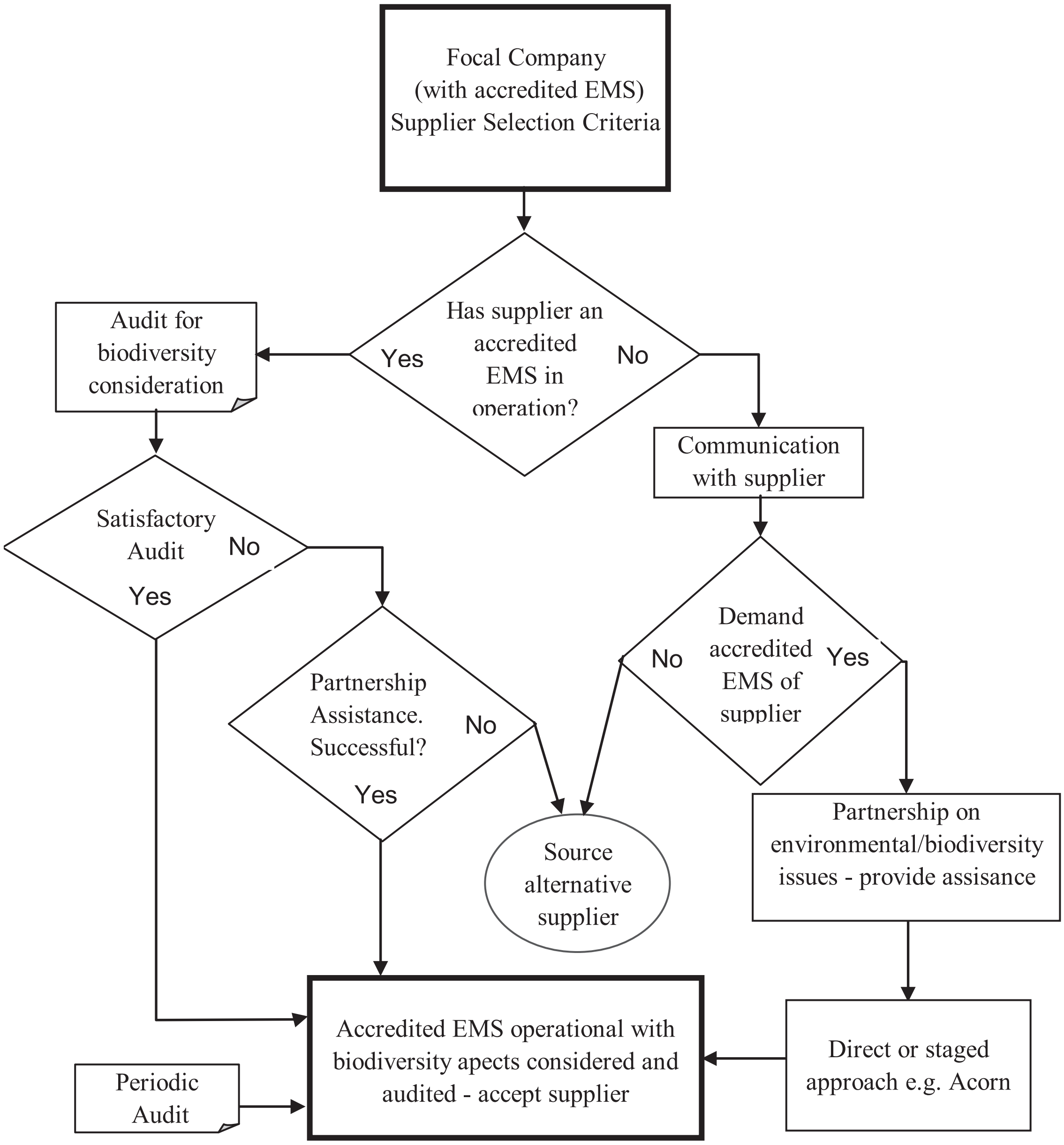
With reference to the continual improvement cycle of the ISO 14001 process figure 12.2 shows the specific biodiversity aspects now included within the ISO 14001 framework.

Figure 12.2 The ISO 14001 Cycle – Focal Company SCM



The procedure for assessing each supply company for their accredited environmental management systems and biodiversity consideration is outlined in Figure 12.5. The procedure uses a buyer/supplier partnership approach to assessing risk and opportunity within product supply chains. The bold weighting boxes in Figure 12.3 signify the application of section 12.3 and ISO 14001 EMS process from Figure 12.2.

Figure 12.3 Biodiversity Assessment of Supply Chain Companies within an Accredited EMS Framework



The focal company, as part of its own procurement principles and ISO 14001 EMS, would establish an environmental partnership relationship with its strategic suppliers.

A close partnership relationship, with good and open communication links, would enable participating organisations to draw up compatible ISO 14001 environmental systems, incorporating shared principles and responsibilities. A focal company's existing procurement management process will play a large part in determining the initial inter-company communication level, for example, the supply chain selection criteria, questionnaires, and subsequent monitoring/auditing processes.

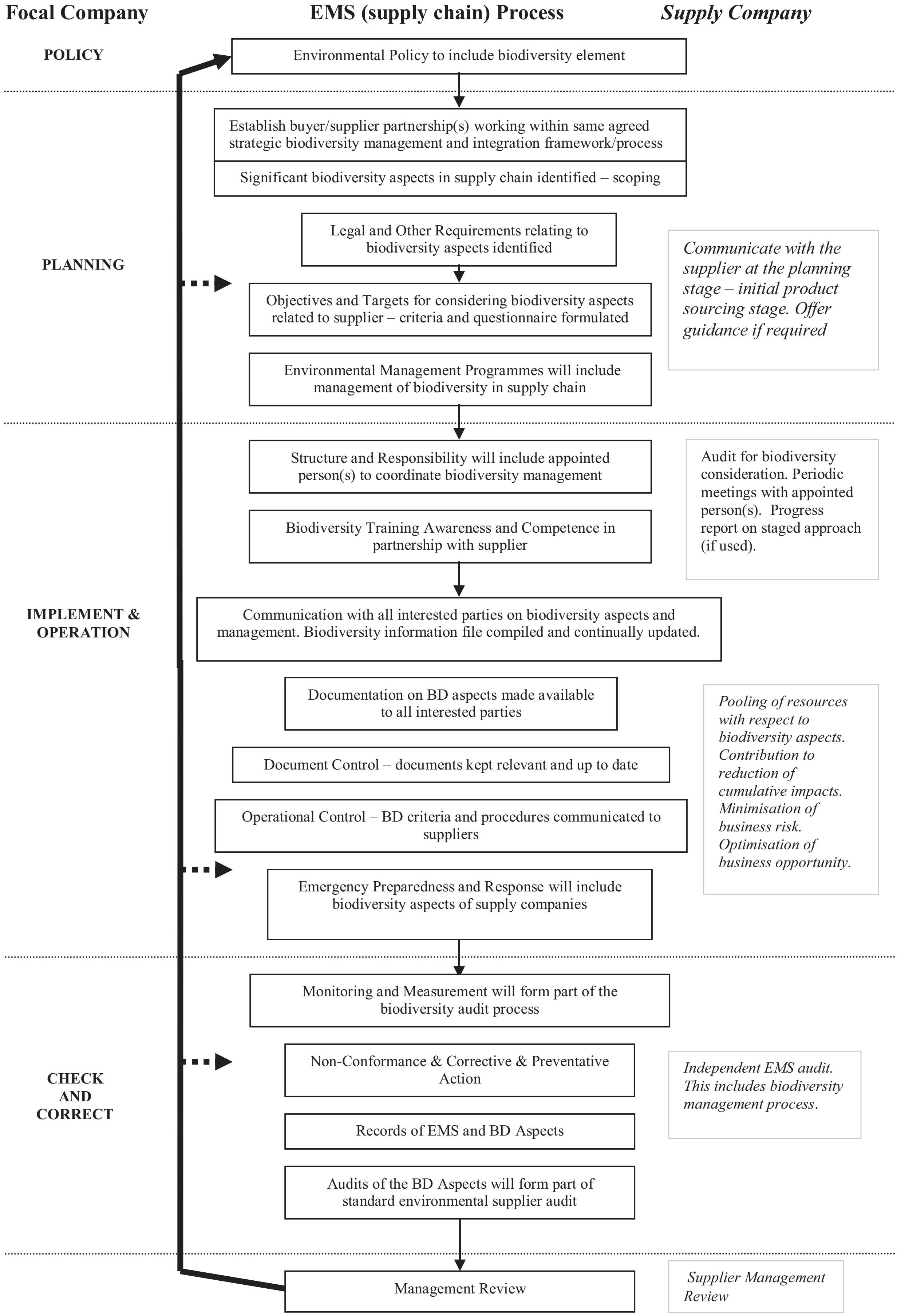
It is often the case that suppliers in whole or part of the chain are SMEs, and larger companies are not involved or do not have the management time to assist. In this scenario the use of external consultancy expert advice for managing the biodiversity aspects of the whole supply chain or network may be needed. For the management of extended supply chains where there are identified mutual benefits in considering biodiversity, a supplier partnership agreement could be arranged which included the pooling of financial resources for funding outside help.

Focal companies who may be buying the same type of product or material from a single supplier would be encouraged to make contact with each other and discuss ways of integrating their external management of biodiversity. A partnership would be formed (Section 2.8 – *Biodiversity in Good Company* Initiative [gtz]) whereby; the resources and knowledge of each buyer plus the supplier could be pooled to manage biodiversity impact efficiently. The methodology/tool described in Chapter 10 could also be introduced to designate a risk or opportunity score for each evidence level of biodiversity impact assigned to a supplier. This methodology is designed to be used within the ISO 14001 framework or as a stand alone bespoke system for companies without an accredit system.

12.4.3 The integration of Biodiversity Aspects with Strategic Suppliers using the ISO 14001 Accredited EMS Framework

The accredited ISO 14001 framework described in chapter 5, is now illustarted in Figure 12.4, to show the integration of the focal company biodiversity aspects to include a first tier supply chain company. The process of integration can be extended to the next supplier in the product chain, then onto the next and so on, to include the whole product or service supply chain.

Figure 12.4 Integrated Biodiversity (BD) Requirements in Supply Chain Management



Each supply chain company would be encouraged to co-manage overlapping biodiversity aspects at each of the framework stages (highlighted with the broken arrows), from policy to review. This cooperation would reduce any duplication in considering impacts, pool financial resources and subject knowledge on mutual biodiversity issues. Biodiversity impact significance and risk to product image can be discussed at the strategic level (planning), implemented at the operation stage and refined at the check and correct stage.

12.5 DISCUSSION

It has been proposed that a focal company has currently 4 choices available for environmental and biodiversity management of its supply chain, as illustrated in Table 12.1. The choices made may depend on the company organisational culture, as discussed in sections 6.4.1 and 8.9, or financial, in-house expertise or by other business factors such as sector or product type. Choice number 4, the bespoke methodology and management tool gives an organisation, regardless of its size, the option to consider biodiversity without having to commit to the often rigorous procedures involved in choices 1 and 2. The methodology is a stand alone system that will assess biodiversity risks and provide the information to turn risk into opportunity. If the accredited EMS route is preferred than choices 1 and 2 would be the route to take. Focal company accredited EMSs are not currently widely interlinked with suppliers, particularly with respect to biodiversity impact as was found in the survey in section 7.5.2, although the survey found that the small number of suppliers that had reported on biodiversity issues were more likely to have such a system.

Changing this situation by the formation of supplier partnerships on biodiversity aspects has the potential for cumulative benefits to business and, to making a real contribution to halting biodiversity decline. The current lack of enthusiasm of smaller suppliers in considering biodiversity could be transformed by working partnerships with suppliers. This approach would produce both more information of the potential risks and opportunities and relevance to business along with the reduction of costs by decreasing duplication and combining environmental budgets. The choice for a company to maintain their in-house designed EMS and to incorporate biodiversity aspects into a bespoke system of environmental supply chain management is now discussed in chapter 13.

CHAPTER 13

CONSTRUCTION OF METHODOLOGY

This chapter describes the final construction of the methodology as stated in Stage 3 (viii) of the objectives outlined in Section 1.3. The methodology enables organisations to assess and manage their supply chains for biodiversity related risks and opportunities without necessarily using the formal accredited environmental management system (EMS) framework, discussed in Chapters 5 and 12. The methodology follows environmental management choice 4 outlined in Figure 12.1.

13.1 Introduction

The business case for biodiversity has been explored and a structured method for achieving advantages from its consideration has been suggested through the ISO 14001 Standard framework described in section 12.3. There are other scenarios where it is not always necessary to demand an accredited EMS (Section 12.2). For example, if the supplier meets the biodiversity element of the supplier selection criteria (for examples see Sections 9.2.2; 9.2.6; and 10.4.4) determined by the results of the supplier pre-qualification questionnaire (PQQ) and subsequent verification audit process (Section 13.2).

The research undertaken during the project has steered the design of the final methodology and the BROSCaT management tool, which is presented in chapter 14. The literature review findings illustrated the link between product, sector, cross-sector, stakeholders and geographical extent of the supply chain. These factors influence the level and type of impact and risk to business and the extent of biodiversity consideration needed. The methodology would therefore be bespoke to each product and the companies making up its supply chain. The amount of management time and expense applied to the implementation and operation of the model is commensurate with the level of risk applied to each supplier in the chain, whether from material source, product manufacturing, distribution or point of sale.

The need for effective information on the subject of biodiversity has been highlighted in sections 1.3 and 1.3.2 and throughout the project. By including a facility for obtaining information on any facet of the biodiversity and related business areas of material supply chains the operation is immediately accessible to all stakeholders regardless of their level of expertise or knowledge of the subject area. The Biodiversity Information File for suppliers (BIFS) will provide access to data from the main drivers of biodiversity consideration, that is, academia, government, NGOs, IGOs, professional bodies and industry. As a result of the findings from previous chapters additional examples and links will be provided for examples of guidelines (section 4.6), legislative issues (section 4.7), compliances (section 7.3), local, national and international regulations (section 4.4), science (section 4.5), and due diligence issues (section 4.4.1).

The case studies provided a practical insight into procurement and corporate environmental organisational practice. The findings relating to the selection and management of supply chain issues from Center Parcs (UK) and AstraZeneca (UK) in particular showed the methodology and BROSCaT tool could be adapted to work alongside or be integrated into their existing management systems.

The extent of the biodiversity management input needed within a supply chain largely depends on the level of the risks, as discussed in section 4.4, and the opportunities (R/O) associated with a product or service (Sections 1.4, 4.1, 4.3, 4.4 and 4.4.1), and the scope and nature of supply activity. Both the project case-study organisations, Center Parcs (UK) and AstraZeneca (UK), cite risk to company operations as a main factor in driving their environmental responsibilities in the supply chain (Sections 9.2.2 and 10.2). By compiling information on the potential R/O to business operations, decisions with respect to priorities and levels of resource input, e.g. towards supplier management and development, can be made. A bespoke R/O methodology designed to work with non-accredited EMSs in managing biodiversity impacts, both case-by-case and cumulatively, is presented in section 13.2. In practice the R/O methodology would be tailored to industrial sector and the products and companies that define a supply chain. The method does not, as presented, detail biodiversity performance requirements but provides a framework for doing so.

13.2 METHODOLOGY FOR ASSESSING AND MANAGING RISKS AND OPPORTUNITIES WITH RESPECT TO BIODIVERSITY IMPACTS WITHIN A SUPPLY CHAIN

The methodology comprises a 4 stage biodiversity related risk and opportunity (R/O) based approach to the management process, which should be applied by the focal company when sourcing a product, material or service and selecting suppliers throughout its supply chain. The 4 stage R/O assessment and biodiversity management process is outlined in Figure 13.1. Each of the 4 stages is divided into 2 components - R/O and biodiversity management of the supply chain (bSCM). Each stage identifies potential biodiversity R/Os and this information informs the direction of bSCM needed concerning the product type.

Figure 13.1 The Four Stages of the Methodology

Assessment of Risks and Opportunities (R/O) and Biodiversity Management in the Supply Chain (bSCM)

Stage 1 (R/O)	**Stage 2 (R/O)**	**Stage 3 (R/O)**	**Stage 4 (R/O)**
Select product, service or material to be sourced. Identify associated potential biodiversity/business R/O. Design biodiversity element of pre-supplier selection questionnaire	Identify biodiversity impact category of supplier. Determine selection criteria – Analyse data from supplier selection criteria and questionnaire	Business R/O supplier assessment. Assess overall R/O in supply chain	Supply chain management action required. Minimise risks and maximise opportunities. Post-consumer life/end of product study
Stage 1 (bSCM) Document biodiversity and business R/O and level of significance – design procurement strategy. Send out questionnaire.	**Stage 2 (bSCM)** Evaluate existing suppliers for level of R/O - use biodiversity questionnaire based on Stage 1 findings. New supplier selection element based on questionnaire and follow-up audit and surveys	**Stage 3 (bSCM)** Evaluate existing suppliers for level of business R/O – Assess new suppliers for business R/O. Select new supplier(s) - establish partnership with suppliers	**Stage 4 (bSCM)** Working within the partnership establish level of management required – expert help – finance – training etc. periodic audit /surveys and monitoring. Annual review and continual improvement

The methodology is designed to be used within company SCM processes and bespoke in-house EMSs. It can however be equally used alongside a standardised plan-do-check-act process such as that used by ISO 14001, see section 13.2.10. This makes the method transferable to accredited systems if required.

13.2.1 Stage 1: Identification of Potential Product Risks and Opportunities

This is the strategic planning stage which defines the product, industrial sector(s) and market(s), from where the focal company will source the product, material or service. In this stage the sector specific biodiversity risks associated with the product (see Section 4.10.2) - for example, identifying stakeholder(s) interest can be assessed.

The industrial sector(s) a focal company operates in will largely identify the legal compliances required and the level of significance of risk or opportunity associated with the product (Section 6.7.3, and Section 4.3). Information (in varying levels of detail) on the relevant compliances and other biodiversity issues is compiled and made available, in a BIFS file as described in section 9.3.1. Examples of the format and type of information included in the BIFS file are shown in Appendix 5 and Figures 14.15, 14.16 and 14.17. With relevant information the focal company is able to make an informed assessment of the baseline situation with respect to biodiversity and the material being sourced. A biodiversity supply chain procurement policy can now be designed with realistic and pertinent objectives and targets. Figure 13.2 shows the general method for assessing the level of biodiversity consideration needed in Stage 1 of the process.

Figure 13.2 Stage 1 of the Methodology

Assessment of Risks and Opportunities (R/O) and biodiversity Management in the Supply Chain (bSCM)

1-a) Internal: R/O Select product type. Source the industrial supply chain sector(s). Supplier selection criteria scope. Biodiversity Policy formulated. BIFS file started and continually updated throughout all 4 stages.	**1-b) External: R/O** At strategic stage, working with suppliers, determine significant impacts on biodiversity in the supply chain.	**1-c) External: R/O** At strategic stage, working with suppliers, determine significant R/O to business from supply chain operations.
1-a) bSCM Send out to suppliers Biodiversity Significance of Impact Criteria (Table 13.3) and Biodiversity Policy; purchasing principles; CR Policy to existing and potential suppliers.	**1-b) bSCM** Design supplier selection questionnaire. Base questions on findings of 1-a to1-b. Send-out questionnaire to existing suppliers and to suppliers on buyer's potential selection list.	**1-c) bSCM** Update supplier selection criteria for biodiversity related business issues with the findings of 1-a to 1-c.

Stage 1 is comprised of 3 phases (1-a to 1-c, Figure 13.3) which are used for assessing the areas and scope of internal and external management requirements of the process. Stage 1-a gives an analysis of the likely, general, biodiversity aspects and impacts associated with the product. At stage 1-a the focal company policy commitment to biodiversity, purchasing principles and CR policy issues in the supply chain is formulated and circulated to suppliers for completion and return.

The BIFS file should now contain biodiversity/environmental information on all the relevant issues concerning the product supply chain. For example:

- How damaging to the environment/biodiversity is the manufacturing/cultivation process likely to be;
- Guidance;
  - CSR; financial index; sustainable procurement;
  - Legislation;
  - Product; sector; safety; environmental; ecology; biodiversity (incl. protected sites); biodiversity impact types;
- Business risk; company influence in sector.

A supplier selection criteria document can now be scoped based on the findings of Phase 1-a.

Phase 1-b of Stage 1 extends the findings of phase 1-a onto the assessment of the risks and opportunities associated with the product and external strategic supply company biodiversity aspects. This phase assesses the level of significance of risk or opportunity relating to the product and methods of production and delivery, adopted by the industrial sector. One approach to assessing biodiversity impact significance can be adopted through adapting the Institute of Ecology and Environmental Management (IEEM) and Department for the Environment, Trade and the Regions (DETR) guidelines; this approach is discussed in section 4.4.3. Information relating to the identified biodiversity impacts are researched and entered into BIFS.

