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DEVELOPING A SECTOR SUSTAINABILITY STRATEGY FOR THE UK PRECAST CONCRETE INDUSTRY

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the degree Doctor of Engineering (EngD), at Loughborough University

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ABSTRACT

Sector sustainability strategies can provide industry sectors with a way of managing risks and opportunities, and contributing to sustainable development. The UK Government has encouraged their development in the construction industry. British Precast, as the trade association for the precast concrete industry in the UK, had undertaken to develop a sector sustainability strategy for that industry. However, the development of such strategies is a departure from the traditional role of the trade association and presented British Precast with a number of challenges. This EngD research programme was therefore established in order to address those challenges and facilitate progress towards a more sustainable precast industry.

The research programme has followed a mixed method strategy of inquiry based on action research methodology, that is, a series of research cycles have been undertaken with the findings from each cycle being used to inform and guide subsequent cycles; archival analysis, survey and case study were the main research methods used. The requirement of the EngD programme to publish elements of the work in refereed journal and conference papers as the research progresses has allowed the research to be validated as scientifically satisfactory.

The strategy development process combined best practice, current and emerging theory, original research, stakeholder engagement, and experience from other sectors and industries. The strategy was produced in the form of an action plan for British Precast. This plan differs from the sustainability strategies produced for other sectors of the construction products industry in that rather than simply promoting action on specific objectives, it provides British Precast with a means of engaging with the industry and its stakeholders, and facilitating progress towards a more sustainable precast industry. The action plan has been well received by the industry and its stakeholders, and there is clear evidence that it is helping to guide the business decisions of companies in the industry, and that progress towards a more sustainable precast industry is being achieved as a result.

The research supporting the strategy development process has added to current knowledge and guidance on the development of sector sustainability strategies, but shown that there are limits to the influence trade associations can have over their members' actions. It has also been shown that the development of management systems, particularly environmental management systems to ISO 14001, and continuous performance improvement cultures can assist companies in managing for sustainability, supporting the findings of other studies. However, further work is needed to build support for the action plan within the precast industry, particularly amongst SMEs, to support the downstream supply chain in using precast products to deliver more sustainable construction, and to assist companies in achieving progress towards corporate sustainability. Recommendations are made for this work.

KEY WORDS

Sustainability; Sustainable Development; Construction; Management; Precast Concrete; Sector Sustainability Strategy.

PREFACE

The major aim of the Engineering Doctorate (EngD) programme operated by the Centre for Innovative and Collaborative Engineering (CICE) at Loughborough University is to develop engineers who are capable of demonstrating innovation in the application of knowledge to the engineering sector (CICE, 2004). The requirements of the EngD are met primarily through project work relating to the solution of one or more significant and challenging engineering problems with an industrial context, the findings from which should be subject to peer-review and published in appropriate conferences and journals during the course of the research programme.

This thesis describes research undertaken by the author between 2004 and 2008 to develop a sustainability strategy for the UK precast concrete industry. The research was undertaken with the support of the British Precast Concrete Federation (British Precast), the trade association for the precast concrete industry in the UK.

The thesis is organised into four main chapters and a series of supporting appendices, which are structured as follows:

- Chapter 1 introduces the research, and sets out the aim and objectives of the research programme.
- Chapter 2 reviews the research methodology followed and the research methods used.
- Chapter 3 presents a detailed description of the research undertaken. Included here are the findings from the literature review and the industry workshops, surveys and case studies that provided essential research data, together with reflections on the results in the context of current knowledge.
- Chapter 4 concludes the research. It contains a review of the key findings and outputs from the research, a discussion of the impact of the research on industry, a critical evaluation of the research methodology, and recommendations for industry and further research.
- Appendices A, B, D, E and F contain the five scientific papers produced in support of the research programme. Although these papers do not necessarily need to be read to understand the research presented in this thesis, it is recommended that they be read in conjunction with it as they contain further details of the work undertaken.
- Appendices C and G contain additional detailed research information.
- Appendices H to K contain other essential supporting material produced during the course of the research programme.

USED ACRONYMS/ABBREVIATIONS

AGM	Annual General Meeting
BDA	Brick Development Association
BERR	Department for Business, Enterprise and Regulatory Reform
BES	BRE Environmental Standard
BIBM	Bureau International du Béton Manufacturé
BRE	Building Research Establishment
BS	British Standard
CICE	Centre for Innovative and Collaborative Engineering
CIRIA	Construction Industry Research and Information Association
CISCF	Concrete Industry Sustainable Construction Forum
CPA	Construction Products Association
DCLG	Department for Communities and Local Government
DEFRA	Department for Environment, Food and Rural Affairs
DETR	Department of the Environment, Transport and the Regions
DTI	Department for Trade and Industry
EngD	Engineering Doctorate
<i>fib</i>	Federation Internationale du Beton
FIDC	Forest Industries Development Council
GDP	Gross Domestic Product
IMD	Institute for Management Development
ISO	International Organisation for Standardisation
KPI	Key Performance Indicator
MNC	Multi-National Company
NGO	Non-Government Organisation
ODA	Olympic Delivery Authority
OHSAS	Occupational Health & Safety Advisory Services
PAS	Publicly available standard
PEST	Political, economic, socio-cultural and technological
RIDDOR	Reporting of Injuries, Diseases and Dangerous Occurrences Regulations
RSM	Responsibly Sourced Material
SCI	Steel Construction Institute
SCTG	Sustainable Construction Task Group
SDC	Sustainable Development Commission
SME	Small to Medium Enterprise
SHEQ	Safety, health, environment and quality
SWOT	Strengths, weaknesses, opportunities and threats
UK	United Kingdom
UKAS	United Kingdom Accreditation Service

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LIST OF PAPERS

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Paper 1 (Appendix A)

Holton, I., Glass, J. and Price, A. (2008). *Developing a successful Sector Sustainability Strategy: Six lessons from the UK Construction Products Industry*. Corporate Social Responsibility and Environmental Management, Vol. 15, No. 1, pp 29-42.

Paper 2 (Appendix B)

Holton, I., Glass, J., Price, A., Clarke, M., Bell, S. and Watkins, M. (2006). *Identification and prioritisation of sustainability issues for the UK precast concrete industry*. Corporate Responsibility Research Conference 2006, Dublin, September 2006.

Note: This paper was not subject to peer review.

Paper 3 (Appendix D)

Holton, I., Glass, J. and Clarke, M. (2007). *Case studies demonstrating reductions in the consumption of natural resources and energy by the UK precast concrete industry*. In: Jacobsen, S., Jahren, P. and Kjellsen, K.O. (editors). (2007). Proceedings of the International Conference on Sustainability in the Cement and Concrete Industry, Lillehammer, Norway, September 2007, pp 501-513.

Paper 4 (Appendix E)

Holton, I., Glass, J., Price, A., Clarke, M., Bell, S. and Watkins, M. (2008). *Facilitating progress towards a more sustainable precast concrete industry in the UK*. In: Dhir, R.K., Newlands, M.D., Jones, M.R. and Halliday, J.E. (editors). (2008). *Precast Concrete: Towards Lean Construction*. Proceedings of the International Conference held at the University of Dundee, Scotland, 8-9 July 2008, pp 427-438.

Paper 5 (Appendix F)

Holton, I., Glass, J. and Price, A. (Forthcoming). *Managing for sustainability: findings from four company case studies in the UK precast concrete industry*. Submitted to the Journal of Cleaner Production, July 2008.

1 INTRODUCTION

This chapter briefly describes the background to the research, and sets out the aim and objectives of the research programme. In the next two chapters, the research methodology followed and research methods used are reviewed, and a detailed description of the research undertaken presented. Following which, the findings and outputs of the research are reviewed; the impacts of the research on industry considered; the limitations of the research discussed; and, recommendations made for industry and for further research.

1.1 BACKGROUND TO THE RESEARCH

A search of the World Wide Web will show that sustainability strategies have been developed by local, regional and national governments around the world, major corporations, and even for major sporting events such as the Olympic Games, but the development of sector sustainability strategies appears to have been limited to the UK. This is a missed opportunity as such strategies can provide industry sectors with a way of managing risks and opportunities, and contributing to sustainable development. They can also help trade associations become more effective champions for their members and their sectors (SDC, 2002a), and are independent of company size, enabling SMEs to contribute to the sustainability agenda, which is an issue of increasing importance, particularly amongst government bodies (Castka *et al.*, 2004).

The British Precast Concrete Federation, generally referred to as British Precast, is the trade association for the precast concrete industry in the UK. In 2002, British Precast signalled its intention to develop a sector sustainability strategy for the precast industry in order to support its competitiveness and ensure its long-term future (Holton *et al.*, 2005).

The development of sector sustainability strategies is a departure from the traditional role of the trade association. More used to providing marketing and technical support to their members, trade associations have found that they now have to be the catalyst to their members taking action on a wide range of economic, environmental and social issues. Although the Government has supported the development of Best Practice guidance to assist trade associations with strategy development, this guidance recognises that “*there’s no blueprint*” and that sectors are diverse with different mandates and priorities (SDC, 2002a). The precast industry is extremely diverse with over 500 companies ranging in size from divisions of MNCs employing over 1,000 staff to SMEs employing only a few staff, and therefore presents a considerable challenge in terms of catalysing into action. As a small trade association, with a few staff stretched across many key issues, British Precast did not have the resources or expertise to develop a sector sustainability strategy for the precast industry on its own. This 4-year Engineering Doctorate (EngD) research programme was therefore established by the Centre for Innovative and Collaborative Engineering (CICE) at Loughborough University, in collaboration with British Precast, in order to meet that requirement.

1.2 AIM AND OBJECTIVES

The overall aim of an EngD research programme should be to drive innovation in industry, not just by seeking optimal viable solutions to multi-faceted engineering problems, but also by implementing those solutions in an industrial context (CICE, 2004).

1.2.1 Aim of the research

In accordance with the requirements of British Precast, the overall aim of this research programme was to:

- Develop a sector sustainability strategy for the UK precast concrete industry.

As the research progressed, it became clear that the development of a sustainability strategy *per se* would not fully meet the requirements of British Precast or an EngD research programme. Specifically, a sector sustainability strategy on its own would not provide an innovative solution which would support the competitiveness of the precast industry and ensure its long-term future. Instead, it became apparent that achieving progress towards a more sustainable precast industry would mean engaging with companies across the industry, encouraging and assisting them in taking actions to improve their performance on a wide range of sustainability issues, and that a means of managing and monitoring that process would need to be developed. The focus of the research has therefore been on these issues and the problem of how to facilitate the development of a more sustainable precast industry, although the overall aim has remained the same.

1.2.2 Supporting objectives

Ten objectives in support of the research aim were identified in the course of the research programme.

1. Understand the precast industry and the processes involved in precast concrete production.
2. Understand the need for a more sustainable precast industry.
3. Assess the sector sustainability strategies produced for other construction products.
4. Develop consensus with industry stakeholders.
5. Identify and prioritise the key sustainability issues facing companies in the precast industry.
6. Identify the sustainability issues of importance to the industry's primary stakeholders.
7. Identify and disseminate best practice on sustainability in the precast industry.
8. Develop a method or methods for facilitating progress towards a more sustainable precast industry.
9. Investigate the process of change for corporate sustainability in the precast industry.
10. Produce a structured action plan for British Precast.

These objectives were met through undertaking a series of inter-related research cycles, together with the supporting activity of developing consensus with industry stakeholders, as shown in Table 1.1. The resulting outputs from the research programme are also shown.

Table 1.1: Research cycles, objectives and outputs

Research cycle/activity	Research objective	Output
Understanding the research area	1. Understand the precast industry and the processes involved in precast concrete production	Literature review
	2. Understand the need for a more sustainable precast industry	
Analysing other sector sustainability strategies	3. Assess the sector sustainability strategies produced for other construction products	Paper 1
Developing consensus with industry stakeholders	4. Develop consensus with industry stakeholders	<i>Sustainability Matters</i> annual progress reports
Mapping sustainability issues	5. Identify and prioritise the key sustainability issues facing companies in the precast industry	Paper 2
	6. Identify the sustainability issues of importance to the industry's primary stakeholders	
Facilitating progress	7. Identify and disseminate best practice on sustainability in the precast industry	Paper 3
	8. Develop a method or methods for facilitating progress towards a more sustainable precast industry	Paper 4
Managing for sustainability	9. Investigate the process of change for corporate sustainability in the precast industry	Paper 5
Formulating and implementing the strategy	10. Produce a structured action plan for British Precast	Paper 4 + <i>Sustainability White Paper</i>

2 RESEARCH METHODOLOGY

2.1 INTRODUCTION

Saunders *et al.* (2007) define research methodology as the theory of how research should be undertaken, and, research methods as the techniques and procedures used to obtain and analyse data. This chapter presents the research methodology followed and the research methods used. It begins with a review of the methodological considerations that led to the adoption of a mixed method strategy of inquiry based on action research methodology, then, following a brief review of the principles of action research, the research methods used are described, and the research process followed is presented.

2.2 METHODOLOGICAL CONSIDERATIONS

2.2.1 Business and management research

Blumberg *et al.* (2005) define business and management research as a systematic inquiry whose objective is to provide the information that will allow managerial problems to be solved and guide business decisions. One of the distinguishing features of business and management research is the requirement for the research to have some practical consequence (Easterby-Smith *et al.*, 2002).

Although the aim of this research was to develop a sector sustainability strategy for the UK precast concrete industry, the research problem faced was how to facilitate the development of a more sustainable precast industry, which was essentially a management problem. In addition, whilst the overall subject of the research was the UK precast concrete industry, in order to meet the research aim and establish a solution to the research problem, it would be necessary to investigate the opinions, practices and performance of companies in the precast industry, and encourage managers in those companies to take actions to improve their economic, environmental and social performance.

This research can therefore be considered to have taken place in the general field of business and management research in that it is concerned with a management problem and will have the practical consequence of guiding business decisions on improving the sustainability of individual companies in the precast industry.

2.2.2 Research strategy

Bryman and Bell (2003) site business research in the context of the social science disciplines, such as sociology, psychology, anthropology and economics, which inform the study of business and its specific fields such as marketing, human resource management, strategy, organisational behaviour, finance and industrial relations. There is a widely used distinction in the social sciences between two types of research strategy; quantitative and qualitative. Fellows and Liu (2003) provide the following descriptions of each.

- Quantitative approaches tend to relate to positivism and seek to gather factual data and to study relationships between facts and how such facts and relationships accord with theories and the findings of any research executed previously (literature). Scientific techniques are used to obtain measurements – quantified

data. Analyses of the data yield quantified results and conclusions are derived from the evaluation of the results in the light of the theory and literature.

- Qualitative approaches seek to gain insights and to understand people’s perceptions of ‘the world’ – whether as individuals or groups. In qualitative research, the beliefs, understandings, opinions, views, etc of people are investigated – the data gathered may be unstructured, at least in the ‘raw’ form, but will tend to be detailed, and hence ‘rich’ in content and scope. Analyses of such data tend to be considerably more difficult than with quantitative data. A variety of external, environmental variables are likely to impact on the data and results and the researchers are likely to be intimately involved in all stages of the work in a more active way than usually is acceptable in quantitative studies.

Essentially, quantitative approaches treat data objectively in order to provide deductive explanations, whilst qualitative approaches are subjective and inductive.

The distinction between quantitative and qualitative strategies has traditionally had a considerable influence over the research methodology, data collection methods and analytical techniques adopted for a specific study. However, Blumberg *et al.* (2005) note that in many social sciences, such as management studies, there is no clear predominance of qualitative or quantitative studies, and it is not uncommon for the two strategies to be combined within an overall research project in a mixed methods approach.

Creswell (2003) suggests that one of the first steps in designing a social science research proposal is to assess the knowledge claims brought to the study; a researcher can then identify whether to follow either a quantitative, qualitative, or mixed methods approach to inquiry. Four different knowledge claim positions can be identified, the major elements of which are presented in Table 2.1. Of the four approaches described, pragmatism is the one most applicable in this case in that the focus of attention is on the problem and deriving knowledge about the problem in order to establish solutions to it. Creswell (2003) suggests that a mixed method strategy of inquiry is best suited to pragmatic knowledge claims; this will typically involve collection of both quantitative and qualitative data sequentially.

Table 2.1: Alternative knowledge claim positions (Creswell, 2003)

Postpositivism	Constructivism	Advocacy/Participatory	Pragmatism
Determination Reductionism Empirical observation and measurement Theory verification	Understanding Multiple participant meanings Social and historical construction Theory generation	Political Empowerment issue- oriented Collaborative Change-oriented	Consequences of actions Problem-centred Pluralistic Real-world practice oriented

2.2.3 Methodology adopted

Taking the various considerations described into account, action research was selected as the most appropriate methodology for this research programme because it promotes broad participation in the research process and supports action (Greenwood and Levin, 1998). Although it is grounded in a qualitative research paradigm whose purpose is to gain greater clarity and understanding of a question, problem or issue (Stringer, 2007), Greenwood and Levin (1998) reject the notion that action research is a qualitative methodology only, since the emphasis on practical outcomes differentiates it from other forms of qualitative investigation and it can involve the collection of both quantitative and qualitative data. Thus action research can be considered to meet the requirement for a mixed method approach established previously. Furthermore, in business and management, action research is seen as particularly useful in researching processual problems in organisations such as learning and change, and in bridging the gap between researchers and managers (Bryman and Bell, 2003).

2.3 ACTION RESEARCH

Saunders *et al.* (2007) define action research as “a research strategy concerned with the management of a change and involving close collaboration between practitioners and researchers”, whilst Stringer (2007) describes it as “a systematic approach to investigation that enables people to find effective solutions to problems”. Although precise definitions may vary, the strengths of an action research strategy are a focus on change, the recognition that time needs to be devoted to diagnosing, planning, taking action and evaluating, and the involvement of practitioners throughout the process (Saunders *et al.*, 2007).

The development of action research has been closely linked to social psychology and the work of Kurt Lewin and the Tavistock Institute of Human Relations (Gill and Johnson, 2002); it has subsequently been interpreted by management researchers in a variety of ways (Saunders *et al.*, 2007). The basic action research routine has therefore been presented in a number of ways, including the classic “plan, act, observe, reflect” attributed to Lewin (1946), but the one common element is representing the research process as a continuing spiral of activity, as shown in Figure 2.1.

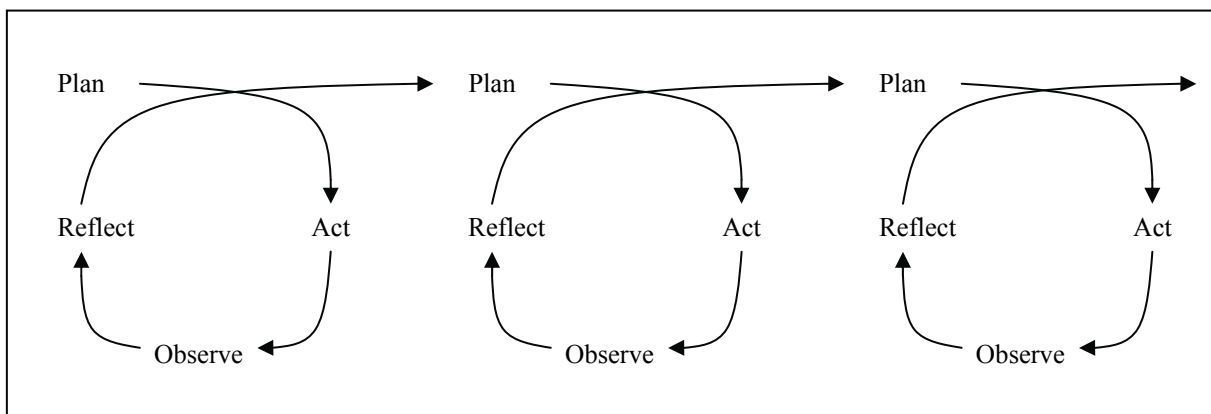


Figure 2.1: Action research ‘cycle of spirals’

Planning is seen as starting with a general idea and a certain objective, followed by more fact-finding about the situation, from this an overall plan is developed together with a decision of the first step to take. This is then followed by a series of actions, observations and a period of reflection, with results and outcomes from the first cycle used to guide actions for the next cycle and so on. Thus, action research is a constantly evolving project with interplay among problem, solution, effects or consequences and new solution (Sekaran, 2003). Adding a note of caution, Stringer (2007) notes that action research is not a neat, orderly activity, and can be a complex process.

Bryman and Bell (2003) note that action research is criticised for its lack of repeatability and consequent lack of rigour and for concentrating too much on organisational action at the expense of research findings. However in its defence, it is noted that involvement with practitioners concerning issues that are important to them provides a richness of insight that cannot be gained in other ways. Whilst Easterby-Smith *et al.* (2002) note that because of the collaborative features of action research, participants (the researcher and the researched) are likely to learn a lot from the research process itself, and their interest may be on what happens next rather than on any formal account of research findings.

2.4 RESEARCH METHODS

Greenwood and Levin (1998) note that action researchers accept no *a priori* limits on the kind of social research techniques they use.

Yin (2003) refers to five main research methods in social science research: experiment, survey, archival analysis, history and case study. Each is a different way of collecting and analysing empirical evidence, following its own logic, and each has its own advantages and disadvantages. When to use a particular method depends on three factors:

- 1) the type of research question posed;
- 2) the extent of control an investigator has over actual behavioural events; and
- 3) the degree of focus on contemporary as opposed to historical events.

Table 2.2 shows how Yin (2003) relates these three factors to the five main research methods.

Table 2.2: Relevant situations for different research methods (Yin, 2003)

Method	Form of research question	Requires control of behavioural events?	Focuses on contemporary events?
Experiment	how, why?	Yes	Yes
Survey	who, what, where, how many, how much?	No	Yes
Archival analysis	who, what, where, how many, how much?	No	Yes/No
History	how, why?	No	No
Case study	how, why?	No	Yes

Of the main research methods identified by Yin (2003), three were used in this research programme; archival analysis, survey and case study. The methods are complementary in that they each allow for a different breadth and depth of study, as illustrated in Figure 2.2. Overviews of each method are given here; further details are given in the next chapter when describing the research undertaken and research findings.

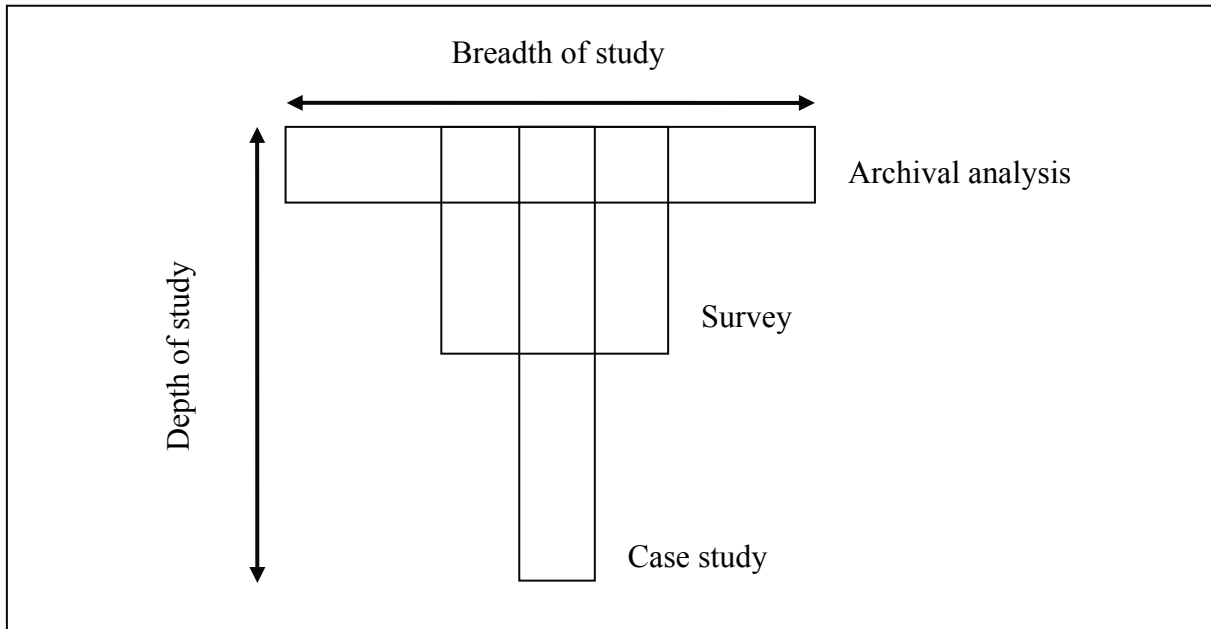


Figure 2.2: Breadth vs. depth of study

2.4.1 Archival analysis

Archival analysis of documents and records, including literature, would typically be used for exploratory rather than explanatory studies (Yin, 2003) and to provide a broad but shallow view on a topic. It has the advantage that it is unobtrusive and does not require participation by the research subject; however, it can be open to bias on the part of the researcher. Two commonly used techniques are critical review and content analysis.

Critical review: A critical literature review provides a detailed and justified analysis of the merits and faults of the literature within a specific area (Saunders *et al.*, 2007). The key factor is for the criticism to be both objective and informed (Fellows and Liu, 2003).

Content analysis: Content analysis is an approach to the analysis of documents and texts, that seeks to quantify their content in terms of predetermined categories in a systematic and replicable manner (Bryman and Bell, 2003). It has the advantage that it is a very transparent and flexible method, but the development of an appropriate coding or categorising scheme is critical since emphasis can be placed on what is measurable rather than on what is theoretically significant or important.

2.4.2 Survey

The main purpose of a survey is to obtain information from, or about, a defined set of people, or population (Easterby-Smith *et al.*, 2002). Survey questions typically concern

fact, knowledge and opinion, and appear in two primary forms – open and closed (Fellows and Liu, 2003). Closed questions have a set number of responses as determined by the researcher, often allowing a greater number of questions to be asked more easily and quickly, but the rigidity of available responses may constrain the responses artificially and limit the depth of information obtained. Open questions are designed to enable the respondent to answer in full, however, they can be difficult to answer, may never be answered fully, and can be difficult to analyse.

Surveys generally operate on the basis of statistical sampling and securing a representative sample (Fellows and Liu, 2003). Questionnaires and interviews are the most commonly used survey methods. The choice of survey method usually depends on the sample size (breadth) and richness of information (depth) required.

Questionnaires: Questionnaires may be administered in a number of ways, but are generally designed to be completed independently by the respondent and thus to be free of any interviewer effects. They are also quicker and cheaper to administer than interviews, and are more convenient for respondents (Bryman and Bell, 2003). Amongst the disadvantages of questionnaires are: not being able to prompt the respondent; not being able to probe or elicit further information; questions can be missed; and, the risk of a low response rate (Bryman and Bell, 2003). The accuracy and success of questionnaire surveys thus depends largely on the careful design of their content, structure and response format.

Interviews: Interviews are typically classified as structured or unstructured depending on the constraints placed on the respondent and the interviewer (Fellows and Liu, 2003). In a structured interview, the interviewer essentially administers a questionnaire and there is little scope for probing responses or obtaining more detail by asking supplementary questions. In unstructured interviews, the interviewer allows the respondent to respond freely on a topic, following up points or introducing additional topics as required. Semi-structured interviews fall in between the two extremes; they will often allow for a more flexible process and more probing questions than in a structured interview, but follow a more defined and repeatable set of questions than in an unstructured interview.

Focus groups: A focus group is essentially a form of group interview; it will typically provide a greater breadth but less depth of information than an interview. Usually it involves a group discussion on a predetermined topic or topics, which is instigated by a researcher who acts as a moderator or facilitator.

2.4.3 Case study

Case studies encourage in-depth investigation of particular instances within the research subject (Fellows and Liu, 2003), are more explanatory, and are the preferred strategy when examining contemporary events, but when the relevant behaviours cannot be manipulated (Yin, 2003). Case study research can include both single- and multiple-case studies, with either single or multiple units of analysis, and studies may be selected on the basis of their being a representative sample, to demonstrate particular facets of a topic, or to show the spectrum of alternatives (Fellows and Liu, 2003).

Case study research has been criticised for lack of rigour and for providing little basis for scientific generalisation (Yin, 2003), but the purpose of the case study is not to generalise to other cases or to populations beyond the case as it is with survey research (Bryman and Bell, 2003), and Yin (2003) suggests the protocol to be a major way of increasing the

reliability of case study research. Yin (2003) also states the case study’s unique strength to be its ability to deal with a full variety of evidence, including documents, interviews and observations.

2.5 THE RESEARCH PROCESS

Following established practice (Fellows and Liu, 2003) the research process began with a literature review. Creswell (2003) notes that in qualitative studies the literature is used to ‘frame’ the problem in the introduction to the study, whilst in quantitative studies it provides direction for the research questions or hypotheses. In this study, the literature review was used for both purposes; reviewing the literature allowed an understanding of the research area to be developed, and provided direction for the subsequent research cycles.

In accordance with action research methodology, a flexible and evolving research process was then followed in which the findings from each research cycle were used to develop objectives for subsequent cycles. However, a recognised strategy development framework (see Figure 3.2) was also used as a guide to ensure that the research process did culminate in the formulation of a sector sustainability strategy for the precast industry.

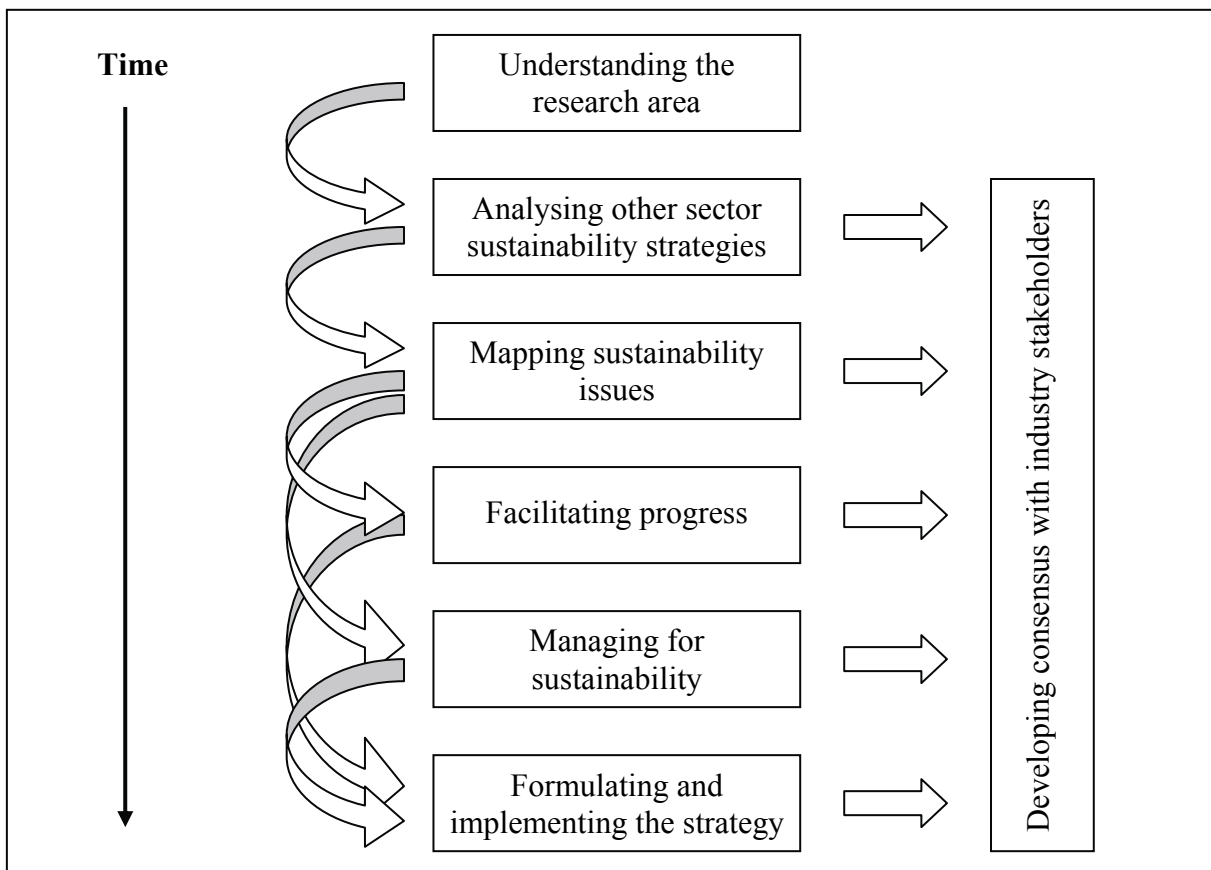


Figure 2.3: Research cycles and activities undertaken

Table 2.3: Research cycles, objectives, methods and outputs

Research aim: To develop a sector sustainability strategy for the UK precast concrete industry		
Research cycle/activity	Research objective	Research method
Understanding the research area	1. Understand the precast industry and the processes involved in precast concrete production	Archival analysis
	2. Understand the need for a more sustainable precast industry	
Analysing other sector sustainability strategies	3. Assess the sector sustainability strategies produced for other construction products	Archival analysis
	4. Develop consensus with industry stakeholders	
Developing consensus with industry stakeholders	5. Identify and prioritise the key sustainability issues facing companies in the precast industry	Survey
	6. Identify the sustainability issues of importance to the industry's primary stakeholders	
Mapping sustainability issues	7. Identify and disseminate best practice on sustainability in the precast industry	Case study
	8. Develop a method or methods for facilitating progress towards a more sustainable precast industry	
Facilitating progress	9. Investigate the process of change for corporate sustainability in the precast industry	Archival analysis
	10. Produce a structured action plan for British Precast	
Managing for sustainability		Case study
Formulating and implementing the strategy		

Six main research cycles were undertaken in the course of the research programme. The inter-relationship between the research cycles is shown in Figure 2.3; the important supporting activity of developing consensus with industry stakeholders is also shown. Table 2.3 shows how the research cycles and activities relate to the research objectives, and where the different research methods were used; the resulting outputs from the research programme are also listed. Further details are given in the next chapter when describing the research undertaken and research findings.

2.6 SUMMARY

This research is based on a pragmatic epistemology in that the focus of attention is on the problem of how to facilitate progress towards a more sustainable precast industry and establishing solutions to it. This has led to the adoption of a mixed method strategy of inquiry based on action research methodology; action research provides a flexible yet focussed methodological approach which promotes participation in the research process and supports action. Six research cycles were undertaken in order to meet the aim and objectives of the research programme. Archival analysis, survey and case study were the main research methods used; the methods are complementary in that they each allow for a different breadth and depth of study. The supporting activity of developing consensus with industry stakeholders was also an important part of the research process.

3 RESEARCH UNDERTAKEN

3.1 INTRODUCTION

This chapter describes the research undertaken to meet the aim and objectives of the research programme; a summary of the supporting work undertaken to develop consensus with industry stakeholders is also included here. Each research cycle is presented as a separate section in which the aim of the cycle, research undertaken and results obtained are described, then, in accordance with action research methodology, the results are reviewed in the context of current knowledge and the next steps for the research programme considered. The chapter ends with an overall summary of the research undertaken.

3.2 UNDERSTANDING THE RESEARCH AREA

The aim of the first research cycle was to develop an understanding of the research area, and thereby inform and guide future research cycles. In order to achieve this aim, a number of distinct but complementary areas were investigated. Archival analysis in the form of a critical literature review was the principal research method used. The research findings are summarised in the following sub-sections.

3.2.1 Sustainable development and the construction industry

In 1987, the Brundtland Commission summarised sustainable development as “*development which meets the needs of the present without compromising the ability of future generations to meet their own needs*” (Brundtland, 1987). Since then, much effort has been spent trying to deepen understanding about sustainable development, both as a concept and in a practical sense (Parkin *et al.*, 2003). Consequently, sustainable development is now a broad concept that has been interpreted in many ways and adopted in many contexts, resulting in a wide range of alternative definitions and responses (Adetunji, 2006).

Despite the lack of a common definition, those working in the field generally consider sustainable development, or sustainability, to have three inter-related dimensions: economic, environmental and social (Hitchcock and Willard, 2006).^{*} These dimensions are often conceptualised as overlapping circles, as shown in Figure 3.1, and have been characterised by business in particular as the ‘triple bottom line’ (Parkin *et al.*, 2003). Instead of trading these dimensions off against one another (jobs *or* the environment; economic growth *or* environmental health; development *or* habitat), sustainable development aims to optimise all three (Hitchcock and Willard, 2006). However, it is important to note that sustainable development is not a fixed state of harmony, but rather a process of change consistent with future as well as present needs (Brundtland, 1987).

^{*} Dresner (2002) discusses what is meant by ‘sustainability’ and ‘sustainable development’ at some length. It would appear that the two terms have been used almost interchangeably, and that it has been politically important for many people to avoid making a distinction. Sustainability is currently the more fashionable expression amongst environmentalists and politicians.

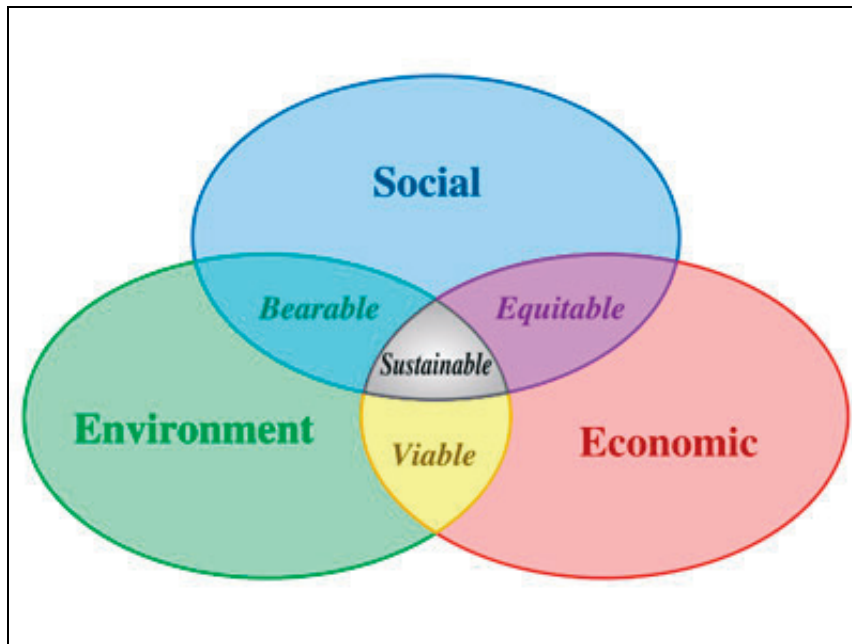


Figure 3.1: Conceptual view of sustainable development

The Government has stated its commitment to making sustainable development for the UK a reality (DETR, 1999); consequently Government policy, in the form of legislation and programmes, is one of the key contexts and drivers for sustainable development in the UK (Parkin *et al.*, 2003). Government policy is guided by the national strategy for sustainable development; the current strategy was first published in 1999 (DETR, 1999) and subsequently revised in 2005 (DEFRA, 2005). This strategy recognises that sustainable development is about delivering a better quality of life for everyone, now and for generations to come, and means achieving social, economic and environmental objectives at the same time (DETR, 2000). Since 1999, these objectives have been defined as (DETR, 1999):

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

In order to achieve these objectives, ten guiding principles for Government policy were defined and a system of indicators established to measure and report progress (DETR, 1999). It was also recognised that action would be required by a wide range of other groups, including business and industry, local authorities, local communities and individuals. To encourage action, a number of priority areas were identified, one of which was construction.

3.2.2 Sustainable construction and sector sustainability strategies

The construction industry was considered to be of significance in achieving progress towards sustainable development in the UK and worthy of separate consideration because of the important impact it has on society and on the environment (DETR, 1998a). It was also recognised that: the construction industry provided the delivery mechanisms for many aspects of Government policy aimed at the provision and modernisation of the nation's

infrastructure – transport, housing, schools, hospitals, etc; and, the benefits that could flow from a more efficient and sustainable construction industry were potentially immense (DETR, 1998a).

CIRIA Report C563 (CIRIA, 2001) considered the business benefits of sustainable construction. The view was expressed that adopting a sustainable approach would address the failings of the construction industry identified in *Rethinking Construction*, commonly referred to as the Egan Report (DETR, 1998b), and lead to significant business benefits, including better understanding of client needs, identification of opportunities for innovation, increased shareholder value, reduced costs, reduced risk, enhanced public relations and community liaison, and increased employee motivation. This shows that becoming more sustainable is as much about efficient, profit-orientated practice and achieving value for money, as it is about helping society and protecting the environment. In fact Bennett and Crudgington (2003) note that there is a growing consensus as to the competitive advantages that can be conferred by businesses taking a sustainable approach.

The Sustainable Construction Task Group in its *Reputation, Risk and Reward* report published in 2002, noted that pressures on businesses in the property and construction sectors to respond to the sustainability agenda were increasing from the environmental, social, governmental and investment sectors (SCTG, 2002). This was not unexpected, since in 2000, the UK Government had published a sustainability strategy specifically for the construction industry (DETR, 2000).^{*} This strategy was intended to make the construction industry more profitable and competitive, deliver buildings and structures that provide greater satisfaction, well-being and value to customers and users, respect and treat its stakeholders more fairly, enhance and better protect the natural environment, and minimise its impact on the consumption of energy (especially carbon-based energy) and natural resources; it encompasses many of the concepts from the Egan Report (DETR, 1998b). The strategy also recognised that action would be required by the Government, the industry and individual businesses.

The complex and fragmented nature of the construction industry is recognised as restricting change within the industry (Myers, 2005). In order to persuade the construction industry to address the sustainability agenda, the Government challenged sector representative bodies and trade associations to develop sector sustainability strategies (DETR, 2000); a sector can be defined as a part or branch of a particular area of activity, especially of a country's economy (Hornby, 1995), and can include everything from small groups of large MNCs to large groups of SMEs and even collections of individual professionals (SDC, 2002b). Such strategies were seen as providing a framework for sectors to assess their economic, environmental and social performance; identify areas for improvement in the light of future opportunities and threats; set targets and implement action plans to bring about those improvements; and then to report progress to stakeholders (DETR, 2000). It was also considered that trade associations which ignored sustainability issues, or tried to fend them off instead of turning them into competitive advantage, were likely to become less effective champions for their members and their sectors (SDC, 2002a).

^{*} A revised strategy was published in June 2008 (BERR, 2008).

3.2.3 The precast concrete industry

The construction industry has been defined as those industries that contribute to the creation and maintenance of the 'built environment' (DETR, 1998a). In the UK, the industry is generally recognised as comprising four principal activities; building, civil engineering, materials and products, and associated professional services (DETR, 2000). Construction materials and products is the largest of these four activity groups with an annual turnover in excess of £40 billion, which accounts for approximately 40% of total construction output, 20% of the UK's manufacturing output and 4% of GDP (CPA, 2005). This in turn is divided into four main areas, raw materials, fabricated components, fixtures and fittings, and cladding and insulation, which provide employment for over 650,000 people in almost 30,000 companies. Over 40 trade associations exist to serve different product groups within the construction products industry (CPA, 2005), suggesting a complex and wide ranging set of concerns and interests.

Precast concrete is an important part of the UK construction products industry; in 2003, it had a turnover of £2 billion from 35 million tonnes of product sales (Clarke, 2003) and sales are predicted to increase by 9% in real terms between 2004 and 2009 (Quality Concrete, 2006). The precast industry also has an impact on society and the environment; for example, the industry provides direct employment for over 20,000 people, is a major user of cement and virgin aggregates, consumes energy and water in its production processes, transports its products nationally, and has many factories in urban areas. Hence, improvements in the economic, environmental and social performance of the precast industry would make an important contribution to sustainable development in the UK, but would also bring business benefits to the industry.

The British Precast Concrete Federation, generally referred to as British Precast, is the trade association for the precast concrete industry in the UK. In 2002, British Precast signalled its intention to develop a sector sustainability strategy for the precast industry in order to support its competitiveness and ensure its long-term future (Holton *et al.*, 2005).

The role of British Precast has traditionally been to provide marketing and technical support to its members (Clarke, 2003); the development of a sector sustainability strategy is a departure from this role and presented British Precast with a number of challenges.

- As a small trade association, with a few staff stretched across many key issues, it did not have the resources or expertise to develop a sector sustainability strategy for the precast industry on its own.
- There are over 500 precast companies in the UK ranging in size from small, independently-owned, single factory operations often employing less than 10 people, to divisions of large national and international companies with 10 or more factories and over 1,000 staff; achieving progress towards a more sustainable precast industry would mean engaging with companies from across the industry and encouraging them all to take action.

This research programme was established in order to meet those challenges and develop the strategy (Holton *et al.*, 2005).

3.2.4 Review and next steps

The aim of this research cycle was to develop an understanding of the research area. The following facts were established from the research undertaken.

- The Government is committed to making sustainable development for the UK a reality.
- The construction industry is of significance in achieving progress towards sustainable development in the UK, but is extremely diverse, with a wide range of issues, interests, and representative bodies.
- In order to persuade the construction industry to address the sustainability agenda, the Government had challenged sector representative bodies and trade associations to develop sector sustainability strategies.
- Such strategies can provide industry sectors with a way of managing risks and opportunities, and contributing to sustainable development.
- Sustainability improvements in the precast industry would make an important contribution to sustainable development in the UK, but would also bring business benefits to the industry.

It was against this background that British Precast had identified the need to develop a sector sustainability strategy for the UK precast concrete industry. This research programme was established to deliver that strategy.

To accelerate the development and implementation of sector sustainability strategies, a best practice forum, the Pioneers Group, was established by two Government departments (DTI and DEFRA) in conjunction with the Sustainable Development Commission and consultants Optimat (SDC, 2002a). Over 40 sectoral organisations covering a range of manufacturing and service industries participated in the Group between 2001 and 2004 (Trade Association Forum, 2007), and as a result of their activities a number of guidance documents are now available; these documents would be used to inform and guide the research.

However, limitations to this guidance were identified. The *Best Practice Toolkit* produced by Optimat (Optimat, 2002) simply provides a framework for managing the strategy development process, as shown in Figure 3.2, and identifies a number of techniques that may assist in that process, e.g. SWOT and PEST analyses. Whilst the *Self Assessment Guide* produced by the Sustainable Development Commission (SDC, 2002b) is stated to provide a quality assurance framework for assessing the quality of a strategy, but contains no performance benchmarks to judge quality against. Guidance on other types of sustainability strategy, such as national sustainable development strategies (Dalal-Clayton and Bass, 2002), has been produced from analyses of such strategies. Similar research on sustainability strategies at a sector level does not appear to have been undertaken or reported; such research would aid the development of the precast sector strategy and would therefore form the aim of the next research cycle.

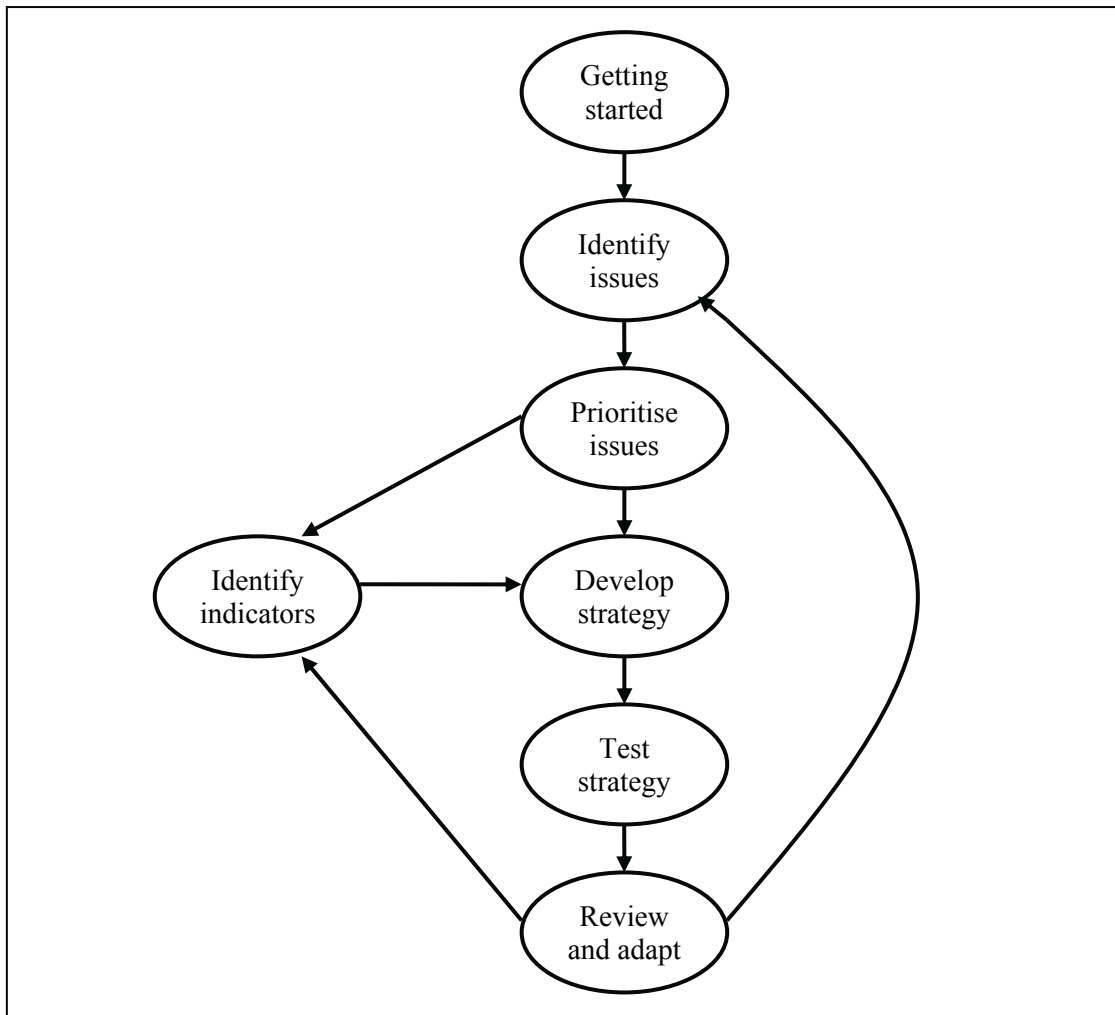


Figure 3.2: Sector sustainability strategy development procedure (Optimat, 2002)

3.3 ANALYSING OTHER SECTOR SUSTAINABILITY STRATEGIES

At the time this research cycle was undertaken, three other sectors of the construction products industry had published sustainability strategies; brick (BDA, 2002), forest industries (FIDC, 2004) and steel construction (SCI, 2002). The aim of the cycle was to characterise and analyse these strategies; this would add to current knowledge on the development of sector sustainability strategies and assist in the development of the precast sector strategy. The research is summarised here and fully documented in Paper 1 (Appendix A).

3.3.1 Research undertaken

Although it is generally agreed that there is no single universally accepted definition of strategy, a fundamental distinction can be made between the process, content and context of a strategy, since these three interacting dimensions define the ‘how, who, when, what and where’ of strategy (De Wit and Meyer, 2004). Organisational purpose then completes the ‘why’ of strategy, since organisations exist to fulfil a purpose and strategies are

employed to ensure that the organisational purpose is realised. These are shown in Figure 3.3. The development of sector sustainability strategies was considered within this broad framework.

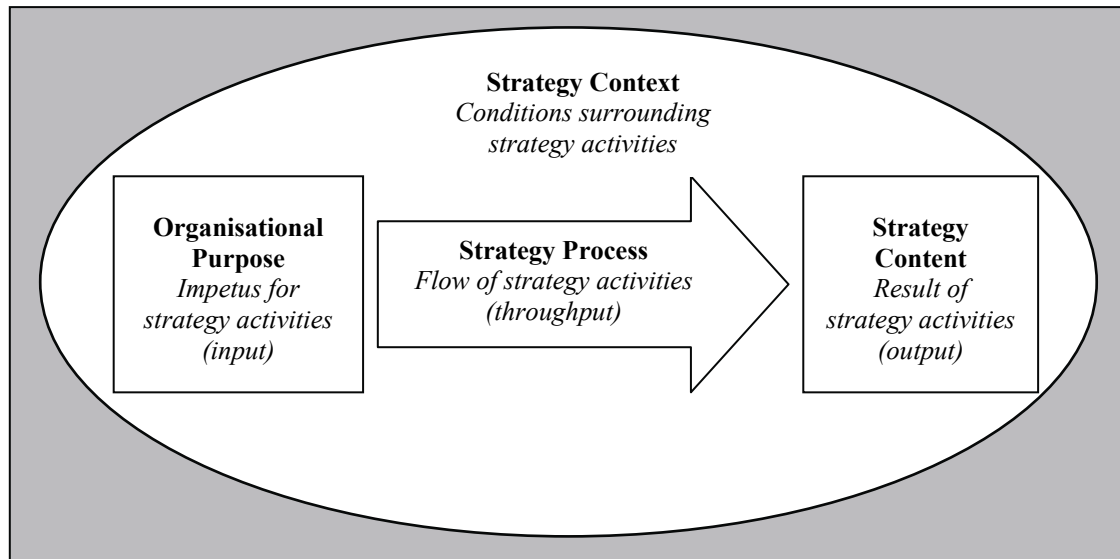


Figure 3.3: Dimensions of strategy (De Wit and Meyer, 2004)

The logical starting point for the research was to investigate the context and purpose of the brick, forest industries and steel construction sector sustainability strategies, since context defines the conditions surrounding strategy activities, and purpose provides the impetus for strategy activities. This was achieved through critical review of the strategy documents.

De Wit and Meyer (2004) suggest that the strategy process can be defined and analysed based on three phases: analysis; formulation; and implementation. The Sustainable Development Commission suggests that these should be defined as follows for sector sustainability strategies (SDC, 2002b).

- Analysis should contain an acceptance and understanding of the key principles of sustainable development, and an audit of the sector’s current performance.
- Formulation, an appraisal of the opportunities and threats related to sustainable development, and the adoption of objectives, targets and indicators.
- Implementation, actions to achieve these targets and objectives, and accounting for action by reporting.

The way in which the three sectors had approached the strategy process was investigated through a content analysis of the strategy documents.* A coding schedule was developed from the Sustainable Development Commission’s self-assessment guide for sector sustainable development strategies (SDC, 2002b); thus ensuring that the three phases of the strategy process described above were investigated fully. The principal disadvantage of content analysis, personal interpretation clouding or biasing coding and interpretation of the data (Creswell, 2003), was avoided by using closed questions and simple “yes” or “no” answers whenever possible.

* The length of the documents varied between 5,000 words (brick) and 10,000 words (steel construction).

Finally, two coding schedules were developed which enabled strategy content to be compared with the objectives for sustainable development and sustainable construction specified by the Government at the time of the research.

3.3.2 Research findings

Johnson and Scholes (2002) relate the success or failure of strategies to three main criteria; suitability, acceptability and feasibility. Suitability is concerned with whether a strategy addresses the circumstances in which the organisation is operating. Acceptability relates to the expected return, the level of risk and the likely reaction from stakeholders. Feasibility is concerned with whether an organisation has the resources and competences to deliver the strategy. These criteria were carefully considered in analysing the research results.

3.3.2.1 Context

Strategy context refers to the conditions surrounding strategy activities. De Wit and Meyer (2004) suggest that the context of any strategy will generally be unique. Although the three sectors differed from the precast industry in their value, size, activities and complexity, as shown in Table 3.1, a number of similarities were identified in the contexts of their strategies:

- they were all sector sustainability strategies;
- the three sectors were all part of the construction products industry;
- they had all been produced in response to a challenge from the UK Government to develop sector sustainability strategies (DETR, 2000); and
- they had all been published by the organisation responsible for promotion and market development in each sector.

Thus, lessons identified from analysing the three strategy documents were likely to be relevant to the development of a sector sustainability strategy for the precast industry.

Table 3.1: Comparison between the precast concrete, brick, forest industries and steel construction sectors

Sector	Annual value	Employees	Factories	Main activities covered
Precast concrete	£2 billion	20,000	800	Precast concrete production
Brick	£550 million	6,000	120	Brick production
Forest industries	£6 billion	190,000	N/A	Forest management, primary wood-processing industries inc. wood based energy, and pulp, wood and wood-based product importers
Steel construction	£3.5 billion	42,000	N/A	Products and activities of steel producers, steelwork contractors and component manufacturers

3.3.2.2 *Purpose*

The purpose of a sector sustainability strategy is not well defined in the literature; however, the case made by the Government for developing sector sustainability strategies (DETR, 2000), and the definition of strategy favoured by the construction industry (Price and Newson, 2003), suggest that the purpose should be to set out a long-term plan for improved economic, environmental and social performance in a sector. Whilst the brick and forest industries sector documents showed clear evidence that this was their primary purpose, the steel construction sector document was found to be less clear in its purpose; the document is described as reporting on a strategic review of how the sustainable development agenda is being addressed by the steel construction sector, rather than a sector sustainability strategy, and it does not set out specific objectives for improvement in a long-term plan.

The suitability of a strategy was defined earlier as depending on whether it addressed the circumstances in which an organisation was operating. For a sector sustainability strategy this can be interpreted to mean whether its purpose is to set out a long-term plan for improved economic, environmental and social performance in a sector. Thus, not clearly achieving this purpose will reduce the suitability of a sector strategy and its chances of success.

Although the strategy documents had all been published by the organisation responsible for promotion and market development in each sector, other organisations and stakeholder groups had been involved in the development process for each strategy; involving key sector organisations and wider stakeholder groups in the strategy development process is a recommended way of enhancing the acceptability of a strategy amongst these groups (Optimat, 2002). However, the steel construction sector acknowledged the difficulty of presenting key messages to different target audiences in one document (SCI, 2002), and parts of the forest industries sector were reported to be developing their own sub-sector specific strategies (FIDC, 2004), suggesting that one strategy might not meet the needs of all groups within some sectors. Other evidence was found which supported this finding; for example, the Non-Ferrous Alliance is reported to have wanted to develop a common strategy for the whole non-ferrous metals industry, but to have found that the sustainability issues were different for each of its four sectors (Optimat, 2002). There is thus a need to carefully consider the needs and interests of all the organisations and stakeholder groups associated with a sector, in order to determine whether they can be encompassed in one strategy; trying to incorporate too wide a range of interests may have an adverse affect on the acceptability of a strategy and reduce its effectiveness in achieving its purpose.

3.3.2.3 *Process*

Each sector began the analysis phase of the strategy process by demonstrating an understanding of the key principles of sustainable development and how they related to the sector, together with an appreciation of the business case for sustainable development, as shown in Table 3.2. Detailed audits of current performance were then given, in which each sector recognised and/or defined its impacts on sustainable development and considered the ways in which it currently mitigates them. However, these were not well balanced with a noticeable concentration on health and safety, and environmental issues; the Sustainable Development Commission states that a sector should take responsibility for all of its impacts as underestimation or omission of impacts is likely to reduce the effectiveness of the resulting strategy (SDC, 2002b).

Table 3.2: Results from content analysis of the strategy process: analysis phase

	Sector strategy		
	Brick	Forest Industries	Steel Construction
<i>Acceptance and understanding of the key principles of sustainable development</i>			
Is an understanding of these principles and how they relate to the sector shown?	Yes	Yes	Yes
Is an appreciation of the business case for sustainable development shown?	Possibly	Yes	Yes
Are stakeholders involved, including supply chain partners, customers and disposers?	No, but will be in the future	Yes	Yes
<i>Audit of current performance</i>			
Are the economic, social and environmental impacts of the sector identified?	Yes	Yes	Yes
Does this include both good and bad?	Yes	Yes	Yes
Does this include impacts from sourcing of raw materials and energy, manufacturing and processing, transport, use of products and disposal?	Yes	Yes	Raw materials and transport excluded
Does this include impacts on employees and community?	Yes	Yes	Yes
Is consideration of the supply chain made?	Possibly	Yes	Yes
Are overseas impacts considered?	No	Yes	No

Table 3.3 shows that the formulation phase of each strategy included a detailed assessment of the opportunities and benefits arising from more sustainable ways of working. However, threats from unsustainable practices were not considered by the steel construction sector and were given less emphasis by the other sectors compared to opportunities. Accentuating the positive in this way may increase the acceptability of a strategy to stakeholders, but threats can pose a greater risk to the success of a strategy and therefore should not be ignored.

The Sustainable Development Commission emphasizes that it should be made clear what the strategy as a whole intends to achieve, and as in any business proposition, needs to progress from its baseline position by setting objectives, targets and indicators for future improvement (SDC, 2002b). The three sectors identified clearly what their strategies would achieve as a whole, but were less clear on some of the subsequent steps and appeared not to consider others. If a clear long-term plan for improved economic, environmental and social performance is not established in the formulation phase, a strategy is not going to achieve its intended purpose. Objectives that were set were considered to be low risk, either building on current initiatives or introducing new ones that would contribute to the Government's sustainability objectives. Low risk may increase acceptability to businesses and stakeholders, but may also limit potential benefits.

Table 3.3: Results from content analysis of the strategy process: formulation phase

	Sector strategy		
	Brick	Forest Industries	Steel Construction
<i>Appraisal of opportunities and threats related to sustainable development</i>			
Are threats to the sector from unsustainable practices identified?	Yes	Yes	No
Are opportunities for the sector to benefit from more sustainable ways of working identified?	Yes	Yes	Yes
Have opportunities for working with other sectors or with sectors from other countries been assessed?	No	Yes	Possibly
<i>Adoption of objectives, targets and indicators</i>			
Is it clear what the strategy as a whole will achieve?	Yes	Yes	Yes
Is an assessment of the sector's baseline position made?	In some areas	No	No
Have objectives been set for future improvement?	Yes	Yes	Not clear
Do these include both short and long-term views?	Not clear	Yes	Not clear
Are costs and benefits identified?	No	No	No
Have targets been set for future improvement, and if so are timescales included?	No	No	No
Is it clear how targets will be achieved and where responsibility for this lies?	No	No	No
Have indicators been specified to measure improvement?	Yes	No	No
Do these indicators suit the sector and reflect the relative importance of different factors?	Yes	N/A	N/A

Smallbone (2004) reported that market transformation, achieved through changing consumer buying behaviour, had become a core area of the Government's strategy for sustainable development, so businesses will not only have to address their own performance on sustainability, but also the contribution their products make to sustainable development. Accordingly the range of actions proposed in the implementation phase of each strategy involved technical, physical and behavioural changes to products, processes, businesses and business practices. A high level of commitment to implementation was demonstrated by each sector, but little detail was given on how changes would be achieved, which stakeholders would be involved, or what the costs and benefits would be (see Table 3.4). It is difficult to see how businesses and stakeholders would commit to support a strategy, without knowing in detail what actions are required of them and what the costs and benefits would be. Without the support of businesses and stakeholders a sector strategy will become unfeasible and will not succeed. Sector level actions appeared to be limited to the dissemination of information, promotion of best practice and introduction of accreditation or certification schemes; this suggests that sector organisations are limited in the actions they are both empowered to undertake and can implement in practice.

Table 3.4: Results from content analysis of the strategy process: implementation phase

	Sector strategy		
	Brick	Forest Industries	Steel Construction
<i>Action to achieve targets and objectives</i>			
Is a clear vision of what needs to be done, by whom and by what means included?	Yes	Yes	Yes
Is a high level of commitment to the implementation of the strategy among participants demonstrated?	Yes	Yes	Yes
Are practical examples of action included?	Yes	Not clear	Yes
Is a process for industry-wide benchmarking included?	No	No	No
Is a process for spreading best practice included?	No	No	No
Are information, advice and guidance provided on how sector members should apply and achieve targets within their own organisations?	Yes	No	No
<i>Accounting for action by reporting</i>			
Is a commitment made to regularly report progress?	Yes, annually	Yes, 5 years	Yes, annually
Is a commitment made to review the strategy?	Yes, annually	Yes, 5 years	Yes, annually

Finally, all sectors made a commitment to measure and report on progress, but only the brick sector specified indicators for this purpose and these did not cover all of their stated objectives. It is now widely recognised that targets and indicators need to be specified in order to measure improvement and demonstrate progress to stakeholders. If quantifiable progress is not demonstrated, stakeholders will consider that strategy ineffective and it will lose their support.

