A Study Investigating how Construction Companies in the UK Interpret and Implement Sustainable Construction Practices.

By

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Abstract.

The construction industry in undoubtedly one of the most intensive in terms of natural resource use, energy consumption, waste production. It is necessary to address these, and the many issues surrounding the industry to meet the goals of sustainable construction. There must be a balance between economic prosperity, environmental quality and social equity to master this concept.

Using the Ten Themes for Action published by DETR (2000), it was attempted to understand how individual construction companies interpret and implement sustainable construction. A review of the current legislation, available guidance and tools to implement sustainable practices and the questionnaire responses, highlighted the various understanding of the term and consequently, the limitations to its up-take. The differences in company capabilities due to availability of finances are also identified as a hindrance.

Following the investigations, analysis of the results led to numerous recommendations to be suggested to overcome the barriers identified from the respondents, and to ensure implementation of sustainable practices are successful.
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Chapter One

Introduction

1.1. What is Sustainability and Sustainable Development?

“The strength of the idea (sustainability) lies both in its simplicity and in its fundamental assumption that environmental issues need to be integrated into everyday thinking, decision-making and accountability processes…” (Schaltegger et al, 2003 pp22).

The concept of sustainable development emerged in the 1970’s, but it was not until the United Nations General Assembly was created in 1983 was there any formal documentation or proposed action under the subject. Before this, a publication by Rachel Carson “Silent Spring” in 1962, began the discussion of sustainability prior to present definitions (Faber et al 2004). This was the first widely read study that recognised many environmental problems were due to our inability to understand the long-term effects of our actions. Without using the word sustainability, Rachel Carson linked the use of manufactured pesticides such as DDT to damage to animal species and human health (IISD, 2003; Dunphy et al, 2000). During the 1980’s many nations’ economies were stagnant, and the global environment was in disarray due to its severe mismanagement. For many this decade was “the lost decade” (Holliday et al, 2002; Elkington, 1997). In combination with the discovery of the ozone hole over Antarctica, and terrible environmental and human effects of events such as the Chernobyl accident led to much discussion on how best to manage their impacts. Twenty-one countries created the World Commission on Environment and Development (WCED), and prepared a report know as The Brundtland Report, outlining the way forward on the sustainable development front. There are approximately 50 definitions of the term sustainable development (Faber et al,
however it was only in 1987 that the following definition was universally accepted from the Brundtland Report, “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” (WCED, 1987; Holliday et al, 2002 pp 13). The WCED asserts that sustainable development requires the simultaneous adoption of these three themes (see Figure 1), environmental quality, economic prosperity and social equity (Bansal et al, 2004). The loss of one dimension is likely to mean the loss of another. Conversely, environmental and economic gains should also lead to social gain (Henriques, 2001). Society depends upon the resources and life support systems the environment provides. The economy relies on the environment for resources to make products and services for society to purchase (Dunphy et al, 2000).

**Figure 1.** The three principles of sustainable development.

Sustainable development does not mean the same as sustainability. Sustainable development was originally directed at the viability of aid programmes for the less developed countries. In contrast, sustainability refers to specific activities in developed countries, (Henriques, 2001). In particular, actions which

- enhance the planet’s ability to maintain and renew the viability of the biosphere
- enhance society’s ability to solve its own problems
- maintain a decent level of welfare for present and future generations of humanity, and
- extend the productive life of organisms and maintain high levels of corporate performance. (Dunphy et al, 2000).

The idea of sustainable development emphasises the interdependence between economic growth and environmental quality. Ecological sustainability is essential as society and the economy ultimately depend on the integrity of the biosphere and ecological processes occurring within it (Dunphy et al, 2000).
From the time the Brundtland Report was published, there has been an ongoing argument as to whether economic development and environmental/ecological protection are compatible. Population growth causes pollution, greater exploitation, and more consumption of natural resources to feed, clothe and house people. Two fundamental positions on sustainability have emerged, “weak” and “strong” sustainability. The term weak sustainability surfaced due to the concerns about the unsustainable forms of economic development that have sacrificed the environment in the name of economic growth (Pearce & Atkinson, 2002) that has occurred since the Second World War. Strong sustainability addresses the fact that humans and ecology are not separate; the functions of natural capital cannot be duplicated by manufactured capital, stocks of natural capital must be enhanced and maintained (Schaltegger et al, 2003). This term emphasises that the environment and the economy are interconnected and interdependent. “In contrast, weak sustainability accepts that manufactured capital of equal value can take the place of natural capital, and that the natural environment can be mastered through existing economic systems…” (Schaltegger et al, 2003). This weak sustainability concept does not question the impacts human activity has upon the environment, or even if it is inline with other views of sustainable development. This is considered as anthropocentric, whereas strong sustainability is considered to be more eco-centric (Bebbington, 2001). Proponents of strong sustainability argue that radical changes are necessary in economic practices to be able to sustain the environment and control mass consumption of natural resources (Welford², 2000).

For this reason there are problems when analysing the Brundtland definition. There is little direction and no mention of the environment in the statement. The document as a whole is mostly about a new era of economic growth and equity. It does make the fundamental point that the economy and the environment are no longer separate worlds, as one does not function without the other. The environment provides human societies and economies life support systems such as air, water, sunlight, and suitable climate. Perhaps the Dunphy definition would be more fitting,

“Sustainable development comprises types of economic and social development that protects and enhances the natural environment and social equity.” (Dunphy et al, 2000 pp23).

The Brundtland Report, like so many other papers put forward since, lack guidance on the matter, how does society implement sustainability into their everyday lives, how does
industry manage to interpret one definition for another with so many sectors to account for, and how do Governments manage these changes?

1.2. Where Sustainability Stands at Present.

Ten years on from the Earth Summit in Rio 1992, the Johannesburg Earth Summit 2002, aptly named the World Summit on Sustainable Development, world leaders realised that the discussion on sustainability had been going on for over a decade. The message at this meeting was clear- sustainable development will make our vital support systems stronger and more secure (UNDP, 2002). Twenty-one countries created the WCED in the 1980’s with the intention to pro-actively tackle our unsustainable way of life. Nevertheless, the theory of sustainable development has not penetrated our entire society, and the “business as usual” model continues. “Humanity has the power to disturb not destroy the life support systems of a globe…what is really threatened is humanity…” (O’Riordan, 2000 pp31).

During the 1980’s and up to the present day, concern and knowledge about the environment has rapidly been growing amongst the general public. As a result, Governments worldwide have had to be seen to be making plans to manage the harmful effects on the environment due to economic growth. The annual conferences, reports by the WCED and Environment Agencies, and the Earth Summits have made pro-active steps in the fight to educate world leaders and implement sustainable development across all sectors. However, after the summits, conferences and reports, it is left to individuals and local council departments to interpret the meaning of sustainability and development, and integrate it into society. Here lies a fundamental problem. Little funds and no guidance are offered or directed to those responsible to help them create a framework to pursue implement sustainability and sustainable development. Without exception, sustainable development must be considered in relation to every environmental problem (Schaltegger et al, 2003). Further complicating matters, the goals set for sustainable development are not identifiable for all sectors. The definitions, incentives and programmes of sustainability introduced above are too general. They need to be sub-defined and modified to suit each specific industry, society, environmental and economic conditions, and all other sectors that need their own set of aims and objectives.

The Brundtland Report (1987) stresses that to accomplish sustainable strategies requires changes in economic practices across the globe. For this to be accomplished, it will entail
tackling the problem of inequality of wealth and standards of living, especially of those in developing nations (Drummond & Marsden, 1999). The level of consumption in the Western world presents a further problem in achieving sustainable development. These consumers are relatively wealthy and reluctant to significantly reduce their own levels of consumption (Welford², 2000). It has become clear, that the way in which we conduct our daily lives is still not environmentally friendly and detracts from sustainability, not contributing to it (Dunphy et al, 2000).

Inequity is one of the contributors to unsustainable development. More than 1 billion people live on less than $1 a day, while 40-50% of the food the United States harvests never gets eaten (Global Issues, 2005). The Earth’s population is increasing annually by 80 million, and expected to increase by 50% in 50 years. Between 10% and 30% of mammals, birds and amphibians are threatened by extinction due to human activities (Millennium Ecosystems Assessment 2003). It has been confirmed by The Intergovernmental Panel on Climate Change (IPCC, 2001) that during the 20th century, average global surface temperatures increased by 0.6°C. Clearly, re-orientation of the traditional ways in which we think of ourselves, our world and the way we work is necessary to make any progress. Crucial to this is educating consumers of the impacts our current way of life has upon our environment. Industry also has a role in educating its consumers and suppliers, and all businesses must be encouraged to increase their own environmental efficiency (Welford², 2000).

1.3. Pressures and Incentives to Consider Sustainability.

Across the globe, various Governments, Agencies and Non-Governmental Organisations (NGO’s), have accepted the sustainability goal. These organisations and establishments have signed numerous agreements or directives such as Agenda 21 and the Brundtland Report “Our Common Future”, and pursued measures to interpret and implement sustainable development. Promoting the theory is also a key element of achieving the original goals of the Brundtland Report, WCED and the goals of the Millennium Declaration. Organisations such as the United Nations Environmental Protection (UNEP), and in the UK, DEFRA and the Environment Agency, have adopted the role of maintaining the environment, developing guidance and working with individual sectors on their sustainable aims. The European Union (EU) recognises that a key element for promoting
sustainable development is the principle of integrating environmental requirements into other policies (Schaltegger et al, 2003).

It was not until the Earth Summit of 1992 in Rio de Janeiro that industry felt the pressure from Governments, environmental groups and communities to change the way in which they conducted business. Businesses were identified as causing adverse impacts upon the environment, and commitment to mitigate them was to be the first step towards sustaining the economy and environment. After the Summit, industry endured attention from environmental groups and increasingly stringent legislation and they were forced to examine the environmental impacts of their activities.