Phase 1-c uses the findings of 1-a and 1-b, in making an assessment of the significance of business risk to the focal company due to its wider operations in the supply chain. Examples of the economic dimension and potential effects on business bottom lines due to biodiversity impacts in the supply chain have been presented in section 2.4 and Chapter 6. The information on potential R/O's with respect to business will directly relate to any biodiversity impact of suppliers, and require a response from relevant management on how the organisation is responding, i.e. reducing risk or exploiting opportunity regarding biodiversity will also reduce or enhance any potential implications to the business.

13.2.2 Supply Chain Management for Stage 1

With the information needed to assess the risks and opportunities to biodiversity a supplier questionnaire (or PQQ) can now be designed and sent out to existing or potential suppliers. Table 13.1 gives an example of a bespoke biodiversity PQQ with additional questions to those presented in the questionnaire example given in Appendix 4.

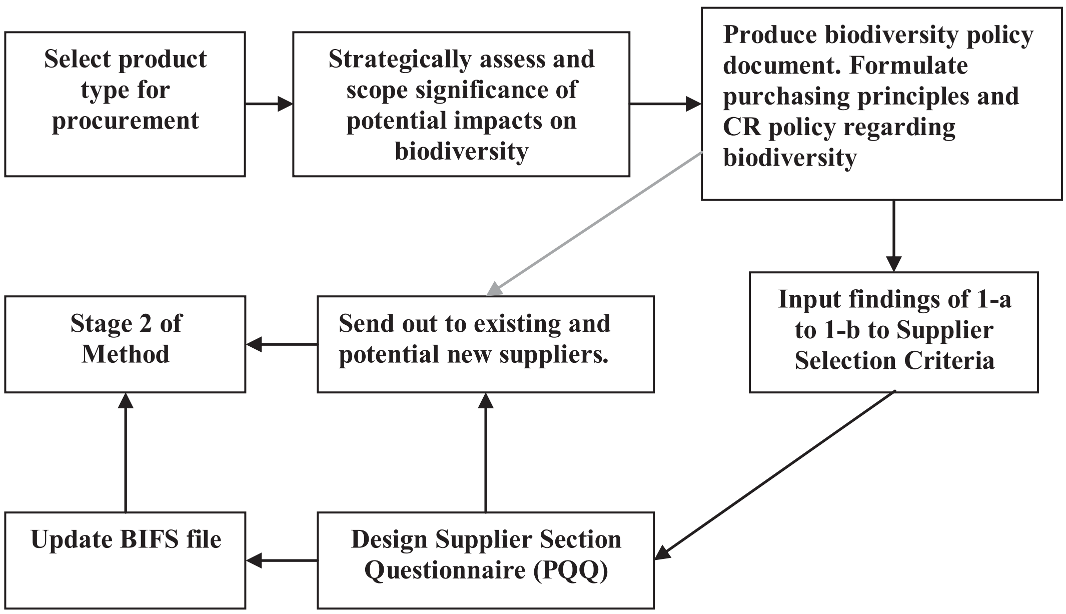
Table 13.1 Example of Bespoke Questions Added to the Supplier Questionnaire

POTENTIAL BIODIVERSITY RISK AND OPPORTUNITIES (EXAMPLES)	QUESTION	YES - COMMENTS	NO - COMMENTS
The product is subject to legislation – example: REACH or WEEE – licensing – H&S - pollution.	Does your company comply with the relevant legislaton? State which.		
The character of the product may pose a Major Adverse risk to biodiversity through a direct impact.(give details)	Have the potential risks been identified and appropriate measures taken to manage the risk? Give details of risk management plans.		
The product also has the potential for a Moderate Beneficial opportunity to enhance biodiversity and business reputation (give details).	Has the potential opportunity been recognised and what measures are in place to maximise the situation?		
Verification audit required	Is the company willing to have their biodiversity management system periodically audited?		

The biodiversity PQQ which is similar to the CP environmental questionnaire but with a biodiversity question added and section 10.6.7 - Table 10.9, requires a supply company to answer general enquiries on their level of biodiversity/business risks or opportunities. The questionnaire forms part of the supplier selection criteria of the procurement management system as discussed in stage 1-b SCM..

The object of the questionnaire is to provide information that will enable managers to undertake an initial assessment in order to categorise a supplier in terms of the potential risks to biodiversity, and to the business. The supplier selection questionnaire is now communicated to existing and potential new suppliers. A summary flow diagram of the management process is shown in Figure 13.3.

Figure 13.3   Process Diagram for Stage 1



The existing or potential new supplier is subject to a selection procedure determined by the buying company. The selection of new suppliers procedure could be similar to the standard example from the Center Parcs case study (Section 8.2.6) and shown in Table 8.2. The supplier selection criteria is determined by the level of impact significance attached to the supply company determined in Stage 2 of the method. Table 13.2 shows a management procedure check list example for each phase of the stage 1 process. The item for management action is listed with the expectations required as a result of the action. A remarks column could be added, as shown in Table 13.2, to show if the action is completed: for example, *Yes*; *Partly* or; *No*, tick box's. A check list, which is current and continually updated, gives management a summary of the risk/opportunity situation, with respect to the supply chain, and is an integral part of any management system documentation.

Table 13.2 Management Check List for Stage 1

ITEM	EXPECTATIONS	REMARKS
Internal: Product or material type selected for procurement	Identify legal and other related compliances/regulations associated with product market, sector(s).	
External: Supply chain biodiversity aspects – initial focus on strategic suppliers	Identify biodiversity impacts associated with biodiversity aspects	
Information file (BIFS)	Compile all relevant and appropriate information on biodiversity related risks or opportunities.	
External: Significance of risks or opportunities – inform supplier selection criteria document.	Determine level of significant risks or opportunities related to the product in supply chain	
Write biodiversity aspects into environmental policy and purchasing policy .	Communicate biodiversity, purchasing and CR policy to existing and potential new suppliers	
Make first assessment of the Business risks or opportunities associated with the product	Make an assessment of significant risks or opportunities to business security of supply/ reputation/ quality/ brand	
Design supplier selection (PQQ) questionnaire – specific to product being sought and to supplier operations.	Questions based on findings of 1-a to 1-c ready to send out to existing strategic and potential new suppliers.	

13.2.3 Stage 2: Supplier Selection and Assessment of Associated Biodiversity Impacts

Stage 2 of the methodology, shown in Figure 13.4, comprises 3 phases 2-a to 2-c. Stage 2 deals with the more detailed individual supply company selection and the process of identifying the likely biodiversity aspects and impacts of both existing and new suppliers operations.

Figure 13.4 Stage 2 of the Methodology

Assessment of Risks and Opportunities (R/O) and biodiversity Management in the Supply Chain (bSCM)

2-a) Internal: R/O Identify supplier biodiversity impact category e.g. low; medium; high risk	**2-b) Internal: R/O** In-depth study of supply company biodiversity impact – conduct surveys	**2-c) In/External: R/O** Estimation of cumulative impact on biodiversity from desk study and surveys
2-a) bSCM Analyse returned supplier questionnaire from existing and potential suppliers.	**2-b) bSCM** Use criteria for biodiversity impact from Table 13.3. Build supplier into category management process. Update BIFS file.	**2-c) bSCM** Use Table 13.3 for assessing cumulative impacts. Update category management process. Audit supplier for verification.

Stage 2 involves the buyer search and selection of suppliers with consideration to the biodiversity element of the organisations supplier selection criteria. A list of potential suppliers is drawn up for the product. As part of the selection process suppliers undergo a risk assessment and value judgement process. This process is governed by the nature of the supply relationship and the level of risk involved. Strategic suppliers are required to at least meet minimum biodiversity performance expectations following the AZ model in section 10.4.4. Any new standards that emerge as part of this process will be communicated to suppliers in an appropriate and timely way.

Phase 2-a - determines the biodiversity impact category which is informed by the returned supplier selection PQQ. The statements made in the returned questionnaires may then be verified with on site biodiversity aspects audits. This could be achieved by incorporating biodiversity aspects into existing company audit procedure, which the AZ case described in section 10.6.8 showed this is possible if qualified persons are involved in the process. Phase 2-b - involves a more in-depth study of the likely and significant impacts an individual supplier has on biodiversity. If necessary a desk study (making use of the BIFS file) of relevant impacts with respect to the product and follow-up biodiversity survey of the supplier will be undertaken. The impacts will be considered with respect to the components and levels of biodiversity outlined in section 3.2. For example, whether any potential impacts to any biodiversity level is direct, indirect or potentially cumulative (Section 4.4.1, and Table 4.1), and the degree of significance, described in section 4.4.2, attached to the impact, the product, and sector in which the supply company operates. As part of this process the BIFS file is continually updated.

Examples of the levels of significance attached to biodiversity impacts in the supply chain are shown in the criteria Table 13.3. The table has been adapted from the DETR (2004, p5) environmental impact assessment (EIA) criteria, set out in section 4.4.2, and Table 4.6. The quantitative Risk and Opportunity scores (Table 13.3) have been designated the acronyms BaRB (Biodiversity and Risk to Business) and BaOB (Biodiversity and Opportunity to Business), respectively.

The IEEM (2006) EIA criteria are designed for environmental (ecological) impact assessment (EcIA) use on developments where a designated site of ecological interest is found. If a supply company operates within designated boundaries then these original IEEM criteria, as shown in section 4.4.3, and Table 4.6, could be utilised in the methodology process. The adapted significance criteria examples set out in Table 13.4 would be used to assess a supply company operating outside designated ecosystem boundaries and would be tailored to particular product supply chains. See section 3.2.6 and 3.4 (Kirby, 2005), for a discussion on the term 'ecosystem'.

There is now the opportunity for individual suppliers to be built into a category management (CM) process following the example of the AZ model as described in section 10.5.1 and discussed in section 10.5.2. Essentially CM separates similar products into categories and manages them as business units and therefore they are subject to business reviews which examine, for example, trends and future opportunities for change or improvement. With respect to product biodiversity impact a category is introduced whereby suppliers are examined for risk and/or opportunity, and based on the BaRB and BaOB scores using Table 13.3. The BaRB scores are given a minus figure to convey a negative impact, as described in section 4.4.2 and given in Table 4.9. The BaOB scores are shown as positive, as described in section 4.4.2 and shown in Tables 4.8 and 4.9. At this stage the product and supplier can be categorised as Low, Medium, or High risk according to the criteria given in Table 13.5. The BIFS file is updated with any new information.

Table 13.3 Examples of Significant Impacts on Biodiversity in the Supply Chain
(Criteria adapted from IEEM, 2006)

Supply Company Effect on Biodiversity	Criteria (impact with respect to the components of ecological, organismal, genetic, and cultural levels of biodiversity)	Business Risk/ Opportunity
Major adverse - *Systematic evidence of negative biodiversity impact.* **Risk** – *Significant –* Biodiversity and Risk to Business **(BaRB) Score** = - 9	Direct impact or indirect impact leading to: non-sustainable supply of product – threat to resource security; no management system or policy objective on biodiversity; the loss of, or permanent damage to, or adverse impact on, the integrity of any part of a natural habitat or ecosystem; loss of or damage to a substantial part or key feature of a habitat or ecosystem; habitat fragmentation; potential invasive species threat; loss of, threat or stress to biodiversity e.g. noise, light, transport systems; loss of or damage to species populations; significant cumulative impact directly assigned to the product sourcing; high potential of pollution event in the product cultivation, manufacture or supply;	*Risk to reputation – brand image- security of supply.* *Recognition for reducing risk to biodiversity asset and business value*
Moderate Adverse - *Good evidence of negative biodiversity impact.* **Risk –** *High* **BaRB Score** = - 5	Temporary disturbance to a habitat, but no permanent damage; loss of or permanent damage to any part of a habitat; loss of a key feature of habitat (biodiversity) importance; a substantial reduction in the numbers of species such that there is immediate or apparent effect but the population is significantly more vulnerable; reduction in the amount of habitat available for species.	*Risk to reputation/brand- interruption to supply.* *Recognition for reducing risk to biodiversity asset and business value*
Minor Adverse – *Some evidence of negative biodiversity impact.* **Risk** – *Low/Medium* **BaRB Score** = - 3	Temporary disturbance to an ecosystem, but no permanent damage; a minor impact on species but no significant habitat loss or reduction in biodiversity; a minor impact on biodiversity due to company operations.	*Risk to reputation /brand* *Recognition for reducing risk to biodiversity asset and business value*
Negligible - *(Adverse or beneficial) – No evidence of biodiversity impact.* **Risk** – *No Risk* **BaRB Score** = 0	No effects on biodiversity, habitats or the ecosystem function; temporary disturbance or damage to a small part of a habitat; no reduction in biodiversity on company land or surrounding area.	*Positive Impact – Significant opportunity to report on situation. Value-added opportunity*
No Information Potential Risk – *High* **BaRB Score** = N	No information available – do not know	**Uncertain** *precautionary stance*

Table 13.3 (continued)

Supply Company Effect on Biodiversity	Criteria (impact with respect to the components of ecological, organismal, genetic, and cultural levels of biodiversity)	Business Opportunity
Major Beneficial – *Systematic evidence of positive biodiversity impact* **Opportunity** – *Significant* – Biodiversity and Opportunity to Business **(BaOB) Score** = 9	Major gains in new habitats (net gains of at least 10 ha) of high significance for biodiversity being those habitats, or habitats supporting viable species populations; sustainable material sourcing methods;	*Maintain and improve biodiversity asset and business image- linked to goodwill; book value.*
Moderate beneficial – *Good evidence of positive biodiversity impact* **Opportunity** – *High* **BaOB Score** = 5	Larger scale new habitats (e.g. net gains over 1 ha in area) created leading to significant measurable gains in relation to the objectives of biodiversity action plans.	*Maintain and improve biodiversity asset and business image - linked to goodwill; book value*
Minor beneficial - *Some evidence of positive biodiversity impact* **Opportunity** – *Low/Medium* **BaOB Score** = 3	A small but clear and measurable gain in general wildlife interest, e.g. small-scale new habitats of wildlife value created where none existed before or where the new habitats exceeds in area the habitats lost.	*Opportunity to improve biodiversity asset and business image.*
No Info/data Potential Opportunity – *High.* **BaOB Score** = N	No information available – do not know	**Uncertain** *precautionary stance*

Phase 2-c takes the returned findings from each supply company questionnaire and assigns an impact criteria level using Table 13.3 which are then entered into a table showing all the suppliers in a product chain in order to assess any cumulative impacts. The examples shown in Table 13.4, for a chain of 12 suppliers, give the total accumulated number of significant impact levels for the product supply chain (using the same configuration as Table 4.7), and assigns a total quantitative figure for each impact level. The minus risk score for the adverse cumulative impact is shown in brackets to convey a ‘deficit’ figure (as used in accountancy) to business managers and provide a link to bottom-line thinking (Sections 4.7 and 6.2.1).

Table 13.4 Method for Assessing the Level of Cumulative Risk/Opportunity in the Supply Chain

Effect (negative impact) Risk Score (minus figure)	**Supplier**												**Cumulative Impact Risk Score**
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	
Major adverse – systematic evidence of adverse biodiversity impact	9								9				**(18)**
Moderate adverse – good evidence of adverse biodiversity impact			5						5				**(10)**
Minor adverse – some evidence of adverse biodiversity impact	3 X 4	3				3					3	3	**(24)**
Negligible (adverse) – no evidence of biodiversity impact					0		0			0			**(3)**
No information available				N				N					**(2N)**
Total Risk Score per Supplier	**(21)**	**(3)**	**(5)**	**N**	**0**	**(3)**	**0**	**N**	**(14)**	**0**	**(3)**	**(3)**	
Effect (positive impact) Opportunity Score	**Supplier**												**Cumulative Impact Opportunity Score**
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	
Major beneficial – systematic evidence of beneficial biodiversity impact				9	9						9 X2		**36**
Moderate beneficial – good evidence of beneficial biodiversity impact		5				5							**10**
Minor beneficial – some evidence of beneficial biodiversity impact	3				3						3		**9**
Negligible (beneficial) – no evidence of biodiversity impact			0				0		0	0		0	**5**
No information available				N				N					**2N**
Total Opportunity Score per supplier	**3**	**5**	**0**	**9+N**	**12**	**5**	**0**	**2N**	**0**	**0**	**21**	**0**	

Each supply company (including their own supply chain) should be assessed using the same significance criteria in order to manage the risk or opportunity on an equal basis, as discussed in sections 4.4.1; 4.4.2. There may be a scenario where an individual supply company has more than one impact within the same risk or opportunity category. In this case the risk/opportunity score is added as shown in the example of supplier numbers 1 and 11 in Table 13.4.

The managerial objective of Table 13.4 is to reduce, across the 12 suppliers, the cumulative impact score of *adverse* impacts to zero (to remove the brackets), and to increase the cumulative *beneficial* impacts score. In addition, an assessment is made, in the vertical column, of the total risk (adverse impact) from each individual supplier, again with the aim of reducing their minus score, and an assessment of the total opportunity (beneficial impact) of each individual supplier, with the aim of increasing their positive score.

The supplementary effect of 'no information available' is included as a result of the situation encountered in the AZ case study described in chapter 10, where the study highlighted the potential risks/opportunities through not knowing a suppliers biodiversity impact situation. An 'N' applied to a supplier will highlight both the uncertainty of the potential risk and/or opportunity, and that immediate management action is required to clarify the situation. The total 'N' score which could be either a beneficial or adverse impact will influence the potential cumulative R/O assigned to a product or supplier.

13.2.4 Supply Chain Management for Stage 2

A summary of the results from Table 13.4 is now entered into Table 13.5 which will define the level of supplier biodiversity risk. A judgment can now be made by the buyers on the course of management action. If the risk is, for example high, the supplier will fail the biodiversity element of the selection criteria and may be asked to reduce the risk. If a supplier is unable to comply the focal company can offer support, for example, through a partnership (Section 2.5.2) agreement on biodiversity issues. In the case where there is a major adverse risk and the supplier is not willing to agree to the overall company selection criteria then an alternative supplier may be sought. An example of supplier selection criterion is given in Table 13.5.

Table 13.5 Supplier Selection Criteria Based on Risk to Biodiversity

Supplier Selection Criteria (Supply Company Name)		Criteria Met? Yes	No	Shortlist Supplier Yes/No
Low Risk	Risk Low Medium – Minor Adverse No effect on operations if supply disrupted			
Medium Risk	Risk High – Potential Moderate Adverse Potential interruption to supply			
High Risk	Risk Significant – Potential Major Adverse Interruption to supply chain operations			
Negligible Risk	No evidence of biodiversity or business risk			
No Information Available	Uncertain – Potential High Risk			

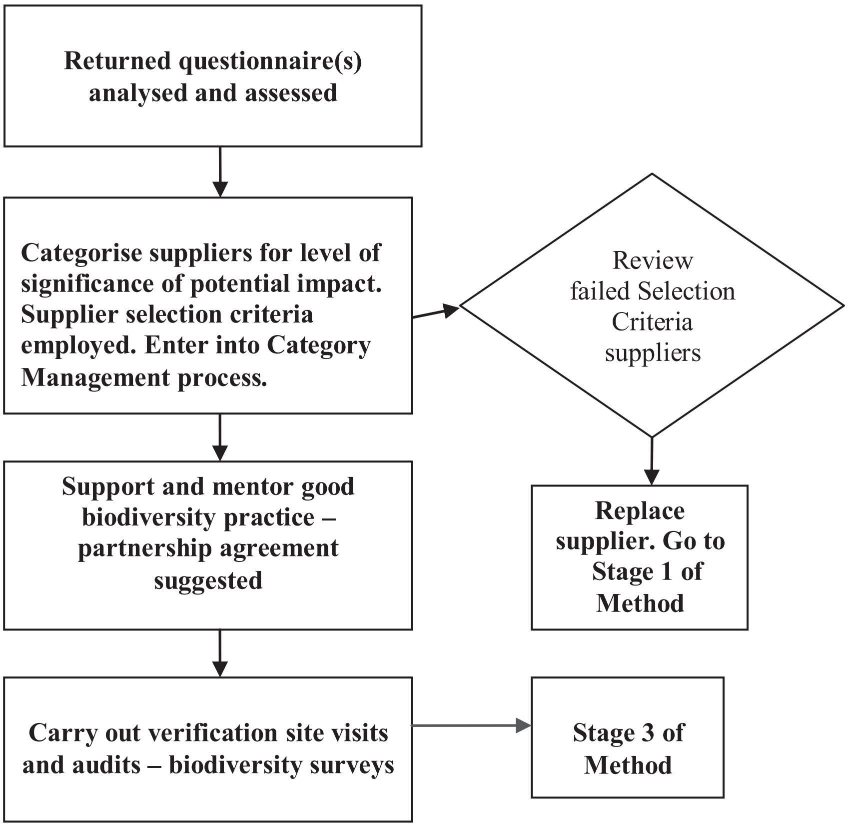
Table 13.6 gives a management check list for Stage 2 of the method.