3.3.2.4 Content

Figure 3.3 shows that strategy content is dependent on strategy context. An important feature in the context of all three strategies was that they were produced in response to a challenge from the Government to develop sector sustainability strategies (DETR, 2000). Consequently, all three strategy documents contained actions aimed at meeting the majority of the Government's objectives for sustainable development and sustainable construction, as shown in Tables 3.5 and 3.6. None of the documents studied appeared to contain actions aimed at meeting all of the Government's objectives, although it is possible that some objectives would be met indirectly, whilst others could possibly be considered to be outside the scope of each strategy.

Table 3.5: Comparison of strategy content with the Sustainable Development Commission's 23 objectives for sector sustainable development strategies (SDC, 2002)

Objectives for sector sustainability strategies	Sector strategy		
	Brick	Forest Industries	Steel Construction
<i>Maintain high and stable levels of economic growth and employment</i>			
1) Produce economic growth	✓	✓	✓
2) Invest in modern plant and machinery as well as research and development to achieve prosperity	✓	✓	✓
3) Maintain high and stable levels of employment	✓	-	-
<i>Social progress which recognises the needs of everyone</i>			
4) Tackle poverty and social exclusion	-	-	-
5) Equip people with the skills to fulfil their potential	✓	✓	✓
6) Achieve fairness at work	-	-	-
7) Maintain safe and healthy environment at work	✓	✓	✓
8) Build sustainable communities	✓	✓	✓
9) Raise quality of life of workers in global supply chains	-	-	-
<i>Effective protection of the environment</i>			
10) Continue to reduce emissions of greenhouse gases now and plan for further reductions in future	✓	✓	✓
11) Reduce air pollution and ensure air quality continues to improve	✓	-	✓
12) Improve water quality in rivers, estuaries and the sea	✓	-	-
13) Reverse the long-term decline in populations of farmland and woodland birds	-	✓	-
14) Reduce noise	-	-	-
<i>Improved distributional impacts</i>			
15) Improve choices in transport, reduce need for travel	✓	✓	-
16) Develop distribution systems which support economic growth, protect the environment and benefit society	-	✓	-
17) Re-using previously developed land, in order to protect the countryside and encourage urban regeneration	-	-	✓
<i>Prudent use of natural resources</i>			
18) Move away from disposal of waste towards waste reduction, recycling and recovery	✓	✓	✓
19) Must not store up pollutant problems for the future	-	-	✓
20) Greater resource efficiency	✓	-	✓
21) Energy efficiency	✓	-	✓
<i>Effective assessment and provision of information</i>			
22) Consumer information and encouraging movement in the market	✓	✓	✓
23) Assess environmental impacts, set targets and produce reports	✓	✓	✓

Table 3.6: Comparison of strategy content with the ten themes for action in the Government's strategy for more sustainable construction (DETR, 2000)

Themes for action	Sector strategy		
	Brick	Forest Industries	Steel Construction
1) Re-use existing built assets	-	-	✓
2) Design for minimum waste	✓	✓	✓
3) Aim for lean construction	✓	✓	✓
4) Minimise energy in construction	✓	✓	✓
5) Minimise energy in use	-	✓	✓
6) Do not pollute	✓	✓	✓
7) Preserve and enhance biodiversity	✓	✓	-
8) Conserve water resources	✓	-	-
9) Respect people and their local environment	✓	✓	✓
10) Set targets	✓	✓	✓

3.3.3 Review and next steps

Research has been undertaken to characterise and analyse the sector sustainability strategies published by three other sectors of the construction products industry: brick, forest industries and steel construction. The research examined strategy context, purpose, process and content; the main research findings concern strategy purpose and process.

The purpose of a sector sustainability strategy is not well defined in the literature. From this work it was established that the purpose of a sector sustainability strategy should be to set out a long-term plan for improved economic, environmental and social performance in a sector. Not clearly achieving this purpose will reduce the suitability of a sector strategy and its chances of success.

Involving key sector organisations and wider stakeholder groups in the strategy development process is a recommended way of enhancing the acceptability of a strategy amongst these groups (Optimat, 2002). However, it was established that the needs and interests of all the organisations and stakeholder groups associated with a sector need to be carefully considered, in order to determine whether they can be encompassed in one strategy; trying to incorporate too wide a range of interests may have an adverse affect on the acceptability of a strategy and reduce its effectiveness in achieving its purpose.

The strategy development process is well defined in the literature. However, a number of short-comings were identified in the three sector strategies studied which, if addressed in the development of the precast sector strategy, would improve the quality of that strategy.

- There was a tendency in the sectors studied to concentrate on health and safety, and environmental issues, in the analysis phase of the strategy process. Current guidance states that the analysis phase should include a detailed audit of current position; underestimation or omission of impacts during the analysis phase is likely to reduce the effectiveness of a strategy.

- Whilst a high level of commitment to implementation was demonstrated by each sector, little detail was given on how changes would be achieved, which stakeholders would be involved, or what the costs and benefits would be. In order to gain the support of businesses and stakeholders, it is believed that these details should be clearly stated.
- Current guidance states that targets and indicators need to be specified in order to measure improvement and demonstrate progress to stakeholders; if quantifiable progress is not demonstrated, stakeholders will consider that strategy ineffective and it will lose their support. Only the brick sector specified indicators and these did not cover all of their stated objectives.

From consideration of these findings it was established that in order to develop a successful sector sustainability strategy for the precast industry:

- the range of stakeholder needs and interests covered by the strategy would need to be carefully considered;
- an analysis of the industry's current position on sustainability was required;
- the opportunities and threats sustainability presents would need to be identified and addressed across the whole industry;
- the strategy would need to set out a long-term plan for improving economic, environmental and social performance in the industry;
- developing consensus with companies and other key stakeholders would be critical to the successful implementation of the strategy; and
- targets and indicators would need to be specified in order to measure improvement and demonstrate progress to stakeholders.

These issues would be addressed in the course of the research programme, commencing with the analysis phase of the strategy development process.

3.4 MAPPING SUSTAINABILITY ISSUES

The overall aim of this research cycle was to analyse the precast industry's current position on sustainability. The key work undertaken in this respect was to map the sustainability issues facing the industry; identifying and prioritising (mapping) sustainability issues at an early stage in the strategy development process helps to ensure that the focus of the strategy is on the most important issues facing a sector (Optimat, 2002). This section therefore concentrates on the mapping process and the results obtained.

Henriques (2004) suggests that for organisations to have the greatest confidence that no relevant sustainability issues have been overlooked, it is crucial for them to work with the full range of their stakeholders; the mapping process was therefore designed to take account of the views of the precast industry and its key stakeholders. Research data was collected from the industry in a two-stage process comprising a facilitated workshop (focus group) with industry practitioners from member companies of British Precast, and a postal questionnaire survey of member and non-member companies of British Precast. Stakeholder views were established through a stakeholder analysis workshop (focus group) with industry practitioners from member companies of British Precast. The results obtained from the workshops and questionnaire survey are summarised in the following sub-sections.

3.4.1 Sustainability issues workshop

The purpose of the first workshop was for participants to openly discuss the opportunities and threats that sustainability posed to both precast producers and their products; this discussion then enabling an initial set of sustainability issues for the industry to be identified. The workshop was held in September 2005, and was facilitated by the author and an academic supervisor. 15 professionals from across the precast industry participated in the workshop, including 5 SHEQ advisors and managers, 6 technical managers and a company director. The results obtained are summarised below; a more detailed account is given in Paper 2 (Appendix B).

The fundamental business concern of participants in the workshop was found to be the profitability and competitiveness of both individual companies and the precast industry as a whole. Ten key factors affecting the profitability and competitiveness of the industry were identified, as shown in Figure 3.4. These factors can be seen to comprise a range of economic, social and environmental issues, either directly or in combination. Thus actions taken to address these issues and improve the profitability and competitiveness of the precast industry, would also improve its sustainability.

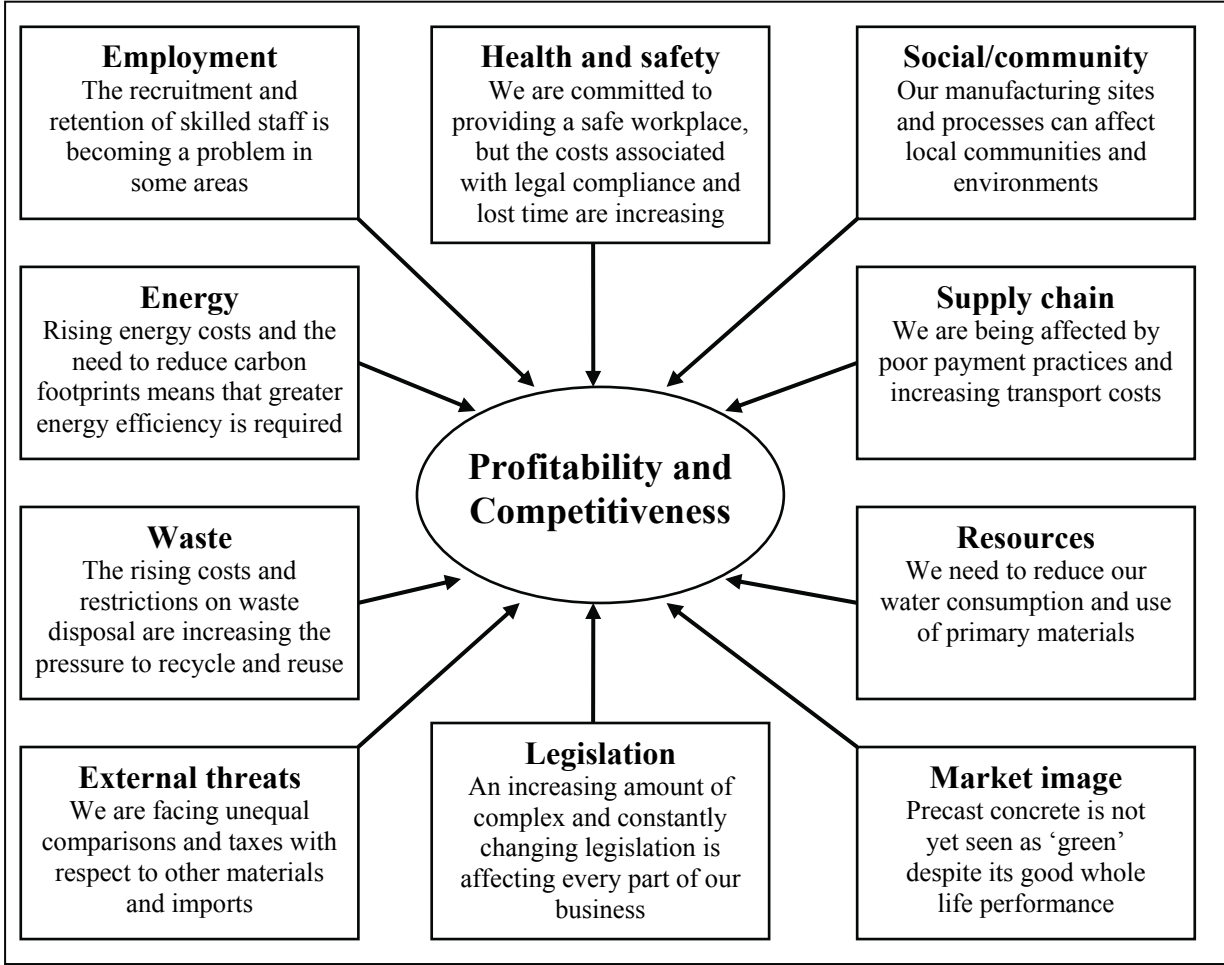


Figure 3.4: Key factors affecting the profitability and competitiveness of the industry

A wide range of actions to address these issues were proposed and discussed, from which it was agreed that the industry needed to be more responsive and responsible, to improve its internal practices and performance, and reduce its external effects. The actors responsible for taking these actions were considered to be individual precast companies, their supply chain partners and their trade association. The sector sustainability strategy would therefore need to engage with these different actors and encourage them to take appropriate action.

3.4.2 Sustainability issues and priorities survey

The primary purpose of the survey was to consult a wider section of the precast industry on the issues identified in the sustainability issues workshop in order to validate and prioritise those issues; it was also used to collect data describing the size and nature of the precast industry, and to investigate aspects of its approach to sustainability, in accordance with the overall aim of the research cycle. The survey was undertaken amongst both member and non-member companies of British Precast in January 2006 using self-completion questionnaires administered by post.

Following the practices described by Bryman and Bell (2003) for designing self-completion questionnaires and asking questions, a 6-page questionnaire incorporating factual, belief and attitude questions was developed for British Precast member companies covering the following topics:

- Production;
- Customers;
- Important issues;
- Policies and systems;
- The future for precast;
- Investment; and
- Sustainability.

Simple closed factual questions were used to collect data on production, customers, policies and systems, and investments. Belief questions were used to assess the significance to companies of a range of business issues and prioritise actions the industry could take to ensure its future, and an attitude question was used to investigate the strength of respondents' views on sustainability. The structure of the questionnaire was designed to progress from facts to opinions, and from current issues to future issues. In addition to which, the topic of sustainability was placed at the end in order to avoid introducing any bias or suggestion in answers to earlier questions. Members of British Precast's Sustainability Committee tested the questionnaire in order to assess its ease of comprehension and completion, and the time required for completion.

A shorter 3-page questionnaire covering production, important issues, customers and the future for precast, was developed and sent to approximately 400 non-member companies. Since the majority of non-member companies are SMEs, it was considered that certain questions or parts of questions were not relevant to them and that by eliminating these, and reducing the length of the questionnaire, recipients would be more willing to complete it.

Copies of the two questionnaires are included in Appendix C. Completed questionnaires were received from 29 member companies, a response rate of approximately 55%, whilst 34 non-member companies responded to the shorter questionnaire, a response rate of

approximately 10%. Since these companies together operated nearly 200 precast factories and had an annual turnover in excess of £1.6 billion, and the annual turnover of the precast industry at the time of the survey was estimated to be in the region of £2.3 billion, the survey can be considered to represent approximately 70% of the industry. The results from the survey are summarised in Appendix C; an analysis concentrating on the identification and prioritisation of sustainability issues for the precast industry is presented in Paper 2 (Appendix B) and summarised below.

The company data collected showed production to be dominated by a small number of MNCs with factories spread across the UK, but also that there are a considerable number of SMEs in the industry operating primarily in niche and local markets. This is illustrated in the graph in Figure 3.5; it can be seen from the graph that six companies, each with a turnover in excess of £100 million, account for over 50% of the reported figures, but there is also a long ‘tail’ of companies with turnovers of £1 million or less.

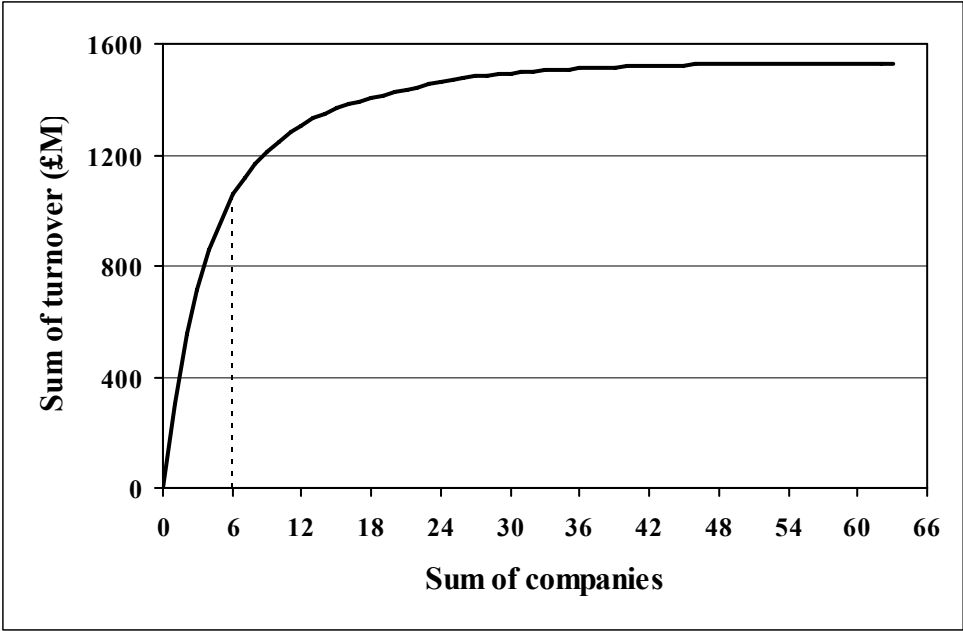


Figure 3.5: Sum of annual turnover of respondent companies

All of the companies responding to the survey agreed that the issues identified in the sustainability issues workshop were likely to have a significant impact on the profitability and competitiveness of the industry, validating the workshop results. However, the priority the issues were placed in was found to vary between different groups of companies, particularly the MNCs and the SMEs. For example, maintaining a good return on assets to sustain future investment, customer consolidation and over capacity in the industry were high priorities for the MNCs, whilst Government policy, legislation and taxes, raw materials, and transport and distribution costs were high priority issues for the SMEs. Consequently, no clear priority issues were identified.

The existence or development of policies and procedures in companies was investigated in order to provide an indication of whether the industry was beginning to address those business issues relating to environmental protection, resource use and social progress. The

results with respect to eight typical areas are shown in Figure 3.6. The industry was found to have a high level of adoption of policies and procedures in the areas related to safety and environmental compliance, but lower levels in the areas related to resource efficiency and social progress; those companies with turnovers > £100 million were found to have policies and procedures in place or under development in the majority of the areas investigated. Since these policies and procedures all related to aspects of sustainability, this finding suggested that some companies in the industry were more advanced in tackling the sustainability agenda than others.

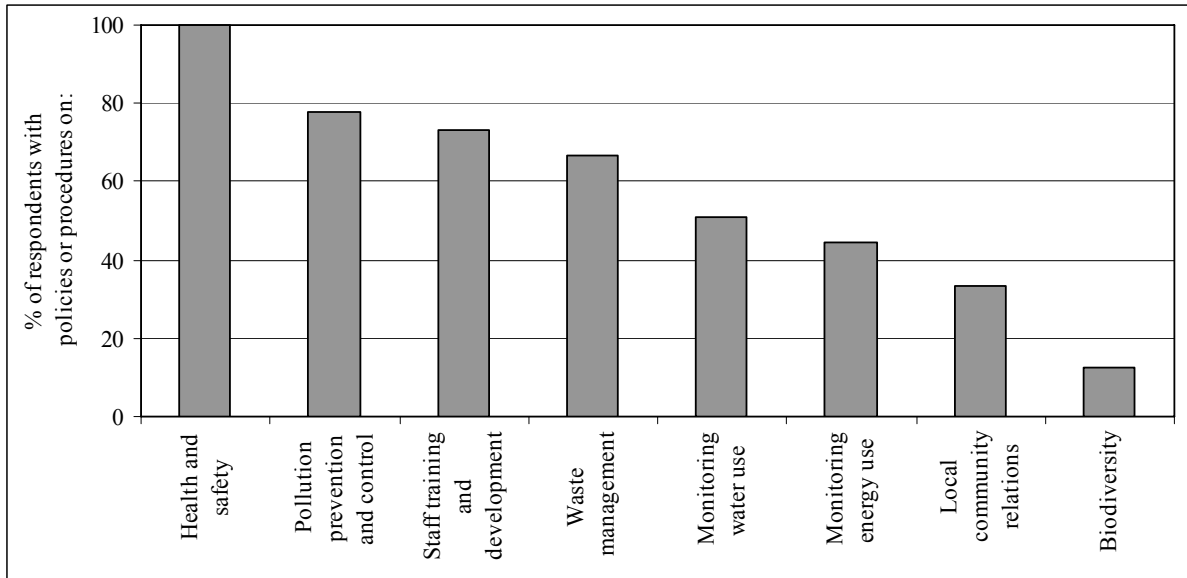


Figure 3.6: Prevalence of various policies and procedures in the precast industry

3.4.3 Stakeholder analysis workshop

The aim of the stakeholder analysis workshop was to identify the sustainability issues of importance to the precast industry's key stakeholders, prioritise them and integrate them with the issues identified previously. The methodology adopted was based on the guidance given by Johnson *et al.* (2006) on stakeholder analysis; although this concentrates on organisations, the basic analysis methods were considered to be equally applicable to sectors. The workshop was held in March 2007; six technical and environmental professionals from the precast industry participated in it, and it was facilitated by the author and an academic supervisor.

The workshop began with a discussion to identify and prioritise the different stakeholder groups for the precast industry; this enabled the stakeholder prioritisation diagram shown in Figure 3.7 to be produced.

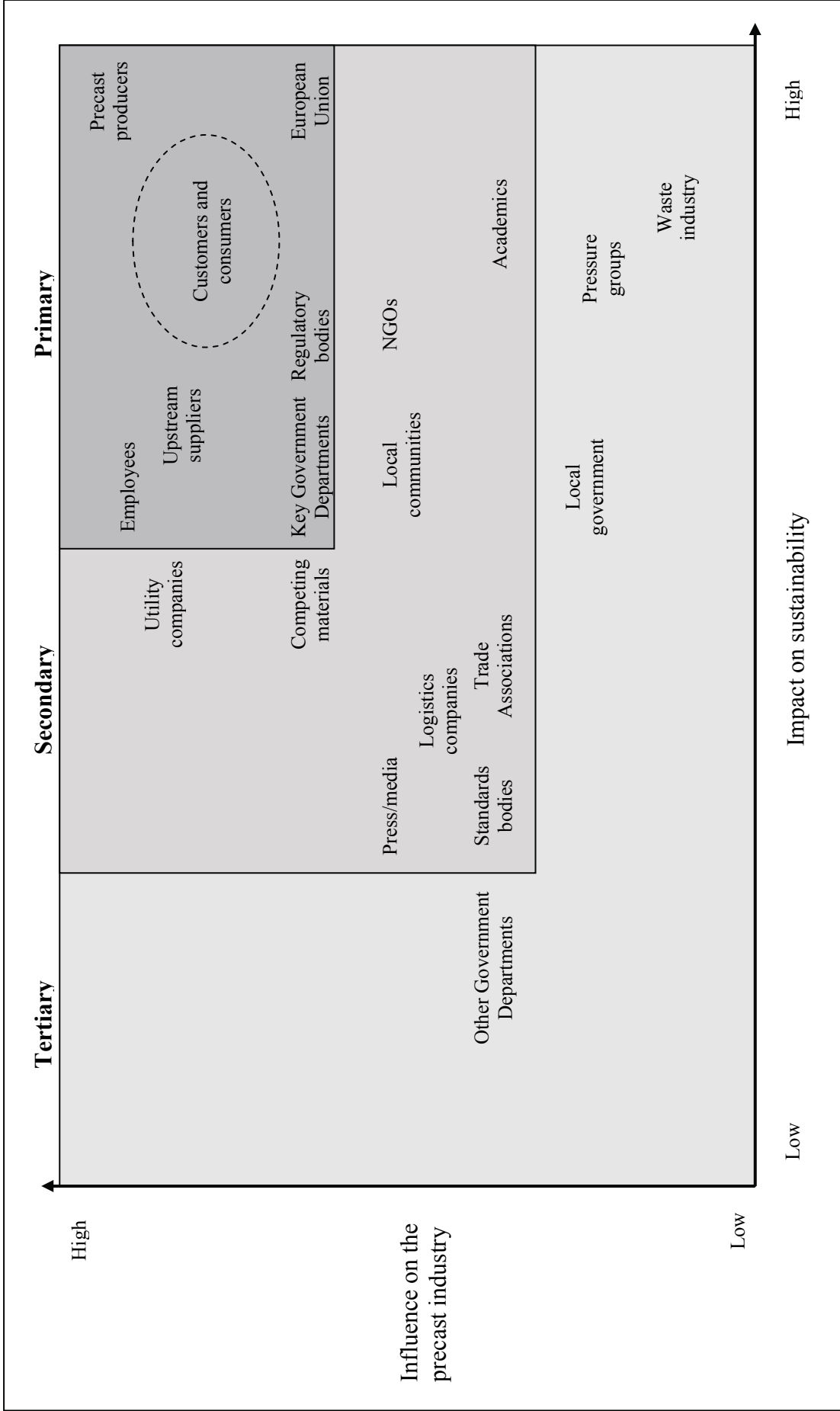


Figure 3.7: Stakeholder prioritisation diagram for the precast industry

The following observations about the industry's stakeholders were also made.

- These are stakeholders for the precast industry rather than stakeholders for individual companies; whilst many stakeholders will be common to both the industry and companies, their importance and influence may differ.
- Shareholders/investors and banks/financial institutions were not considered to be direct stakeholders in the industry, but because of their considerable influence on companies, were considered to be 'hidden' stakeholders behind the precast producers.
- The customers and consumers group of primary stakeholders covers an area rather than holds a position. This is because the impact and influence of the many different commercial customers, public sector customers, designers and specifiers, building owners, and building users and consumers that constitute the group, can vary depending on the specific product and/or application.
- The impact and influence of several of the secondary and tertiary stakeholders could change on certain issues, elevating them to the status of primary stakeholders; NGOs, the press and media, and pressure groups were of particular note in this respect.

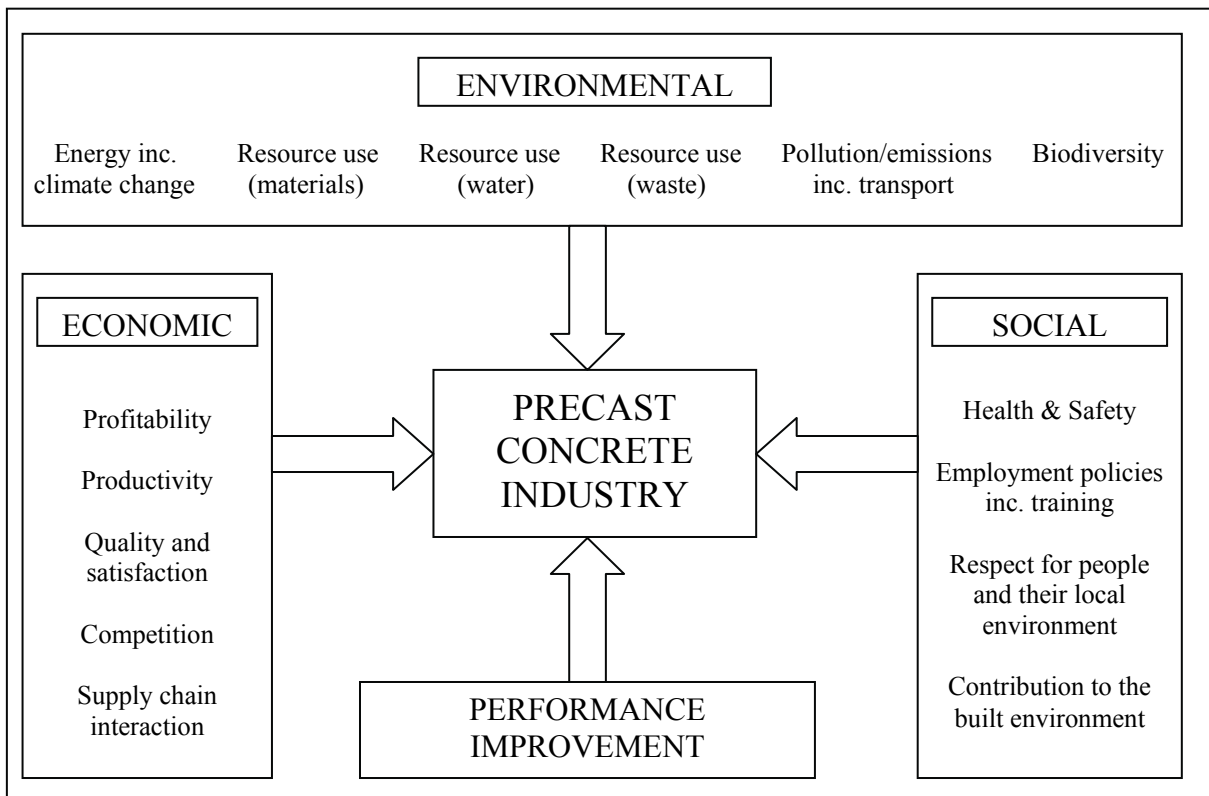


Figure 3.8: The key sustainability issues facing the precast industry

From consideration of the sustainability priorities and concerns of the industry’s primary stakeholders, 16 sustainability issues that the sector should be engaging with its stakeholders on were identified, as shown in Figure 3.8. Some of these were new issues; others were modifications or expansions of the ten key sustainability issues previously identified for the precast industry. In broad terms, it was considered that legislators and regulators, together with customers and consumers, needed to be engaged on almost the entire range of issues identified, whilst employees and upstream suppliers needed to be engaged on a limited number of more specific issues. The sector sustainability strategy would therefore need to address all of these issues and include an appropriate mechanism for stakeholder engagement.

3.4.4 Review and next steps

The main purpose of this research cycle was to ensure that the focus of the sector sustainability strategy was on the most important issues facing the precast industry. The key sustainability issues facing the precast industry were identified through consultation with the industry and consideration of the priorities and concerns of its primary stakeholders. However, no clear sustainability priorities could be identified amongst these issues and some companies were found to be more advanced in tackling the sustainability agenda than others.

**Table 3.7: Phases in the development of corporate sustainability
(after Dunphy *et al.*, 2003)**

PHASE	HUMAN RESOURCES	NATURAL RESOURCES
1: Rejection	Employees and subcontractors are exploited. Community concerns are rejected outright.	The environment is regarded as a free good to be exploited.
2: Non-responsiveness	Financial and technological factors exclude broader social concerns.	Ecological factors are excluded from decision-making.
3: Compliance	The emphasis is on compliance with legal requirements in industrial relations and safety.	Ecological issues unlikely to attract strong litigation or strong community action are ignored.
4: Efficiency	Technical and supervisory training augmented with interpersonal skills training. Community projects and HR value-adding strategies are pursued only when a cost benefit to the company is obvious.	Environmental issues are ignored if they are not seen as generating avoidable costs or increasing inefficiencies. Sales of by-products are encouraged.
5: Strategic pro-activity	Intellectual and social capital is used to develop strategic advantage through innovation in products/services.	Proactive environmental strategies such as product and process redesign are seen as a source of competitive advantage.
6: The Sustaining Corporation	Key goals both inside and outside the firm are the pursuit of equity and human welfare and potential.	The firm works with society towards ecological renewal and positive sustainability policies.

Dunphy *et al.* (2003) describe six phases in the development of corporate sustainability, as summarised in Table 3.7. The phases characterise the way an organisation treats the human and natural resources it employs. It can be seen that there is a progression from active antagonism, through indifference, to a strong commitment to actively furthering sustainability values, not only within the organisation but within industry and society as a whole, although an organisation does not necessarily have to progress through the phases step-by-step, or hold equal positions across both human and natural resource dimensions.

Kolk and Mauser (2002) note that such models are generally broad and conceptual, do not take sufficient account of organisational and strategic complexities, and as a result have a limited suitability for specific situations. However, this model indicates that the sustainability priorities of organisations will change as they progress through its phases, thus providing an explanation for the situation found in the precast industry. For example, some precast companies could be considered to be in the higher phases of development based on the broad range of sustainability related policies and procedures they had in place, whilst the response to the questionnaire suggests 30% of the industry to be in the lower phases, rejecting or not responding to the issue of sustainability. From which it was concluded that given the different levels of corporate sustainability exhibited by companies in the precast industry, differences in the sustainability priorities of companies were to be expected.

Further consideration of this model suggested that improving the corporate sustainability of precast companies was likely to make a significant contribution to the development of a more sustainable precast industry, based on the rationale that improving the economic, environmental and social performance of companies in the precast industry would lead to them producing more sustainable products, the use of which would lead to more sustainable construction. However, it was also acknowledged that the development of corporate sustainability was not a total solution to the problem of achieving progress towards sustainability and more sustainable construction; consideration would therefore still need to be given to upstream and downstream activities and impacts associated with precast concrete products and production, i.e. life-cycle and supply chain issues. Thus, it was established that a priority for the research programme should be to investigate ways of facilitating the progress of companies through the phases of the corporate sustainability model, and that because there were no clear sustainability priorities, companies should be encouraged to take action on all of the issues identified.

3.5 FACILITATING PROGRESS

The aim of this research cycle was to examine ways of facilitating the progress of companies through the phases of the corporate sustainability model identified earlier. Two distinct pieces of work were undertaken in the process of achieving this aim; firstly, the issues surrounding how and why companies in the precast industry were adopting more proactive approaches to sustainability were examined, from which a business case for sustainability was established, then ways in which British Precast could promote the adoption of more sustainable practices were investigated. The research is summarised here and reported in greater detail in Paper 3 (Appendix D) and Paper 4 (Appendix E).

3.5.1 Best practice case studies

Examples of companies taking a proactive approach to sustainability can be found each year in the annual British Precast Best Practice Awards; these cover health and safety and innovation, in addition to sustainability. A series of best practice case studies in the form of histories about contemporary events were produced from entries to the awards in order to examine how and why companies were adopting a more proactive approach to sustainability.*

The case studies focused on the consumption of natural resources and energy, as these issues were considered to be of increasing importance to the industry and its stakeholders, evidenced by the number of high quality award entries in these areas, and to have a direct impact on the profitability and competitiveness of companies in the industry.

The best practice case studies are reported in Paper 3 (Appendix D). Many of the measures employed were relatively simple, such as recycling production waste back into the production process rather than disposing of it to landfill, and provided rapid return on investment from the savings achieved; in several cases the savings made were significant, and in many cases the savings were made on a continuous basis. The case studies thus demonstrated quite clearly the economic benefits that companies were achieving by reducing their consumption of natural resources and energy, in addition to becoming more sustainable by protecting the environment and achieving social progress. This in turn was leading to the realisation of a range of other benefits including better market image and increased investor confidence. Thus, there was a clear business case for companies in the precast industry to adopt a more proactive approach to sustainability.

However, whilst many more examples of good and best practice on sustainability were available, the majority were found to come from a small number of companies; this suggested that there were still a large number of companies in the industry that were not aware of the benefits of adopting more sustainable practices. Thus, the need for British Precast to engage with these companies, raise their awareness of the business case for sustainability and promote the adoption of more sustainable practices was identified.

3.5.2 Encouraging change

Woodall *et al.* (2004), reporting research conducted in 2002/03 amongst 145 managing directors of construction firms including architects, engineers, contractors and suppliers, found that legislation was often considered to be the primary driver towards the adoption of more sustainable business practices in their organisations. As a trade association, British Precast is unable to adopt a command-and-control type legislative approach and force companies to change their practices; a different way of influencing the behaviour of companies in the precast industry would therefore have to be found.

The Government's revised Strategy for Sustainable Development published in 2005 (DEFRA, 2005) proposed a new approach to influencing behaviours focusing on measures to encourage change, rather than measures to force change, suggesting encouraging change to be a more effective way of influencing behaviours than forcing change. It was thus concluded that British Precast would also have to find ways of encouraging change; this was the focus of the second part of this research cycle.

* Yin (2003) notes that the strategy for producing histories about contemporary events, overlaps with that for producing case studies.

The importance of continuously improving the precast industry's performance on health and safety has long been recognised by British Precast; its 'Concrete Targets' schemes were created to assist in that process and have succeeded in raising performance on health and safety across the industry. It was possible that ways of encouraging change in the precast industry could be identified from examination of these schemes.

The first 'Concrete Targets' scheme for accident reduction was launched by British Precast in 2001 as a response to the Government's 'Revitalising Health and Safety' initiative (British Precast, 2006). The scheme's target was for a 50% reduction in accidents and lost time over the five years to 2006. Although the 21 member companies supporting the scheme recorded a 45% reduction after four years, they narrowly missed the five year target. Despite this, the scheme was highly regarded by the Health and Safety Executive (HSE) as a benchmark programme for accident reduction; the HSE estimated that scheme members performed 50% better than non-scheme members. Participants in the scheme also reported cost savings in terms of less accidents, less visits from HSE, more opportunity to cut insurance costs, less production disruption, more efficient production, less lost time days and improved employee engagement in business needs (British Precast, 2005a).

The current scheme, 'Concrete Targets 2010', came into operation in January 2006 with the aim of continually improving the corporate financial, environmental and social responsibility performance of each company by reducing accidents, improving communication, sharing best practice and areas of concern, improving plant efficiency and reducing environmental impact (British Precast, 2006). The overall target of the rolling five year programme is to reduce the RIDDOR (Reporting of Injuries, Diseases and Dangerous Occurrences Regulations) rate by at least 50% from the 2005 base year, working towards a sector target of zero accidents and zero injuries. 31 member companies have pledged to support the scheme; that pledge is a serious commitment, requiring companies to provide evidence of satisfactory implementation of improvement activities, supported by submission of key statistics.

A key feature of the scheme is the setting of specific safety themes each year; these themes are selected in support of HSE 'hot topics', changes in legislation and practical industry needs and aspirations. Although the onus is on individual companies to work out how to improve their performance under each of the specified themes, British Precast produces supporting documentation each year describing how to implement improvement activities and sharing best practice that has been developed within the precast industry or parallel industries. Annual Awards are presented to scheme members in recognition of achievements in accident reduction, and in order to reward individual and team performance; the latter to improve employee engagement and involvement.

Five ways of encouraging change in the precast industry were identified from examination of the 'Concrete Targets' schemes; these are reported in Paper 4 (Appendix E) and summarised here.

1. There need to be clear and tangible benefits to companies from participating.
2. Clear objectives and targets for improvement need to be specified, covering issues of importance to both the industry and its stakeholders.

3. Good quality data needs to be collected in order to measure progress.
4. Progress needs to be demonstrated to stakeholders.
5. Best practice needs to be recognised and supporting documentation produced in order to promote it to others.

3.5.3 Review and next steps

The research cycle began with the production of a series of best practice case studies from entries to the annual British Precast Best Practice Awards which demonstrated the economic and other benefits that companies were achieving by taking a proactive approach to sustainability and reducing their consumption of natural resources and energy; Bennett and Crudginton (2003) note that there is a growing consensus in the UK as to the competitive advantage that can be conferred by businesses taking a sustainable approach. However, these case studies came from a small number of companies and the need for British Precast to promote the adoption of more sustainable practices amongst other companies in the precast industry was identified.

As a trade association, British Precast can only encourage companies in the precast industry to adopt more sustainable practices. A number of lessons for encouraging change in the precast industry were identified from British Precast's own experience with schemes designed to improve the precast industry's performance on health and safety. Recently published good practice guidance designed to help trade associations to engage with the issue of sustainable consumption and production (Trade Association Forum, 2007), supports these lessons and provides additional guidance for encouraging change including measuring sector performance, making commitments and promoting sustainable industry standards through voluntary certification schemes. These lessons and this good practice guidance will be used in the strategy formulation phase of the research programme to produce an action plan which will enable British Precast to engage with companies across the industry and facilitate progress towards a more sustainable precast industry.

3.6 MANAGING FOR SUSTAINABILITY

It was established earlier that there were clear differences in the priorities and achievements of companies in the precast industry on sustainability issues, with some companies being more advanced in the development of corporate sustainability than others. Dunphy *et al.* (2003) suggest that managing for sustainability is critical to the development of corporate sustainability.

There are an increasing number of tools and guidance documents available to help companies manage for sustainability. However, Henriques (2001, page 53) makes the following statement in respect to the profusion of initiatives, codes, tools, standards, new organisations, systems, principles, labels and more, all designed to help companies with sustainability: *"Unfortunately the very profusion is under-mining itself. It is so hard to know where to start for many companies that they are simply waiting to see where the consensus emerges"*. Furthermore, many of these tools and guidance documents create the impression that sustainability is an achievable level of performance or competence, whereas, as Braithwaite (2007) notes, sustainability is a continuing process of improvement rather than an achievable objective.

Roome (1998) states that managing for sustainability is fundamentally about strategic organisational development and change, change in management structure, systems and competencies. This suggests that key differences in how companies approach these three broad areas could explain the differences observed in the precast industry. In order to assist companies in the development of corporate sustainability, research was undertaken to investigate how leaders in corporate sustainability in the precast industry had changed their management structures, systems and competencies in order to develop the capabilities necessary to manage for sustainability. The research is summarised here and comprehensively reported in Paper 5 (Appendix F).

3.6.1 Research undertaken

The overall aim of this research cycle was to investigate how leaders in corporate sustainability in the precast industry had developed the capabilities necessary to manage for sustainability. Objectives in support of the research aim were to:

- identify the leaders in corporate sustainability in the precast industry;
- establish how these companies manage for sustainability;
- determine what changes have been made to their management structures, systems and competencies in order to manage for sustainability;
- investigate how these changes were made; and
- assess how effective they were.

These objectives were met by undertaking a series of company case studies; case studies are recognised as a suitable research methodology for these types of explanatory questions focusing on contemporary events (Yin, 2003). Due to the diversity of company size and structure in the precast industry, a single-case design with multiple units of analysis was adopted in accordance with the guidance offered by Yin (2003). That is, four companies of different size and structure were studied using the same case study protocol; the protocol is included in Appendix G.

For the purpose of this study, the leaders in corporate sustainability in the precast industry were considered to be those companies that had moved beyond the ‘compliance’ phase of corporate sustainability; a number of companies meeting this requirement were identified from the industry survey conducted in January 2006 (see section 3.4.2). There is considerable diversity in the precast industry in terms of the range of products it produces, the manufacturing processes it uses, and the size and structure of the companies within it. From the companies identified, four companies that reflected this diversity were invited to participate in the study; all four accepted. A comparison between the four companies is presented in Table 3.8, based on some of their defining characteristics; for confidentiality, the companies are referred to as Company A, B, C and D.

Table 3.8: Comparison of some defining characteristics of each company

Characteristic	Company A	Company B	Company C	Company D
Age	Established over 100 years	Elements of the company have been established over 100 years	Established over 50 years	Established 1972
Ownership	UK based plc quoted on the London stock market	Part of a privately owned Belgian industrial group	Part of an international group of companies, which are quoted on the Danish stock market	Privately owned UK based company
Products/markets	Concrete and natural stone hard landscaping products for the UK construction, home improvement and landscape markets	Roofing and cladding solutions to the UK construction and house building markets	Aircrete products for the UK construction and house building markets	Prestressed flooring and roofing products, stairs, staircases, terracing units and bespoke items to the UK construction market
UK infrastructure	18 quarries, 38 manufacturing sites of which 18 are precast, 12 service centres, 5 regional sales offices and 12 administrative offices	3 concrete tile factories, 3 clay tile factories and a head office	4 manufacturing plants at 3 locations plus a network of distribution depots and a head office	1 manufacturing site comprising 3 factories and associated offices
Employees	Approximately 3,000	Approximately 1,000	Approximately 350	Approximately 150

Interviews provided the primary source of data, supplemented by information from the company websites and publicly available reports. Two directors and/or senior managers were interviewed in each company; all of the interviewees were considered to have a thorough knowledge of how their company was managed for sustainability and to have been able to provide credible information on the subject. The interviews were semi-structured using a number of key and supplementary questions to identify organisational developments and changes made in relation to managing for sustainability, and to investigate the development and change process. Transcripts were made of each interview, from which narrative reports were produced for each company. The narrative reports were then compared and analysed.

3.6.2 Research findings

3.6.2.1 Compliance and management systems

Roome (1998) states that managing for sustainability is fundamentally about strategic organisational development and change. Dunphy *et al.* (2003) suggest that the change process begins with compliance, and argue that by focusing first on compliance, firms gain initial understandings, tools, techniques and capabilities that are valuable in themselves, but also form a base from which they can more pro-actively engage with other sustainability issues. They outline a broad and compelling case for adopting a compliance approach, reasons for which include the emergence of more widespread and increasingly sophisticated forms of government regulation; increasing scrutiny by NGOs; and opportunities to improve the firm's competitive situation by achieving compliance. However, they also note that there is a limit to what can be achieved by an *ad hoc* approach to compliance which is leading companies to adopt more systematic approaches such as environmental management systems.

Managing for sustainability in each of the four companies studied was found to have begun with a compliance approach based on the development of ISO 14001 certified environmental management systems, the decision to develop these systems typically being made in response to commercial and legislative pressure, and, as one interviewee noted, the need to demonstrate that "*things were being done correctly*"; thus supporting the argument presented by Dunphy *et al.* (2003).

3.6.2.2 From compliance to efficiency

Dunphy *et al.* (2003) suggest that in many cases the development of an efficiency approach to sustainability is a natural extension of an organisation's engagement in compliance activities because it simply builds on existing operational and technical capabilities. The management systems now operated by each company are listed in Table 3.9. The principal benefit of developing certified management systems identified by the interviewees was the development in each company of a continuous performance improvement culture; as one interviewee noted, "*for directors of the business, we love that (continuous performance improvement) because it actually forces everybody in the business to continually get better*". This in turn was leading to a range of economic benefits, including improving stakeholder confidence. Identifying and implementing performance improvement measures that will provide cost benefit to the company is characteristic of the 'efficiency' phase of corporate sustainability. Thus, by adopting a compliance approach to managing for sustainability, characterised by the development of management systems and continuous performance improvement cultures, there was evidence of the four companies studied having progressed naturally to this phase of corporate sustainability.

Table 3.9: Management systems operated by the four companies

System	Company A	Company B	Company C	Company D
Quality Management	Certified to ISO 9001	Certified to ISO 9001	Certified to ISO 9001	Certified to ISO 9001
Environmental Management	Certified to ISO 14001	Certified to ISO 14001	Certified to ISO 14001	Certified to ISO 14001
Health & Safety Management	Certified to OHSAS 18001	Working towards OHSAS 18001	Certified to OHSAS 18001	In house system
Integrated Management	Working towards PAS 99	No system	Certified to PAS 99	No system

Benn *et al.* (2006) suggest that the move to ‘compliance’ and ‘efficiency’ is characterised by gradual, planned, continuous and ongoing incremental change, but to progress beyond this requires more transformational change. The experiences of the companies studied supported this; they all reported making the incremental changes associated with continuous performance improvement, but none of them reported making any transformational changes.

3.6.2.3 *Monitoring performance and implementing improvements*

The interviewees all considered performance monitoring to be essential in order to provide the evidence of continuous performance improvement required by the various management standards; it was also used by the companies to help identify and prioritise areas for improvement, and to enable improvement targets to be set.

All of the interviewees reported that legal compliance was considered to be the baseline performance level for their company and that they always strived to perform above this. Similarly, they all reported that the performance targets their companies set were only used as a guide and would often be reviewed in the light of market and other operational factors.

When implementing performance improvements, the need for progressive development was stressed by all of the interviewees, for example, by following a Plan-Do-Check-Act cycle, by taking account of resource limitations, not trying to do everything at once, and going at a pace that everyone could follow.

3.6.2.4 *Eco-efficiency and socio-efficiency*

Dyllick and Hockerts (2002) propose that to manage for sustainability requires the concept of ‘efficiency’ (the economic value added in relation to the aggregated resource used) to be extended to include ‘eco-efficiency’ and ‘socio-efficiency’ (the economic value added in relation to the aggregated ecological and social impacts, respectively).

It was noted that, historically, the focus of improvement activities in all four companies had been on improving their environmental performance, suggesting that they were only achieving progress towards eco-efficiency; this was reported to be a consequence of having developed environmental management systems and the mass of environmental legislation now facing precast companies in the UK. Research conducted by the Institute for Management Development (IMD) in Lausanne, Switzerland, to investigate the business

case for corporate sustainability in the automotive, aviation, chemical, electric utilities, financial services, food and beverage, pharmaceutical, oil and gas, and technology industries of 16 countries in Europe, North America and the Far East (Steger, 2006), also found that the overall focus of implementation processes in companies was on environmental management; companies reported difficulty in defining social aspects and related criteria clearly. So although the move to efficiency may be considered to be a natural extension of installing compliance systems, it may also have its limitations.

Benn *et al.* (2006) argue that the move to eco-efficiency must be supported by a corresponding move to socio-efficiency. There was evidence of this process, which involves organisations making maximum use of their human capabilities, starting to occur in all four companies. For example, the interviewees all noted that their companies were now starting to broaden their sustainability focus to include: internal social issues such as staff training and development; local community relations; the performance of their suppliers; and the contribution of their products to sustainable construction. The interviewees also noted that including wider sustainability issues within the scope of their management systems was helping them to manage many different aspects of their businesses including training, transport, customer relations, and supplier performance. Therefore whilst the development of ISO 14001 certified environmental management systems and continuous performance improvement cultures may enable companies to achieve progress towards eco-efficiency, there is also a need for them to broaden their sustainability focus, make better use of their human capabilities and achieve complementary progress to socio-efficiency, in order to develop a comprehensive efficiency approach to sustainability.

The development of integrated management systems is noteworthy in this respect. In the IMD study (Steger, 2006), no company was found to have developed an integrated corporate sustainability management system, although the necessity of such a system had been stressed by a majority of advanced companies. Several interviewees in this study of precast companies noted that increasing alignment between the management standards for quality, environment, and health and safety, was leading them to develop integrated management systems, the focus of which was improving their corporate sustainability.

3.6.2.5 Overcoming barriers to certification and change

Of the many management system standards now available, MacDonald (2005) notes that ISO 14001 certified environmental management systems have become a widespread administrative tool in the field of corporate responses to sustainability. However, the high cost of certification was the highest ranked obstacle to certification in a survey of 177 ISO 14001 certified industrial companies in the USA reported by Babakri *et al.* (2003). All four companies in this study acknowledged that they had had to allocate additional resources to the development of their management systems and achieving certification, but the benefits were found to outweigh the costs.

The four companies also encountered barriers to change; the ways in which they overcame those barriers included:

- having the commitment of senior management and transferring that commitment down through the company, so that performance improvement becomes part of every employee's job;
- initiating programmes of training to raise awareness and improve the competence of staff at all levels on sustainability issues;

- clearly communicating the reasons for doing things and potential benefits to employees and other stakeholders;
- ensuring local ownership, i.e. that the people operating the systems were involved in their operation; and
- setting clear objectives and targets for improvement that focus on the issues that have the biggest impact on the company and its employees.

3.6.2.6 *Change agents*

Dunphy *et al.* (2003) recognise that senior management play an important change agent role by recognising the need to change and committing to support change, but stress that other internal change agents then have to work to deliver that commitment; the four companies studied here were no exception. One or more Directors in each company were found to have taken direct responsibility for sustainability and that commitment to sustainability and change had then been transferred down through the company. This was typically achieved by careful education, by example, and to a degree by competition. In the three larger precast companies studied, responsibility for developing the various management systems and performance improvement was initially taken centrally by the safety, health, environment and quality (SHEQ) teams, and their efforts were concentrated on the manufacturing function; these teams having the necessary diagnostic and project management skills to identify where and how to implement changes, and manufacturing being the primary function of these companies. As the companies have progressed, day-to-day responsibilities have been devolved to factory-level teams, allowing the central teams to concentrate on the more strategic tasks such as extending their systems and sustainability focus to include other functions beyond manufacturing. Transformation of the SHEQ teams into sustainability teams or departments was also apparent. Thus the companies had established change agents at different operational levels and begun to develop an integrated approach to sustainability across different functions.

3.6.3 **Review and next steps**

British Standard BS 8900:2006 *Guidance for managing sustainable development* takes the form of guidance and recommendations which are described as providing a framework for embedding sustainable development management in everyday decision making. The guidance covers the activities an organisation should engage in and capabilities it should develop in order to continually improve performance along a path towards sustainability. The performance of the four companies studied has been considered against this guidance in order to assess whether they were engaging in the activities and developing the capabilities considered necessary to manage for sustainability; the results are summarised in Table 3.10. This guidance was chosen because it is non-commercial, relatively simple, not industry specific and based on the experience of many leading practitioners in the field.

Table 3.10: Comparison of observations with recommendations in BS 8900

Activity/capability	BS 8900 recommendation	Observation
Organisational commitment	<p>The leadership of the organisation should:</p> <ul style="list-style-type: none"> • define and communicate a strategic vision for sustainable development; and • promote those values that express the types of behaviour the organisation has or wants to become known for. <p>In addition, the purpose, vision and values of the organisation with respect to sustainable development should be reflected in its operations at all levels.</p>	<p>The commitment of senior management to sustainability was apparent in each company. That commitment was clearly being transferred down through their organisational structures, resulting in performance improvement becoming part of every employee's role.</p>
Identification of issues	<p>The organisation should identify and manage its sustainable development issues. The main mechanism should be through stakeholder engagement. The organisation should also consider significant issues that may derive from other factors arising where there may not be a stakeholder voice.</p>	<p>All four companies undertook some form of basic stakeholder engagement, such as dialogue with their employees and customers, however, they all used their management systems as the main mechanism for identifying and managing their sustainability issues.</p>
Capability of the organisation	<p>For the principles of sustainable development to be converted into practice the organisation requires appropriate resources and a range of competencies. The organisation should therefore:</p> <ul style="list-style-type: none"> • allocate appropriate resources to achieve its sustainable development objectives; and • identify the competencies needed by its managers and employees, and invest time and money to provide resources for building appropriate levels of competence. 	<p>All four companies reported having allocated resources to improving their performance on sustainability issues, usually as part of their normal planning, budgeting and business development processes. All of the companies reported having initiated programmes of training to raise awareness and improve the competence of staff at all levels on sustainability issues.</p>
Management	<p>Within organisations, sustainable development issues can be managed using a range of techniques including recognised management systems or performance-based approaches.</p>	<p>In all of the companies studied, it was clear that the management systems they used provided the basis on which they managed sustainability issues, particularly their ISO 14001 certified environmental management systems.</p>
Performance review and reporting	<p>Sustainable development should be included in an organisation's operational review and should form an integral part of the regular planning and budgeting cycle.</p>	<p>All four companies claimed to give equal consideration to economic, environmental and social impacts in their management and planning processes. In addition, they all reviewed and reported progress at the operational level at intervals of 3 to 6 months, in accordance with the requirements of the different management standards they operated.</p>

The comparison in Table 3.10 shows that the four companies studied were all engaging in the activities and developing the capabilities necessary to manage for sustainability described in BS 8900 to varying degrees. However, the companies had achieved this by developing management systems and continuous performance improvement cultures, rather than following the guidance in BS 8900.

Thus, it was determined that in order to assist companies in the development of corporate sustainability and to progress through the phases of the sustainability model, the sector sustainability strategy should encourage companies to develop management systems, particularly environmental management systems to ISO 14001, and continuous performance improvement cultures. Whilst those companies that already had management systems in place should be encouraged to broaden their sustainability focus to include: wider environmental issues; internal social issues such as staff training and development; local community relations; the performance of their suppliers; and the contribution of their products to sustainable construction.

3.7 FORMULATING AND IMPLEMENTING THE STRATEGY

The aim of this research cycle was to formulate and implement a sector sustainability strategy for the precast industry using the information and knowledge gained from the preceding research cycles (see Figure 2.3). The requirements the strategy would need to meet were firstly reviewed. This led to the development of a programme of initiatives designed to improve performance across the precast industry on sustainability; the programme is described and its suitability in meeting the various requirements identified reviewed. Following encouraging feedback from the industry and its stakeholders, the programme was launched in November 2007; progress in implementing the initial phases of the programme is reviewed.

3.7.1 Requirements

It was established in Section 3.3 that the purpose of a sector sustainability strategy should be to provide a long-term plan for improving economic, environmental and social performance in the precast industry. However, a number of other requirements the precast sector strategy would need to meet were also established from the research.

- The main focus of the strategy should be on improving the sustainability of companies within the precast industry.
- The strategy would need to engage with individual precast companies and their supply chain partners, and offer clear and tangible benefits.
- The strategy would need to take account of the different levels of development of companies on sustainability.
- The strategy should encourage companies to develop management systems and continuous performance improvement cultures, and to take action on the 16 key sustainability issues identified.
- Targets and indicators should be specified in order to measure improvement and demonstrate progress to stakeholders.
- Best practice should be recognised and promoted to others.
- There would need to be an appropriate mechanism for stakeholder engagement.

From these requirements it was evident that the strategy would need to do more than simply promote action by the precast industry against a series of sustainability objectives and targets; specifically, the strategy would also need to provide British Precast with a means of engaging with companies across the precast industry, encouraging and assisting companies to adopt more sustainable practices, engaging with stakeholders, and demonstrating to stakeholders that measurable progress towards a more sustainable precast industry was being achieved. This led to the formulation of an action plan that would allow British Precast to achieve all of these requirements; this action plan forms the basis of the sector sustainability strategy for the UK precast concrete industry.

3.7.2 Action plan

The action plan contained a programme of initiatives to be introduced in stages between 2007 and 2009, as shown in Table 3.11. The programme is described in Paper 4 (Appendix E) and required British Precast to establish the following for the precast industry:

- Key Performance Indicators;
- A Sustainability Charter;
- A Responsibly Sourced Materials Scheme;
- A Best Practice Forum; and
- Objectives and targets for improvement.

Table 3.11: Timeline for introduction of initiatives

2007	2008	2009
Key Performance Indicators	Responsibly Sourced Materials Scheme	Best Practice Forum
Sustainability Charter		Objectives and targets for improvement

3.7.2.1 Key Performance Indicators

The use of Key Performance Indicators (KPIs) to measure and report progress on sustainability is a well established practice (Trade Association Forum, 2007). The Government, for example, measures the success of its policies and legislative programmes in achieving progress on sustainability in the UK through its ‘quality of life’ indicators (DEFRA, 2006). The rationale for establishing KPIs for the precast industry is that in order to remain profitable and competitive, the industry must demonstrate to key stakeholders such as the Government and its major customers, that it is continuously improving its performance on a range of economic, environmental and social issues. If the industry does not do this, Government policy and legislation will force changes upon it and customers will turn to industries and products that are perceived to be ‘more sustainable’. KPIs also provide a means for companies and product groups to monitor their own performance and benchmark themselves against the industry as a whole.

3.7.2.2 Sustainability Charter

The Sustainability Charter is a voluntary certification scheme designed to encourage companies across the precast industry to go beyond legislation and take actions to make their operations and products more sustainable. Using the key sustainability issues facing the precast industry shown in Figure 3.8, a set of sustainability principles that companies in

the industry should endeavour to work to was determined; these principles are contained in the 'Member Declaration on Sustainability' (see Appendix H). The first step towards Charter status is for a company to sign this declaration and formally commit to adopting these principles into its normal business and working practices. The second step is to pass a performance audit from British Precast; this is to ensure that signatory companies are complying with the spirit of the Charter and taking voluntary actions to improve their performance across a broad range of issues.

Voluntary certification schemes such as this are now emerging across many industries and increasingly being used in procurement specifications (Trade Association Forum, 2007). The benefits to companies in participating in the Charter scheme are that it guides them on where and how to take action to improve their economic, environmental and social performance, encourages progression regardless of starting point, and provides stakeholders with a means of differentiating between those companies that are committed to sustainability and continuous improvement of their performance, and those that are not.

3.7.2.3 Responsibly Sourced Materials Scheme

There is an increasing requirement in the construction industry for responsibly sourced materials; it is already a feature of the Government's Code for Sustainable Homes (DCLG, 2006) and the Olympic Delivery Authority's procurement policy (ODA, 2007). This is leading to the development of Responsibly Sourced Materials (RSM) certification schemes. The benefits to companies of participating in such schemes are that they promote continuous performance improvement on a wide range of issues, and can enable them to gain recognition and competitive advantage from their improvement activities. The development of a certified RSM scheme for the precast industry is a natural progression from the Sustainability Charter. Such a scheme would provide independent third-party evidence that the sources from and processes by which a product has been made have been managed in accordance with a series of sustainability policies and standards verifying that all local and national legislative requirements are met and that initiatives are in place to ensure continuous performance improvement on social and environmental issues. It would also encourage companies to develop appropriate management systems and require British Precast to establish a formal engagement process with the industry's stakeholders on behalf of the industry.

3.7.2.4 Best Practice Forum

A Best Practice Forum was proposed in order to encourage participation and performance improvement across the precast industry. The Forum will require British Precast to produce a series of best practice and other guidance documents, hold seminars and workshops to disseminate this information to the industry, and provide a discussion forum for companies to participate in. In addition, it was proposed that the annual British Precast Sustainability Awards scheme be expanded to recognise performance improvement in addition to the current themes of innovation and excellence. These measures will not only encourage the less proactive companies to take action, but will enable companies at all levels to learn from the experiences of others.

3.7.2.5 Objectives and targets for improvement

The Sustainable Development Commission identified the adoption of objectives and targets for improvement to be one of the key features in a sector sustainability strategy (SDC, 2002b). The KPIs will allow the performance of the industry to be evaluated, following which it will be possible to establish objectives and targets for improvement;

thus providing the industry with a long-term plan for improving its sustainability. The objectives and targets will need to be developed in consultation with the industry and its key stakeholders, and be informed by the UK Government's strategies for sustainable development (DEFRA, 2005) and more sustainable construction (BERR, 2008).

3.7.3 Approval and implementation

The action plan was presented to the governing body for British Precast in March 2007 and approved in principle. A consultation document describing the programme of initiatives was then prepared and distributed to the industry and its key stakeholders for discussion and comment; a copy of the *Sustainability White Paper* consultation document is included in Appendix I. Following a favourable response to the consultation document, introduction of the different initiatives began in November 2007.

An important element of this EngD research programme has been to assist British Precast to establish these initiatives and build support for them across the precast industry; accordingly, progress to date in implementing the different initiatives is reviewed here.

3.7.3.1 Key Performance Indicators

From the key sustainability issues facing the precast industry shown in Figure 3.8, a set of KPIs has been defined which provide an overview of the impact of the precast industry on society and the environment, and how that impact is managed (see Appendix I). Two sets of KPI data have been prepared to date using data collected for the 2006 and 2007 calendar years, and published in the annual *Sustainability Matters* progress reports (see Section 3.8.3). 2006 data was provided by 19 companies relating to 132 production units and approximately 17 million tonnes of production, whilst 2007 data was provided by 25 companies relating to 122 production units and approximately 20 million tonnes of production; the annual production output for the industry is estimated to be 38 million tonnes. The two sets of data show little variation in the impact of the industry year on year. In fact the consistency between the two data sets is an encouraging sign that a robust performance benchmark from which objectives and targets for improvement for the industry can soon be established.

3.7.3.2 Sustainability Charter

The Sustainability Charter was launched on 29 November 2007. By November 2008, 20 companies had made the commitment to adopt its principles into their normal business and working practices, including most of the major companies in the industry.

The process of British Precast auditing companies to ensure that they are delivering on their commitments began in autumn 2008. The audit involves a suitably qualified member of British Precast staff visiting each company to review their records and procedures against a set of criteria based on good practice. Initial indications are that companies are finding the audit process a useful way of sharing knowledge and identifying potential areas for improvement, and that there are some clear sustainability 'champions' in the industry.

3.7.3.3 Responsibly Sourced Materials Scheme

In February 2008, BRE Global, the UKAS accredited certification arm of the Building Research Establishment (BRE), signalled its intention to develop an overall framework standard for the assessment of responsible sourcing that would be applicable to all construction products. BRE Environmental & Sustainability Standard BES 6001 was launched in October 2008, following extensive development and consultation with a wide

range of industry stakeholders, including British Precast, many precast companies, and other companies and representative bodies from across the concrete industry. This standard now provides a direct route to certification for responsibly sourced construction products.

Rather than develop its own RSM scheme, British Precast decided that its member's interests would be best served in the short-term by producing a guidance document in support of BES 6001. An industry working group was established to produce the guidance document, working in conjunction with BRE Global and in collaboration with other representative bodies from across the concrete industry. The guidance document was published in December 2008 (CISCF, 2008). It indicates how compliance with the requirements of responsible sourcing in BES 6001 can be demonstrated for a wide range of products including aggregates, cements, precast concrete and ready-mixed concrete using established practices and procedures in the concrete industry, and how higher levels of compliance can be demonstrated by adopting practices and procedures that are considered "best practice" across the construction industry. In addition, it provides background and guidance to be used by assessors in the process of confirming third-party certification against BES 6001.

3.8 DEVELOPING CONSENSUS

The need to develop consensus with companies and other key stakeholders in order to build support for the strategy and strategy activities was identified from the analysis of other sector sustainability strategies. This was undertaken as a continuous supporting activity through the research programme (see Figure 2.3); conference papers, presentations and dedicated progress reports were the principal mediums used to develop consensus. Whilst this activity was not strictly research, it was considered to be an important part of the research process and thus warrant inclusion in this thesis.