Aside from pressure groups, Government, and the general public, investors and stakeholders are also paying increased attention to the sustainable future of their investments. Sustainability challenges industry to produce higher levels if output, while generating lower levels of inputs and generating less waste (Welford¹, 1998). Companies wishing to be sustainable need to perform not against a single, financial bottom line, but against the triple bottom line, consisting of financial, environmental and social bottom lines (Elkington, 1997). Corporations are becoming increasingly aware of the benefits of actively addressing environmental issues; those who partake in pollution abatement measures also avoid heavy penalties, and consequently gain a competitive edge over their market rivals (Welford¹, 1998), to name but a few. From sustainable business arise numerous opportunities; improving environmental performance also enhances business performance.

Attempts to promote and implement sustainable development are encouraged outside the realms of Government. There are significant and mounting pressures on companies to take a deeper financial interest in sustainability (Henriques, 2001). The meaning of sustainability at the business level has been debated endlessly, mainly with regard to equity. As discussed above, equity across the globe has restricted the spread and penetration of sustainability and sustainable development into our society. Empowering workers increases their decision-making powers, morale, and democracy and brings a more ethical approach to the work place. These all facilitate environmental, social and financial benefits (Welford², 2000). This more ethical approach also allows significant environmental improvement. Traditionally, firms have been judged on their financial performance (Starkey & Welford, 2001), now there are currently a number of tools and
mechanisms available to measure and track environmental, social and economic performance. Recently this has been carried out in the stock market. In the late 1990’s Sustainable Asset Management (SAM) joined forces with the Dow Jones & Company to establish the Dow Jones Sustainability World Indexes (DJSI), the first major benchmark tracking the financial performance of sustainable leaders on a global basis (Holliday et al, 2002). Criteria defined for the FTSE4Good Index is designed to reflect a broad consensus on what constitutes corporate responsibility (FTSE4Good, 2003). The FTSE4Good Index is another means of assessing performance of corporations, and includes companies who have a high standard of environmental performance, human rights and stakeholder engagement (SAM Group, 2005).

Over the coming years and decades, as the role of government changes and billions more people come to live in market economies, the world must learn how to work with businesses and through markets to achieve sustainability (Elkington, 1997). Industry has a major role to play in re-orientating the way people work and conduct their lives. Creating a positive image to direct and in-direct stakeholders. Furthermore, according to Schaltegger et al 2003, to be sustainable is to remain in existence (Schaltegger et al, 2003), the primary goal of every business manager. Some feature actions of environmentally responsible companies include ensuring the entire life-cycle of the company is efficient, the “cradle to grave” concept, from the use of materials, energy consumption, transportation of products and the recycle/reuse of a product at the end of its life. This is known as reducing a firms “ecological footprint” (Bansal et al, 2004). Tools and forcing mechanisms have emerged as a means by which corporations can behave and conduct their business in a sustainable manner. For many, setting objectives and targets to assess and monitor, then improve their performance, is an example of such a mechanism. The Government has enforced tools such as eco-taxation, for example in the form of the Climate Levy and Landfill Tax. These extra costs are a rude awakening for some as environmental considerations are now a necessity of everyday business operations. Concepts such as eco-design are being encouraged to be consider sustainability impacts of a product when is in the earliest stages of development. It has become increasingly common for larger businesses who buy products from smaller firms, to require basic environmental protection; an environmental management system (EMS) or an adopted ISO certificate.

Based on this review, the following conclusions can be made. At the global and business level, integrating sustainable development principles into national and corporate policies is
the key to successful implementation and promotion of environmental objectives. The lack of understanding of and direction towards sustainable development is clearly evident. Most agree that sustainable development is one of the planets main goals to secure our future. There have been numerous attempts to implement this concept on a global, national and local scale, without much success. Both the Rio and Johannesburg Earth Summits were declared failures by state representatives and NGO’s, such as Greenpeace (UNDP, 2003). There appears to be no real consensus on how to achieve sustainability and sustainable development. O’Riordan puts it quite plainly, “There is no clear agreement as to what sustainable development is, every pathway begins and ends at different points, and almost inevitably the current pattern of economic gain and political power is institutionally ensnared in non-sustainable development…” (O’Riordan, 2000 pp 30).

However, what must be kept in mind is the complex and nebulous nature of the sustainable development concept. As discussed above, the concept means different things to different sectors of society. In terms of industry, sustainable business is further complicated by the lack of transparent guidance. Recognising this problem, there have been various attempts to develop sustainability frameworks for specific individual industries, and offer guidance to aid its implementation.

This project will focus attention on the construction industry and attempts at sustainable construction. Awareness and education within individual firms, appears to be a key factor in the level of understanding and implementation of sustainable operation and environmentally friendly practices. In addition policies and requirements that are currently voluntary should be made mandatory. Governments, NGO’s, and senior business management must develop these together to ensure all aspects of the environment, society and economy are considered. This will maximise the potential to meet targets and objectives, thus improving business performance.

1.4. What is Sustainable Construction?
Sustainable construction is meeting environmental and social responsibilities, and at the same time improving profitability. The key characteristics of sustainable construction are similar to those set for sustainable development. The end result is to reduce a firm’s detrimental effects on the environment. Sustainable construction is generally used to describe the application of sustainable development to the construction industry, (M4i, 2005), and balances four elements:

- effective protection action of the environment
- prudent use of natural resources
- social progress which recognises the needs of everyone
- maintenance of high and stable levels of economic growth and employment

(CIRIA¹, 2001).

The industry is defined by a number of sectors, all who plan, design, build, alter or maintain the built environment. Also it’s subsidiaries, those who manufacture materials, suppliers, and end of life occupiers or owners. The entire life cycle of any structure, from initial concept to demolition must be encompassed in the definition of sustainable construction. Buildings and structures change the face of towns and countryside, and their construction, use, repair, maintenance, and demolition consume vast amounts of energy and resources compared to many other industrial sectors, (DETR, 2000).

1.5. The Need for Change.

Construction is arguably one of the most energy and resource intensive industries, and there is no denying the need for strategies to sustain the environment and prolong the life of individual companies. There is a pressing need to manage the negative impacts the industry has upon the environment and society. Globally, construction accounts for 40% of total flow of raw material into the global economy every year. In the UK over 2 million people are directly and indirectly employed in the industry and represents 10% of the GDP. Every year in the UK, 90% of non-energy materials are extracted for use in the construction and demolition industry. Yet shockingly, 72 million tonnes of construction and demolition waste is produced annually, that is 17% of the UK’s total waste (BRE, RRR, 2002 & DETR, 2000). Roughly 13 million tonnes of that is unused and wasted, filling up landfill sites. The negative public image of the industry is reiterated in the number of complaints it receives. Of all commercial and industrial noise complaints, over 12% are directed towards the construction industry (DETR, 1998). The construction industry consumes vast amounts of energy. The extraction, transport and eventual disposal
of aggregates from the ground have severe implications for the environment. Extraction of aggregates represents 82% by tonnage of all non-fossil fuel minerals from the land and sea in the UK (DEFRA, 2005). As highlighted in Figure 2 compared with other industry, production and transportation of building materials accounts for nearly a quarter, 24%, of the total UK industry energy consumption.

![Energy consumption of building materials industry as a proportion of total UK industry energy consumption (1996)](source: BRE)

**Figure 2.** Energy consumption in the UK across the industry sector. (DETR, 2000).

The Environment Agency considers the current environmental performance of the industry to be unsatisfactory and in the medium term future regulatory controls may therefore increase (Environment Agency, 2005).

More efficient and sustainable construction can offer many social, economic and environmental benefits. Reducing impacts upon the environment as a whole is one aim of sustainable construction. In particular, reducing natural resources consumed, opting for secondary materials, and also controlling the amount of waste going to landfill each year. The opportunities for recycling and re-use are ever increasing. The economic benefits relate to improved market advantage, and overall image to clients and the competition. Furthermore, the industry does not have a positive public image history. Construction is seen as dangerous, damaging to the environment, disruptive and dirty. Re-building the relationships with the public is a major step towards sustaining the industry. Stakeholders and the general public are increasingly putting pressure on companies to act in a socially and environmentally responsible way, (DETR, 2000). For these reasons, the industry must
strive to make practical steps to overcome their negative impacts and image, allowing it to be competitive and innovative.

1.6. What the Construction Industry can do.

One of the first steps in moving towards sustainable development in business is recognising the strategic advantages of corporate environmental management can bring and to ensure that commitment to environmental improvement exists in business (Welford¹, 1998). In business, the concept of sustainability also embraces the three themes of the environment, economy and society, this known as The Triple Bottom Line.

To begin the transition to sustainable construction, individual firms must understand and accept the devastating effects their activities are having upon the environment, and the importance of operating in an environmentally friendly manner. They will then have to commit to not only agreeing to change how they operate, but actually set up a pro-active framework for all employees, suppliers, and sub-contractors to adhere to. Sustainable companies that demonstrate social corporate responsibility; benefit financially through more efficient procedures and use of resources; improve their corporate image; and maintain a competitive advantage, (MaSC, BRE, 2005).

There are a number of steps firms can take towards sustainable construction, as identified by CIRIA, (2000).

- Make a commitment to address their impacts, maybe by adopting a formal environmental management system (EMS).
- Aim to be the best and benchmark their performance
- Take into account the life cycle costs of products and their impacts
- Communicate with stakeholders with environmental and social reports
- Work with others in the supply chain to improve performance
- Improve staff awareness through training

1.7 Tools, Policies and Guidance.
There are various tools, policies and guidance notes published for companies to follow to help them put the principles of sustainable construction into practice. Some examples include Key Environmental Performance Indicators (KEPI), Pollution Prevention Guidelines (PPGs), Environmental Management Systems (EMS), and the MaSC by BRE.