Table 13.6 Management Checklist for Stage 2

ITEM	EXPECTATIONS	TARGETS/OBJECTIVES
Supplier Selection Criteria - List of suitable suppliers	Meet at least minimum CR performance. Meet risk criteria. Short list suitable suppliers including existing suppliers	
New standards and initiatives	Communicated to supplier. Follow-up recommendations	
Initial supplier biodiversity questionnaire or PQQ	Fully completed and returned with 'Yes' response. A 'No' answer is a management meeting and follow up audit	
Management support	Supplier responsive to offer of assistance. Implement any recommendations. Training requirement.	
Detailed study of significant biodiversity. aspects	Significant aspects and associated impacts identified. Assessment of cumulative risk and opportunity impact. Update BIFS File.	

Figure 13.5 shows the process flow diagram for Stage 2 of the method.

Figure 13.5 Process Flow Diagram for Stage 2



Purchasing - biodiversity and CR risk is considered with similar responsibility principles used by AstraZeneca in section 10.9 and are measured as part of an ongoing supply chain management (SCM) process. Additionally, these elements are considered as an integrated risk management (IRM) and total responsibility management (TRM) exercise as outlined in section 6.6.2. The processes involved throughout stage 2 require a high degree of partnership working between buyer and supplier, as discussed in section 9.3.

Section 3 now introduces the potential business R/Os associated with the identified biodiversity aspects/issues in relation to the product or supplier. The introduction of this third stage is made in order to segregate the assessment of impacts on biodiversity from potential related impacts on the management of business operations. Adding this third stage highlights the influence biodiversity has on bottom-line performance (Sections 4.7; 6.2.1; 6.3; 6.4.1). It also links the two elements of business and biodiversity to corporate responsibility (CR) reporting and its potential in marketing good corporate practice while showing the ‘value added’ or materiality potential of biodiversity (Section 6.6). Figure 13.6 shows stage 3 of the management process.

13.2.5 Stage 3: Mitigating Risks and Opportunities in the Supply Chain

Figure 13.6 Stage 3 of the Methodology

Assessment of Risks and Opportunities (R/O) and Biodiversity Management in the Supply Chain (bSCM)

3-a) Internal: R/O Identify business R/O category	**3-b) External: R/O** Work with supplier(s) and any other buyers of the same product, in evaluating risk	**3-c) Internal: R/O** Make available information from the 3 stages for final management action
3-a) bSCM Document business R/O based on assessment using Stage 2. Update BIFS file – exploit good partnership working	**3-b) bSCM** Communicate potential business R/O to existing suppliers and to potential new suppliers. Selection of new supplier(s)	**3-c) bSCM** Data from previous stages on R/O made available to suppliers.

Phase 3-a uses the degree of significance impact assessments from stage 2, and assesses the level of business risks or opportunities associated with the product and company brand (Sections 4.9, 6.4.3 and 6.6.1). Current trends in biodiversity related environmental issues are considered and the high degree of partnership working needed in Stage 2, is further encouraged between buyers and suppliers.

Phase 3-b establishes communications specifically concerning potential business R/Os with strategic suppliers and agrees a partnership working relationship on business and biodiversity management. The biodiversity and business risk information relating to the product category is made available for supply chain environmental/biodiversity managers to design a specific biodiversity management system (BMS) if desired. The pooling of resources on management, specialist knowledge, and budgets is encouraged. The establishment of supply chain partnerships (Sections 4.7, 4.10 and 9.3.2) will have the advantage of combining experiences, defining mutual biodiversity impacts (to prevent overlap and waste of resources), and presenting a combined consideration of biodiversity. The partnership ethos extends to stakeholder engagement throughout industry with, for example, NGOs, statutory bodies and local communities.

Phase 3-c involves the collation of supply chain biodiversity impact information and business risk information which is made available for management action. This information is also sent out to strategic and other supply companies.

13.2.5.1 Selection of New Suppliers

The selection of new suppliers will be determined by the organisations own supplier selection criteria. In the examples given in chapter 8, Birse Civils, White Gold and Jordan's Cereals all had a biodiversity question as part of their selection criteria. A suggested example for AstraZeneca to include a biodiversity question in their criteria is given in Table 10.9. The biodiversity element is intended to highlight both potential risks and opportunities. The potential for a supplier to be rejected or de-listed on biodiversity grounds alone increases if the supplier is of strategic importance and the risk is either major adverse/high/significant, with a risk score of (-9), or a high cumulative score associated with the whole product supply chain. The degree of significance attached to the biodiversity question, and hence its importance in supplier selection, will depend on the industrial sector (Section 10.2) and product being sourced. For example, Center Parcs have a biodiversity image to protect and this is a driver for its consideration (Section 9.2).

13.2.6 Supply Chain Management for Stage 3

The significance of potential biodiversity and associated business impacts has now been assessed. Existing and new strategic suppliers can now be contacted initially, and working partnerships formed whereby the risks and opportunities can be managed in a mutually beneficial way. Other suppliers down the chain can be contacted according to objectives set and as dictated by the level of risk. Relevant stakeholders can form part of the partnership and give access to product related information and form transparent relationships.

Partnership working prioritises management action on reducing biodiversity impact and focuses resources where they can be most effective. Table 13.7 is a priority management list, for focal and supply companies, and shows the risk score and significance level for biodiversity risk for individual suppliers for the example of 12 supply companies given in Table 13.4. Significance levels are highlighted in colour to convey urgency action level: Red for high/significant and uncertain risk and orange for medium risk. Suggested management action and action completion target dates are also provided.

Table 13.7 Priority Management Action List – Individual Supplier Risk Assessment

Supplier Number	Risk score	Biodiversity Risk	Business Risk	Action – Targets/Objectives	Action Completed	Further Action
1	(9)	Major Adverse	High/Significant	Contact supplier – Manage risk		
9	(9)	Major Adverse	High/.Significant	Contact supplier – manage risk		
9	(5)	Moderate Adverse	Medium	Contact supplier – manage risk		
3	(5)	Moderate Adverse	Medium	Contact supplier – manage risk		
4	(N)	No information available	Uncertain	Supplier senior management contact – alternative source?		
8	(N)	No information available	Uncertain	Supplier senior management contact – alternative source?		

The impact of 'No information available' is a potential adverse risk to biodiversity and the business. The designation 'N' in Table 13.3 has to be given a significant risk rating until further information can be obtained from the immediate management action demand of Table 13.7.

Table 13.8 shows the level of non-priority biodiversity associated business risk for individual suppliers with suggested actions. The partnerships established, during Stage 3, throughout the product supply chain will aim to maintain a biodiversity policy/principles and management system link between companies. The objective is corporate responsibility (CR) transparency and the continually improving and monitoring the processes of the methodology.

Table 13.8 Non-Priority Management Action List – Individual Supplier Risk Assessment

Supplier Number	Risk Score	Biodiversity Risk	Business Risk	Action – Targets/ Objectives	Acton Completed – Target Date
1	(3) x 2	Minor Adverse but cumulative score of (18) with suppliers 2; 6; 11 and 12	Individually Low risk to operations from supply disruption	Contact supplier(s) – manage individual and cumulative risk	
2	(3)	Minor Adverse but cumulative score (15) with suppliers 1; 6; 11 and 12.	Low risk to operations from supply disruption	Contact supplier – manage risk	
6	(3)	Minor Adverse but cumulative score (15) with suppliers 1; 2; 11 and 12.	Low risk to operations from supply disruption	Contact supplier – manage risk	
11	(3)	Minor Adverse but cumulative score (15) with suppliers 1; 2; 6 and 12.	Low risk to operations from supply disruption	Contact supplier – manage risk	
12	(3)	Minor Adverse but cumulative score (15) with suppliers 1; 2; 6 and 11.	Low risk to operations from supply disruption	Contact supplier – manage risk	
5	0	Negligible – cumulative impact potential	Low risk to operations from supply disruption	Contact supplier – discuss any implications	
7	0	Negligible – cumulative impact potential	Low risk to operations from supply disruption	Contact supplier – discuss any implications	
10	0	Negligible – cumulative impact potential	Low risk to operations from supply disruption	Contact supplier - discuss any implications	

The data obtained from Stage 2, shown in the example 12 suppliers in Table 13.4, for the low/medium, no risk/opportunity categories, may be regarded as a less or non-priority management action when compared to the major/moderate adverse impacts. These non-priority risks or opportunities by virtue of their character may be of the type that can be resolved relatively quickly. This separation of priorities serves to focus action on the most urgent impacts first. The data obtained from Stage 2, Table 13.4, for the management opportunities action list for individual suppliers, is transferred to Table 13.9.

Table 13.9 Management Action List – Individual Supplier Opportunity Assessment

Supplier Number	Opportunity Score	Biodiversity Opportunity	Business Opportunity	Action – Targets/Objectives
1	3	Minor beneficial. And cumulative opportunity score of 9 with suppliers 5 and 11	Low/medium for individual suppliers but higher cumulative opportunity	*Improve biodiversity asset and business image.*
2	5	Moderate beneficial. And cumulative score of 10 with supplier 6	High for individual supplier and high cumulative opportunity with supplier 6	*Maintain and improve biodiversity asset and business image - linked to goodwill; book value*
3	0	Negligible	Potential cumulative with suppliers 7,9,10,12 – publicise no impact.	*Positive Impact – Significant opportunity to report on situation. Value added opportunity*
4	9 + N	Major beneficial and cumulative score of 27 with suppliers 5 and 11. N score - Potential opportunity	Significant for individual supplier and cumulative with suppliers 5 and 11	*Maintain and improve biodiversity asset and business image- linked to goodwill; book value*
5	12	Major and minor beneficial	Significant for individual supplier and cumulative with suppliers 4 and 11	*As for major plus - Opportunity to improve biodiversity asset and business image.*
6	5	Moderate beneficial	High for individual supplier and high cumulative with supplier 2	As for supplier 2
7	0	Negligible	Potential cumulative with suppliers 3,9,10,12 – publicise no impact.	As for supplier 3
8	N	No information available	Potential opportunity	**Uncertain** *Precautionary stance but potential opportunity.*
9	0	Negligible	Potential cumulative with suppliers 3,7,10,12 – publicise no impact.	As for supplier 3
10	0	Negligible	Potential cumulative with suppliers 3,7,9,12 – publicise no impact.	As for supplier 3
11	21	Major and Minor beneficial	Significant with individual supplier and cumulative with suppliers 4 and 5	As for supplier 5
12	0	Negligible	Potential cumulative with suppliers 3,7,9,10 – publicise no impact.	As for supplier 3

Figure 13.7 shows the management flow diagram for Stage 3.

Figure 13.7 Process Flow Diagram for Stage 3

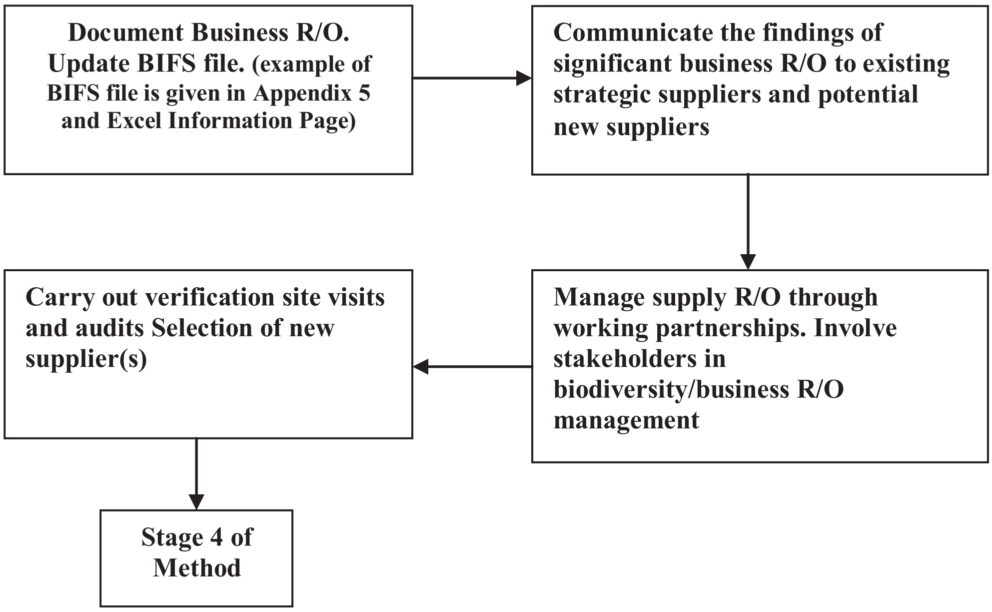


Table 13.10 shows the management check list example for stage 3.

Table 13.10 Management Checklist for Stage 3

ITEM	EXPECTATIONS – TARGETS/OBJECTIVES	COMPLETED
Business risk	The significance level of risk acknowledged and linked to the supply logistical area. Specific high risk suppliers identified.	Yes No Partially
Business opportunity	The significance level of opportunity acknowledged and linked to the supply logistical area. Specific suppliers identified. Biodiversity management initiatives explored e.g. BBOP. Ensure information in public domain e.g. CSR report.	Yes No Partially
Partnership working and dialogue with stakeholders	Relationship established. Pooling of relevant knowledge and budgets agreed. Communication links agreed with responsible persons managing the issues. BMS designed if required. External assistance brought in, if necessary.	Yes No Partially
BIFS File	Update continually	

A typical scenario for business risk from strategic suppliers is taken from the example in section10.4.6 (scenario 3 – high risk – strategic suppliers). Taking the supply companies 1 and 9, from the examples in Table 13.4, where the significant biodiversity impact potential will categorise that supplier as high risk, the business risk may pose a:

- Clear risk to reputation or operations.
- Interruption of supply risk.

The management actions required to mitigate these risks are shown in stage 4. The significance of impact process would in practice be tailored to a specific company environmental/business situation operating in mutual agreement with other suppliers in the chain. The aim is to maintain a 'level playing field' where the same criterion for significance is agreed between buyers and suppliers. Figure 13.8 shows the management process for stage 4.

13.2.7 Stage 4: Continual Management of Risks and Opportunities in the Supply Chain

Figure 13.8 Stage 4 of the Methodology

Assessment of Risks and Opportunities (R/O) and Biodiversity Management in the Supply Chain (bSCM)

4-a) In/External: (R/O) Check supply chain management action process of stages 1 - 3	**4-b) In/External: (R/O)** Check biodiversity management action process of stages 1 - 2	**4-c) In/External: (R/O)** Check business management action process of stages 1 and 3.
4-a) bSCM Continuous interaction with suppliers and improvement of management systems. Management Review.	**4-b) bSCM** Continual assessment of biodiversity R/O and regular biodiversity audits of suppliers. Encourage partnerships	**4-c) bSCM** Maximise business opportunities and reduce risks identified in previous stages. Annual review and improvement in partnership with suppliers.

Phase 4-a categorises the continuous management action required as a result of the risk/opportunity assessment in Stages 1, 2 and 3. The findings from the previous stages of the methodology are divided between biodiversity and business management action in the phase's 4-b and 4-c. The object of stage 4 is to check the process and effectiveness of the method and implement continual improvement.

13.2.8 Supply Chain Management for Stage 4

Individual supply companies and collective supply chain have been assessed in stages 1 to 3 for their potential biodiversity and business risks and opportunities. A programme of regular monitoring and auditing is applied in order to ensure continual improvement of the methodology. Initially, the strategic or high R/O suppliers are audited and this procedure may be extended to other suppliers down the chain when appropriate. An annual review in collaboration with strategic suppliers will examine the audit procedure and results, ensure minimum compliance to supplier criteria and monitor progress against objectives and suggest improvement plans. A management check list for Stage 4 is shown in Table 13.11.

ITEM	EXPECTATIONS	TARGETS/ OBJECTIVES
Major adverse biodiversity risk. Business risk high/significant	Supplier informed of focal company criteria for managing risk.	
Moderate adverse risk. Business risk medium	Supplier informed of focal company criteria for managing risk.	
No information available	Supplier informed of focal company criteria	

Table 13.11 Management Checklist for Stage 4

	for managing risk.	
Source alternative supplier(s)	Protect security of supply	
Minor adverse risk. Business risk low	Reduce the risk to negligible	
BIFS File	Update file continually	

The flow diagram shown in Figure 13.9 outlines the four stages of the methodology.

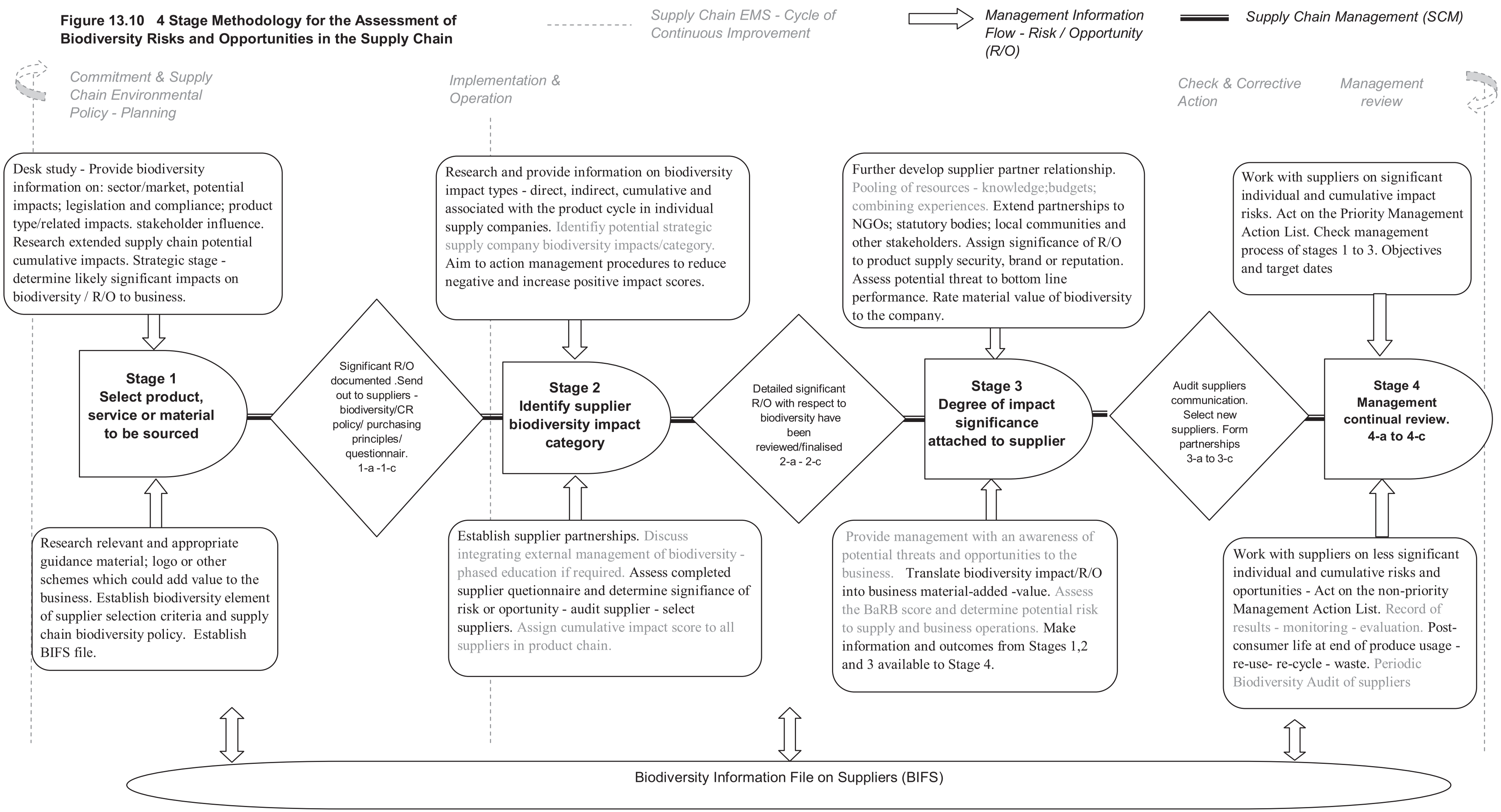
Figure 13.9 Process Flow Diagram for Stage 4

13.2.9 Summary of Focal Company Biodiversity R/O Management Action with Supply Companies

The risk and opportunity assessment outlined in the previous sections focuses the resources and management process on the significant impacts concerning strategic suppliers. The methodology allows the assurance needed for management and interested parties that the organisation can comply with regulations and meet its stated biodiversity policy objectives and targets. At this stage the assessment of risks and opportunities process described above can be entered into an organisation's in-house environmental management system. The design of the in-house system would determine how and where the method would be factored into it.