3.8.1 Conference papers

A visioning paper setting out the context for developing a sector sustainability strategy and the benefits it would offer the precast industry was presented to the international concrete industry at the 2005 BIBM Congress in Amsterdam:

- Holton, I.R., Glass, J., Clarke, M.A., Bell, S. and Price, A.D.F. (2005). *Developing a sector sustainability strategy for the UK precast concrete industry*. Proc. 18th BIBM International Congress, Amsterdam, May 2005, pp 175-176. BFBN, The Netherlands.

A paper reviewing the outcomes from the programme and the impact it has had on the sustainability of the precast industry will be presented to the international concrete industry at the 2009 *fib* symposium in London:

- Holton, I.R., Glass, J. and Clarke, M.A. (2009). *More from Less – Outcomes from the UK precast concrete industry sustainability programme*. Concrete: 21st Century Superhero. *fib* symposium, London, June 2009.

Copies of these papers are included in Appendix J.

3.8.2 Presentations

The presentations made during the course of the research programme for the specific purpose of developing consensus are listed in Table 3.12; the primary audience in all cases was the UK precast industry and its supply chain partners.

Table 3.12: Consensus building presentations made

Date	Event	Topic
December 2005	<i>Sustainability and the Concrete Producer</i> events organised by British Precast and the British Ready-mixed Concrete Association	Progress reports on the precast sector sustainability strategy
June 2006		
May 2007	British Precast AGM and National Conference	The Precast Sector Sustainability Programme – An Introduction
May 2008	British Precast AGM and National Conference	The Precast Sector Sustainability Programme – Progress Report

3.8.3 Publications

The *Sustainability Matters* series of annual reports was established in 2005 to inform stakeholders of the progress being achieved by the precast industry on sustainability. They have been used to report progress towards the sector sustainability strategy, provide examples of the ways in which companies have tackled specific sustainability issues, showcase the achievements of the annual Sustainability Award winners, and, most recently, to report the sustainability KPI data for the industry. Copies of the reports are widely distributed and are also freely available to download from the British Precast website; copies of the reports produced to date are included in Appendix K.

3.9 SUMMARY

The overall aim of this research programme was to develop a sector sustainability strategy for the UK precast concrete industry. Six research cycles were undertaken in the course of achieving that aim, with the findings from each cycle used to guide subsequent cycles. The research undertaken is summarised here; the key findings and implications from the research are reviewed in Chapter 4.

1. Understanding the research area

- A literature review was undertaken to develop an understanding of the research area, and to inform and guide future research cycles.
- In the course of the review, guidance documents that could help with the strategy development process were identified, including a framework for managing the strategy development process.
- The need to analyse other sector sustainability strategies was also identified.

2. Analysing other sector sustainability strategies
 - A critical review and content analysis of the sustainability strategies published by the brick, forest industries and steel construction sectors was undertaken, from which six factors which would contribute to the development of a successful sustainability strategy for the precast industry were identified.
3. Mapping sustainability issues
 - An industry survey and stakeholder analysis workshop were undertaken in order to determine the precast industry's current position on sustainability.
 - 16 key sustainability issues facing the industry were identified; however, there were no clear priorities amongst these issues and some companies were found to be more advanced in tackling the sustainability agenda than others.
 - A corporate sustainability model provided an explanation for the situation found in the precast industry; the model also suggested that improving the corporate sustainability of precast companies was likely to make a significant contribution the development of a more sustainable precast industry.
 - This led to the following priorities being established for the research programme:
 - Investigate ways of facilitating the progress of companies through the phases of the corporate sustainability model; and,
 - Encourage companies to take action on all of the issues identified.
4. Facilitating progress
 - A series of best practice case studies were produced from which a clear business case for companies in the precast industry to adopt a more proactive approach to sustainability was identified.
 - However, British Precast was found to be limited in the influence it had over companies in the precast industry; five ways in which companies could be encouraged to adopt more sustainable practices were identified.
5. Managing for sustainability
 - Managing for sustainability is critical to the development of corporate sustainability.
 - A series of company case studies were undertaken to investigate how leaders in corporate sustainability in the precast industry had developed the capabilities necessary to manage for sustainability.
 - The development of management systems and continuous performance improvement cultures was found to have assisted the companies studied to develop the capabilities necessary to manage for sustainability.
6. Formulating and implementing the strategy
 - A sector sustainability strategy was formulated for the precast industry using the information and knowledge gained from the preceding research cycles.
 - The strategy was produced in the form of an action plan which requires British Precast to establish the following for the precast industry:
 - Key Performance Indicators;
 - A Sustainability Charter;
 - A Responsibly Sourced Materials Scheme;
 - A Best Practice Forum; and
 - Objectives and targets for improvement.

- Implementation of the action plan began in November 2007; good progress has been made in implementing its initial phases and obtaining the support of companies in the industry to it.

4 RESEARCH FINDINGS AND IMPLICATIONS

4.1 INTRODUCTION

This chapter serves as an overall conclusion to the thesis and research programme. It begins with a review of the key findings and outcomes from the research, and a discussion of the impact of the research on British Precast, the precast industry and industry in general. The research methodology is then critically evaluated, and recommendations made for industry and further research.

4.2 KEY FINDINGS

The overall aim of this research programme was to develop a sector sustainability strategy for the UK precast concrete industry. That aim has been met through undertaking a series of inter-related research cycles, as shown in Figure 2.3, in which the findings from each cycle were used to develop objectives for subsequent cycles. This section reviews the key findings from those cycles.

4.2.1 Understanding the research area

The research began with a literature review; this allowed an understanding of the research area to be developed (objectives 1 + 2), and provided direction for the subsequent research cycles.

Sector sustainability strategies can provide industry sectors with a way of managing risks and opportunities, and contributing to sustainable development. In order to persuade the construction industry to take action and address the sustainability agenda, sector representative bodies and trade associations were encouraged by the UK Government to develop sector sustainability strategies (DETR, 2000). British Precast, as the trade association for the precast concrete industry in the UK, had undertaken to develop a sector sustainability strategy for that industry. However, the development of such strategies is a departure from the traditional role of the trade association and presented British Precast with a number of challenges. This research programme was established in order to meet those challenges and facilitate progress towards a more sustainable precast industry.

4.2.2 Analysing other sector sustainability strategies

A number of guidance documents that could help with the strategy development process were identified from the literature review. These provided a framework for managing the strategy development process and identified a number of techniques that could assist in that process, but were also considered to have their limitations. Research was therefore undertaken to characterise and analyse the sustainability strategies published by three other sectors of the construction products industry; brick, forest industries and steel construction (objective 3).

Strategy context, purpose, process and content were investigated through critical review and content analysis of the strategy documents. From this work (see Paper 1: Appendix A) it was established that in order to develop a successful sector sustainability strategy for the precast industry:

- the range of stakeholder needs and interests covered by the strategy would need to be carefully considered;
- an analysis of the industry's current position on sustainability was required;
- the opportunities and threats sustainability presents would need to be identified and addressed across the whole industry;
- the strategy would need to set out a long-term plan for improving economic, environmental and social performance in the industry;
- developing consensus with companies and other key stakeholders would be critical to the successful implementation of the strategy; and
- targets and indicators would need to be specified in order to measure improvement and demonstrate progress to stakeholders.

4.2.3 Mapping sustainability issues

Following good practice guidance (SDC, 2002b), the strategy development process comprised analysis, formulation and implementation phases. The guidance also suggests that identification and prioritisation (mapping) of sustainability issues is a key task in the analysis phase (Optimat, 2002), and that it is crucial for organisations to work with the full range of their stakeholders at this stage (Henriques, 2004). The mapping process was therefore designed to take account of the views of both the precast industry and its primary stakeholders (objectives 5 + 6).

From the mapping, 16 key sustainability issues facing the precast industry were identified; however, there were no clear priorities amongst these issues and some companies were found to be more advanced in tackling the sustainability agenda than others (see Paper 2: Appendix B). Dunphy *et al.* (2003) suggest that the sustainability priorities of companies will change as they go through different phases of development on corporate sustainability; from which it was concluded that given the different levels of corporate sustainability exhibited by companies in the precast industry, differences in the sustainability priorities of companies were to be expected. Further consideration of this model suggested that improving the corporate sustainability of precast companies was likely to make a significant contribution to the development of a more sustainable precast industry. Thus, it was established that a priority for the research programme should be to investigate ways of facilitating the progress of companies through the phases of the corporate sustainability model proposed by Dunphy *et al.* (2003), and that because there were no clear sustainability priorities, companies should be encouraged to take action on all of the issues identified. Ways in which these objectives could be met had to be investigated and solutions found before a strategy could be formulated.

4.2.4 Facilitating progress

From a series of best practice case studies (objective 7), a clear business case for companies in the precast industry to adopt a more proactive approach to sustainability was identified (see Paper 3: Appendix D). However, as a trade association, British Precast was found to be limited in the influence it had over companies in the precast industry; specifically, it could not force companies to adopt more sustainable practices, only encourage them to do so.

Five ways of encouraging change in the precast industry were identified from British Precast's own experience with schemes designed to improve the precast industry's performance on health and safety (objective 8):

1. There need to be clear and tangible benefits to companies from participating.
2. Clear objectives and targets for improvement need to be specified, covering issues of importance to both the industry and its stakeholders.
3. Good quality data needs to be collected in order to measure progress.
4. Progress needs to be demonstrated to stakeholders.
5. Best practice needs to be recognised and supporting documentation produced in order to promote it to others.

Good practice guidance designed to help trade associations to engage with the issue of sustainable consumption and production (Trade Association Forum, 2007), supported these findings and provided additional guidance for encouraging change including promoting sustainable industry standards through voluntary certification schemes (see Paper 4: Appendix E).

4.2.5 Managing for sustainability

Managing for sustainability is considered to be critical to the development of corporate sustainability (Dunphy *et al.*, 2003), and is fundamentally about strategic organisational development and change (Roome, 1998). Four company case studies were undertaken to investigate how leaders in corporate sustainability in the precast industry had developed the capabilities necessary to manage for sustainability (objective 9). All four companies were well established businesses in the industry, and reflected the diversity of the industry in terms of the range of products it produces, the manufacturing processes it uses, and the size and structure of company within it.

By adopting a compliance approach to managing for sustainability, characterised by the development of management systems and continuous performance improvement cultures, the four companies studied were found to have progressed naturally to the ‘efficiency’ phase of corporate sustainability as defined by Dunphy *et al.* (2003) (see Paper 5: Appendix F). However, there was a noticeable tendency amongst the companies to concentrate on improving their own environmental performance, i.e. only achieve progress towards eco-efficiency, as a consequence of their ISO 14001 accreditations and the mass of environmental legislation now facing precast companies in the UK. Benn *et al.* (2006) argue that the move to eco-efficiency must be supported by a corresponding move to socio-efficiency; the four companies were found to be achieving complementary progress towards socio-efficiency by broadening their sustainability focus and making better use of their human capabilities.

From these findings, recommendations were made that would assist companies in the development of corporate sustainability and to progress through the phases of the corporate sustainability model.

4.2.6 Formulating and implementing the strategy

Having investigated ways in which British Precast could encourage companies across the precast industry to take action on sustainability and how companies could improve their position on corporate sustainability, it was then possible to formulate a sector sustainability strategy for the precast industry (objective 10), and thus achieve the overall aim of the research programme.

4.3 OUTCOMES

This section reviews the outcomes from the research programme, highlighting the innovative aspects of the work, and the contribution to existing knowledge and practice.

4.3.1 The strategy development process

The findings from the research undertaken to characterise and analyse the sustainability strategies published by the brick, forest industries and steel construction sectors, have added to current knowledge and guidance in that six lessons were identified that will assist in the development of a successful sector sustainability strategy (see Paper 1: Appendix A).

From these lessons and the experience gained in developing the precast sector sustainability strategy, a revised framework for managing the strategy development process is now proposed, based on the framework shown in Figure 3.2. The elements of the revised framework are described below and shown in Figure 4.1.

Purpose: A clear purpose for the strategy needs to be established. For a sector sustainability strategy that purpose should be to set out a long-term plan for improved economic, environmental and social performance in a sector. Not clearly achieving this purpose will reduce the suitability of a strategy and its chances of success.

Context: The context of a sector strategy should be carefully considered, particularly the needs and interests of all the organisations and stakeholder groups associated with a sector, in order to determine whether these can be encompassed in one strategy. Involving wider stakeholder groups may increase the acceptability of a strategy, but too wide a context may reduce the likelihood of it achieving its intended purpose.

Consensus: The support of businesses and stakeholders is critical to the successful implementation of a strategy. In order to gain that support, it is necessary to develop and maintain consensus with key stakeholders throughout the strategy development process.

Analysis: The analysis phase should include the identification and prioritisation of the sustainability issues affecting a sector, both directly and indirectly, through consultation with key stakeholders.

Formulation: Within the formulation phase, technical, physical and behavioural changes to products, processes, businesses and business practices may be proposed.

Implementation: A clear plan for implementing the strategy needs to be established and appropriate resources allocated.

Commitment: A way or ways of obtaining and maintaining the commitment and support of companies in the sector to the strategy needs to be established.

Monitor and report progress: Targets and indicators need to be specified in order to measure improvement and demonstrate progress to stakeholders. If quantifiable progress is not demonstrated, stakeholders will consider the strategy ineffective and it will lose their support.

Review and adapt: Regular reviewing is essential to ensure that progress is being achieved, the focus of the strategy is on the correct issues, the right mechanisms are in place, commitment is being maintained and stakeholder needs are being met.

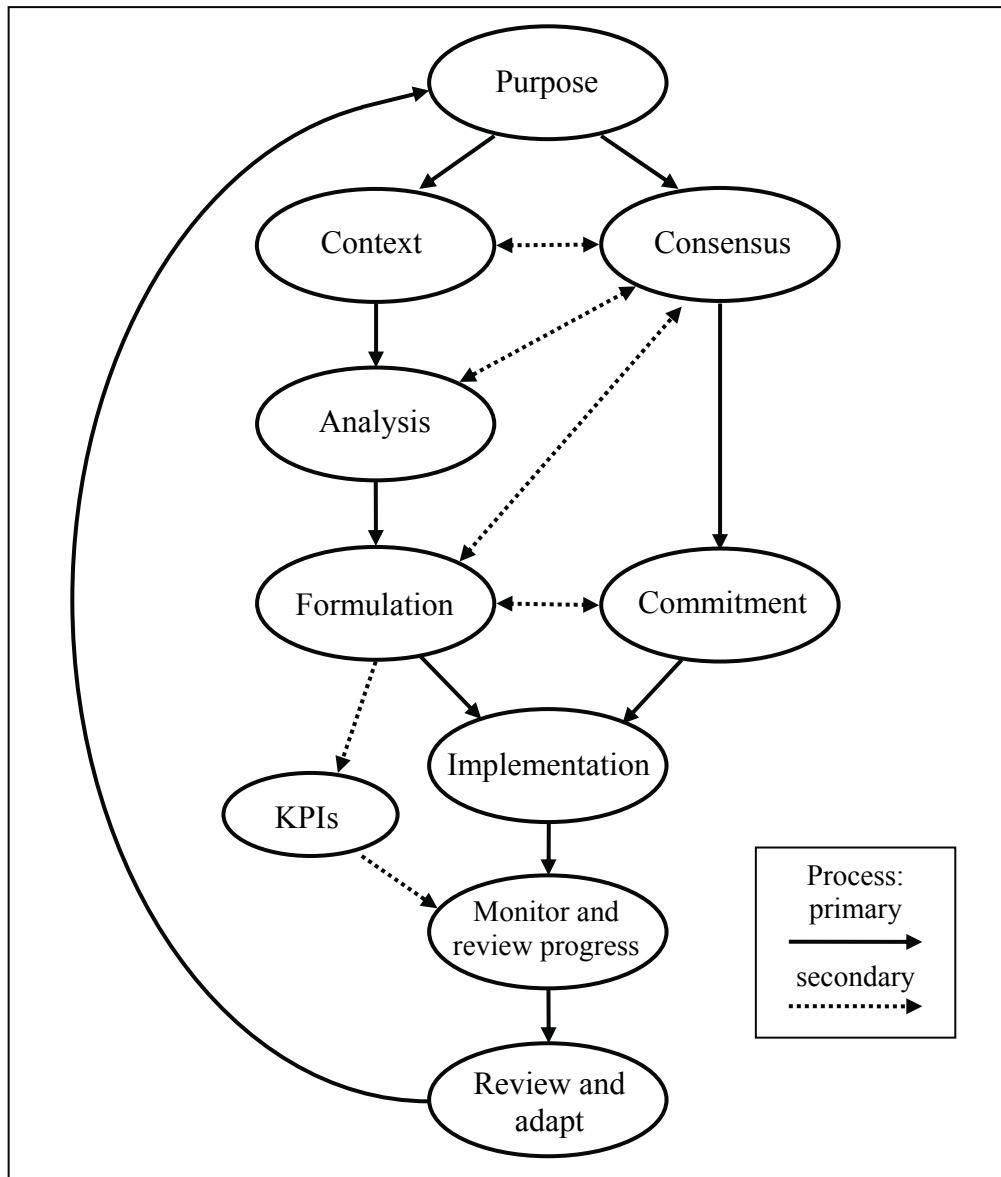


Figure 4.1: Revised framework for managing the strategy development process

4.3.2 Facilitating progress

Although a clear business case for adopting a more proactive approach to sustainability in the precast industry was established from the best practice case studies, trade associations were also shown to be limited in the influence they have over the actions of their members. Five ways of encouraging change in the precast industry were identified from examination of schemes designed to raise performance on health and safety across the industry (see Paper 4: Appendix E). These findings have contributed to current knowledge and were supported by guidance designed to help trade associations to engage with the issue of sustainable consumption and production (Trade Association Forum, 2007).

4.3.3 Managing for sustainability

Azapagic (2003) notes that for many industry leaders and corporations, corporate sustainability has become an invaluable tool for exploring ways to reduce costs, manage risks, create new products, and drive fundamental internal changes in culture and structure. However, Azapagic (2003) also notes that achieving corporate sustainability is not a trivial task. Dunphy *et al.* (2003) suggest that managing for sustainability is critical to the development of corporate sustainability; whilst Roome (1998) states that managing for sustainability is fundamentally about strategic organisational development and change, change in management structure, systems and competencies. The four company case studies undertaken have added to current knowledge on managing for sustainability (see Paper 5: Appendix F).

- Dunphy *et al.* (2003) suggest that the change process begins with compliance and that in many cases the development of an efficiency approach to sustainability is a natural extension of an organisation's engagement in compliance activities because it simply builds on existing operational and technical capabilities. By developing management systems and continuous performance improvement cultures, the four companies studied were found to have progressed naturally to the 'efficiency' phase of corporate sustainability, thus supporting the argument presented by Dunphy *et al.* (2003).
- Dyllick and Hockerts (2002) propose that to manage for sustainability requires the concept of 'efficiency' to be extended to include 'eco-efficiency' and 'socio-efficiency'. However, Steger (2006) found that the focus of companies was often limited to environmental management, i.e. achieving progress towards eco-efficiency; companies reported difficulty in defining social aspects and related criteria clearly. Whilst the four companies studied had concentrated on improving their environmental performance, as their improvement cultures had developed, they had also begun to broaden their sustainability focus and make better use of their human capabilities, i.e. achieve progress towards socio-efficiency, suggesting a natural progression from eco-efficiency to socio-efficiency.
- It is widely accepted that the commitment of senior management is critical in any change process. The four companies studied were no exception, each having one or more Directors taking direct responsibility for sustainability, but they also showed that it is essential to transfer that commitment down through the company; this was typically achieved by careful education, by example, and to a degree by competition. The companies were also found to have established change agents at different operational levels and begun to develop an integrated approach to sustainability across different functions.
- The four companies studied were all found to be engaging in the activities and developing the capabilities necessary to manage for sustainability described in BS 8900 to varying degrees. Thus, by developing management systems and continuous performance improvement cultures, each company has also developed the capabilities necessary to manage for sustainability. However, whilst following the guidance in BS 8900 is likely to have achieved a similar result, these findings suggest that following the guidance in BS 8900 will only enable companies to progress to the 'efficiency' phase of corporate sustainability.

4.3.4 The precast sector sustainability strategy

The precast sector sustainability strategy was produced in the form of a structured action plan requiring British Precast to establish the following for the precast industry (see Paper 4: Appendix E):

- Key Performance Indicators;
- Sustainability Charter;
- Certification Scheme;
- Best Practice Forum; and,
- Objectives and targets for improvement.

The sustainability strategies published by the brick, forest industries and steel construction sectors of the construction products industry were studied in the course of this research. These strategies have been compared with the precast sector strategy using the information presented in Section 3.3 and the *Self Assessment Guide* produced by the Sustainable Development Commission (SDC, 2002b).

A comparison of different aspects of the strategy development process is presented in Table 4.1. It would appear that the analysis, formulation and implementation phases of the development process were approached in a similar way for each strategy.

- Analysis included understanding the principles of sustainable development, establishing a business case and identifying the impacts of the sector.
- A clear purpose for the strategy was established in the formulation phase, together with a clear plan of action to address the opportunities and threats sustainable development presented to the sector.
- Implementation included establishing a clear vision of what needed to be done, obtaining commitment and undertaking to produce regular progress reports.

However, the precast sector strategy differs from the other three strategies in the plan of action developed in the formulation phase. The plans presented in the brick, forest industries and steel construction sector strategies were all based around specific objectives and actions that would contribute to meeting some, but not all, of the Government's sustainability objectives, as shown in Tables 3.5 and 3.6. In addition, the objectives set were typically short-term and low risk, often building on current initiatives.

Writing about the creation of a sustainable world, Senge *et al.* (2008, page 6) note that “*If we see each problem as separate, and approach each separately, the solutions we come up with will be short-term, often opportunistic ‘quick fixes’ that do nothing to address deeper imbalances*”, and suggest that deeper solutions that connect many different problems are necessary in order to create lasting change. The precast sector strategy differs from these other strategies in that rather than simply promote action on specific objectives, the ‘quick fixes’ referred to by Senge *et al.* (2008), the action plan that forms the basis of the strategy has been designed to embed an enduring approach to sustainability into the precast industry. Objectives and targets for improvement in specific areas will be set, but only as part of the overall process of achieving progress towards a more sustainable precast industry.

Table 4.1: Comparison of the strategy development process followed by each sector

	Sector			
	Brick	Forest industries	Steel construction	Precast concrete
Analysis phase				
Acceptance and understanding of the key principles of sustainable development	Yes	Yes	Yes	Yes
Appreciation of the business case for sustainable development	Possibly	Yes	Yes	Yes
Audit of current performance and impacts on the sector	Yes	Yes	Some impacts excluded	Yes
Involvement/consideration of stakeholders and the supply chain	Some	Yes	Yes	Some
Formulation phase				
Clear purpose established	Yes	Yes	No	Yes
Appraisal of opportunities and threats related to sustainable development	Yes	Yes	Only opportunities	Yes
Clear plan of action established	Yes	Yes	Yes	Yes
Indicators specified to measure impacts	Yes	No	No	Yes
Objectives set for future improvement	Yes	Yes	Not clear	Will be set
Targets set for future improvement	No	No	No	Will be set
Implementation phase				
Clear vision established of what needs to be done, by whom and by what means	Yes	Yes	Yes	Yes
High level of commitment to implementation of the strategy demonstrated	Yes	Yes	Yes	Yes
Includes practical examples of action	Yes	Not clear	Yes	Sustainability Charter and Best Practice Awards
Includes a process for benchmarking performance	No	No	No	No
Includes a process for spreading best practice	No	No	No	Yes
Regular progress reports	Yes, annually	Yes, 5 years	Yes, annually	Yes, annually

This innovative approach has combined best practice, current and emerging theory, original research, stakeholder engagement, and experience from other sectors and industries. It offers the following benefits:

- it is not constrained to tackling a specific set of issues, it has the flexibility to address a wide range of current and future sustainability issues;
- it is not time constrained;
- it encourages companies across a diverse industry sector to contribute, regardless of their size and starting point on sustainability; and
- it has the potential to create lasting change in the industry.

4.4 INDUSTRIAL IMPACT

4.4.1 British Precast

The development of sector sustainability strategies is a departure from the traditional role of the trade association. Although the Government has supported the development of Best Practice guidance to assist trade associations with strategy development, this guidance recognises that “*there’s no blueprint*” and that sectors are diverse with different mandates and priorities (SDC, 2002a). The precast industry is extremely diverse and is represented by a small trade association with a few staff stretched across many key issues. So although British Precast had recognised the need to develop a sector sustainability strategy for the precast industry in order to support its competitiveness and ensure its long-term future, it did not have the resources or expertise to do this on its own. This research programme was established to assist British Precast in meeting that requirement.

That requirement has now been met and a sector sustainability strategy for the UK precast concrete industry produced in the form of a long-term action plan. The suitability of this plan in meeting the requirements of British Precast and its member companies is evident in the support it has received from the industry and its key stakeholders. Furthermore, precast industries in other regions including Scandinavia, North America and Australia have also expressed interest in adopting similar initiatives.

The strategy itself is now enabling British Precast to encourage the industry to move forward and become more sustainable, thereby providing valuable support and added value to its members. However, the research programme has had a greater impact than simply meeting the requirement of developing a strategy. It has given British Precast an insight into the sustainability issues faced by the industry, the significance of those issues across the industry, the range of approaches to sustainability across the industry, and ways of achieving progress on sustainability across the industry, all of which are enabling it to better understand and represent the interests of its members.

Furthermore, by developing knowledge and capability in this area, British Precast is now recognised as a proactive trade association on sustainability and its input and opinions are sought by others. For example, it has taken a leading role in the development of a *Sustainable Construction Strategy for the UK Concrete Industries* (Optimat, 2008) and a number of other pan-concrete industry sustainability initiatives. It has also made informed contributions to the revision of the Government’s *Strategy for Sustainable Construction* (BERR, 2008) and the development of the BRE Environmental Standard BES 6001 *Framework Standard for the Responsible Sourcing of Construction Products*.

4.4.2 The precast industry

The level of support for the Sustainability Charter provides clear evidence that the research is helping to guide business decisions on improving the sustainability of individual companies in the precast industry. For example, the Sustainability Policy published by Trent Concrete in 2008 clearly commits the company to adopting the sustainability principles contained in the Charter (Trent Concrete, 2008). Further evidence of the impact of the research on the precast industry can be demonstrated by considering the contribution the research has made to the performance of companies in the industry using some of the characteristics or ‘hallmarks’ of sustainable performance identified by Forum for the Future (Draper *et al.*, 2006).

Leadership and commitment

- 20 companies have demonstrated their commitment to sustainability by signing the Sustainability Charter, providing evidence that senior figures in the industry now have a thorough understanding of the significance of sustainability to the future success of their companies and the industry.
- Many companies are now reporting real performance improvements; for example, in the company case studies (see section 3.6), one interviewee noted that Company A had saved well over £1 million through environmental improvements in recent years.

Products and services

- Products are being developed to address specific challenges and deliver sustainable solutions, e.g. sustainable urban drainage systems (SUDS) using permeable concrete block paving can help control and prevent flooding in urban areas.
- There is evidence of a move away from linear models of production and consumption towards closed-loop systems with companies not only recycling their own waste but also collecting waste and surplus products from their customers for recycling.
- The need to demonstrate product stewardship and for products to be responsibly sourced is increasingly understood.

Environment

- The benefits of reducing environmental impacts and working within environmental limits are well understood, and the KPI data shows that an increasing number of companies are using Environmental Management Systems to manage and improve their environmental performance.

Stakeholder relations and Reporting

- The industry’s stakeholders have been identified and prioritised, and the benefits of engaging with stakeholders are increasingly understood.
- Mechanisms for demonstrating commitment and reporting progress to stakeholders have been established and are being used, for example, KPI data is now reported for approximately 50% by mass of the precast products produced in the UK.
- Companies are also adopting the industry KPIs to monitor and report their own performance.

Employees and Community affairs

- Companies are recognising that achieving social progress is just as important to their future performance as being environmentally responsible. For example, the KPI data shows that:
 - the benefits of a skilled and motivated workforce are being recognised through increased investment in staff training and development; and,
 - the benefits of forging positive links with local community groups are being increasingly recognised, with many factories now introducing formal community liaison meetings.
- A strong health and safety culture already exists across the industry, but there is evidence of this extending to sustainability, with companies increasingly informing and consulting with their employees.

All of which according to David Szymanski, British Precast President between 2005 and 2007, is leading to the development of a more sustainable precast industry: an industry that produces more outputs from fewer inputs, has more profitable operations at lower cost, is more efficient with less waste, and has more trained staff who are at less risk of accident and injury (British Precast, 2005b).

4.4.3 The wider concrete industry

The wider concrete industry comprises the 10 production industries that collectively supply aggregates, cement, ready-mixed concrete, mortar and precast concrete products to the UK construction industry; it is dominated by a small number of MNCs that are increasingly vertically integrated (Optimat, 2008). This vertical integration means that sustainability improvements resulting from this research are being transferred to other operations within these major companies such as aggregates and cement production; consequently, the sustainability of the wider concrete industry is improving.

4.4.4 Industry in general

The impact of the work on industry in general is harder to determine, although elements of the precast sector sustainability strategy have been recognised as exemplars of best practice. For example, Paul King, the Chief Executive of the UK Green Building Council, has praised British Precast for the comprehensive set of issues covered by the Sustainability Charter, and has encouraged other sectors of the construction industry to adopt similar initiatives. The research has also shown that it is possible to embed an enduring and flexible approach to sustainability in a sector, although the strategy development process has been shown to be more complex than suggested by current guidance (Optimat, 2002).

It is generally recognised that the complex and fragmented nature of the construction industry is restricting it from making a rapid transition to the adoption of more sustainable practices – if any at all (Myers, 2005). The diversity present in the precast industry is in many ways a reflection of the diversity of the construction industry, particularly regarding company size and structure. This work has shown that it is possible to engage with and achieve progress on sustainability in a diverse sector, and it is therefore possible to achieve progress elsewhere in the construction products industry and, eventually, the broader construction industry. The full extent of the impact of this work on the construction industry may not therefore be apparent until some time in the future, when the knowledge obtained from the research has been applied elsewhere.

4.5 CRITICAL EVALUATION

This section discusses the limitations of the research with particular reference to the scope of the research and the research methodology adopted.

4.5.1 Scope of the research

The fact that this research has been conducted on behalf of one industry, the precast concrete industry, could suggest that the research findings are therefore only applicable to that industry. However, much of the research has been industry-neutral because it has been focussed on the common issue of facilitating the development of a more sustainable industry sector by encouraging and assisting companies across that sector to take actions to improve their performance on a wide range of sustainability issues. As such, the practices of other industries have been studied in the course of the research, and best practice guidance developed from the experiences of a wide range of companies and industry sectors has been applied. Consequently, many of the findings from this research are also industry-neutral, enabling companies in other industries and other industry sectors to learn from or apply them. In addition, rather than address an industry specific set of issues, the precast sector strategy has been designed to engage with a broad range of companies across a diverse industry and embed an enduring approach to sustainability into that industry; an approach that has the flexibility and adaptability to be applied across many other sectors of the construction industry and beyond. Thus, while the research has been undertaken in collaboration with the precast industry, the scope of the research has not been limited to that industry, nor are the research findings and outcomes restricted to, or only applicable to, that industry.

4.5.2 Research process

In undertaking the research, the different and sometimes conflicting industrial and academic requirements have had to be balanced, and limitations in the key areas of time, resource availability, and access to companies in the precast industry taken into consideration.

Progress was expedited by using a recognised strategy development framework as a guide (see Figure 3.2), but combining this with an action research based methodology allowed the flexibility to explore key areas in greater detail. Thus it was possible to balance academic rigour with the evidence of progress and engagement required by industry, and complete the research within the time allotted. Blindly following the framework would have accelerated and simplified the research, but in doing so, significant parts of the research would have been omitted and the resulting strategy devalued accordingly.

Resource constraints have possibly limited the depth of investigation or levels of engagement achieved with the industry and its stakeholders, but are considered not to have had any significant detrimental effects on the quality of the research findings and outcomes.

User participation was investigated by Whyte (1989) who distinguished three forms, depending on the degree of user participation in the research process.

- 1) A clinical, problem-orientated approach, undertaking tasks, and reporting results with minimal user involvement in the research.

- 2) An attempt to make a change within an organisation with restricted user participation, usually to making decisions about solutions proposed and developed by the researcher.
- 3) Participatory action research which involves all users in all stages of the research project.

Whilst the participation of companies in the precast industry in various elements of this research programme was considered critical to meeting several key research objectives, it was not considered necessary to engage in full participatory action research at any stage; again, this is considered not to have had any significant detrimental effects on the quality of the research findings and outcomes.

4.5.3 The impact of the researcher

Generally, action research involves active participation by the researcher in the process under study, in order to identify, promote and evaluate problems and potential solutions (Fellows and Liu, 2003). Action research is thus particularly suited to meeting the requirements of the EngD programme. However, the impact of the researcher must be considered, both as an observer, experimenter, etc, whose presence may impact on the data collected and the results derived, and also through bias which may be introduced in data collection, analyses and inferences (Fellows and Liu, 2003). To mitigate the impact of the researcher on the research findings and outcomes, careful planning of each research cycle and the selection of appropriate research methods was essential.

4.5.4 Research methods

The focus of the research was on contemporary rather than historic events, and no behavioural control of subjects or conditions was required; the archival analysis, survey and case study research methods used in the course of the research programme were thus appropriate to the nature of the research undertaken as indicated by Yin (2003); Table 2.2.

As the research has progressed, the breadth of the study has progressively decreased, but the level of detail required has increased. The research methods selected were able to provide the necessary breadth and depth of study at each stage in the research process, and were thus considered to have been appropriate selections. However, each method did have its limitations; the effects of these limitations on the validity and reliability of the research data is discussed in the next section.

4.5.5 Validity and reliability of the data

Archival analysis can be open to bias on the part of the researcher. This bias can be overcome in a critical review by ensuring that the criticism is both objective and informed, and in a content analysis by ensuring that the emphasis is on what is significant rather than what is measurable. The potential for bias in the analysis of the sector sustainability strategies produced by the brick, forest products, and steel construction industries, was reduced by extensive referral to key Government documents and best practice guidance. The analysis was limited in that only three strategies were studied, but these were the only published strategy documents available from the construction products industry at the time. Whilst documents were available from sectors such as the Chemical Process Industry, the Motor Industry and the Retail Sector, their relevance to the precast industry was considered to be limited, and including them in the study would have placed significant additional strain on time and resources.

Response bias in surveys, particularly the effect of non-responses, can significantly affect the validity of the data obtained and reliability of any analyses performed on that data (Creswell, 2003). Thus, when conducting surveys it is essential to secure a representative sample of the set or population being studied (Fellows and Liu, 2003). The postal questionnaire conducted as part of the mapping of sustainability issues facing the precast industry only received 63 responses from an estimated 500 companies in the industry. However, the companies that did respond were considered to represent a good cross-section of the types and size of company in the industry, were together estimated to account for approximately 70% of the industry's turnover, and therefore provided a representative sample of the precast industry. In addition, the effect of non-responses was considered in the subsequent analysis. The potential for researcher bias in the questionnaire, such as from asking leading questions, was mitigated through careful design and testing.

It was not possible to involve a broad range of external stakeholders in the stakeholder analysis workshop due to time and resource constraints, both on the part of the researcher and many stakeholders. However, the analysis process was designed to take advantage of the sustainability priorities and concerns of the majority of the key stakeholders identified being published or well recognised, and was thus not considered to have been compromised in any way.

The validity of the lessons identified regarding encouraging change in the precast industry was demonstrated through good practice guidance published after the work was undertaken (Trade Association Forum, 2007).

The issue of obtaining a representative sample of a population also applies to case studies, but Eisenhardt (1989) notes that it is common practice to balance the desire for theoretical saturation (where any new case adds no significant new findings) with more pragmatic considerations, such as time and resource constraints. The companies approached to participate in the case studies examining how companies had developed the capabilities necessary to manage for sustainability, were carefully selected to be representative of the diversity of company size and structure in the precast industry, whilst also being industry leaders in the development of corporate sustainability. Thus, it is considered that including further leading companies in the study would not have added any significant additional findings, whilst including companies that were not leaders in the study would have compromised the findings. The potential for researcher bias in collecting and analysing the case study data was mitigated through development of, and adherence to, a detailed protocol.

4.5.6 Validation of the research

Unlike traditional scientific approaches to research, action research has been criticised for lacking rigour and standard methods of validation, as the cyclic process can be disorderly and make it difficult to trace a clear connection between outcomes and actions taken (Ward, 2004). However, Karlson (1991) suggests that validation can be derived from a number of sources within the research:

- The process contributes to corroboration because the assumptions about the causal relationships on which actions are based will continuously be tested. The recirculation of data sets and derived hypotheses in effect provide a control that is scientifically satisfactory.

- The corroboration of users and practitioners in evaluating and interpreting actions opens up the research process to validation through consensus.

The requirement of the EngD programme to publish elements of the work in refereed journal and conference papers as the research progresses validates the research as being scientifically satisfactory. The involvement of British Precast and companies in the precast industry in the study, and their adoption of the research outcomes, demonstrates validation of the research through consensus.

4.6 RECOMMENDATIONS FOR INDUSTRY AND FURTHER RESEARCH

This section makes recommendations for further work to be undertaken by industry and other relevant actors to achieve progress towards a more sustainable precast industry, and for further academic research in the field. Whilst it has been possible to make firm recommendations to British Precast for actions to be taken in the short to medium-term, the recommendations to the precast industry and beyond are less well defined, and as such do not have clear timescales for action.

4.6.1 British Precast

In their good practice guide on developing sector sustainability strategies, consultants Optimat state: *“The success of a sector in producing a strategy will depend on the commitment of its members”* (Optimat, 2002). Perhaps more critical for a sector body is gaining the commitment of its members to support and implement a sector strategy, especially when that strategy is in the form of a long-term action plan. Whilst British Precast has been successful in building initial support and implementing the first stages of the action plan, it is essential that it builds on this success. The following recommendations are therefore made, presented in order of priority.

- **KPIs:** The accuracy of the data and coverage of the industry needs to be improved year on year in order to establish credible performance benchmarks for the industry. Only when this has been achieved, can progress to setting objectives and targets for improvement be realistically considered; immediate action is therefore required.
- **Sustainability Charter:** The importance of the Charter and the benefits of adopting its principles into normal operating and business practices needs to continue to be emphasised to members and wider stakeholders, so that support continues to grow and it becomes the industry norm over the next 2 to 3 years.
- **Impact on the industry:** In addition to measuring the performance of the industry through KPIs, there is a need to measure the impact of the strategy on corporate sustainability in the industry; the development of an industry-specific sustainability positioning tool similar to the MaSC matrix (Woodall *et al.*, 2004) could be helpful in this respect.

- **Mapping of sustainability issues:** The mapping exercise should be repeated within the next 2 years and at regular intervals thereafter to ensure that focus of the sector strategy remains on the key issues facing the industry and its stakeholders.
- **Certification Scheme:** In order to encourage companies to participate in the proposed scheme, there is a need to better understand and promote the business and performance benefits that can be gained through product stewardship. This work should be undertaken over the next 2 to 3 years.

Moving beyond the sector sustainability strategy, there are a number of other areas in which British Precast should also consider taking action in the short to medium-term.

- **Product Groups:** Given the diverse nature of the precast industry, consideration should be given to producing indicators and targets for specific product groups, such as architectural cladding, landscaping, masonry and structural products, to better understand the impact these groups have on the overall performance of the industry and the contributions they can make to achieving overall improvement targets.
- **Stakeholders:** There is a need for British Precast to establish a formal engagement process with the industry's stakeholders on behalf of the industry in order to support its members in meeting the requirements for stakeholder engagement that are an essential part of demonstrating responsible sourcing.
- **Supply chain:** There is evidence that more sustainable precast products are now being produced by more sustainable precast companies. However, for these products to be used to deliver more sustainable construction, the precast industry needs to interact more with the downstream supply chain, and become more involved in the design and construction stages. The industry's trade association is ideally placed to engage with other industry representative bodies and begin addressing this issue.

4.6.2 The precast industry

The principal recommendation to companies in the precast industry is that they must continue to address the sustainability agenda and find ways of improving their performance. There are a number of ways in which this can be achieved:

- by continuing to support British Precast in its activities;
- encouraging the adoption and dissemination of best practice across the industry;
- measuring, improving and reporting their performance to stakeholders;
- continuing to develop more sustainable products with lower embodied impacts and better whole-life performance; and
- working more closely with the downstream supply chain to deliver more sustainable construction.

These recommendations are also applicable to the wider concrete industry.

4.6.3 The wider construction industry

The main focus of the precast sector strategy has been on improving the sustainability of companies within the precast industry, i.e. achieving progress towards corporate sustain-

ability. The rationale for this being that improving the economic, environmental and social performance of companies would lead to them produce more sustainable products, the use of which would in turn lead to more sustainable construction. Indeed there is considerable interest in the construction industry at present in demonstrating corporate sustainability, with ethical trading and sustainable procurement initiatives being the most obvious examples of activity (Mustow, 2006). However, these activities are only part of the answer to delivering more sustainable construction. There is a need to integrate the different stages of the construction process more – design, procurement, construction, operation, end of life – in order to actually deliver more sustainable construction. This need has been recognised in the 2008 *Strategy for Sustainable Construction* produced by the Government in association with the construction industry (BERR, 2008), with a specific call for more integrated project teams. The major companies in the industry and its representative bodies and trade associations must now work together to achieve this.

4.6.4 Other relevant groups

This research has shown that the development of management systems, particularly environmental management systems to ISO 14001, and continuous performance improvement cultures can assist companies in managing for sustainability; the benefits of management systems in this respect have also been recognised in other studies and guidance, e.g. the IMD study (Steger, 2006) and BS 8900. However, in the IMD study, no company was found to have developed an integrated corporate sustainability management system, despite the necessity of such a system being stressed by a number of advanced companies. Standards bodies should therefore be encouraged to develop such systems.

4.6.5 Further academic research

The following recommendations are made for academic research to provide the knowledge and guidance needed to underpin the development of more sustainable companies and a more sustainable construction industry.

This research investigated how companies in the precast industry had achieved progress towards the ‘efficiency’ phase of corporate sustainability. Benn *et al.* (2006) suggest that this move is characterised by gradual, planned, continuous and ongoing incremental change, but to progress beyond ‘efficiency’ requires more transformational change. Research is needed to identify and better understand these transformational changes, so that companies can be assisted in making them and achieving further progress on corporate sustainability.

The precast industry is characteristic of the construction industry in that it is dominated by a small number of MNCs, but the majority of companies in the industry are in fact SMEs, many of which are unaware of, or do not want to respond to, the sustainability agenda. Real progress towards a more sustainable precast industry and towards more sustainable construction will only be achieved if these SME companies can be persuaded to act. The barriers to engaging with and achieving progress amongst SMEs in the precast and wider construction industry therefore require further investigation.

This study has investigated ways of achieving progress towards sustainability within a single UK based manufacturing industry. The IMD investigated the business case for corporate sustainability in the automotive, aviation, chemical, electric utilities, financial services, food and beverage, pharmaceutical, oil and gas, and technology industries of 16

countries in Europe, North America and the Far East (Steger, 2006). Some useful comparisons were made with the results of the IMD study in the course of this work; this suggests that there would be benefits in conducting comparative studies amongst other UK based manufacturing industries, and amongst the precast industries in other countries around the world.

A key element in the precast sector sustainability strategy is the development of a certified Responsibly Sourced Materials scheme for precast products and producers. It was noted earlier that there is considerable interest in the construction industry at present in demonstrating corporate sustainability through sustainable procurement initiatives and certification schemes such as this. Research is needed to support the development of these schemes, assess their benefits and provide a means of comparing different schemes.

There is an increasing need for companies and sectors to engage with and report their performance on sustainability to a broad range of stakeholders. Guidance on undertaking these activities in an efficient, effective and consistent manner would greatly assist the precast, construction and other industries.

4.7 SUMMARY

Based on action research methodology, a series of inter-related research cycles were undertaken, in which the findings from each cycle were used to develop objectives for subsequent cycles, and achieve the overall aim of developing a sector sustainability strategy for the UK precast concrete industry. Table 4.2 summarises the objectives and how they were met. The strategy itself was produced in the form of a long-term action plan that will enable British Precast to engage with the industry and facilitate progress towards a more sustainable precast industry.

In the course of the research: the range of stakeholder needs and interests covered by the strategy has been considered; an analysis of the industry's current position on sustainability has been undertaken; the opportunities and threats sustainability presents to companies in the industry have been identified and a plan for encouraging the whole industry to act developed; and, activities have been undertaken to develop consensus with companies in the industry and other key stakeholders. In addition, the action plan that constitutes the strategy requires the establishment of key performance indicators, and objectives and targets for improving the long-term economic, environmental and social performance of the industry. These actions were identified as contributing to the development of a successful sector sustainability strategy.

However, the precast sector strategy differs from the sustainability strategies produced for other sectors of the construction products industry in that rather than promote action on specific sustainability objectives, the action plan that forms the strategy has been designed to embed an enduring approach to sustainability into the precast industry that has the potential to create lasting change. This innovative approach has combined best practice, current and emerging theory, original research, stakeholder engagement, and experience from other sectors and industries; and its success is evident in the support the strategy has received from the precast industry and its stakeholders, which has enabled British Precast to make good progress in implementing its initial phases.

Table 4.2: How the research aim and objectives were met

Research aim: to develop a sector sustainability strategy for the UK precast concrete industry	
Research objective	Met by:
1. Understand the precast industry and the processes involved in precast concrete production	Undertaking archival analysis in the form of a critical literature review
2. Understand the need for a more sustainable precast industry	
3. Assess the sector sustainability strategies produced for other construction products	Investigating the context, purpose, process and content of the strategies published by the brick, forest industries and steel construction sectors through critical review and content analysis of the strategy documents
4. Develop consensus with industry stakeholders	Producing conference papers, giving seminar and conference presentations, and publishing dedicated progress reports
5. Identify and prioritise the key sustainability issues facing companies in the precast industry	Running a facilitated workshop (focus group) with industry practitioners from member companies of British Precast, and undertaking a postal questionnaire survey of member and non-member companies of British Precast
6. Identify the sustainability issues of importance to the industry's primary stakeholders	Running a stakeholder analysis workshop (focus group) with industry practitioners from member companies of British Precast
7. Identify and disseminate best practice on sustainability in the precast industry	Producing a series of best practice case studies in the form of histories about contemporary events from entries to the annual British Precast Best Practice Awards
8. Develop a method or methods for facilitating progress towards a more sustainable precast industry	Studying schemes designed to improve the precast industry's performance on health and safety, and combining the findings with best practice guidance
9. Investigate the process of change for corporate sustainability in the precast industry	Undertaking four company case studies to investigate how leaders in corporate sustainability in the precast industry had developed the capabilities necessary to manage for sustainability
10. Produce a structured action plan for British Precast	Establishing from the research the requirements that needed to be met, then formulating an action plan that would allow British Precast to meet all of these requirements

The research supporting the strategy has added to current knowledge and guidance on the development of sector sustainability strategies, encouraging change within industry sectors, and how companies can improve their position on corporate sustainability.

The strategy development process has enabled British Precast to better understand and represent the interests of its members on sustainability issues, whilst the strategy itself has enabled British Precast to provide valuable support and added value to its members.

There is clear evidence that the strategy is helping to guide the business decisions of companies in the precast industry, and that progress towards a more sustainable precast industry is being achieved.

Despite different and sometimes conflicting industrial and academic requirements having to be balanced in the course of the research, the research methodology was considered to be appropriate, both in the flexibility it allowed, and the breadth and depth of information it produced.

Recommendations for industry and further research have been made which if implemented, will allow British Precast to continue to support the development of a more sustainable precast industry, will contribute to the achievement of more sustainable construction, the development of more sustainable companies, and provide the knowledge and guidance needed to underpin these activities.

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APPENDIX A Paper 1

Holton, I., Glass, J. and Price, A. (2008). *Developing a successful Sector Sustainability Strategy: Six lessons from the UK Construction Products Industry*. Corporate Social Responsibility and Environmental Management, Vol. 15, No. 1, pp 29-42.

DEVELOPING A SUCCESSFUL SECTOR SUSTAINABILITY STRATEGY: SIX LESSONS FROM THE UK CONSTRUCTION PRODUCTS INDUSTRY

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Abstract

Sector sustainability strategies can provide frameworks to help business sectors identify and manage economic, environmental and social risks in an integrated way, and unlock opportunities to improve competitiveness and enhance reputation. They can also help trade associations to become more effective champions for their members; however, little research has been undertaken on their development. Current best practice guidance simply provides frameworks for managing the strategy development process. To add to this guidance, the context, purpose, process and content of three strategies from the UK construction products industry have been investigated. Strategy context and content were found to be unique; it is therefore not considered feasible to develop a generic sector sustainability strategy. However, six lessons have been identified with respect to strategy purpose and process which may improve the chances of success of a sector sustainability strategy.

Keywords: sustainable development; sustainability; sustainable construction; strategy; lessons; construction products

1 INTRODUCTION

A search of the World Wide Web will show that sustainability strategies have been developed by local, regional and national governments around the world, major corporations, and even for major sporting events such as the Olympic Games, but the development of sector sustainability strategies appears to have been limited to the UK.* This is a missed opportunity. Such strategies can provide frameworks to help business sectors identify and manage economic, environmental and social risks in an integrated way, and unlock opportunities to improve competitiveness and enhance reputation (DETR, 2000). They can also help trade associations become more effective champions for their members and their sectors (SDC, 2002a), and are independent of company size, enabling small-to-medium enterprises to contribute to the sustainability agenda, which is an issue of increasing importance, particularly amongst government bodies (Castka *et al.*, 2004).

A sector sustainability strategy is currently being developed for the UK precast concrete industry (Holton *et al.*, 2005), an industry of significance within the concept of sustainable construction. Current best practice guidance on the development of sector sustainability strategies simply provides frameworks for managing the strategy development process (e.g. Optimat, 2002). Guidance on other types of sustainability strategy has been produced from analyses of such strategies. Similar research on sector sustainability strategies does not appear to have been undertaken or reported, but would complement the current guidance.

Three other sectors of the UK construction products industry have already published strategy documents; brick (BDA, 2002), forest industries (FIDC, 2004) and steel construction (SCI, 2002). These documents have been examined in relation to strategy context, purpose, process and content. Strategy context and content were found to be unique; it is therefore not considered feasible to develop a generic sector sustainability strategy. However, six lessons have been identified with respect to strategy purpose and process, which may improve the chances of success of a sector sustainability strategy and will be used to support the development of a strategy for the UK precast industry. Although the research has been restricted to the construction products industry, these lessons complement current best practice guidance and will therefore be relevant to other industry sectors involved in the development of sector sustainability strategies.

2 RESEARCH CONTEXT

2.1 Sustainable development in the UK

Parkin *et al.* (2003) identified the five key contexts and drivers for sustainable development in the UK to be: evidence-based policy; ethics and values; the UK policy framework; risk assessment, innovation and technology; and corporate responsibility and reporting. Woodall *et al.* (2004), reporting research conducted amongst 145 managing directors, showed that 'legislation' in the form of government policy was considered to be the primary driver towards the adoption of more sustainable business practices in their organisations. Bennett and Crudginton (2003) gave due recognition to government policy

* A sector can be defined as a part or branch of a particular area of activity, especially of a country's economy (Hornby, 1995), and can include everything from small groups of large multi-national corporations to large groups of small and medium sized enterprises and even collections of individual professionals (SDC, 2002b).

as a driver, but also noted a growing consensus in the UK as to the competitive advantages that can be conferred by businesses taking a sustainable approach. The primary drivers to sustainable development in the UK, therefore, appear to be government policy (top down) and business pressure (bottom up).

2.2 Sustainable construction

The construction industry creates and maintains the built environment. In the UK, it provides employment for approximately 1.5 million people and accounts for approximately 8% of Gross Domestic Product (DTI, 2004). It also makes an environmental impact, since it (Parkin *et al.*, 2003):

- consumes 6 tonnes of material per person per annum;
- obtains less than 20% of the 240 million tonnes of aggregates used per annum from secondary sources;
- generates 70 million tonnes of waste per annum;
- throws away unused 13 million tonnes of material delivered to sites per annum; and
- is the most frequent industrial polluter, with increasing incidents against a falling overall trend.

The UK Government has acknowledged the significance of the construction industry within the overall concept of sustainable development in the UK, recognised the benefits which could flow from a more efficient and sustainable construction industry (DETR, 1998a), and has been making progress towards more sustainable construction through its policies, legislations and programmes (DTI, 2003, 2004), including publishing a sustainability strategy specifically for the construction industry (DETR, 2000). This strategy encompasses many of the concepts from *Rethinking Construction*, commonly referred to as the Egan Report (DETR, 1998b). Indeed, it has been suggested that adopting a sustainable approach would address the failings of the construction industry identified in this report and lead to significant business benefits, including: better understanding of client needs; identification of opportunities for innovation; increased shareholder value; reduced costs; reduced risk; enhanced public relations and community liaison; and increased employee motivation (CIRIA, 2001).

The Sustainable Construction Task Group, in its *Reputation, Risk and Reward* report (SCTG, 2002), lists some of the many strategic benefits that good management of sustainability would offer to companies in the construction industry, together with specific operational benefits available to companies that manage sustainability issues effectively. This shows that sustainability is as much about efficient, profit-orientated practice and achieving value for money, as it is about helping the environment. However, the report concluded that there would be a number of strategic management challenges to be faced in the move towards greater levels of sustainability and business strategies would need to be reassessed.

Progress towards more sustainable construction thus requires both government and individual businesses to take action. However, the Government's strategy for more sustainable construction (DETR, 2000) recognised that action would also be required by the construction industry. Sector representative bodies and construction trade associations were therefore encouraged to develop sector sustainability strategies; the reasoning behind this was that "*These will provide a framework for sectors to assess their economic, environmental and social performance; identify areas for improvement in the light of*

future opportunities and threats; set targets and implement action plans to bring about those improvements; and then to report progress to stakeholders” (DETR, 2000). It was also considered that trade associations which ignored sustainability issues, or tried to fend them off instead of turning them into competitive advantage, were likely to become less effective champions for their members and their sectors (SDC, 2002a).

3 DEVELOPING A SECTOR SUSTAINABILITY STRATEGY FOR THE UK PRECAST CONCRETE INDUSTRY

The UK construction industry is generally recognised as comprising four principal activities: building, civil engineering, materials and products, and associated professional services (DETR, 2000). Construction materials and products is the largest of these four activity groups with an annual turnover in excess of £40 billion, which accounts for approximately 40% of total construction output and 20% of the UK’s manufacturing output (CPA, 2005). This in turn is divided into four main areas, raw materials, fabricated components, fixtures and fittings, and cladding and insulation, which provide employment for over 650,000 people in almost 30,000 companies. Over 40 trade associations exist to serve different interests within the construction products industry (CPA, 2005), suggesting a complex and wide ranging set of concerns and interests.

Precast concrete is an important sector of the UK construction products industry, providing direct employment for 22,000 people (Clarke, 2003). In 2003, it had a turnover of £2 billion from 35 million tonnes of product sales (Clarke, 2003) and sales are predicted to increase by 9% in real terms between 2004 and 2009 (Quality Concrete, 2006). The sector is also of significance in achieving progress towards sustainability because it is a major user of cement and virgin aggregates, consumes energy and water in its production processes, transports its products nationally, has many factories in urban areas and because its products are widely used in creating and maintaining the built environment. The British Precast Concrete Federation (British Precast) is the trade federation for the precast sector in the UK. Following consultation with its members, British Precast identified the need to develop a sector sustainability strategy for the precast concrete industry (Holton *et al.*, 2005). This strategy would bring members together large and small to drive the industry forward, raise its standards and improve its performance. A four-year research programme to develop the strategy commenced in October 2004, in collaboration with the Department of Civil and Building Engineering at Loughborough University.

To accelerate the development and implementation of sector sustainability strategies, a best practice forum, the Pioneers Group, was established by two Government departments (DTI and DEFRA) in 2001 (SDC, 2002a). Over 40 sectoral organisations covering a range of manufacturing and service industries participated in the Group between July 2001 and June 2003 (Hunter, 2003), and as a result of their activities a number of guidance documents are now available (e.g. Optimat, 2002). However, this guidance, in common with much of the guidance on managing sustainability (e.g. Henriques, 2001; BSI, 2006), simply provides a framework for managing the strategy development process. Guidance on other types of sustainability strategy, such as national sustainable development strategies (Dalal-Clayton and Bass, 2002), has been produced from analyses of such strategies. Similar research on sustainability strategies at a sector level does not appear to have been undertaken or reported.

In order to assist in the development of the precast sector strategy, research to characterise and analyse sustainability strategies published by other sectors of the construction products industry was proposed. This research would add to the available guidance by establishing the context and purpose of these strategies; it would also allow the strategy process to be analysed and provide a comparison of strategy content. Although the research would be restricted to the construction products industry, it was undertaken with the understanding that the results would also be relevant to others involved in the development of sector sustainability strategies.

4 RESEARCH METHODOLOGY

It is generally agreed that there is no single universally accepted definition of strategy and the topic of strategy cannot be explained as a set of straightforward definitions and rules to be memorised and applied (De Wit and Meyer, 2004). However, Price and Newson (2003), reporting an investigation into how the managerial function of long-term strategy development was being applied within the construction industry, established that the following definition proposed by Johnson and Scholes (2002) was the one most favoured by industry representatives, as it emphasized key terms that were considered important to construction organisations: *“the direction and scope of an organisation over the long-term: which achieves advantage for the organisation through its configuration of resources within a changing environment, to meet the needs of markets and to fulfil stakeholder expectations”*.

Despite the apparent lack of a clear definition, a fundamental distinction can be made between the process, content and context of a strategy, since these three interacting dimensions define the ‘how, who, when, what and where’ of strategy (De Wit and Meyer, 2004). Organisational purpose then completes the ‘why’ of strategy, since organisations exist to fulfil a purpose and strategies are employed to ensure that the organisational purpose is realised. These are shown in Figure 1. It is appropriate, therefore, to consider the development of sector sustainability strategies within this broad framework.

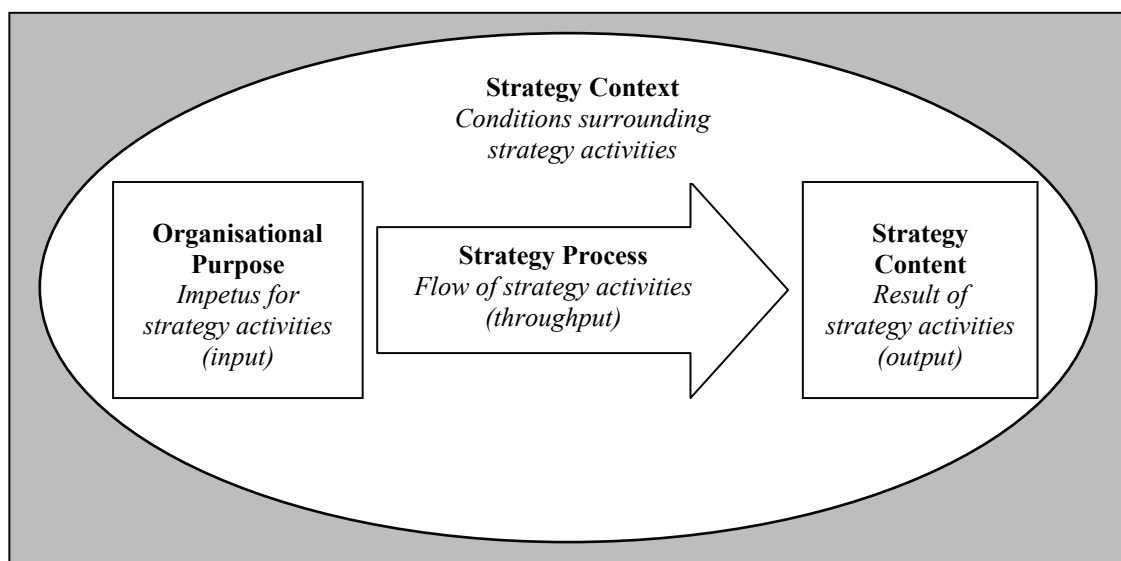


Figure 1: Dimensions of strategy (De Wit and Meyer, 2004)

In 2005, when the research was undertaken, published strategy documents were available from the brick (BDA, 2002), forest industries (FIDC, 2004) and steel construction (SCI, 2002) sectors. The logical starting point for the research was to investigate the context and purpose of these documents, since they define the conditions surrounding the strategy activities and provide the impetus for strategy activities. This was achieved through critical review of the strategy documents.

De Wit and Meyer (2004) suggest that whilst the content and context of any strategy will generally be unique, the strategy process can be defined and analysed based on three phases: analysis; formulation; and implementation. The Sustainable Development Commission (SDC, 2002b) suggests that these should be defined as follows for sector sustainability strategies.

- Analysis should contain an acceptance and understanding of the key principles of sustainable development, and an audit of the sector's current performance.
- Formulation, an appraisal of the opportunities and threats related to sustainable development, and the adoption of objectives, targets and indicators.
- Implementation, actions to achieve these targets and objectives, and accounting for action by reporting.

The way in which the three sectors had approached the strategy process was investigated through a content analysis of the strategy documents.* A coding schedule was developed from the Sustainable Development Commission's self-assessment guide for sector sustainable development strategies (SDC, 2002b). The principal disadvantage of content analysis, i.e. personal interpretation clouding or biasing coding and interpretation of the data (Creswell, 2003), was avoided by using closed questions and simple 'yes' or 'no' answers whenever possible. Using the Commission's guide also ensured that the three phases of strategy process described above were investigated fully.

Finally, two coding schedules were developed which enabled strategy content to be compared with the Government's objectives for sustainable development and sustainable construction. The first schedule used the 23 objectives for sector sustainable development strategies listed by the Sustainable Development Commission (SDC, 2002b), which are based primarily on the objectives from the Government's 1999 sustainable development strategy (DETR, 1999).† The second used the ten themes for action listed in the Government's strategy for more sustainable construction (DETR, 2000).

5 RESULTS AND ANALYSIS

Johnson and Scholes (2002) related the success or failure of strategies to three main criteria; suitability, acceptability and feasibility. Suitability is concerned with whether a strategy addresses the circumstances in which the organisation is operating. Acceptability relates to the expected return, the level of risk and the likely reaction from stakeholders. Feasibility is concerned with whether an organisation has the resources and competences to deliver the strategy. These criteria have been considered carefully in analysing the research results.

* The length of the documents varied between 5,000 words (brick) and 10,000 words (steel construction).

† A revised sustainable development strategy was published in 2005 (DEFRA, 2005).

5.1 Context

The descriptions of the three sectors given in their respective strategy documents show them to be unique as they differ in their value, size, activities and complexity.

- The brick sector has an annual production value of £550 million, making it the dominant force in the £670 million clay construction products market. The principal activity of the sector is brick production, through which it provides direct employment for around 6,000 people in 120 factories operated by 30 companies, although five companies account for 84% of UK production.
- The forest industries sector includes forest management, primary wood-processing industries producing sawn-wood, panel-board, pulp-and-paper and wood based energy, and pulp, wood and wood-based product importers. It provides employment for over 190,000 people and is worth over £6 billion per annum.
- The steel construction sector covers a wide range of products and activities from steel producers, steelwork contractors and component manufacturers; it has an annual value of £3.5 billion and employs some 42,000 people. The strategy applies not just to manufacturers and suppliers of constructional steelwork, but also considers the contribution that designers and specifiers can make to the sustainability of the sector.

Despite this uniqueness, all three strategies were produced in response to the Government's challenge to develop sector sustainability strategies (DETR, 2000) and were published by the organisation responsible for promotion and market development in each sector as summarised below.

- The Brick Development Association (BDA) promotes the use of clay bricks and pavers in architectural, structural, landscape and craft applications.
- The Forest Industries Development Council (FIDC) is a developmental body incorporating businesses and organisations along the UK wood supply chain.
- The Steel Construction Institute (SCI) is an independent, technical, member-based organisation whose objective is to develop and promote the effective use of steel in construction.

Other stakeholders were involved to varying degrees in the strategy development process.