Companies must initiate programmes to implement best practice in all aspects of sustainable construction, and then measure their performance. One such programme sets Key Environmental Performance Indicators (KEPI), and is endorsed by several industry groups and stakeholders, including the Construction Industry Board, the Environment Agency, Motivation for Innovation (M4i), the Sustainable Focus Group and the Construction Industry Council. Two types of indicators have been developed: 1) quantitative measures against which companies can measure the sustainability of their business (strategic indicators), and 2) the activities they perform (operational indicators) (CIRIA\(^1\), 2001). The principle purpose of these indicators is to promote sustainability, and provide an idea of how much progress a business is making in all dimensions of sustainable construction, part of environmental and social reporting. Using this method will enable companies to benchmark their performance, while demonstrating that they are innovative, well managed and responsive to stakeholders (CIRIA\(^1\), 2001 & M4i, 2005).

The Environment Agency and Scottish Environment Protection Agency (SEPA) have worked together to produce a number of Pollution Prevention Guidance Notes (PPGs). Each note is specifically targeted for a particular industrial sector, giving advice on statutory responsibilities and good environmental performance (The Environment Agency, 2005). It is stated that compliance with PPGs should minimise the effect of work on the environment. PGG 06 covers a broad range of issues, including site deliveries, drainage, waste management, concrete, storage and security, and emergencies.

Another voluntary method is the adoption of a certified ISO 14001 or verified Environmental Management Systems (EMS). With ISO 14001 companies can conduct annual environmental audits, reviews and set targets for the following year, (Welford\(^1\), 1998). EMSs and ISO standards are acknowledged as worthy mechanisms through which industry can implement environmental goals and polices. They are appropriate systems to manage the environmental, economic and social impacts; and describing the responsibilities for these impacts should be integrated with normal management processes (Henriques, 2001). To help companies in the task of adopting or aligning themselves with
an EMS or ISO 14001 standard, CIRIA have developed a project called Easy Access. CIRIA, together with White Young Green Environment, have created a system with the aim of phased implementation of an EMS (CIRIA\textsuperscript{2}, 2005).

There are also a number of organisations that offer advice and guidance to companies wishing to change their unsustainable methods of operations. The sustainability experts, BRE have a number of tools for managing problem areas of construction. SMARTWaste monitors and benchmarks waste management; another tool is MaSC, Managing Sustainable Companies. MaSC is a process that introduces sustainable practices into a firm. Part of the process identifies the changes that need to be made within a firm, then set targets, followed by developing an implementation scheme (MaSC, BRE, 2005). The final part of the process comprises of a strategic review to set objectives, develop an action plan, assign responsibilities, and set targets for continuous improvement.

The Organisation for Economic Co-Operation and Development (OECD), have produced a set of recommendations to improve environmental polices in the building sector (OECD, 2003). The recommendations include establishing a regulatory framework to monitor environmental performance, a national strategy for improving environmental performance, supporting environmental research and evaluating the effectiveness of policy instruments.

The Government have introduced a number of taxes and charges in an attempt to encourage sustainable practices in construction. The Landfill Tax appears to be having a positive impact on the volume of waste being detracted from landfill. An Aggregate Levy also emerged from the Government in 2002, to reduce demand for primary aggregates such as sand and gravel, by increasing their costs. It is hoped this will encourage the use of secondary and recycled materials. These are mandatory payments, unlike the voluntary schemes discussed above. The tax started at £10 per tonne of material, this figure has risen to £17 per tonne since its introduction in 1996 (DEFRA\textsuperscript{3}, 2003). This has encouraged businesses to re-think their traditional landfill disposal routine, and actively seek alternatives. Figures 3 and 4 illustrate the change in waste management, which are clearly linked to the increasing taxation of the Landfill Tax and Waste Management Licensing Regulations (DEFRA\textsuperscript{1}, 2005).
Waste is a severe problem in construction and incentives are being developed to try to reduce the volumes of primary material unused and discarded. Taxes, levies and charges are an option; the other is adopting waste management strategies such as the Waste Hierarchy.

There are numerous impacts upon the environment from construction aside from issues of waste disposal, such as primary aggregate extraction, natural resource extraction and depletion, transportation emissions, energy consumption, impacts upon biodiversity, water pollution.
1.8. The Ten Themes for Sustainable Construction.

The need to improve performance in the construction industry is essential for it to become more sustainable. Managing and reducing the environmental impacts of buildings and structures, and the processes of construction, is a common starting point for many organisations wishing to address sustainability (DETR^1, 2000). Government consultation with the construction industry produced various key themes under sustainability and sustainable development. Ten Themes for Action (Building a Better Quality of Life) were published with the aim of providing individual firms with practical pointers for achieving sustainable construction, and are outlined in Table 1.

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<tr>
<td>Re-use existing built assets, and renovate/refurbish which improves their sustainability, where possible</td>
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<td>Design for minimum waste. Design out waste at all stages of product, building or structure, think about using recycled materials. Aim for lean construction, working on continuous improvement and high quality work.</td>
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<td>Minimise energy in construction, be aware of energy consumption during construction and opt for green policies</td>
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<td>Minimise energy in use, consider more energy efficient solutions in the design stage.</td>
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<td>Do not pollute, understand environmental impacts and adopt an EMS or ISO to manage them</td>
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<td>Preserve and enhance biodiversity throughout the construction process, from extraction of materials to landscaping buildings.</td>
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<td>Conserve water resources, design for water efficiency in buildings.</td>
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<td>Respect people and their local environment, be responsive to community and consider your workforce.</td>
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<td>Set Targets to measure and compare your performance against others, set targets for continuous improvement.</td>
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Table 1. The Ten Themes for Action, to implement sustainable construction. (DETR^1, 2000 & DTI^1, 2003)
1.9. The Benefits of Sustainable Construction.

The ten themes for action discussed above simply make good business sense, for example, designing a project for minimal waste (DTI\textsuperscript{1}, 2003). For the industry to successfully implement sustainable practices into all stages of the construction cycle, it must recognise the needs of each of the three principles of sustainability. There are benefits to reap from such actions, economically, socially and environmentally, as described in Table 2. In practice, delivering more sustainable construction involves stakeholders within the industry at every stage of the construction cycle, taking simple actions to deliver better projects (CIRIA\textsuperscript{1}, 2001).

<table>
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<th>Environmental</th>
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<td>• Sustainable performance can deliver significant business efficiency and profitability</td>
<td>• Emerging evidence of productivity gains for staff involved in environmental and social performance improvement schemes.</td>
<td>• There are significant opportunities available to enhance or sustain market position</td>
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<td>• Lean construction and pollution prevention can generate quantifiable cost savings</td>
<td>• From a social perspective, economic benefits arise from better relationships with clients, local communities and other stakeholders.</td>
<td>• Construction and business activities will not be constrained by local opposition, regulatory bodies or client requirements</td>
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<td>• Recycling more waste material will reduce landfill tax and material purchasing costs</td>
<td>• Better health and safety practices to improve efficiency and reduces accidents, saving both managerial time and legal costs and fines.</td>
<td>• Improving project delivery is essential to build trust with clients, improve profitability and investment</td>
</tr>
<tr>
<td>• Improved efficiency through regulatory compliance, eg: ISO or EMS</td>
<td>• Avoidance of pollution incidents, preventing fines, court costs and negative publicity</td>
<td>• This type of management will encourage mutual, beneficial long term relationships with clients</td>
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<td>• Improved public image and enhanced professional reputation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Avoidance of pollution incidents, preventing fines, court costs and negative publicity</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2. The various benefits companies may enjoy as a result of putting sustainable principles into practice. (Source CIRIA\textsuperscript{1}, 2001, DTI\textsuperscript{1}, 2003, Starkey & Welford, 2001)

Innovative, well-managed companies, who have acknowledged the need for change and are responding to the opportunities available to enhance or sustain their market position, are also securing their future in the economy. This type of innovative and proactive attitude
to business is encouraging to stakeholders, both with direct and indirect links to a company.

### 1.10. The Challenges for the Industry.

There remain many challenges for all business to overcome to achieve sustainable development. Despite the frameworks, polices and guidance from various organisations, there are few mechanism available to implement change. Those that are available are voluntary schemes, which only the environmentally conscious would actively investigate, and implement. This problem highlights the issue of awareness. Many business leaders are blissfully unaware of the environment in which they live and work in. They are unaware of its fundamental role in their company’s financial and social stability. Unfortunately, this lack of knowledge filters down from senior management, to all employees. Education and business practices must change if any progress is to be made. According to Starkey and Welford (2001), sustainable thinking and practices, which for the most part will remain on the periphery of the business mainstream, need to be firmly within the emerging core of 21st century business (Starkey and Welford, 2001).

For business, there is little encouragement or help offered to aid their transition to sustainable development. The highly competitive market detracts their attention away from many issues outside of producing their goods or service and making a profit. There are significant difficulties in encouraging small, medium and larger construction firms to take up free and highly subsidised opportunities of assistance to improve their environmental performance (Hillary, 200). The implementation process of these programmes also need to be assisted and monitored. The Government must present construction companies with incentives to implement sustainable practices if they are to keep policy uptake voluntary. Without it, as seen over the past thirty years, there can be much discussion but no action. It is not only the damaging effects of business that so many are in the dark about, but also the enormous long-term benefits sustainable business can have.

### 1.11. Aims.

The aim of this project is to investigate how construction companies interpret and implement sustainable construction. To understand how, and if individual companies consider the environment in any aspect of their business, the ten themes for action
published by DETR in “Building a Better Quality of Life” (2000), were used as the basis for investigation.