The methodology has enabled, if required, biodiversity issues to be incorporated into an organisation's environmental policy and has identified and made an assessment of biodiversity impact in terms of significance of risk and opportunity within an organisations supply chain. It has provided information for improving biodiversity within the supply chain and where targets and objectives for improvement can also be set as a result of the above information. The assessment of risks and opportunities for business is also made and linked to biodiversity. Also enabled is the continual monitoring and cycle of continual improvement of the methodology by management review and, by including the audit of stated claims, assured the management actions concerning biodiversity impact; and provided a pathway or framework for communicating with the supply chain with respect to biodiversity and engaging in partnerships with suppliers in order to pool resources. The 4 stage methodology is now summarised in Figure 13.10.

Figure 13.10 4 Stage Methodology for the Assessment of Biodiversity Risks and Opportunities in the Supply Chain

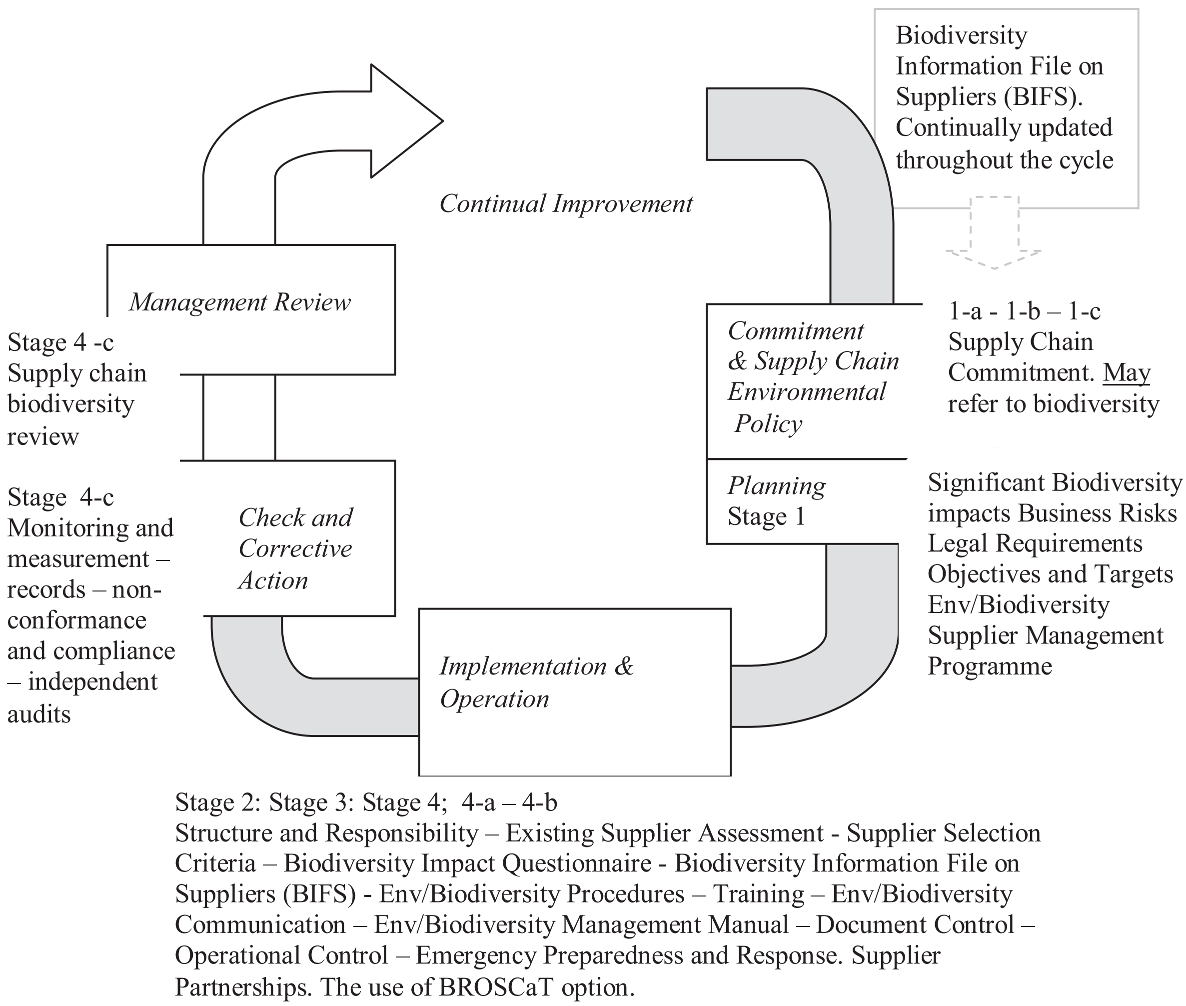


13.2.10 Risk and Opportunity Management Incorporated within a Standard EMS Framework for Supply Chain Management

The four stages of the methodology are designed to have the flexibility to operate both as a stand-alone supply chain risk/opportunity assessment process, or to be integrated into an organisation's in-house supply chain environmental/biodiversity management system. The in-house system can, if required, mirror the structural framework of a standard EMS such as ISO 14001 and be adapted for supply chain management, as discussed in chapter 12, Figure 12.2. Figure 13.11 shows the stages of the ISO 14001 cycle of continual improvement (CCI) in italics, (Section 12.4.2) with each of the 4 methodology stages described above incorporated into the phases of the cycle.

Figure 13.11 The 4 Stage Method for Assessing Biodiversity R/O Using the ISO 14001 Cycle of Continual Improvement for Managing the Supply Chain

The ISO 14001 cycle is shown in italics



The focus of the management cycle is the integration of the 4 methodology stages (Figure 13.1) into supply chain management of biodiversity. The first stage of the methodology is incorporated at the planning phase of the continual improvement cycle of the ISO 14001 EMS. Stages 2, 3 and 4 are built into the implementation and operation phase, with Stage 4 also included in the check and corrective action and management review phases.

13.2.11 Biodiversity Surveys

The methods for finding the extent of consideration and potential impacts on biodiversity involve two processes, the audit and the biodiversity survey. The audit trail element of the methodology forms part of the verification process and provides a record of all assessments and evaluations of impacts made during the process. The auditing of legislative or regulatory issues is a precise process whereas the assessment of biodiversity base-line levels is often an inexact activity. As Morgan (1998) pointed out in section 3.2.6 uncertainty is an integral part of impact prediction in ecological surveys, introducing a high degree of subjectivity. In order to minimise this records and reports of the surveys explain the options considered and show how decisions were made but they do rely on the expert opinion of the surveyors. This process is continually reviewed and investigated for changing conditions and new scientific knowldge. In the case of biodiversity surveys there is scope for suggesting continual improvements and the survey should not be as rigid as the audit process which often, as Hamschmidt and Dyllick (2006, p565) said, *'over-emphasises compliance and conformance issues'*.

This chapter has discussed the methodology for assessing biodiversity impacts and associated business risks within the product supply chain. The following chapter now applies the principles of the methodology described above to the design of a practical working tool for environmental, procurement and business practitioners.

CHAPTER 14

BIODIVERSITY RISK AND OPPORTUNITIES IN SUPPLY CHAINS ASSESSMENT TOOL (BROSCAT)

This chapter now takes the 4 stages of the methodology described in chapter 13 and uses the 2 components of each stage, that is, risk/opportunity (R/O) and biodiversity management of the supply chain (bSCM) as the basis for the design of the Biodiversity Risks and Opportunities in Supply Chains Assessment Tool (BROSCaT).

14.1 Introduction

One of the requests often made by business practitioners during the research was that the projects outcome be designed to easily fit into existing management systems, and this was particularly emphasised by AstraZeneca, see section 10.6.9. In order to meet this request the project has designed a computer based method for applying the methodology using the Excel format, with the working acronym BROSCaT (see Table 14.1). The model uses the same components and methods described in chapter 13 and puts emphasis on the potential R/O presented to business from biodiversity related issues, which is in line with the project aim stated in section 1.4.

Table 14.1 The Rationale Behind the BROSCaT (working) Acronym

BROSCaT Acronym	RATIONALE
Biodiversity	Presenting biodiversity from a business centric viewpoint. Refer to section 1.3.2.
Risk	Risk averse approach to biodiversity with respect to business. Refer to section 1.3.
Opportunity	Highlighting the business opportunities of biodiversity consideration. Refer to section 1.3.
Supply **C**hain	Seen from a supply chain environmental management context. Refer to chapter 4.
Assessment	An assessment of the individual and cumulative business risks and opportunities and associated biodiversity impacts. Refer to section 4.4.2.
Tool	A practical business management tool for easy access to relevant information and a platform for decision making. Refer to chapters 13 and 14.

This shift away from the design of a model with a biodiversity/ecosystem centric stance to a business centric one sits better with industry's general focus on business opportunity rather than any risk to biodiversity. There were examples of this business position as the literature review found in sections 2.2 and 2.4.1 and general attitudes to biodiversity found in sections 3.7 and 4.5 with related support from Henriques and Richardson (2004) as they comment on approaches to sustainability in section 4.7 and Welford (1997) in section 6.4.1.

The Excel format uses 2 separate pages whereby biodiversity issues relating to a supplier are assessed separately from any business issues. The findings of the biodiversity assessment page are then electronically transferred to a business R/O page, giving procurement personnel a continually updated overview of biodiversity related business R/O in a product supply chain. There then follows a method for assessing the material risk or opportunity to business operations as a result of potential biodiversity impact.

The model is designed to help supply chain managers determine either the level of consideration companies should give to biodiversity issues relating to individual suppliers or as a complete product sourcing assessment across a whole supply chain. The Model consists of a range of aspects or issues that a buying (or focal) company may have to consider when assessing the potential impact (risk or opportunity) on biodiversity as a result of product or service sourcing in its supply chain. The model can be tailored to assess an individual product or service for biodiversity consideration and to fit into existing environmental or procurement management systems.

The model will help managers highlight suppliers who potentially present a risk or opportunity to, for example, security of supply and/or the risk of adverse publicity attached to a brand or company image. The significance of risk to biodiversity can be considered and appropriate management action applied. Opportunities for adding value in the supply chain would also be highlighted, for example, ethical investment and city profile, planning profile, regulatory compliance and sector differentiation.

14.2 EXCEL TOOL FOR ASSESSING BIODIVERSITY RISKS AND OPPORTUNITIES IN SUPPLY CHAINS

The Excel format is now used as an aid in assessing the significance of risk and opportunity criteria described in section 13.2 and is given the acronym BROSCaT (Biodiversity Risks and Opportunities in Supply Chain Assessment Tool), refer to Table 14.1. By using BROSCaT information is electronically available for interested departments and personnel. The application of the methodology has 4 Excel worksheet pages, consisting of instructions, data entry, information access and database. Table 14.2 gives a summary of the Excel worksheet layout.

Table 14.2 Summary of the Excel Worksheet Layout

PAGE	WORKSHEET	EXPLANATION
1	Instruction Page.	Contains the contents list. Explanation of each stage of the biodiversity and business assessment process. The instructions in this example explain the range of potential biodiversity aspect impacts which may be associated with supply chain business operations. A bespoke impact entry can be made to suit each business situation.
2	Biodiversity Aspects	This page lists the biodiversity impact type under the headings of Direct, Indirect, and/or Cumulative Impact. In the example shown, biodiversity areas of conservation status and significant effect criteria are also listed.
3	Business Aspects	This page lists the business related risks or opportunity associated with the biodiversity impacts listed in page 2. Supplier relationships are listed to give managers a one page view of the degree of influence they have on the supplier. Individual supply companies can be categorised on their risk or opportunity levels.
4	Information Access	The biodiversity impacts of page 2 and the business impacts of page 3 are hyperlinked to this information page. The page provides individual impact-type links to web-page information and contacts and/or takes the reader directly to any in-house information documents, such as the BIFS file.

The instruction worksheet page 1, also gives the contents, with explanations on each stage of the biodiversity assessment process. Worksheet 2 (Biodiversity Aspects) covers biodiversity impact of suppliers, and product(s). Worksheet 3 (Business Aspects) covers the business risk or opportunity (R/O) data entry. Worksheet 4 is the biodiversity and business information/database page (part of the BIFS file), which can be linked to from both worksheets 2 and 3. The biodiversity impact (Page 2) data is entered by managers responsible for environmental issues, whereas, the business risk or opportunity worksheet (Page 3) is entered by business and/or procurement managers.

14.3 BIODIVERSITY ASPECTS

Worksheet 2 covers the biodiversity aspects associated with the product or service, and with each supplier in the chain. The method takes the form of a checklist where biodiversity related information on the product/service or sector can be collated. For example, the type of impact – direct, indirect, and/or cumulative.

These results can then be assigned to each supplier. Figures 14.1, 14.2, 14.3 and 14.4 show examples taken from the biodiversity aspects worksheet 2. A full Excel worksheet can be seen in Appendix 5. In addition, The BROSCaT worksheet example can be seen in a CD provided with the methodology.

Figure 14.1 Number of Supply Chain Companies Entered B-G

Column A	B	C	D	E	F	G
Supply Chain Biodiversity Impact Category: Significant impacts associated with the product/service.	Strategic Supplier 1	Strategic Supplier 2	Strategic Supplier 3	Strategic Supplier 4	2nd Tier Supplier 5	2nd Tier Supplier 6

The buying company name is entered in column A and the product/service being sourced, in column B (1). The supply company status is also entered in column B, e.g. strategic or second tier supplier. Column A gives examples of typical direct, indirect or cumulative biodiversity impacts associated with the sector, market and product type. The type of impact is based on the Treweek and Mulder (2007) Criteria for *Direct, Indirect and Cumulative* Impact, given in Table 4.1.

Figure 14.2 Biodiversity Aspects Example (Columns A - D)

	A	B	C	D
1	**Supply Chain Biodiversity Impact Assessment Check List**			
2	Enter Company Name (Buyer)	Product/ Service Supply Company		
3	**Supply Chain Biodiversity Impact Category: Significant impacts associated with the product/service.**	**Strategic Supplier No. 1**	**Strategic Supplier 2**	**Strategic Supplier 3**
4	**Direct Impact**			
5	**Does the material originate from an organic source?**	*Don't know*		YES
6	**Habitat Loss**			
7	**Habitat Change**	N		
8	**Temporary Habitat loss**	N		No
9	**Permanent Habitat loss**	Yes	Yes	
10	**Habitat Fragmentation**	*Don't know*		No

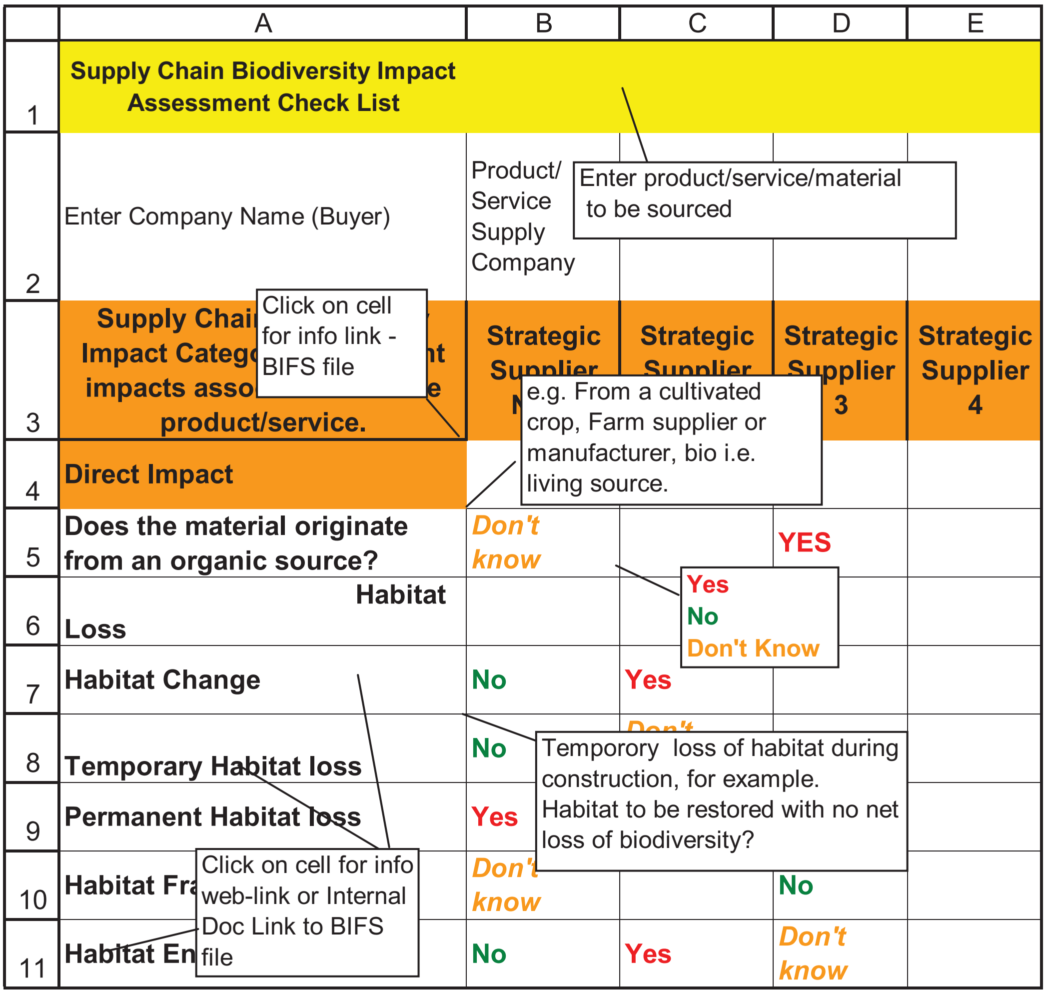
Permanent loss due to extraction of materials in product sourcing

Yes
No
Don't Know

Each of the impact-types (Direct impact is shown in the example) has a comment attached, which gives a brief explanation of the impact-type and its importance to business (Figure 14.3).

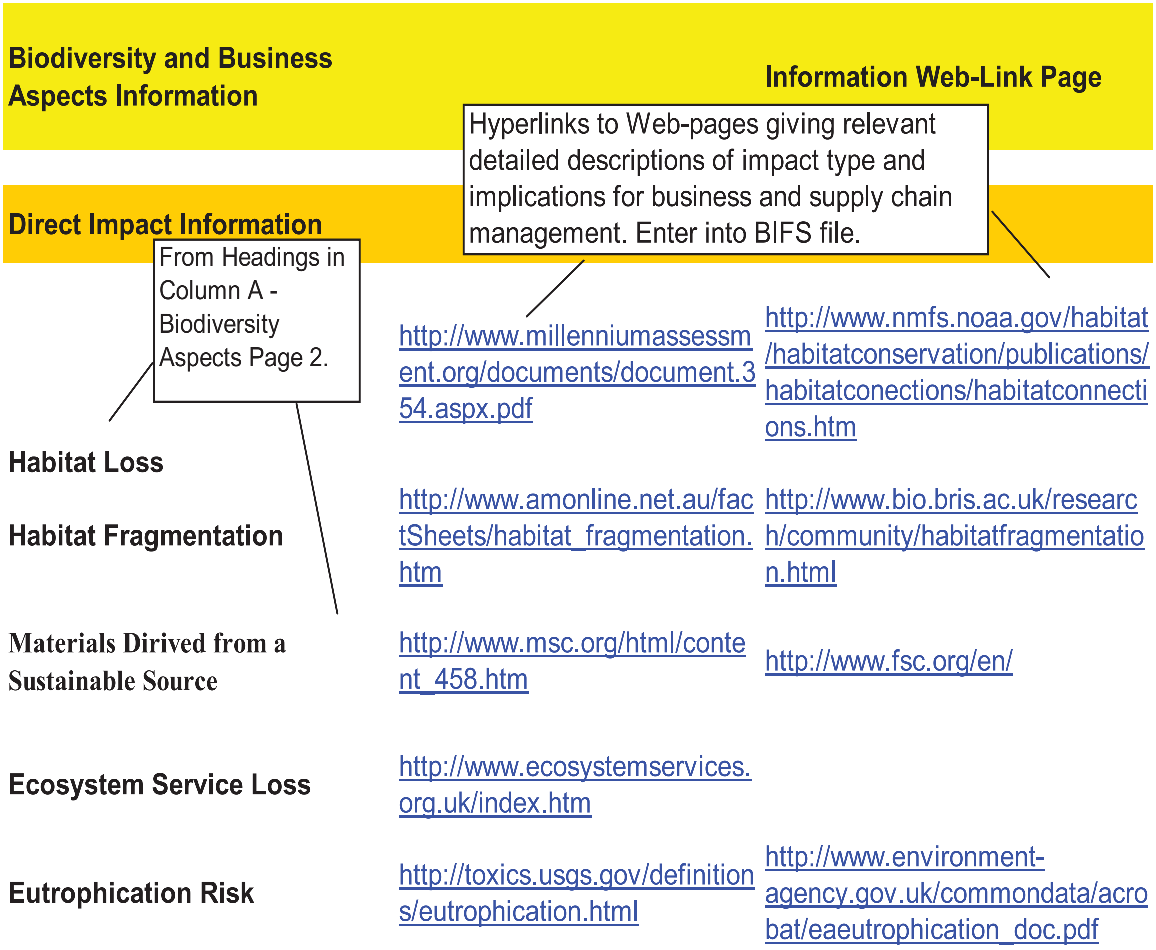
The first column (A) headings (biodiversity impact type) are responded to in columns B to G >, where the number of supply companies in the chain is entered (Figure 14.13). Each cell in columns B to G (in the example) has a drop-down selection of explanations to the type of impact associated with each individual supply company. The dropdown selection in this case is: *Yes* (Red), *No* (Green), and *Don't Know* (Orange), see Figures 14.2 and 14.3. Alternatively, relevant personnel can enter their own text into the individual supplier dropdown cells. In the example given in Figure 14.3, the direct impact of *Habitat Change* is answered in column B, under strategic supplier number 1, as, *No* (green). The same exercise can be undertaken for each of the supply companies in the chain, and for each impact category.