- The British Ceramic Confederation (BCC), a trade association for UK manufacturers of a range of ceramic products including bricks, collaborated in the development of the brick sector strategy. Industry stakeholders and other interested parties were not directly involved, but were invited to express their views on the content of the strategy and how they could work with the sector to help achieve its objectives.
- Nine other trade associations from the forest industries sector supported the development of the strategy and are committed to its implementation, whilst the strategy was produced by a task group of key stakeholders from the sector, in consultation with environmental and social stakeholders and government.
- The steel construction sector strategy was developed by a committee comprising representatives from Corus, SCI and the British Constructional Steelwork Association (BCSA). Corus Group, with an annual turnover of £9 billion, is the largest steel producer in Europe and the third largest in the world, whilst BCSA is the national organisation for the constructional steelwork industry. These organisations convened a team representing steelwork contractors, designers, steel

suppliers and information providers to prepare the strategy. A wider group representing users of steel in construction was also consulted.

However, the steel construction sector acknowledged the difficulty of presenting key messages to different target audiences in one document (SCI, 2002), and parts of the forest industries sector were reported to be developing their own sub-sector specific strategies (FIDC, 2004). Thus, whilst involving key sector organisations and wider stakeholder groups in the strategy development process may enhance the acceptability of a strategy amongst these groups; one strategy might not meet the needs of all groups within some sectors. This is supported by the Non-Ferrous Alliance, which is reported to have wanted to develop a common strategy for the whole non-ferrous industry, but to have found that the sustainability issues were different for each of its four sectors (Optimat, 2002). There is thus a need to carefully consider strategy context and in particular the needs and interests of all the organisations and stakeholder groups associated with a sector, in order to determine whether these can be encompassed in one strategy. Too wide a context may have an adverse affect on the acceptability of a strategy and reduce its effectiveness in achieving its purpose.

5.2 Purpose

The three strategy documents might be expected to share a common purpose as they were all produced in response to the Government's challenge to develop sector sustainability strategies (DETR, 2000). The challenge, and the definition of strategy favoured by the construction industry (Price and Newson, 2003), suggest that purpose was to set out a long-term plan for improved economic, environmental and social performance in each sector.

Indeed, the brick and forest industries sector documents show clear evidence that this was their primary purpose as illustrated below.

- The brick strategy document is described as setting the context for future work; it identifies the brick industry's contribution to the objectives of sustainable development and the ways in which it will build on its achievements. This includes the setting of specific objectives for improvement in the areas of social progress, environmental protection, resource use and economic growth.
- The objective of the forest industries strategy was stated to be "to enhance the contribution that the forest industries make to sustainable development in the UK" and the strategy document is described as a statement of commitment towards that objective. The environmental, economic and social aspects of sustainability for the sector are addressed in the document with a list of key topics for each, a review of progress to date, the identification of future aims and the actions required to meet them.

The steel construction strategy document was less clear in its purpose. Firstly, the document is described as reporting on a strategic review of how the sustainable development agenda is being addressed by the UK steel construction sector, rather than a sector sustainability strategy. Secondly, it does not set out specific objectives for improvement in a long-term plan. The sector and its importance to both the economy and the achievement of sustainable development objectives are described, progress achieved by the sector is documented and future priority actions together with relevant on-going initiatives are set down, but sector specific objectives are not included. Finally, it could be argued that the purpose of the document was promotion and market development, since it was produced by the organisation responsible for this function in the sector in conjunction

with the largest steel producer in Europe. Similar arguments about promotion and market development exist in respect to the underlying purpose of the brick and forest industries sector strategies, but at least this did not detract from their primary purpose.

The suitability of a strategy was defined earlier as depending on whether it addressed the circumstances in which an organisation was operating. For a sector sustainability strategy this can be interpreted to mean whether it meets the Government's challenge (DETR, 2000) and whether its purpose is to set out a long-term plan for improved economic, environmental and social performance in a sector. Thus, not clearly achieving this purpose will reduce the suitability of a sector strategy and its chances of success.

5.3 Process

The results from the content analyses are presented in Tables 1-3, and reviewed below with respect to the analysis, formulation and implementation phases of the strategy process.

Each sector began the analysis phase by demonstrating an understanding of the key principles of sustainable development and how they related to the sector, together with an appreciation of the business case for sustainable development. Detailed audits of current performance were then given, in which each sector recognised and/or defined its impacts on sustainable development and considered the ways in which it currently mitigates them. However, these were not well balanced with a noticeable concentration on health and safety, and environmental issues; impacts from the sourcing of raw materials and transport were also excluded by the steel construction sector. Dyllick and Hockerts (2002) indicate that businesses will focus on their negative environmental and social impacts, since these will lead to eco and socio-efficiency, and thereby increase economic sustainability. But underestimation or omission of impacts is likely to reduce the effectiveness of the resulting strategy; the Sustainable Development Commission (SDC, 2002b) states that a sector should take responsibility for all of its impacts.

In each case the formulation phase began with a detailed assessment of the opportunities and benefits arising from more sustainable ways of working. However, threats from unsustainable practices were not considered by the steel construction sector and were given less emphasis by the other sectors compared to opportunities. Accentuating the positive in this way may increase the acceptability of a strategy to stakeholders, but threats can pose a greater risk to the success of a strategy and therefore should not be ignored.

The Sustainable Development Commission emphasizes that it should be made clear what the strategy as a whole intends to achieve, and as in any business proposition, needs to progress from its baseline position by setting objectives, targets and indicators for future improvement (SDC, 2002b). The three sectors identified clearly what their strategies would achieve as a whole, but were less clear on some of the subsequent steps and appeared not to consider others. If a clear long-term plan for improved economic, environmental and social performance is not established in the formulation phase, a strategy is not going to achieve its intended purpose. Objectives that were set were considered to be low risk, either building on current initiatives or introducing new ones that would contribute to meeting the Government's sustainability objectives (DETR, 1999 and 2000). Low risk may increase acceptability to businesses and stakeholders, but may also limit potential benefits.

Smallbone (2004) reported that market transformation, achieved through changing consumer buying behaviour, had become a core area of the Government's strategy for sustainable development, so businesses will not only have to address their own performance on sustainability, but also the contribution their products make to sustainable development. Accordingly the range of actions proposed in the implementation phase of each strategy involved technical, physical and behavioural changes to products, processes, businesses and business practices. A high level of commitment to implementation was demonstrated by each sector, but little detail was given on how changes would be achieved, which stakeholders would be involved, or what the costs and benefits would be. It is difficult to see how businesses and stakeholders would commit to support a strategy, without knowing in detail what actions are required of them and what the costs and benefits would be. Without the support of businesses and stakeholders a sector strategy will become unfeasible and will not succeed. Sector level actions appeared to be limited to the dissemination of information, promotion of best practice and introduction of accreditation or certification schemes, although the steel construction sector included a commitment to assist clients and designers to develop design solutions that address sustainable development issues. This suggests that sector organisations are limited in the actions they are both empowered to undertake and can implement in practice.

Finally, all sectors made a commitment to measure and report on progress, but only the brick sector specified indicators for this purpose and these did not cover all of their stated objectives. It is now widely recognised that targets and indicators need to be specified in order to measure improvement and demonstrate progress to stakeholders. If quantifiable progress is not demonstrated, stakeholders will consider that strategy ineffective and it will lose their support.

Table 1: Results from content analysis of the strategy process: analysis phase

	Sector strategy		
	Brick	Forest Industries	Steel Construction
<i>Acceptance and understanding of the key principles of sustainable development</i>			
Is an understanding of these principles and how they relate to the sector shown?	Yes	Yes	Yes
Is an appreciation of the business case for sustainable development shown?	Possibly	Yes	Yes
Are stakeholders involved, including supply chain partners, customers and disposers?	No, but will be in the future	Yes	Yes
<i>Audit of current performance</i>			
Are the economic, social and environmental impacts of the sector identified?	Yes	Yes	Yes
Does this include both good and bad?	Yes	Yes	Yes
Does this include impacts from sourcing of raw materials and energy, manufacturing and processing, transport, use of products and disposal?	Yes	Yes	Raw materials and transport excluded
Does this include impacts on employees and community?	Yes	Yes	Yes
Is consideration of the supply chain made?	Possibly	Yes	Yes
Are overseas impacts considered?	No	Yes	No

Table 2: Results from content analysis of the strategy process: formulation phase

	Sector strategy		
	Brick	Forest Industries	Steel Construction
<i>Appraisal of opportunities and threats related to sustainable development</i>			
Are threats to the sector from unsustainable practices identified?	Yes	Yes	No
Are opportunities for the sector to benefit from more sustainable ways of working identified?	Yes	Yes	Yes
Have opportunities for working with other sectors or with sectors from other countries been assessed?	No	Yes	Possibly
<i>Adoption of objectives, targets and indicators</i>			
Is it clear what the strategy as a whole will achieve?	Yes	Yes	Yes
Is an assessment of the sector's baseline position made?	In some areas	No	No
Have objectives been set for future improvement?	Yes	Yes	Not clear
Do these include both short and long-term views?	Not clear	Yes	Not clear
Are costs and benefits identified?	No	No	No
Have targets been set for future improvement, and if so are timescales included?	No	No	No
Is it clear how targets will be achieved and where responsibility for this lies?	No	No	No
Have indicators been specified to measure improvement?	Yes	No	No
Do these indicators suit the sector and reflect the relative importance of different factors?	Yes	N/A	N/A

Table 3: Results from content analysis of the strategy process: implementation phase

	Sector strategy		
	Brick	Forest Industries	Steel Construction
<i>Action to achieve targets and objectives</i>			
Is a clear vision of what needs to be done, by whom and by what means included?	Yes	Yes	Yes
Is a high level of commitment to the implementation of the strategy among participants demonstrated?	Yes	Yes	Yes
Are practical examples of action included?	Yes	Not clear	Yes
Is a process for industry-wide benchmarking included?	No	No	No
Is a process for spreading best practice included?	No	No	No
Are information, advice and guidance provided on how sector members should apply and achieve targets within their own organisations?	Yes	No	No
<i>Accounting for action by reporting</i>			
Is a commitment made to regularly report progress?	Yes, annually	Yes, 5 years	Yes, annually
Is a commitment made to review the strategy?	Yes, annually	Yes, 5 years	Yes, annually

5.4 Content

The results from the comparisons of strategy content with the Government's objectives for sustainable development and sustainable construction are presented in Tables 4 and 5, and reviewed below.

The 23 objectives for sector sustainable development strategies listed by the Sustainable Development Commission (SDC, 2002b) are divided into six themes, as shown in Table 4. Each sector was found to have included actions under all of the themes, but not all of the objectives. 19 objectives were met in total, but only 9 were common to all three sectors and the number of objectives addressed by each sector varied from 12 (forest industries) to 15 (brick). Strategy content is dependent on strategy context, as shown in Figure 1. Some of the objectives could possibly be considered to be outside the context of each strategy. For example, none of the sectors included actions to tackle poverty and social exclusion, or to raise the quality of life for workers in global supply chains. However, the reason or reasons for precluding actions to meet other objectives that were clearly in context, such as achieving fairness at work and reducing noise, are less clear.

By developing a sustainability strategy specifically for the construction industry (DETR, 2000), the Government acknowledged that its sustainable development objectives were broad and might not be applicable to all industries. Each sector included actions under eight of the ten themes for action listed in the strategy for more sustainable construction (DETR, 2000), although not the same eight themes. Again, some omissions could have been justified as being outside a strategy's context (such as the brick and forest industries sectors not including actions to promote the re-use of existing built assets), whereas others (such as the forest industries and steel construction sectors not including actions to conserve water resources) could not, although it is possible that some objectives would be met indirectly through other actions. This area therefore warrants further critical investigation. It also needs to be established whether benefits can be gained from aligning strategy objectives with other stakeholders' objectives, such as those from the Government.

Table 4: Comparison of strategy content with the Sustainable Development Commission's 23 objectives for sector sustainable development strategies (SDC, 2002)

Objectives for sector sustainability strategies	Sector strategy		
	Brick	Forest Industries	Steel Construction
<i>Maintain high and stable levels of economic growth and employment</i>			
1) Produce economic growth	✓	✓	✓
2) Invest in modern plant and machinery as well as research and development to achieve prosperity	✓	✓	✓
3) Maintain high and stable levels of employment	✓	-	-
<i>Social progress which recognises the needs of everyone</i>			
4) Tackle poverty and social exclusion	-	-	-
5) Equip people with the skills to fulfil their potential	✓	✓	✓
6) Achieve fairness at work	-	-	-
7) Maintain safe and healthy environment at work	✓	✓	✓
8) Build sustainable communities	✓	✓	✓
9) Raise quality of life of workers in global supply chains	-	-	-
<i>Effective protection of the environment</i>			
10) Continue to reduce emissions of greenhouse gases now and plan for further reductions in future	✓	✓	✓
11) Reduce air pollution and ensure air quality continues to improve	✓	-	✓
12) Improve water quality in rivers, estuaries and the sea	✓	-	-
13) Reverse the long-term decline in populations of farmland and woodland birds	-	✓	-
14) Reduce noise	-	-	-
<i>Improved distributional impacts</i>			
15) Improve choices in transport, reduce need for travel	✓	✓	-
16) Develop distribution systems which support economic growth, protect the environment and benefit society	-	✓	-
17) Re-using previously developed land, in order to protect the countryside and encourage urban regeneration	-	-	✓
<i>Prudent use of natural resources</i>			
18) Move away from disposal of waste towards waste reduction, recycling and recovery	✓	✓	✓
19) Must not store up pollutant problems for the future	-	-	✓
20) Greater resource efficiency	✓	-	✓
21) Energy efficiency	✓	-	✓
<i>Effective assessment and provision of information</i>			
22) Consumer information and encouraging movement in the market	✓	✓	✓
23) Assess environmental impacts, set targets and produce reports	✓	✓	✓

Table 5: Comparison of strategy content with the ten themes for action in the Government’s strategy for more sustainable construction (DETR, 2000)

Themes for action	Sector strategy		
	Brick	Forest Industries	Steel Construction
1) Re-use existing built assets	-	-	✓
2) Design for minimum waste	✓	✓	✓
3) Aim for lean construction	✓	✓	✓
4) Minimise energy in construction	✓	✓	✓
5) Minimise energy in use	-	✓	✓
6) Do not pollute	✓	✓	✓
7) Preserve and enhance biodiversity	✓	✓	-
8) Conserve water resources	✓	-	-
9) Respect people and their local environment	✓	✓	✓
10) Set targets	✓	✓	✓

6 CONCLUSIONS

Sector sustainability strategies can provide frameworks to help business sectors identify and manage economic, environmental and social risks in an integrated way, and unlock opportunities to improve competitiveness and enhance reputation (DETR, 2000). They can also help trade associations to become more effective champions for their members and their sectors (SDC, 2002a). However, little research on their development has been undertaken or reported. Current best practice guidance (e.g. Optimat, 2002) simply provides frameworks for managing the strategy development process. To add to this guidance, research has been undertaken to characterise and analyse three sector strategies from the UK construction products industry; brick, forest industries and steel.

The research examined strategy context, purpose, process and content. Although the three sectors studied were all from the same industry, the context of each strategy was found to be unique. The contents were also found to be unique and demonstrated a clear dependency on strategy context when compared with the Government’s objectives for sustainable development and sustainable construction. It is therefore not considered feasible to develop a generic sector sustainability strategy. However, six lessons have been identified with respect to strategy purpose and process that will assist in the development of a successful sector sustainability strategy.

Lesson 1: Who is the strategy for?

The context of a sector strategy should be carefully considered, particularly the needs and interests of all the organisations and stakeholder groups associated with a sector, in order to determine whether these can be encompassed in one strategy. Involving wider stakeholder groups may increase the acceptability of a strategy, but too wide a context may reduce the likelihood of it achieving its intended purpose.

Lesson 2: What is the purpose of the strategy?

A strategy should suit its intended purpose. For a sector sustainability strategy developed in response to the Government's challenge (DETR, 2000), that purpose is to set out a long-term plan for improved economic, environmental and social performance in a sector. Not clearly achieving this purpose will reduce the suitability of a sector strategy and its chances of success.

Lesson 3: Have all impacts been considered?

The analysis phase of a strategy should include a detailed audit of current performance; the Sustainable Development Commission states that a sector should take responsibility for all of its impacts on sustainable development (SDC, 2002b). Underestimation or omission of impacts during the analysis phase is likely to reduce the effectiveness of a strategy.

Lesson 4: Has the strategy been formulated to meet its purpose?

If a sector sustainability strategy is to achieve its intended purpose, a clear long-term plan for improved economic, environmental and social performance must be established in the formulation phase. This plan should take advantage of opportunities arising from more sustainable ways of working, but should also mitigate threats from unsustainable practices.

Lesson 5: How will the strategy be implemented?

The support of businesses and stakeholders is critical to the successful implementation of the technical, physical and behavioural changes to products, processes, businesses and business practices a sector sustainability strategy may propose. In order to gain that support, it is necessary to clearly specify how these changes will be achieved, which stakeholders would be involved, and what the costs and benefits will be.

Lesson 6: How will progress be measured and reported?

Targets and indicators need to be specified in order to measure improvement and demonstrate progress to stakeholders. If quantifiable progress is not demonstrated, stakeholders will consider that strategy ineffective and it will lose their support.

These lessons will be used in the development of a sustainability strategy for the UK precast concrete sector. Although they are based on results from the UK construction products industry, the lessons complement current best practice guidance and will therefore be relevant to other industry sectors involved in the development of sector sustainability strategies.

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APPENDIX B Paper 2

Holton, I., Glass, J., Price, A., Clarke, M., Bell, S. and Watkins, M. (2006). *Identification and prioritisation of sustainability issues for the UK precast concrete industry*. Corporate Responsibility Research Conference 2006, Dublin, September 2006.

IDENTIFICATION AND PRIORITISATION OF SUSTAINABILITY ISSUES FOR THE UK PRECAST CONCRETE INDUSTRY

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Abstract

As part of its strategy for more sustainable construction, the UK Government has been encouraging sector representative bodies and trade associations to develop sector sustainability strategies. A four-year research programme aimed at developing such a strategy for the precast concrete industry was therefore established by the British Precast Concrete Federation in 2004, in collaboration with the Department of Civil and Building Engineering at Loughborough University.

In accordance with best practice, the research began with the identification and prioritisation of sustainability issues for the precast industry. A facilitated workshop with key practitioners from the industry identified a series of key business issues for the industry and demonstrated that sustainability was intrinsically linked to the profitability and competitiveness of the industry. A questionnaire survey was then conducted to verify and prioritise these issues across the wider industry. Whilst the survey verified the issues, priorities were found to vary between groups of companies as a result of them being in different phases of a corporate sustainability model.

The research has enabled priorities for the precast sector sustainability strategy to be identified which will facilitate progress towards a more sustainable precast concrete industry in the UK.

Keywords: sustainability; sustainable construction; sustainability strategy

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1 INTRODUCTION

A sector can be defined as a part or branch of a particular area of activity, especially of a country's economy (Hornby, 1995). Sectors can include everything from small groups of large multinational corporations to large groups of small and medium sized enterprises and even collections of individual professionals (SDC, 2002a).

Sector sustainability strategies are an integral part of the UK Government's strategy for more sustainable construction. They encourage industries and businesses to address the sustainability agenda by providing a framework to help business sectors identify and manage economic, environmental and social risks in an integrated way, and unlock opportunities to improve competitiveness and enhance reputation (DETR, 2000). A sector strategy is currently being developed for the precast concrete industry in the UK (Holton *et al.*, 2005).

Best practice guidance based on the cumulative experience of 20 sectoral organisations (Optimat, 2002) indicates that the strategy development process should include identification and prioritisation of sustainability issues for the sector. Research undertaken to identify and prioritise the sustainability issues for the precast concrete industry is described.

The research indicates a link between the profitability and competitiveness of the industry and its sustainability, and that companies in the industry are in different phases of the corporate sustainability model described by Dunphy *et al.* (2003). This has enabled priorities for the sector sustainability strategy to be identified and a sustainable precast industry to be defined.

2 RESEARCH CONTEXT

2.1 Sustainable construction

The construction industry creates and maintains the built environment. Its impact on society is therefore critical since the built environment provides the context for most human activities and has a huge impact on our quality of life. The construction industry also provides employment for approximately 1.5 million people in the UK and accounts for approximately 8% of Gross Domestic Product * (DTI, 2004). Sustainable construction is therefore of significance within the overall concept of sustainable development in the UK. The UK Government has acknowledged this and has also recognised the benefits which could flow from a more efficient and sustainable construction industry (DETR, 1998a).

The UK Government has been making progress towards sustainable construction through its policies, legislations and programmes (DTI, 2003 and 2004), including publishing a sustainability strategy specifically for the construction industry (DETR, 2000). This strategy was intended to make the construction industry:

- more profitable and competitive;
- deliver buildings and structures that provide greater satisfaction, well-being and value to customers and users;

* The UK's GDP is in the region of £1,000 billion (ONS, 2004).

- respect and treat its stakeholders more fairly;
- enhance and better protect the natural environment; and
- minimise its impact on the consumption of energy (especially carbon-based energy) and natural resources.

This encompasses many of the concepts from *Rethinking Construction*, commonly referred to as the Egan Report (DETR, 1998b). Indeed, it has been suggested that adopting a sustainable approach would address the failings of the construction industry as identified in the Egan Report (DETR, 1998b) and lead to significant business benefits, including: better understanding of client needs; identification of opportunities for innovation; increased shareholder value; reduced costs; reduced risk; enhanced public relations and community liaison; and increased employee motivation (CIRIA, 2001).

2.2 Sector sustainability strategies

The Sustainable Construction Task Group, in its *Reputation, Risk and Reward* report (SCTG, 2002), noted that pressures on businesses to respond to the sustainability agenda were increasing from the environmental, social, governmental and investment sectors. The report goes on to list some of the many strategic benefits that good management of sustainability would offer to companies in the property and construction sectors, together with specific operational benefits available to companies that manage sustainability issues effectively. This shows that sustainability is as much about efficient, profit-orientated practice and achieving value for money, as it is about helping the environment. However, the SCTG concluded that there would be a number of strategic management challenges to be faced in the move towards greater levels of sustainability and business strategies would need to be reassessed.

Progress towards more sustainable construction thus requires both government and individual businesses to take actions. However, the government's strategy for more sustainable construction (DETR, 2000) recognised that action would also be required by the construction industry. Sector representative bodies and construction trade associations were therefore encouraged to develop sector sustainability strategies. The reasoning behind this was that "*These will provide a framework for sectors to assess their economic, environmental and social performance; identify areas for improvement in the light of future opportunities and threats; set targets and implement action plans to bring about those improvements; and then to report progress to stakeholders*" (DETR, 2000). It was also considered that trade associations which ignored sustainability issues, or tried to fend them off instead of turning them into competitive advantage, were likely to become less effective champions for their members and their sectors (SDC, 2002b).

2.3 The construction products industry

The UK construction industry is generally recognised as comprising four principal activities; building, civil engineering, materials and products, and associated professional services (DETR, 2000). Construction materials and products is the largest of these four activity groups with an annual turnover in excess of £40 billion, which accounts for approximately 40% of total construction output, 20% of the UK's manufacturing output and 4% of GDP (CPA, 2005). This in turn is divided into four main areas, raw materials, fabricated components, fixtures and fittings, and cladding and insulation, which provide employment for over 650,000 people in almost 30,000 companies. Over 40 trade

associations exist to serve different interests within the construction products industry (CPA, 2005), suggesting a complex and wide ranging set of concerns and interests.

2.4 The precast concrete sector

Precast concrete is an important sub-group of the UK construction products industry; it sells 35 million tonnes of products each year, generating an annual turnover of around £2 billion, and providing direct employment for 22,000 people (Clarke, 2003). Although often considered part of the cement and concrete sector, the precast concrete industry is so large and diverse it can be considered as a sector in its own right.

The diversity of the precast sector is evident in the range of products it produces, the manufacturing processes it uses, and the size and structure of the companies within it. Precast products are made to consistently high quality standards using a combination of skilled labour and automated processes. Mass produced products range from small hydraulically pressed items such as concrete bricks, paving and roof tiles, to larger extruded or wet-cast items such as pipes, piles and floor beams. Bespoke items include large wet-cast products such as cladding panels and structural units designed and manufactured to specific architectural and engineering requirements. There are over 500 precast companies in the UK operating approximately 800 factories; these range from small independently owned single factory operations employing less than 10 people, to divisions of multi-national companies with 10 or more factories and over 1,000 staff.

3 DEVELOPING A SUSTAINABILITY STRATEGY FOR THE PRECAST CONCRETE SECTOR

To accelerate the development and implementation of sector sustainability strategies, a best practice forum, the Pioneers Group, was established by two government departments (DTI and DEFRA) in 2001 (SDC, 2002b). Over 40 sectoral organisations covering a range of manufacturing and service industries participated in the Group between July 2001 and June 2003 (Hunter, 2003). Basic mentoring was provided to those organisations starting to develop sustainability strategies, and more advanced mentoring to those involved in implementing strategies and monitoring and reporting their progress.

As a result of the Group's activities a number of documents are now available that can assist in the strategy development process, including a best practice toolkit (Optimat, 2002). This suggests what information a strategy document should contain and provides an outline process for collecting this information, as shown in Figure 1.

One of the fundamental steps to starting the sector strategy development process is to recognise that 'Sustainable Development' is a strategic business issue (Optimat, 2002). Environmental and social issues are having an increasing impact on business performance, and effective management of these issues, alongside traditional economic and financial issues, can help minimise risks and unlock new opportunities and business benefits.

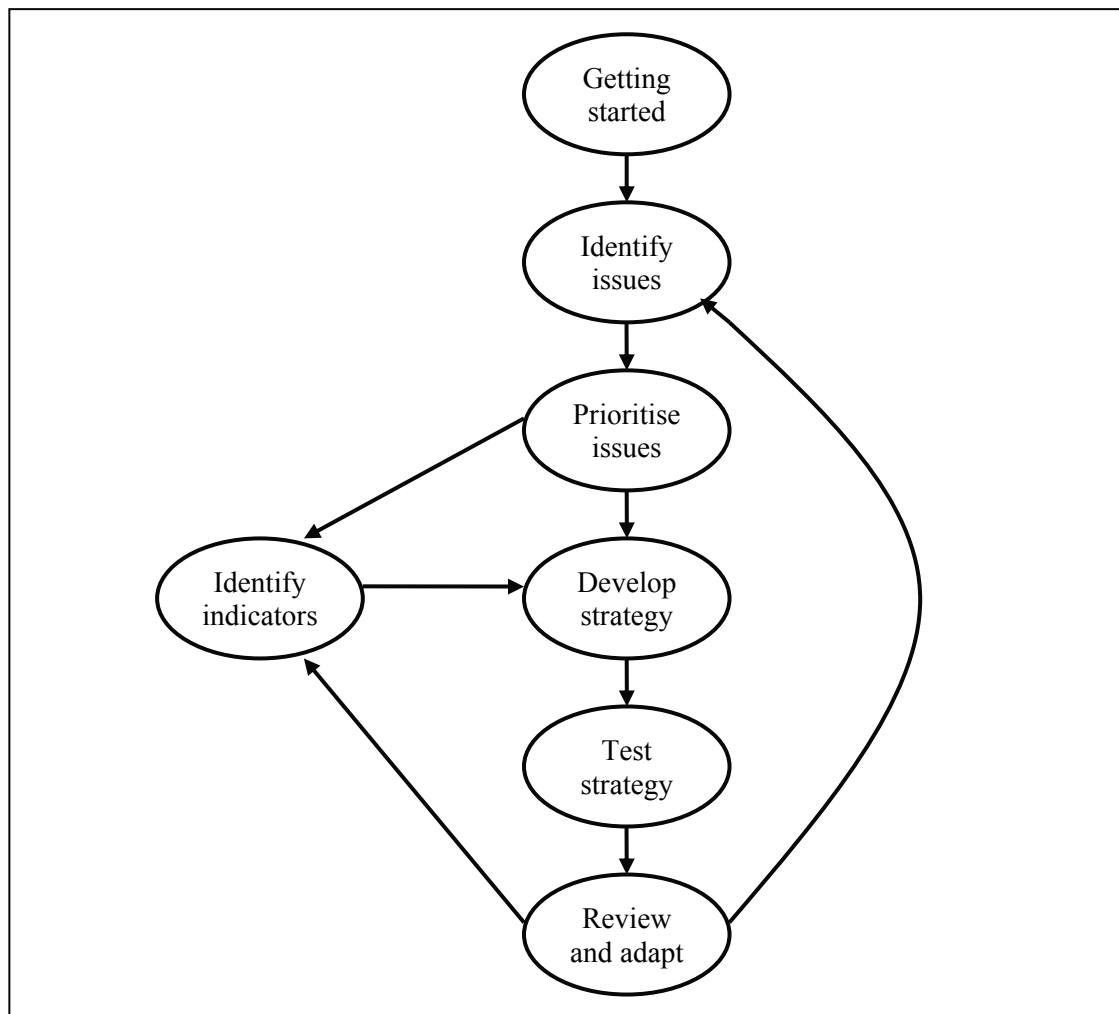


Figure 1: Sector sustainability strategy development procedure (Optimat, 2002)

The British Precast Concrete Federation (British Precast) is the trade federation for the precast sector in the UK. Following consultation with its members, British Precast identified the need to develop a sustainability strategy for the precast concrete sector in order to support the competitiveness of the sector and ensure its long-term future (Holton *et al.*, 2005).

Amongst the other best practice lessons identified from the Pioneers Group's activities, was the need to assign dedicated resources, adopt a project management approach and treat strategy development as a logical research and development process (Optimat, 2002). British Precast therefore began a four-year research programme to develop their sector strategy in October 2004, in collaboration with the Department of Civil and Building Engineering at Loughborough University (Holton *et al.*, 2005).

The first stage in the research programme was to identify and prioritise the sustainability issues for the precast sector. The research method adopted for this purpose and the results obtained are described in the following sections.

4 RESEARCH METHODOLOGY

Research data was collected in a two-stage process comprising a facilitated half-day workshop with industry practitioners from British Precast's member companies and a postal questionnaire survey of member and non-member companies of British Precast.

Stage 1: Facilitated workshop

The purpose of the workshop was for participants to openly discuss the opportunities and benefits that sustainability can bring to both precast products and precast production, from which discussion a number of sustainability priorities for the industry could be identified. Fifteen technical and environmental professionals from the precast industry attended the workshop and it was facilitated by two members of the research team.

Three tasks were undertaken:

- 1) Divided into three groups, participants were asked to discuss and agree the top 10 business issues for the precast industry at the present time. Each group then presented their findings to the workshop and they were discussed together.
- 2) In the same groups, participants were asked to discuss and agree the actions to be taken against each of the top 10 issues identified in Task 1, including who should take each action. These were again presented to the workshop and discussed.
- 3) Participants were given a semi-structured form and, based on the day's discussions, asked to write their own definitions of 'what a sustainable precast concrete industry looks like'.

Stage 2: Questionnaire survey

The primary purpose of the questionnaire survey was to consult a wider section of the precast industry on the issues identified in the workshop in order to validate and prioritise those issues. The opportunity was also taken in the survey to collect data describing the size and nature of the precast industry, and to investigate aspects of its approach to sustainability.

Following the practices described by Bryman and Bell (2003) for designing self-completion questionnaires and asking questions, a 6-page questionnaire incorporating factual, belief and attitude questions was developed covering the following topics:

- Production
- Customers
- Important issues
- Policies and systems
- The future for precast
- Investment
- Sustainability

Simple closed factual questions were used to collect data on production, customers, policies and systems, and investments. Belief questions were used to assess the significance to companies of a range of business issues and prioritise actions the industry could take to ensure its future, and an attitude question was used to investigate the strength of respondents' views on sustainability. The structure of the questionnaire was designed to progress from facts to opinions, and from current issues to future issues. In addition to which, the topic of sustainability was placed at the end in order to avoid introducing any bias or suggestion in answers to earlier questions. Development included piloting of the

questionnaire by members of British Precast's Sustainability Committee in order to assess its ease of comprehension and completion, and the time required for completion.

The questionnaire was sent to each 'Sustainability Champion' within the 50 full member companies of British Precast* and respondents invited to reply on behalf of their companies. A covering letter jointly signed by the President and Chief Executive of British Precast was used to encourage recipients to reply.

A shorter 3-page questionnaire covering production, important issues, customers and the future for precast, was developed and sent to approximately 400 non-member companies. Since the majority of non-member companies are small to medium-sized enterprises (SMEs), it was considered that certain questions or parts of questions were not relevant to them and that by eliminating these, and reducing the length of the questionnaire, recipients would be more willing to complete it.

5 RESULTS AND ANALYSIS

Presentation of the research results in this paper will concentrate on the identification and prioritisation of sustainability issues for the precast industry. Other aspects of the results will be covered in future research papers.

Stage 1: Industry workshop

The business issues identified by each group in the first task are shown in Table 1. From the subsequent discussion, it was clear that the fundamental business concern of participants was the profitability and competitiveness of both individual companies and the precast sector as a whole. In regards to which, the other issues were all considered to be contributory factors.

* Each full member company of British Precast has nominated a 'Sustainability Champion' who provides the first point of contact between the company and the Sector Sustainability Strategy project team.

Table 1: Top 10 business issues for the precast industry, as identified by the three workshop groups

Group 1	Group 2	Group 3
Skilled human resources	Instability in energy market	Profitability and competitiveness
Economic resources	Environmental impact of product and agreement of rating	Employment issues (training and retaining)
Legislation	Image of industry (community relations and recruitment)	Poor image (e.g. concrete vs. timber)
Market demand	Health and safety in production and use of product	Raw materials (availability and cost)
Waste	Competition from alternative materials	Cheaper foreign imports
External threats	Transport concern of heavy input materials and output products	Waste management
R&D (innovation)	Sustainability concerns of specifiers not reflected in purchasing policies	Community relations
Accounting and supply chain	Availability of virgin and recycled aggregates	Rising energy costs and difficulty of supply
Health and safety	Increasing legislative burden	Transport and distribution
Social acceptance	Waste management in general, packaging in particular	Over capacity in the industry

With many of these other issues duplicated or overlapping, a list of key factors affecting the profitability and competitiveness of the industry was proposed and agreed for use in the next task; these are described in Figure 2. Consideration of these factors shows them to comprise a range of economic, social and environmental issues, either directly or in combination. Since sustainability also consists of a combination of economic, social and environmental issues, this suggests that the profitability and competitiveness of the precast industry is intrinsically linked to its sustainability. This is of significance because there is a growing consensus in the UK as to the competitive advantages that can be conferred by businesses taking a sustainable approach (Bennett and Crudgington, 2003).

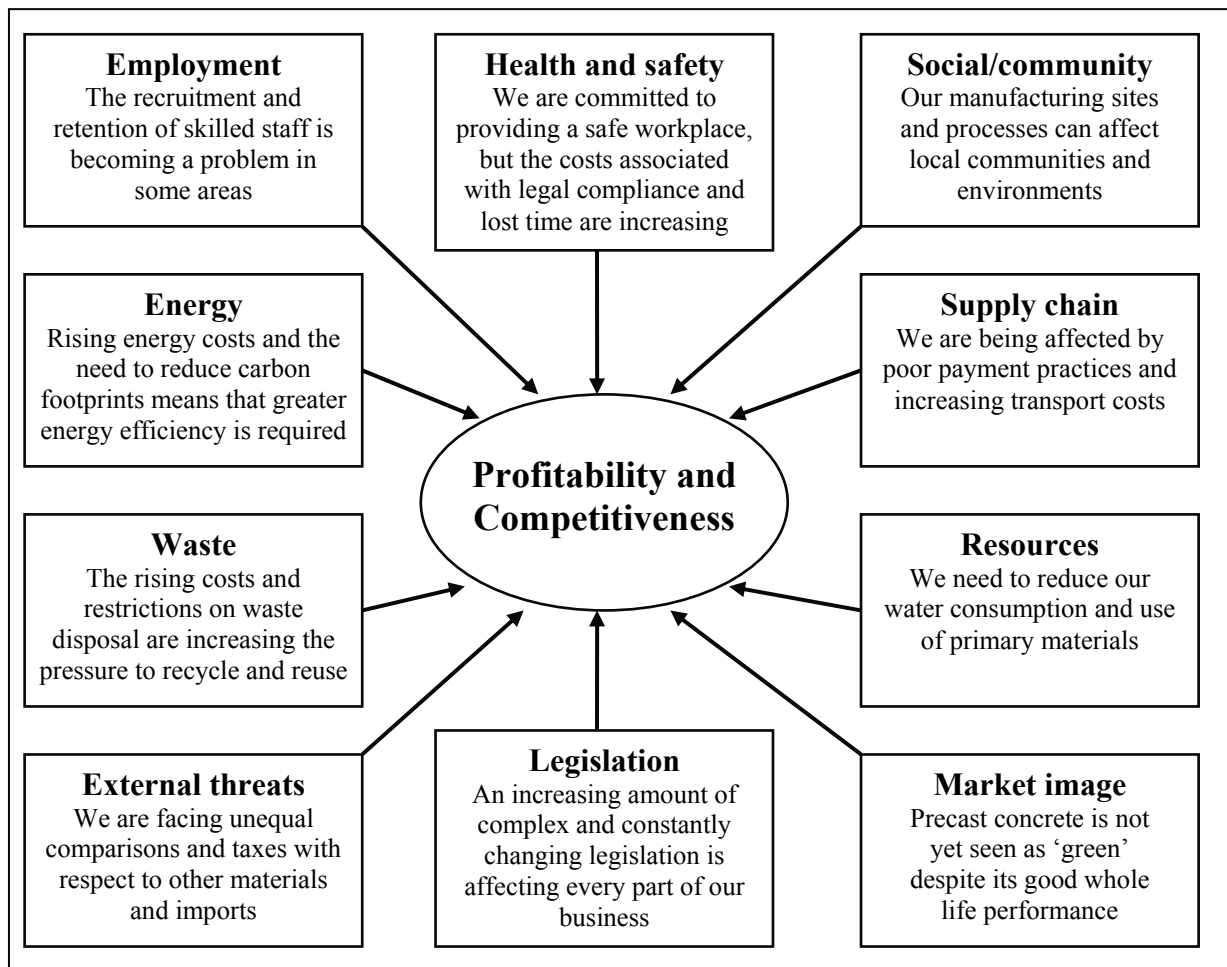


Figure 2: Key factors affecting the profitability and competitiveness of the industry

A wide range of specific problems and actions to be taken against each factor were discussed in the second task. The actions proposed can be summarised as requiring the industry to be more responsive and responsible, to improve its internal practices and performance, and reduce its external effects, and the actors responsible were considered to be individual precast companies, their supply chain partners and their trade association. These views were repeated and reflected in many of the definitions of a sustainable precast industry proposed by participants in the final task. A sustainable precast industry has therefore been defined as one which:

- is profitable and competitive;
- is responsive and responsible in all aspects of its business; and
- strives to improve its internal performance whilst reducing its external effects.

Stage 2: Questionnaire survey

Completed questionnaires were received from 29 member companies, a response rate of approximately 55%, whilst 34 non-member companies responded to the shorter questionnaire, a response rate of approximately 10%. These companies together operate nearly 200 precast factories, with an annual turnover in excess of £1.6 billion. Since the total annual turnover of the precast industry is currently estimated to be in the region of

£2.3 billion, the response received can therefore be considered to represent approximately 70% of the industry.

The factual data collected on production and customers showed the precast sector to be diverse in the range of products it produces, the size and structure of the companies within it, and its customer base.

There are ten principal precast product groups covering both mass produced and bespoke items:

- 1) Architectural cladding
- 2) Cast stone and other decorative
- 3) Drainage inc. pipes, culverts and manholes
- 4) Flooring inc. beam and block, and hollowcore
- 5) Masonry inc. blocks and walling
- 6) Paving, landscaping and street furniture
- 7) Piles and foundations
- 8) Railway specific products
- 9) Roof tiles
- 10) Structural inc. beams, columns and panels

Flooring, structural components, masonry and paving products, were the most popular product groups for companies to operate in, and companies would typically operate in more than one group, however, insufficient data was returned to reliably define the size of each group.

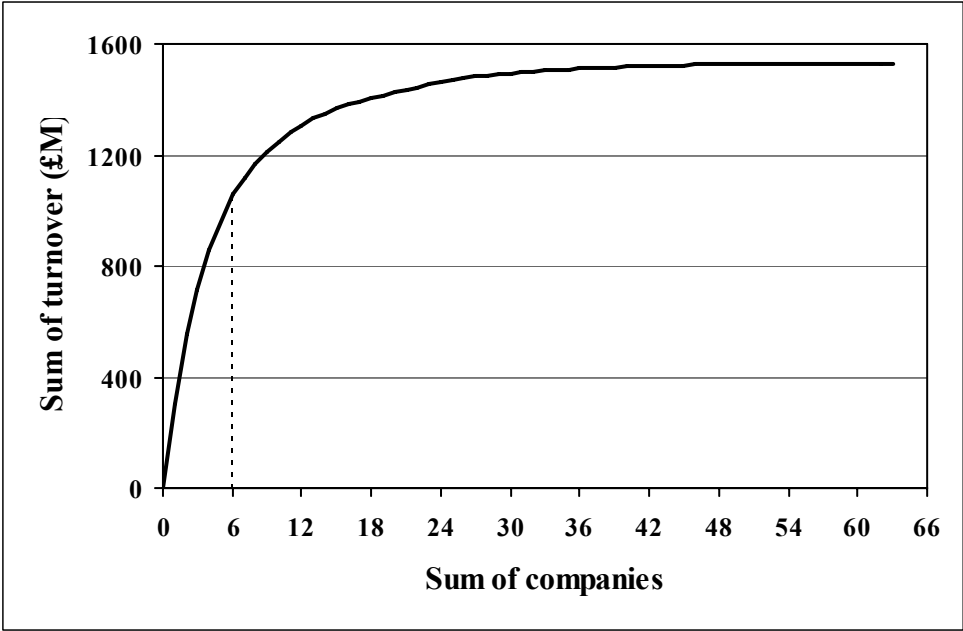


Figure 3: Sum of annual turnover of respondent companies

The respondent companies varied in size from single factory operations with less than 20 employees, to divisions of multi-national corporations operating multiple factories and employing over 1,000 staff. Whilst this disparity in company size reflects the diverse

nature of the industry, it also means that a small number of companies have the ability to dominate or lead the industry. Figure 3 is a graph of the cumulative annual turnover of the respondent companies; it can be seen from the graph that six companies, each with a turnover in excess of £100 million, account for over 50% of the reported figures.

Data provided on customers showed the industry to have a wide customer base for its products, ranging from local to national companies and including organisations such as local authorities and government, within which contractors, builders and builders' merchants were the primary customer groups.

Table 2: Prioritisation of business issues for the industry

Issue	Priority			
	Method 1	Method 2	Method 3	Method 4
Cash flow and payment practices	4	5=	2=	3=
Cheaper foreign imports	13	12=	17	16=
Community relations	19=	17=	20	20
Competition from other products and materials	3	3=	8	3=
Customer consolidation	12	5=	13=	14
Employment issues including recruitment, training and retention	10	15=	10	9=
Energy and climate change	14=	10=	15	15
Government policy, legislation and taxes	14=	14	2=	8
Health and safety	1	1	1	1
Maintaining good return on assets to sustain future investment	5	3=	9	7
Over capacity in the industry	7	5=	13=	13
Planning restrictions on factories	18	19=	16	18
Poor image of the industry and its products	16=	19=	18=	16=
Profitability and competitiveness	2	2	5=	2
Raw materials including price, availability and taxes	8	9	4	6
Regulations and regulatory trends	11	12=	7	9=
Slow down in markets and the economy	6	8	11	11
Transport and distribution costs	9	10=	5=	3=
Variability in buying decisions, e.g. price, green, whole life cost	19=	17=	18=	19
Waste management and pollution control	16=	15=	12	12

Respondents' beliefs on business issues of significance to the precast industry were investigated using a list of 20 issues derived from the workshop, as shown in Table 2. Member companies were asked to rank their top five issues in order of importance and note any other issues of concern, whilst non-member companies were simply asked to identify any issues of concern. The opportunity was also given in both cases to add issues to the list.

All of the issues listed were identified to be of concern by at least one respondent, validating the list created, and no further significant issues were added. Four methods were used to prioritise the list, the results from which are shown in Table 2:

- 1) Member companies' responses were reverse weighted, i.e. 6 points for the highest ranked issue, descending to 2 points for the fifth ranked issue, and 1 point given to any other issues of concern;
- 2) The responses from those member companies with turnovers > £100 million were reverse weighted as in method 1;
- 3) Non-member companies' responses were ranked by frequency of occurrence; and
- 4) All responses were combined and the issues ranked by frequency of occurrence.

Although health and safety was the highest priority in all cases, a number of economic issues were found to be of consistently high priority including cash flow and payment practices; competition from other products and materials; health and safety; and profitability and competitiveness. This supports the workshop finding that the top priority of the industry is its economic performance, represented by its profitability and competitiveness. Issues found to be of lower priority in all cases included community relations; planning restrictions on factories; poor image of the industry and its products; and variability in buying decisions. However, there was no clear and consistent pattern of priorities across the industry because certain issues were clearly of higher priority to some groups of companies than they were to others and vice versa. For example, maintaining a good return on assets to sustain future investment, customer consolidation and over capacity in the industry were high priorities for those companies with annual turnovers > £100 million, but not the non-member companies. Government policy, legislation and taxes, raw materials, and transport and distribution costs were higher priority issues for the non-member companies than they were for the larger companies.

The existence or development of policies and procedures in companies was investigated in order to provide an indication of whether the industry was beginning to address those business issues relating to environmental protection, resource use and social progress. The results with respect to the 10 areas selected for investigation are shown in Figure 4; the industry clearly has a higher level of adoption of policies and procedures in some areas than others. Those companies with turnovers > £100 million had policies and procedures in place in all 10 areas shown.

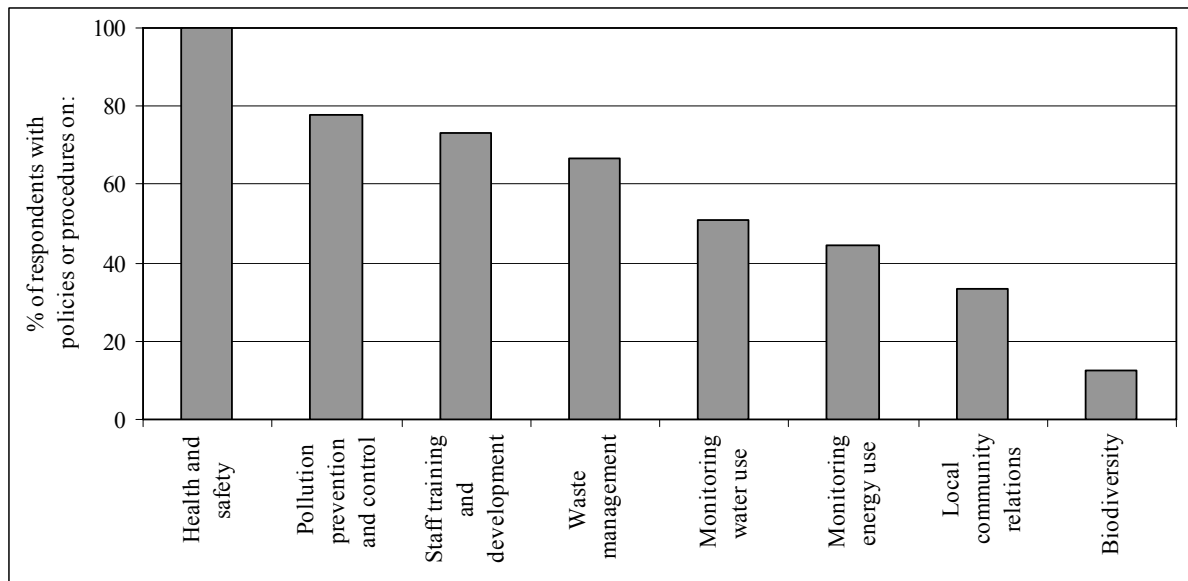


Figure 4: Prevalence of policies and procedures in the industry

6 IMPLICATIONS FOR THE PRECAST SECTOR SUSTAINABILITY STRATEGY

The purpose of the research undertaken was to identify and prioritise the sustainability issues for the precast industry. Whilst sustainability issues have been identified for approximately 70% of the industry, the priority of these issues was found to vary between different groups of companies. Experience from the Pioneers Group (Optimat, 2002), suggests that one strategy might not meet the needs of all groups within a complex sector. However, Dunphy *et al.* (2003) describe six phases in the development of corporate sustainability, as shown in Table 3. Certain companies in the industry, typically those with turnovers > £100 million, are recognised as operating in the higher phases of this model because of their good environmental and social performance, and contribution to the emergence of a sustainable society. Others are in the middle phases, showing increasing awareness of sustainability issues, whilst the response rate to the questionnaire suggests that 30% of the industry is in the lower phases, rejecting or not responding to the issue of sustainability. On this basis, differences in the sustainability priorities of companies in the industry are to be expected, and a priority for the sector sustainability strategy must be to engage with the whole industry and to facilitate the progression of companies through the phases of the sustainability model.

Table 3: Phases of corporate sustainability (after Dunphy *et al.*, 2003)

Phase	Description
Rejection	“We exist to make a profit and the wider community does not have legitimate claims on our business. We think that all greens are anti-social activists. At best, we pay lip service to the environment.”
Non-responsiveness	“We don’t oppose sustainability, but we just don’t understand it. We tend to operate a ‘business as usual’ approach. Environmental consequences are taken for granted, or if negative, ignored.”
Compliance	“We are a decent employer and corporate citizen because we avoid environmental abuses that could lead to litigation, but we do tend to have a reactive attitude to legal requirements.”
Efficiency	“We are becoming aware that there are advantages to be gained from using sustainable practice. For example, some of our waste may be a valuable resource to others.”
Strategic pro-activity	“We view sustainability as a potential competitive advantage and try to position ourselves as a leader in sustainable business practices. Our commitment is still bedded in profitability.”
The sustaining corporation	“We voluntarily go beyond profitability to promote sustainable values and practices. Sustainability is strongly internalized and we have enlightened attitudes towards our role in society.”

Woodall *et al.* (2004), reporting research conducted in 2002/03 amongst 145 managing directors, showed that ‘legislation’ in the form of government policy was considered to be the primary driver towards the adoption of more sustainable business practices in their organisations. However, the UK Government’s revised Strategy for Sustainable Development published in 2005 (DEFRA, 2005) proposed a new approach to influencing behaviours focusing on measures to encourage behaviour change, rather than measures to force change. This suggests that encouraging change is more effective than forcing change. The precast sector sustainability strategy must therefore adopt a similar approach and encourage change in the industry.

Consideration of the factors identified as key to the profitability and competitiveness of the industry and therefore its sustainability, as described in Figure 2, shows that three are pan-industry issues: external threats; legislation; and market image. As the industry’s trade association, British Precast exists to manage these issues on behalf of the industry (Clarke, 2003). The other issues, relating to internal performance and external effects, need to be addressed at company level with the support of British Precast and the industry’s supply chain. The investigation into the adoption of policies and procedures in companies relating to environmental protection, resource use and social progress, showed the industry to have a higher level of adoption of policies and procedures in some areas than others. Since these are all aspects of sustainability, this suggests that some companies are more sustainable than others in accordance with the sustainability model of Dunphy *et al.* (2003) described previously. Actions to encourage the adoption across the industry of policies and procedures in respect of key aspects of sustainability would be a first step in facilitating the progression of many companies through the phases of the sustainability model.

7 CONCLUSIONS

The sustainability issues for the precast industry in the UK have been identified through a workshop and verified across approximately 70% of the industry (by turnover) through a questionnaire survey.

Profitability and competitiveness was shown to be the most important issue for the industry and key factors affecting this were identified. Consideration of these factors indicates that the profitability and competitiveness of the industry is intrinsically linked to its sustainability, since they comprise a range of economic, environmental and social issues.

Different groups of companies were found to have different sustainability priorities as a result of companies in the industry being in different phases of a corporate sustainability model. This has enabled priorities for the sector sustainability strategy to be identified, including engaging with the whole industry and encouraging companies to be more responsive and responsible in all aspects of their business.

Addressing these priorities should facilitate progression towards a more sustainable precast industry, an industry which is profitable and competitive, is responsive and responsible in all aspects of its business, and strives to improve its internal performance whilst reducing its external effects.

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APPENDIX C Sustainability issues and priorities survey

1. Questionnaire for British Precast member companies
2. Questionnaire for non-member companies
3. Summary report

1) About you

Name: _ _ _ _ _

Position: _ _ _ _ _

Company: _ _ _ _ _

Parent company or group (if applicable): _ _ _ _ _

2) About your products

a) How many factories in your company make precast concrete products? _ _ _ _ _

b) Approximately how many people do these factories employ? _ _ _ _ _

c) Approximately how many people in total does your company employ in precast?
(i.e. including production, sales, marketing, distribution, etc) _ _ _ _ _

d) What is your approximate annual turnover from precast products? (£ million) _ _ _ _ _

e) What is your approximate annual precast production output? ('000 tonnes) _ _ _ _ _

f) Please indicate which of the following precast product types are core or secondary to your company's business, and if possible, please provide annual turnover and production tonnages.

Product type	Core (tick all that apply)	Secondary (tick all that apply)	Turnover (£ '000)	Production ('000 tonnes)
Architectural cladding	<input type="checkbox"/>	<input type="checkbox"/>	_____	_____
Cast stone and other decorative	<input type="checkbox"/>	<input type="checkbox"/>	_____	_____
Drainage inc. pipes, culverts and manholes	<input type="checkbox"/>	<input type="checkbox"/>	_____	_____
Flooring inc. beam and block, and	<input type="checkbox"/>	<input type="checkbox"/>	_____	_____
Masonry inc. blocks and walling	<input type="checkbox"/>	<input type="checkbox"/>	_____	_____
Paving, landscaping and street furniture	<input type="checkbox"/>	<input type="checkbox"/>	_____	_____
Piles and foundations	<input type="checkbox"/>	<input type="checkbox"/>	_____	_____
Railway specific products	<input type="checkbox"/>	<input type="checkbox"/>	_____	_____
Roof tiles	<input type="checkbox"/>	<input type="checkbox"/>	_____	_____
Structural inc. beams, columns and panels	<input type="checkbox"/>	<input type="checkbox"/>	_____	_____
Other <i>(please specify)</i>	<input type="checkbox"/>	<input type="checkbox"/>	_____	_____

3) About your customers

a) In which region or regions of the UK does your company normally do business? *Please tick all that apply.*

- East Anglia
- East Midlands
- North East
- Northern Ireland
- North West
- Scotland
- South East
- South West
- Wales
- West Midlands
- Yorkshire and

b) With whom does your company normally do business? *Please tick all that apply.*

- Central Government
- Regional Government
- Local Government
- Architects
- Consulting Engineers
- Property developers
- Major contractors
- Small contractors
- Builders merchants
- Local builders
- General public
- Other (*please specify*)

c) How do you normally do business with your customers? *Please tick one box only.*

- Products supplied from stock
- Products made to order
- Products supplied from stock and made to order
- Other (*please specify*)

4) Important issues for your company

Of the following business issues, which are of concern to your company and how important are they? *Please rank your top five issues in order of importance (1 = most important) and tick any others that apply.*

- Cash flow and payment practices
- Cheaper foreign imports
- Community relations
- Competition from other products and materials
- Customer consolidation

- Employment issues including recruitment, training and
- Energy and climate change
- Government policy, legislation and taxes
- Health and safety
- Maintaining good return on assets to sustain future

- Over capacity in the industry
- Planning restrictions on factories
- Poor image of the industry and its products
- Profitability and competitiveness
- Raw materials including price, availability and taxes

- Regulations and regulatory trends
- Slow down in markets and the economy
- Transport and distribution costs
- Variability in buying decisions, e.g. price, green, whole life
- Waste management and pollution control

Please note any other business issues of concern to your company that are not listed, together with their importance relative to your top five issues above.

5) About your policies and systems

a) Does your company have working policies in place in the following areas of environmental protection, resource use and social progress? *Please tick one box for each.*

Environmental protection	Yes	No	Under development
Biodiversity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Dust prevention and control	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Monitoring environmental impact	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Noise monitoring and control	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pollution prevention and control	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Waste management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Waste minimisation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Resource use	Yes	No	Under development
Monitoring energy use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Monitoring water use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Promoting energy efficiency	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Recycling and reusing waste products	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Recycling water	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Reducing cement consumption	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Transport efficiency	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Use of secondary and recycled materials	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Social progress	Yes	No	Under development
Local community relations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Provision of a safe and healthy working environment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Staff training and development	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

b) Does your company have the following systems in place? *Please tick one box for each.*

An ISO 9000 series compliant quality management system.

Yes No Under development An equivalent system (*please specify*)

An ISO 14000 series compliant environmental management system.

Yes No Under development An equivalent system (*please specify*)

An OHSHS 18000 series compliant health and safety system.

Yes No Under development An equivalent system (*please specify*)

An integrated management system covering quality, environment and health and safety.

Yes No Under development An equivalent system (*please specify*)

6) The future for precast

Of the following activities, which do you think the precast industry needs to do more of to secure its future? *Please rank your top five in order of importance (1 = most important) and tick any others that apply.*

- Add value to its products
- Adequately educate specifiers and users of its products
- Benefit the community it serves
- Control pollution and emissions
- Consolidate
- Diversify
- Engage with Government, customers, suppliers and the
- Improve its viability for investors
- Innovate
- Invest in new technologies
- Minimise its environmental impact
- Promote fair practice and partnership through the supply
- Promote the sustainability benefits of its products
- Provide a safer working environment
- Reduce waste
- Respect the community it serves
- Use resources more efficiently
- Value its employees
- Work together for the benefit of the whole industry

Please note anything else you think the precast industry needs to do more of to secure its future, and its importance relative to your top five issues above.

7) About your investments

In what areas has your company invested significant resources (time and money) over the last 5 years and where does it expect to be investing over the next 5 years? *Please tick any that apply.*

	Last 5 years	Next 5 years
Plant and machinery	<input type="checkbox"/>	<input type="checkbox"/>
New product development	<input type="checkbox"/>	<input type="checkbox"/>
Adding value to existing products	<input type="checkbox"/>	<input type="checkbox"/>
Legal compliance	<input type="checkbox"/>	<input type="checkbox"/>
Promotion and market development	<input type="checkbox"/>	<input type="checkbox"/>
Staff welfare and development	<input type="checkbox"/>	<input type="checkbox"/>
Other (<i>please specify</i>)	<input type="checkbox"/>	<input type="checkbox"/>

8) Sustainability

Please indicate your level of agreement with each of the following statements by circling the appropriate answer.

Sustainability:	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
is just a passing fashion	SD	D	N	A	SA
is just a way of taxing our business more	SD	D	N	A	SA
just means more legislation to deal with	SD	D	N	A	SA
does not have a direct impact on our business and the way we operate	SD	D	N	A	SA
is only a concern for big companies	SD	D	N	A	SA
is about improving the competitiveness and profitability of our business	SD	D	N	A	SA
is about protecting the environment and conserving resources	SD	D	N	A	SA
is about being responsive and responsible in all aspects of our business	SD	D	N	A	SA
is about social progress that meets the needs of everyone	SD	D	N	A	SA
is about ensuring a future for our business	SD	D	N	A	SA

Thank you for completing the questionnaire. Please return it in the envelope provided.

Please supply your e-mail address if you wish to receive a summary of the questionnaire results.

British Precast industry issues questionnaire

British Precast is conducting a survey of the precast concrete industry to examine its views on a range of issues which may impact on future performance. This information will be used to focus our efforts on the most important ones. We would greatly appreciate a few minutes of your time to complete this questionnaire, as we would like to obtain a comprehensive view across the entire precast industry, not just British Precast members. Your replies will be confidential and will not be connected in any way to you or your company. In return, we will be pleased to share the results of the survey with you.



Martin Clarke, Chief Executive, British Precast

Please **fax** your completed questionnaire to **0116 251 4568** or return it to the address above by 31 January. If you have any queries about the questionnaire, please contact Ian Holton at British Precast on 0116 253 6161.

1) About you

Name: _____

Position: _____

Company: _____

2) About your production

Which of the following precast product types does your company normally produce?

Please tick all that apply.

- | | |
|---|--|
| <input type="checkbox"/> Drainage inc. pipes, culverts and manholes | <input type="checkbox"/> Architectural cladding |
| <input type="checkbox"/> Flooring inc. beams and hollowcore | <input type="checkbox"/> Cast stone and other decorative |
| <input type="checkbox"/> Masonry inc. blocks and walling | <input type="checkbox"/> Piles and foundations |
| <input type="checkbox"/> Paving, landscaping and street furniture | <input type="checkbox"/> Railway specific products |
| <input type="checkbox"/> Structural inc. beams, columns and panels | <input type="checkbox"/> Roof tiles |
| <input type="checkbox"/> Other (<i>please specify</i>) | |

What is your approximate annual turnover from precast products? _ _ _ _ _ £ '000

What is your annual production tonnage of precast products? _ _ _ _ _ '000 tonnes

How many people do you employ, including admin and part-time staff? _ _ _ _ _

For which of the following do you have policies or procedures in place? *Please tick all that apply.*

- | | |
|---|---|
| <input type="checkbox"/> Health and safety | <input type="checkbox"/> Pollution prevention and control |
| <input type="checkbox"/> Local community relations | <input type="checkbox"/> Recycling and reusing waste products |
| <input type="checkbox"/> Monitoring energy use | <input type="checkbox"/> Recycling water |
| <input type="checkbox"/> Monitoring water use | <input type="checkbox"/> Staff training and development |
| <input type="checkbox"/> Noise monitoring and control | <input type="checkbox"/> Waste management |

3) Important issues for your company

Which of the following business issues are of concern to your company? *Please tick all that apply.*

- Cash flow and payment practices
- Cheaper foreign imports
- Community relations
- Competition from other products and materials
- Customer consolidation
- Employment issues including recruitment, training and retention
- Energy and climate change
- Government policy, legislation and taxes
- Health and safety
- Maintaining good return on assets to sustain future investment
- Over capacity in the industry
- Planning restrictions on factories
- Poor image of the industry and its products
- Profitability and competitiveness
- Raw materials including price, availability and taxes
- Regulations and regulatory trends
- Slow down in markets and the economy
- Transport and distribution costs
- Variability in buying decisions, e.g. price, green, whole life cost
- Waste management and pollution control

What is your company's most important business issue at present? _ _ _ _ _

4) About your customers

With whom does your company normally do business? *Please tick all that apply.*

- | | | |
|--|---|--|
| <input type="checkbox"/> Central Government | <input type="checkbox"/> Consulting Engineers | <input type="checkbox"/> Builders merchants |
| <input type="checkbox"/> Regional Government | <input type="checkbox"/> Property developers | <input type="checkbox"/> Local builders |
| <input type="checkbox"/> Local Government | <input type="checkbox"/> Major contractors | <input type="checkbox"/> General public |
| <input type="checkbox"/> Architects | <input type="checkbox"/> Small contractors | <input type="checkbox"/> Other <i>(please specify)</i> |

5) The future for precast

Of the following activities, which do you think the precast industry should do more of to secure its future? *Please tick all that apply.*

- Add value to its products
- Adequately educate specifiers and users of its products
- Benefit the community it serves
- Control pollution and emissions
- Consolidate
- Diversify
- Engage with Government, customers, suppliers and the general public
- Improve its viability for investors
- Improve its sustainability credentials
- Innovate
- Invest in new technologies
- Minimise its environmental impact
- Promote fair practice and partnership through the supply chain
- Promote the sustainability benefits of its products
- Provide a safer working environment
- Reduce waste
- Respect the community it serves
- Use resources more efficiently
- Value its employees
- Work together for the benefit of the whole industry

Of those you have ticked, which do you think is the most important? _ _ _ _ _

Thank you for completing the questionnaire

Please supply your e-mail address if you would like to receive a summary of the survey results

Please tick if you would like to receive details of British Precast membership

**BRITISH
PRECAST**



British Precast/Loughborough University Sector Sustainability Project

The precast industry's current position on sustainability

Summary report on an industry survey

Ian Holton, May 2006

CONTENTS

1. Introduction
2. Survey questionnaires
3. Response rate
4. Production
5. Customers
6. Important issues
7. Policies and systems
8. The future for precast
9. Investment
10. Sustainability
11. Summary

Appendix A: Summary of the sector sustainability strategy project

1. INTRODUCTION

In collaboration with Loughborough University, British Precast made a commitment in 2004 to develop a sector sustainability strategy for the UK precast concrete industry. This strategy will help to make precast concrete products more competitive in the arena of sustainable construction, and make precast businesses more efficient, profitable and responsible in their operation. A summary of the sector sustainability strategy project is included as Appendix A to this report.