1.12. Objectives.

The objectives of this project are to:

- Review current sustainable construction tools, guidance and initiatives available.
- Identify general understanding of the term “sustainable construction” from each of the companies investigated.
- Identify key barriers, and forcing mechanisms with regards to implementing these methods.
- Gather an overview of general operation of each company site, and the willingness to opt for more sustainable methods of conducting business.
- Highlight areas where more guidance is required.
- Create recommendations for companies to overcome barriers and lack of knowledge on sustainable practices.
Chapter Two

Methodology

To meet the aims and objectives stated in Chapter One, the data and information collected for the project is from a small sample study of individual construction companies. For the purpose of this project individual construction companies were assessed on the way in which they interpret and implement sustainable construction into daily operations. The business support group Groundwork has carried out similar research. They commissioned Market Opinion Research International (MORI) to conduct a survey of small firms in the UK to identify the factors that influence their environmental performance (MORI, 1998 & Hillary, 2000). The survey found a substantial gap between the awareness of environmental problems and the business benefits that can be gained from implementing simple sustainable practices, such as waste management strategies, or aiming for lean construction.

For this project a small sample size was used to enable a more in-depth investigation. The small number of companies investigated for this project was necessary for this topic and to meet the aims and objectives in Chapter 1. Subsequently, a much more in-depth study of each company was collected. Time restrictions and resource limitations also contributed to this. To be able to capture range of information, opinions and perceptions more than one sized company was decided as the better option. To achieve the objectives, a questionnaire was selected as a means to collect information to compare, and describe the knowledge, attitudes and behaviour of various construction companies to achieve the objectives. Studies carried out by Hillary (2000) and Collins and Lawrence (2004) also used questionnaires to collect information about a similar topic in the construction industry.
These studies used much smaller questionnaires, with no more than eight questions to give an overview of general behaviour of the industry towards sustainable issues.

The outline of the methodology is shown in Figure 5.

2.1. Research and Company Selection.

The first stage of the methodology encompassed an extensive literature review, exploring the concept and practices of sustainable development and sustainable construction. Following this, research into individual companies and their current policies and management frameworks was undertaken. The research design chosen for the project was cross-sectional, or a social survey design (Fink, 2003). This approach has the benefit of allowing the use of a range of methods such as questionnaires, interviews and observation (Denscombe, 1998). Qualitative research was appropriate for the nature of the topic and to achieve the aims of the project. This type of method was suitable, because the aim of the project was not to test a hypothesis, but to discover information of the operations and interpretations of individual construction companies (Denzin and Lincoln, 2000).
Information was gathered from a number of different companies to analyse how individual construction companies interpret and implement sustainable construction. These companies were selected at random, and on the basis that people at the companies were willing to offer information, and were not restricted by time limitations of their own work. One advantage with a small-scale project such as this is a more in-depth analysis of each company is possible. However, this has its drawbacks due to the trade-off between in-depth analysis versus generalability and statistical analysis.

The majority of the 4 million businesses in the UK are small to medium companies (SMEs), 600,000 of which are construction firms (DTI\(^2\), 2004). They account for 58% of employment and are a very important component of the UK economy, (Hillary, 2000). SMEs are defined by the number of employees and annual turnover as highlighted in Table 3.

<table>
<thead>
<tr>
<th>Company Classification</th>
<th>Number of Employees</th>
<th>Annual Turnover (£)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Micro</td>
<td>1-9</td>
<td>Not exceeding £50 million</td>
</tr>
<tr>
<td>Small</td>
<td>10-99</td>
<td>Not exceeding £50 million</td>
</tr>
<tr>
<td>Medium</td>
<td>100-249</td>
<td>Not exceeding £50 million</td>
</tr>
<tr>
<td>Large</td>
<td>&gt;250</td>
<td>More than £50 million</td>
</tr>
</tbody>
</table>

Table 3. Small to medium sized company classification according to employee number and annual turnover. (Source DTI\(^2\) & Hillary, 2000)

These companies produce pollution, waste and many other unsustainable practices. However, because they are small, they do not perceive themselves as having significant negative impacts upon the environment when compared against larger companies. But due to their huge number, collectively, they do. Consequently, from the random selection of companies, a high proportion of them were expected to be SMEs.

To get a broad idea of how individual firms of different sizes interpreted and implemented any kind of sustainable practices, it was decided that at least twelve companies should be investigated, and in depth. The reason for this is that the construction industry has various sized companies, and this is a potential influencing factor in interpretation and implementation of sustainable construction. Before any information was collected, categories for the companies to fall under were developed using their annual turnover as a rough guide. The following categories were made:

- £1-9 million (small)
- £10-49 million (medium)
- + £50 million (large)

The objective of the categories is to be able to compare the difference in interpretation and implementation of sustainable construction between different sized companies. Furthermore, to identify whether finances, human resources or awareness play a part in implementation of sustainable practices. The geographical location of the companies was initially confined to those in Norfolk. However, after research and making contact with a number of companies a small number of them were national firms. They have offices and sites across the nation serving most of the UK construction industry, not just in Norfolk. This was limited to the companies falling into the medium and large categories; these firms answered the questionnaire from the national perspective.

The selection of the companies was random, with no prior knowledge of any firms in the area. The aim was to collect information from twelve companies, four in each category of small, medium and large. Although twelve companies was the aim, eight completed the questionnaire. Companies were first contacted via telephone and appointments made to speak to environmental responsible persons, as the majority were on site, away from the office or busy at the time of the initial enquiries. These telephone calls were followed up at the arranged times and all were asked to take part in the questionnaires. Using the telephone requires a clear and short explanation of the purpose and intentions of the call, while keeping the respondent interested from the beginning. To manage for this, a short speech was prepared before any telephone calls were made. By speaking to each respondent before they had even seen the questionnaire was one way of developing a good rapport with them, and displayed a personal involvement in the project (Creswell, 2003).

2.2. Construction of Questionnaire.

To conduct the investigation, a questionnaire was developed with the aim of primarily ascertaining how individual companies interpret and understand what is expected of them with regards to sustainability. A period of four weeks was allowed for information and data collection. This enabled companies to arrange interviews around their schedules, and fill in the questionnaires at their leisure without being pressurised, with the risk of non-completion. After the literature based research and company selection, the process of constructing the questionnaire began. The focus of the first section of the questionnaire was to investigate management priorities and concerns in associated with sustainable
construction the sample companies had when a development is proposed. To do this, the Ten Themes for Action from a document named “Building a Better Quality of Life”, published by DETR (2000) were used as a template.

All of the companies were asked about the types of factors that would both limit and force their decisions to consider the environment, based on the Ten Themes for Action. Limiting and forcing mechanisms at each company will make it apparent which are able to adhere to legislation and voluntary guidance, and those who are not. Furthermore, the questionnaire attempted to gain an overview of the key operations of construction, and how companies are trying to be more sustainable or not. This should highlight areas where more awareness, education, guidance, training and understanding are needed, and whether or not the Government’s efforts are working.

The exact nature of the questionnaire was determined based on the findings of the literature review. According to Denscombe (1998), questionnaires should avoid technical language and include only the most necessary questions. This ensures that the respondent understands what is being asked of them. Following guidance from Punch (2005) and Denscombe (1998) the questionnaire was created, and included all essential questions. Some questions were prompted (closed), where respondents were able to pick an answer from a list (Fink, 2003). These consisted of “Yes/ No/ Don’t Know” answers or a pre-defined list of options. Others were unprompted (open) with no suggestions provided, allowing the respondent to write what they wanted. This approach was used by Hillary (2000) to assess a number of objectives, such as environmental awareness, perceived role companies play in the economy, rate of environmental performance.

One respondent from each of the three categories agreed to pilot test the questionnaire, an opportunity to try out the questionnaire before its final draft was completed (Fink, 2003). As a result of this pilot testing, a number of issues were highlighted, and amendments made accordingly. For example, the length of the questionnaire was reduced, and the topic of sustainability was introduced in the first section, rather than the last.
The questionnaire (presented in Appendix 2) was divided into five sections to guide the respondent through the series of questions.

**Section A: You and Your Company**

In this section, there was a series of questions asked to develop a general overview of each respondent. They were asked their name and the name of the firm, their role, and the type of activities the firm undertakes. To gain a brief insight to their current understanding of environmental pressures they caused, details of any adopted measures to meet legislation requirements and staff training were asked for. They were also asked about how, and if companies considered the environment in any aspect of their work using the Ten Themes for Action. This highlights opinions and attitudes towards the environment, and also if forcing mechanisms and barriers influenced their decisions when conducting their daily business.

**Section B: Materials and Waste**

In this section the aim was to establish each company’s activities in relation to materials and waste produced. They were asked about their material range using a tick list of options, followed by a question that asked if they purchase secondary materials and for what reasons. This highlighted those who actively seek the cheaper option and if so, for which reasons. These questions were incorporated into the questionnaire to build a picture of each company’s decision-making priorities; whether in terms of money, the environment or complete unawareness of options available.

To identify problem areas in waste management, keeping in mind that all businesses have to pay the landfill tax, this section asked for information on waste disposal streams. Over-specification is a major contributor to the waste problem in construction in the UK. A question about the issue was included to identify those who over-specify and what they do with that material. The question was intended to elicit if some companies are worried about Landfill Tax, or the environment or are constrained by the size of their site to consider using materials on another project.

**Section C: Transport and Resource Sources**

In this section, geographical location of each material source in relation to each company’s site was asked for. The options were local, regional, national and international. This question was used to determine if any environmental concerns
stated in section A was reflected in the geographical location of suppliers chosen by the companies. Following this, the method of material transportation to each company site was asked to give an indication of how fossil-fuel intensive these parts of their operations are. To identify companies who are willing to change to more sustainable practices form those who were not, whether or not a company would use bio-diesel was asked. The next questions asked if the companies were willing to use local suppliers for materials if they were available. The use of local suppliers reduces the use of fossil fuels, as transport distances are shorter. The reasons for and against the idea will provide an indication of companies that are more environmentally and cost conscious, and those that are unaware of such options and benefits.