Figure 14.3 Excel page example detailing Comment Box's and Detailed Information Links



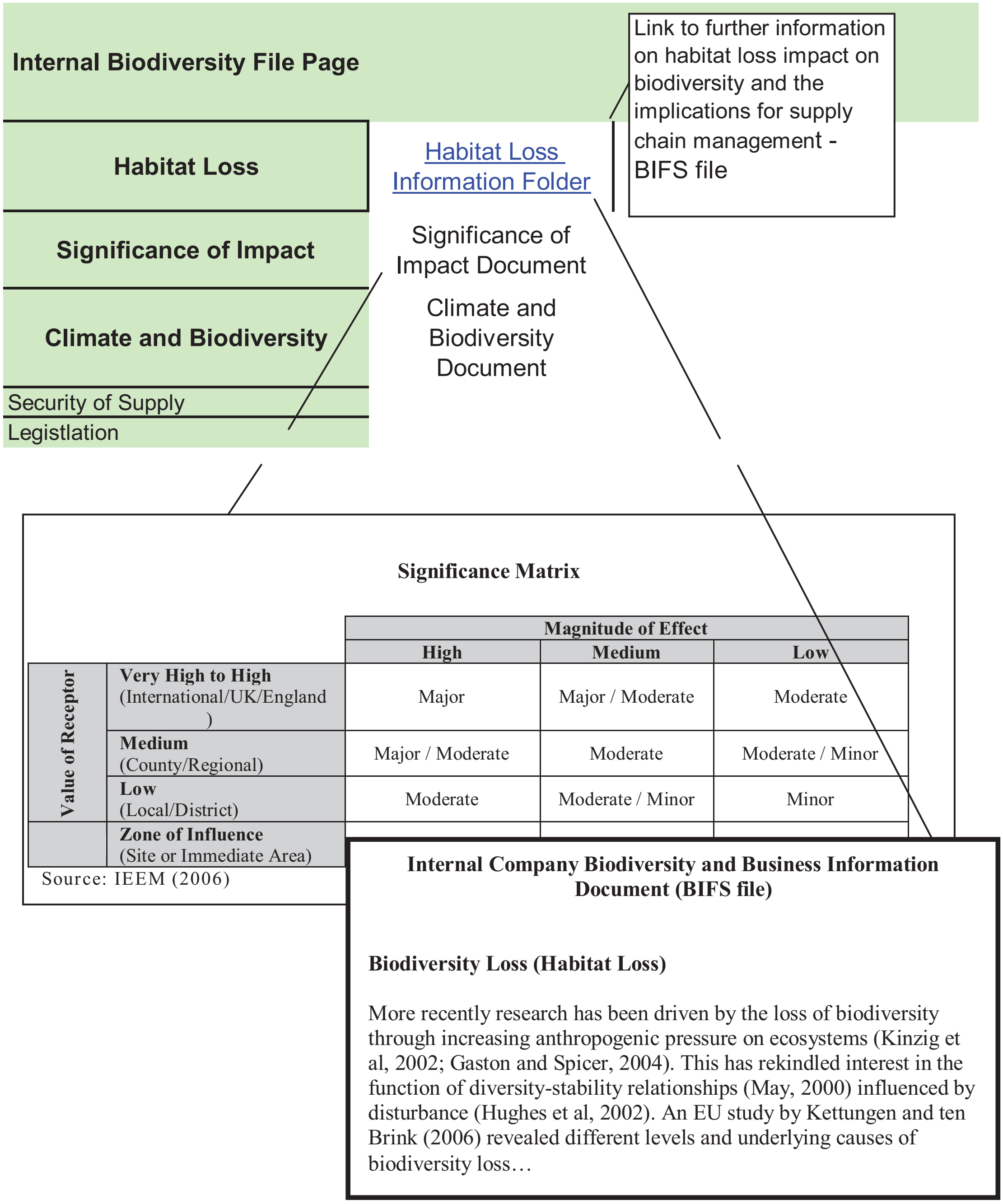
In addition, the impact-type (cell) links to the biodiversity information page (worksheet 4, part of the BIFS file). For example, the direct impact of *Habitat Loss* is linked direct to web-site(s) with the pages also entered into the information worksheet 4, which gives an explanation of the impact along with the implications for business in the supply chain; see Figure 14.4 and Appendix 5.

Figure 14.4 Biodiversity and Business Information Page 4 Web-Links



The impact types entered in column A could also be exclusively linked to a bespoke internal company document or database (part of the BIFS file), giving all relevant business and biodiversity information associated with the sector, product or company, and its supply chain, see Figure 14.5.

Figure 14.5 Internal Biodiversity and Business Information Document Links



Significance Matrix

		Magnitude of Effect		
		High	**Medium**	**Low**
Value of Receptor	**Very High to High** (International/UK/England)	Major	Major / Moderate	Moderate
	Medium (County/Regional)	Major / Moderate	Moderate	Moderate / Minor
	Low (Local/District)	Moderate	Moderate / Minor	Minor
	Zone of Influence (Site or Immediate Area)			

Source: IEEM (2006)

Internal Company Biodiversity and Business Information Document (BIFS file)

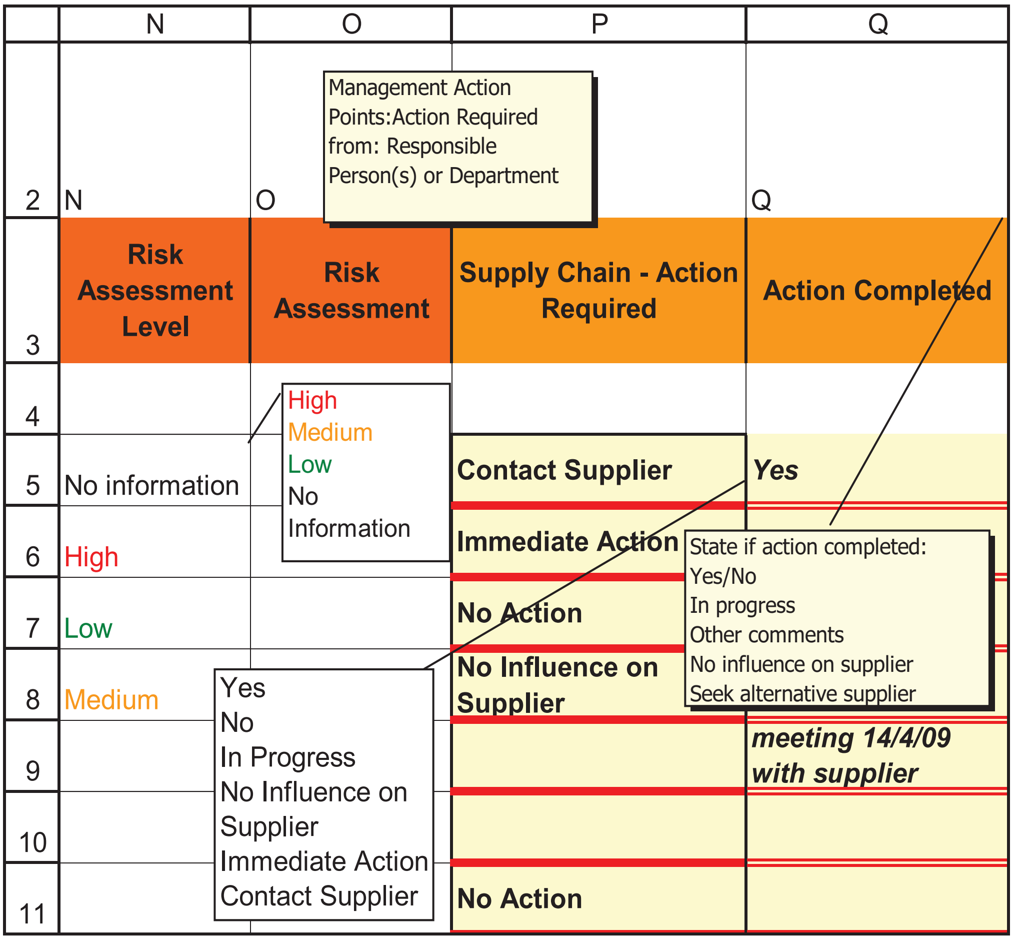
Biodiversity Loss (Habitat Loss)

More recently research has been driven by the loss of biodiversity through increasing anthropogenic pressure on ecosystems (Kinzig et al, 2002; Gaston and Spicer, 2004). This has rekindled interest in the function of diversity-stability relationships (May, 2000) influenced by disturbance (Hughes et al, 2002). An EU study by Kettungen and ten Brink (2006) revealed different levels and underlying causes of biodiversity loss…

A biodiversity risk assessment, based on the answers given in column's B – G, can be made in (for example) columns N and O, for example see Figure 14.6, *High, Medium, or Low risk*. A supply chain 'Action Required' statement can be entered into column P which has a drop-down list of, in this example, *Yes, No, In-progress, No influence on supplier, Immediate action, Contact supplier or No action needed*. Column Q informs managers of the status of any action taken, with a drop-down list, for example, *Yes, No, action completed, action in progress, or action in 6 month review*.

In addition, other answers can be added manually. If the buying company does not have any biodiversity action-influence on the supply company (Figure 10.11), then the company has exercised due diligence in pointing out the potential impact(s) to the supplier, and has the option of seeking an alternative supplier. See examples in Figure 14.6.

Figure 14.6 Risk Assessment and Action Columns



The issues presented here are that unknown potential impacts on biodiversity have been identified, and hence may pose a risk to the business, but the buying company can not influence the supplier to consider the risk. Therefore, where the buyer can not obtain information on biodiversity aspects of a supplier's operations, and there is an area of uncertainty of risk attached to the product. This scenario applied to the organic solvent 2-Me-THF supply chain of AstraZeneca (Section 10.6.5), where the company may or may not have a biodiversity business risk in this supply chain, but cannot obtain any information to clarify the situation. The use of the biodiversity supply chain methodology would force a management action to take place in order to resolve the issue.

After the direct, indirect and/or cumulative impact-types decided upon in column A, there then follows, in the example given in Figure 14.7, sections on *biodiversity areas of conservation*, and *significant effect criteria,* in the EU. The category criteria are taken from the Institute of Ecology and Environmental Management (IEEM) (Very High; Major Adverse) Guidelines, Significance Matrix and Likely Significant Effects Criteria, outlined in Chapter 4, Tables 4.4, 4.5, and 4.6.

These significance criteria are given to illustrate the type of information that may be relevant to supply companies in relation to, for example, where the product is sourced, manufactured, or transported, or if company operations affect protected areas of biodiversity conservation. Figure 14.7 shows an example from the general worksheet given in Appendix 5. Column B, and the other supplier columns, give a drop-down level of significance list of *Very High, High, Lower, Medium,* or *Negligible*. Significance levels can be highlighted by colour to emphasise importance. The 'Action Required' columns can be completed based on the answers given in the company supplier columns shown in Figure 14.3.

Figure 14.7 Conservation Status and Significant Effect Criteria.

	A	B	C
45	**Biodiversity Areas of Conservation Status in the EU**	**Strategic Supplier 1**	**Strategic Supplier 2**
46	International	**Very High**	
47	UK / National		High
48	Regional / County		
49	District / Local		
50	Within Zone of Influence		
51	**Significant Effect Criteria in the EU**		
52	Loss of, permanent damage to or adverse impact on integrity of any part of a site of international or national importance;	**Major Adverse**	
53	Loss of a substantial part or key feature of a site of county importance;		
54	Loss of favourable conservation status (FCS) of a legally protected species;	**Major Adverse**	

14.4 BUSINESS ASPECTS

Worksheet 3 is the Business Aspects area of biodiversity consideration. This worksheet deals with the business risks presented to brand and/or company image and assigns a level of potential business risk attached to a sector, product, or supply company. Figure 14.8 illustrates the business aspects worksheet with an example from the AstraZeneca (AZ) case study (refer to Chapter 10 and 5), and the organic solvent 2-Me-THF supply chain.

Because of the lack of information AZ has in regard to the strategic suppliers of the solvent, the data input is only able to point out the potential exposure (risk or opportunity) the company faces. The method is proving useful, in spite of the lack of information, by highlighting the situation to AZ managers surrounding biodiversity risk or opportunity information, for this particular solvent source. Knowing the potential risks of 'not knowing the risks', the company can then pursue further investigations in this area, and aim to improve communications with supply companies.

Figure 14.8 Example of AstraZeneca 2-Me-THF Supply Chain

	A	B	C	D
72	**Potential Supply Chain Biodiversity Aspects of 2-Me-THF**	**Camida (Agent)**	**Penn Speciality Chemicals USA (Manufacturer)**	**Organic Waste Supplier USA**
73	Agrochemical Use - Farm use of chemicals	Low Signif	Potential Signif Risk	Potential Signif Risk
74	Land-use - extent o	if	Potential Signif Risk	Potential Signif sk
75	Mono Cropping - l	if	Potenti Risk	tential Signif sk
76	Transport - distanc manufacturers site	if	Potenti Risk	tential Signif Risk
77	Company biodiversity aspects - Association with company operations	Low Signif	Potential Signif Risk	Potential Signif Risk
78	Biodiversity sensitive sites - proximity to sites	Low Signif	Potential Signif Risk	Potential Signif Risk
79	Pollution risk - during supply operations	Low Signif	Potential Signif Risk	Potential Signif Risk
80	Ecosystem Services Issues - Risk to services due to operations	Low Signif	Potential Signif Risk	Potential Signif Risk

For detailed description of Aspects - link to BIFS file or Worksheet 1 - Information Page.

Significance of Risk list. Colour code for emphasis

The visual representation, given by the worksheet, of the whole solvent supply chain presented on one page, allows managers to make decisions on minimising the company exposure to biodiversity related single or cumulative risk, and/or exploit potential advantages, at any point in the chain. In addition, the worksheet can be presented at board level meetings – showing the complete strategic supplier risk and opportunity position that the company is exposed to.

The associated parallel research and case studies (Chapters 6 and 9 - 11) have highlighted the reluctance of procurement managers to 'get involved' with biodiversity, a subject of which they have little knowledge. Procurement and other managers involved in corporate social responsibility (CSR) issues, have to base their decisions on company policy principles. Unless those principles include biodiversity aspects in the supply chain and, there is good biodiversity risk or opportunity information regarding the supply chain, which assures company statements, biodiversity stands little chance of being considered.

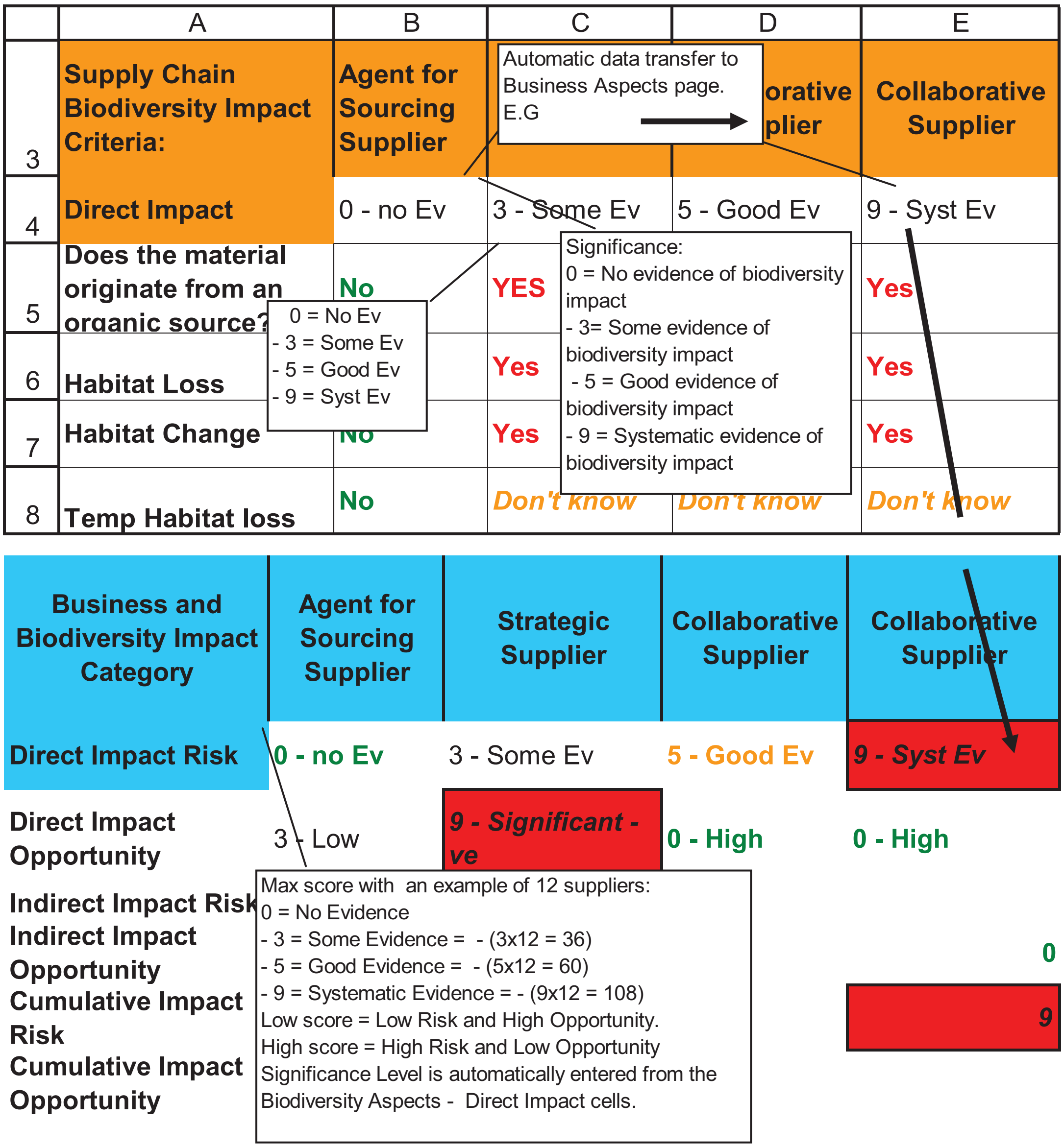
As described in section 13.2, data and information regarding biodiversity aspects of a product or supply company are partly based on a number of supplier selection processes. These may consist of, for example, bespoke supplier selection criteria, results from a biodiversity specific questionnaire, follow-up supply company audits, management systems employed, and sector and product research (Chapter 8).

These supplier selection processes, which focus specifically on biodiversity related issues, should be conducted by relevant personnel with some knowledge or access to information on biodiversity issues within industry. The information hyperlinks used within the Biodiversity Aspects worksheet (2) in BROSCaT (Figures 14.3; 14.4 and 14.5) are a source of finding biodiversity information. The type of information can be tailored to a specific sector, product/service or material, or company, as stated in section 13.2, Stage 1 of the methodology process.

Supply chain managers can not normally be expected to understand what constitutes a biodiversity risk, and conversely, environmental managers would not necessarily know the business risks associated with inadequate or inappropriate biodiversity consideration. To allow for the above potential obstacles to implementing good biodiversity management, the data input to cells in the Biodiversity Aspects worksheet

(2), *automatically* updates cells in the Business Aspects worksheet (3), see Figure 14.9.