As part of this project, British Precast has conducted a survey of member and non-member companies to establish the sector's current position on a range of business and sustainability related issues which may impact on the future performance of the precast concrete industry. This report provides a summary of the survey results.

2. SURVEY QUESTIONNAIRES

A 6-page questionnaire covering the following topics was sent to the Sustainability Champion within all full member companies of British Precast in January 2006:

- Production
- Customers
- Important issues
- Policies and systems
- The future for precast
- Investment
- Sustainability

A shorter 3-page questionnaire covering production, customers, important issues and the future for precast, was sent to approximately 400 non-member companies at the same time.

3. RESPONSE RATE

Completed questionnaires were received from 29 member companies, a response rate of approximately 55%, whilst 34 non-member companies responded to the shorter questionnaire, a response rate of approximately 10%. The response from member companies was disappointing given the importance the British Precast Council has placed on sustainability and this project. A low response rate was expected from non-members since many are small single factory operations employing only a few people that may not have the resources or awareness of the issues currently facing the precast industry necessary to complete the questionnaire.

However, those member and non-member companies that replied together operate nearly 200 precast factories, with an annual turnover in excess of £1.6 billion. Since the total annual turnover of the precast industry is currently estimated to be in the region of £2.3 billion, the response received can therefore be considered to represent approximately 70% of the industry.

4. PRODUCTION

The 29 member companies together operated 155 factories and employed over 10,000 staff to produce a combined annual turnover of approximately £1.5 billion.

Table 1 shows that 13 members were single factory operations and 16 multiple factory operations ranging from 2 to 44 factories, indicating a wide range of company size. The number of employees per factory also varied from less than 10 to over 100, indicating a wide range of factory sizes.

Table 1: Distribution of member companies by number of factories operated

Number of member companies operating:				
1 factory	2 – 4 factories	5 – 10 factories	> 20 factories	> 40 factories
13	9	4	2	1

The effect of company size can be seen in Figures 1 – 3 in which cumulative figures for numbers of factories, annual turnover and annual production tonnage have been plotted against the cumulative membership; the production figures are incomplete as not all members were able to disclose them or report them in tonnage terms. These graphs show that a small number of companies account for a significant proportion of the membership's production capacity, output and turnover.

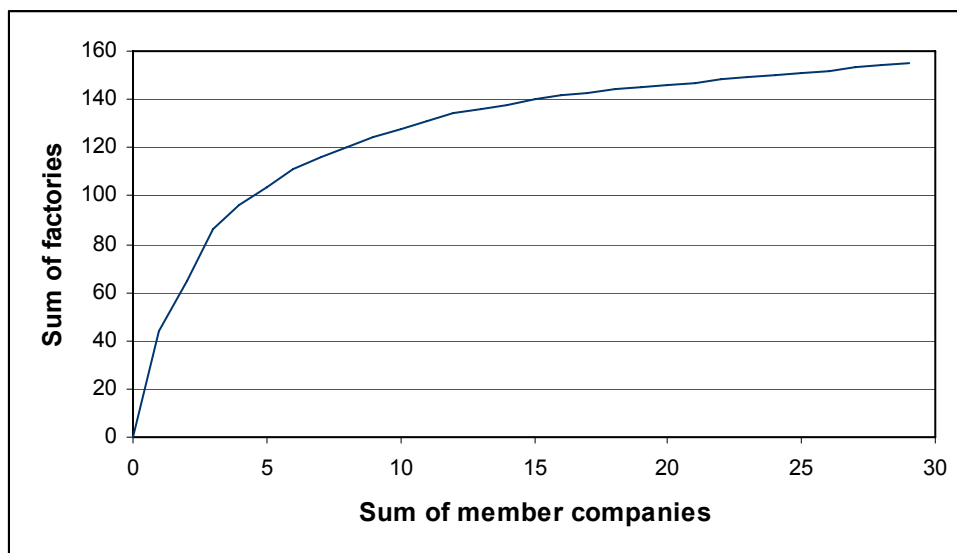


Figure 1: Sum of factories operated by member companies

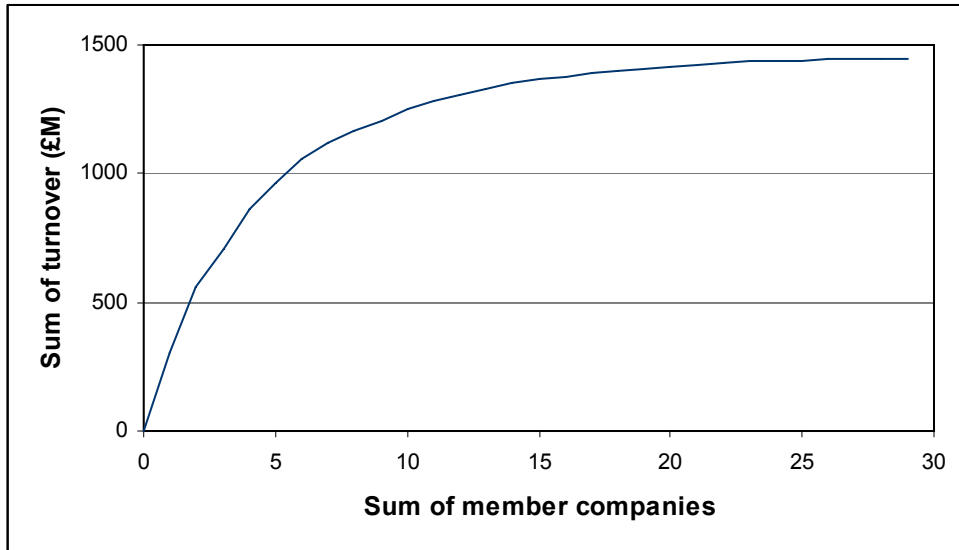


Figure 2: Sum of annual turnover generated by member companies

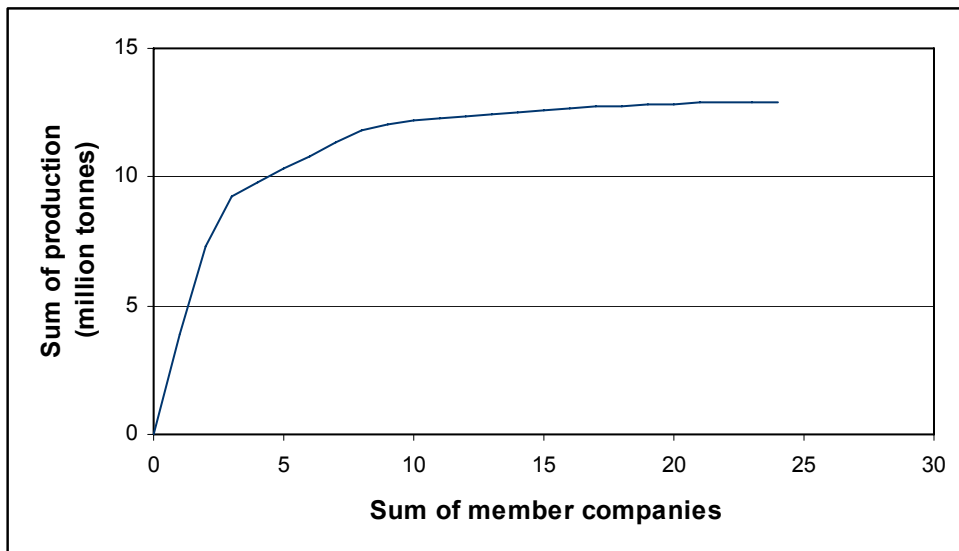


Figure 3: Sum of annual production tonnage from member companies

The 34 non-members were typically single factory operations employing < 50 staff and achieving annual turnovers in the range £1 - £10 million.

Precast products were divided into 11 product groups and members asked to identify those which were core and secondary to their businesses, whilst non-members only identified those product groups they were involved in. The results are shown in Table 2.

Table 2: Distribution of member and non-member companies by product type

Product type	Members		Non-members
	Core	Secondary	
Architectural cladding	3	2	4
Cast stone and other decorative	1	4	15
Drainage inc. pipes, culverts and manholes	6	3	3
Flooring inc. beam and block, and hollowcore	9	2	4
Masonry inc. blocks and walling	5	2	13
Paving, landscaping and street furniture	5	2	14
Piles and foundations	-	-	1
Railway specific products	2	1	3
Roof tiles	3	3	-
Structural inc. beams, columns and panels	10	3	7
Other	-	2	6

Insufficient data was returned on production tonnages and turnover to reliably define the size of each product group. However, an indication of relative importance can be obtained from the number of companies operating in each group; structural and flooring being the main product groups for member companies, cast stone, paving and masonry for non-members.

5. CUSTOMERS

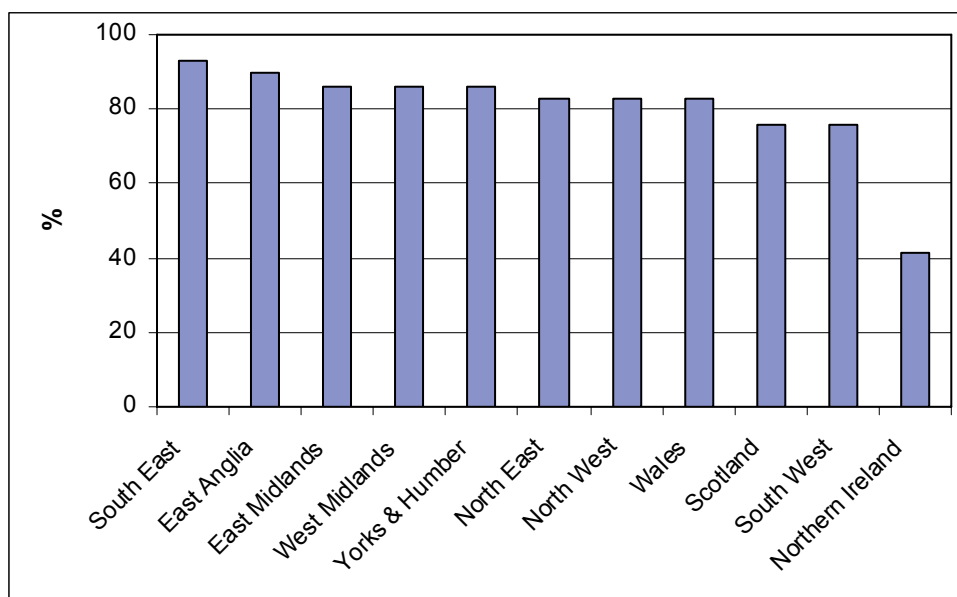


Figure 4: Where members do business in the UK

Figure 4 shows where member companies did business. This indicates that the majority of member companies regularly supply their products on a nationwide basis, with the exception of Northern Ireland.

Figures 5 and 6 show who member and non-member companies do business with on a regular basis. These graphs demonstrate the wide customer base the industry has for its products, within which contactors, builders and builders' merchants are the primary customers.

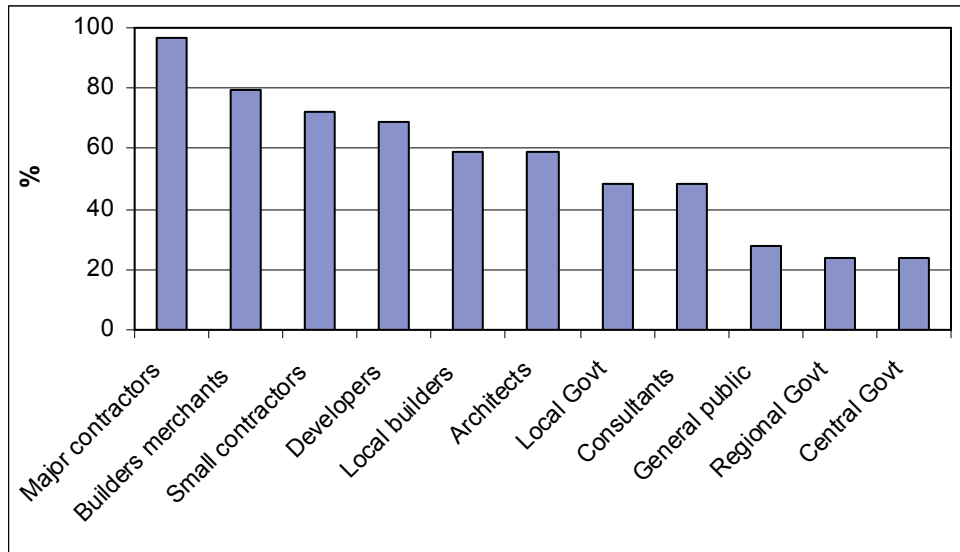


Figure 5: Who members do business with

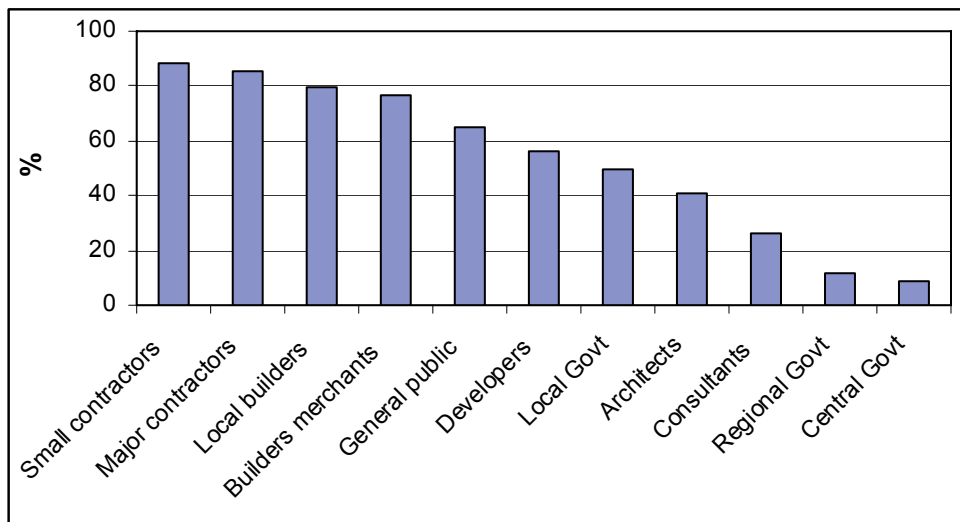


Figure 6: Who non-members do business with

6. IMPORTANT ISSUES

Members were asked to identify those business issues of concern to their companies from a list of 20 issues identified in an industry workshop and then rank their top five in order of importance. The issues were then scored on their rankings to produce the weighted list shown below:

1	Health & Safety
2	Profitability and competitiveness
3	Competition from other products and materials
4	Cash flow and payment practices
5	Maintaining good return on assets to sustain future
6	Slow down in markets and the economy
7	Over capacity in the industry
8	Raw materials inc. price, availability and taxes
9	Transport and distribution costs
10	Employment issues inc. recruitment, training and retention
11	Regulations and regulatory trends
12	Customer consolidation
13	Cheaper foreign imports
14=	Energy and climate change
14=	Government policy, legislation and taxes
16=	Poor image of the industry and its products
16=	Waste management and pollution control
18	Planning restrictions on factories
19=	Community relations
19=	Variability in buying decisions, e.g. price, green, whole life

Non-members were asked to simply identify those issues of concern, the issues then being ranked by the frequency with which they were identified as shown below.

1	Health & Safety
2=	Cash flow and payment practices
2=	Government policy, legislation and taxes
4	Raw materials inc. price, availability and taxes
5=	Profitability and competitiveness
5=	Transport and distribution costs
7	Regulations and regulatory trends
8	Competition from other products and materials
9	Maintaining good return on assets to sustain future
10	Employment issues inc. recruitment, training and retention
11	Slow down in markets and the economy
12	Waste management and pollution control
13=	Over capacity in the industry
13=	Customer consolidation
15	Energy and climate change
16	Planning restrictions on factories
17	Cheaper foreign imports
18=	Poor image of the industry and its products
18=	Variability in buying decisions, e.g. price, green, whole life
20	Community relations

Similar priorities are evident in both lists with Health & Safety the primary concern ahead of a range of economic issues, whilst those issues related to the environment and society were less highly rated.

7. POLICIES AND SYSTEMS

The presence or development in member companies of procedures for specific areas of environmental protection, resource use and social progress are shown in Figures 7 – 9.

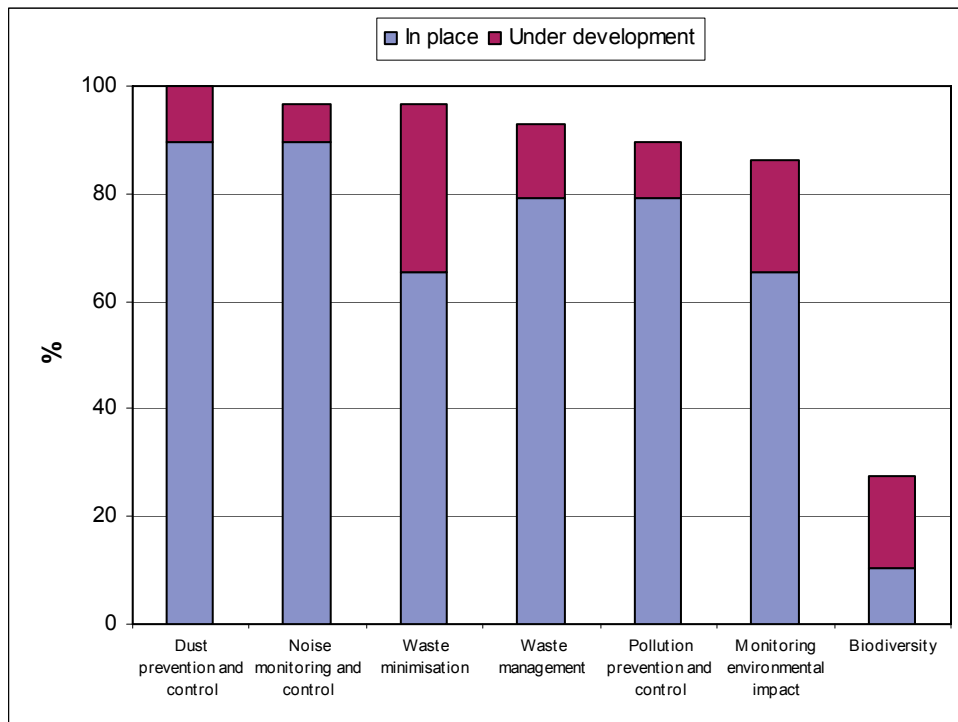


Figure 7: Environmental protection policies in member companies

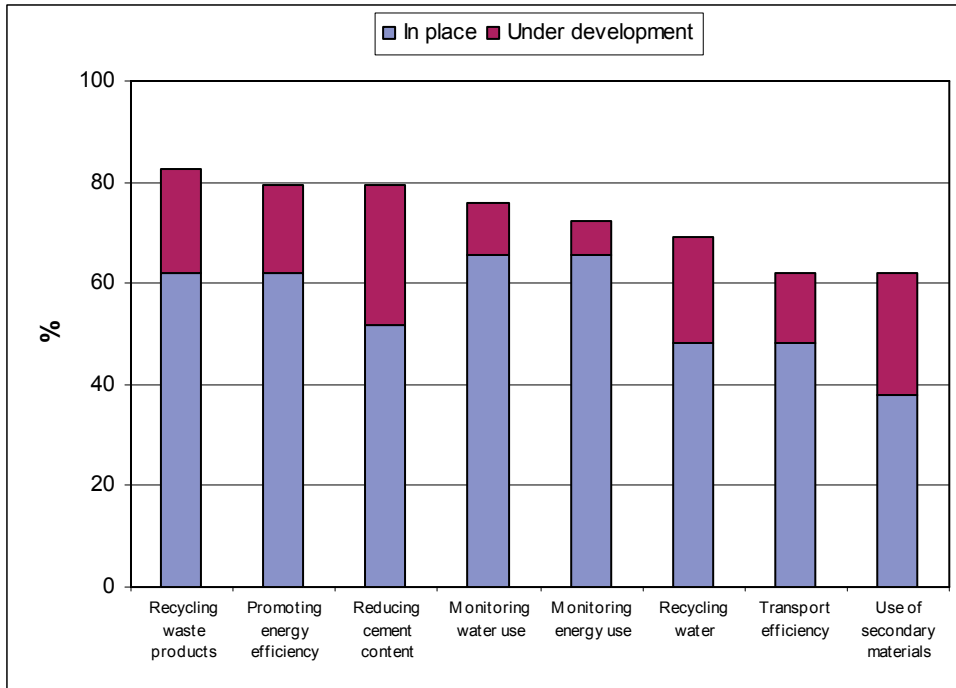


Figure 8: Resource use policies in member companies



Figure 9: Social progress policies in member companies

Figure 7 shows that environmental protection policies covering pollution prevention and control (including dust and noise), waste and environmental impact have or will soon be adopted by the majority of member companies. The figures for resource use policies in Figure 8 are slightly lower, but demonstrate widespread policy development. Figure 9 shows that all member companies have health and safety policies in place, together with staff training and development policies in the majority of companies.

The presence in member companies of systems for quality management to ISO 9000, environmental management to ISO 14000, health and safety management to OHSHS 18000 and an integrated management system covering all three areas was also investigated. The results are shown in Figure 10.

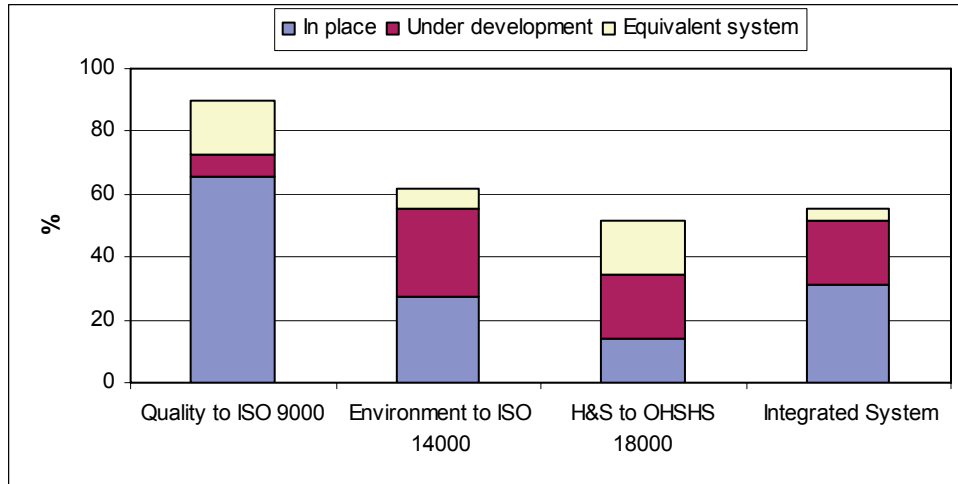


Figure 10: Management systems in member companies

The presence of a shorter list of policies was investigated in non-member companies, and the results shown in Figure 11. The data shows that non-member companies clearly take health and safety seriously, and suggests that basic environmental management measures are increasing.

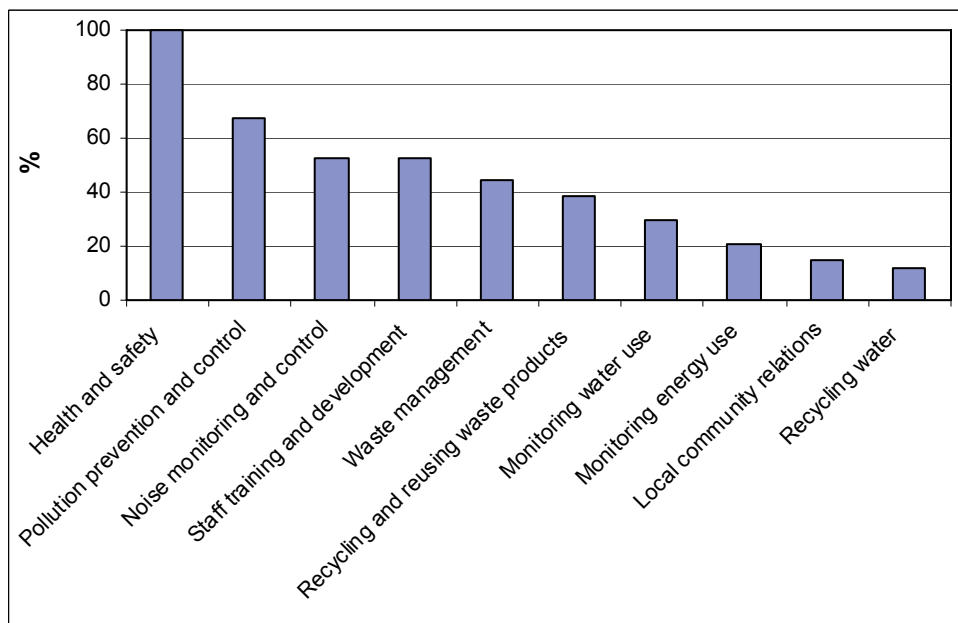


Figure 11: Policies present in non-member companies

8. THE FUTURE FOR PRECAST

Members were asked to identify those activities they thought the precast industry needed to do more of to secure its future and then rank their top five in order of priority. The activities were then scored on their rankings to produce the weighted list shown below:

1	Adequately educate specifiers and users of its products
2	Add value to its products
3	Innovate
4	Promote the sustainability benefits of its products
5=	Invest in new technologies
5=	Provide a safer working environment
7	Work together for the benefit of the whole industry
8=	Engage with Government, customers, suppliers and the public
8=	Value its employees
10	Use resources more efficiently
11	Promote fair practice and partnership through the supply chain
12	Improve its viability for investors
13	Minimise its environmental impact
14	Reduce waste
15=	Control pollution and emissions
15=	Consolidate
15=	Diversify
18	Respect the community it serves
19	Benefit the community it serves

Non-members were asked to simply identify those activities they believed to be of importance, the activities then being ranked by the frequency with which they were identified as shown below.

1	Adequately educate specifiers and users of its products
2	Innovate
3	Work together for the benefit of the whole industry
4	Invest in new technologies
5=	Add value to its products
5=	Promote the sustainability benefits of its products
7=	Minimise its environmental impact
7=	Reduce waste
9=	Engage with Government, customers, suppliers and the public
9=	Promote fair practice and partnership through the supply chain
9=	Value its employees
12	Provide a safer working environment
13=	Control pollution and emissions
13=	Use resources more efficiently
15=	Consolidate
15=	Diversify
15=	Improve its viability for investors
18	Respect the community it serves
19	Benefit the community it serves

The priorities are similar in both lists and comprise internal and external actions for the industry to undertake, the most important of which is to adequately educate specifiers and users of its products.

9. INVESTMENT

Member companies were asked where they had invested significant resources (time and money) over the last 5 years and where they expected to be investing over the next 5 years. The results are shown in Figure 12.

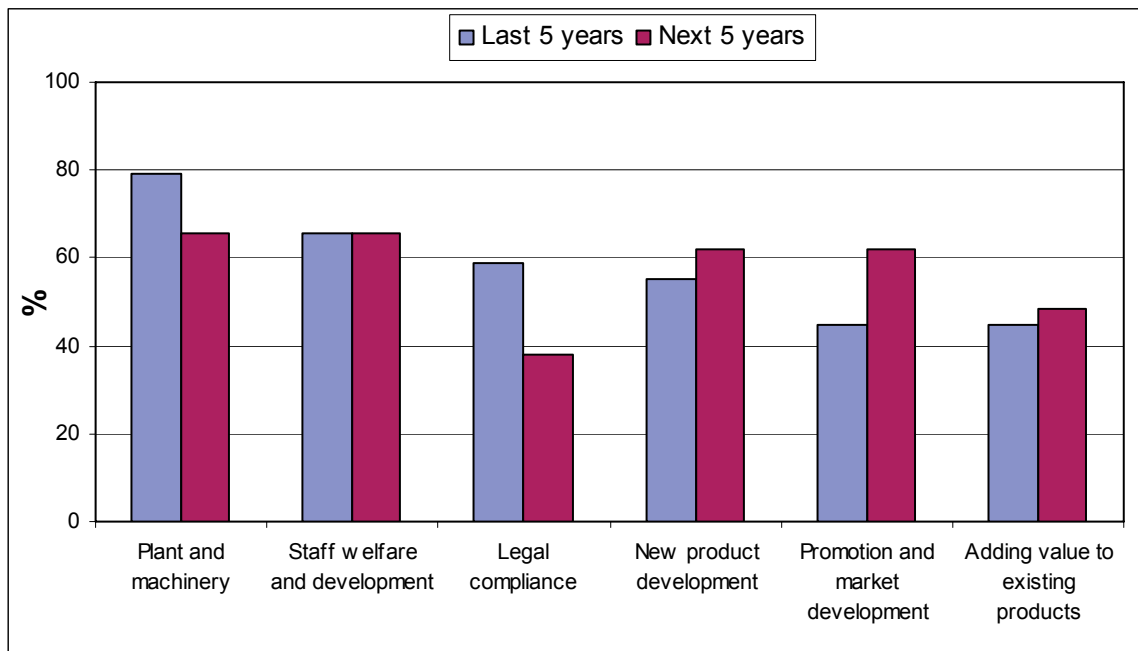


Figure 12: Investment areas of member companies

10.SUSTAINABILITY

The level of agreement amongst members with a series of statements concerning sustainability and its effect on their companies is shown in Figure 13.

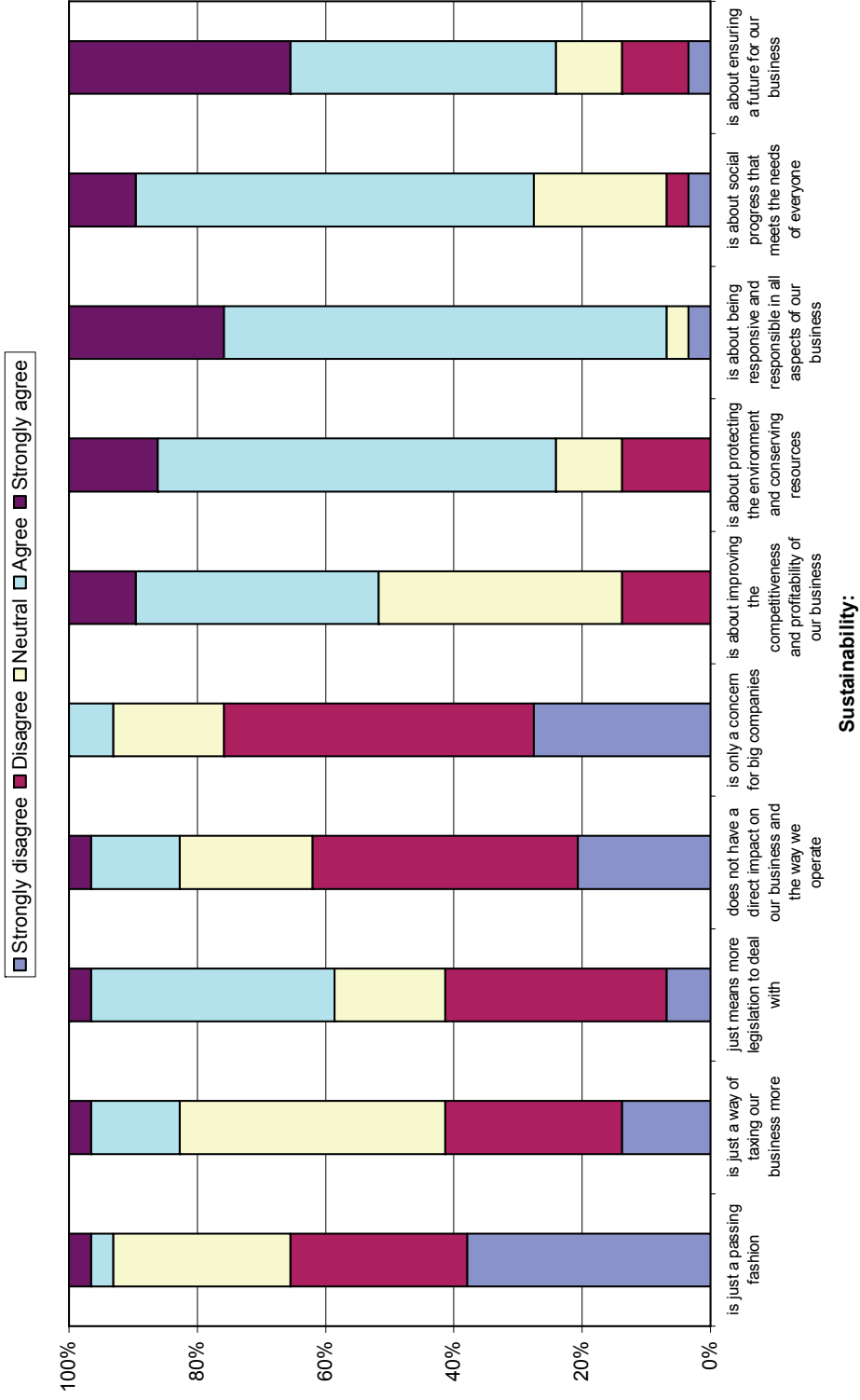


Figure 13: Agreement with statements on sustainability

Over 90% of those questioned agreed with the following statement:

- Sustainability is about being responsive and responsible in all aspects of our business

Less than 10% agreed with the following statements:

- Sustainability is just a passing fashion
- Sustainability is only a concern for big companies

Over 70% agreed with the following statements:

- Sustainability is about protecting the environment and conserving its resources
- Sustainability is about social progress that meets the needs of everyone
- Sustainability is about ensuring a future for a business

Over 60% disagreed with the following statement:

- Sustainability does not have a direct impact on our business and the way we operate

There was neutrality or agreement with the following statement:

- Sustainability is about improving the competitiveness and profitability of our business

Opinion was divided on the following statements:

- Sustainability is just a way of taxing our business more
- Sustainability just means more legislation to deal with

11.SUMMARY

The results represent approximately 70% of the precast industry based on estimated total turnover.

A small number of large companies account for a significant proportion of the industry's production capacity, output and turnover.

The industry has a wide customer base within which contractors, builders and builders' merchants are the primary customers.

Health and Safety was rated the top business concern for companies at present followed by a range of issues affecting economic performance. Issues related to the environment and society, were found to be less of a concern to companies.

Many member companies now have policies in place or under development relating to aspects of environmental protection, resource use and social progress, although biodiversity and local community relations were found to be poorly covered.

Of the activities the industry needed to do more of to secure its future, adequate education of specifiers and users of precast products was the top priority. Promoting the sustainability benefits of its products was also a high priority.

Examination of members' opinions on sustainability indicates a widespread understanding amongst members that sustainability is not a passing fashion, should not just be a concern for big companies, and is about being responsive and responsible in all aspects of business. For all companies, members generally agreed that sustainability should involve protecting the environment and its resources, social progress which meets the needs of everyone, and ensuring a future for the company.

Appendix A: Summary of the sector sustainability strategy project

Sustainable development and construction

Sustainable development is about delivering a better quality of life for everyone and means achieving social, economic and environmental objectives at the same time [1]. The UK Government's strategy for sustainable development launched in 1999 [2], defined these objectives as:

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

In the consultation exercise that informed the strategy [3], it was recognised that:

- the construction industry had a significant impact on society and the environment;
- the construction industry provided the delivery mechanisms for many aspects of Government policy aimed at the provision and modernisation of the nation's infrastructure; and
- benefits could flow from a more efficient and sustainable construction industry.

This led to the publication of a sustainable development strategy aimed specifically at the construction industry in 2000 [1], with the Government driving the construction industry to:

- be more profitable and competitive;
- deliver buildings and structures that provide greater satisfaction, well-being and value to customers and users;
- respect and treat its stakeholders more fairly;
- enhance and better protect the natural environment; and
- minimise its impact on the consumption of energy (especially carbon-based energy) and natural resources.

In essence, it was encouraging the construction industry to take a pro-active attitude to sustainability on the basis that "Much of what needs to be done is about competitiveness and survival in the global economy and is good business sense".

There was also encouragement for sector representative bodies and trade associations to develop sector sustainability strategies. The reasoning behind this was "These will provide a framework for sectors to assess their economic, environmental and social performance; identify areas for improvement in the light of future opportunities and threats; set targets and implement action plans to bring about those improvements; and then to report on progress to stakeholders" [1].

Precast sector sustainability strategy

In 2004, members of the BPCF's governing council agreed to support a four-year research programme in collaboration with the Department of Civil and Building Engineering at Loughborough University to develop a sustainability strategy for the precast sector.

This 4-year research programme will be of broad application because it will address a number of key issues that are key to developing a sustainability strategy for this type of industrial sector, for example, how to:

- identify an appropriate balance between the triple bottom line issues (economic, environmental and social aspects);
- establish useful indicators and targets for the sector;
- compile meaningful sector-wide data in such a diverse industry;
- map what sustainability means and what it looks like; and
- develop consensus with industry stakeholders up and down the supply chain.

The research will be of benefit to individual precast manufacturers, trade associations and those measuring the progress of manufacturing industries towards sustainability goals such as government and environmental agencies. Architects, Engineers and Clients will also be interested in the research as sustainability moves up their agendas.

References

1. Department of the Environment, Transport and the Regions, (2000). Building a Better Quality of Life. A Strategy for more Sustainable Construction. Department of the Environment, Transport and the Regions, London.
2. Department of the Environment, Transport and the Regions, (1999). A better quality of life: a strategy for sustainable development in the UK. The Stationery Office, London. ISBN 0101434529.
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APPENDIX D Paper 3

Holton, I., Glass, J. and Clarke, M. (2007). *Case studies demonstrating reductions in the consumption of natural resources and energy by the UK precast concrete industry*. In: Jacobsen, S., Jahren, P. and Kjellsen, K.O. (editors). (2007). *Proceedings of the International Conference on Sustainability in the Cement and Concrete Industry*, Lillehammer, Norway, September 2007, pp 501-513.

CASE STUDIES DEMONSTRATING REDUCTIONS IN THE CONSUMPTION OF NATURAL RESOURCES AND ENERGY BY THE UK PRECAST CONCRETE INDUSTRY

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SUMMARY

A four-year research programme to develop and implement a sector sustainability strategy for the UK precast concrete industry was established by the British Precast Concrete Federation in 2004, in collaboration with the Department of Civil and Building Engineering at Loughborough University. The research has shown that a more sustainable precast industry, an industry that takes a proactive approach to resource use, environmental protection and social progress, will be a more profitable and competitive industry. Examples of the proactive approach to sustainability being taken by companies can be found each year in the annual British Precast Best Practice Awards; these cover health and safety and innovation, in addition to sustainability. Using recent award winning entries and other material, a series of best practice case studies have been prepared which demonstrate the economic benefits of reducing the consumption of natural resources and energy, in addition to protecting the environment and achieving social progress.

1 INTRODUCTION

Sustainability is about ensuring that development meets the needs of the present without compromising the ability of future generations to meet their own needs (Brundtland, 1987). Many governments, international bodies and multi-national corporations have realised that it is no longer simply desirable to address these issues, but it is now essential, in order to ensure future growth (Parkin *et al.*, 2003). Business analysts are reporting that those industries and companies that are really improving their performance on sustainability issues are reaping the benefits of growth and investor confidence, whilst those that are not are being left behind (Henriques and Richardson, 2004). Sustainability has thus become a strategic business issue.

The UK precast concrete industry has recognised the importance of sustainability as a strategic business issue and through its trade association, the British Precast Concrete Federation (commonly referred to as British Precast), has assigned dedicated resources to the development of a sector sustainability strategy (Holton *et al.*, 2005).

Strategy development began with the identification and prioritisation of sustainability issues for the precast industry (Holton *et al.*, 2006). The ten key sustainability issues facing the industry were initially identified in a workshop held in September 2005 and subsequently verified across approximately 70% of the industry (by turnover) as part of a questionnaire survey conducted in January 2006. These issues are shown in Figure 1. Three of these issues, external threats, legislation and market image, are pan-industry issues that British Precast takes responsibility for. Company level responses are required to the others; responses that will result in an industry that produces more outputs from fewer inputs, has more profitable operations at less cost, is more efficient with less waste, and has more trained staff with fewer accidents.

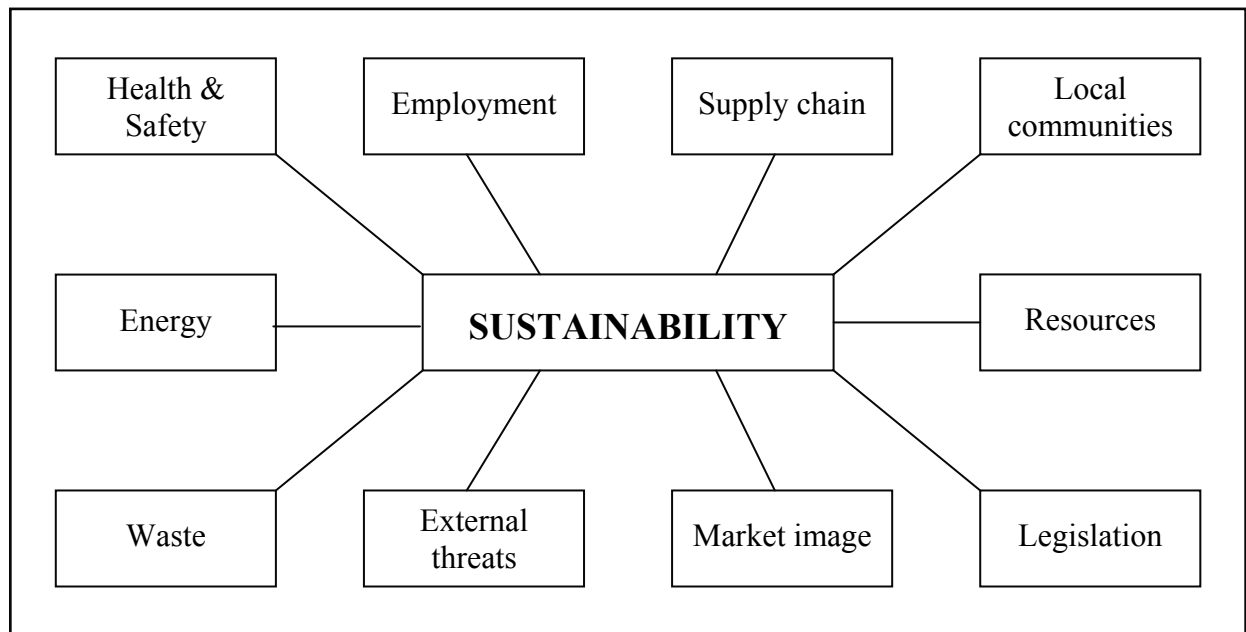


Figure 1: The ten key sustainability issues facing the UK precast concrete industry

The survey also showed some companies in the industry to be more advanced in dealing with the sustainability agenda than others (Holton *et al.*, 2006); the majority of companies were found to be actively implementing policies and procedures relating to health and safety, and environmental compliance, but fewer companies were doing this with respect to resource efficiency and social progress. Being more sustainable involves not just some companies addressing these issues, but encouraging all companies in the precast industry to address them. By progressing from compliance to efficiency to pro-activity on sustainability issues, companies and the industry will share in the benefits of being more sustainable.

Examples of the proactive approach to sustainability being taken by companies can be found each year in the annual British Precast Best Practice Awards (British Precast, 2004; 2005; 2006); these cover health and safety and innovation, in addition to sustainability. Using recent award winning entries, a series of best practice case studies have been prepared which demonstrate the economic benefits of reducing the consumption of natural resources and energy, in addition to protecting the environment and achieving social progress.

2 NATURAL RESOURCES

The five case studies presented in this section demonstrate responsible approaches to the consumption of aggregates and water in precast concrete production, through either maximising their use or using cheaper alternative resources. Reducing cement consumption and the sustainability issues associated with cement production are beyond the scope of this paper.

2.1 Replacement of natural aggregates

An environmental evaluation for generic concrete blocks undertaken by the Building Research Establishment (BRE) in 2005 identified a significant proportion of the environmental impact of concrete blocks to come from the raw materials used; these impacts principally arising from mineral extraction associated with aggregate production and carbon emissions associated with cement production. The Enviromasonry range from Aggregate Industries' Fyfestone Division is a new generation of environmentally engineered concrete block products developed in response to the increasing demand for sustainable products for construction. By using specially selected secondary recycled aggregates and cement replacement materials, the environmental impact of these products is reduced without sacrificing quality or performance. The production processes are also continually analysed to measure performance and determine areas where the impacts associated with materials, water and energy can be reduced. Enviromasonry products comply with all relevant technical standards, and are manufactured under the quality procedures of BS EN ISO 9001 and environmental standard BS EN ISO 14001. In addition, products have a measurable environmental footprint certified by BRE under their Environmental Profiles Scheme.

The benefits of using secondary recycled aggregates include:

- Reduced environmental impact associated with the consumption of natural resources; and
- Utilisation of by-products and wastes from other industries.

Benefits can also be accrued down the supply chain. The Environmental Assessment Method (BREEAM) developed by BRE (Howard *et al.*, 1999) is a scheme for the environmental labelling of buildings; one of its aims is to encourage the use of materials that have a lower impact on the environment. By using products with a low environmental impact such as Enviromasonry, specifiers can achieve more sustainable buildings without having to change from traditional products or construction techniques.

2.2 Recycling waste product

Marley Eternit manufactures an extensive range of concrete roof tiles and associated fittings on several automated, semi-automated and hand-made production lines at their factory at Beenham, Berkshire. There have always been waste streams generated from these activities, but with the introduction of a formal environmental management system certified to ISO 14001, there has been a focus to re-use, reduce or recycle waste wherever possible. Two waste streams are considered here, dry concrete waste and pigmented liquid slurry, both of which were traditionally disposed of to landfill.

In common with many other factories, dry concrete waste used to be disposed of to landfill. A waste concrete crushing facility is now in operation at Beenham, whereby a mobile crushing plant is periodically brought onto site and dry waste concrete is crushed and recycled for use as an aggregate substitute. This not only reduces the cost and impact of disposal to landfill, but also saves 15,000 tonnes of aggregates a year, providing a total saving in the region of €380,000 per annum.

As part of the factory's overall plans for waste minimisation, an effluent plant was installed to treat waste pigmented slurries, negating the need to have waste liquid slurry removed by tanker for treatment and disposal. Treated liquid effluent arising from the plant is also recycled back into the manufacturing process, reducing water consumption. However, a solid waste was left which had to be disposed of as a special waste because of the pigments and treatment chemicals it contained. Trials were undertaken which established that this waste could be crushed and added to the already crushed concrete waste at a rate of 10%, without any detrimental effect on the finished products. This has saved having to dispose of nearly 300 tonnes of hazardous waste each year at a cost of approximately €40,000.

The benefits of these waste management measures were:

- Cost savings on waste disposal, particularly with respect to hazardous liquid wastes;
- Elimination of risks associated with storage and transport of hazardous wastes;
- Reduced raw material costs;
- Reduced water consumption;
- Less environmental impact from reduced consumption of primary aggregates; and
- Less environmental impact from disposal of waste to landfill.

2.3 Dust recycling

At Marshalls' Brookfoot Works, shot-blasting of concrete paving products to create a textured finish generates approximately 100 tonnes per week of dust. Because of concerns about contamination with steel shot, this dust used to be collected in bulk sacks and transported to landfill, a process which was expensive, labour intensive and wasteful of

natural resources. Trials established that any steel shot in the dust could be removed using magnetic separators and that the dust could then be reintroduced into the concrete mix at up to 5% aggregate replacement without any performance issues. A central mechanical dust collection facility was therefore installed to service the four shot-blasting machines at the works, incorporating two magnetic separators and a storage silo. The dust is now transferred by bulk tanker to a second silo from where it is blended with the concrete mix and used to make new products. The payback period on the capital investment was around two years.

Benefits arising from this investment were:

- 5,000 tonnes per annum saving in disposal costs;
- Reduced raw material costs;
- Elimination of a hazardous and labour intensive process, thus saving labour costs and improving working conditions;
- Less environmental impact from reduced consumption of primary aggregates; and
- Less environmental impact from disposal of waste to landfill.

2.4 Alternative water sources

Aggregate Industries manufactures approximately 0.5 million tonnes of precast concrete products per annum at its Hulland Ward site and consumes over 110,000 m³ of water in the process. With mains water costs approaching €1/m³ this clearly represents a significant cost as well as a significant demand on local resources. Since 2002, three methods have been used to reduce the volume of mains water required for production:

- Approximately 60,000 m³ of water per annum is abstracted under licence from a large natural pond located within the site boundary. In addition to providing a resource, the pond also provides a local amenity and a habitat for a wide variety of flora and fauna.
- Approximately 70% of the site rainfall is collected in storage lagoons for reuse in production; the area available for rainwater collection is over 200,000 m².
- All process water is collected and reused in the production process.

The financial costs of these measures are minimal compared to the economic, social and environmental benefits associated with reduced mains water consumption.

2.5 Water treatment

Many precast factories generate process water that has a high pH (11-13), contains solids and heavy metal ions, and has to be treated before discharge. Marshalls' Brookfoot works was no exception, generating approximately 1,400 m³ of process water per week; some of which was recycled, but approximately 880 m³ per week was discharged after treatment. The installation of a CO₂ water treatment system allowed the volume of process water being recycled at the works to be increased, and the volume of water being discharged to be reduced to approximately 50 m³ per week. With this system, process water is collected in external sumps in which heavy particles settle out under gravity, the remaining water is then pumped to the CO₂ plant in which gaseous CO₂ is bubbled through the process water reducing its pH to 7-9 and also reducing the heavy metal content. Solids are separated out in a second stage. The pH neutral water is then pumped back for use in production. The payback period on the investment was just one year.

Benefits arising from this investment were:

- Cost savings from reduced volume of process water being treated and discharged;
- Cost savings from less mains water being drawn;
- Less social and environmental impact on local water services; and
- Improved working conditions with reduced risk of exposure to high pH water.

3 WASTE

Although properly managing and minimising waste can be considered to be an integral part of demonstrating responsible resource consumption, they are also important issues in their own right and therefore warrant separate consideration. Waste management typically starts with waste audits in order to understand what waste is produced where. In some cases, measures can be taken to design out or eliminate waste from the production process. For example, by switching from bagged to bulk deliveries of materials. Where this is not possible, waste streams can be segregated and opportunities for recycling or reusing waste identified, in order to minimise the amount of waste being disposed of to landfill. Similarly, the ways in which products are supplied can be changed by, for example, using packaging materials that can be recycled or returned for reuse. The case studies in this section demonstrate these three approaches.

3.1 Waste management

In 1999, the management of Aggregate Industries' Charcon Division made a commitment to eliminate all aspects of waste from their operations. They began by establishing a waste minimisation steering group and assessing the scope for savings across their business. Four areas were identified in which waste could potentially be reduced; raw materials, secondary materials, energy and water. Their first target was to improve energy efficiency; an investment programme in meter installations isolated the energy consumption of individual manufacturing units and facilitated effective consumption profiling and benchmarking activities. In addition, responsibility for waste minimisation was cascaded down from the steering group to operational line management; factory managers set waste reduction targets for their operations and established multi-disciplined waste minimisation teams to help achieve these targets. Staff at the operational level often have the best understanding of where waste arises and what can be done to minimise it. To support their efforts, a training programme demonstrating waste minimisation strategies was implemented and awareness of the benefits of reducing waste was raised by a poster campaign across offices and factories (Figure 2).

The waste reduction schemes implemented in the first two years alone achieved savings of nearly €500,000 over the nine factories in the Charcon Division, and were considered so successful that the methodology was repeated in 2002. Although the magnitude of the savings achieved has decreased in subsequent years as all the easy targets have been addressed, the culture and determination now exists to tackle some of the harder targets and progress towards a zero waste operation continues to be made.

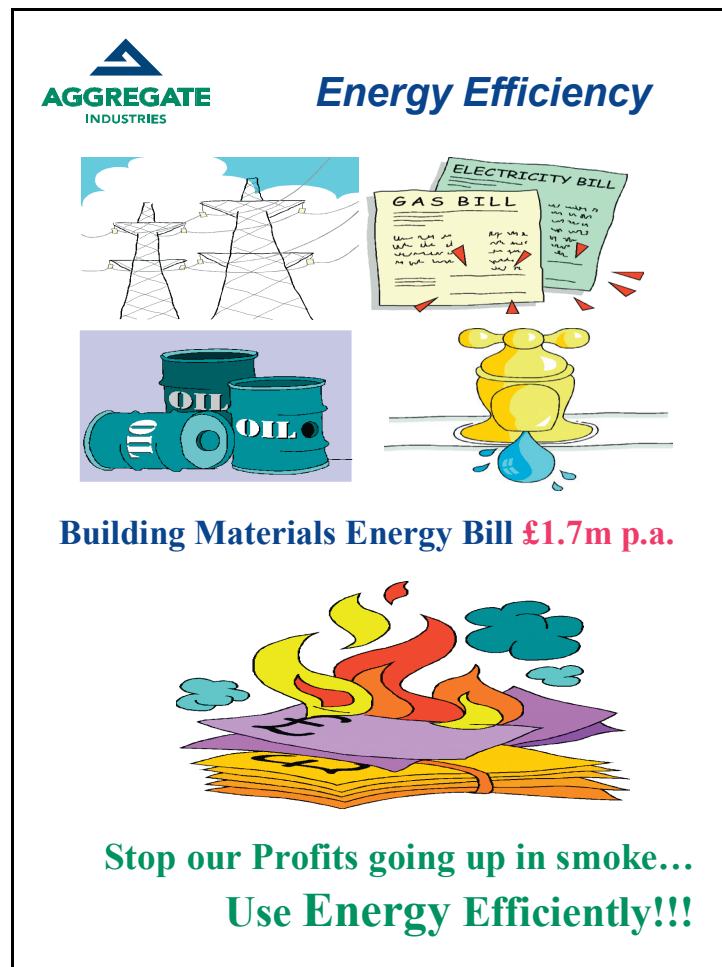


Figure 2: Example from the poster campaign

3.2 Factory waste reduction

All waste generates a cost and in 2001 Marshalls' Brookfoot Works generated 1,200 tonnes of packaging waste from materials delivered to them, which cost approximately €30,000 to dispose of to landfill. This waste consisted of pallets, cardboard, polythene, wood, paper, and polyethylene banding and tubes. A new waste management initiative to recycle packaging waste and reduce this cost was therefore introduced. Before starting the scheme, all employees at the site undertook environmental awareness training to encourage their participation, following which each department nominated an environmental champion to oversee the scheme locally. Through simple measures such as identifying and segregating waste streams, reusing pallets, bailing cardboard and polythene for recycling, and using wood chips for fuel, only 40 tonnes of waste packaging had to be disposed of in 2005. Furthermore, a profit of €15,000 was generated from sales of waste which has been channelled into projects to help the local community.

The benefits of this scheme were:

- Cost saving on waste disposal;
- Less environmental impact from waste disposal;
- Saving resources through recycling and reuse; and
- Assisting the local community.

3.3 Packaging waste reduction

Products need to be adequately packaged to ensure that they are delivered to the customer both safely and without being damaged in transit. Whilst the UK's packaging waste regulations require companies to demonstrate that they are using the minimum quantities of packaging consistent with these needs. The challenge for responsible companies is therefore to optimise the use of packaging and minimise the generation of packaging waste, whilst meeting quality and safety requirements.

Marley Eternit is one company that has risen to this challenge by looking at the packaging its roofing products are sent out in order to reduce waste wherever possible. This has involved optimising plastic thicknesses, reducing cardboard interleaving, and operating a returnable timber pallet scheme. Compared with 2004, the packaging savings in 2005 amounted to 163 tonnes of timber pallets, 43 tonnes of cardboard and 119 tonnes of plastic wrap. This amounted to an annual financial saving of approximately €170,000. Further savings have been generated by recycling packaging materials they receive, rather than disposing of them to landfill.

The benefits of optimising packaging were:

- Cost savings of €170,000 per annum;
- Reduced consumption of resources;
- Less environmental impact from waste disposal; and
- Demonstrating legal compliance.

4 ENERGY

Increasing energy costs combined with concerns over climate change and security of supplies has raised the importance of energy saving in many companies. Whilst savings can be made through investing in more efficient plant, these can be very site and/or process specific and have lengthy payback periods. This section considers some alternatives that are more widely applicable and will provide benefits more quickly.

4.1 Raising staff awareness

A range of energy saving measures that could easily be adopted by other companies are demonstrated in the **SavE** (Save Energy) campaign established by Tarmac Building Products. The campaign is part of the company's commitment to increase its energy efficiency, invest in clean, energy efficient technologies, and reduce the environmental impact arising from its consumption of energy. It is also a key element in achieving the company's ambitious target of reducing its specific energy consumption (i.e. energy used per unit production) by 15% between 2004 and 2014. This equates to a saving of approximately €1 million per annum at current energy prices.

The campaign is the result of a strategy developed by production and engineering management in the business to include all areas of the business, involve all levels of employees and provided a sound framework for monitoring/reviewing progress and achieving the targets. That strategy included:

- The development of a steering group made up of representatives of production management from each distinct area of the company, chaired by a senior manager and supported and facilitated by an energy champion for the business.
- Completion of an initial site survey of all sites by site management to highlight obvious areas of saving.
- Setting site-specific targets for energy reduction with annual interim targets to gauge progress; progress is fed back to sites and employees through business and site-specific graphs.
- Training of all site managers and energy champions in energy efficiency techniques and knowledge by the Carbon Trust.
- The development of an extensive employee information booklet that highlighted areas where everyone could make a difference (Figure 3).
- Topic specific campaigns have been rolled out over a period of months which include information sheets for managers and maintenance personnel supported by toolbox talks to be given to all employees.
- Energy efficient ideas from all levels can be entered into a suggestion scheme with rewards for the best and/or most innovative ideas.

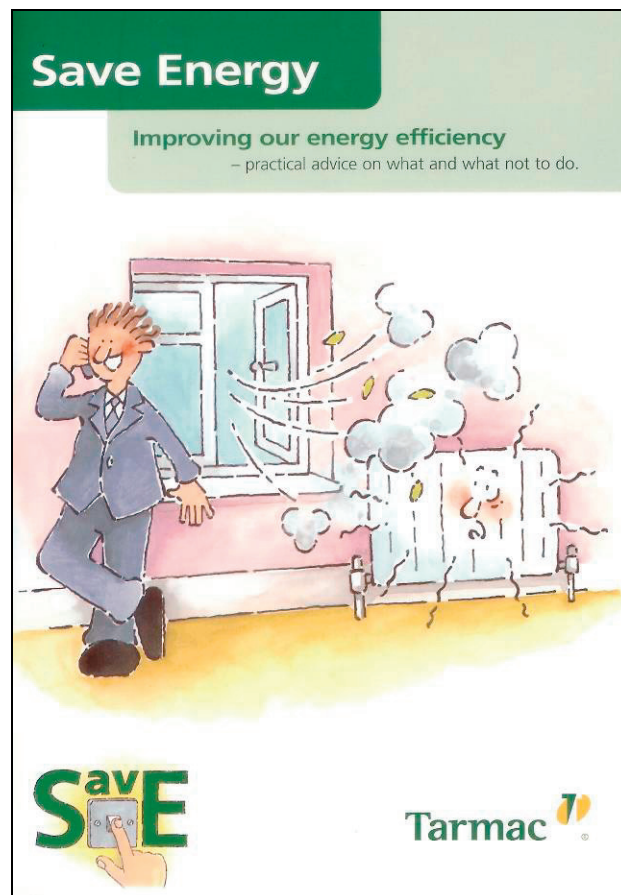


Figure 3: Employee information booklet

As a result of the campaign, energy awareness has increased significantly across the business and early indications are that the reduction targets will be met and probably

surpassed. In addition to reductions in specific energy consumption, reductions in CO₂ emissions from efficient use of energy and alternative fuels have been achieved, together with increases in plant availability as maintenance improves and reductions in solid waste as manufacturing techniques improve. In fact the campaign has been so successful that it is now being promoted across the whole of Tarmac's parent company Anglo American; the scale of their energy use across the globe is equal to that of some countries, so the potential savings are enormous.

This campaign has demonstrated that raising staff awareness and encouraging their participation is just as important an energy saving measure as investing in more efficient plant and processes.

4.2 Self-compacting concrete

Self-compacting concrete (SCC) has often been described as the 'quiet' revolution in concrete construction, because it removes the need to vibrate concrete in order to fully compact it and therefore eliminates the noise associated with vibration from the concrete construction process (Concrete Society, 2005). The use of SCC also offers benefits in other key areas such as construction process, concrete quality, health and safety, and energy. Anecdotal evidence suggests that more than 2/3 of precast factories in the UK are now using SCC in the production of wet cast products; Billington (2003) believes this is due to consistent filling of moulds, better compaction, reliable de-moulding and reduced energy consumption (from needing no vibration). This reduction in energy use is cited as a significant sustainability advantage, with one admixture supplier describing its viscosity-modifying SCC agent as a 'zero energy system' (Corradi *et al.*, 2005). However, despite the advantages of SCC cited in the literature and anecdotally by industrialists, substantiated, accurate quantification of the levels of benefits experienced in all the areas stated (process, quality, health and safety and environment) continues to be absent. A research programme has therefore been established at Loughborough University to provide substantive new data on the business benefits associated with SCC, so that its use can be optimised both on and off-site (Glass *et al.*, 2007). Energy use will be one of the key areas investigated.

5 AN INTEGRATED APPROACH

Bison Concrete Products' new €45 million hollowcore flooring factory at Swadlincote in Derbyshire is the first carousel production facility in the world for precast, prestressed hollowcore flooring slabs. In building the factory, Bison and specialist equipment supplier Nordimpianti, not only introduced state-of-the-art technology which is setting new industry standards in product quality, safety and logistics (Contract Journal, 2006), but also integrated many current best practices on recycling and sustainability into its operation. The key features of the Swadlincote factory and how they contribute to its impressive sustainability credentials are described below.

- Designs are produced in the company's centralised production planning department, then downloaded to the factory and conveyed to the machines via a wireless link. This eliminates printing of drawings, reduces human error in transferring data from the office to the shop floor and provides accurate guidelines to add detail to products such as cut-out and lifting hook locations. Furthermore, Bison employ the latest design and detailing techniques to ensure the adequacy of

the design. The use of pre-stressing in hollow core slabs is the most efficient design for flooring and produces a least weight to span ratio. Designs for all products are configured to optimise the minimum use of materials consistent with the robust requirements of the building.

- To speed up production, 150 m lengths of pre-stressing wire are pre-prepared in a facility adjacent to the main production area, and wound on to drums. A drum with the correct number and size of wires is then brought in when required and the wires simply run down the casting bed by machine and pre-tensioned, removing the need to cut and prepare wires on the casting beds.
- The fully automated production process based on the carousel principle is highly efficient, and the resulting product is able to combine high quality and accuracy with significant economy. The carousel process utilises fixed casting and sawing stations with moving casting beds. This has enabled larger machines to be used, bringing increased speed and efficiency to the production process; the complete casting, curing and cutting process can take as little as 12 hours. Health and safety risks during production are significantly reduced as a consequence, as less manual input is required and many of the risks associated with the use of mobile casting and sawing equipment have been eliminated.
- Any special end details required are hydraulically pressed into the fresh concrete and the waste material sucked out to be recycled. This has eliminated a time consuming labour intensive process, and is more accurate.
- Bison are committed to environmental impact studies, including Life Cycle Analysis of their manufacturing techniques as a method of mapping operational decisions. A closed circuit recycling process enables all wet waste from the production process to be automatically conveyed to a central recycling plant where the constituent materials are reclaimed. Depending on its cementitious content, water is either cleaned and used for washing, or returned to the mix to optimise cement consumption. Aggregates are cleaned and added to production stocks or transferred to the on-site crushing station where all dry waste from the production process is recycled.
- Steam curing takes place in a series of cloches; the temperature and time products spend in each cloche being optimised to achieve the desired rate of strength gain with the minimum input of heat energy.
- Credit card sized plastic cards glued to the product just before it is cut, contain unique data stored on programmable chips in the cards, such as delivery load number and the bed serial number. The system provides a fail-safe approach to identifying a specific product during the production process and in transport. It also provides for long-term access to data such as layout drawings and product specifications, should change of use of a building be required in the future.
- The computer controlled dry cutting machines are housed in a sound-proofed booth to reduce noise levels in the factory. Reading data from the programmed cards, the increasing amount of detail required by customers can be quickly and accurately

cut into each product. Weep holes and other secondary details are added in a similar manner, once the products have been stripped from the casting beds.