Section D: The Environment

In an attempt to identify a general picture of attitudes and opinions towards the environment among the companies, the respondents were asked whether or not they believed their activities have a negative impact upon the environment with closed “Yes/No/Don’t Know” question. The answers to this were to develop some recommendations for sustainable construction practices. To complete the section, respondents were asked about the negative impacts the industry has on the environment, and also the benefits they believed they could gain from using more sustainable practices. Both were closed questions with an option list.

Section E: Communication

This final section attempts to build a picture of the communication networks available and used by each company. This may possibly highlight the access each company has to legislation, initiatives and guidance. The final question asked if the companies take part in any kind of public consultations, a key component of sustainable development, and hence sustainable construction.

2.3. Data Collection.

After contacting a number of companies, the method of completing the questionnaire was agreed individually. A range of different methods of questionnaire delivery were used, including face-to-face interviews, post and email questionnaires. The preferred method of data collection was face-to-face interviews; they offered the chance to meet the respondent.
They also provided a more in-depth discussion of the topic of the project, and further information for Chapter 4. The specific method of delivery used depended on the time availability of the various companies, their access to the Internet, and their willingness to meet in person. Using the three methods should not affect the results, because a structured questionnaire was used.

**Post and Email:**
Denscombe (1998) suggests that the postal method of delivery is a “cold” concept due to the lack of personal contact. To try to overcome this problem, the respondents were first telephoned, and then arrangements made to post them the questionnaire. Respondents had prior noticed of the questionnaires arrival, with a stamped addressed envelope and cover letter, as recommended by Bourque and Fielder (2003), to minimise the risk of non-response. This was an agreed method of communication with two companies. Six other companies requested the questionnaire via email, which they regarded as a less onerous method of completing the questionnaire and returning it.

**Face-to–face Interview:**
Two respondents preferred this method of information collection. In agreement with Denscombe (1998), this type of survey allowed an extension of information compared to the post or emailed questionnaire. The interviews provided more details, beyond what the questions required, in each section of the questionnaire. However there are limitations, the researcher’s presence may bias responses of the questionnaire (Creswell, 2003). The interview also took up more of the respondents’ time than those who filled in the questionnaire by post or email due to travelling to meeting place and the depth of detail they offered for different questions.

**2.4. Analysis of Responses.**

The analysis comprised of identifying themes and patterns in responses, making a set of generalisations to justify these themes. One of the objectives of this project is to identify whether there is a general understanding of the term “sustainable construction”, with the information supplied by each company, and qualitative data are the product of a process of interpretation (Fink, 2003). The answers from Ten Themes for Action table in Section A provided a good basis to make interpretations of the operations and attitudes of each company.
Trends and patterns between the categories of company size were analysed, to identify any gaps in the up-take of sustainable practices, awareness or ability to adhere to voluntary guidance. The differences between each category were discussed qualitatively. Recommendations then made about the possible paths companies should take to implement sustainable practices into their business plans. Areas where more guidance is required were highlighted, and suggestions made to overcome this problem.
Chapter Three

Results

3.1. Questionnaire Response

A representation of how the individual construction companies interpret and implement sustainable construction was gained from the questionnaires. This was also a pre-requisite to establishing recommendations for putting the principles of sustainable development into practice, using the information gained from each company. The responses from the questionnaires portrayed the current standing of a number of companies in environmental thinking, and pro-active measures undertaken by each firm. The results of the questionnaires are presented in this chapter; the findings of the results and recommendations for the companies are discussed in Chapter 4.

A total of eight companies completed the questionnaire covering the three pre-defined categories, according to annual turnover. This will enable an investigation of the differences in interpretation and implementation of sustainable construction of various sized companies. To describe and interpret the answers to the closed questions, each company was assigned a letter

- Small are A, B and C (£1-9 million)
- Medium are D and E (£10-49 million)
- Large are F, G and H (> £50 million)
The following results are describes in relation to the separate sections and topics of the questionnaire. This provides a systematic method for analysing the responses of each company.

3.2. Analysis of the Data

Section A. You and Your Company

Of the companies investigated, there was a sharp difference between the number of staff employed in small size firms and medium and large firms. The three small companies had fewer than 60 permanent employees. The employee number of the medium and large companies did not differentiate them from each other. The five companies in the two categories had between them 192 and >1,500 staff members.

The activities of the small companies were limited to house repairs and alterations, with companies B and C undertaking commercial building, repairs and alterations. The medium and large companies covered all aspects of construction from civil engineering, house building and repairs, commercial building and repairs and some private contracts.

None of the small firms had an environmental officer or person/s responsible for environmental management. Instead, they indicated that any problems or issues were down to the site foreman. Company A identified the Construction Director with this role. In contrast, the medium sized firms D and E, had environmental officers. They described their roles as managing the impacts on the environment that results from the activities of the companies, according to their certified ISO or verified environmental management systems. Two of the larger companies also had environmental officers, again to manage their impacts upon the environment in alignment with legislative requirements, and Health and Safety procedures. However, the largest company, H, did not employ any such person. Nonetheless, they had a certified ISO 14001, followed PPG’s, and set targets and objectives within a sustainability framework.

To gain an idea of the pro-active environmental management and sustainability related measures taken in the work place, the companies were asked for details of specific training they provided. It was found that the small companies, A, B and C, were limited to few training schemes such as health and safety for all staff. Training in best practice techniques were provided for all staff at company B. Such training was also given in A, however they confined any environmental issues training to senior management only. One medium sized
firm E provided extensive training in environmental issues, production efficiency, health and safety and best practice techniques for all staff. Health and safety was a priority in company D for all staff, but environmental issues training was kept at senior management level.

The large firms had more extensive training schemes. All three firms, F, G and H, conducted training in health and safety for all staff. Companies F and G had training in environmental issues for all staff, while in H this was restricted to supervisors and senior management. It was discovered that companies F, G and H carried out training for production efficiency at supervisor and senior management levels only. Company H trained its entire staff in best practice techniques.

With regards to legislation, a great difference between the companies was again clear. Of the small firms, only company B had adopted measures to meet legislative requirements, which was a certified ISO 14001 EMS. The medium sized firms D and E both had certified ISO’s, followed PPG’s, and set targets and objectives; company E also had a verified environmental management system. The larger companies had significantly more measures, company F had a certified ISO 14001, a verified environmental management system, followed PPG’s, a sustainability framework and set targets and objectives. Company H had adopted similar measures. Company G did not follow any PPG or sustainability framework.

The individual companies’ definitions of sustainable construction appeared to follow a theme according to their size category. The small companies A, B and C believed that sustainable construction focuses on using materials from sustainable sources. Company A also mentioned the briefing note from the DTI Briefing Note in 2003, did not elaborate how that affected their business. The medium sized companies referred to using materials from renewable sources, using recycled materials and considering the entire life cycle of a product. It was the large companies F and G that vastly extended their understanding and interpretation of sustainable construction. They considered the importance of reducing impacts arising from waste, pollution, primary materials, energy consumption, and impacts on local communities. In contrast, the largest company, H, only referred to using materials that can be recycled, and from renewable sources.
The Ten Themes for Action are a key area of investigation for this project to interpret the level of environmental concern and awareness of different sustainability issues. From the questionnaires it was evident that the smaller companies considered less of the themes than the medium and large companies. The results relating to these themes are as follows.

**Minimise Waste.**

The results vary across the sample. Two of the small companies B and C, both actively minimise waste, while company A believed themselves as not applicable. Of the medium sized firms company D considered waste as an issue, but E did not. From the large group, F and G minimise their waste, however the largest, H did not believe this concern applicable to them.

**Re-use Built Assets.**

The results of this depended upon the type of work carried out by the companies, but a viable option to consider. Two small companies utilised their existing site and one did not. Of the medium companies this option was not applicable to one, while company D, to some extent considered this practice. Companies F and G to some extent also re-use built assets instead of new site, however for company H this is not applicable.

**Aim for Lean Construction.**

Two of the small companies, A and B aimed for lean construction to work towards continuous improvement, waste elimination and value for money. However company C did not aim for this. The medium firms were divided, with one that did aim for lean construction and one that did not. Of the large companies F sets this as one of its priorities, and G and H did to some degree.

**Minimise Energy in Construction and Use.**

The responses to these themes followed a similar trend through the companies. To some extent companies A and B both considered these when a project is proposed, while company C did not. In contrast both medium sized companies only considered these themes to some extent. Large company F regarded the two themes during project proposal. Company G did not manage for energy consumption during construction, but for minimising use in building designs to some extent. Company H considered both themes to some level.
Do Not Pollute.
Most notably, this theme produced a strong trend in respond. All eight companies unanimously stated that this was a concern and managed when a project was proposed.

Preserve and Enhance Biodiversity.
This produced conflicting results across the different sized companies. Small firms B and C, to some extent tried to keep this as one of their concerns when conducting business. Company A were unaware if biodiversity played a part in decisions made. Both medium sized companies managed the biodiversity impacts of a project to some level. Of the large companies, only F had this theme as a high priority, while company G stated that this was to some extent a concern for them. In contrast, company H did not manage for these aspects of their daily operations.

Conserve Water Resources.
Of all eight companies, only the smallest A, stated “Yes” for this theme, however both B and C did not. The mediums sized firms, to some degree were concerned and managed this aspect of the environment. Companies F and G also had the same response, whereas the largest company did not have any concerns or management priorities to manage water resources.

Respect People and Their Local Environment.
Local opinion obviously played an important role in various firms operations, as reflected by the results. The smallest company once again leads the group and viewed this as an area worthy of concern and management. Companies B and C considered people and their local environment to some extent. The same responses were determined from the medium sized forms. However, all three of the large companies stated, “Yes” for this theme.