Figure 14.9 Example of Automatic Data Transfer from Biodiversity Aspects (orange) to the Business Aspects (blue) Worksheet Page



The business and biodiversity risk and opportunity score (taken from Table 4.9, Section 4.4.3) can be entered into the BROSCaT Business Aspects worksheet, with the number of strategic supply companies in the chain deciding the maximum scores. An example is given in Appendix 5, taken from the AstraZeneca worksheet showing from the case-study in Chapter 10. Figure 14.9 shows an example of the automatic data transfer between Biodiversity and Business Aspect worksheets. A low score would indicate a low risk supplier and a high opportunity to exploit good biodiversity management. A high score would indicate a higher risk and low short-term opportunity from biodiversity consideration.

The low opportunity could be improved with partnership management between buyer and supplier, making an eventual good business opportunity for improving the biodiversity situation. The scores can be totalled by biodiversity impact-type or business risk and for individual or numerous supply companies. The management aim, for the example of 12 supply companies in Figure 14.9, would be to keep the score as low as possible.

In addition to the biodiversity categories shown in column A, other influences on how the company considers biodiversity can be entered. Figure 14.10 shows examples, taken from Chapters 2, 6, and 8, of the stakeholder influences and corporate risks likely to be affecting the company in relation to biodiversity aspects in the supply chain.

Figure 14.10 Examples of Stakeholder Influence and Corporate Risk

Stakeholder Influence	**Strategic Supplier**	**Strategic Supplier**	**Strategic Supplier**
Financial - shareholder	Ethical Invester		
Community	Local Interest	Education	NGO
Government	Planning		
Statutory Body		Env Agency	
Internal			Good supplier
Employee	Company Ethics		
Corporate Risk			
Company Reputation	High Risk		
Brand Image	Low Risk	Medium Risk	
Legistlation/ regulatory			
Security of Supply			Alternatives
CSR	Good CSR		
Business Risk	Strategic	Strategic	Collaborative
Potencial CR Risk	High	High	Medium

The headings under Stakeholder influences can be hyperlinked to the information and guidance entered into the BROSCaT information worksheet (BIFS). The corporate risks entered here are directly associated with both data entries in the Biodiversity Aspects worksheet and Business Aspects worksheet.

Other items to be included in the BIFS worksheet could include the relationship status the buyer has with the supply company. The example in Figure 14.11 shows a link to a CSR guidance internal company document.

Figure 14.11 Supply Chain Relationship

Supply Chain Relationship	Strategic Supplier			
Partnership	Yes		*Don't Know*	
Influence	High		Medium	
Environmental Policy	Yes		No	*Don't Know*
Biodiversity Policy	Yes		Staged Approach	No
ISO 14001			Staged Approach	
EMAS		*Don't know*		
IN-House EM System	Y	Yes		
SME	S	SME	UK Only	
CSR Report Incl. Biodiversity Element	Yes	*Don't Know*		No
Biodiversity considered In the suppliers own Procurement Criteria	Yes	*Don't Know*		*Don't Know*
UK/EU Supplier/ Other	EU			UK

Link to internal CSR guidance information Document

14.5 Practical Application

In order to evaluate the value and appropriateness of BROSCaT, a demonstration of the methodology was given to the environmental and purchasing departments at the AstraZeneca (UK) Brixham facility. This resulted in the company agreeing that the bespoke BROSCaT option would be useful in assessing biodiversity issues in their supply chain. AstraZeneca liked the method for its potential in the bringing together of group policies, supporting standards, procedures, and guidelines into one common format and structural framework. This will allow all managers and staff to understand the responsibilities for compliance that corporate governance demands under the foundations of the AZ 'Code of Conduct' (Brown, 2008). A further meeting was suggested where BROSCaT could be demonstrated to top procurement management at their head office at Alderley Park Cheshire. This chapter and the project in general are now discussed in chapter 15 and the concluding chapter 16.

CHAPTER 15

DISCUSSION

This chapter reviews the preceding chapters and considers how the findings might influence existing and future attitudes and options for business in managing biodiversity in the supply chain. The final methodology with the working acronym BROSCaT is demonstrated to AstraZeneca and the outcome discussed along with its evolution both in the short term and the longer view.

15.1 **Biodiversity** – The Next Item on the Agenda is..

The findings of this research project have pointed to a consensus of opinion supporting the view that biodiversity loss, discussed in Section 3.4 (refer to BES & IEEM (2009) for their position statement on losses), and the decline in ecosystem services can have significant implications for business. For example, work by the Millennium Ecosystem Assessment (MA, 2005) and Sukdev (2008), section 1.3, highlighted the way that consumer expectation is driving the demand for more finite materials which is resulting in greater pressures on bio-diverse ecosystems. Examples from Kettunen and ten Brink (2006), section 3.3, discussed how these ecosystems are now experiencing difficulty in sustaining the services and goods that facilitate business development. In addition, work by Perrings *et al* (1999) and Holling and Gunderson (2002), section 3.4, related how rapid environmental changes are affecting the longer-term function of biodiversity in, for example, providing ecosystem evolutionary resilience, time-influenced adaptability and the contribution to climate regulation, as the example from Bowers (2007) showed in section 3.5 and Dietz *et al* (2007) in section 3.5.1.

It has been suggested in section 1.3.1 that a clear and unambiguous definition of biodiversity is needed by industry, and in this respect there are new explanations appearing which are more understandable to a wider audience. Such as the one given by LGE (2007), which proposes that rapid environmental changes need tested responses by natural ecosystems and these are provided by a pool of evolution potential or *biodiversity*, diversity which has been tested throughout a long history.

The definition offered by Bishop (2008) in section 1.3.2 allows business to relate to biodiversity and includes potential benefits from using natural resources sustainably. The definition also includes sharing benefits and so brings in a social dimension, the cultural diversity mentioned in Figure 3.1 and section 3.2.7, and the importance of including a wide stakeholder audience in management decisions as advocated by Marshal *et al* (2007), section 2.4.1, and discussed in section 8.9 and chapter 6. It is the area of cultural diversity that determines the level of anthropogenic interaction with biodiversity as the example from SCOPE (1991) found in section 3.2.7. Although the natural sciences explain the phenomenon (refer to section 1.7) it is, as Delthey in 1892 held (section 3.7.2), within the social sciences that understanding is sought.

With a better social understanding of the science of biodiversity then the link to business can be made, and this paradigm shift may be driven by the social revolution articulated by Price Waterhouse Cooper (PWC, 2006), section 1.3.3, and the power of the consumer. This is the change needed if the links with the sustainable use/economic dimension and the economic equitable sharing/social dimension mentioned by the IUCN (2007) in section 2.4.1, are to be realised and a common understanding of the issues made. Any changes to the way biodiversity is considered will likely emanate from a wide stakeholder influence. The banking sector is an example of this where the better understanding and integration of environmental, social and governance (ESG) in underwriting and product development (UNEPFI, 2007a), section 2.5, will drive responsible finance for industry.

Wider stakeholders includes governments and there are regulatory frameworks largely in place to help drive consideration for biodiversity within industry as identified by UNEP (2002) and Chapin *et al* (2000), discussed in sections 3.6 and 6.5. There are also drivers from various European and United Nations conventions and directives which steer organisations to minimum environmental and biodiversity compliance (Section 3.6), while NGOs (section 6.2) lobby for change and offer guidance to industry on how to comply (sections 4.6, and 6.5.2). Private companies, public sector authorities and government involvement in any published environmental statements, are scrutinised by NGOs and assurance bodies for their accuracy (section 6.4.2). In the public sector there are guidelines for sustainable procurement with, for example, the 'Procuring the Future' document (section 6.6.3). In addition, financial indices, such as the FTSE4Good, the Dow Jones Sustainability Indices, or the Business in the

Community CR Index, give an institutional and public league table for benchmarking environmental credentials (sections 2.5.8, 6.4.3 and 6.6). There are obstacles, however, as Bishop *et al* (2006) found, in the case of biodiversity the subject is often regarded as a public good and an area for government and charities to consider, and therefore offers little incentive for voluntary initiatives particularly in smaller enterprises. Despite the plethora of regulations and policy statements, voluntary frameworks and other rhetoric emanating from administrative stakeholders it is the business world that has to work with economic adaptation to the problem of biodiversity loss. Getting cross-sector industry appreciation of the risks will be a slow process if materiality, discussed by Ashley and Jones (2007) section 6.6, and quality value outlined by Barry (2006) section 6.6.1, and biodiversity remain difficult to reconcile.

It is suggested, Stocking (2008) section 3.7, that the scientific departments of political instruments such as the Convention on Biodiversity (CBD) may be politically biased towards issues of trade and economic growth and are often seen as disregarding scientific advice. This area of political interference needs to be identified and a more open CBD encouraged, balancing the science with politics.

15.2 **Biodiversity** – Awareness of the Risks to Supply Chain Operations

The majority view held by the 3 case study companies in sections 8.6 (Table 8.3) and 8.8, with regard to the environment is one of risk aversion, and biodiversity too is regarded in potential business risk terms. Although the case studies did not engage the supply chain in the research, the case participants themselves are onward suppliers of their products and so the value of the studies in this area is equally good. It is the implementation of the model down an extended supply chain that now needs further practical research, see section 15.4.1. Research by DEFRA (2003) mentioned in section 5.1, also pointed to risk aversion in industry on environmental issues. Out in the wider industrial world, however, the general perception of risk with respect to biodiversity is obscured by an ignorance of the subject, section 1.3. In order to make management decisions with regard to risk an accurate assessment of the potential types and levels of risk is needed. Finding out potential biodiversity risk attached to a product requires good information (section 3.7) from expert opinion and then conveying that information to interested stakeholders, as argued by Allenby (2000) and Brown *et al* (2005) in section 6.2. Lack of knowledge of the subject is one of the main problems within business and has been a recurrent theme throughout the project with Brady (2005) as an example (section 6.5.3), and the need for educating industry, described in section 6.5.4. With education comes the potential to change company attitudes to biodiversity and in regarding the subject beyond compliance, something that McCarthy (2007) stated as a problem in section 4.5.

The lack of information (raised by IEMA (2002) in section 3.6.1), and related education in industry, has potentially added to the low priority given to environmental responsibility, particularly in smaller companies as work by Thankappen *et al* (2004) and Preuss (2005), section 4.5.1, have illustrated. Lack of information has contributed to the situation which now largely exists where biodiversity is not considered as part of environmental management and is seen as external to company responsibility. The example by Adams (2007), section 6.6.4, on poor links to climate change highlights this. The Economics of Ecosystems and Biodiversity (TEEB) climate issue update might focus more attention on links to climate. Phase 1 of TEEB report (2008) identified climate change as the second largest driver, after land-use change, of the loss of terrestrial biodiversity over the projected period 2010-2050 (Braat and ten Brink, 2008). In fact, if biodiversity could be linked to climate change it would elevate its importance to business and help '*internalise the value of ecosystem services into the economy*' (Sukhdev *et al*, 2009, p10). This is the idea put forward by the TEEB initiative, where not only so called brown carbon (CO_2 emissions) and black carbon (formed by incomplete combustion of fossil fuels) but the carbon sequestration potential of green carbon (natural terrestrial ecosystems) and blue carbon (marine ecosystems) should be valued as climate regulators (TEEB, 2009), section 3.5.

Getting this message across and achieving wider industry buy-in is frequently, in reality, difficult. The acceptance of new information and initiatives on the environment is often dependant on, as Welford (1997) stated (section 5.1), the organisational culture of the company (section 8.9), which present internal barriers to progress, as Morton (2004) said (section 2.7), and often the environment is seen as a short term problem as Sheldon (1996) argued, see section 5.1.

Following on the education theme and considering the middle management level within industry, Brady (2005, p104) noted the increasing trend for larger organisations to include environmental and social issues as part of their risk management processes. The findings of this project support Brady's view, however, these issues are often not effectively followed up because of a lack of understanding by all levels of management responsible for risk identification (section 7.8). Biodiversity therefore has even less chance of being considered. Awareness to the potential risks would allow business to decide on the level of management input required for minimum cost and effective outcomes. As part of the BROSCaT package offered to industry there would be an education programme where both the model and business and biodiversity aspects are explained. This would be both in the wider business context and internal organisational implementation stages. Any potential risks or opportunities are identified by level of significance and a score value assigned giving a material value to the biodiversity aspect in question.

15.3 **Biodiversity -** Cumulative Risks and Responsibilities within the Supply Chain

The components of supply chain management, as Stevens (1989) stated in his definition (section 4.1); include the raw material stage, manufacturing, distribution and customers. Therefore the consideration of biodiversity has to include all of these stages and in the same vein as Handfield and Nichols (1999) definition in section 4.1, that is, the integration of biodiversity consideration through supplier relationships. This is essential as multi-tiered supply networks are extended globally as Price Waterhouse Cooper (2006) pointed out, giving companies not governments the power to dictate environmental directions, as the example from Korten (2001) stated in section 4.3. With global operations comes global responsibility, and as Freeman (2007) argues, section 6.2.1, suppliers should be included in any environmental discussion. There are examples of drivers for including suppliers in environmental management, as Ridgewick (2008) section 4.4.1 found, where wider outsourcing and industrial fragmentation bring dangers through inadequate due diligence of sub-contractors within a supply network. The due diligent management of environmental issues, including biodiversity, within a supply chain has to be done by applying the same criteria and processes to all companies. This is also the idea of a common framework used by guidelines, section 4.4.2, and the operation of the same significance of risk criteria, section 5.5. These processes all offer a level playing field and the same principle applies to the accredited environmental management system, Table 8.2 and section 8.5.

The 4 choices of managing environmental issues given in section 12.3 give a focal company options depending on their organisational situation. Whichever type of EMS is used by an organisation it is the level of risk, assessed in context, attached to a biodiversity aspect that determines the level of action needed, and this is again connected to good quality information. Whatever the level of management action in the wider company operation those suppliers have the collective potential to add considerably to halting biodiversity decline (Section 4.4). Supply chain management (SCM) is, however, often seen as old fashioned in terms of considering environmental issues, restrictive to new initiatives and is at present, often a barrier to innovation (Section 4.7). An environmental management system process has the potential to by-pass these barriers if used throughout the whole supply chain.

The use of environmental management systems (EMS) is becoming more widespread within industry, and the increasing use of accredited systems such as ISO 14001 and EMAS is testament to the market forces driving companies to achieve them, in order to maintain and compete in the market (section 6.4.1). The survey in Chapter 6 indicated that currently the majority of organisations rely on their own in-house designed EMSs, which have been in place and tested for many years. The project case-studies, with supportive evidence from the wider study, showed that, whichever type of EMS is used, finding and communicating the relevant information needed for continual improvement on biodiversity issues is difficult, as discussed above (refer to section 8.2.1 for an example). A consequence of this poor communication is that for the majority of companies, in particular small and medium sized organisations, the fast moving 'green' business world described above, is putting them at the back of the grid, and they are losing competitive advantage as a result (Section 4.5.1).

Communicating biodiversity/business information often relies on dedicated personnel within an organisation. In this respect the project case-study research (Chapter 8) has highlighted the importance of a 'champion' within an organisation, with empowerment to drive biodiversity consideration (Section 7.7). The loss of the project champion in all of the case-study companies proved to be a stumbling-block to completing the wider company supply chain research, and the testing of the methodology (Chapter 8). The modern business climate necessarily means a high probability of company take-overs and/or management restructures. The management systems operating within departments, whether procurement or environmental, are processes which are designed for self-running, and shield the day-to-day operation of the company from changes in management or ownership (section 6.6.2). A current obstacle to biodiversity consideration within an organisation is that it is often not part of any embedded management process. Therefore, if the person who recognises and is driving biodiversity consideration leaves a department or organisation, its importance is no longer recognised. A newly appointed manager often means departmental changes which may 'reset' any progress in attitude, and biodiversity then has to restate its case for consideration. The Bath University School of Management (2005) in section 4.9 concluded that 'harnessing the potential of individuals' was an important factor in sustainable procurement and the existence of champions to drive biodiversity is a key factor to achieving progress.

Achieving company departmental 'buy-in' of any procedural change or new concepts or paradigms can be difficult, and the involvement of all interested departments is essential in whatever idea is being 'sold'. The same principle applies to external suppliers, where getting them involved in a partnership at the policy stage is essential. Rose (2008, p12) commented on the selling of new paradigms with,

'*The lesson for companies is that selling is hard work. And it is no good to get too far ahead of the customer. Half a step ahead is about right, much more and you won't sell. Any less and you won't lead'.*

The same principle applies to 'selling' biodiversity to industry and a gradual approach is needed. The BROSCaT model is designed to be adapted to individual company organisational culture and can include the exact level of biodiversity consideration tailored to the resources available.

15.3.1 Existing initiatives where biodiversity could be included

The research conducted by this project has shown that companies are protective of the power and influence a brand has in the consumer market (sections 6.4.3 and 6.6.1).

Companies will put energy and resource into shielding a brand's image from product or supplier publicity events which may reflect on the organisations reputation (sections 4.4.2 and 4.10). Protecting product brands has become a brand in its own right, with examples from Marks and Spencer's 'Plan A' (M&S, 2008), BskyB's 'Bigger Picture' (BskyB, 2008), Boots 'Botanics' (Alliance Boots, 2008) and General Electrics 'Ecomagination' (GE, 2008) - all companies keen to present good sustainability credentials. Taking M&S's mantra, 'Plan A because there is no plan b' – maybe the final methodology of this project could be called Plan B (where the 'B' is biodiversity). Another example of this continuing trend comes from the French Environmental Minister who is asking French companies whose brands use animal logos, such as, Lacoste (crocodile), Peugeot (lion), to help save endangered species with the campaign 'Save Your Logo' (AFP, 2009). Companies with the resources to do so, publicise their environmental achievements in corporate responsibility reports (Chapter 6) often presented within environmental guideline formats (sections 2.7 and 6.5), which offer assurance to the reader (section 6.3). The life cycle assessment model discussed in sections 2.5.1 and 5.5 could be used to incorporate biodiversity but a barrier to its wider use, suggested by Tickel (2009), by industry could also be that it is often too costly to implement across a whole supply network. The BROSCaT model is more cost effective to use as it focuses resources on strategic suppliers or suppliers with a potential significant risk. These identified suppliers then apply BROSCaT to their highlighted suppliers and they bear any associated costs. The aim is to spread the costs of biodiversity consideration of a product through partnership working down a supply chain.

There are areas where attitudes to biodiversity are slowly changing as Henriques and Richardson (2004) maintain, section 4.7, and companies are beginning to discuss the issues, not just in terms of 'savings', but in financial 'value added' (sections 4.5, 4.9 and 4.10.1). Businesses are finding it harder to disregard the circular process between finance, biodiversity impacts, business development and the link back to a financial origin (Goba *et al*, 2008), and are assessing the material value of this realisation (section 6.6). Forward looking organisations are seeing economic prosperity and employment linked in fundamental ways to a stable climate and healthy ecosystems.

There are also related business functions that may suffer without timely action, for example, many jobs could be lost due to resource depletion, biodiversity loss, increasing natural disaster impacts, and other disruptions (UNEP, 2009). The assessment and risk identification of biodiversity impact needs to be regularly updated in order to protect the business. It is also important, as Brady mentioned that environment risks to business due to times of change, such as ownership or reorganisation, should be reviewed to ensure continuity is maintained. This has been the situation with all 3 of the project case studies where biodiversity initiatives have stopped or been delayed due to management change. The implementation of BROSCaT helps to ensure the continuity of effective biodiversity and business consideration through management or owner changes or the loss of a champion, discussed in section 8.7.5.1, within a company's organisational culture, discussed in section 8.9.

15.4 **Biodiversity** – Educating all Interested Parties

As discussed in section 8.9 it is vital if new initiatives are to be integrated into existing management processes that both internal and external stakeholders are included in discussions. Added to that, cross-departmental ownership of that initiative has to be achieved, sections 9.3; 10.4.1; and 10.7.4. Ownership spreads the risk of losing single champions if whole departments with top management backing buy into new processes. It is important therefore to integrate training and education programmes when introducing new processes, in this case the BROSCaT model.

Suhkdev *et al* (2009, p28), section 3.5, used the term 'fungibility' to illustrate the interchangeable aspects of the colours of carbon and the same principle of connective-ness has been a recurrent theme throughout this project. For example, in describing the levels of biodiversity (section 3.2 and Treweek (1999), section 3.2.4) and related environmental, social and economic components (Elkington (1994), section 4.7) with respect to business operations, illustrated by Korten (2001) in section 4.3. Biodiversity can not be discussed as an isolated topic but should be considered within the social and business context in question, and this principle forms the basis of training and education of personnel and other stakeholders as part of the BROSCaT model, the advantages pointed out by Porritt (2005), in section 4.7.