- Once the product is manufactured and cut to shape, it is loaded onto delivery pallets in the sequence required for erection on site. The complete load, weighing up to 30 tonnes, is then picked up by a straddle crane and put on a vehicle, locked and sent to site, saving time, loading errors and double handling of products.

Swadlincote is now probably the most efficient concrete flooring plant in the UK; this has been achieved by integrating key sustainability practices such as maximising the use of resources, minimising energy consumption and providing a safe and healthy working environment, in order to achieve significant economic benefits.

6 DISCUSSION

A technique has yet to be found in which precast concrete products can be made without consuming aggregates and water, but many of these case studies show ways in which the demand for these primary resources can be reduced, often generating considerable cost savings from minimal investment. Consumption of virgin aggregates can be reduced by utilising by-products and waste materials from our own production processes or from other industries. Water consumption can be reduced by using alternative sources, or treating and recycling. Effective waste management can minimise the waste we generate and maximise what we recycle. Remember, waste has to be accounted for twice; firstly the cost of producing it and secondly the cost of disposing of it. Indications of the annual cost savings achievable are given in Table 1, based on the case studies.

Table 1: Cost savings achieved through saving natural resources

Target	Action	Annual savings
Reduce consumption of virgin aggregates	Recycle by-products and waste into the production process	Recycling 7,000 tonnes of dry concrete waste saved €100,000 in disposal costs and €80,000 in aggregates
Reduce mains water consumption	Alternative sources, collection and recycling	Using 110,000 m ³ on non-mains water saved approx. €100,000
Factory waste reduction	Waste management including segregation and recycling of waste streams	Recycling 1,200 tonnes of waste saved €30,000 in disposal costs and raised €3,000
Packaging waste reduction	Optimise product packaging	Saving 325 tonnes of packaging materials saved €170,000

Raising staff awareness to the benefits of recycling and conserving natural resources has contributed to the successful implementation of the schemes described. It is also an important aspect of energy management, alongside investment in more efficient plant and processes. But visionary management is also required to see the economic, environmental and social benefits of implementing more sustainable practices; such management is exemplified by Bison Concrete Products integration of sustainability best practices into its new Swadlincote factory.

However, whilst many more examples of good and best practice on sustainability can be found in the UK precast concrete industry; there are still a large number of factories in which natural resources and energy are not being used as effectively as they could be. British Precast in its role as the industry's trade association cannot force companies to change, it can only help to identify and disseminate best practice; this is achieved primarily through its awards, events and publications. It is then up to companies to take advantage of the information and networking opportunities provided through membership of their trade association in order to learn from others and realise the economic, environmental and social benefits that can be gained from adopting best practice and becoming more sustainable.

7 CONCLUSIONS

The aim of the British Precast Sustainability Award scheme is to reward excellence within the British Precast membership and to publicise the progress of the industry towards sustainability. The case studies included in this paper demonstrate not just the progress being achieved by companies on sustainability, but the economic benefits that can be achieved by reducing consumption of natural resources and energy, in addition to protecting the environment and achieving social progress. Many of the measures employed were relatively simple and provided rapid return on investment from the sometimes significant savings achieved; savings that arose on an annual basis. Companies in the UK and elsewhere are encouraged to learn from these examples and move towards a proactive approach to sustainability. They are also encouraged to take advantage of the opportunities to make progress on sustainability provided through membership of British Precast or their own national trade association.

8 ACKNOWLEDGEMENTS

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APPENDIX E Paper 4

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FACILITATING PROGRESS TOWARDS A MORE SUSTAINABLE PRECAST CONCRETE INDUSTRY IN THE UK

Ian Holton¹, Jacqui Glass², Andrew Price³, Martin Clarke⁴, Stuart Bell⁵ and Miles Watkins⁶

ABSTRACT

As part of its strategy for more sustainable construction, the UK Government has been encouraging trade associations to develop sector sustainability strategies. A four-year research programme aimed at developing such a strategy for the precast industry was therefore established by British Precast in 2004, in collaboration with Loughborough University. The research has shown that a more sustainable precast industry will be a more profitable and competitive industry, but companies were found to be in different stages of development on sustainability. Facilitating progress across the industry on sustainability thus became a priority for the research programme. Lessons regarding facilitating the progression of the industry have been identified from examination of the 'Concrete Targets' schemes for improving health and safety. Using these lessons and emerging best practice, a programme of measures to facilitate progress towards a more sustainable precast industry will be developed and implemented over the period 2007-2009; the programme is described in outline.

Keywords: Precast, Sustainability, Strategy, Health and safety, Performance improvement

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1 INTRODUCTION

Sustainable development calls for improving the quality of life for all of the world's people without increasing the use of natural resources beyond the earth's carrying capacity (United Nations, 2001). Its achievement requires the integration of actions in the key areas of economic growth and equity, conserving natural resources and the environment, and social development (United Nations, 2001).

The UK precast concrete industry has recognised the importance of sustainability as a strategic business issue and has assigned dedicated resources to the development of a sector sustainability strategy (Holton *et al.*, 2005). Research to identify and prioritise the sustainability issues for the precast industry found that different groups of companies had different sustainability priorities as a result of companies being in different stages of development on sustainability, corresponding to the phases of a corporate sustainability model (Holton *et al.*, 2006). From this, the need to engage with the whole industry and to facilitate the progression of companies through the phases of the model was identified as a priority for the precast sector sustainability strategy.

Lessons regarding facilitating progress across the industry have been identified from examination of the 'Concrete Targets' schemes from British Precast for improving health and safety in the industry. Using these lessons and emerging best practice, a programme of measures to facilitate progress towards a more sustainable precast industry will be developed and implemented over the period 2007-2009; the programme is described in outline.

2 SUSTAINABILITY AND THE UK PRECAST CONCRETE INDUSTRY

The construction industry creates and maintains the built environment. Its impact on society is therefore critical since the built environment provides the context for most human activities and has a huge impact on quality of life. The construction industry also provides employment for approximately 1.5 million people in the UK and accounts for approximately 8% of Gross Domestic Product (DTI, 2004). Sustainable construction is therefore of significance within the overall concept of sustainable development in the UK, which the Government has acknowledged (DETR, 1998).

The Government's strategy for sustainable construction (DETR, 2000) recognised that the achievement of more sustainable construction would require actions from itself, industries and individual businesses. The Government has been making progress towards sustainable construction through its policies, legislations and programmes (DTI, 2003; 2004). In order to encourage industries and businesses to address the sustainability agenda, sector representative bodies and trade associations were challenged to develop sector sustainability strategies.

A sector can be defined as a part or branch of a particular area of activity, especially of a country's economy (Hornby, 1995); sectors can include everything from small groups of large multinational corporations to large groups of small and medium sized enterprises and even collections of individual professionals (Sustainable Development Commission, 2002a). Sector sustainability strategies were thus seen as providing a framework to help

business sectors identify and manage economic, environmental and social risks in an integrated way, and unlock opportunities to improve competitiveness and enhance reputation (DETR, 2000). It was also considered that trade associations which ignored sustainability issues, or tried to fend them off rather than turning them to competitive advantage, were likely to become less effective champions for their members and their sectors (Sustainable Development Commission, 2002b).

The UK construction industry is generally recognised as comprising four principal activities; building, civil engineering, construction materials and products, and associated professional services (DETR, 2000). Construction materials and products is the largest of these four activity groups with an annual turnover in excess of £40 billion, which accounts for approximately 40% of total construction output, 20% of the UK's manufacturing output and 4% of GDP (CPA, 2005). This in turn is divided into four main areas, raw materials, fabricated components, fixtures and fittings, and cladding and insulation, which provide employment for over 650,000 people in almost 30,000 companies. Over 40 trade associations exist to serve different interests within the construction products industry (CPA, 2005), several of which have now published and begun implementation of sector sustainability strategies, including the brick (Brick Development Association, 2002), forest industries (Forest Industries Development Council, 2004) and steel construction sectors (Steel Construction Institute, 2002).

The cement and concrete sector has acknowledged that it has a responsibility to improve the sustainability of its products (Collins, 2003), and has also reported on the progress of the sector towards sustainability (Parrott, 2002; British Cement Association, 2003). However, unlike some other sectors of the construction products industry, the cement and concrete sector comprises four distinct areas, cement, aggregates, ready-mixed concrete and precast concrete, each with its own trade association, issues and agendas. Rather than develop an over-arching strategy, these trade associations have opted to develop individual sector sustainability strategies.

The British Precast Concrete Federation (British Precast) is the trade federation for the precast sector in the UK. Following consultation with its members, British Precast identified the need to develop a sustainability strategy for the precast concrete sector in order to support the competitiveness of the sector and ensure its long-term future (Holton *et al.*, 2005). A four-year research programme to develop this strategy commenced in October 2004, in collaboration with the Department of Civil and Building Engineering at Loughborough University.

3 THE STRATEGY DEVELOPMENT PROCESS

To accelerate the development and implementation of sector sustainability strategies, a best practice forum, the Pioneers Group, was established by two government departments (DTI and DEFRA) in 2001 (Sustainable Development Commission, 2002b). Over 40 sectoral organisations covering a range of manufacturing and service industries participated in the Group between July 2001 and June 2003 (Hunter, 2003). Basic mentoring was provided to those organisations starting to develop sustainability strategies, and more advanced mentoring to those involved in implementing strategies and monitoring and reporting their progress.

As a result of the Group’s activities a number of documents were made available to assist in the strategy development process, including a best practice toolkit (Optimat, 2002). This suggests information a strategy document should contain and provides an outline process for collecting this information, as shown in Figure 1.

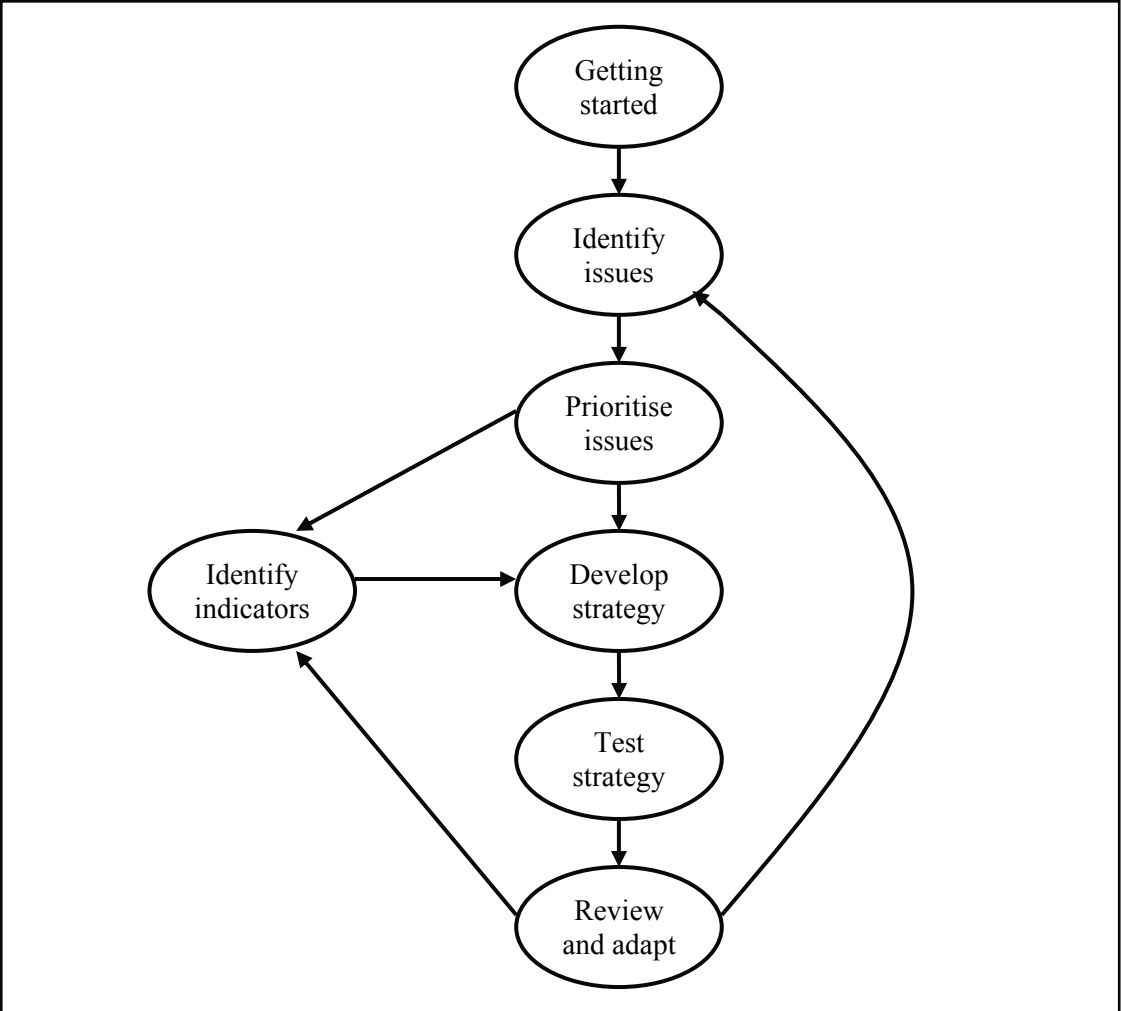


Figure 1: Sector sustainability strategy development procedure (Optimat, 2002)

The first stage in the process involves recognising the importance of sustainable development as a strategic business issue and assigning dedicated resources to strategy development. As British Precast had already done this, development of the precast sector sustainability strategy began with the identification and prioritisation of sustainability issues.

A facilitated workshop was held in September 2005 with 15 technical and environmental professionals from British Precast’s member companies (Holton et al., 2006). The fundamental business concern of participants in the workshop was found to be the profitability and competitiveness of both individual companies and the precast industry as a whole. Ten key factors affecting the profitability and competitiveness of the industry were then identified, as shown in Figure 2. These factors can be seen to comprise a range of economic, social and environmental issues, either directly or in combination. Thus

measures taken to address these issues and improve the profitability and competitiveness of the precast industry, would also improve its sustainability. This view is supported by Bennett and Crudgington (2003) who reported a growing consensus in the UK as to the competitive advantage that can be conferred by businesses taking a sustainable approach.

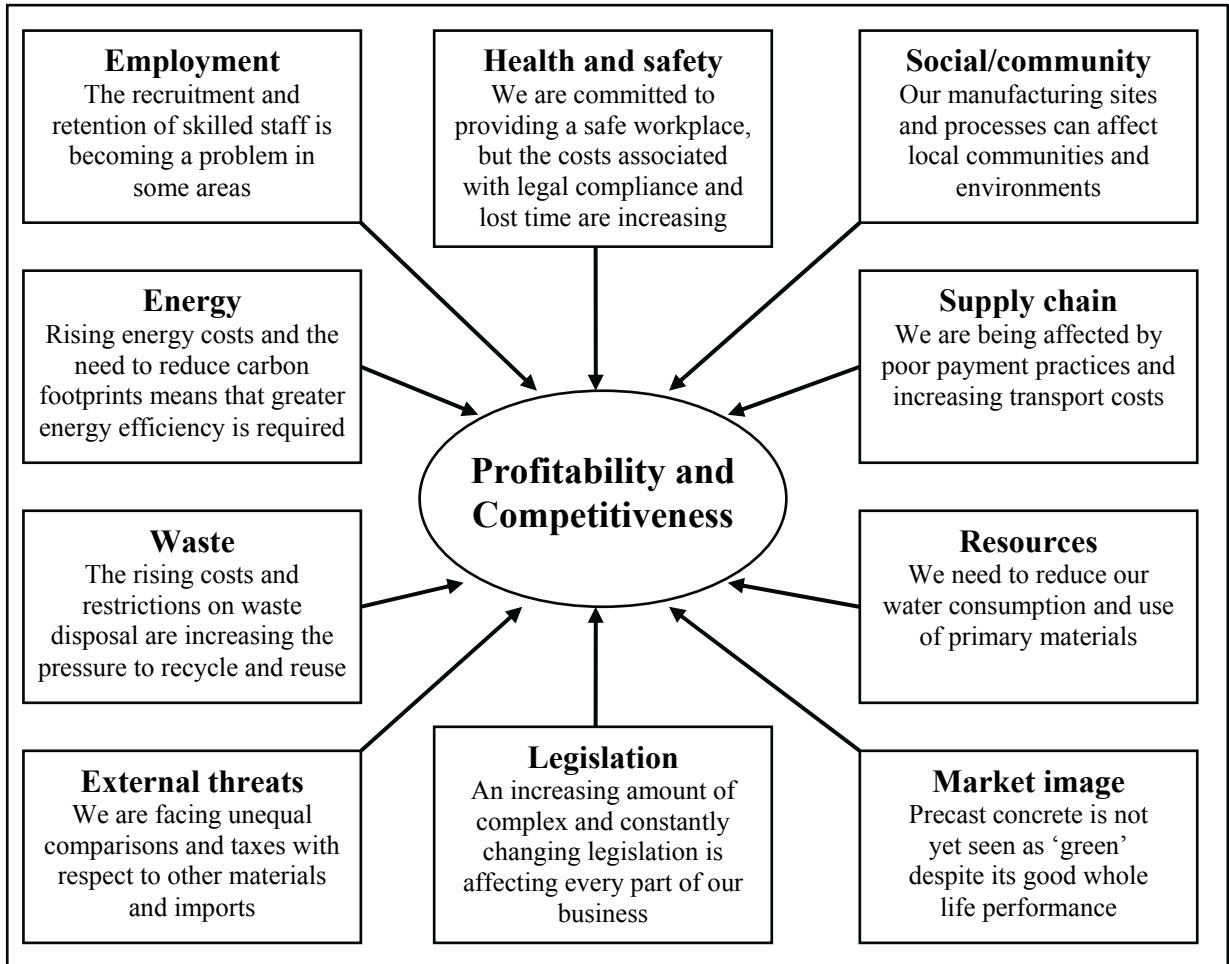


Figure 2: Key factors affecting the profitability and competitiveness of the industry

Consideration of the factors described in Figure 2, shows that three are pan-industry issues: external threats; legislation; and market image. As the industry's trade association, British Precast exists to manage these issues on behalf of the industry (Clarke, 2003). The other issues, relating to internal performance and external effects, need to be addressed at company level.

A postal questionnaire survey was used to consult a wider section of the precast industry on the issues identified in the workshop in order to validate and prioritise those issues (Holton *et al.*, 2006). 63 companies participated in the survey from an estimated 500 in the industry; these companies together operated nearly 200 precast factories and had an annual turnover in excess of £1.6 billion. Since the annual turnover of the precast industry at the time of the survey was estimated to be in the region of £2.3 billion, the survey can therefore be considered to represent approximately 70% of the industry. In addition, the 63 participating companies varied in size from single factory operations with less than 20

employees, to divisions of multi-national corporations operating multiple factories and employing over 1,000 staff, and were therefore representative of the diversity of company size within the industry.

The survey results succeeded in validating the issues identified in the workshop, but priorities were found to vary between different groups of companies (Holton *et al.*, 2006). The variations were most noticeable between the small to medium size enterprise (SME) companies and the six companies with annual turnovers > £100 million.

The survey also investigated the existence or development of policies and procedures in companies in order to provide an indication of whether the industry was beginning to address those business issues relating to environmental protection, resource use and social progress (Holton *et al.*, 2006). The results with respect to ten typical areas are shown in Figure 3. The industry was found to have a high level of adoption of policies and procedures in the areas related to safety and environmental compliance, but lower levels in the areas related to resource efficiency and social progress; those companies with turnovers > £100 million were found to have policies and procedures in place or under development in the majority of the areas investigated. Since these policies and procedures all relate to aspects of sustainability, this suggests that some companies in the industry are more advanced in tackling the sustainability agenda than others.

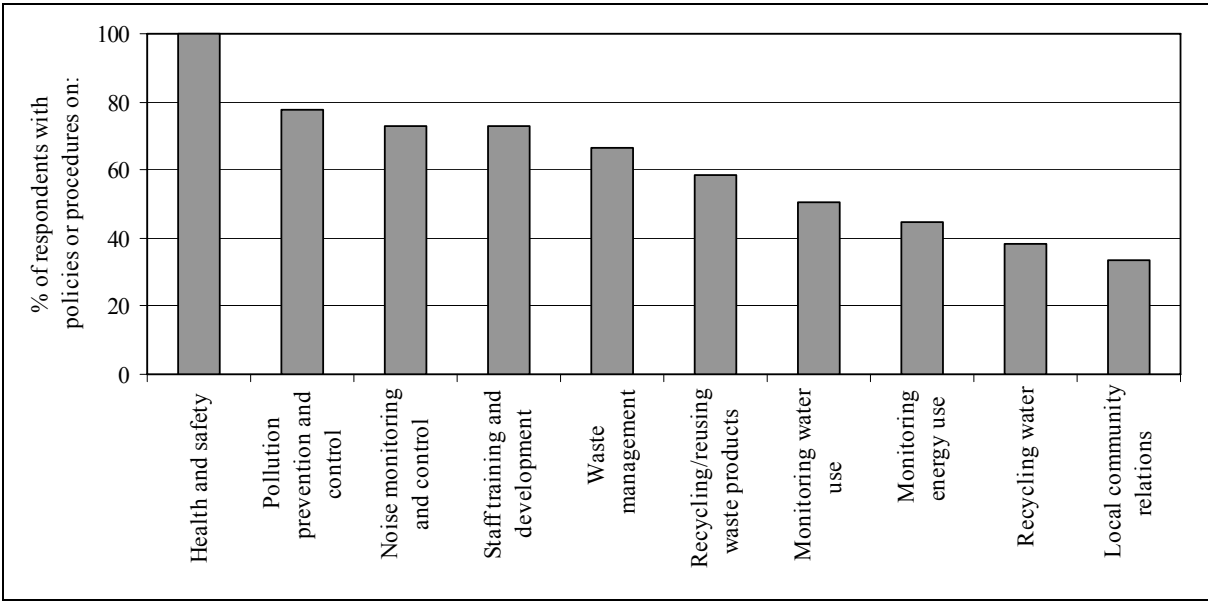


Figure 3: Prevalence of policies and procedures in the industry

Dunphy *et al* (2003) describe six phases in the development of corporate sustainability, as summarised in Table 1 (Benn *et al.*, 2006). The phases outline a set of distinct steps organisations take in progressing towards human and ecological sustainability. There is a progression from active antagonism, through indifference, to a strong commitment to actively furthering sustainability values, not only within the organisation but within industry and society as a whole.

Table 1: Phases in the development of corporate sustainability (Benn *et al.*, 2006)

PHASE	HUMAN SUSTAINABILITY	ECOLOGICAL SUSTAINABILITY
1. Rejection	Employees and subcontractors exploited. Community concerns are rejected outright.	The environment is regarded as a free good to be exploited.
2. Non-responsiveness	Financial and technological factors exclude broader social concerns.	Ecological factors are excluded from decision-making.
3. Compliance	The emphasis is on compliance with legal requirements in industrial relations and safety.	Ecological issues unlikely to attract strong litigation or strong community action are ignored.
4. Efficiency	Technical and supervisory training augmented with interpersonal skills training. Community projects and HR value-adding strategies are pursued only when a cost benefit to the company is obvious.	Environmental issues are ignored if they are not seen as generating avoidable costs or increasing inefficiencies. Sales of by-products are encouraged.
5. Strategic pro-activity	Intellectual and social capital is used to develop strategic advantage through innovation in products/services.	Proactive environmental strategies such as product and process redesign are seen as a source of competitive advantage.
6. The Sustaining Corporation	Key goals both inside and outside the firm are the pursuit of equity and human welfare and potential.	The firm works with society towards ecological renewal and positive sustainability policies.

Certain companies in the precast industry, typically those with turnovers > £100 million, are recognised as operating in the higher phases of this model because of their pro-active performance on environmental and social issues, and contribution to the emergence of a sustainable society. Others can be considered to be in the middle phases, showing increasing awareness of the link between sustainability and business efficiency, whilst some are still in the lower phases, rejecting or not responding to the issue of sustainability. Holton *et al* (2006) therefore concluded that differences in the sustainability priorities of companies in the precast industry were to be expected, and identified the need to engage with the whole industry and to facilitate the progress of individual companies through the phases of the sustainability model as a priority for the precast sector sustainability strategy.

4 FACILITATING PROGRESS

The questionnaire survey found health and safety to be the highest priority issue across the industry, regardless of company size (Holton *et al.*, 2006). The importance of continuously improving the industry's performance on health and safety has long been recognised by British Precast; its 'Concrete Targets' schemes were created for that purpose and have been successful in raising performance on health and safety across the industry. Lessons regarding facilitating the progression of the industry can therefore be identified from examination of these schemes.

The first ‘Concrete Targets’ scheme for accident reduction was launched by British Precast in 2001 as a response to the Government’s ‘Revitalising Health and Safety’ initiative (British Precast, 2006). The schemes target was for a 50% reduction in accidents and lost time over the five years to 2006. Although the 21 member companies supporting the scheme recorded a 45% reduction after four years, they narrowly missed the five year target. Despite this, the scheme was highly regarded by the Health and Safety Executive (HSE) as a benchmark programme for accident reduction; the HSE estimated that scheme members performed 50% better than non-scheme members. Participants in the scheme also reported cost savings in terms of less accidents, less visits from HSE, more opportunity to cut insurance costs, less production disruption, more efficient production, less lost time days and improved employee engagement in business needs (British Precast, 2005).

The current scheme, ‘Concrete Targets 2010’, came into operation in January 2006 (British Precast, 2006) with the aim of continually improving the corporate financial, environmental and social responsibility performance of each company by reducing accidents, improving communication, sharing best practice and areas of concern, improving plant efficiency and reducing environmental impact. The overall target of the rolling five year programme is to reduce the RIDDOR (Reporting of Injuries, Diseases and Dangerous Occurrences Regulations) rate by at least 50% from the 2005 base year, working towards a sector target of zero accidents and zero injuries. 31 member companies have pledged to support the scheme; that pledge is a serious commitment, requiring companies to provide evidence of satisfactory implementation of improvement activities, supported by submission of key statistics.

A key feature of the scheme is the setting of specific safety themes each year in the key areas of physical safety, occupational health and human factors; example themes are given in Table 2. These themes are selected in support of HSE ‘hot topics’, changes in legislation and practical industry needs and aspirations. Although the onus is on individual companies to work out how to improve their performance under each of the specified themes, British Precast produces supporting documentation each year describing how to implement improvement activities and sharing best practice that has been developed within the precast industry or parallel industries. Annual Awards are presented to scheme members in recognition of achievements in accident reduction, and in order to reward individual and team performance; the latter to improve employee engagement and involvement.

Table 2: Example safety themes from ‘Concrete Targets 2010’ [25]

PHYSICAL SAFETY	OCCUPATIONAL HEALTH	HUMAN FACTORS
Transport	Vibration and noise	Consultation and involvement
Slips and trips	Health and absence management	Control of contractors
Manual handling	Silica/asthma problems	Audit and inspection
Working at height	Skin or stress	Risk assessment
Machinery	Musculo-skeletal disease	Training

4.1 Lessons Identified

The following lessons for facilitating progress across the industry have been identified from the 'Concrete Targets' schemes:

- there need to be clear and tangible benefits to companies from participating;
- clear objectives and targets for improvement need to be specified, covering issues of importance to both the industry and its stakeholders;
- good quality data needs to be collected in order to measure progress;
- progress needs to be demonstrated to stakeholders; and
- best practice needs to be recognised and supporting documentation produced in order to promote it to others.

Emerging best practice by trade associations in addressing the challenges of sustainable development at sector level supports these lessons and provides additional guidance for facilitating progress (Trade Association Forum, 2007). This additional guidance includes measuring sector performance, making commitments and promoting sustainable industry standards through voluntary certification schemes.

5 TOWARDS A MORE SUSTAINABLE PRECAST INDUSTRY

Using the lessons identified from the 'Concrete Targets' schemes and the emerging best practice by trade associations (Trade Association Forum, 2007), a programme of measures to engage with the industry and facilitate progress towards a more sustainable precast industry has been proposed. The outline programme was approved by the governing body for British Precast in March 2007, and phased development and implementation is expected to take place over the period 2007-2009. The five phases of the programme are described here in outline.

Phase 1: Key Performance Indicators. Phase 1 involves the introduction of a set of sustainability Key Performance Indicators (KPIs); the indicator set will reflect the issues shown in Figure 2. The rationale for establishing KPIs for sustainability is that in order to remain profitable and competitive, the precast industry must show key stakeholders such as the Government and its major customers, that it is continuously improving its performance on a range of economic, environmental and social issues. If the industry does not do this, Government policy and legislation will force changes upon it and customers will turn to industries and products that are perceived to be 'more sustainable'. The use of KPIs to measure and report progress on sustainability is a well established practice (Trade Association Forum, 2007). The Government, for example, measures the success of its policies and legislative programmes in achieving progress on sustainability in the UK through its 'quality of life' indicators (DEFRA, 2006).

Phase 2: Sustainability Charter. The objective of the Sustainability Charter is to engender commitment from companies to a set of industry-based principles that will contribute to economic viability, social progress and environmental responsibility in the precast concrete sector. Achieving Charter status will allow a company to demonstrate that it is going beyond legislation and undertaking voluntary actions to improve its performance on a range of issues under the broad theme of sustainability, and will provide stakeholders with a means to differentiate between those companies that are committed to sustainability and continuous improvement of their performance, and those that are not. Voluntary

certification schemes such as this are now emerging across many industries and increasingly being used in procurement specifications (Trade Association Forum, 2007).

Phase 3: Certification Scheme. Responsibly sourced materials credits provide a means for encouraging the use of more sustainably produced products. They are already a feature of the Code for Sustainable Homes (DCLG, 2006) and are set to be commonly used in the construction industry. To obtain these credits, a certified Chain of Custody is required for a product throughout its supply chain. The independent certification scheme for sustainable timber developed by the Forest Stewardship Council (FSC) is a widely recognised example of a Chain of Custody scheme (Trade Association Forum, 2007). British Precast is working with The Concrete Centre and other organisations in the cement and concrete industry to develop a certified Chain of Custody scheme for cement-based building products.

Chain of Custody certification provides evidence that the sources and processes by which a product has been made are managed in accordance with a series of sustainability policies and standards. It applies whenever a company carries out any material alteration to the product and whenever they are in physical or legal ownership of it. These policies and standards must verify that all local and national legislative requirements are met, and assess that initiatives are in place to ensure continuous performance improvement on social and environmental issues. The verification process is usually referred to as Product Stewardship certification. The Sustainability Charter (Phase 2) is the first stage in the development of a certified Product Stewardship scheme for precast producers.

Phase 4: Best Practice Forum. In order to encourage participation and performance improvement amongst smaller companies, a series of best practice and other guidance documents will be developed, and seminars and workshops held in order to disseminate this information and provide a discussion forum for companies to participate in.

In addition, the annual British Precast Sustainability Awards scheme will be revised in order to recognise improvement in addition to excellence.

Phase 5: Objectives, indicators and targets for improvement. The Sustainable Development Commission identified the adoption of objectives, indicators and targets to be one of the key features in a sector sustainability strategy (Sustainable Development Commission, 2002a). Objectives for improvement will need to cover the internal performance and external effects issues for the industry shown in Figure 2, and relate to the UK Government's strategies for sustainable development (DEFRA, 2005) and more sustainable construction (DETR, 2000). Of particular interest are the targets and visions for sustainable construction to 2015 and beyond, proposed by the government in its Sustainable Construction Strategy Review (DTI, 2006), because they indicate where government wishes to see the construction industry going in terms of its future development.

6 CONCLUSIONS

Research to identify and prioritise the sustainability issues for the UK precast industry found that different groups of companies had different sustainability priorities as a result of companies being in different phases of a corporate sustainability model (Holton *et al.*, 2006). From this, the need to engage with the whole industry and to facilitate the progress

of individual companies through the phases of the model was identified as a priority for the precast sector sustainability strategy.

Health and safety has been identified as the highest priority issue across the industry. The importance of continuously improving the industry's performance on health and safety has long been recognised by British Precast, and its 'Concrete Targets' schemes were created for that purpose. Lessons regarding facilitating progression across the industry have been identified from examination of these successful schemes.

Using the lessons identified and emerging best practice (Trade Association Forum, 2007), a programme of measures to facilitate progress towards a more sustainable precast industry will be developed and implemented over the period 2007-2009. The programme will allow directors, business managers and factory managers to improve the sustainability, and therefore profitability and competitiveness of their operations, thereby ensuring a future for their companies. They will also be able to accurately assess where they stand against their competitors and the industry as a whole, learn from others on specific issues, and achieve recognition and reward for their achievements. While British Precast will be able to demonstrate a proactive approach to sustainability that is applicable to all companies in the sector and report measurable progress on sustainability issues to key stakeholders, thereby increasing their confidence in the precast industry. Progress in the development and implementation of the programme will be reported on the website www.sustainableprecast.com.

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APPENDIX F Paper 5

Holton, I., Glass, J. and Price, A. (Forthcoming). *Managing for sustainability: findings from four company case studies in the UK precast concrete industry*. Submitted to the Journal of Cleaner Production, July 2008.

MANAGING FOR SUSTAINABILITY: FINDINGS FROM FOUR COMPANY CASE STUDIES IN THE UK PRECAST CONCRETE INDUSTRY

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Abstract

Managing for sustainability is considered to be critical to the development of corporate sustainability, and is fundamentally about strategic organisational development and change. This paper presents the key findings from four case studies undertaken to investigate how leaders in corporate sustainability in the UK precast concrete industry had developed the capabilities necessary to manage for sustainability. It was found that by adopting a compliance approach, characterised by the development of management systems and continuous performance improvement cultures, the four companies studied were developing the capabilities necessary to manage for sustainability and had progressed naturally to the 'efficiency' phase of corporate sustainability.

Keywords: *Corporate sustainability; Organisational development; Management systems; Management capabilities; Change agents.*

1 INTRODUCTION

Using the ‘triple bottom line’ concept described by Elkington (1997), corporate sustainability can be defined as improving corporate social, environmental and financial performance in a balanced and integrated way. Azapagic (2003) notes that for many industry leaders and corporations, corporate sustainability has become an invaluable tool for exploring ways to reduce costs, manage risks, create new products, and drive fundamental internal changes in culture and structure. However, Azapagic (2003) also notes that achieving corporate sustainability is not a trivial task.

The UK construction industry is generally recognised as comprising four principal activities, of which construction materials and products is the largest with an annual turnover in excess of £40 billion, which accounts for approximately 40% of total construction output and 20% of the UK’s manufacturing output (CPA, 2005). The construction industry in the UK is under increasing legal and commercial pressure to become more sustainable (Bennett and Crudgington, 2003), whilst being made increasingly aware of the many strategic and operational benefits that good management of sustainability would offer to companies in the industry (SCTG, 2002); corporate sustainability has thus become an important issue for the UK construction products industry.

Dunphy *et al.* (2003) suggest that managing for sustainability is critical to the development of corporate sustainability. Roome (1998) states that managing for sustainability is fundamentally about strategic organisational development and change, change in management structure, systems and competencies. This paper presents the findings from four company case studies undertaken in the UK precast concrete industry, an important part of the UK construction products industry (Clarke, 2003). The overall research aim was to investigate how leaders in corporate sustainability in the precast industry had developed the capabilities necessary to manage for sustainability. The paper begins with a description of the context for the study, following which the research approach and a summary of the key findings are presented. The results are then discussed with reference to some of the key sources of literature in the area. It was found that by adopting a compliance approach to managing for sustainability, characterised by the development of management systems and continuous performance improvement cultures, the four companies studied were developing the capabilities necessary to manage for sustainability described in BS 8900 and had progressed naturally to the ‘efficiency’ phase of corporate sustainability as defined by Dunphy *et al.* (2003).

Although this study relates to a specific sector of the UK construction products industry, becoming more sustainable and managing for sustainability are issues faced by many companies in many sectors of many industries. The findings may therefore be of relevance to a range of parties working in this field.

2 SUSTAINABILITY AND THE UK PRECAST CONCRETE SECTOR

The construction industry creates and maintains the built environment. Its impact on society is therefore critical since the built environment provides the context for most human activities and has a huge impact on our quality of life. The construction industry also provides employment for 1.5 million people in the UK and accounts for approximately

8% of Gross Domestic Product (DTI, 2004). The UK Government has: acknowledged the significance of the construction industry within the overall concept of sustainable development in the UK; recognised the benefits which could flow from a more efficient and sustainable construction industry (DETR, 1998); and been making progress towards more sustainable construction through its policies, legislations and programmes (DTI, 2003 and 2004), including publishing a sustainability strategy specifically for the construction industry (DETR, 2000).*

The Government's strategy for more sustainable construction (DETR, 2000) recognised that action would also be required by the construction industry. To encourage action, industry sector representative bodies and trade associations were challenged to develop sector sustainability strategies.† These strategies were seen as providing a framework to help business sectors identify and manage economic, environmental and social risks in an integrated way, and unlock opportunities to improve competitiveness and enhance reputation (DETR, 2000). It was also considered that trade associations that ignored sustainability issues, or tried to fend them off rather than turning them to competitive advantage, were likely to become less effective champions for their members and their sectors (SDC, 2002b). As such a trade federation, the British Precast Concrete Federation (British Precast), represents an extremely diverse industry sector. There are over 500 precast companies in the UK, manufacturing products such as concrete pipes, blocks, tiles and structural elements, and ranging in size from small, independently-owned, single factory operations often employing less than 10 people, to divisions of multi-national companies with 10 or more factories and over 1,000 staff. Following consultation with its members, British Precast identified the need to develop a sustainability strategy for the sector to support its competitiveness and ensure its long-term future (Holton *et al.*, 2005); a four-year research programme to develop this strategy commenced in October 2004, in collaboration with the Department of Civil and Building Engineering at Loughborough University.

Based on established best practice (Optimat, 2002), the strategy development process began with the identification and prioritisation of sustainability issues for the sector (Holton *et al.*, 2006). Although a common set of sustainability issues was identified and verified across approximately 70% of the industry (by turnover) as shown in Figure 1, Holton *et al.* (2006) found that the priority of these issues varied between different groups of companies; the reasons for this were investigated using key sources from corporate sustainability management literature. For instance, Table 1 shows a model of the developmental phases through which organisations progress towards corporate sustainability, as defined by Dunphy *et al.* (2003). The phases characterise the way an organisation treats the human and natural resources it employs. It can be seen that there is a progression from active antagonism, through indifference, to a strong commitment to actively furthering sustainability values, not only within the organisation but within industry and society as a whole, although an organisation does not necessarily have to progress through the phases step-by-step, or hold equal positions across both human and natural resource dimensions.

* A new Strategy for Sustainable Construction was published in June 2008 (BERR, 2008).

† A sector can be defined as a part or branch of a particular area of activity, especially of a country's economy (Hornby, 1995); sectors can include everything from small groups of large multinational corporations to large groups of small and medium sized enterprises and even collections of individual professionals (SDC, 2002a).

Table 1: Phases in the development of corporate sustainability (after Dumphy *et al.*, 2003)

PHASE	TREATMENT OF HUMAN RESOURCES	TREATMENT OF NATURAL RESOURCES
1: Rejection	Employees and subcontractors are exploited. The organisation does not take responsibility for the health, welfare and development of its employees. Community concerns are rejected outright.	The organisation does not take responsibility for the environmental impact of its operations nor does it modify its operations to lessen future ecological degradation. The environment is regarded as a free good to be exploited.
2: Non-responsiveness	Financial and technological factors dominate business strategies to the exclusion of most aspects of human resource management. Issues of wider social responsibility and community concern are ignored.	Financial and technological factors dominate business strategies to the exclusion of environmental concerns. Environmental risks, costs, opportunities and imperatives are seen as irrelevant or not perceived at all.
3: Compliance	Financial and technological factors still dominate business strategies. Compliance is undertaken mainly as a risk-reduction exercise. Community concerns are addressed only when the company faces risk of prosecution or where negative publicity may have a damaging impact on the company's financial bottom line.	Financial and technological factors still dominate business strategies. Compliance is undertaken mainly as a risk-reduction exercise. The most obvious environmental abuses are eliminated, but environmental issues which are unlikely to attract litigation or strong community action, are ignored.
4: Efficiency	There is a systematic attempt to integrate human resource functions into a coherent HR system to reduce costs and increase efficiency. Community projects are undertaken where funds are available and where a cost benefit to the company can be demonstrated.	Environmental issues that generate costs are systematically reviewed in an attempt to reduce costs and increase efficiency, but other issues are still ignored. There may be active involvement in a management systems approach such as ISO 14001.
5: Strategic pro-activity	Intellectual and social capital is used to develop strategic advantage through innovation in products and services. Communities affected by the organisation's operations are taken into account and initiatives to address adverse impacts on them are integrated into corporate strategy.	Proactive environmental strategies are seen as a source of strategic business opportunities to provide competitive advantage. The organisation seeks competitive leadership through spearheading environmentally friendly products and processes.
6: The Sustaining Corporation	The organisation adopts a strong and clearly defined corporate ethical position based on multiple stakeholder perspectives and seeks to exert influence on the key participants in the industry and in society in general to pursue human welfare, equitable and just social practices and the fulfilment of human potential.	The organisation becomes an active promoter of ecological sustainability values and seeks to influence key participants in the industry and society in general. Environmental best practice is espoused and enacted because it is the responsible thing to do.

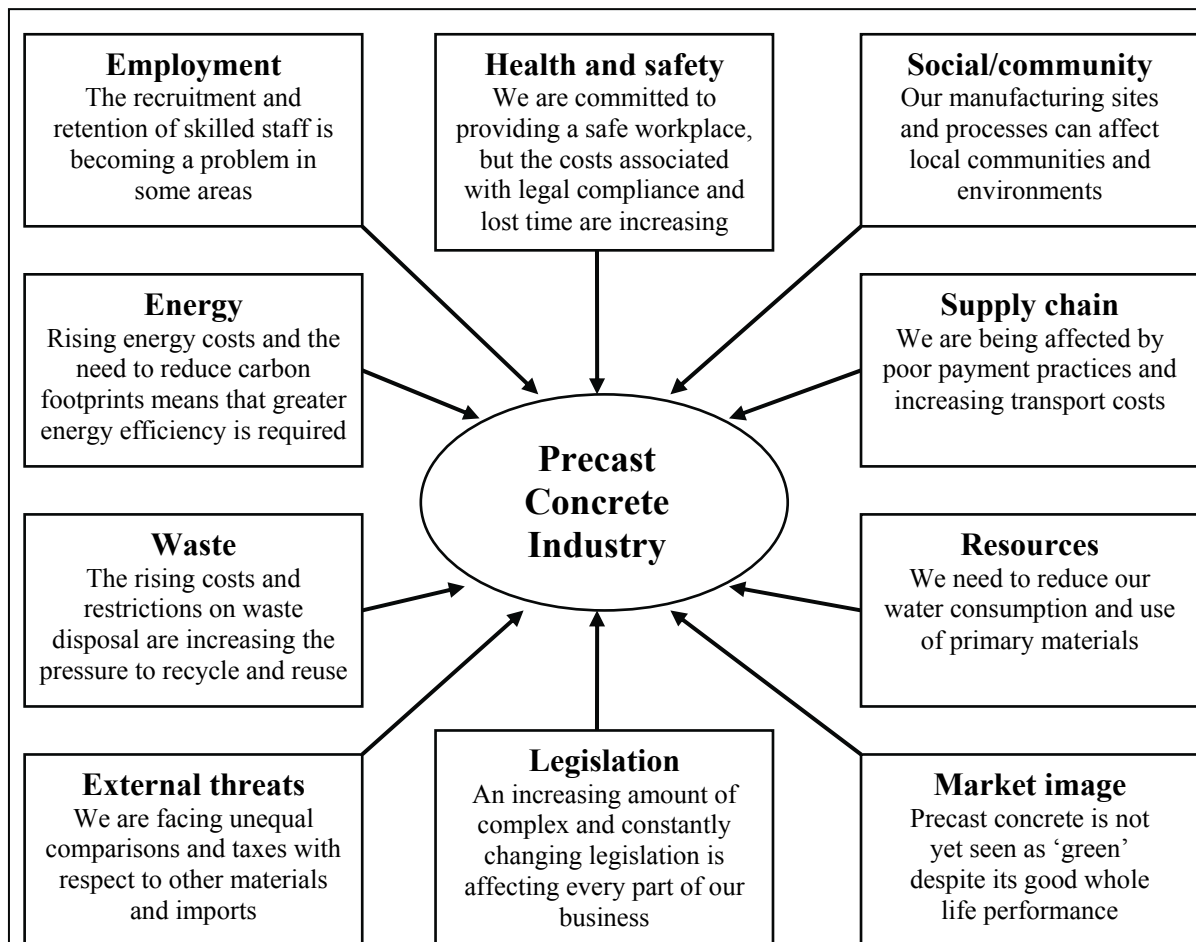


Figure 1: Key sustainability issues facing the precast industry (Holton *et al.*, 2006)

Kolk and Mauser (2002) note that such models are generally broad and conceptual, do not take sufficient account of organisational and strategic complexities, and as a result have a limited suitability for specific situations. Holton *et al.* (2006), however, recognised certain companies in the precast sector to be in the higher phases of this developmental model, because of their proactive performance on environmental and social issues, and contribution to the emergence of a sustainable society. Other companies were considered to be in the middle phases, showing increasing awareness of the link between sustainability and business efficiency, and some in the lower phases, rejecting or not responding to the issue of sustainability. Consequently, Holton *et al.* (2006) concluded that differences in the sustainability priorities of companies in the precast sector were to be expected. However, the question of how the leading companies had progressed through the phases and were 'managing' for sustainability then arose. The case for examining this issue further was made well by Dunphy *et al.* (2003) who suggest that managing for sustainability is critical to the development of corporate sustainability. Roome (1998) expands on this, by stating that managing for sustainability is fundamentally about strategic organisational development and change; change in management structure, systems and competencies. Whereas Dyllick and Hockerts (2002) propose that to manage for sustainability requires the concept of 'efficiency' (the economic value added in relation to the aggregated resource used) to be extended to include 'eco-efficiency' and 'socio-efficiency' (the economic value added in relation to the aggregated ecological and social impacts, respectively), as shown in Figure 2.

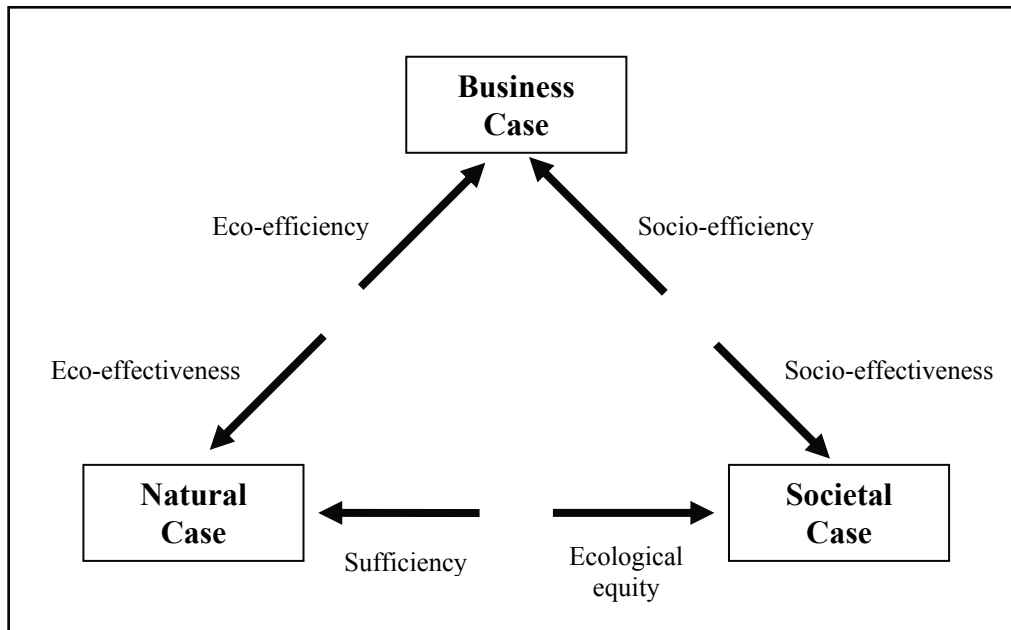


Figure 2: Criteria for managing corporate sustainability (Dyllick and Hockerts, 2002)

Interestingly, Dyllick and Hockerts (2002) also introduce the concepts of ‘eco-effectiveness’ and ‘socio-effectiveness’ to deal with absolute thresholds in ecological and social sustainability, and ‘sufficiency’ and ‘ecological equity’ to manage the relationship between nature and society. Thus, managers aiming for corporate sustainability will have to satisfy six criteria: eco-efficiency, socio-efficiency, eco-effectiveness, socio-effectiveness, sufficiency and ecological equity. From this, it can be argued that the capability to manage for sustainability differs from the capability to manage for economic competitiveness. van Kleef and Roome (2007) add further weight to this argument through their study establishing that the capability to innovate for sustainability differs from the capability to innovate for competitiveness.

It is of no great surprise therefore to find that there are an increasing number of tools and guidance documents available to help companies manage for sustainability. However, Henriques (2001, page 53) makes the following statement in respect to the profusion of initiatives, codes, tools, standards, new organisations, systems, principles, labels and more, all designed to help companies with sustainability: “*Unfortunately the very profusion is under-mining itself. It is so hard to know where to start for many companies that they are simply waiting to see where the consensus emerges*”. Furthermore, many of these tools and guidance documents create the impression that sustainability is an achievable level of performance or competence, whereas, as Braithwaite (2007) notes, sustainability is a continuing process of improvement rather than an achievable objective.

3 THE RESEARCH APPROACH – COMPANY CASE STUDIES

Holton *et al.* (2006) recognised that there were clear differences in the priorities and achievements of companies in the UK precast sector on sustainability issues, and although they postulated that companies could be in different phases of development with respect to corporate sustainability, no evidence was given as to why this should be the case.

However, Roome's (Roome, 1998) position that managing for sustainability is about strategic organisational development and change (in management structure, systems and competencies) suggests that key differences in how companies approach these three broad areas could explain the trends observed in the precast sector. So, the question arises as to how companies have changed their management structures, systems and competencies in order to develop the capabilities necessary to manage for sustainability. This was posed as a research question in the context of the UK precast concrete industry.

The overall research aim was to investigate how leaders in corporate sustainability in the precast industry had developed the capabilities necessary to manage for sustainability. Objectives in support of the research aim were to:

- identify the leaders in corporate sustainability in the precast industry;
- establish how these companies manage for sustainability;
- determine what changes have been made to their management structures, systems and competencies in order to manage for sustainability;
- investigate how these changes were made; and
- assess how effective they were.

The information gathered was to be used to make formative recommendations on how to manage for sustainability in the precast industry, which could then be incorporated into the precast sector sustainability strategy.

The research objectives were met by undertaking a series of company case studies; case studies are recognised as a suitable research methodology for these types of explanatory questions focusing on contemporary events (Yin, 2003). Due to the diversity of company size and structure in the precast industry, a multiple-case design with single units of analysis was adopted for the case studies in accordance with the guidance offered by Yin (2003). That is, four companies of different sizes and structures were studied using the same case study protocol; the case study protocol was developed around a research hypothesis and a series of research questions.

The first requirement in selecting companies to study was to identify the leaders in corporate sustainability in the UK precast industry; for the purpose of this study, these were considered to be those companies that had moved beyond the 'compliance' phase of corporate sustainability. To make this move, companies need to change the way they manage social and ecological issues (Dunphy *et al.*, 2003). In the 'compliance' phase, the emphasis is on compliance with legal requirements in respect to industrial relations, health and safety, environmental law, etc, in order to minimise risk to the company. Anything that does not require compliance is ignored. Whereas in the next phase, the 'efficiency' phase, the emphasis is on the development of a learning culture to support the identification and implementation of efficiency measures and provide cost benefits to the company.

An industry-wide questionnaire survey conducted in January 2006 had included an investigation of the policies, procedures and systems that UK precast companies had in place to manage a range of ecological (environmental protection and resource use) and social issues (Holton *et al.*, 2006). The results from this section of the survey allowed those companies that had moved beyond the 'compliance' phase to be identified; defining features of these companies were that they had adopted management system approaches such as ISO 9001 and ISO 14001, and had a broad range of policies in place to manage and improve their ecological and social performance. From the companies identified, four were

invited to participate in the study; all four accepted. A comparison between the four companies is presented in Table 2, based on some of their defining characteristics; for confidentiality, the companies are referred to as Company A, B, C and D.

Table 2: Comparison of some defining characteristics for each company

Characteristic	Company A	Company B	Company C	Company D
Age	Established over 100 years	Elements of the company have been established over 100 years	Established over 50 years	Established 1972
Ownership	UK based plc quoted on the London stock market	Part of a privately owned Belgian industrial group	Part of an international group of companies, which are quoted on the Danish stock market	Privately owned UK based company
Products/markets	Concrete and natural stone hard landscaping products for the UK construction, home improvement and landscape markets	Roofing and cladding solutions to the UK construction and house building markets	Aircrete products for the UK construction and house building markets	Prestressed flooring and roofing products, stairs, staircases, terracing units and bespoke items to the UK construction market
UK infrastructure	18 quarries, 38 manufacturing sites of which 18 are precast, 12 service centres, 5 regional sales offices and 12 administrative offices	3 concrete tile factories, 3 clay tile factories and a head office	4 manufacturing plants at 3 locations plus a network of distribution depots and a head office	1 manufacturing site comprising 3 factories and associated offices
Employees	Approximately 3,000	Approximately 1,000	Approximately 350	Approximately 150

Although all four companies were considered to be beyond the ‘compliance’ phase of corporate sustainability and could be considered to be well-established businesses in the precast industry, based on the length of time they had been trading, it can be seen from Table 2 that there were some significant differences in their size, infrastructure and ownership, at the time of the research. The products they manufactured and markets in which they operated were also different, plus Company C and Company D only made precast products, whilst Company A and Company B had additional interests. There was thus a certain degree of diversity between the four companies. Indeed, there is considerable diversity in the precast industry in terms of the range of products it produces, the manufacturing processes it uses, and the size and structure of the companies within it (Holton *et al.*, 2006). The four companies studied are therefore considered to present a reasonable cross-section of the leading companies in the precast industry in the development of corporate sustainability.

Interviews provided the primary source of data, supplemented by information from the company websites and publicly available reports. The suitability of interviews for studies of this nature is evidenced by the Institute for Management Development (IMD) in Lausanne, Switzerland; more than 400 interviews with global companies and stakeholders from 16 countries in Europe, North America and the Far East, provided the primary source of data in a study undertaken there to investigate the business case for corporate sustainability in nine industries (Steger, 2006).

In the research which is the focus for this paper, two directors and/or senior managers were interviewed in each company. All of the interviewees were considered to have a thorough knowledge of how their company was managed for sustainability and to have been able to

provide credible information on the subject. The interviews were semi-structured using a number of key and supplementary questions to identify organisational developments and changes made in relation to managing for sustainability, and to investigate the development and change process. Transcripts were made of each interview, from which narrative reports were produced for each company. The narrative reports were then compared and analysed. The results obtained are summarised and discussed in the following sections.

4 KEY FINDINGS

A wealth of data on various related aspects was collected during the interviews which it is impossible to report comprehensively on in a single paper, however, it has been possible to identify key cross-cutting themes that help to explain each company's position with respect to how they manage for sustainability. This section presents key findings; a discussion section follows.

4.1 Management systems

The key changes identified in respect of managing for sustainability in each company are described below, together with the reason or reasons for change.

- Between 1995 and 2002, Company A was described by the interviewees as having been 'professionalized' in response to a transition in the hard landscape market from a relatively static position to a highly competitive one, combined with pressure starting to rise in the investor community and the company's desire to be the differentiator business in that market. The principal change that occurred during this period was the introduction of certified quality, environmental, and health and safety management systems; this was seen as a way of bringing the company to a common platform, ensuring that the right systems were in place to enable growth and success, and demonstrating to stakeholders that things were being done correctly. The company now uses these systems as its basis for managing for sustainability, as shown in Figure 3.
- The key change identified in Company B in the last 10 years was the development of ISO 14001 certified environmental management systems at all of its factories; the factories already had ISO 9001 certified quality management systems in place. Development started in the mid-1990s in response to an increasing burden of environmental legislation, but following a takeover in 2001, the system was formalised and certified to ISO 14001 obtained in accordance with a Group policy which was based on minimising the risk of non-compliance with environmental legislation.
- The interviewees referred to two significant changes having occurred in Company C: firstly, environmental management systems certified to ISO 14001 were established at all of the company's factories by 2002; and secondly, all of their management systems were brought together into an integrated system certified to PAS 99 in 2007. The company had identified that environmental management was going to become an issue at least 10 years ago and started development of an environmental management system at that time; the company already had an ISO

9001 certified quality management system. Development then accelerated as environmental management became a commercial issue in their market sector. The development of an integrated management system was seen as a natural progression.

- The only change identified in Company D in the last 10 years was the certification of the company's quality and environmental management systems to ISO 9001 and ISO 14001 respectively. In all other respects, the interviewees believed the company had carried on doing business as usual. The decision by the company to have its management systems certified appears to have been based primarily on commercial pressure from its customers, since the interviewees believed that the company already had good quality and environmental management systems in place.

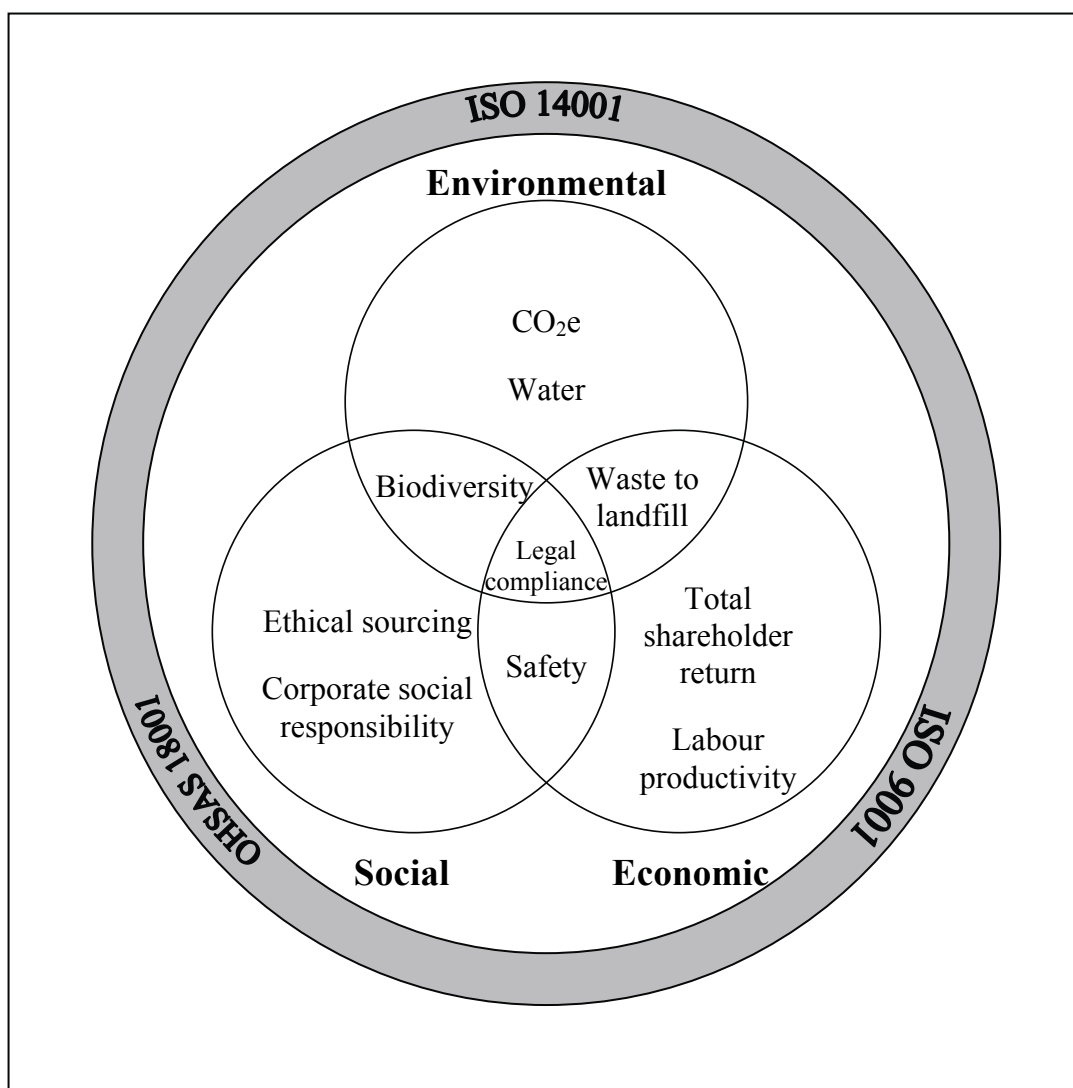


Figure 3: Sustainability focus for Company A

It would therefore appear that the key change made in each company in respect of managing for sustainability was the development of an ISO 14001 certified environmental

management system, and that the decision to develop such a system was typically made in response to commercial and legislative pressure, and the need to demonstrate that “*things were being done correctly*”.

4.2 Continuous performance improvement

The management systems now operated by each company are listed in Table 3. The principal benefit of developing certified management systems, as identified by the interviewees, was the development in each company of a continuous performance improvement culture; as one interviewee noted, “*for directors of the business, we love that (continuous performance improvement) because it actually forces everybody in the business to continually get better*”. This in turn was leading to a range of economic benefits, including improving stakeholder confidence; for example, one interviewee noted that improvements to the company’s environmental and social performance had actually helped Company D to win orders and retain customers. Other benefits of developing management systems identified by the interviewees included:

- providing the company with a way of managing risk, not just economic performance;
- enabling clear objectives and targets for improvement to be identified;
- keeping the company up to date with changes in legislation and helping to ensure that relevant changes were communicated to the factories; and
- helping to manage many different aspects of the business including training, transport, local community relations, customer relations and supplier performance.

Table 3: Management systems operated by the four companies

System	Company A	Company B	Company C	Company D
Quality Management	Certified to ISO 9001	Certified to ISO 9001	Certified to ISO 9001	Certified to ISO 9001
Environmental Management	Certified to ISO 14001	Certified to ISO 14001	Certified to ISO 14001	Certified to ISO 14001
Health and Safety Management	Certified to OHSAS 18001	Working towards OHSAS 18001	Certified to OHSAS 18001	In house system
Integrated Management	Working towards PAS 99	No system	Certified to PAS 99	No system

The focus of the individual improvement programmes varied from company to company.

- The issues Company A was focusing on are shown in Figure 3; the interviewees explained that these were “*the key things that will really make a difference to our customers, to our shareholders, stakeholders, etc*”.
- The improvement programme at Company B was focussed primarily on environmentally responsible manufacturing (i.e. waste, energy and resource use), and health and safety, in accordance with their own Sustainability Policy and their Group’s environmental and health and safety (EHS) policy.

- Company C was focusing on energy use, process waste, raw materials and water, all of which “*have an effect on the bottom line*” according to one of the interviewees. Other areas, such as health and safety, were also considered, but were not current priorities.
- Health and safety was stated to be Company D’s top priority for improvement; after which there did not appear to be any formal prioritisation process, although it was noted that anything to do with legal compliance was dealt with as a matter of urgency. Areas in which the company had made performance improvements in recent years included water usage, waste minimisation and energy consumption.

Although there was a noticeable tendency to concentrate on improving their own environmental performance, the interviewees all noted that their companies were now starting to consider wider sustainability issues, other aspects of their business beyond production, the performance of their suppliers, and the contribution of their products to more sustainable construction. For example, Company D has voluntarily limited the geographical area in which it will do business in order to reduce its transport costs and impacts. However, nothing was done without there being a benefit to the company; “*everything we do is driven by the need to improve, but it also has to work economically*” stated one interviewee.