Set Targets.
This theme displayed similar results as the previous one. Company A set targets when a project was proposed to manage for environmental issues. The other two companies set targets to a lesser extent. Of the medium sized forms, D had target setting as a priority, and company E to a lesser degree. All three large companies set targets to manage for environmental concerns when a project is proposed.
Another of the aims of the project was to establish the limiting and forcing mechanisms for implementing sustainable principles. Factors restricting the companies from considering these environmental issues followed a similar trend across all themes. The main limiting factors discussed here were client requirements, costs and profitability. The medium and large companies were also restricted by availability of recycled materials and specific expertise.

Following the limiting factors, the forcing mechanisms for environmental concerns and implementation of sustainable practices, if any were asked for. Of the small and medium companies, only company B offered examples, their reputation and the law. The others, A, C, D and E believed no such mechanisms influenced their concerns or practices. Both companies F and G stated that legal requirements and their management systems influenced how they view the environment when undertaking a project. Company H referred to the cost of waste disposal and pollution problems as its forcing mechanisms.

Section B. Materials and Waste.

To gain a general overview of the operations of the individual companies, various questions were asked about materials, waste, transportation and the environment. The objective of this section was to ascertain how the companies used primary and secondary materials, and the sorts of reasons for their choices. In the questionnaire a range of construction materials were listed: Concrete, Aggregates, Masonary, Metal/ steel, Timber, Glass, Plasterboard and Cardboard/ paper. All of the companies used these materials and all the companies, bar one used second-hand material from the local area. Company D, a medium sized firm, could not provide evidence to their clients of second hand material performance to specification requirements and thus opted not to use them. All three of the small companies required second hand material for traditional materials and to maintain the existing appearance of buildings. Companies E, F, G and H all referred to legal and legislation requirements, availability, and client requirements as reasons for deciding to use second hand materials.

Waste minimisation strategies were regarded as an indication how aware a company is about the issues surrounding waste disposal, and whether they have made pro-active measures to address the problem. The Landfill Tax is often a defining factor in how
companies choose to dispose of excess material and waste, as discussed in Chapter One. Figure 6 depicts the number of companies who have minimisation strategies or not.

![Figure 6. Companies with and without waste management strategies across the three size categories.](image)

Only one of the small and medium companies had some kind of strategy. Companies F and G had strategies but not the largest company, H. The implications of this are discussed in Chapter Four.

Companies A, B and E used all of the listed methods of waste disposal: Landfill, recycling, re-use, specialist disposal and sold to another construction/building company. Companies C and D used landfill and specialist disposal only. Of the larger companies, F, G and H used landfill, recycling, re-use and specialist disposal, and company G additionally sold material to other construction and building companies.

Ordering more materials than is necessary (over specification) is recognised as a problem in the construction industry, especially with regard to waste disposal. From the data collected in this project, there appeared to be no pattern between those companies who over-specified, those who did not and the size of the company.
It is apparent from the graph that the smaller companies found a means of utilising surplus material in other projects or through recycling. The medium sized companies D and E appeared to adapt to different waste disposal approaches. Company D reported that they had little space to store surplus material, and thus it was all treated as waste. Company E took a different stand on excess materials. Materials left over were stored and used on other projects, and also recycled where possible. Each of the large companies utilised the option of recycling. In addition companies F and H also stored their surplus material for later projects. Company G stated that it had limited space for storage, and surplus was treated as waste.

**Section C. Transport and Resource Sources.**

The companies were asked about the location of their material suppliers in relation to their site or offices to get an indication of how energy intensive the first stages of construction of a project are. Here the willingness to change a small aspect of construction operations to a more sustainable and environmentally friendly method was also explored. Companies A, B, C and D used local suppliers for all of their materials. In comparison, the medium and larger firms used a number of suppliers for some materials and from a variety of local, regional, national and international locations. These companies clearly required more materials and for a wider client base and specifications. It appeared that the larger the company the further away were their suppliers, and they also had a larger number of suppliers for each material. Metal and steel were ordered from various sources including
internationally by both medium and large companies E and G. Company G had by far the largest supplier list, followed by company H.

The modes of transport for materials were a further indication of how energy intensive a particular company can be. All eight companies had their material delivered to their site by road. The medium and large companies who had regional and national suppliers consumed more fuel and energy than the smaller firms. In addition, companies E and G who had international suppliers, used cargo ships for transportation, using extra fuel and energy compared to the other firms.

Following on from this question, the types of fuels used on site vehicles and machinery were asked about. All eight firms used diesel. Company E used approximately 10% gas in its machinery. The willingness of the companies to switch fuels to biodiesel produced contrasting results. All small and medium companies, and company F from the large category said they would opt for biodiesel. The largest companies G and H did not know if they would change this aspect of their operations.

The final question in this section focussed on the willingness of the companies to use local suppliers for materials if they were available and if so, the reasons for this. The indication was that all the companies would use local suppliers if they could provide what was needed. The reasons for this followed a reoccurring trend across the three sized categories. The availability of materials and the costs associated with this were the key concerns for the majority of the companies. Company F stated their only reason for using local suppliers was to support local communities. Medium-sized company D stated that they believed that local suppliers were more reliable.
Section D. The Environment.

This section of the questionnaire had the primary aim of determining the awareness of the individual respondents about the environmental, social and economic aspects of the construction industry.

![Negative Impact on the Environment or Not?](image)

**Figure 8.** The responses of companies when asked if they believed the construction industry had a negative impact on the environment.

As illustrated in Figure 8, two of the respondents did not consider that the activities of the construction industry had any negative impacts upon the environment. Surprisingly, one of these respondents was the largest of those investigated, and the implications of this will be discussed in chapter 4. The other six respondents unanimously agreed that construction does have adverse impacts upon the environment.

The awareness of the companies, and also possible areas where guidance and knowledge on environmental issues are lacking were assessed further. A number of known environmental and social impacts arising due to the construction industry’s activities were listed, and respondents then asked which they believed resulted from their own operations:

- Waste and disposal problems;
- Natural resource depletion;
- Air pollution;
- Dust pollution;
- Noise pollution, and;
- Disturbance to plants and wildlife.
Respondents from companies A, B, D, E, F and G all stated that they caused these negative impacts. The respondent from company H, who previously answered that the construction industry had no negative impact on the environment, had however agreed that they caused waste problem and natural resource depletion. As a consequence of the respondent from company C not believing the industry had any problems for the environment, they believed they did not cause any of the above listed impacts.

The last question of this section set about identifying how aware each company was about the financial and social benefits linked to implementing sustainable practices and maintaining the environment. Figure 9 highlights the different areas the companies believed they would gain something positive, and also where they would not.

![Benefits of Sustainable Practices](image)

**Figure 9.** Number of companies aware of the benefits of sustainable practices across the three categories.

From Figure 9, it is evident that all the companies were definite in their knowledge of the cost effectiveness and attractiveness to clients that sustainable practices can have. The majority of the companies, despite the existence of an environmental officer or an EMS, appeared to understand the opportunities available to them when considering the environment, its employees and local community. However, it was also highlighted that
three companies, one small, one medium and one large, did not believe anything would be gained for the business, such as “attractive to investors, competitive advantages or improved staff morale” from sustainable practices.

**Section E. Communication.**

This final section of the questionnaire tried to establish if the limitations of the up-take of sustainable practices in the industry in connection with communication. Communication with employees, stakeholders and the local community are important to be able to continuously improve performance with the ever-changing requirements of legislation. Whether companies are online or not may be a serious hindrance to this, however all eight companies had access to the Internet.

There are various methods of communication available for firms to correspond with employees and stakeholders. The following list of options were included in the questionnaire,

- Intranet;
- Notice boards;
- Internal meetings;
- Training sessions;
- Internet;
- Information sessions;
- Information leaflets;
- Environmental reports;
- Sustainability reports, and;
- Stakeholder meetings.

The main difference was evident in the number of communication channels used by the different sized companies. Small companies A, B and C ranged from three to four methods only, compared to the medium and large companies who utilised between all six to all ten methods listed.

Public consultation offers companies an opportunity to interact with the local community and those who will be directly affected by construction projects. The benefits were stressed in Chapter One. One of the small companies stated that they did participate or organise public consultations, while companies B and C did not. Of the medium sized firms,
company D did take part in public consultation, however company E did not. Companies F and G did conduct or take part in this type of consultation, in contrast again to the largest company H. They have stated that they do not know if they interact with the public in this way.

The significance and interpretations of the results presented above are discussed further in the following Chapter.
Chapter Four

Discussion

The aim of this project was to investigate how construction companies interpret and implement sustainable construction. From research, and analysis of the information provided, recommendations to overcome the barriers that limit the uptake of sustainable practices will be presented in this Chapter. Issues arising from the data collection method, and the data presented in the results in Chapter 3 will be discussed.

The environmental, social and economic impacts of the construction industry will be discussed in relation to the companies’ current environmental guidance influence and their daily operations. Gaps in the present manner of delivering guidance is also examined and highlighted. From this, recommendations will be made to further help companies implement sustainable practices.

4.1 Discussion of Results.

From the onset of contacting the various companies, it became apparent that many were unable to offer any information on the way they managed their environment or implemented sustainable practices. As a result they could not take part in the questionnaire. However, those who did contribute to this project gave their full support and offered any information they could.

The issues surrounding the lack of environmental performance by the construction industry have been stressed in Chapter 1. The Environment Agency believes that the industry’s unsatisfactory performance may lead to future regulatory controls increasing (Environment Agency, 2005). In accordance with this, the first aim of this project was to review the current sustainable construction guidance, tools and incentives; and then those in place in each company. The research produced a vast array of information. Discussed in Chapter 1 are tools such as ISO 14001, MaSC by BRE and the Landfill Tax, to name a few. These certainly aid the process of implementing sustainable construction, but from the questionnaires there appears to be a link missing that puts these tools and guidance into practice for firms of all sizes and financial ability.