All players in both the world market of business and ecosystem science bodies should be made aware of the mutual relationship of natural ecosystems and business material supply, as examples show from Gaston and Spicer (2004), section 3.2; Chapman *et al* (2001), Leemans (2001) and the MA Assessment (2005), section 3.3. It is also important to keep relevant stakeholders informed and up to date on the latest biodiversity related information, particularly within the context of industrial sector, product or service type and organisational structure. In parallel with educating individual businesses, as part of the BROSCaT process, a series of workshops, seminars, academic papers in business journals should be instigated and aimed at scientific bodies (e.g. British Ecological Society, Society of Biology), business schools and academic and business conferences.

15.5 Presentation to AstraZeneca (UK)

A presentation was given on 14 July 2009 outlining the results of the PhD project. As part of the presentation a demonstration was given on the biodiversity risks and opportunities in supply chains assessment tool (BROSCaT).
The presentation was made to the AZ Essentials SHE Biodiversity Projects Manager, the SHE Outsourcing Engagement Manager and the Global Real Estate Manager.

The presentation was titled: *Managing biodiversity impacts and opportunities in company supply chains.* The presentation covered the following areas:

- Drivers for considering biodiversity in the supply chain.
- Identifying potential opportunities and threats (incl. sustainable sourcing of raw materials, ensuring security of supply).
- AZ case study – solvent supply chain.
- Practical problems/issues encountered and key learning points gained during the project (incl. other case studies).
- Practical tools for risk appraisal.
- Recommendations.

Following the presentation there was an open discussion on how BROSCaT could be incorporated into purchasing guidelines and practices. For example, the integration of these considerations/tools with existing management systems (ISEP, see Section

10.4.4 and 10.4.5) and CR principles in purchasing practice (Section 10.4.4). The idea was to discuss how best to sell biodiversity and associated risk assessment tools to internal purchasing managers.

15.5.1 Further Meetings

The attendees at the Alderley Park meeting thought the project proposal should proceed to the next stage and a WebEx internet meeting was planned for a further presentation to more interested parties at AZ. This presentation was intended to cover a number of areas highlighted by AZ, that is: Links between biodiversity and climate change; valuation of biodiversity and ecosystem services; outsourced manufacturing is considered to be a significant risk, how can BROSCaT help; how would the KTP work for AZ – contributions – cost, time; how great is regulatory and stakeholder pressure behind biodiversity; who is sponsoring the KTP.

As soon as more information on the proposed KTP is available, on costs and timescales, AZ would consider becoming a participating partner in the project (Brown, 2009).

15.5.2 Knowledge Transfer Programme (KTP)

As a result of the interruptions to the momentum of the 3 case studies the testing of BROSCaT model alongside existing procurement processes was not possible. However, the case study companies as well as being buyers are also suppliers, therefore, the model is seen to be equally useful from a suppliers viewpoint. The advantages of the BROSCaT model are seen from all stakeholders viewpoints. The general format of BROSCaT has been accepted by AstraZeneca as a potential workable business tool that would benefit both the company and contribute to the halting of biodiversity decline, as described in Section 1.3 on the initial need for the research. In order to make the model more powerful and provide a viable platform for introducing the tool to industry further refining is needed with real situation testing within company supply chains. The ideal situation would be to work alongside academia and business to share theoretical and practical knowledge in designing the final product and tailoring it to specific product lines.

The KTP programme fits the above criteria with the potential of a further 2 years of development time. In addition, the extra time enables the model to be presented to a wide range of potential stakeholders making them aware of the need for the tool and its potential business opportunities. A KTP proposal has therefore been submitted and been approved by the funding bodies with the intended start date in January 2010. The academic partner for the KTP will be Cranfield University.

15.6 **BIODIVERSITY -** Future Directions and Opportunities for Further Research

As pointed out in section 4.10 a responsible environmental image is good for business and investors, good for attracting and retaining employees, good for local communities, and essential for their licence to operate. The next step for industry is to build on these initiatives concerning their landholdings and direct operations, and recognize their biodiversity responsibilities in the supply chain.

The experience and publicity gained through other environmental and business efforts to combat change, for example, dangerous climate change (sections 2.8; 3.5; 4.9) should now be used to address other global environmental issues, such as biodiversity loss. The success of providing incentives for business to reduce carbon emissions could provide mechanisms for adding material value to biodiversity. An example comes from the United Nations Environment Programme (UNEP), the Conservation Union (IUCN) and Secretariat of the Convention on Biodiversity (SCBD) which has launched an initiative to research options for an International Payment Mechanism for Ecosystem Services (IPES). IPES will now have a special emphasis on biodiversity (IPES, 2008). This area of research would benefit from including the supply chain in assessing impacts on ecosystem services and biodiversity.

Since the Conference of the Parties (COP-8) the business and biodiversity agenda has been receiving an increasing amount of attention. The encouragement provided, for example, by corporate social responsibility reporting (Chapter 6) could be a driver in persuading the private sector to become a full partner in biodiversity conservation, and promote enabling environments for private investment in sustainable management of biodiversity. COP- 9 further promoted business engagement with the focus on continued development of the business case for biodiversity.

This project has suggested that different industrial sectors have different incentives for considering biodiversity, and require different approaches to managing risk or opportunity. Some organisations have more experience than others in dealing with biodiversity. In this regard some European countries are adopting a proactive stance, notably Germany, where for the first time a group of internationally renowned businesses from a wide range of sectors has acknowledged their responsibility for the protection and sustainable use of biodiversity. A group of global 'trailblazing' companies from various sectors have taken on the IUCN initiative 'Business & Biodiversity', and joined in a partnership agreement under the motto of 'Biodiversity in Good Company' (Section 2.5.2). This is an area where further research, which encompasses the assessment of risks and opportunities to biodiversity within supply chain partnerships, has possibilities to produce real results for reducing cumulative impacts.

Obstacles to the take-up of biodiversity consideration across industry will be difficult to overcome in the short term however. One test for assessing attitudes as to how important large organisations regard risks, such as biodiversity impact, is the extent they are prepared to pay for insurance cover. White (2009) comments, that it is unlikely within the insurance industry that biodiversity issues will be considered in terms of products for risk in the supply chain, at least not in the short term. White and Pohl (2009) comment that initiatives from various (mentioned above) agencies (see sections 2.6; 3.6), conventions and treaties, are seen as just rhetoric from a business perspective. They further comment that business attitudes (section 4.5) are unlikely to change in the short term unless they get pressure from national governments and governments will not act until, in the European context as an example, they get pressure from the European Parliament (EP) and the EP will not drive issues such as biodiversity without sustained pressure from NGO's. This type of lobbying will be more successful if coupled with a change in consumer attitude to the natural environment.

Recommendations for further research to strengthen the methodology include:

- Reducing the uncertainty surrounding biodiversity with wider publicity and;

- including biodiversity aspects into business management processes and management school curriculum's – showing how biodiversity consideration can make a meaningful difference to business operations;
- additionally, research into altering consumer attitude's to biodiversity would ultimately drive manufacturers to change their methods of supply chain management – education and training of the supply chain from raw material suppliers to manufacturing/production services to distribution and the consumer, as the definition by Stevens (1989) stated in Section 4.1;
- further development of a supportive auditing method for assuring company supply chain biodiversity claims, in order to avoid a 'tick-box' mentality, as mentioned in Section 5.1;
- research into electronically linking similar biodiversity impact and supplier management responses to situations, where the information is not sensitive. In respect to the latter, the linking of information would reduce the management 'action overlap' of similar supply chain networks, and streamline scarce resources for biodiversity management;
- work on quantifying biodiversity material value is needed (The TEEB Initiative is an example) in order to provide incentives for businesses predominantly accountable to dividend inspired shareholders;
- the development of a database platform where both adverse management actions and successes could be archived and accessed for training internal management or external partnership suppliers;
- bodies such as regulators and NGOs could be approached for help in partnerships and may form part of the partnership.

Whichever market position an organisation is operating, the opportunity for considering biodiversity in the supply chain exists through the product or service, and the associated material supply, which is the common subject matter linking the buyer and supplier. This business relationship is the framework and the opportunity to form partnerships whereby biodiversity aspects are managed within a common accredited EMS such as ISO 14001 or through a bespoke in-house designed system (section 4.4.2), with the option of using BROSCaT as a common assessment format. Designing a database for extending the real time multiple use of BROSCaT would be useful future research.

The conclusion drawn form these findings is that the BROSCaT methodology described in chapter 14 would not regard any general industrial sector, or biodiversity risk sector as described by the F&C study, as a particular special case requiring separate consideration. As biodiversity is poorly considered over all sectors the fundamental framework of the methodology would be the same for all industry. Individual companies would have a bespoke version to take account of, for example, company size and organisational culture; product/service type and cross-sector influences; the levels of biodiversity (including the cultural element); plus the degree of management/resource needed depending on the significance of the supply chain biodiversity issues in question. The BROSCaT methodology described in chapter 14 is a facilitating management tool which works according to the same operational framework or playing field, across a whole supply network.

This project's aim and objectives have been designed to investigate existing business environmental practice in supply chain procurement and evaluate the benefits of considering biodiversity. The findings have resulted in a methodology and practical model whereby these benefits can be maximised for the profit of business and biodiversity. The aim and objectives are now evaluated in chapter 12.

CHAPTER 16

CONCLUSIONS

16.1 INTRODUCTION

This Chapter concludes the project and examines whether the aim and objectives, set out in Chapter 1, have been met. A summation of the methodology and consideration of the projects value is discussed in terms of offering a novel approach to managing biodiversity within company supply chains.

16.2 PROJECT AIM

The overall aim of the project was set out in Section 1.4, as:

To design a research programme specifically to answer the questions posed by business on how to consider, assess and manage impacts on biodiversity in the supply chain. The end result will be a methodology for incorporating the assessment and management of environmental impact on biodiversity of supply chain companies, into accredited company Environmental Management Systems such as ISO 14001 and EMAS. In addition, a methodology will be developed for considering biodiversity in the supply chain in non-accredited management systems. The methodology is not intended to provide any detailed or technical method for directly surveying biodiversity, but to give companies a process for introducing awareness of the risks and opportunities and to integrate biodiversity into their supply chain management systems.

The aim of the project has been achieved with the creation of a methodology which allows business managers to specifically assess and manage the risks and opportunities regarding likely biodiversity aspects within the supply chain. The methodology examines both individual and cumulative potential risks and opportunities to business operations and ecosystem function. The methodology has the flexibility to be adapted to any industrial sector in providing a novel, attractive, and commercially viable proposition in supply chain management of biodiversity issues. This is achieved both within a bespoke biodiversity management system and the framework of an accredited environmental management system (EMS) such as ISO

14001. The process has also been designed to be transferred to a computer management tool (BROSCaT) using the Excel based system allowing another option to managers for practical operation of the method.

The aim was accomplished in 3 stages by establishing the following 9 distinct objectives, as outlined in Section 1.3. How successful the project was in achieving each objective will now be discussed.

16.3 PROJECT OBJECTIVES

Stage 1:

> **Objective (i)** – *Conduct a literature review and business and biodiversity appraisal to a) gain a knowledge and understanding of work undertaken to date relating to the management by organizations of biodiversity within their supply chains and b) to gain a wider view of the overall business and biodiversity debate and of any schemes and initiatives that may relate to achieving the project aim.*

This objective was achieved in two parts. Part (a) was accomplished by conducting an extensive literature search into material concerning biodiversity and business, within a supply chain context. The scope of the project included a broad examination of the historical and current attitudes to biodiversity issues within industry, and wider stakeholder groups (Chapters 2, 3, and 4). This provided the project with an informed base-line appraisal of what was being discussed in this specific area.

Part (b) investigated the business notion of the importance of biodiversity issues to the continuity of growth (development) within cultural and ecosystem sustainable limits. The knowledge gained enabled an informed approach to conducting Objective (ii), and the ability to 'speak the same language' to both environmental managers and business/supply chain practitioners.

> **Objective (ii)** – *Undertake a series of interviews to assess the current attitudes of businesses to biodiversity within their supply chain and where relevant explore their biodiversity management practices.*

Objective (ii) was achieved by designing a research programme to deliver the objective in an efficient way, within the project duration and budgetary framework.

This entailed attending UK and international business, biodiversity, ecology, academic, political, institutional and professional workshops, seminars, and conferences, throughout the project. These events are tabulated in Appendix 6.

By entering the business and environmental debate ‘circuit’, the researcher was able to integrate with the key players active within business, biodiversity, academia, politics, NGOs and other stakeholder groups. This gave access to topic keynote speakers, CEOs, leaders and managers, within single venues who would otherwise be difficult or impossible to engage with through the normal communication channels. This direct approach enabled interviews with people who could offer expert opinion, be in a position to raise awareness and ultimately, drive change in attitudes to biodiversity within supply chain operations.

The evidence obtained from these events (Chapters 2, 3, 4) substantiated the findings from Objective (i). The subject areas covered by the research included, general environmental issues that were considered to have a connection to biodiversity, such as, climate change, supply chain logistics, energy consumption and use, waste, recycle/reuse, and ecological/conservation. Attending, participating and interviewing/networking within the wider environmental debate enabled the project to orientate, in what is a fast changing and complex business arena. In addition, the information gained was on the latest management attitudes and the position that biodiversity currently occupies within business, and political and wider stakeholder agendas (for examples see Sections 1.3.1 and 1.3.2, and Section 4.5).

The interviews revealed the reasons and barriers that have resulted in the current marginal relationship between business and biodiversity, and informed the exercise undertaken in Objective (iii).

Objective (iii) – *Determine the drivers motivating organisations to engage with biodiversity issues within their supply chains.*

This objective was met by focusing the outcomes from the research undertaken in Objectives (i) and (ii), and identifying companies who had already considered to some extent the biodiversity responsibilities of their wider operations. A broad based case-study was employed which investigated a wide spectrum of industry in order to examine how these organisations regard the opportunities and advantages of good biodiversity management in the supply chain. To augment this research an investigation was conducted into the role and drivers of Corporate Social Responsibility (CSR) reporting in managing and publicising company biodiversity issues and environmental procedures and operations (Chapter 6). Emphasis was given to examining the company supply chain and its position in the context of sustainable development and procurement (Section 6.4.1). As part of the exercise a study was made on the driving influences that internal and external stakeholders exert and how their collective pressure can often change company policy (Section 6.2).

Following an overview of CSR reporting in general, a survey of published CSR reports from companies across a range of industrial sectors was made (chapter 7). The object of this survey was to look for suggestions of industrial sectorial trends in the level of biodiversity consideration content in these reports. Within this review, there was a particular focus on environmental management systems (EMS) and their use within company supply chains. The survey found that the majority of survey companies had some form of EMS in their internal (non-supply chain) operations. With regard to external operations, companies were more likely to extend their in-house EMSs into their supply chains for information on general environmental issues. Fewer companies required suppliers to take up an accredited system such as ISO 14001 (Section 7.4, Table 7.4).

A pattern emerged throughout different industrial sectors of similar drivers (and obstacles), which determine the extent to which a company engages with its suppliers, on environmental and specifically biodiversity issues (Chapters 2, 4 and Chapter 7, Section 7.8). The findings of this objective influenced the criteria employed in selecting potential partners for an in-depth case study (Section 7.5).

Objective (iv) – *Identify a small number of businesses covering a range of activities where Biodiversity plays a significant role within their supply chains, and establish their willingness to collaborate in the research.*

This objective was partially achieved by asking a number of organisations (that met the criteria for selection (Table 8.2) if they would be willing to work with the project as case study companies (Section 8.5). Four organisations had collaborated with previous biodiversity related PhD projects, and they were initially willing to work with the project (Section 8.5.1). However, due to company takeovers and/or management reorganisation, two of these organisations dropped out of the project (Section8.7).

This left BAA (Heathrow) and Center Parcs (UK) as the key case study partners. In order to strengthen this element of the research a third company was sought. A number of organisations were approached, with AstraZeneca (UK) eventually joining the case study group. The resultant delays in finding case study working partners impacted on the time available to conduct Objective (v). The Objective (iv) was eventually achieved but, the time taken in doing so resulted in a rescheduling of the projects intended time frame (Section 8.7). A number of other companies were approached and they provided supporting information which gave a triangulated element to the results (Section 8.8.1). The loss of project ‘champions’ proved to be a significant factor in the design of the case-studies and illustrates their importance in driving these issues forward (Section 8.9). There was also a lack of willingness on the part of suppliers, to respond to specific questions on biodiversity. The reasons for this may include lack of time or ability (knowledge) to respond, but nevertheless reflects the relatively low importance attached to the subject.

Stage 2:

Objective (v) – *Undertake pilot studies of at least two businesses to inform the research procedure.*

Case study pilot procedures at BAA (Heathrow), Center Parcs (UK) and AstraZeneca (UK) were undertaken. These initial investigations into the company supply chains management procedures, revealed their suitability for further in-depth study (Chapter 8). BAA, CP and AZ are organisations from different industrial sectors, but all have direct, indirect and cumulative impacts on biodiversity in their supply chains. The pilot studies for these companies took longer to complete than was initially planned due to the reasons explained in Objective (iv). However, the time allowed for these initial evaluations was enough to establish their suitability for further in-depth study (Section 8.7).

Objective (vi) – *Evaluate the practices and procedures adopted by organizations for assessing and managing the impacts on biodiversity of their supply chain, using the case study approach.*

The case studies with the working partners (Chapters 9, 10, 11) enabled this objective to be achieved. Information on supply chain management procedure, which had been obtained before the management changes at these companies, was enough to inform the construction of the methodology. Center Parcs (CP), as a result of the management restructuring, could only give access to internal management procedures relating to environmental issues in the supply chain (chapter 9). Communications with the CP supply companies was not possible during the time of the project. However, AstraZeneca (AZ) indicated that communications with their solvent supplier list was possible, and contact information was provided by their buying departments.

The AZ case-study encountered a number of obstacles in contacting their solvent suppliers, and in obtaining responses to a supplier biodiversity questionnaire (Appendix 4). The 3 organic solvents manufacturers investigated all failed to supply any information on their biodiversity impacts and management procedures, and AZ was also unable to obtain information. The main solvent manufacturer in the supply chain, selected by AZ for particular attention, did not respond to email or telephone communications (Section 10). The buying departments at AZ, however, supplied enough information on their general procedures and relationships with suppliers to inform the case study with meaningful data regarding their internal management procedures (chapter 10). The case study could not, however, be extended to direct engagement with AZ suppliers.

The Objective called for an investigation into the internal management practices and procedures of suppliers. Although information obtained was adequate for the Objective, the supplier perspective that would have supported and strengthened the design of the methodology was not achieved. Having said this, AZ and the other participating companies are suppliers as well as buyers and the suppliers viewpoint was understood and equally valid. This underlines the need for buying companies to engage and work in partnership with suppliers. However, as the ethical investment company F&C Asset Management suggest, suppliers themselves need to be more proactive and realise that by failing to take some initiative they may lose competitive advantage and business opportunities (F&C Asset Management, 2008).

Stage 3:

Objective (vii) – *Construct a methodology that employs an EMS framework, for assessing and managing biodiversity impacts within a supply chain.*

The ISO 14001 EMS framework identifies environmental aspects as part of the initial environmental review (IER). This objective was achieved by emphasising biodiversity aspects, with respect to the supply chain, as part of the IER (chapter 12). If, as a result of the IER, any biodiversity aspects within the supply chain pose a significant risk to a company then the likely impacts are evaluated and included into the EMS process. An appropriate focus on biodiversity consideration may be included in the environmental policy of the company (Section 12.4).

Objective (viii) – *Construct a methodology that can be used without a formal EMS framework for assessing and managing biodiversity impacts within a supply chain.*

The appropriate process principles and values from the previous objectives were applied to the construction of a non-accredited EMS framework. The method's design allows for both environmental department expert input on biodiversity aspects, and buying department input relating to specific suppliers. Each departmental manager or relevant person then has access to biodiversity and business related information and data, through the internal document (BIFS File) and external web-based links. This leads to a demystification of the science of biodiversity by explaining its impacts on company responsibilities in business related language (Sections 12.4.1 and 13.2.1).

The four stage approach of the methodology allows the biodiversity risks and opportunities identified with the product and market to be assessed and entered into strategic planning. Working relationships are encouraged with strategic suppliers on environmental and specific biodiversity issues. The main impacts relating to the biodiversity aspects are identified, and the significance of the risk evaluated. This allows managers in the supply chain to know the level of actual and potential risk or opportunity both to biodiversity and to the business and to action the appropriate management response (Section 13.2).

At each stage the biodiversity information file (BIFS) is updated with relevant and appropriate data that will enable practitioners to apply an informed response in managing impacts. The biodiversity information file can also be utilised for training and continual improvement of the method (Section 13.2).