This pattern of identifying and implementing efficiency measures that will provide cost benefit to the company is characteristic of the ‘efficiency’ phase of corporate sustainability. Thus, by adopting a compliance approach to managing for sustainability, characterised by the development of management systems and continuous performance improvement cultures, there was evidence of the four companies studied having progressed naturally to this phase of corporate sustainability. Interestingly, several interviewees noted that increasing alignment between the management standards for quality, environment, and health and safety, was leading them to develop integrated management systems, the focus of which was improving their sustainability, whilst Company C had already developed an integrated system on this basis.

4.3 Performance monitoring and review

Performance monitoring was considered to be essential in order to provide the evidence of continuous performance improvement required by the various management standards; it was also used to help identify and prioritise areas for improvement, and to enable improvement targets to be set. Companies A, B and C had developed comprehensive performance monitoring systems based on the monthly production of key performance indicators (KPIs). Core sets of indicators were typically used to monitor overall performance on a long-term basis, with frequently reviewed sets of secondary indicators used to monitor specific aspects of performance on a short-term basis. The KPIs were typically reviewed at several levels in each company. Company D did not have a formalised procedure for collecting performance data and producing key performance indicators across the business, but the interviewees did state that areas selected for improvement would be monitored before and after, to develop the business case and to assess whether the benefit achieved met expectations. Several interviewees drew attention to the time it took to produce reliable data; others drew attention to the need to continuously review what was being measured in order to ensure that it was relevant, and to invest in monitoring systems and equipment to improve the quality of the data. There

was also general agreement on the need for employees to perceive collecting performance data as a valuable task, rather than just as an administrative burden.

High-level planning varied with company size, ranging from 12-18 months ahead at Company D, to at least 5 years ahead at Company A, with progress reviewed at 6-monthly intervals in all cases. Companies A, B and C all set performance targets across their businesses, then cascaded these down through their management structures to their factories, where designated teams took responsibility for identifying and implementing improvements, whilst the two Directors of Company D generally identified the areas for improvement, and then worked directly with their managers and others to determine and carry out the required actions. Factory level planning was typically done on an annual basis in all four companies, with progress reviewed at intervals of 3 to 6 months, in accordance with the requirements of the different management standards.

All of the interviewees reported that legal compliance was considered to be the baseline performance level for their company and that they always strived to perform above this. Similarly, they all reported that the performance targets their companies set were only used as a guide and would often be reviewed in the light of market and other operational factors.

When implementing performance improvements, the need for progressive development was stressed by all of the interviewees, for example, by following a Plan-Do-Check-Act cycle, by taking account of resource limitations, not trying to do everything at once, and going at a pace that everyone could follow. One interviewee also drew attention to prioritising where improvements were made, *“understanding the issues, doing the things that have greatest impact first, not just doing things for the sake of it or because it sounds good”*, whilst another noted that it was nice to have some short-term targets *“so the factories can get stuck in and show some benefit”*. Companies A, B and C promoted a degree of competition between their sites to encourage performance improvement, but this was not allowed to adversely affect the overall performance of each business since all three companies also promoted transfer of best practice between their sites.

4.4 Responsibility

Responsibility for managing for sustainability in all four companies ultimately resided at Board level and with one or two specific Directors. Each company was found to have established clear responsibilities and authorities within its organisational structure to enable the required responses to improvement and monitoring activities to be undertaken effectively. The responsibilities established in each company are described below.

- Company A pass responsibility for sustainability down through the company’s management structure to their factories where designated teams take responsibility for monitoring performance and implementing improvements with assistance from specialist central staff.
- In Company B, three central teams cover health and safety, quality and the environment, and liaise with corresponding teams at each factory. The factory teams have day-to-day responsibility for monitoring performance and implementing improvements, whilst the central teams have overall responsibility for the management systems, legal compliance, performance monitoring and performance improvement in each area.

- In Company C, environmental improvement teams at each factory are responsible for identifying and managing specific improvements in conjunction with the individual Works Managers. Meetings are then held three times a year with senior managers in the company to review progress. Similar arrangements are in place for quality, and health and safety, although the company is now considering integrating them all.
- The Directors of Company D generally identify the areas for improvement, and then work directly with their managers and others to determine and carry out the required actions.

4.5 Commitment

Company A demonstrated the most comprehensive organisational commitment to sustainability.

- Sustainability was clearly built in to the company's corporate objectives and commitments, thereby aligning its sustainability activities with its primary purpose.
- These objectives and commitments incorporated the needs and issues of the company's internal and external stakeholders, and were widely communicated inside and outside the company.
- The company's directors showed a clear understanding of and commitment to sustainability. This commitment had been communicated down through the company, appeared to be supported at all levels of the company, and was evident in all aspects of its operations.
- Policies on Corporate Social Responsibility, the Environment, Climate Change, Health and Safety, and Quality were used to promote a set of values throughout the company.
- Sustainability was incorporated in the company's planning and management processes, rather than treated as a separate issue.

Whilst the other companies may not have shown such comprehensive organisational commitments, the commitment to change clearly began at board level in each company with one or more directors taking responsibility for introducing their management systems. One interviewee explained how the commitment to change and performance improvement had then been transferred down through their company by careful education, by example, and to a degree by competition. Other interviewees reported similar experiences from their companies, with one noting that their company now considered performance improvement and operation of their management systems to be part of every employee's job.

All of the interviewees stressed the importance of good communication up and down the management chain, and making sure that employees at each level had both the correct and necessary information to undertake their jobs efficiently and effectively. There was a general consensus that keeping the workforce informed of the reasons for and benefits of change helped to overcome any resistance to change. A range of communication methods and styles were demonstrated, including regular factory briefings and newsletters, informal

factory walkabouts and the introduction of electronic document management systems. It was also noted that obtaining staff loyalty, by being seen as a fair and responsible employer improved communications; *“If you’ve got a highly changeable workforce, it is very difficult to get the message over and for people to appreciate what you’re trying to achieve”* stated one interviewee.

4.6 Capability

All four companies were found to have initiated programmes of training to raise awareness and improve the competence of staff at all levels on sustainability issues, in order to assist in the implementation and operation of their management systems. There was a trend amongst these programmes to include mentoring and coaching in addition to formal courses, and to train internal staff to deliver training courses, rather than go to third-party training providers, thereby transferring knowledge internally and saving money. There was also a trend towards changing behaviours rather than simply enhancing technical skills; for example, one interviewee stated *“we developed the training necessary for every individual to have at least the basic knowledge to think about the environment, quality, and health and safety”*. Several of the interviewees noted that their sustainability-related training and development programmes were now extending beyond production to other parts of their businesses such as sales and marketing.

5 DISCUSSION

5.1 Compliance

Roome (1998) states that managing for sustainability is fundamentally about strategic organisational development and change. Dunphy *et al.* (2003) suggest that the change process begins with compliance, and argue that by focusing first on compliance firms gain initial understandings, tools, techniques and capabilities that are valuable in themselves, but also form a base from which they can more pro-actively engage with other sustainability issues. They outline a broad and compelling case for adopting a compliance approach, reasons for which include the emergence of more widespread and increasingly sophisticated forms of government regulation; increasing scrutiny by NGOs; and opportunities to improve the firm’s competitive situation by achieving compliance. However, they also note that there is a limit to what can be achieved by an ad hoc approach to compliance which is leading companies to adopt more systematic approaches such as total quality management and environmental management systems.

Managing for sustainability in the four companies studied clearly began with a compliance approach based on the development of ISO 14001 certified environmental management systems, the decision to develop these systems typically being made in response to commercial and legislative pressure, and the need to demonstrate that *“things were being done correctly”*; thus supporting the argument presented by Dunphy *et al.* (2003).

5.2 From compliance to efficiency

Dunphy *et al.* (2003) suggest that in many cases the development of an efficiency approach to sustainability is a natural extension of an organisation’s engagement in compliance activities because it simply builds on existing operational and technical capabilities. This certainly appeared to be the case in the four companies studied. For example, one interviewee at Company C stated *“We thought we would quickly run out of ideas for*

improvement, but that hasn't proven to be the case at all, because it's a natural progression that once we've achieved a certain amount ... other projects fall out of that investigation. And so we've gone on and in fact we've got more than enough ideas to improve our sustainability as a company." However, there was a noticeable tendency amongst the companies to concentrate on improving their own environmental performance, i.e. only achieve progress towards eco-efficiency, as a consequence of their ISO 14001 accreditations and the mass of environmental legislation now facing precast companies in the UK. Research conducted by the Institute for Management Development (IMD) in Lausanne, Switzerland, to investigate the business case for corporate sustainability in the automotive, aviation, chemical, electric utilities, financial services, food and beverage, pharmaceutical, oil and gas, and technology industries of 16 countries in Europe, North America and the Far East (Steger, 2006), also found that the overall focus of implementation processes in companies was on environmental management; companies reported difficulty in defining social aspects and related criteria clearly. So although the move to efficiency may be considered to be a natural extension of installing compliance systems, it may also have its limitations.

Benn *et al.* (2006) argue that the move to eco-efficiency must be supported by a corresponding move to socio-efficiency, confirming the view of Dyllick and Hockerts (2002) presented earlier. There was evidence of this process, which involves organisations making maximum use of their human capabilities, occurring in all four companies, but Company A in particular. For example, the interviewees all noted that their companies were now starting to broaden their sustainability focus to include: internal social issues such as staff training and development; local community relations; the performance of their suppliers; and the contribution of their products to sustainable construction. The interviewees also noted that including wider sustainability issues within the scope of their management systems was helping them to manage many different aspects of their businesses including training, transport, customer relations, and supplier performance. Therefore whilst the development of ISO 14001 certified environmental management systems and continuous performance improvement cultures may enable companies to achieve progress towards eco-efficiency, there is also a need for them to broaden their sustainability focus, make better use of their human capabilities and achieve complementary progress to socio-efficiency, in order to develop a comprehensive efficiency approach to sustainability.

The development of integrated management systems is noteworthy in this respect. In the IMD study (Steger, 2006), no company was found to have developed an integrated corporate sustainability management system, although the necessity of such a system had been stressed by a majority of advanced companies. Several interviewees in this study of precast companies noted that increasing alignment between the management standards for quality, environment, and health and safety, was leading them to develop integrated management systems, the focus of which was improving their sustainability.

5.3 Change agents – making it happen

Dunphy *et al.* (2003) recognise that senior management play an important change agent role by recognising the need to change and committing to support change, but stress that other internal change agents then have to work to deliver that commitment. It is widely accepted that the commitment of senior management is critical in any change process. For example, in the nine industries included in the IMD study (Steger, 2006), it was found that the support of a board member was crucial for building and implementing effective

strategies, and an ‘astonishing’ number of board members were found to be directly involved in achieving progress towards sustainability. The four companies studied here were no exception each having one or more Directors taking direct responsibility for sustainability, but they also showed that it is essential to transfer that commitment down through the company. This was typically achieved by careful education, by example, and to a degree by competition, and was summed up by one interviewee, who stated that Company C considered performance improvement and operation of their management systems to be part of every employee’s job. However, none of the companies had a specific Sustainability Manager or Sustainability Department, and day-to-day responsibility for sustainability and implementing performance improvements varied from company to company.

The IMD study (Steger, 2006) established that within the nine surveyed industries, the concept of sustainable development had typically emerged within Environment, Health and Safety (EHS) departments. In some industries this department was still responsible for taking the lead on sustainable development, but in most industries responsibilities were now split between different functions, and only a few companies were found to have a specific sustainability unit or department. Despite this division of responsibility, all sustainability officers/units across the different industries surveyed agreed that the involvement of specific functions was crucial for progress in terms of sustainable development and as a reliable indicator of ‘integration’. In the three larger precast companies studied here, responsibility for developing the various management systems and performance improvement was initially taken centrally by the safety, health, environment and quality (SHEQ) teams, and their efforts were concentrated on the manufacturing function; these teams having the necessary diagnostic and project management skills to identify where and how to implement changes, and manufacturing being the primary function of these companies. As the companies have progressed, day-to-day responsibilities have been devolved to factory-level teams, allowing the central teams to concentrate on the more strategic tasks such as extending their systems and sustainability focus to include other functions beyond manufacturing. Transformation of the SHEQ teams into sustainability teams or departments was also apparent. Thus the companies have established change agents at different operational levels and begun to develop an integrated approach to sustainability across different functions.

5.4 Beyond efficiency – the next steps

Benn *et al.* (2006) suggest that the move to ‘compliance’ and ‘efficiency’ is characterised by gradual, planned, continuous and ongoing incremental change, but to progress beyond this requires more transformational change. None of the companies studied reported making any transformational changes, favouring instead the incremental changes associated with continuous performance improvement. The IMD study (Steger, 2006) also found that managers tended to focus more on operational (incremental) than strategic (radical) management of risks and opportunities. However, the four companies studied were all considered to be in the ‘efficiency’ phase of corporate sustainability.

To take the next steps and progress beyond ‘efficiency’ could be very difficult. Research on progress towards sustainable business strategies in a number of important Dutch companies (Keijzers, 2002), showed many larger enterprises to be experiencing great difficulty in making the next move towards sustainability. Barriers to progress identified included short-term horizons for major investment decisions blocking sight of the potential of long-term changes, and internal management structures not being geared towards the

identification of opportunities for ecological modernisation. Benn *et al.* (2006) suggest that this is a complex phase of development requiring transformational change, a shift in values and cultures, and strategic repositioning. Keijzers (2002) reiterates this view, noting that internal organisational changes are required, coupled with the development of long-term objectives to organise a strategic re-orientation of the firm, and concluding that sustainability requires a re-orientation on tomorrow's technologies and markets. Whilst for the construction industry in particular, Price and Newson (2003) recommend that to be successful in the future, organisations will need to supplement their current short-term approaches based on improving organisational effectiveness, with more long-term strategic approaches; this will require greater long-term investment, long-term relationships, and rewarding those who innovate. All of these studies indicate that further progress in the precast sector and others will be critical in the years to come if they are to become truly 'sustainable'.

5.5 Managing for sustainability: comparison with BS 8900

Henriques (2001) argues that the vision of an organisation as to how it will become sustain-able and maintain its sustainability may be different to that of any other organisation, but all organisations must account for their impacts as they develop their vision. He also argues that managing impacts typically involves dealing with a series of issues, i.e. issue management. It can thus be argued that managing for sustainability is primarily a matter of issue management. Steger (2006), however, notes that as a strategic concept, managing for sustainability goes far beyond issue management. This is supported by the guidance and recommendations in British Standard BS 8900:2006 *Guidance for managing sustainable development*. This standard takes the form of guidance and recommendations which are described as providing a framework for embedding sustainable development management in everyday decision making.* The guidance covers covers the activities an organisation should engage in and capabilities it should develop in order to continually improve performance along a path towards sustainability, including developing organisational commitment and capability, identifying and managing issues, reviewing and reporting progress, and building stakeholder confidence.

The performance of the four companies studied has been considered against the guidance and recommendations given in BS 8900 in order to assess whether they were engaging in the activities and developing the capabilities considered necessary to manage for sustainability. This guidance was chosen because it is non-commercial, relatively simple, not industry specific and based on the experience of many leading practitioners in the field.

1. *Organisational commitment.* BS 8900 recommends a number of ways to develop an organisational commitment to sustainability. Organisational commitments had clearly been established in all four companies, in that a purpose, vision and values for the company were found to be embedded into each one, and they all claimed to give equal consideration to economic, environmental and social impacts in their management and planning processes, but not necessarily all of those recommended.
2. *Identification of issues.* BS 8900 recommends stakeholder engagement as the main mechanism for identifying and managing sustainability issues. Whilst all of the companies studied undertook some form of basic stakeholder engagement, such as

* Henriques (2001, page 32) suggests the terms 'sustainable development' and 'sustainability' to be largely interchangeable.

dialogue with their employees and customers, this wasn't the main mechanism they used for identifying and managing their sustainability issues; all four stated that they used their management systems as the basis for identifying and managing their sustainability issues. Company A was the most advanced in this respect in that it had established a clear set of economic, environmental and social issues on which it focused, which was stated to incorporate the needs and issues of its internal and external stakeholders, but was clearly linked to its quality, environmental, and health and safety management systems (see Figure 3). The other companies appeared to be more focused on environmental, and health and safety issues, however, they all stated that they were starting to consider wider issues, other aspects of their business beyond production, the performance of their suppliers, and the contribution of their products to more sustainable construction.

3. *Organisational capability.* BS 8900 recommends developing the capability of the organisation through the allocation of appropriate resources (human, financial or manufactured) and the development of a range of competencies, although no detail is given on where resources may need to be allocated or what competencies may be required. All four companies reported having allocated resources to improving their performance on sustainability issues, usually as part of their normal planning, budgeting and business development processes:
 - Each company had established within its organisational structure clear responsibilities and authorities at each level to enable the required responses to improvement and monitoring activities to be undertaken effectively.
 - Companies A, B and C had comprehensive performance monitoring systems in place, based on the monthly production of KPIs; the KPIs were also used to identify and prioritise areas for improvement.
 - All of the companies were reported to have initiated programmes of training to raise awareness and improve the competence of staff at all levels on sustainability issues.
4. *Management.* BS 8900 does not prescribe any particular management approach, but does note the possibility of including elements of sustainability into recognised management systems, for example in the areas of accountancy, environmental management and employment. In all of the companies studied, it was clear that the management systems they used provided the basis on which they managed sustainability issues, particularly their ISO 14001 certified environmental management systems. In addition, several interviewees noted that increasing alignment between the management standards for quality, environment, and health and safety, was leading them to develop integrated management systems, the focus of which was improving their sustainability.
5. *Performance review and reporting processes.* BS 8900 recommends that sustainability is integrated into both strategic and operational level performance review and reporting processes. Company A was the most advanced at the strategic level, for example, the interviewees noted that social and environmental performance was discussed alongside economic performance at management meetings, rather than as separate agenda items, they also claimed that economic, environmental and social benefits were assessed for all the decisions and improvements the company made. However, all four companies reviewed and reported progress at the operational level at intervals of 3 to 6 months, in accordance with the requirements of the different management standards they operated.

6. *Building stakeholder confidence.* BS 8900 does not contain any specific performance criteria in this respect, but all four companies reported increased stakeholder confidence associated with improved performance on sustainability issues, particularly amongst their customers, employees, shareholders and, where applicable, parent companies.

The comparison shows that the four companies studied were all engaging in the activities and developing the capabilities necessary to manage for sustainability described in BS 8900 to varying degrees. Thus, by developing management systems and continuous performance improvement cultures, each company has also developed the capabilities necessary to manage for sustainability. However, whilst following the guidance in BS 8900 is likely to have achieved a similar result, these findings suggest that following the guidance in BS 8900 will only enable companies to progress to the 'efficiency' phase of corporate sustainability.

5.6 Barriers to certification and change

Of the many management system standards now available, MacDonald (2005) notes that ISO 14001 certified environmental management systems have become a widespread administrative tool in the field of corporate responses to sustainability. However, the high cost of certification was the highest ranked obstacle to certification in a survey of 177 ISO 14001 certified industrial companies in the USA reported by Babakri *et al.* (2003). The experiences of the four companies in this study indicate some of the benefits that can be realised to offset the cost of certification.

All four companies acknowledged that they had had to allocate additional resources to the development of their management systems and achieving certification, but the benefits were found to outweigh the costs. For example, one of the interviewees noted that improving their environmental performance was benefiting Company B economically through factors such as reduced waste disposal costs, reduced resource requirements and reduced energy consumption, which in turn was improving the environmental credentials of its products, giving the company commercial advantage in the market place. Another interviewee explained that Company C had conducted a cost-benefit analysis before going for third-party accreditation of their environmental management system, and the benefits were found to outweigh the costs. Other interviewees mentioned the cost benefits of phased implementation and learning as they progressed from site to site, as well as starting with a simple system and addressing the issues that really matter, rather than trying to do everything at once with a system that was complex to administer. Additional benefits were gained by doing things themselves or working with others, rather than appointing consultants to develop systems for them, and drawing on the experience of others, particularly their management system auditors.

The four companies also encountered barriers to change; the ways in which they overcame those barriers included:

- having the commitment of senior management and transferring that commitment down through the company, so that performance improvement becomes part of every employee's job;
- initiating programmes of training to raise awareness and improve the competence of staff at all levels on sustainability issues;

- clearly communicating the reasons for doing things and potential benefits to employees and other stakeholders;
- ensuring local ownership, i.e. that the people operating the systems were involved in their operation; and
- setting clear objectives and targets for improvement that focus on the issues that have the biggest impact on the company and its employees.

Interestingly, several of the interviewees referred to increasing awareness amongst their staff of sustainability issues resulting from increased media attention, which was not only helping them to introduce changes, but also increasing the pressure on them to make changes and improve their performance.

6 CONCLUSIONS AND RECOMMENDATIONS

The overall aim of this research was to investigate how leaders in corporate sustainability in the precast concrete industry had developed the capabilities necessary to manage for sustainability; achieving corporate sustainability and managing for sustainability are issues faced by many companies in many sectors of many industries, but achieving corporate sustainability is not a trivial task. The research involved a series of four, interview-based, company case studies; the companies studied were considered to be industry leaders in corporate sustainability, but were also representative of the diversity of company size and structure in the precast concrete industry. The following conclusions have been drawn from the case studies with regards to how the four companies had developed the capabilities necessary to manage for sustainability.

- Managing for sustainability in each company began with a compliance approach based primarily on the development of ISO 14001 certified environmental management systems.
- The principal benefit of developing certified management systems, as identified by the interviewees, was the development in each company of a continuous performance improvement culture.
- By adopting a compliance approach to managing for sustainability, characterised by the development of management systems and continuous performance improvement cultures, there was evidence that the four companies studied had progressed naturally to the ‘efficiency’ phase of corporate sustainability.
- There is a tendency for organisations to focus on improving only their environmental performance and therefore only achieve progress towards eco-efficiency. In order to develop a comprehensive efficiency approach to sustainability, there is also a need to achieve complementary progress towards socio-efficiency; the four companies were achieving this by broadening their sustainability focus and making better use of their human capabilities.
- The commitment of senior management in each company was essential to the success of the change process, but it was also important for that commitment to be transferred down through the company and for change agents to be established at different operational levels.

- The development process is characterised by gradual, planned, continuous and ongoing incremental change, but to progress beyond this may require more transformational change and strategic repositioning.
- Developing management systems and continuous performance improvement cultures has enabled each company to develop the capabilities necessary to manage for sustainability described in BS 8900.

From these conclusions, the following recommendations are made for encouraging other companies (but particularly those within the precast sector) to develop the capabilities necessary to manage for sustainability and achieve progress towards the 'efficiency' phase of corporate sustainability.

- Companies should be encouraged to develop management systems, and in particular, environmental management systems certified to ISO 14001.
- Those companies that already have management systems in place should to be encouraged to broaden their sustainability focus to include: wider environmental issues; internal social issues such as staff training and development; local community relations; the performance of their suppliers; and the contribution of their products to sustainable construction.

Barriers to the development of certified management systems have been considered, although, as one interviewee in this study noted, recognising the need to change in the first place may still be the most important barrier to be overcome in some companies. Given the strength of the business case for sustainability and the level of interest and concern now being shown by governments, lobby groups, investors and consumers, it is going to be increasingly difficult for companies to ignore sustainability issues and the need to manage for sustainability.

7 ACKNOWLEDGEMENT

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APPENDIX G Case study protocol

1 OVERVIEW

The overall aim of this piece of research is to investigate how companies in the precast industry have become leaders in corporate sustainability and how they manage for sustainability. By investigating these areas, lessons can be identified and recommendations made which will help other companies to make progress on sustainability.

Objectives in support of the research aim are:

- to identify the leading companies in the development of corporate sustainability in the precast industry;
- to establish how these companies manage for sustainability;
- to determine what changes have been made to their management structures, systems and competencies in order to manage for sustainability;
- to investigate how these changes were made;
- to assess how effective they were; and
- to make formative recommendations on how to manage for sustainability in the precast industry.

These objectives will be met by undertaking a series of company case studies; case studies are recognised as a suitable research methodology for these types of explanatory questions focusing on contemporary events (Yin, 2003).

Due to the diversity of company size and structure in the precast sector, a single-case design with multiple units of analysis will be adopted for the case studies in accordance with the guidance offered by Yin (2003). That is, four companies of different size and structure will be studied using the same case study protocol. Interviews will provide the primary source of data, supplemented with documentation, records and observations where available and as appropriate. The results of the individual cases will then be combined in a cross-case report, from which lessons will be identified and recommendations made.

2 RESEARCH HYPOTHESIS AND QUESTIONS

Research hypothesis:

- To become industry leaders in corporate sustainability, companies have had to change the way they manage for sustainability.

Preparatory questions:

- Which companies are at the efficiency stage of corporate sustainability or beyond?
- Which of these are most representative of the precast industry?

Case specific research questions:

- How does each company manage for sustainability, i.e. manage its economic, environmental and social performance?
- How does their approach compare to BS 8900 and ISO 9004?
- What changes have been made to their management structures, systems and competencies in order to manage for sustainability?
- How were these changes decided?
- When were they made?

- How were they made?
- Who was involved?
- How effective were they?
- What would they do differently now?

Overall research questions:

- What similarities were there?
- What differences were there?
- What was intentional?
- What was unintentional?
- What worked best?
- What could have worked better?
- What went wrong?
- Were there any critical success factors?
- What conclusions can be drawn and recommendations made?

3 PREPARATORY STAGE

To move from the ‘compliance’ to the ‘efficiency’ stage of corporate sustainability as defined by Dunphy *et al.* (2003), companies need to change the way they manage human and ecological issues. At the ‘compliance’ stage, the emphasis is on compliance with legal requirements in respect to industrial relations, health and safety, environmental law, etc, in order to minimise risk to the company. Anything that doesn’t require compliance is ignored. Whereas in the ‘efficiency’ stage, the emphasis is on the development of a learning culture to support the identification and implementation of efficiency measures and provide cost benefits to the company. On ecological sustainability, this may be seen as a systematic review of procurement, production and distribution processes to reduce costs and increase efficiency by reducing waste, possibly through a TQM approach such as ISO 14001. And on human sustainability, employees become a resource to be developed rather than exploited, team building is seen as important, and community projects are pursued where a cost benefit to the company can be demonstrated.

The industry-wide questionnaire survey conducted in January 2006 included an investigation of the policies, procedures and systems companies had in place to manage a range of ecological (environmental protection and resource use) and human sustainability issues. The results from this section of the survey have allowed those companies that have moved beyond the ‘compliance’ stage to be identified. These are companies that typically have:

- Staff training and development policies in place;
- Local community liaison schemes in operation;
- Waste management and minimisation policies in place;
- Energy efficiency schemes;
- ISO 14001 accredited environmental management systems; and
- OHSAS 18001 accredited health and safety management systems.

Of the companies identified, only those companies in which the manufacture of precast concrete products was their primary business activity have been considered as case study companies in order to ensure that the research data is representative of the precast sector

and the influence of other sectors and business activities is minimised. From these, four companies have been selected on the basis of the number of factories they operate in order to reflect the composition of the industry. These companies are:

- Marshalls (21 factories);
- Marley Eternit Ltd (5 factories);
- H+H UK Ltd (4 factories); and
- Coltman Precast Concrete Ltd (1 factory).

A letter will be sent to the managing director of each company outlining the research and inviting them to participate in it.

4 INTERVIEWS

The interviews will be semi-structured using a number of key and supplementary questions, and will cover three main topics:

- i) Management of economic, environmental and social performance;
- ii) Changes to management structures, systems and competencies; and
- iii) Examining the changes identified in detail.

Each company's 'sustainability champion' will be their principal interviewee; these people were responsible for completing the earlier questionnaire survey and are recognised as having extensive knowledge of their company's policies, procedures and management systems. Other interviewees will be sought to enable a broad range of perspectives covering different aspects of the business to be included.

5 INTERVIEW QUESTIONS

i) Management of economic, environmental and social performance

Key question: How is your company's economic, environmental and social performance currently managed?

Supplementary questions to expand the answer and probe key areas if necessary:

- Is your environmental and social performance managed in conjunction with your economic performance?
- Are the implications of economic decisions on your environmental and social performance considered?
- Are the implications of environmental and social decisions on your economic performance considered?
- Do you follow a Plan-Do-Check-Act cycle?
- Have you implemented policies and systems to help manage your economic, environmental and social performance?
- What areas do these policies and systems cover?
- Who developed or had responsibility for developing these?
- Are the needs of stakeholders considered?
- Are planned outcomes monitored and measured?
- Is your progress regularly reviewed?

BS 8900 provides guidance on how to manage for sustainability based on articulating a mission and vision; developing a strategic plan to achieve these; and implementing systems to support the realisation of the strategic plan. Supplementary questions based around these three areas will be used to assess whether the company is managing for sustainability in accordance with BS8900.

Supplementary questions:

- Do you have a corporate mission and/or vision on sustainability?
- Do you have a strategic plan to deliver this?
- Have you implemented policies and systems to support the realisation of your strategic plan?
- Who developed or had responsibility for developing these?
- Why were they developed?
- Was any published guidance followed?
- What order were they developed in?

ii) Changes to management structure, systems and competencies

Key question: What changes have occurred or been made to your company's management structure, systems and competencies in order to get to your current position?

Supplementary questions to probe for detail and specific areas of change:

- Does anyone have corporate responsibility for sustainability at board level?
- Have any new roles been created?
- Have any additional resources been provided?
- Has any training been given?
- Have any new initiatives been introduced?
- Have your priorities changed?
- Do you comply with legal requirements or attempt to go beyond them?
- Do you undertake voluntary commitments to improve your performance?
- Is the development of a learning culture amongst your workforce encouraged?
- Does everything you do have to provide a cost benefit or add value to the company?

iii) Examining the changes identified in detail

Interviewees would be invited to provide more detail on each of the changes identified, and in particular:

- Was it planned or unplanned?
- Who was responsible?
- When was it made?
- How was it made?
- Who was involved?
- What did it achieve?

Access to policies, plans and other relevant documents would be sought where applicable.

Finally, a set of opinion questions will be asked including:

- What worked best or resulted in the best improvement?
- What could have been done better?
- What worked worst or was the least effective?
- What would you do differently now?
- What advice/guidance would have helped you?
- What would you advise other companies/managers in the industry to do to improve their economic, environmental or social performance?

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APPENDIX H Member Declaration on Sustainability

THE PRECAST SECTOR SUSTAINABILITY CHARTER BRITISH PRECAST CONCRETE FEDERATION MEMBER DECLARATION ON SUSTAINABILITY

acknowledges the need to go beyond legislation and take voluntary actions to make its products and operations more sustainable, and commits that from this date it will do this by working towards the adoption of the following principles:

- Develop products that improve the quality and sustainability of the built environment
- Liaise effectively with local communities to foster mutual understanding and respect
- Manage all waste streams effectively and minimise waste disposed to landfill
- Measure, report and improve performance on sustainability issues
- Minimise pollution and emissions associated with production and transportation
- Operate in a responsible manner to protect employees, contractors and visitors
- Operate in an efficient and financially sustainable manner without compromising legal, quality or sustainability principles
- Operate to the highest ethical standards necessary to develop a skilled and competent workforce
- Operate to the highest quality standards necessary to satisfy customers and consumers
- Protect and enhance the natural environment adjacent to or affected by precast production
- Recognise that competition encourages the development of more sustainable products and practices
- Use energy more efficiently and reduce carbon footprint
- Use primary materials more efficiently and promote the use of secondary materials
- Use water more efficiently and minimise demand on mains water supplies
- Work constructively with other organisations to deliver sustainable policies and practices

Signatories

Chief Executive, British Precast Concrete Federation

President, British Precast Concrete Federation

APPENDIX I Sustainability White Paper



Sustainability White Paper - May 2007

“Towards a more sustainable precast industry”

A document for discussion and comment

**BRITISH
PRECAST**

**MORE
FROM
LESS**

Introduction

In March 2007, the British Precast Council approved a programme of measures designed to improve performance across the precast industry on sustainability, comprising:

- **Key Performance Indicators (KPIs)**
- **A Sustainability Charter**
- **A Certification Scheme**
- **A Best Practice Forum**
- **Objectives, Indicators and Targets for Improvement**

Significant time and effort has been invested in the development of this programme – members of British Precast staff and the Sustainability Committee have worked hard to bring it to fruition. Now is the time to publicise this work and gather feedback from industry.

This document introduces the KPI scheme and sets out draft Charter statements for the industry and its stakeholders to consider. It also explains how the development of a Certification Scheme for precast producers will help precast products to gain responsibly sourced materials credits in the Code for Sustainable Homes.

[Details of how to submit your comments are shown on the inside-back page.](#)

Sustainability today

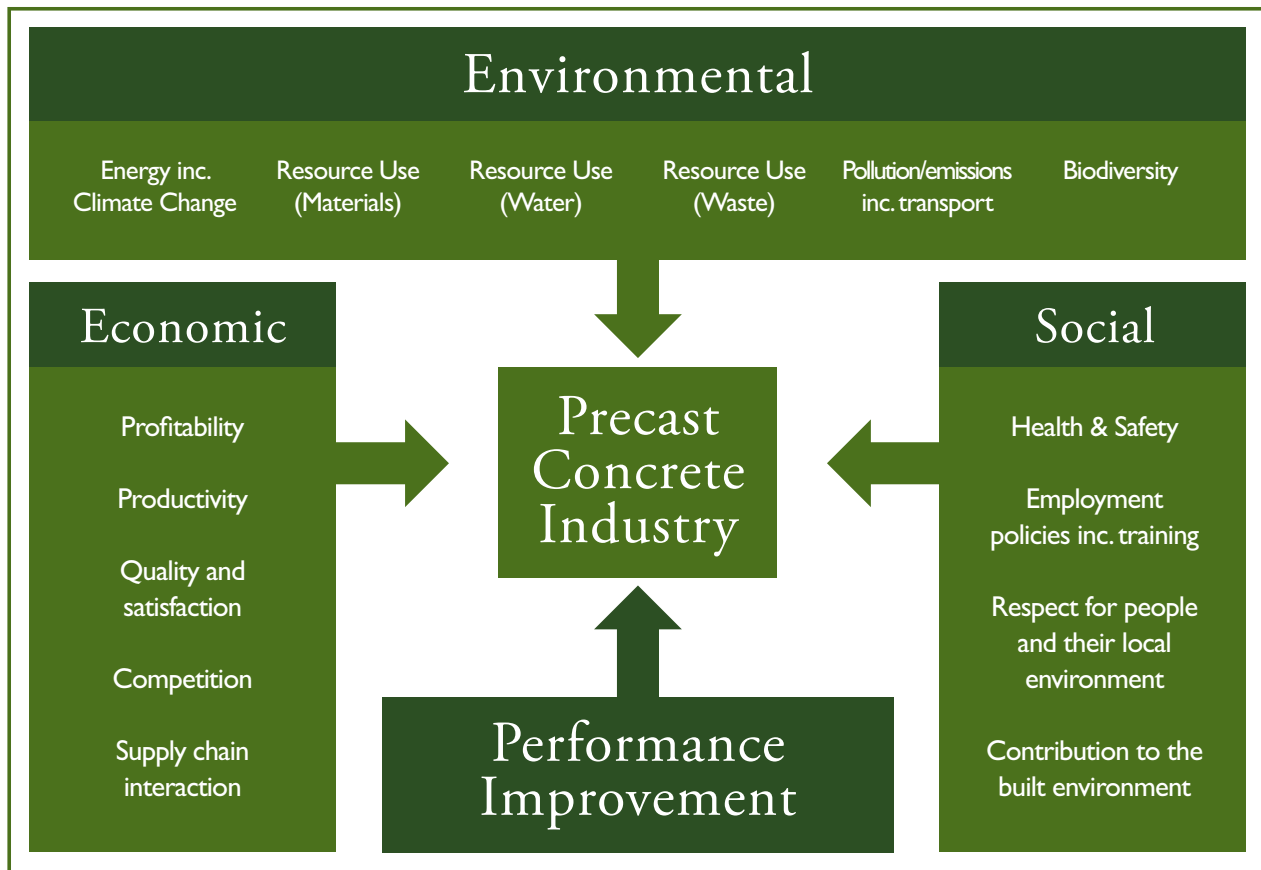
The sustainability agenda is constantly moving forward, affecting both consumption and production. The UK Government has launched its Code for Sustainable Homes and new moves towards all zero carbon homes by 2016. The DTI is revising its Strategy for Sustainable Construction. Further emphasis on climate change, carbon emissions and energy saving is in evidence as a result of the Stern Report, the IPCC Reports and market forces.

The precast industry must respond to these developments and become more sustainable in the way it operates; it must take responsibility for the resources it consumes, the impacts it has on the environment and its relationship with society. This will lead to a more sustainable precast industry: an industry which produces more outputs from fewer inputs, has more profitable operations at lower cost, is more efficient with less waste, and has more trained staff who are at less risk of accident and injury.

But just becoming more sustainable is not enough; stakeholders are now demanding evidence of commitment and improvement. The overall aim of the sustainability programme is therefore to demonstrate to key stakeholders that the industry is committed to sustainability and that measurable progress towards a more sustainable precast concrete industry is being achieved.

Sustainability issues

The programme will focus on the 16 key sustainability issues facing the precast industry shown in the diagram below. These have been identified following consultation with the industry and examination of the priorities and concerns of its primary stakeholders. In addition to recognising the economic, environmental and social pressures on the industry, the need to demonstrate performance improvement is now considered to be a key issue.



Timeline for implementation

Implementation of the programme will take place over the next two years in accordance with the timeline shown below.



Key Performance Indicators (KPIs)

These will allow British Precast to measure and report progress to key stakeholders; companies will also be able to benchmark their performance. The initial data set to be collected is shown here.

1. Precast production

- Number of precast factories operated
- Annual production output
- Annual turnover from precast products

2. Quality

- Presence of an ISO 9000 series compliant quality management system

3. Annual resource use (production)

- Cementitious material consumption (CEM I, GGBS, PFA, other)
- Aggregate consumption (primary, recycled production, secondary)
- Water consumption (mains, harvested and borehole, recycled)
- Energy consumption (gas, electricity, oil/diesel, other)
- Packaging materials consumption
- Quantity of waste disposed of to landfill
- Quantity of solid waste recycled on site
- Quantity of solid waste recycled off site

4. Environmental protection

- Presence of an ISO 14000 series compliant or EMAS compliant environmental management system
- Number of environmental incidents recorded and reported to an outside authority in the year

2006 data

Company or group level data for 2006 will be collected later this year; a guidance document and data forms are currently being prepared.

5. Health and safety

- Presence of an OHSHS 18000 series compliant health and safety system
- Number of RIDDOR reportable accidents in the year
- Number of RIDDOR major injuries in the year
- Number of chronic injuries in the year
- Time lost due to RIDDOR reportable accidents

6. Employment

- Average number of full-time equivalent staff employed over the year
- Presence of a formal staff training and development policy

7. Supply chain (transport)

- Number of deliveries received in the year (main production materials only)
- Cement delivery distance (road, rail, ship or barge)
- Aggregates delivery distance (road, rail, ship or barge)
- Number of deliveries made in the year
- Total delivery mileage for the year (road, rail, ship or barge)

8. Local community relations

- Number of factories operating a local community or local authority liaison scheme
- Number of local meetings held or attended in the year

Confidentiality

The data supplied will be handled in strict confidence by British Precast and presented in a form that will not allow individual companies to be identified.

The Precast Sector Sustainability Charter

The aim of the Charter is to engender commitment from member companies to a set of sustainability principles that are appropriate to the precast concrete sector:

British Precast requires that Sustainability Charter Members shall make a formal declaration to:

- Develop products that improve the quality and sustainability of the built environment
- Liaise effectively with local communities to foster mutual understanding and respect
- Manage all waste streams effectively and minimise waste disposed to landfill
- Measure, report and improve performance on sustainability issues
- Minimise pollution and emissions associated with production and transportation
- Operate in a responsible manner to protect employees, contractors and visitors
- Operate in an efficient and financially sustainable manner
- Operate to the highest ethical standards necessary to develop a skilled and competent workforce
- Operate to the highest quality standards necessary to satisfy customers and consumers
- Produce 'more from less' without compromising quality or sustainability principles
- Protect and enhance the natural environment adjacent to or affected by precast production
- Recognise that competition encourages development of more sustainable products and practices
- Use energy more efficiently and reduce carbon footprint
- Use primary materials more efficiently and promote the use of secondary materials
- Use water more efficiently and minimise demand on mains water supplies
- Work constructively with other organisations to deliver sustainable policies and practices

Achieving Charter Status

To achieve Charter status, companies will initially be required to undergo a simple sustainability audit by British Precast staff to ensure their commitment. The attainment of Charter status will allow companies to demonstrate that they are going beyond legislation and undertaking voluntary action to improve their sustainability performance. Charter status will thus provide stakeholders with a means of differentiating between those companies that are committed to sustainability and continuous improvement of their performance, and those that are not.

Responsibly Sourced Materials Credits

Responsibly Sourced Material Credits provide a means for encouraging the use of more sustainably produced products. They are already a feature of the Code for Sustainable Homes and the Olympic Development Authority's procurement policy, and are set to be commonly used in the construction industry.

To obtain these credits, a certified Chain of Custody is required for a product throughout its supply chain. Chain of Custody certification provides evidence that the sources and processes by which a product has been made are managed in accordance with a series of sustainability policies and standards. It applies whenever a company carries out any material alteration to the product and whenever they are in physical or legal ownership of it. The certification scheme for timber developed by the Forest Stewardship Council (FSC) is a widely recognised example of a Chain of Custody scheme.

To develop a certified Chain of Custody scheme for cement-based building products, a series of sustainability policies and standards covering all stages in the production process are required. These policies and standards must verify that all local and national legislative requirements are met, and assess that initiatives are in place to ensure continuous performance improvement on social and environmental issues. The verification process is usually referred to as Product Stewardship certification.

The Sustainability Charter featured in this document is the first stage in the development of a certified Product Stewardship scheme by British Precast. This will be followed by the development of a series of assessment criteria against which compliance with the sustainability policies of the Charter can be determined and independently certified.

The Concrete Centre is facilitating the development of an overall Chain of Custody scheme for cement-based building products and British Precast is participating in this vital work.

How to comment

British Precast welcomes your feedback on the various measures set out in this document. A one month consultation period has therefore been allowed before further development and implementation takes place. Please send your views, comments, ideas or questions on any aspect of this White Paper to Ian Holton at British Precast.

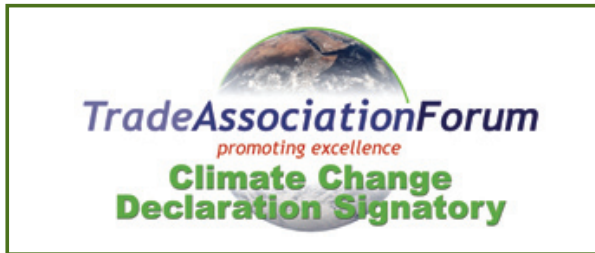
DEADLINE: FRIDAY 15 JUNE 2007

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Further copies of this document can be downloaded from www.britishprecast.org.

Climate Change Declaration

British Precast signed the Trade Association Forum Members' Climate Change Declaration on 13th March 2007. This action acknowledges the increasing impact that climate change will have on our country and other countries during the 21st Century and commits British Precast to tackling the causes and effects of a changing climate within the precast industry. All Full and Associate members have been sent a copy of the signed declaration certificate for display purposes.



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APPENDIX J Additional conference papers produced for developing consensus

Holton, I.R., Glass, J., Clarke, M.A., Bell, S. and Price, A.D.F. (2005). *Developing a sector sustainability strategy for the UK precast concrete industry*. Proc. 18th BIBM International Congress, Amsterdam, May 2005, pp 175-176. BFBN, The Netherlands.

Holton, I.R., Glass, J. and Clarke, M.A. (2009). *More from Less – Outcomes from the UK precast concrete industry sustainability programme*. Concrete: 21st Century Superhero. *fib* symposium, London, June 2009.

DEVELOPING A SECTOR SUSTAINABILITY STRATEGY FOR THE UK PRECAST CONCRETE INDUSTRY

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1 INTRODUCTION

The British Precast Concrete Federation (BPCF) is the trade association for the precast concrete industry in the UK. In 2004, the Federation, in collaboration with the Department of Civil and Building Engineering at Loughborough University, began a four-year research programme associated with the development of a sector sustainability strategy for the industry. This paper is a visioning paper; it sets out the context for the work in respect of sustainable development and sustainable construction, it considers other construction sector sustainability strategies, and suggests ways in which the precast sector strategy could be developed.

Although the research relates specifically to a UK based industry, it will be of interest to individual precast manufacturers and trade associations in other countries, and those measuring the progress of manufacturing industries towards sustainability goals such as government and environmental agencies. Architects, Engineers and Clients will also be interested in the research as sustainability moves up their agendas.

2 SUSTAINABLE DEVELOPMENT AND CONSTRUCTION

Sustainable development is about delivering a better quality of life for everyone and means achieving social, economic and environmental objectives at the same time [1]. The UK Government's strategy for sustainable development launched in 1999 [2], defined these objectives as:

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

In the consultation exercise that informed the strategy [3], it was recognised that:

- the construction industry had a significant impact on society and the environment;
- the construction industry provided the delivery mechanisms for many aspects of Government policy aimed at the provision and modernisation of the nation's infrastructure; and
- benefits could flow from a more efficient and sustainable construction industry.

This led to the publication of a sustainable development strategy aimed specifically at the construction industry in 2000 [1], with the Government driving the construction industry to:

- be more profitable and competitive;
- deliver buildings and structures that provide greater satisfaction, well-being and value to customers and users;
- respect and treat its stakeholders more fairly;
- enhance and better protect the natural environment; and
- minimise its impact on the consumption of energy (especially carbon-based energy) and natural resources.

In essence, it was encouraging the construction industry to take a pro-active attitude to sustainability on the basis that *“Much of what needs to be done is about competitiveness and survival in the global economy and is good business sense”*.

There was also encouragement for sector representative bodies and trade associations to develop sectoral sustainability strategies. The reasoning behind this was *“These will provide a framework for sectors to assess their economic, environmental and social performance; identify areas for improvement in the light of future opportunities and threats; set targets and implement action plans to bring about those improvements; and then to report on progress to stakeholders”* [1]. To accelerate the development and implementation of these sectoral strategies, a best practice forum was established in 2001. This forum included brick, cement and concrete, forest products and steel construction. With the exception of cement and concrete, brick, forest products and steel have all now produced strategies.

3 PRECAST SECTOR SUSTAINABILITY STRATEGY

The BPCF, the precast industry’s trade association in the UK, joined the forum in November 2002 to signal its willingness to develop a sector sustainability strategy applicable to the precast concrete industry. In September 2003, Loughborough University facilitated an industry workshop at the BPCF to discuss how the precast industry should proceed. The workshop concluded that BPCF should pursue the development of a sector sustainability strategy and aim to obtain maximum buy-in from its members. To help deliver the strategy, members of the BPCF’s governing council agreed to support a four-year research programme in collaboration with the Department of Civil and Building Engineering at Loughborough University.

The research began with an analysis of the brick [4], forest products [5] and steel construction [6] sector strategies, together with other relevant sources of information [7]. Three common steps were identified in the development of these strategies:

1. they began by recognising and/or defining the impact of the industry, usually in economic, environmental and social terms;
2. they then set objectives to mitigate those impacts; and
3. key performance indicators were used to measure progress towards meeting those objectives.

Whilst development of the precast strategy is likely to follow the same process, it is important that the triple bottom line issues of economic, environmental and social development are treated in a balanced way.

The operational phase of a building or structure usually has significantly more economic, environmental and social impact than the construction phase. This led to variations in the scope of each strategy, for example, the brick strategy only covered brick production whilst the steel strategy extended to downstream issues of usage, but not upstream issues relating to iron and steel making. Because stakeholder consultation was identified as an important part of the strategy development process, it is considered important that the precast strategy does at least present a review of the end use of precast products.

A report on the progress the UK has made towards more sustainable construction between 2000 and 2003 [7], showed that whilst progress was being made in setting and promoting targets, monitoring and observing performance, and promoting best practice, there were also areas of poor performance. These included demonstrating a clear business case for sustainability and dissemination; the right information needed to be presented to the right audience in the right way, and there were problems in reaching SMEs and entire supply chains. It is important that the precast strategy addresses these issues and is applicable to the whole sector as it is to sub-sectors and individual companies.

Over the next three years the research will focus on mapping the key sustainability issues for the sector, establishing useful targets and indicators, and developing consensus with industry stakeholders. It is the research team's intention to then present a reporting paper at the BIBM Congress in 2008 to communicate the results.

4 CONCLUSIONS

- Development of a sector sustainability strategy is about competitiveness and survival in the global economy and is good business sense.
- The sustainability strategy for the UK precast concrete industry has to balance the triple bottom line issues of economic, environmental and social development.
- Although the strategy will apply primarily to product manufacture, it must also aim to review issues of product use.
- Useful indicators and targets need to be established for the sector in order to measure its progress.
- Consensus needs to be developed with industry stakeholders up and down the supply chain.

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MORE FROM LESS – OUTCOMES FROM THE UK PRECAST CONCRETE INDUSTRY SUSTAINABILITY PROGRAMME

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Key words: *Sustainable development, precast concrete, sustainability strategy.*

Abstract: *As part of the construction products industry, the precast concrete industry is under increasing pressure from the Government and market forces to become more sustainable. In its role as the trade association for the precast industry in the UK, British Precast set up the 'More from Less' sustainability programme to support the competitiveness of the industry and ensure its long-term future. The programme recognises that becoming more sustainable is as much about efficient, profit-orientated practice and achieving value for money, as it is about helping society and protecting the environment. The main output from the programme has been a sector sustainability strategy for the precast industry; this was produced as part of a 4-year collaborative research project with Loughborough University. There is clear evidence that the strategy is already helping to guide the business decisions of companies in the industry, and that progress towards a more sustainable precast industry is being achieved as a result. The research supporting the strategy development process has added to current knowledge and guidance on the development of sector sustainability strategies, but shown that there are limits to the influence trade associations can have over their members' actions. It has also shown that the development of management systems, particularly environmental management systems to ISO 14001, and continuous performance improvement cultures can assist companies in managing for sustainability. The programme is continuing with a new 4-year research project investigating the benefits of product stewardship.*

1. INTRODUCTION

The British Precast Concrete Federation, generally known as British Precast, is the trade association for the precast concrete industry in the UK. The 'More from Less' sustainability programme was set up by British Precast in 2004 to support the competitiveness of the industry and ensure its long-term future. This paper reviews the main outcomes from the programme to date, the impact it has had on the sustainability of the precast industry, and outlines its future direction.

2. THE NEED FOR A MORE SUSTAINABLE PRECAST INDUSTRY

Sustainable development has been defined as "*development which meets the needs of the present without compromising the ability of future generations to meet their own needs*"¹; its achievement requires the integration of actions in the key areas of economic growth and equity, conserving natural resources and the environment, and social development. Government policy and business pressure are reported to be the main drivers towards sustainable development in the UK².

The construction industry has been defined as those industries that contribute to the creation and maintenance of the 'built environment'³. Its impact on society is therefore critical since the built environment provides the context for most human activities and has a huge impact on our quality of life. The industry also has an important impact on the economy and the environment, since it provides employment for around 3 million people in the UK⁴, accounts for 8% of Gross Domestic Product⁴, and is a major user of resources and producer of waste⁵. The construction industry is therefore of significance in achieving progress towards sustainable development in the UK; the Government, investment community and others have recognised this. Consequently the construction industry is under considerable pressure to become more sustainable.

The UK construction industry is generally recognised as comprising four principal activities: building, civil engineering, materials and products, and associated professional services⁶. Precast concrete is an important part of the construction products industry; in 2007, it had an estimated turnover of £2.5 billion from 38 million tonnes of product sales, and provided direct employment for over 20,000 people⁷. The precast industry also has an impact on society and the environment; for example, the industry is a major user of cement and virgin aggregates, consumes energy and water in its production processes, transports its products nationally, and has many factories in urban areas. Hence, sustainability improvements in the precast industry would have a major beneficial effect on sustainable development in the UK.

However, there are other benefits to becoming more sustainable. For example, CIRIA Report C563 considered the business benefits of sustainable construction⁸. The view was expressed that adopting a sustainable approach would address the failings of the construction industry identified in 'Rethinking Construction', commonly referred to as the Egan Report⁹, and lead to significant business benefits, including better understanding of client needs, identification of opportunities for innovation, increased shareholder value, reduced costs, reduced risk, enhanced public relations and community liaison, and increased employee motivation. This shows that becoming more sustainable is as much

about efficient, profit-orientated practice and achieving value for money, as it is about helping society and protecting the environment.

It was against this background that British Precast had identified the need to facilitate progress towards a more sustainable precast industry in the UK in order to support its competitiveness and ensure its long-term future¹⁰.

3. SECTOR SUSTAINABILITY STRATEGY

Sector sustainability strategies are recognised as providing industry sectors with a way of managing risks and opportunities, and contributing to sustainable development; consequently the UK Government has encouraged their development in the construction industry⁶.

Although it is often considered to be part of the cement and concrete sector, the precast industry is so large and diverse that it can be considered as a sector in its own right. This diversity is evident in the range of products the industry produces, the manufacturing processes it uses, and the size and structure of the companies within it.

- Precast products are made to consistently high quality standards using a combination of skilled labour and automated processes.
- Mass produced products range from small hydraulically pressed items such as concrete bricks, paving and roof tiles, to larger extruded or wet-cast items such as pipes, piles and floor beams.
- Bespoke items include large wet-cast products such as cladding panels and structural units designed and manufactured to specific architectural and engineering requirements.
- There are over 500 precast companies in the UK ranging in size from small, independently-owned, single factory operations often employing less than 10 people, to divisions of large international companies with 10 or more factories and over 1,000 staff.

In 2003, following consultation with its members, British Precast undertook to develop a sector sustainability strategy for the precast industry¹⁰. However, the development of such strategies is a departure from the traditional role of the trade association and presented British Precast with a number of challenges. The 'More from Less' research programme was therefore established in 2004, in collaboration with Loughborough University, to address those challenges, develop the strategy, and help facilitate progress towards a more sustainable precast industry.

4. KEY FINDINGS

The research programme has followed a mixed method strategy of inquiry based on action research methodology, that is, a series of research cycles have been undertaken with the findings from each cycle used to inform and guide subsequent cycles; archival analysis,

survey and case study have been the main research methods used ¹¹. This section describes the key findings.

- The purpose of a sector sustainability strategy is not well defined in the literature. It was established that the purpose of such a strategy should be to provide a long-term plan for improving economic, environmental and social performance in a sector; not clearly achieving this purpose will reduce the suitability of the strategy and its chances of success ².
- Targets and indicators need to be specified in order to measure improvement and demonstrate progress to stakeholders; if quantifiable progress is not demonstrated, stakeholders may consider the strategy ineffective and it will lose their support ².
- It was established that the focus of the precast sector strategy should be on improving the sustainability of companies within the industry; improving the economic, environmental and social performance of companies would lead to them producing more sustainable products, the use of which would in turn lead to the achievement of more sustainable construction.
- A broad range of sustainability issues companies in the precast industry needed to improve their performance on were identified, but there were no clear priorities amongst these issues. It was therefore concluded that the strategy should encourage companies to take actions on all of the issues identified ¹²; these issues are shown in Figure 1.

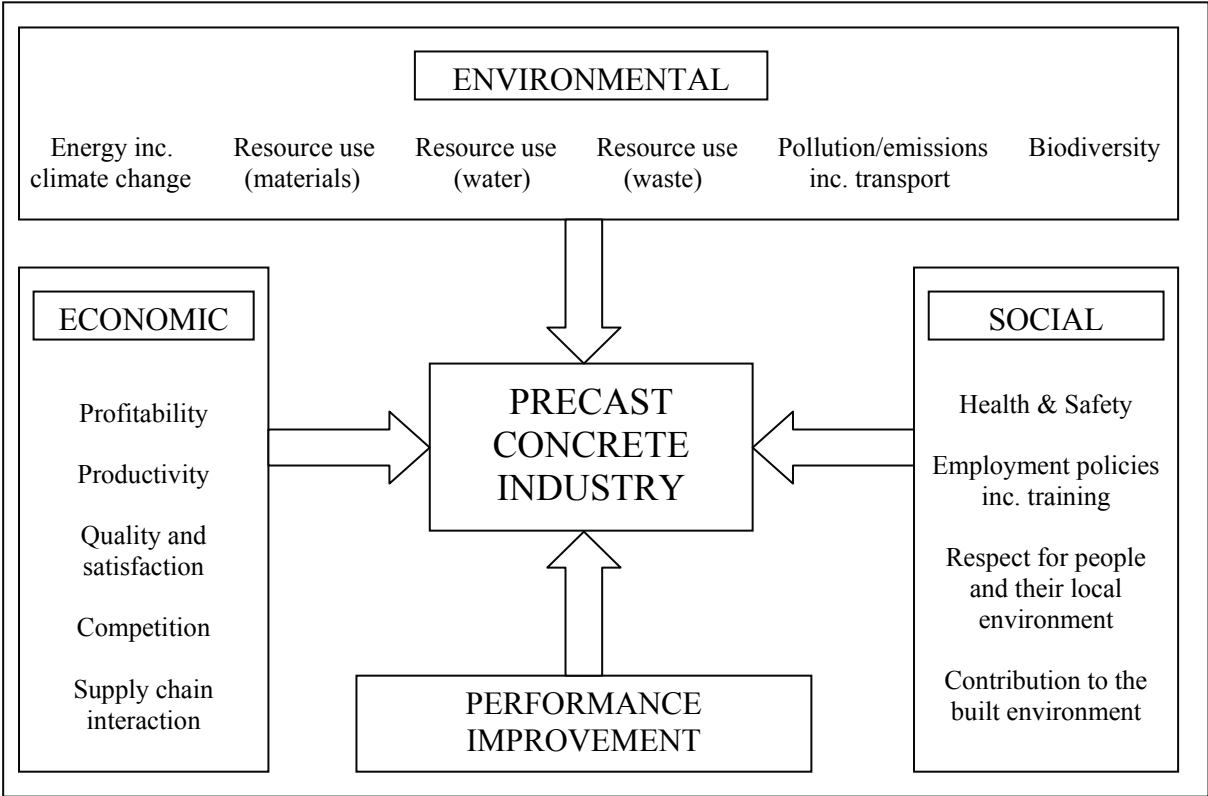


Figure 1: The key sustainability issues facing the precast industry

- Companies in the precast industry were found to be at different levels of development with respect to corporate sustainability; this was not unexpected given the diverse nature of the industry. It was therefore concluded that the strategy would need to engage with all companies in the industry regardless of their starting point on sustainability and help them to progress ¹².
- A clear business case for companies in the precast industry to adopt a more proactive approach to sustainability was identified, however, as a trade association, British Precast was found to be limited in the influence it had over companies in the precast industry; specifically, it could not force companies to adopt more sustainable practices, only encourage them to do so. Ways in which British Precast could encourage change in the industry were therefore identified ¹³.
- A number of precast companies were found to have progressed to the ‘efficiency’ phase of corporate sustainability as defined by Dunphy *et al.* (2003) ¹⁴ and to be developing the capabilities necessary to manage for sustainability described in BS 8900; they had achieved this by adopting a compliance approach to managing for sustainability, characterised by the development of environmental management systems to ISO 14001 and continuous performance improvement cultures ¹⁵.

5. ACTION PLAN

The research findings were combined with best practice guidance, current and emerging theory, stakeholder engagement, and experience from other sectors and industries, in order to produce a long-term plan for improving economic, environmental and social performance in the precast industry. The main elements of the plan were reported by Holton *et al* (2008) ¹³ and are briefly described here.

- **Key Performance Indicators (KPIs):** The use of KPIs to measure and report progress on sustainability to key stakeholders is a well established practice ¹⁶. A set of indicators has been selected that provides an overview of the impact of the precast industry on society and the environment, and how that impact is managed. Companies will also be able to use these indicators to monitor their own performance and benchmark themselves against the rest of the industry.
- **Sustainability Charter:** The Charter contains a set of principles which, if incorporated into the normal business and working practices of a precast company, will encourage it to go beyond legislation and take voluntary actions to make its products and operations more sustainable; the principles are based on the sustainability issues shown in Figure 1. It also provides stakeholders with a simple means of differentiating between those companies that are committed to sustainability and continuous improvement of their performance, and those that are not. Voluntary certification schemes such as this are now emerging across many industries and increasingly being used in procurement specifications. ¹⁶
- **Certification Scheme:** The development of a Certification Scheme for precast products and producers is a natural progression from the Sustainability Charter. Such a scheme would provide independent third-party evidence that the sources from and processes by which a product has been made have been managed in

accordance with a series of sustainability policies and standards verifying that all local and national legislative requirements are met and that initiatives are in place to ensure continuous performance improvement on social and environmental issues.

- **Best Practice Forum:** In order to encourage participation and performance improvement across the precast industry, a series of best practice and other guidance documents will be developed, and seminars and workshops held in order to disseminate this information and provide a discussion forum for companies to participate in.
- **Objectives and targets for improvement:** These are a key feature in any sector sustainability strategy, providing a long-term plan for improving sustainability; they will be developed in consultation with the precast industry and its stakeholders using the KPI data, and be informed by the UK Government's strategies for sustainable development and more sustainable construction.^{17, 4}

Senge *et al.* (2008) refer to the need to create lasting change, rather than adopt short-term 'quick fix' solutions to individual problems, in order to achieve progress on sustainability¹⁸. The precast sector strategy differs from other sector sustainability strategies in that rather than promote action on specific short-term objectives, the action plan that forms the strategy has been designed to embed an enduring approach to sustainability into the precast industry. It achieves this by having the flexibility to address a wide range of current and future sustainability issues, by not being time constrained, and by encouraging companies across a diverse industry sector to take action, regardless of their size and starting point on sustainability, by offering them clear benefits from doing so. This will create the lasting change that is necessary to achieve progress on sustainability.

6. IMPACT

There is clear evidence that the 'More from Less' programme is helping to guide business decisions being made in the precast industry; decisions that will lead to the development of a more sustainable precast industry.

- Within 12 months of the Sustainability Charter being launched, 20 companies had made a formal declaration to adopt its principles into their normal business and working practices thereby demonstrating their commitment to become more sustainable; together these companies account for over 50% by mass and value of all precast concrete produced in the UK.
- An increasing number of companies are using Environmental Management Systems to manage and improve their environmental performance, and are reporting significant performance improvements as a result.
- Companies are starting to move away from linear models of production and consumption towards closed-loop systems in which they not only recycle their own waste but also collect waste and surplus products from their customers for recycling.
- The benefits of a skilled and motivated workforce are being recognised through increased investment in staff training and development.

- The benefits of forging positive links with local community groups are also being increasingly recognised, with many factories now introducing formal community liaison meetings.

There is also evidence of the programme impacting on the wider concrete industry. For example, using its new found knowledge and capability in the development of sustainability strategies, British Precast was able to take a leading role in the development of the *Sustainable Construction Strategy for the UK Concrete Industry* published in July 2008¹⁹. In addition, precast industries in other regions including Scandinavia, North America and Australia have expressed interest in adopting similar sustainability programmes and strategies.

7. FUTURE DIRECTION

The research project between British Precast and Loughborough University to develop a sector sustainability strategy for the UK precast industry was completed in 2008. However, the ‘More from Less’ programme is continuing with a new 4-year research project to better understand and promote the business and performance benefits that can be gained by the precast industry through product stewardship; sometimes referred to as extended producer responsibility. Work also continues to build support across the precast industry for the sector sustainability strategy, to establish objectives and targets for improvement, and to engage with the industry’s stakeholders.

8. CONCLUSION

The ‘More from Less’ programme was set up to develop a sector sustainability strategy for the UK precast concrete industry. The research supporting the strategy development process has added to current knowledge and guidance on the development of sector sustainability strategies, but shown that there are limits to the influence trade associations can have over their members’ actions. It has also been shown that the development of management systems, particularly environmental management systems to ISO 14001, and continuous performance improvement cultures can assist companies in managing for sustainability. The strategy has been produced as an action plan designed to create lasting change. There is clear evidence that the strategy is helping to guide the business decisions of companies in the industry, and that progress towards a more sustainable precast industry is being achieved as a result. The programme is continuing with a new 4-year research project investigating the benefits of product stewardship.