The responses of the questionnaire repeatedly highlighted the differences in capabilities between the small, medium and large companies. The small companies lacked various training, environmental and economic management, and sustainability principles. Reasons such as lack of human and financial resources played a significant role in the deficit of basic measures to improve overall performance. The medium and large firms, in contrast, had all the means to employ an environment officer and relevant training and legislation.

It cannot be expected that companies with annual turnovers of a few million GB pounds, and in an extremely competitive industry, to take it upon themselves to implement sustainable practices. Initiatives and funding are essential for these firms to acknowledge their impact upon the environment, and then pro-actively work towards targets to improve their performance and alter the traditional ways of operating.

4.1.2. “Sustainable Construction”.

The responses from the companies when asked for their understanding of sustainable construction were as expected. The term sustainable construction means meeting environmental and social responsibilities, and at the same time improving profitability. These three principles are interconnected. Just as sustainable development requires the simultaneous adoption of environmental quality, economic prosperity and social equity (Bansal et al, 2004) sustainable construction depends upon all three components being implemented. Despite guidance notes such as “Building a Better Quality of Life” (2000),
and organisations such as DEFRA and DTI, the scope of interpretation of the term is extremely limited.

From the results it was clear that the small and medium sized firms primarily focussed upon the sustainability of material sources, and nothing further about their economic progress or their interactions with society. This narrow view of an extremely broad concept once again highlights the missing link between sustainable construction guidance and actually implementing practices to meet specific goals. A number of respondents emphasised that clients expect a certain level of business that does not affect their reputation. Consequently their requirements play a significant role in how construction companies operate and understand their responsibilities with regard to the local community and environment. The results demonstrated this fact in numerous answers of the questionnaire such as the Ten Themes for Action, or whether they use secondary materials.

However, this trend does not run true for the largest company investigated. Throughout the questionnaire this firm displayed the potential to benchmark its environmental performance, with a large annual turnover and workforce. Its understanding of sustainable construction was similar to those of the small and medium firms, principally referring to material sources and use. Unfortunately this company appeared to operate in ignorance of many of its own negative impacts upon the environment, and the means to change this. It emerged that this is down to the individual companies and their management and operational culture.

Further to this question, the Ten Themes for Action identified gaps in understanding and abilities for companies to interpret and implement sustainable practices. This highlights barriers preventing the construction companies from fully engage with issues of environmental management, social interaction and economic prosperity. The fact that two of the firms believed they were exempt from such issues as minimising their waste production suggests an ignorance to problems surrounding them, not just for the construction industry but for communities, as space in landfills rapidly decreases. This result followed the trend of inadequate environmental management, training and understanding. The answers to whether or not lean construction was a concern or priority produced mixed results. I believe this to be because of the partial understanding of what exactly was meant by this term, and the issue previously discussed about the lack of environmental understanding and responsibility.
Minimising energy in construction is an extremely difficult task. As all aspects of construction, from material extraction, building and then demolition uses energy. However the potential to incorporate energy saving schemes into developments are ever increasing, but as discussed previously clients have the final say. Considerable proportions of buildings are designed by developers then sold or rented to other people who will inevitably pay the electricity, gas and water bills. One respondent emphasised that there is no incentive for these developers to pay more than usual for eco-housing, energy efficiency or water conserving systems as they are not responsible for the life long cost of buildings (Johnson, 2005).

From the findings, the extremely obvious trend under the “Do not pollute” theme bares no surprises. I do not believe any company exists to intentionally harm the environment, but the lack of guidance and help offered to them has created a gap between the acceptance of pollution prevention and other issues such as biodiversity and water conservation. Elkington (1997) talks of the rise of the environmental revolution occurring waves. The concepts of pollution and environmental degradation have been around for decades, in what Elkington describes as the first two waves on environmentalism. Through the 1990’s the third wave began and is driven by the triple bottom line principle and fundamentally the ecosystems of the planet. Biodiversity and water conservation are important aspects of our planet, but this relatively new concept is taking its time to penetrate to businesses and industry.

The benefits of interaction with the local community are discussed in Chapter 1, including less resistance to projects in the local area which will reduce costs associated with delays and court proceedings. The findings produced results which indicate that of the companies investigated, respect towards the public was of high priority for all.

4.1.3. Key Barriers and Forcing Mechanisms.

Implementing environmental management schemes and sustainable practices is no easy task. The results indicate that small to medium, even large companies face barriers that limit their decision making capabilities. As stated previously, annual turnover is no guarantee a company will operate responsibility in terms of the environment, society and the economy.
The results show that key barriers are client requirements and associated costs, which fundamentally rule the decisions made. These barriers identified restrict companies from incorporating lean construction, or minimising energy in building use, and even control the amount of material purchased. There is a pressing need to educate clients and the general public of the sustainable options now available, as opposed to the traditional methods of building. Starkey and Welford (2001) make the point that firms are familiar with being judged on their financial performance. As discussed in Chapter 1 this is no longer the case. To eradicate these limiting factors, there must be a transparent method to utilise the many forcing mechanisms available, such as ISO 14001 and the OECD recommendations.

Of those companies investigated, many could not offer any incentives or mechanisms that would force them to consider the environment more or implement sustainable practices. Only those with ISO management systems legally binding them to improve their performance repeatedly demonstrated the measure they had taken to do so. It is evident from the results of questionnaire and research that the voluntary state of tools and mechanism is a significant hindrance to sustainable construction.

4.1.4. General Operations and Willingness to Change

The Landfill Tax is a mandatory fee all industrial sectors have to pay to dispose of their waste. Since its introduction in 1996, waste to landfill has fallen considerably (DEFRA, 2004). This indicates a substantial change in waste disposal. The respondents of the questionnaire demonstrated a wide range of waste disposal methods, but limited use of waste minimisation strategies. An example of an effective solution to waste generation is the adoption of the Waste Hierarchy. This scheme suggests that using fewer materials is most desirable for managing waste and a more prudent use of materials, in line with the aims of sustainable construction (DETR 1, 2000). This consequently is another barrier that construction companies are facing. Landfill Tax is an extra cost they must endure, but appears to be a substantial forcing mechanism to put waste minimisation strategies in place to reduce waste.

This issue highlighted the need for more communication between all, the design team, contractors and clients throughout the design stage. This will help with purchasing the correct amounts of material and reduce waste. It is more cost effective to prevent waste arriving on site than having to manage it in terms of waste.
The results also demonstrated willingness to some degree, across all the companies investigated to manage their environmental impacts. Either by recycling materials, using local suppliers or, if given the option, use biodiesel in site vehicles and machinery. All of the companies stated they would use local suppliers if their material requirements could be met. This indicates motivation on the part of all the companies to address the environmental impacts their activities. One such motivation was the use of biodiesel. This proved a popular consideration with all but two firms. This clean burning fuel contains no petroleum, but utilises recycled cooking greases, vegetable oil (BABFO, 2005). The power output is very similar to that of low sulphur diesel, and a major advantage is that biodiesel can be used with existing engines.

Communication is another key element of interpreting and implementing sustainable construction. All eight companies had access to the Internet, and therefore no reason not to voluntarily access schemes such as Easy Access for phased EMS implementation, or PPGs, or any other type of tool. The fact that the tools are voluntary raises the issue of whether or not future guidance and regulation should be mandatory. This would boost the industry to actively address its traditional methods of operating, and with the necessary assistance engage sustainable principles into business management.

### 4.2. Recommendations.

The literature review and personal interviews with the companies presented a number of opportunities for firms to adopt sustainable principles and manage the environment in which they operate. However, the results of the questionnaire have highlighted significant limiting factors in the uptake of sustainable practices, but also the willingness to change among the companies. The following recommendations provide what I believe to be essential steps for a company to interpret and then implement sustainable practise, based on the results and research of this project:

- Increase the Aggregate Levy and Landfill Tax, with the aim of having a significant impact on costs. This will encourage companies to pro-actively find methods of re-using and recycling materials, and using secondary material.
• The Government must take the lead and set performance benchmarks/targets across the industry in waste, fuel consumption, resource use, and brownfield site utilisation.
• These targets must be appropriate for local companies, for them to adopt successfully and understand there aims.
• Widespread encouragement of biodiesel, especially with on-site vehicles.
• Training and awareness sessions on all aspects of sustainable construction for all staff and sub-contractors.
• Communication between all involved in project design, material procurement, contractor and demolition team.
• Financial aid/incentives for firms to implement sustainable measures, especially for the small companies who have the primary aim of meeting financial targets each year.
Chapter Five

Conclusion

This section summaries and highlights the key findings of the questionnaire responses, examining whether the aims and objectives stated in Chapter 1 have been achieved. Following this, limitations surrounding the project will be identified, and further angles of investigation suggested.

The aim of the project was to investigate how construction companies interpret and implement sustainable construction. The results were collated using a questionnaire, and interviews with an environmentally responsible person of two of the companies. From the eight companies investigated, it appears that various interpretations of the term sustainable construction and the means by which to achieve its goals. The results highlighted very narrow interpretations of the term, indicating an area where vast improvements can be made. It is evident that the uptake of sustainable construction is hindered by the lack of understanding of the term, and what is expected of construction companies. As a consequence, implementing any measures to improve business performance in terms of the environment, the local community and the economy are limited.

The results portray that the limitations of sustainable construction implementation are due to a number of barriers, primarily client requirements, individual company culture or ignorance, and the deficit in guidance to put principle into practice. It is evident from the results that there may be an advantage associated with companies with annual turnovers above £50 million, and their ability to utilise their resources in environmental management.
This is not true for all, as company culture and environmental awareness play a significant role in whether a company operates sustainably.