The main concern of supply chain practitioners interviewed throughout the project was that any new methodology should easily integrate with existing management tools. This reaction from managers essentially meant that a standard 'paper method' for biodiversity management would probably not achieve the full 'buy in' or reach its potential to be practically effective within procurement departments (Chapters 9, 10, 11). This feedback from industry was the driver for the methodology to add a practical 'tool' for managers to implement the findings of the IER and the biodiversity management methodology. The practical method uses the Excel based system (with the acronym BROSCaT – Biodiversity Risks and Opportunities in Supply Chain Assessment Tool) as the vehicle or tool for implementing the methodology (Section 13.3). The decision to adopt an Excel based system was endorsed by one of the case study companies, as likely to be the best way forward (Tables 8.2, 14.1, and Section 14.5).

The information contained within BROSCaT (and backed-up by the biodiversity information file (BIFS)) can then be evaluated for the level of business and biodiversity related risk to which the company is exposed. The resulting one page summation of risk and/or opportunity, associated with a whole product supply chain, gives company directors an informed 'biodiversity picture' of the organisation's wider operations (Section 14.3). The findings shown through the application of the methodology require management action. Management decisions can then direct their resources towards mitigation of risk or to exploit opportunity, and lead to better partnerships with suppliers. Better dialogue then allows potential pooling of expertise and resources in mutually beneficial actions, which both endorses a product and contributes towards the halting of biodiversity loss.

Objective (ix) - *Undertake trials of the proposed methodology and evaluate its viability.*

The intended trials of the methodology, in order to meet Objective ix, experienced difficulties as a result of the loss of project champions. Both BAA and Center Parcs were not in a position, within the project time scale, to allow a trial of the methodology (Section 8.2.9).

However, the methodology was demonstrated to AstraZeneca (AZ), procurement and biodiversity managers. The feedback from the presentation was positive, and AZ said they would be happy to use the methodology particularly in its bespoke BROSCaT format. The methodology designed as per Objective viii, would initially be tailored to the AZ organic solvent supply chain and later expanded to other products, services and materials. The AZ management believed, however, that any introduction of the method to present buying procedures was not possible within the next two years. Further presentations were given with a favourable response from AZ managers (section 15.5).

Although the case study of AZ organic solvents was not fully implemented, the information displayed on the methodology worksheet did highlight the potential exposure AZ faces to biodiversity issues.

16.4 EVALUATION OF THE PROJECT RESEARCH PROCESS

The early research during this project indicated the lack of understanding of the esoteric subject of biodiversity within industry in general. The chapters have therefore been written with the non-biologist in mind. Specialists in the subject may feel the chapters are lengthy but the intention is to provide information for a general industry audience.

There is one key change that the author would make if starting the research again. The industrial partner had been associated with two precursor research projects, and had approached the original clients/case study partners for a similar collaboration to support this research. In hindsight, this meant that the project had not directly formed the relationship, and a feeling of 'ownership' from the prospective case study partner was lacking.

These companies subsequently left without genuinely 'buying-into' the project, which resulted in a significant loss of time. In hindsight it would have been better if the project had found its own case study partners, as it did with AstraZeneca, where the ownership was between the researcher and the company concerned. This approach would also take away any suggestion of a direct commercial link with the project, and allow a more objective relationship.

16.5 SUMMATION

Business and society attitudes have introduced barriers that have resulted in biodiversity occupying a relatively low profile in business supply chain management. The methodology produced by this project provides a novel mechanism to elevate biodiversity to a higher profile by allowing an organisation to integrate biodiversity issues into an existing non-accredited or accredited management process. This can be achieved without a continuous input from one individual or champion. The method links both expert and non-specialist procurement managers to relevant levels of detailed information on biodiversity in order to facilitate its management in the supply chain. The information displayed on the schemes worksheet draw attention to the cumulative impacts, to both biodiversity and to the business, of a product supply chain and any related financial implications can not then be overlooked or ignored at any level of management. This was highlighted in the AZ study (Section 10.3), where the solvent supply chain had a great deal of uncertainty attached to it, prompting further precautionary investigation into the likely potential risks involved in purchasing a particular product.

The public disclosure of (non-commercially sensitive) good biodiversity management in the supply chain can be used to gain competitive advantage (Sections 4.3, 4.7 and 4.10), and should be a powerful incentive for business. This is apparent within the industrial sectors discussed in chapter 2. But the potential for associated market gains could also present a barrier in terms of instigating biodiversity partnerships and information exchange with suppliers, from buyers afraid of losing market differentiation. Conversely, competitive advantage could be strengthened by linking a chain of suppliers with the focal company and the product, for example, in publicising the reduction in cumulative impacts (Table 4.1, Sections 4.4 and 4.10).

The study in Chapter 6 indicated that biodiversity aspects present mutual monitory advantages in both business and corporate responsibility terms, in reducing biodiversity loss. Partnerships formed by biodiversity principles/policy agreements, with the same philosophy of pooling common resources discussed in Section 6.6.2, would have the potential to strengthen both individual organisations and sector management of the likely risk to brand or reputation. An approach similar to the chemical industries REACH Regulation – Substance Information Exchange Forum (SIEF) could be used (Section 2.5.2). SIEF is a communication requirement whereby suppliers have the information they need to use chemicals safely. Registrants are required to share information to prevent duplication of existing data (EC, 2007). Care would have to be taken in ensuring that biodiversity 'information partnerships' would not constitute a monopoly (Section 2.5.2), as the competition commission (CC, 2008) worn, when it appears that competition may be being prevented, distorted or restricted in a particular market.

Chapter 13 described an alternative methodology from that discussed for accredited environmental management systems (EMS), in Chapter 12. Although the project methodology was primarily designed for integrating with existing in-house management systems, the method can be used within the frameworks of both non-accredited and accredited systems. As a prerequisite, suggested by business managers in the case studies throughout this project, the method has been designed to be easily incorporated into an IT platform already widely used in general management and procurement supply chain management.

The aim is to offer to management the possibility of assessing company exposure to *inter alia,* potential material supply interruption, brand image, and reputation issues, while highlighting the potential opportunities to business of good biodiversity awareness and the contribution to halting biodiversity loss.

With detailed information on the level of exposure to risk, managers can direct resources where they can be most effective. The degree of risk therefore determines the level of management resource expended on biodiversity. The above explanation is essentially a compliance view where organisations need do only the minimum to satisfy their responsible business practice codes. For companies that would like to operate beyond compliance, the information the methodology provides on one worksheet for each supplier provides opportunities to enhance biodiversity throughout the whole material supply chain.

In conclusion, the methodology produced by this thesis gives buying management teams a novel outline view of a product or material procurement chain, which gives access to relevant business and biodiversity educational information, while highlighting areas for attention. This allows company business leaders to be better positioned to both forecast potential improvements and threats to brand image (with respect to biodiversity), and future-proof the company in terms of securing reliable, uninterrupted, and sustainable material supply for a product. Importantly, the methodology allows different company departments, who often operate separate agendas, to interact with each other. Increasing dialogue helps takes out any mystique which may be attached to biodiversity and related business issues, and allows non-specialist managers to understand the commercial importance of biodiversity.

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GLOSSARY

Aspects – Activities, products and processes that can or do interact with the environment.

Asset - Anything of value. Assets can be in the form of money, such as cash at the bank or amounts owed to you; they can be fixed assets such as property or equipment; or they can be intangibles such as your company's **goodwill** or **brand**-names. For accounting purposes, assets are things with future economic benefits, for example providing future cost savings or generating future revenue (Carew, 2008).

Amortisation - An accounting description of the writing-down of the book value of an asset over time. Accountants use the term 'amortisation' to describe what others would call 'depreciation' when writing down the value of intangibles such as patents or brand name, good reputation, or goodwill.

Bagasse (Oxford University Press) - The residues from sugar-cane milling, consisting of the crushed stalks from which the juice has been expressed; it consists of 50% cellulose, 25% hemicelluloses, and 25% lignin. It is used as a fuel, for cattle feed, and in the manufacture of paper and fibre board. The name is sometimes also applied to the residues of other plants, such as beet, which is sometimes incorporated into foods as a source of dietary fibre.

Biodiversity Aspect – element of an organisation's activities or products or services that can interact with ecosystems and biodiversity.

Biodiversity Impact – any change to biodiversity, whether adverse or beneficial, wholly or partially resulting from an organisation's biodiversity aspects.

Biological Systematics - is the study of the diversity of life on the planet Earth, both past and present, and the relationships among living things through time. It is used in the understanding of evolutionary history of life on Earth.

Book value - The value of an asset as stated in a company's financial records. Accountants distinguish between book value and net book value. The former is the original (historical) purchase price of the asset, possibly revalued. It is not necessarily the price the asset would fetch if sold in the market, or what it would cost to replace. Net book value is the original value of the asset less depreciation which has been charged against it.

Brand Equity - The intangible value associated with a particular brand identity.

Business Case - A rationale for a business decision, based on analysis of costs, risks and benefits.

Champion - A person that actively endorses a proposed initiative and thus influences its adoption.

GLOSSARY Continued

Climate Change (UNFCCC usage) - A change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods. (Houghton *et al*, 1996)

Climate Change (IPCC usage) - Climate change as referred to in the observational record of climate, occurs because of internal changes within the climate system or in the interaction between components, or because of changes in external forcing either for natural reasons or because of human activities. It is generally not possible clearly to make attribution between these causes. Projections of future climate change reported by IPCC generally consider only the influence on climate of anthropogenic increases in greenhouse gases and other human-related factors. (Houghton *et al*, 1996)

Corporate Citizenship - Treatment of stakeholders in an ethical and socially responsible manner.

Corporate governance - The system by which business corporations are directed and controlled.

Corporate Social Responsibility (CSR) - Commitment to uphold human rights, behave according to accepted environmental and ethical standards, and contribute to socio-economic development and quality of life.

Cost of ownership - The total cost incurred by a customer in acquiring, using, and disposing of a product.

Constructivism – an ontological position that asserts that social phenomena and their meanings are continually being accomplished by social actors.

Design for Environment (DfE) - A systematic process for incorporating environmental life cycle awareness into the development of new products and processes. Design for EHS is a similar practice that includes health and safety.

Differentiation - A competitive business strategy that seeks to offer products with distinctive features in order to differentiate the brand from those of competitors.

Economic value added (EVA) - A measure of a company’s financial performance, calculated by deducting its opportunity cost of capital from its after-tax operating profit.

Eco-efficiency - A measure of the resource intensity of a company’s operations, including the inputs of materials, natural resources, and energy required to produce and deliver a unit of output.

Energy intensity - A measure of environmental efficiency in production, calculated by dividing the net energy consumption by the quantity or monetary value of the output.

GLOSSARY Continued

Environmental footprint - The total environmental burden associated with a business operation, including resource consumption, land use, waste and emissions, and ecological impacts.

Environmental health & safety (EHS) - A professional discipline concerned with protecting the environment, human health, and safety through scientific, engineering, and management methods.

Extended producer responsibility - A doctrine that assigns responsibility to manufacturers for minimizing the adverse environmental impacts of their products during customer use and end-of-life disposition.

Ethanol - produced from the sugar in sugarcane is a popular fuel in Brazil. The cellulose rich bagasse is now being tested for production of commercial quantities of cellulosic ethanol.

Ex-situ - In the genetic resources context for example it means resources originally collected *in-situ* but subsequently cultivated under suitable conditions outside their natural *in-situ* habitats.

EVA – Economic Value Added. A company that is able to generate a flow of profits greater than its cost of capital is adding shareholder value, while a firm whose cost of capital exceeds its profits is destroying shareholder value.

Excipient – an inactive substance that serves as the vehicle or medium for a drug or other active substance. Such as a solvent.

Focal Company - The main or first buying company in a particular product or material supply chain. Often the company that is manufacturing the product or providing the service.

Fungibility – Mutually interchangeable.

Furfural - is an industrial chemical derived from a variety of agricultural by-products, including corncobs, oat and wheat bran. It is used as a chemical intermediate in the production of the solvents furan and tetahydrofuran (THF).

Genetic Resource - Any material of plant, animal, microbial or other origin containing functional units of hereditary of actual or potential value – based on Article 2 of the CBD, combining the definition of 'genetic resources' and genetic material'.

Global warming - Gradual increase in average temperatures at the earth's surface, attributed to increased atmospheric concentrations of carbon dioxide and other greenhouse gases (GHGs), also known as global warming gases (GWGs).

GLOSSARY Continued

Goodwill - The value attaching to the reputation of a company, individual or product; the intangible asset constituted by the tendency of the customers or clients of a business or professional practice to deal with that business or practice despite a change of personnel operating it.

Green purchasing - A business practice whereby purchasing agents in business or government evaluate products and services based upon selected environmental performance attributes.

Greenhouse Gas - A gas that absorbs radiation at specific wavelengths within the spectrum of radiation (infrared radiation) emitted by the Earth's surface and by clouds. The gas in tern emits infrared radiation from a level where the temperature is colder than the surface. The net effect is a local trapping of part of the absorbed energy and a tendency to warm the planetary surface. Water vapour (H_2O), carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4), and ozone (O_3), are the primary greenhouse gases in the Earth's atmosphere. (Houghton *et al*, 1996).

Impacts – Changes to the environment caused by environmental aspects.

In-House – Design of a management process by and within an organisation - such as an environmental management system.

In-situ - means the occurrence of a genetic resource in its natural habitat.

Intangible asset - A non-monetary asset or value driver, including people, ideas, networks, and processes, which is not traditionally accounted for on the balance sheet. Resources of a business which have no easily measurable dollar value but which are nonetheless valuable, such as a good reputation, brand-name or goodwill. Generally, intangible assets cannot be sold separately from the business as a whole.

ISO 14000 - A series of international standards for environmental management. It is the first such series that allows organisations from around the world to pursue environmental efforts and measure performance according to internationally accepted criteria (Roberts and Robertson, 1998).

ISO 14001 - The first in the 14000 series. It specifies the requirements of an environmental management system. ISO 14001 is a voluntary standard developed by the International Organisation for Standardisation (ISO). It is intended to be applicable to all types of and sizes of organisations and to accommodate diverse geographical, cultural and social conditions. The overall aim of both ISO 14001 and other standards in the 14000 series is to support environmental protection and the prevention of pollution in harmony with socio economic needs (Roberts and Robinson, 1998).

License to operate - The ability of a corporation or business to continue operations based on ongoing acceptance by external stakeholder groups.

GLOSSARY Continued

Logistics - The business function that plans, implements, and controls the efficient, effective forward and reverse flow and storage of goods, services, and related information.

Macroeconomics - The study of the overall aspects and workings of a national economy, such as income, output, and the interrelationship among diverse economic sectors. Basically it is a study of all aspects of the economy. It is different from microeconomics, which studies how individual entities (such as people, families, or even corporations) fit in the economy.

Management System - A management approach that enables an organization to identify, monitor and control its performance, including financial, environmental, or social aspects.

Material Intensity - A measure of environmental efficiency in production, calculated by dividing the net material consumption by the quantity or monetary value of the output.

Methyl *tertiary*-butyl ether (MTBE) - is a chemical compound with molecular formula $C_5H_{12}O$. MTBE is a volatile, flammable and colorless liquid that is highly soluble in water. MTBE has a minty odour vaguely reminiscent of diethyl ether, leading to unpleasant taste and odour in water. MTBE is a gasoline additive, used as an oxygenate and to raise the octane number, although its use has declined in the United States in response to environmental and health concerns. It has been found to easily pollute large quantities of groundwater when gasoline with MTBE is spilled or leaked at gas stations. MTBE is also used in organic chemistry as a relatively inexpensive solvent with properties comparable to diethyl ether but with a higher boiling point and lower solubility in water. It is also used medically to dissolve gallstones.

Non-governmental organization (NGO) - A not-for-profit organization that is not associated with government, e.g., charitable foundations, advocacy groups.

Non-renewable resource - A natural resource that cannot be replaced within the same time scale that it is consumed for industrial purposes, e.g., fossil fuels.

Objectivism – an ontological position that asserts that social phenomena and their meanings have an existence that is independent of social actors

Orientation – The process of familiarising the Project with the wider situation concerning the natural environment and business, in order to be relevant to the current biodiversity position, within the context of procurement and supply chain management.

Partnership - A tailored business relationship that yields a competitive advantage, resulting in business performance greater than would be achieved by the firms working together routinely.

GLOSSARY Continued

Product - Once clearly understood to mean something tangible, which resulted from a creative effort and usually involved physical energy and machinery, the word has taken on a new colouration in the language of commerce. Now it means something that can be sold, bartered, taken advantage of or just talked about. When an advertising man talks of a product he may mean his strategy for selling an item. A financial dealer may call an interest rate a product, as if he had made it with his own hands (Carew, 2008).

Product life cycle - (1) A series of stages in the physical life of a product, including resource extraction, procurement, transportation, manufacturing, product use, service, and end-of-life disposition or recovery. (2) A series of stages in the commercial life of a product, including concept development, design, introduction, growth, extension, phase-out, and discontinuance.

Product stewardship - Integration of EHS and sustainability considerations into the management of a product's life cycle, including relationships with customers and suppliers.

Product take-back - A program, either voluntary or mandatory, whereby manufacturers take responsibility for recovering and recycling obsolete products at the end of their useful lives.

Paradigm Shift - *"During the transition period* [of a paradigm] *there will be a large but never complete overlap between the problems that can be solved by the old and by the new paradigm... When the transition is complete, the profession will have changed its view of the field, its methods, and its goals."* (Kuhn, 1962).

Public Good – technically a public good is something that (a) any number of people can enjoy without congestion effects i.e. non-rivalry, and (b) people cannot be prevented from enjoying (non-excludability). (Cornes and Sandler, 1996).

Renewable resource - A natural resource that can be replaced within the same time scale that it is consumed for industrial purposes, e.g., lumber.

Return on investment (ROI) - A measure of a corporation's profitability, equal to a fiscal year's income divided by common stock and preferred stock equity plus long-term debt.

Return on net assets (RONA) - A measure of a corporation's profitability determined by dividing net income for the past year by total average assets minus total liabilities, i.e., net worth.

Risk management -The process of identifying and evaluating risks and selecting and managing techniques to adapt to risk exposures.

GLOSSARY Continued

Risk - (1) The possibility of losing rather than gaining. (2) A measure of price fluctuation relative to the market. (3) The possibility of an adverse incident due to hazards or uncertainties. Risks are inherent in every forward-looking business decision, so successful risk management should be an integral part of an organisation's strategy and operations – an important dimension of good management practice (Ernst and Young, 2008)

Shareholder value - The value that a shareholder is able to obtain from his/her investment in a company, including capital gains, dividends, and proceeds from buyback programs.

Stakeholder - Any party that has an interest, financial or otherwise, in a firm — shareholders, creditors, employees, customers, suppliers, the community, interest groups, and the government.

Strategic risk – A risk that could cause severe financial loss or fundamentally undermine the competitive position of a company.

Strategy - A set of goals and aspirations combined with an action plan for achieving those goals.

Supply chain - A network of suppliers and customers that add value in the form of materials, components, or services, ultimately resulting in a final product.

Supply chain management (SCM) - The integration of key business processes from end user through original suppliers, which provides products, services, and information that add value for customers and other stakeholders.

Supplier Visibility – Openness on disclosing environmental knowledge concerning all supply companies in an extended supply web.

Sustainability - Conditions or characteristics supportive of sustainable development, encompassing the environmental, social, and economic aspects of a corporation.

Sustainable development - Economic development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Solvent - A general term for any liquid that is used to dissolve other substances. Solvents such as organochlorines, commonly used as cleaning agents, are responsible for a considerable amount of groundwater contamination. The most common industrial solvents include acetic acid, acetone, benzene, cyclohexanol, ethanol, furfural, glycerol, hexine, isopropanol, methanol, methylethylketone (MEK), n-propanol, toluene and trichloroethylene. The most common solvent in everyday life is water.

GLOSSARY Continued

Organic Solvent - this is a solvent derived from a carbon source.

A Standard - is a document, established by consensus and approved by a recognized body, that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context. (ISO, 2008).

Taxonomy - is properly the describing, identifying, classifying, and naming of organisms, while "classification" is focused on placing organisms within groups that show their relationships to other organisms. All of these biological disciplines can be involved with extinct and extant organisms. Systematics uses taxonomy as a primary tool in understanding organisms, as nothing about an organism's relationships with other living things can be understood without it first being properly studied and described in sufficient detail to identify and classify it correctly.

Time to market -The time interval or cycle time between the launch of a new product development effort and the market introduction of the new product.

Transparency - Openness of a company or organization with regard to disclosing information about its policies, principles, and decision-making processes.

Triple bottom line - A framework for sustainable development that defines three fundamental aspects of corporate performance — economic, environmental, and social.

Value creation - Activities that generate shareholder value for a company, e.g. value-based management.

Value driver - A fundamental and persistent characteristic of a business enterprise that influences its market value positively.

Volatile Organic Compounds (VOC) - Compounds such as solvents, propylene, acetone, styrene, benzene and ethylene which evaporate and contribute to air pollution and photochemical smog.