The Ten Themes for Action published by the DETR (2000) were used to identify gaps in knowledge about the fundamental principles of sustainable construction. As discussed in Chapter 4, sustainable development and sustainability encompasses many aspects of the environment, not just pollution prevention, as all of the companies investigated stated as a major concern. Preserving biodiversity and water conservation are parts of the concept that need to be addressed. However from the results and research many companies find it difficult to justify or even understand this.

General operations of each construction company highlighted various methods of waste disposal, material transportation and purchasing that also needs to be modified to fall in line with the demands of sustainable construction. It became clear that many of the companies lacked guidance on how to implement simple measures such as using biodiesel, not over-specifying materials, or using a waste minimisation strategy. These simple suggestions would not interfere with current operations, but in fact boost their performance in monetary terms, and also their reputation. In conjunction with the aim of identifying where more guidance is needed, this is an area that must be promoted to all firms so they are in no doubt of how they can benefit from making these sorts of changes.

Further to this, key areas of improvement are needed in the procurement of materials and increased awareness of the impacts the industry has upon the environment. Communication across the entire sector is necessary from the designers, and clients, the contractors and suppliers, to ensure sustainable construction goals are achieved.

The Government, and organisations charged with the responsibility of creating guidance and tools, should further engage with construction companies, to ensure implementation is successful and targets are set to further improve. The voluntary state of these tools is clearly a problem. While the guidance, pollution prevention notes and management systems remain optional to companies, they will be misjudged as unnecessary and not implemented. An appropriate mix of incentives and penalties should be introduced, similar to the Landfill Tax. Targets should be set for the industry as a whole to switch to renewable sources of fuels, utilise local suppliers and introduce waste minimisation strategies. These targets must also be continuously monitored to ensure they are being met.
by all companies. Critically the targets must be adaptable to companies of all sizes and financial abilities.

There are a number of limitations associated with this project. The financial boundaries constrained the investigation of a greater proportion across the sector, so the results are only an indication of the construction industry’s performance. Time was another limiting factor in this project. To ensure that some responses were received, very long periods of return were allowed to fit in with the firms’ time, to try to manage for lack of interest. The small sample size can be interpreted as a narrow look at the industry, however the problems identified are not confined to those companies investigate as suggested by the literature review. The inconsistency in answers which one company displayed may be the result of the respondent not knowing of certain aspect of their company and therefore not qualified to give all the information required for the questionnaire.

To extend this study further, the questionnaire would include a question asking each firm if they had been approached by any organisation such as DEFRA, BRE or local council to help improve their performance. The small scale of the project has thrown up points which must be dealt with, while trying to achieve sustainable development in the construction industry. Environmental management and sustainable practices need to be adaptable by companies of all sizes, especially SMEs and consider some of the barriers identified in this project. However the companies investigated demonstrated motivation to improve their current methods of operating and to proactively consider the environment and society, and at the same time achieve their financial goals. These are the three principles of sustainable development.
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Appendix 1.
The Questionnaire
Please indicate your answers to the following questions by placing a tick in the appropriate boxes, thank you.

Section A. You and Your Company

1. Please state your name and position in the company

2. How many permanent staff are employed within the company?

3. Is an environment officer or other environmentally responsible person/s employed in the company?
   Yes ☐   No ☐   Don’t know ☐

4. If yes, what is their role?

5. Please indicate whether there is staff training on any of the following (please tick all relevant boxes).

<table>
<thead>
<tr>
<th></th>
<th>All staff</th>
<th>Supervisors</th>
<th>Line managers</th>
<th>Senior management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental issues</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Production Efficiency</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health and Safety</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Best practice techniques</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6. Does the company engage in any environmental management programmes?
   Yes ☐   No ☐   Don’t know ☐

7. Please indicate which of the following legislation and management systems the company has undertaken or adopted? (please tick all that apply)

   Accredited ISO (international organisation standards) ☐
   Verified Environmental Management System ☐
   PPG (Pollution Prevention Guidelines) ☐
   Any Sustainability framework ☐
   Set objectives and targets ☐
8. What do you understand by the term “sustainable construction”?

9. Under the following 10 themes, please indicate if the company has any management priorities, processes or concerns when undertaking a proposed development? (please tick all relevant boxes)

<table>
<thead>
<tr>
<th>Themes</th>
<th>Yes</th>
<th>To some extent</th>
<th>No</th>
<th>Not Applicable</th>
<th>Don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design for minimum waste</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Re-use existing built assets</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aim for lean construction</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimise energy in construction</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimise energy in use</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do not pollute</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preserve and enhance biodiversity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conserve water resources</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respect people and local environment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Set targets</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

10. Please state factors that would limit the company considering these environmental issues?

11. Are there any forcing mechanisms or incentives in place that ensure these environmental issues are considered? If so, please state what they are.
12. Which ONE of the following best describes the main type of work the company undertakes? (please tick one)

- Housing building
- House repairs, maintenance and alterations / improvements (extensions)
- Commercial property building
- Commercial repairs, maintenance and alterations / improvements
- Other (please specify)

Section B. Materials and Waste

1. Please indicate, with a tick, which of the following building materials the company uses. (please tick as many as appropriate)

<table>
<thead>
<tr>
<th>Materials</th>
<th>Tick</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete</td>
<td></td>
</tr>
<tr>
<td>Aggregates, sand and gravel</td>
<td></td>
</tr>
<tr>
<td>Masonary (brick, blocks and tiles)</td>
<td></td>
</tr>
<tr>
<td>Metal / steel</td>
<td></td>
</tr>
<tr>
<td>Timber</td>
<td></td>
</tr>
<tr>
<td>Glass</td>
<td></td>
</tr>
<tr>
<td>Plasterboard</td>
<td></td>
</tr>
<tr>
<td>Cardboard / paper</td>
<td></td>
</tr>
<tr>
<td>Other:</td>
<td></td>
</tr>
</tbody>
</table>

2. Does the company purchase any “second-hand” materials from the local area?

- Yes □
- No □
- Don’t know □

If NO, please state why.

3. What are the reasons for using “secondary material”? (eg: aggregate levy, regulation, impact on environment….)


4. Are there any waste minimisation strategies in place.

Yes ☐ No ☐ Don’t know ☐

5. Please indicate how the company disposes of waste material (please tick all relevant boxes)

<table>
<thead>
<tr>
<th>Waste disposal method</th>
<th>Tick</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taken to local landfill</td>
<td></td>
</tr>
<tr>
<td>Recycled on or off site</td>
<td></td>
</tr>
<tr>
<td>Re-used for another project</td>
<td></td>
</tr>
<tr>
<td>Taken away by specialist disposal company</td>
<td></td>
</tr>
<tr>
<td>Sold to another construction/building company</td>
<td></td>
</tr>
</tbody>
</table>

6. When ordering materials for a project, does the company over-specify to correct for error margins?

Yes ☐ No ☐ Don’t know ☐

7. Please indicate what the company does with any surplus material. (please tick the relevant boxes)

- All surplus material is treated as waste ☐
- All surplus is stored and used on another project at a later date ☐
- All surplus is treated as waste due to the lack of storage space ☐
- Recyclable surplus material is recycled ☐
- Surplus material is sold to another local builder/construction company ☐

Section C. Transport and Resource Sources.

1. For each of the following materials please indicate the location (approximate) of the supplier the company uses (please tick all relevant boxes)

<table>
<thead>
<tr>
<th>Materials</th>
<th>Local supplier</th>
<th>Regional supplier</th>
<th>National supplier</th>
<th>International supplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aggregates, sand and gravel</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Masonary (brick, blocks and tiles)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metal / steel</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Timber</td>
<td></td>
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<tr>
<td>Glass</td>
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<tr>
<td>Plasterboard</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cardboard / paper</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2. How are the materials transported to the company site?

Concrete

Aggregates, sand and gravel

Masonry (brick, blocks and tiles

Metal/ steel

Timber

Glass

Plasterboard

Cardboard/ paper

Other

3. What type of fuel do the company vehicles and machines use?

4. (if relevant) Would the company consider using bio-diesel in all vehicle and machinery?

Yes ☐ No ☐ Don’t know ☐

5. Would the company use local suppliers for its material orders if the materials were available locally?

Yes ☐ No ☐ Don’t know ☐

6. If YES, please state the reasons why.

7. If NO, please state the reasons why.

Section D. The Environment

1. Do you think the construction industry has a negative impact upon the environment?

Yes ☐ No ☐ Don’t know ☐
2. Please indicate which of the following environmental impacts you believe may be caused by your company (please tick all relevant boxes)

- Waste and disposal problems
- Natural resource depletion
- Air pollution
- Dust pollution
- Noise pollution
- Disturbance to plants and wildlife

3. Please indicate which of the following you believe would result in the company being more sustainably conscious (please tick all relevant boxes).

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>Don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost effective</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attractive to clients</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimise risks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improve public image</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attractive to investors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improved staff morale</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Competitive advantage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improve efficiency in terms of environmental management</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Section E. Communication

1. Does the company have access to the Internet?

Yes ☐  No ☐  Don’t know ☐

2. Which methods does the company use to communicate with employees? (please tick all relevant boxes)

<table>
<thead>
<tr>
<th>Communication methods</th>
<th>Employees</th>
<th>Stakeholders and community</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intranet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Notice boards</td>
<td></td>
<td></td>
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<tr>
<td>Internal meetings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Training sessions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Information sessions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Information leaflets</td>
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<td>Environmental reports</td>
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<td>Sustainability reports</td>
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<td>Stakeholder meetings</td>
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<tr>
<td>Other (please specify)</td>
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</tbody>
</table>

4. Does the company part-take or organise public consultations with the community who are to receive a development project in their area?

Yes ☐  No ☐  Don’t know ☐

Thank you for taking time to complete this template/questionnaire. Your contribution is much appreciated.