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APPENDIX K Sustainability Matters progress reports



Sustainability Matters

December 2005

First report on the precast industry's progress on sustainability

**MORE
FROM
LESS**

**BRITISH
PRECAST**

Introduction

This is the first report from British Precast on the precast concrete industry's progress on sustainability - highlighting our **More from Less** programme. In this and future reports we will set out the sustainability issues for our industry, our commitments to tackling those issues, and chronicle our progress. We are doing this because the choices on sustainability are simple: be proactive and reap the benefits, or ignore it and suffer the consequences.

I believe that a more sustainable approach is the key to the future of the precast industry; an industry that produces more outputs from fewer inputs, has more profitable operations at less cost, is more efficient with less waste, and has more trained staff with fewer accidents.

British Precast President, David Szymanski



Social progress: precast concrete is the material of choice for many urban regeneration schemes



Environmental protection: precast concrete is widely used to protect our coastline



Prudent use of natural resources: the precast industry is committed to reducing waste by, for example, using secondary and recycled materials



Economic growth: the precast industry continues to invest in plant and resources, such as Bison Concrete's new £30 million flooring plant, the largest in Europe

Why sustainability matters

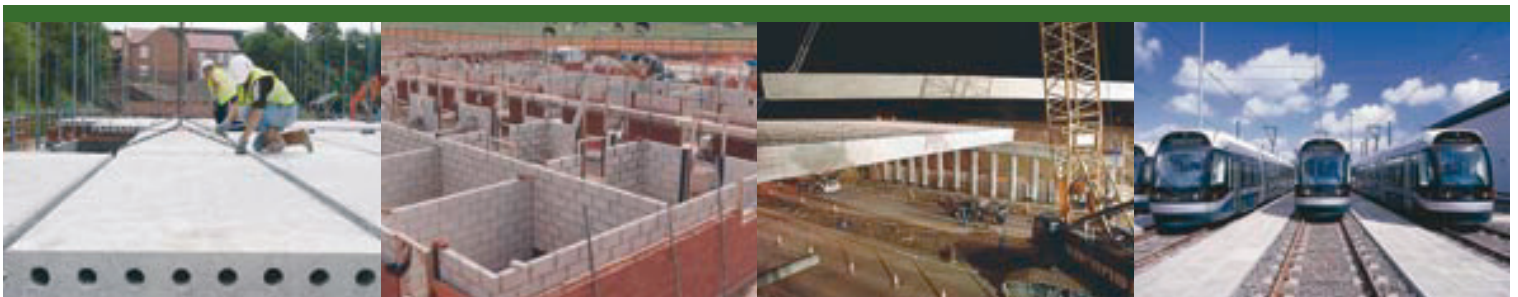
Sustainability is about ensuring that development meets the needs of the present without compromising the ability of future generations to meet their own needs. It covers a wide range of issues, including:

- Social progress that recognises the needs of everyone;
- Effective protection of the environment;
- Prudent use of natural resources; and
- Maintenance of high and stable levels of economic growth and employment.

Many governments, international bodies and multi-national corporations have realised that it is no longer simply desirable to address these issues, but that it is now essential in order to ensure future growth. Business analysts are reporting that those industries and companies that are really improving their performance on sustainability issues are reaping the benefits of growth and investor confidence, whilst those that are not are being left behind.

There is another compelling reason to address sustainability. The Government published its strategy for sustainable development in 1999, setting out ten guiding principles to its policies that would encourage a more sustainable approach to all aspects of life. In the 2005 revision of this strategy, it is clear that where measures to enable and encourage changes in behaviour are not sufficient to change entrenched habits, ways to catalyse change will be introduced. Industry can therefore be assured that it needs to take sustainability seriously, or it will face an increasing amount of social and environmental legislation in the future.

More information on the Government's approach to sustainable development can be found at www.sustainable-development.gov.uk



The Precast Industry

The precast concrete industry is an important national industry producing over 35 million tonnes of products annually for the construction sector; worth in excess of £2 billion. There are around 800 precast factories located across the UK, which provide direct employment for 22,000 people and many more in the upstream and downstream sectors.

Precast concrete products make a significant contribution to the built environment; they are widely used in public and private sector projects of many sizes, from housing and landscaping, through commercial buildings to highways and infrastructure.

Precast products are made to consistent high quality standards using a combination of skilled labour and automated processes. Mass produced products range from small hydraulically pressed items such as concrete bricks, paving and roof tiles, to larger extruded or wet-cast items such as pipes, piles and floor beams. Bespoke items include large wet-cast products such as cladding panels and structural units designed and manufactured to specific architectural and engineering requirements.

British Precast

British Precast is the trade federation for precast concrete manufacturers in the UK. Founded in 1964, its federated structure acknowledges that the precast sector is, in fact, a matrix of industries, each with its own characteristic markets and supply chains, technologies, standards and lobbying issues. British Precast exists to manage this matrix through a number of product groups and associations, each with its own agenda and devolved budget. Spanning all product areas are a number of overarching issues common to all members. The management of these issues – research, building regulations, design codes, health and safety, training, government relations and sustainability – is the other role of British Precast and is growing in its importance. Increasingly sustainability is becoming the supreme consideration.

Our progress on sustainability

Making progress on sustainability is about continual improvement in economic, social and environmental performance, regardless of whether the subject is a country, industry, company or factory. British Precast is actively encouraging better performance in the precast industry, ensuring that our members continue to prosper; but at the same time protecting the industry's workforce, reducing its reliance on non-renewable resources and ensuring that its products are the best performing when developing sustainable communities.

Our progress to date includes:

1999	Environment and Health & Safety committees formed to provide a pan-sector approach to these important issues.
2001	Concrete Targets Award scheme announced to improve health and safety across the industry.
2002	Best Practice Awards started in order to recognise and promote excellence amongst the membership in the areas of innovation, health and safety, and environment. British Precast joins the DEFRA and DTI Pioneers Group to signal its willingness to develop a sector sustainability strategy applicable to the precast industry.
2003	British Precast's governing council agree to support a research project with Loughborough University to develop a sector sustainability strategy.
2004	Environment Committee becomes the Sustainability Committee, with issues such as corporate social responsibility and community relations now included in its remit. Sector Sustainability Strategy Project started (see page 5 for details).
2005	Concrete Sector Sustainability Working Group set up to facilitate a joined up approach to sustainability from the cement and concrete industry

Work also goes on behind the scenes with British Precast staff and representatives contributing to initiatives such as the Code for Sustainable Buildings and the review of the Government's strategy for sustainable construction, which will affect the whole construction industry.

Our commitment to sustainability

British Precast is committed to the development of a more sustainable precast industry and is working to deliver on that commitment through its committees, Best Practice Awards and the Sustainability Strategy Project. But we cannot achieve it without the commitment and participation of our members, for which I thank them. I would also encourage all non-members to join British Precast, to commit their support and make sustainability their number one business issue.

British Precast Chief Executive, Martin Clarke



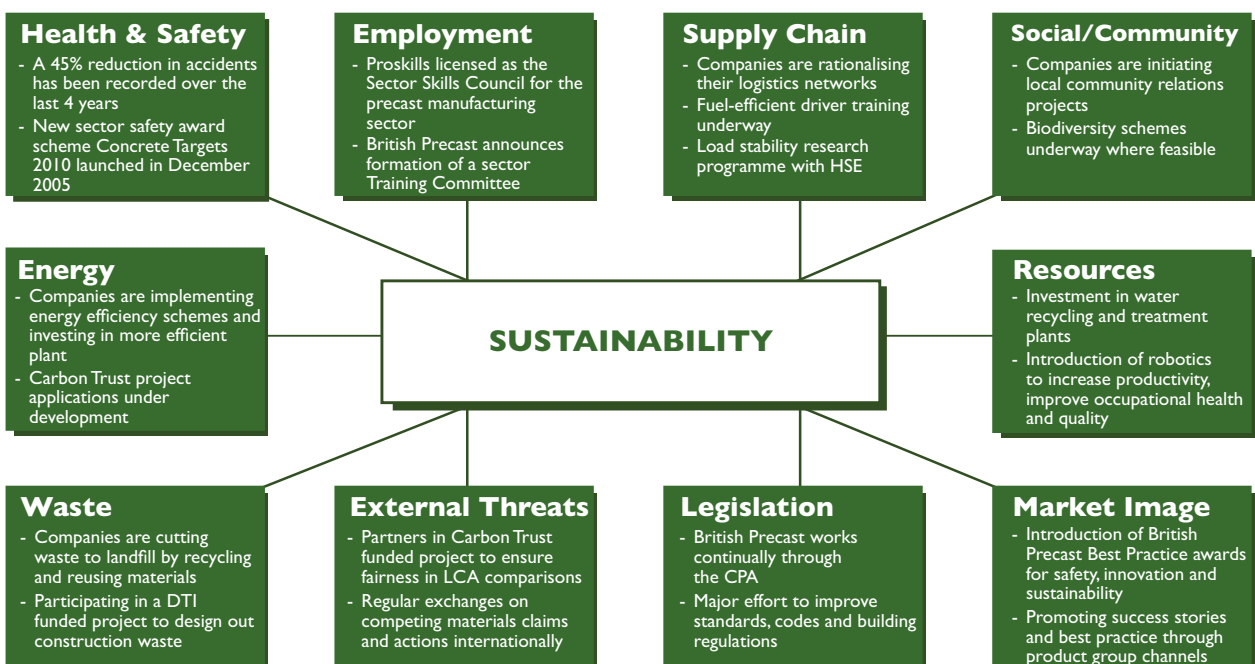
Top 10 business issues in the precast industry

An industry survey in August 2005 identified profitability and competitiveness to be the top business issue for the precast industry. A workshop held at Loughborough University in September then identified ten further issues that contributed to this; these are briefly explained in the diagram below.



Sustainable solutions

The precast industry, through British Precast and the efforts of individual companies, is already implementing solutions to improve its sustainability; some of these are included in the diagram below. Compare this diagram with the one above and you can see that the profitability and competitiveness of the industry is intrinsically linked to its sustainability. However, we are more advanced on some issues and in certain parts of the industry than in others, and still have many challenges ahead.



Sector sustainability strategy project

A sector-wide approach to sustainability is of increasing importance to the efficient, effective and responsible operation of business. In fact the Government has encouraged trade associations and sector representative bodies to develop sector sustainability strategies, because these provide a focused way of addressing sector-specific economic, social and environmental issues. British Precast's governing council made a commitment in 2003 to develop a sector sustainability strategy applicable to the precast industry, and in 2004 a research programme was started with Loughborough University to facilitate development and implementation of this strategy.

Working with the Department of Civil and Building Engineering at Loughborough University will allow the project team access to specialist knowledge on sustainability and strategic management in the construction industry.

In order to produce a strategy document, the research programme will:

- Identify the economic, social and environmental impacts, both good and bad, of the sector;
- Establish the precast industry's awareness and understanding of the opportunities and threats related to sustainable development; and
- Establish objectives, targets and indicators for future improvement.

Successful implementation of the strategy will require:

- Identification of actions to achieve those targets and objectives;
- Accounting for the industry's actions by reporting progress; and
- Developing consensus amongst industry stakeholders.

British Precast members will be encouraged to commit to the strategy and the initiatives it produces, provide data to monitor progress and reap the benefits that a more sustainable precast industry brings.

The project is currently investigating the industry's sustainability priorities, the actions it needs to take and those it is already taking.

Further details of the project including downloadable reports and other information, can be found on the Sustainable Precast website www.sustainableprecast.com.

The importance of energy

Dominant in our *More from Less* programme is the drive to improve the carbon footprint of precast products and to meet the challenge of rapidly escalating energy and fuel costs. Here is an example of one company's approach to energy saving.

Tarmac Concrete Products recognised the need for saving energy and how a company wide effort was required in order to achieve maximum benefits. The target of reducing specific energy consumption (i.e. energy used per unit production) by 15% between 2004 and 2014 was set and the SavE (Save Energy) campaign launched in order to achieve this.



A company steering group was formed that developed and implemented a strategy that involved all levels of employees and provided a sound framework for monitoring and reviewing progress, and achieving the targets set. The campaign included an employee SavE booklet, site surveys, training of all managers, advice and assistance from the Carbon Trust, site survey guides and employee toolbox talks.

The campaign has been very successful in a very short period from launch. Energy awareness has increased significantly across the business and early indications are that the reduction targets will be met and probably surpassed.



In addition to reductions in specific energy consumption, reductions in CO₂ emissions from efficient use of energy and alternative fuels have been achieved, together with increases in plant availability as maintenance improves and reductions in solid waste as manufacturing techniques improve.

Tarmac Concrete Products' achievements were recognised in British Precast's annual Sustainability Awards. More details of the Awards and 2005 winners are given on page 6.



2005 Sustainability Award Winners

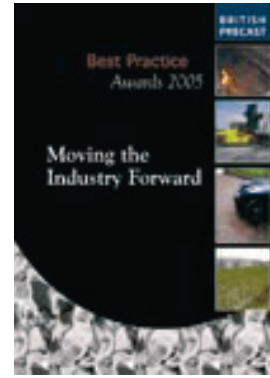
The aim of the Sustainability Awards, sponsored in 2005 by The Concrete Centre, is to reward excellence within the British Precast membership and to publicise the industry's progress towards sustainability. Entries this year were invited on either a single-site or company-wide basis, and judged against their sustainability benefits, innovatory approach, wider applicability and employee participation.



Schemes to recycle water reduce consumption and can improve the environment

The winning entries in the single-site category demonstrated the positive link between profitability and a rigorous approach to waste minimisation. Many of the entries were relatively simple and cost effective solutions to common problems that everyone in the industry could learn and benefit from. Marshalls Eaglescliffe Works won the category with their work to reduce water consumption, running costs and their overall environmental impact. Significant results were produced through the combined efforts of everyone that works at the site, together with the effective implementation and combination of their Quality, Health and Safety, and Environmental Management systems into an integrated management system. Recycling of previous waste streams, including used pallets, steel waste and reject concrete is now fully implemented.

The winning entries in the corporate category showcased the efforts of the larger member companies who, with their specialist teams, are working to establish more sustainable production and operational platforms. Marley Eternit won the category for their development of a company-wide life cycle assessment (LCA) program. As a result of this, Marley Eternit is leading the way by having LCA data for all of its products, is reducing the environmental impact of its products, and is influencing the supply chain by running CPD seminars on sustainable pitched roofing.



Details of all the entries and award winners can be found in the Best Practice Awards 2005 brochure *Moving the Industry Forward*, available from info@britishprecast.org or as a download at www.britishprecast.org.



Improving logistics brings sustainability benefits through reduced costs, emissions and congestion.

Comments and further information

British Precast welcomes your views on this report and our approach to developing a more sustainable precast industry. You can give us your comments by writing to Ian Holton at British Precast or email Ian at ih@britishprecast.org.

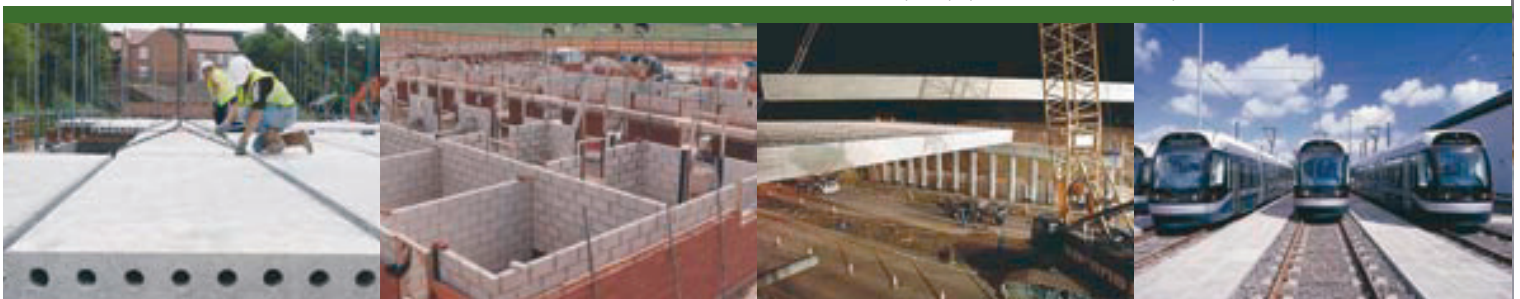
Further information is published in the sustainability section of our website and in *More from Less*, our sustainability newsletter.



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Sustainability Matters

December 2006

Second report on the precast
industry's progress on sustainability

**MORE
FROM
LESS**

**BRITISH
PRECAST**

Introduction

This is the second report from British Precast, produced as part of our *More from Less* programme, on the precast concrete industry's progress on sustainability. It shows how over the last year British Precast and its member companies have delivered on their commitment to develop a more sustainable precast industry. In particular it highlights the issues they are tackling, the solutions they are employing and the benefits that they are accruing.

This report shows that significant investment, as well as continuing effort and imagination, is being applied towards the development of a more sustainable precast industry. However we cannot rest on our laurels. The sustainability agenda is constantly moving forward; the Government has published its Code for Sustainable Homes and we will be working hard on the technical manual to support the Code in 2007. The DTI is revising its Strategy for Sustainable Construction, and further emphasis on climate change, carbon emissions and energy saving is in evidence as a result of both the Stern Report and market forces. I am pleased therefore to praise our member companies that are moving forward on sustainability and urge others to follow suit and take advantage of the benefits it can bring.

British Precast President, David Szymanski



The Precast Industry

The precast concrete industry is an important national industry producing over 38 million tonnes of products annually for the construction sector, worth in excess of £2.5 billion. There are around 800 precast factories located across the UK, which provide direct employment for 22,000 people and many more in upstream and downstream sectors.

Precast concrete products make a significant contribution to the built environment; they are widely used in public and private sector projects of many sizes, from housing and landscaping, through commercial buildings to highways and infrastructure.

Precast products are made to consistent high quality standards using a combination of skilled labour and automated processes. Mass produced products range from small hydraulically pressed items such as concrete bricks, paving and roof tiles, to larger extruded or wet-cast items such as pipes, piles and floor beams. Bespoke items include large wet-cast products such as cladding panels and structural units designed and manufactured to specific architectural and engineering requirements.

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British Precast is committed to the development of a more sustainable precast industry and is working to deliver on that commitment through its committees, Best Practice Awards and dedicated Sustainability Project. An increasing number of our members are recognising the importance of adopting more sustainable practices and are supporting our work in order to ensure a future for the industry.

The range of precast concrete products includes:

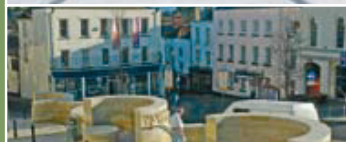
- Architectural cladding



- Flooring including beam & block and hollowcore



- Cast stone and other decorative products



- Masonry including blocks and walling



- Drainage including pipes, culverts and manholes



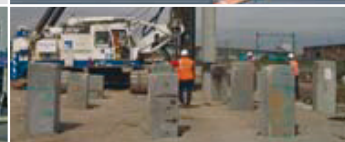
- Paving, landscaping and street furniture



- Roof tiles



- Piles and foundations



- Structural components including beams, columns and panels



- Railway products



Sustainability is a strategic business issue

Sustainability is about ensuring that development meets the needs of the present, without compromising the ability of future generations to meet their own needs. Many governments, international bodies and multi-national corporations have realised that it is no longer simply desirable to address these issues, but it is now essential in order to ensure future growth. Business analysts are reporting that those industries and companies that are really improving their performance on sustainability issues are reaping the benefits of growth and investor confidence, whilst those that are not, are being left behind. Sustainability has thus become a strategic business issue.

What does being more sustainable involve?

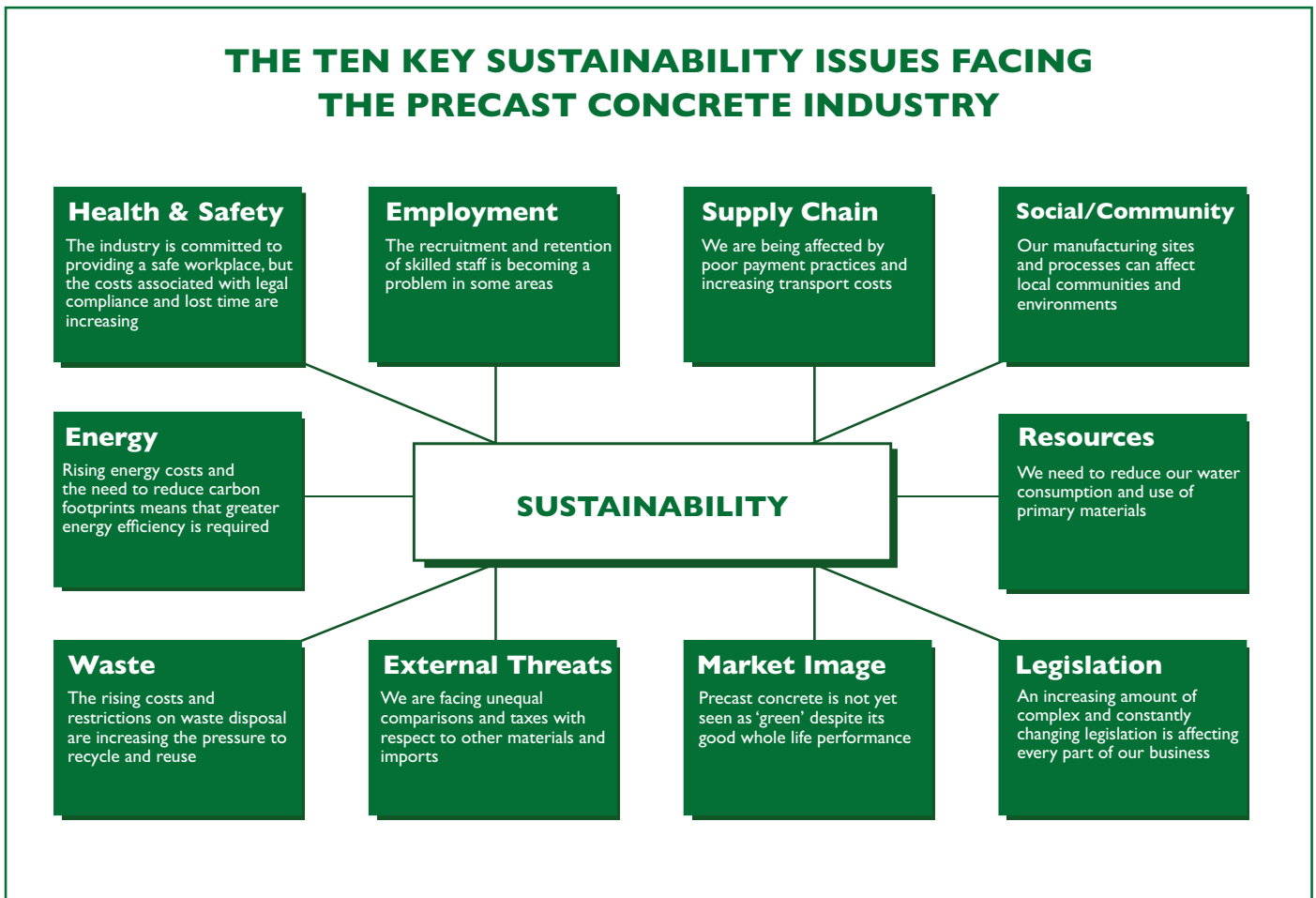
The precast industry has acknowledged the significance of sustainability and recognises that it needs to be more sustainable in order to ensure its future profitability and competitiveness. But what does being more sustainable involve?

Being more sustainable starts with our business and production processes; it involves taking responsibility for the resources we consume, the impacts we have on the environment and our relationship with society. From here, the development of more sustainable precast concrete products will follow, and their use will in turn contribute to more sustainable concrete construction.

The ten key sustainability issues facing the industry were initially identified in a workshop held in September 2005. These were subsequently verified across approximately 70% of the industry (by turnover) as part of a questionnaire survey conducted in January 2006. These issues are shown in the diagram below. Three of these issues, external threats, legislation

and market image, are pan-industry issues for which British Precast takes responsibility. Company level responses are required to the others; responses that will result in an industry that produces more outputs from fewer inputs, has more profitable operations at less cost, is more efficient with less waste, and has more trained staff with fewer accidents.

The survey also showed some companies in the industry to be more advanced in dealing with the sustainability agenda than others; the majority of companies were found to be actively implementing policies and procedures relating to health and safety and environmental compliance, but fewer companies were doing this with respect to resource efficiency and social progress. Being more sustainable involves not just some companies addressing these issues, but encouraging all companies in the precast industry to address them. By progressing from compliance to efficiency to proactivity on sustainability issues, companies and the industry will share in the benefits of being more sustainable.



Being proactive

The following examples show some of the ways in which companies are taking a proactive approach to improving their performance on the key sustainability issues and the benefits they are accruing; approaches that can and are being adopted by other companies.

Health and Safety

Ensuring the health and safety of its workforce is of paramount importance to the precast industry. The Concrete Targets 2010 scheme was launched by British Precast in 2006 as part of its commitment to maintain and improve the industry's health and safety record. The scheme is an industry-wide programme to reduce reportable accidents and lost time by 50% between 2006 and 2010. It works by encouraging companies to improve health and safety by following a co-ordinated plan of initiatives. These initiatives cover physical safety, occupational health and human factors, and have been selected to reflect the problems that can arise in the industry and to support the work of the Health and Safety Executive. The initiative selected for 2006 was reducing the impact of noise and vibration on the working environment.



SCC being used in the production of stairs and landings at Hanson Building Products, Hoveringham.

Many companies in the industry have reduced the impact of noise and vibration on the working environment by incorporating self-compacting concretes (SCC) into their wet cast production processes. These are concretes that are able to flow under their own weight and completely fill the formwork. They maintain homogeneity even in the presence of congested reinforcement and then consolidate without the need for vibrating compaction. They thereby eliminate the potentially harmful levels of noise, vibration and physical strain that are associated with the compaction process. The use of SCC can bring additional sustainability benefits including energy saving, improved productivity and improved concrete quality.

Further details of the Concrete Targets 2010 scheme are available at www.concretetargets.org

Resources

The principal resources consumed in the manufacture of precast concrete products are aggregates, cement, water and energy. Aggregates and cement traditionally come from non-renewable primary resources, however, many companies are now incorporating secondary aggregates and cementitious materials into their products with no adverse effects on quality and durability. These secondary materials are often by-products of other industries such as power generation and steel making, or waste products such as plastics and glass. Their use minimises the amount of new materials being consumed. Drawing water from mains sources and discharging it back to mains drainage can be expensive because of the treatments required and can place heavy demands on local infrastructures. Companies are utilising practices such as recycling, reclamation and rainwater harvesting to minimise their impact on mains resources.



The Enviromasonry range from Aggregate Industries' Fyfestone Division is a new generation of environmentally engineered building block products developed in response to the increasing demand for sustainable products for construction. The raw materials used within the range are specially selected for their environmental performance. The production processes are continually analysed to measure performance and determine areas where the impacts associated with materials, water and energy can be reduced. In addition, Enviromasonry products comply with all relevant technical standards, are manufactured under the quality procedures of BS EN ISO 9001 and environmental standard BS EN ISO 14001, and are certified by BRE under their Environmental Profiles Scheme.



Aggregate Industries manufactures approximately 0.5 million tonnes of precast concrete products per annum at its Hulland Ward site and consumes over 110,000 m³ of water in the process. A water recycling and abstraction scheme was set up at the site in 2002 in order to reduce the volume of mains water required for production; greater collection of site surface water; together with recycling, has resulted in savings on mains water worth £96,000 per annum.

Waste

Properly managing and minimising waste is an important environmental and economic issue for the industry. Waste management typically starts with waste audits in order to understand what waste is produced where. In some cases, measures can be taken to design out or eliminate waste from the production process. For example, by switching from bagged to bulk deliveries of materials. Where this is not possible, waste streams can be segregated and opportunities for recycling or reusing waste identified, in order to minimise the amount of waste being disposed of to landfill. Similarly, the ways in which the products are supplied can be changed, for example, by using packaging materials that can be recycled or returned for reuse.

Marley Eternit has gone above and beyond the Packaging (Waste) Regulations by looking at the packaging in which its products are sent out, in order to reduce waste wherever possible. This has involved optimising plastic thicknesses, cardboard interleaving and use of timber pallets. Compared with 2004, the packaging savings in 2005 amounted to 163 tonnes of timber pallets, 43 tonnes of cardboard and 119 tonnes of plastic wrap. This amounted to a financial saving of approximately £110,000.

In 2001, Marshalls Brookfoot site generated 1,200 tonnes of packaging waste from materials delivered to them, which cost approximately £20,000 to dispose of to landfill. With employee support, a new waste management initiative was introduced. This achieved a saving of 350 tonnes in its first year and by the end of 2005, total waste packaging had reduced to a mere 40 tonnes, equating to savings of £19,738. Furthermore, a profit of £11,208 was generated from sales of waste which has been channelled into projects to help the local community.



A robotic packaging line in operation



Segregation of waste streams for recycling.

Energy

Rising energy prices, potential supply shortages, increased concerns over carbon emissions and greenhouse gases and many other factors make energy efficiency a high priority issue for everyone. Comprehensive energy saving and awareness schemes that seek to involve staff at all levels are now commonplace in the industry. Energy saving measures can range from simple actions such as ensuring that lights and heaters are turned off when not needed, practical measures such as ensuring that maintenance schedules are followed in order to keep equipment operating at optimum efficiency, up to major capital investments in new energy efficient equipment.

The 'GUILD' (General Utilities Initiative to Lower Demand) programme was introduced at 15 sites operated by CEMEX Concrete Products in 2003. The focus of the programme was on managing electricity demand at peak times, when rates are highest. The principles were straightforward: times at which peak rates applied were identified, then production was managed to avoid these where possible. Manuals and a set of posters designed to drive home the message were distributed to all participating sites. The programme also alerted staff to the benefits of working in an energy efficient manner at all times, not just at peak periods.

In 2004, Tarmac Building Products set itself the target of reducing specific energy consumption by 15% between 2004 and 2014. Recognising that a company wide effort was required in order to achieve maximum benefits, a steering group was formed that developed and implemented a strategy that involved all levels of employees and provided a sound framework for monitoring and reviewing progress, and achieving the targets set. Measures taken have included an information campaign, site surveys, training of all managers, advice and assistance from the Carbon Trust, and employee toolbox talks. In addition to reductions in specific energy consumption, reductions in CO₂ emissions from efficient use of energy and alternative fuels have been achieved, together with increases in plant availability as maintenance improves and reductions in solid waste as manufacturing techniques improve.

Employment

Companies in the industry are aware that they need to recruit, develop and retain a skilled and dedicated workforce in order to function effectively now and in the future. In addition to introducing competence training and awareness programmes to facilitate staff development, many companies are actively involving staff at all levels in development and sustainability initiatives.

Marley Eternit has introduced a comprehensive training package to raise the environmental awareness of the staff at its Delamere site. The package targets site specific practices, control measures and responsibilities, and provides a detailed insight into the impacts of the industry upon the environment. As a result of the training, employees have significantly contributed to the continued reduction of environmental non-conformances and pollution incidents at the site.



In 2004, Tarmac Building Products set out on a campaign to reduce energy by 15% per unit production by 2014. Realising that employees on the shop floor would have a significant role to play in achieving this target, the company introduced its SavE Energy Information Campaign (SavE) to obtain their support and reward achievement. The result has been a heightened awareness amongst staff at all levels of what the company, sites and individuals are doing to save energy.



Supply chain

The relationships and interactions with both upstream and downstream supply chains can affect everybody's sustainability credentials. This is particularly apparent in respect to transport.

Aggregates are bulky and expensive materials to transport. Many precast factories are located close to quarries in order to make use of local material supplies and minimise the cost, congestion and emissions associated with transport. Where this is not possible, companies are increasingly looking to other more sustainable methods of transport, such as rail and shipping.



In 2004 Marshalls carried out a review of the transport operations involved in the delivery of its products in order to improve operational performance. Major changes made included: investing in new lower emission more fuel-efficient vehicles; reduced use of contractors; improved driver training; and centralised transport planning. These changes resulted not only in improved performance to customers and lower transport costs, but also produced social and environmental benefits. For example, drivers working conditions and security of employment were improved, whilst 4,000 fewer vehicle movements per year reduced traffic congestion, and cut emissions by an estimated 1,500 tonnes CO₂ per annum on like for like operations.



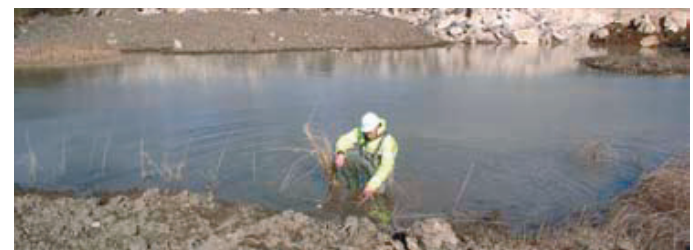
Social/Community

The precast industry takes its social responsibility seriously, whether this is to its workforce, the communities adjacent to its factories or to society in general.

The introduction of a local liaison committee at its Thornfalcon Works enabled Tarmac Building Products to reduce environmental complaints from the local community and the local environmental health office, by identifying issues that directly affected its neighbours, such as noise from site operations and light pollution at night. The scheme was also successful in strengthening links with the local community. The success of the scheme has led Tarmac to implement similar schemes across its business.



Marshalls has been working with the local community to reduce the environmental impact of its Maltby site in South Yorkshire. Through a number of nature conservation partnerships and the active participation of its workforce, a range of actions have been taken which have improved biodiversity at the site, showing that manufacturing and nature can develop side by side.



Bison Concrete Products, Swadlincote factory – innovative and sustainable

In building its new £30 million hollowcore flooring factory at Swadlincote in Derbyshire, the first carousel production facility in the world for precast, prestressed hollow core flooring slabs, Bison Concrete Products took every opportunity to introduce innovations that make this not only the most advanced precast factory in the UK, but also the most sustainable. The key features of the Swadlincote factory and how they contribute to its impressive sustainability credentials are described below:



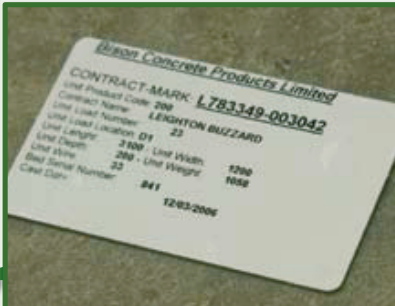
The designs for all of Bison's products are configured to optimise the minimum use of materials consistent with the performance requirements of the user. The use of prestressing in hollowcore slabs is the most efficient design for flooring and produces the least weight to span ratio.



Designs are produced in the company's centralised production planning department. They are then downloaded to the factory and conveyed to the machines via a wireless link. This process eliminates printing of drawings, reduces human error in transferring data from the office to the shop floor and provides accurate guidelines to add detail to products, such as cut-out and lifting hook locations.



The fully automated production process, based on the carousel principle, is highly efficient; the complete casting, curing and cutting process can take as little as 12 hours. Health and safety risks are significantly reduced as less manual input is required, and the resulting product combines high quality and accuracy with significant economy.



Credit card sized plastic cards containing unique data stored on programmable chips, such as delivery load number and the bed serial number, are glued to the product just before it is cut. The system provides a fail-safe approach to identifying a specific product during the production and transporting processes. It also provides for long-term access to data such as layout drawings and product specifications, this can help should the use of a building be changed in the future.



Any special end details required are hydraulically pressed into the fresh concrete and the waste material is sucked out to be recycled. This has eliminated a time consuming labour-intensive process and is more accurate.



The carousel principle utilises fixed casting and sawing stations with moving casting beds. This has enabled larger machines to be used, bringing increased speed and efficiency to the production process, whilst eliminating many of the risks associated with mobile casting and sawing equipment.



The dry cutting machines are housed in a sound-proofed booth to reduce noise levels in the factory. By reading data from the programmed cards, the increasing amount of detail required by customers, can be quickly and accurately cut into each product.



Once the product is manufactured and cut to shape, it is loaded onto delivery pallets in the sequence required for erection on site. The complete load, weighing up to 30 tonnes, is then picked up by a straddle crane and put on a vehicle, locked and sent to site, saving time and double handling of products.



Bison are committed to environmental impact studies, including life cycle analysis of their manufacturing techniques. At Swadlincote, a closed circuit recycling process enables all wet waste from the production process to be automatically conveyed to a central recycling plant. Here the constituent materials are reclaimed. Depending on its cementitious content, water is either cleaned and used for washing or returned to the mix to optimise cement consumption. Aggregates are cleaned and added to production stocks or transferred to the on-site crushing station where all dry concrete waste is recycled.

2006 Sustainability Award Winners

The aim of the Sustainability Awards, sponsored in 2006 by The Concrete Centre, is to reward excellence within the British Precast membership and to publicise the industry's progress towards sustainability. More than 20 excellent entries were received in the two award categories, which showcased the ever increasing progress being achieved by companies on a broad range of environmental, social and economic issues. The leading entries this year showed a real commitment to sustainability, integrating it into company and site practices, and recognising that it will provide long-term value.



Tarmac win the Corporate Award

Entries in the corporate category demonstrated the wide range of ways in which companies are now moving the sustainability agenda forward. Tarmac Building Products won the category with their SavE Energy Information Campaign. This campaign is part of the company's ambitious plan to reduce energy consumption per unit production by 15% from 2004 to 2014, and recognises the need for employee participation at all levels in achieving this target. The judges felt that this entry demonstrated a very clear and structured approach to energy saving and raising staff awareness that could easily be adopted by other companies.

Entries in the category for site-specific projects also covered a wide range of initiatives covering social progress, environmental protection and resource conservation, all of which resulted in economic benefit. The winners were Marley Eternit, Delamere, for their competence training and



Marley Eternit win the Site Specific Award

awareness programme which has actively developed the skills and knowledge of its workforce on environmental issues. Benefits of the programme include: reduced risk of environmental pollution; improved housekeeping; early identification of environmental hazards; quick and effective responses to incidents; positive environmental culture and improved environmental performance with minimum capital spend. The judges commented that this outstanding entry demonstrated how to achieve a positive environmental culture and identified many of the long-term environmental performance benefits such an approach could provide.

Details of all the entries and award winners can be found in **Moving the Industry Forward 2006**, our Best Practice Awards brochure, available as a download at www.britishprecast.org or by request from publications@britishprecast.org.



'Sustainability and the Concrete Producer'

British Precast and the British Ready-Mixed Concrete Association have jointly promoted three one-day seminars on this theme during 2005/06. The first event in December 2005 gave a broad view of how the aggregates, cement, ready-mix and precast sectors were progressing on the sustainability agenda, supported by company case studies from Aggregate Industries, Marley Eternit and Marshalls. Presentations from BRE, The Concrete Centre, HSE and WRAP covered other areas of interest such as forthcoming regulations and sustainability tools. The second event in June 2006 followed a similar theme with sector updates, company case studies from CEMEX UK, Lafarge UK and Marshalls, together with updates on current research and forthcoming legislation. With sustainability becoming an increasingly important factor influencing buying decisions in construction, the third event in November 2006 was targeted at the industry's sales and marketing professionals. Delegates learnt that as sales and marketing professionals they had an important role to play in delivering a positive message on sustainability for both their companies and the industry as a whole. They gained valuable guidance to assist in fulfilling that role. The day's programme (right) highlights the broad range of issues covered.

A DVD showing the presentations and speakers in a split screen format is available at £100 plus VAT to members and £200 plus VAT to non-members from events@britishprecast.org. This is a valuable resource for sales and marketing teams who are new to sustainability or simply wish to review some of the key issues.

Market pull – how to position your company to meet customer and client needs for sustainable construction solutions	Sue Innes, Constructing Excellence
Product case study: Green marketing of insulated concrete formwork homes	Joe Lyman, ICFA USA
Customer viewpoint: Jewson policy going forward	Steve Millward, Jewson
Competitor analysis: The sustainability credentials of steel, plastics and timber	Dr Jane Anderson, BREEAM Centre
Company case study: Aggregate Industries	Dr Miles Watkins, Aggregate Industries
Product case study: Selling sustainability – the Thermalite experience	Dr Rob Carroll, Hanson Thermalite
Product case study: Termodeck and Thermocast	Emma Reese and Geoff Russell-Smith, Tarmac Building Products
The Green Guide	Andrew Frost, The Concrete Centre
Company case study: LCA and product marketing in Marley Eternit	Sarah Hanlon, Marley Eternit
Questions on sustainability – has the industry got the answers?	Stuart Bell, Marshalls
Resources available from The Concrete Centre	Dr Andrew Minson, The Concrete Centre
Aligning sustainability values for enhanced product competitiveness	Dr Jacqui Glass, Loughborough University

Comments and Further Information

British Precast welcomes your views on this report and on our approach to developing a more sustainable precast industry. You can give us your comments by writing to Ian Holton at British Precast or via email at ian.holton@britishprecast.org. Further information is published in the sustainability section of our website and in *More from Less* our sustainability newsletter.

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**BRITISH
PRECAST**



Sustainability Matters

Third Annual Progress Report from the Precast Industry

**BRITISH
PRECAST**

Published February 2008

**MORE
FROM
LESS**

Introduction

This is the third report from British Precast on the precast concrete industry's progress on sustainability, produced as part of our 'More from Less' programme. It marks a significant step forward for the precast industry with the introduction of the first in a series of

measures designed to improve performance across the industry on sustainability. Those measures include reporting quantitative data in the form of KPI's and making voluntary commitments to take actions to improve performance on a broad range of sustainability issues. Also in this report are examples of the progress being made by our product groups and member companies.

A message from the President

I have been pleased to see the real progress in Sustainability made in the Precast sector in the last 12 months. Our Spring 2007 White paper consultation proved a very useful initiative and there now seems to be a real appreciation of the need to reduce the environmental impact of our products by improving the use of material and energy resources. Most precast producers can now see for themselves that a systematic approach to more sustainable operations can produce a real benefit on the bottom line - more and more clients and specifiers are demanding sustainable solutions. I commend the new Sustainability Charter not only to fellow member companies in British Precast but also to those producers who still remain outside. We have signed up to it - so should you.



British Precast President, David Sarti, Chief Operating Officer, Marshalls plc

The Precast Industry

The precast concrete industry is an important national industry producing over 36 million tonnes of products annually for the construction sector, worth in excess of £2.3 billion. There are around 800 precast factories located across the UK, which provide direct employment for over 20,000 people and many more in upstream and downstream sectors. Precast concrete products make a significant contribution to the built environment; they are widely used in public and private sector projects of many sizes, from housing and landscaping, through commercial buildings to highways and infrastructure.

Precast products are made to consistent high quality standards using a combination of skilled labour and automated processes. Mass produced products range from small hydraulically pressed items such as concrete blocks, paving and roof tiles, to larger extruded or wet-cast items such as pipes, piles and floor beams. Bespoke items include large wet-cast products such as cladding panels and structural units designed and manufactured to specific architectural and engineering requirements.

British Precast

British Precast is the trade federation for precast concrete manufacturers in the UK. Founded in 1964, its federated structure acknowledges that the precast sector is, in fact, a matrix of industries, each with its own characteristic markets and supply chains, technologies, standards and lobbying issues. British Precast exists to manage this matrix through a number of product groups and associations, each with its own agenda and devolved budget. Spanning all product areas are a number of overarching issues common to all members. The management of these issues – research, building regulations, design codes, health and safety, training, government relations and sustainability – is the other role of British Precast and is growing in its importance.

British Precast is committed to the development of a more sustainable precast industry and is working to deliver on that commitment through its committees, Best Practice Awards and dedicated Sustainability Programme. An increasing number of our members are recognising the importance of adopting more sustainable practices and are supporting our work in order to ensure a better future for the industry.

The range of precast concrete products includes:

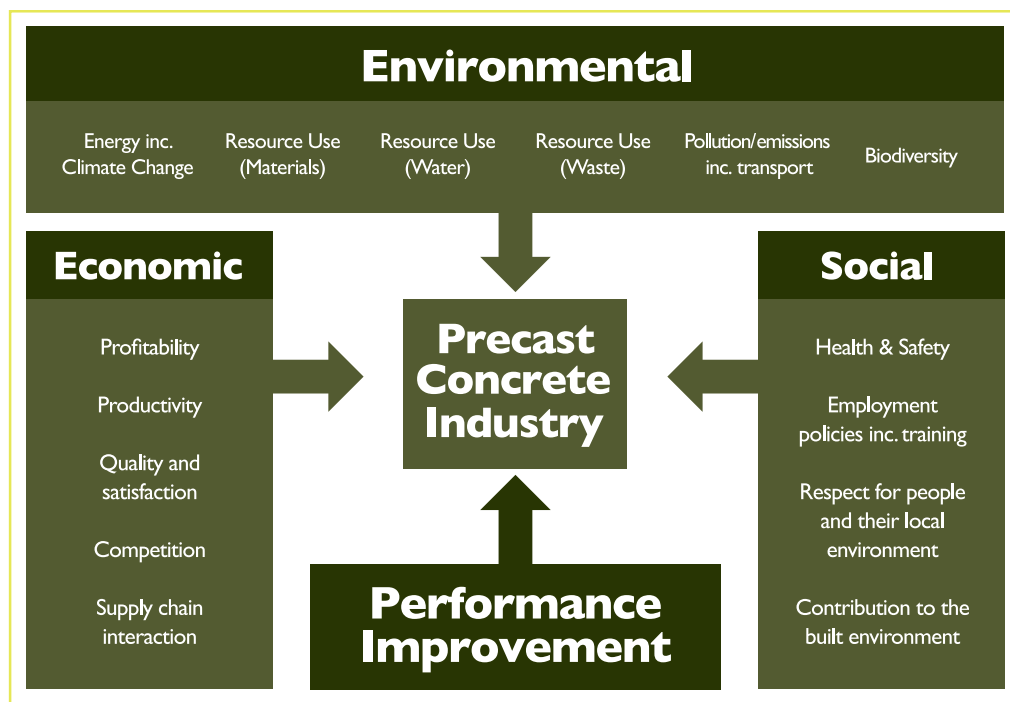
Architectural cladding 	Flooring including beam & block and hollowcore 	Cast stone and other decorative products 	Masonry including blocks and walling 	Piles and foundations 
Roof tiles 	Paving, landscaping and street furniture 	Structural including beams, columns and panels 	Drainage including pipes, culverts and manholes 	Railway products 

Sustainability Programme

In March 2007, the British Precast Council approved a programme of measures designed to improve performance across the precast industry on sustainability, comprising:

- Key Performance Indicators
- A Sustainability Charter
- A Certification Scheme
- A Best Practice Forum
- Objectives, Indicators and Targets for Improvement

The overall aim of the programme is to demonstrate to key stakeholders that the industry is committed to sustainability, and that measurable progress towards a more sustainable precast concrete industry is being achieved. It was developed as part of the Sector Sustainability Strategy project, being undertaken in conjunction with Loughborough University, and will be introduced in stages over the next two years. A consultation paper outlining the programme received favourable comments from stakeholders, and many companies have pledged their support for it.



Sustainability Issues

The programme focuses on the 16 key sustainability issues facing the precast industry shown in the diagram on the left. These have been identified following consultation with the industry and examination of the priorities and concerns of its primary stakeholders. In addition to recognising the economic, environmental and social pressures on the industry, the need to demonstrate performance improvement is now considered to be a key issue.

Health & Safety Programme

The Sustainability Programme sits alongside and complements the CT2010 Health & Safety Scheme operated by British Precast. Following the success of the British Precast 'Four Star Scheme' from 2001 to 2005, launched in response to the Government-led initiative, 'Revitalising Health and Safety', a new scheme was created. Starting in 2006, the CT2010 scheme is committed to maintaining and improving the Industry's Health & Safety Record with members pledging to reduce RIDDOR reportable accidents and lost time by a minimum of 50% in five years, working towards an overriding goal of zero accidents.

The scheme promotes sharing of Health & Safety information, both across companies and the industry, but also actively within

companies, from top to bottom of the management structure. All companies signing up to the scheme agree to hold regular H&S committee meetings within their organisations.

The scheme recognises members' performance at the annual Best Practice awards dinner.

Data Collection

All members of the scheme are required to submit statistical Health and Safety information every six months. Data monitored includes RIDDOR reportable accidents and major injuries, chronic injuries (injury that occurs but cannot be associated to a specific event), time lost due to accidents, sub-contractor reportable accidents and HSE enforcement notices.

Awards

The CT2010 Awards are presented each year to member companies who have successfully implemented scheme elements, ranging from Bronze to Gold award levels and an additional 'Seal' to indicate those companies whose performance is in line with or ahead of the scheme targets.

As well as the annual awards, the scheme seeks to recognise the valuable contributions made by individuals and small teams that such schemes rarely reward by the presentation of an 'Outstanding Contribution to Health & Safety' award.

Further details of the CT2010 scheme are available at www.concretetargets.org

Key Performance Indicators

This initial set of indicators provides an overview of the precast industry, and demonstrates that it is being managed responsibly. It is envisaged that the set will be expanded in time to include all of the sustainability issues facing the industry. The figures reported here relate to the 2006 calendar year. As this is the first year for which data has been collected, only the basic figures can be reported. However, these will provide the benchmark against which future performance will be assessed.

Coverage

- Data has been provided by 19 companies relating to 132 production units and approximately 17 million tonnes of production; there are believed to be in the region of 800 precast production units in the country and the total production output for the industry is estimated to be 38 million tonnes.

The following statistics have been calculated from the data supplied.

Productivity

- 8,309 full-time equivalent staff were employed during the year, and 1,648 tonnes of concrete was produced per employee.

Quality and satisfaction

- 14 million tonnes (81.5%) of production was covered by an ISO 9000 series certified quality management system or a recognised Manufacturers Quality Assurance Scheme.

Energy including climate change

- 54.9 kWh of energy was used per tonne of concrete produced, of which 53% was gas, 20% electricity, and 24% gas oil or diesel. This is equivalent to 13.9 kg of CO₂ per tonne of concrete produced.

Resource use - materials

- 0.140 tonnes of cementitious materials were used per tonne of concrete produced, of which 22% was fly ash and 6% ground granulated blast-furnace slag.
- 0.747 tonnes of aggregates were used per tonne of concrete produced, of which 84% was primary aggregate and 16% secondary aggregate.
- 3.0 kg of packaging materials were used per tonne of concrete produced, of which 82% was timber and 17% plastic.

Resource use - water

- 163 litres of water was used per tonne of concrete produced, of which 71% came from mains supplies and 29% from licensed non-mains sources.

Note: Water from other sources such as harvesting and recycling is not included in this figure.

Resource use - waste

- 32 kg of waste was produced per tonne of concrete produced, of which 14% was disposed of to landfill, 29% was recycled on site and 57% recycled off site.

Pollution/emissions including transport

- 12.9 million tonnes (75%) of production was covered by an ISO 14000 series or EMAS certified environmental management system.
- 14 environmental incidents were reported to external regulatory authorities during the year, equivalent to one incident per 1.2 million tonnes of concrete produced.
- The majority of concrete products were delivered by road with the average delivery being 27.4 tonnes and the average delivery distance being 108 miles.

Note: Limited transport data coverage.

Health & Safety

- 4.4 million tonnes (25%) of production was covered by an OHSHS 18000 series certified H&S management system.
- The British Precast Four Star scheme closed in 2005, having reduced accidents by 45% compared to the commencement of the scheme in 2000. Continuing the progress of the earlier scheme, the Concrete Targets CT2010 scheme has just completed its second year and now reports a combined reduction from the two schemes of over 60%, from the original baseline performance.

Employment policies including training

- 7,083 (85%) employees were covered by formal training and development policies.
- An average of 8.9 hours of training was provided per employee.

Respect for people and their local environment

- 31 factories operated formal local liaison schemes during the year, equivalent to one scheme per 4.25 factories.

Sustainability Charter

The objective of the Sustainability Charter is to engender commitment from companies to a set of industry-based principles; these will contribute to the economic viability, social progress and environmental responsibility in the precast concrete sector.

British Precast requires that Sustainability Charter Members shall make a formal declaration to:

- Develop products that improve the quality and sustainability of the built environment
- Liaise effectively with local communities to foster mutual understanding and respect
- Manage all waste streams effectively and minimise waste disposed to landfill
- Measure, report and improve performance on sustainability issues
- Minimise pollution and emissions associated with production and transportation
- Operate in a responsible manner to protect employees, contractors and visitors
- Operate in an efficient and financially sustainable manner without compromising legal, quality or sustainability principles
- Operate to the highest ethical standards necessary to develop a skilled and competent workforce
- Operate to the highest quality standards necessary to satisfy customers and consumers
- Protect and enhance the natural environment adjacent to or affected by precast production
- Recognise that competition encourages the development of more sustainable products and practices
- Use energy more efficiently and reduce carbon footprint
- Use primary materials more efficiently and promote the use of secondary materials
- Use water more efficiently and minimise demand on mains water supplies
- Work constructively with other organisations to deliver sustainable policies and practices

Although the commitment is made voluntarily by companies, during 2008, British Precast will be introducing an audit process to ensure that signatory companies are fulfilling that commitment.

At the launch of the Charter on 29 November 2007, Paul King, Chief Executive of the UK Green Building Council, praised British Precast for the comprehensive range of issues covered in the Charter and encouraged other sectors to adopt similar initiatives. Since it was launched, the following companies have signed the Charter:

- **Aggregate Industries**
- **Coltman Precast**
- **Cornish Concrete Products**
- **FP McCann**
- **H+H UK**
- **Hanson Building Products**
- **Litecast**
- **Marley Eternit**
- **Marshalls**
- **Tarmac Group**
- **Trent Concrete**

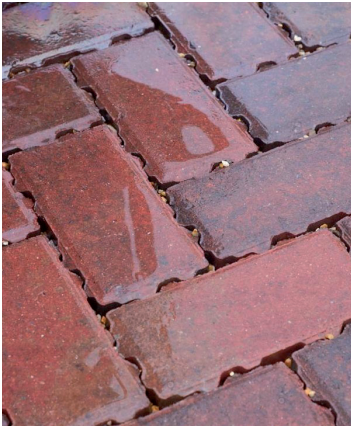


Paul King, Chief Executive of the UK Green Building Council, and Martin Clarke, Chief Executive of British Precast, with some of the first Charter signatories.

Sustainable Paving

Sustainable Drainage Systems (SUDS) have grown in popularity in the UK over the last 20 years and are now a firm planning requirement. Concrete block permeable pavements are one of the most important SUDS techniques, providing a structural pavement whilst allowing water to pass straight into the pavement construction for temporary storage and dispersal into the ground or for collection.

Interpave, which represents the UK's leading precast concrete paving and kerb manufacturers, is particularly active in promoting best practice with this versatile technology to ensure that it is accepted by all as a mainstream drainage and paving technique with predictable, long-term performance. Interpave's extensive on-line technical resource - found at www.paving.org.uk - is designed to



help local authority planning, drainage, highways and adoption officers, as well as developers and their consultants, with all aspects of permeable pavements. The website covers updated comprehensive design and construction information, including detailing and management of service runs, as well as case studies. Other guidelines review the legal background for sustainable

drainage, including the latest document 'Permeable Paving for Adoption'.

Interpave has also developed guidance on responsible rain water management around the home based upon the edict of not discharging run off from driveways, paths and patios into drains. This approach alleviates concerns of local authorities, the Royal Horticultural Society and others about "concreting over front gardens". Based on design calculations using sound engineering principles, it offers a step-by-step process for choosing the right type of sustainable drainage system – including 'rain gardens' or bio-retention areas.

To support its own activities in this area, Interpave sponsors and supports Landform and SUDSnet. Both of these organisations provide a UK-wide network for researchers, practitioners, agencies, developers and all those who are interested in SUDS as well as presenting training seminars.

Drainage isn't the only area of activity for Interpave. Other initiatives include commissioning an independent Life Cycle Assessment from the Building Research Establishment (BRE) comparing precast concrete paving with sandstone flags imported from India, ahead of the new BRE 'Green Guide'. This research concluded that the precast concrete paving manufactured in the UK by Interpave members had significantly better environmental performance than equivalent imported sandstone products.

John Howe, Development Manager, Interpave

Architectural Cladding & Sustainability

In a society where many products have a short life and disposability is often built in, the construction industry is ploughing a totally different furrow by putting sustainability at the top of its agenda. Members of the ACA are committed to playing a leading role in this, responsibly promoting and developing sustainable precast concrete cladding construction techniques. These not only apply to issues arising from the manufacture of cladding panels, but, as importantly, extend to their design and subsequent installation.

Decisions at the design stage have a fundamental impact on the sustainability of a building from initial construction, through its life and eventual demolition. Design can increase the building's performance during its life and eliminate unnecessary waste during its construction. Obvious lifetime implications are energy and maintenance costs. Sustainable design demands that the whole design/construction team works together to develop design that drives out waste and inefficiency.

Manufacturing building components in factory conditions with permanently employed skilled workers has several immediate effects, notably elimination of the effects of weather. Materials are

ordered in accordance with production requirements and are carefully stored and protected against contamination, minimising waste. Also, product defects are close to zero and energy consumption is lower.

Sustainable construction will often lead to more efficient and more cost-effective construction, the precaster providing expert advice on the impact of a particular design on the efficiency of off-site manufacture, transport and site erection. To do this, the precast specialist must be appointed early to make a significant contribution to the design development process and to help the sustainability strategy of the project.

Uniquely, concrete is 100% recyclable after crushing. Some construction companies are reporting a recycling rate of 70–90% of concrete from their waste streams returning as aggregate. A further sustainable benefit of concrete is its inherent fire resistance, robustness, durability and long-term performance.

Stephen Maddalena, Managing Director, Marble Mosaic Company

Industry Firsts

Biodiversity Benchmark

The Wildlife Trust's Biodiversity Benchmark enables organisations across the country to assess the quality of their land management, improve their contribution to the environment and demonstrate their commitment to biodiversity. In February 2007, Marshalls' Maltby works was awarded the Biodiversity Benchmark, the first time that an active manufacturing site has received the rigorously audited accreditation in the UK.



To achieve the Biodiversity Benchmark, the works produced an exacting Biodiversity Action Plan to ensure that their site would be properly managed to improve its wildlife value, long term. The plan included creating a new conservation area around its old pump lagoon. A bespoke man-made island retreat was created using more than 200 tonnes of soil, with reeds placed to form new wetland areas. Some 150 new trees were planted and areas were sown with grass and wild flower seed. Maltby is now also actively managing its hedgerows and remaining habitats to encourage new flora, fauna and wildlife. This action has already led to new breeding pairs of birds visiting the site to accompany the yearly return of a flock of Sand Martins who make home around the lagoon area.

With an already keen interest from within, its site employees have been actively involved throughout the process. This has now grown to include the involvement of the local community, arranging site visits for schools and developing partnerships with a range of local groups.

Ian Manley, Health & Safety Coordinator, Marshalls' Maltby Works, who was pivotal in managing the Biodiversity Action Plan commented: "We are delighted to have achieved accreditation to The Wildlife Trust's Biodiversity Benchmark. Whilst it has been hard work, we feel that it has been well worth the effort and have been pleasantly surprised by the amount of flora, fauna and wildlife already within our site boundary."

Following the success of the project, Marshalls is now looking forward to working in partnership with The Wildlife Trust to improve biodiversity at additional sites.

Energy Efficiency Accreditation Scheme

H+H UK has become the first aircrete manufacturer and the first company in the precast concrete industry to achieve accreditation under the Energy Efficiency Accreditation Scheme (EEAS), the UK's independent benchmark for energy efficiency. Colin Cook, process systems manager for H+H UK, commented: "The award emphasises our commitment to the principles of sustainability. Not only are Celcon products 'light on the planet' in use, but this award demonstrates that we go to extraordinary efforts to minimise energy consumption in manufacture as well".

EEAS assessor Bob Spain was impressed by the level of investment in energy efficiency measures. These include recycling steam from the autoclaves used to cure aircrete, recovering combustion heat to raise the temperature of boiler feed water and a recent innovation, the installation of wind turbines to generate power.

The assessor was also impressed by the efforts made to increase awareness of energy efficiency with regular in-house briefing

sessions and staff being sent on training courses. H+H already has plans for further investment in ways to reduce their CO₂ emissions through energy efficiency, Bob Spain commented "these plans for further investment reflect a continual search for improvement of technology and best practices - most commendable".

H+H UK Limited joins a network of over 200 organisations accredited under the scheme for their active reduction of CO₂ emissions.



Achieving accreditation meant maintaining and improving on good practice in energy management, keeping up to date with new energy saving initiatives and above all, encouraging staff and the public to be energy aware.

Zero Carbon

British Precast signed the Government's Zero Carbon pledge in 2007, committing us to work with others to ensure that all new homes are built to zero carbon performance standards by 2016. Our main efforts are being channelled through the Futures Group run between the Home Builders Federation and the Modern Masonry Alliance, whilst in the non-housing field we are following with interest the development of the Code for Sustainable Buildings through our membership of the UK Green Building Council.

Concrete Pipeline Systems Association

Sustainability is a key issue for the CPSA, as it is for all of our product groups. Following its earlier work on the environmental impact of concrete and plastic pipeline systems, the CPSA has introduced a web-based calculator to show just how much virgin aggregate bedding can be saved by the specification of concrete pipes. The CPSA has also been lobbying for greater and better targeted investment in improving Britain's storm-water and combined sewerage systems. A copy of the six point plan can be downloaded from www.concretepipes.co.uk

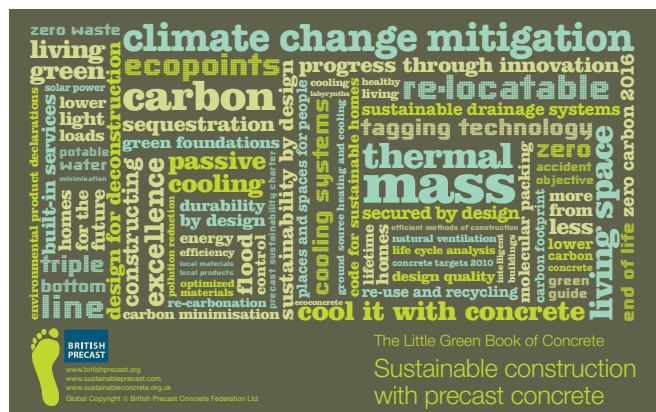
UK Concrete Platform Sustainable Construction Task Group

The UK Concrete Platform brings representative bodies from across the concrete industry together to address a range of key issues. British Precast and its members have been prominent in the work of the Platform's Sustainable Construction Task Group, with Martin Clarke of British Precast taking over as mentor of the Group for 2008 from Mike Gilbert of the BCA. During 2007 the Task Group and British Precast fed into the BERR Sustainable Construction Strategy consultation at workshops and with written submissions. Individually and collectively the Task Group has been constantly feeding into the development of the Green Guide by the BRE - a complex role for all – and is now focusing on chain of custody issues and on developing a broad sustainability strategy for the whole cement and concrete sector. The Task Group has also sponsored a new website www.sustainableconcrete.org.uk

Carbon Labelling

Those of you who eat crisps may have noticed a carbon label now features on all Walkers crisp packets. Two British Precast members Marshalls and Aggregate Industries are key members of a Carbon Trust scheme to broaden carbon labelling into other product areas. It won't be long before UK-made paving and other concrete products carry similar messages. The two companies also sponsored a study by BRE in 2007 which showed that the carbon footprint of UK made paving was half that of imported Indian sandstone. Since then reports are coming out that the environmental cost of shipping has been seriously underestimated by upto three times adding considerable weight to our arguments for locally sourced products.

Little Green Book of Precast



This new volume is due to be published in May 2008 and copies will be available via the website.

Print Commitment

At British Precast we aim to be sustainable in everything we do, and that includes our print. All our publications are printed on recycled paper that has a minimum of 50% post-consumer waste content and is FSC certified and we only use vegetable based inks. We audit all our printers to ensure they have ISO 14001 or equivalent standards and have their own sustainability strategy.

Comments and Further Information

British Precast welcomes your views on this report and our approach to developing a more sustainable precast industry. You can give us your comments by writing to Ian Holton at British Precast or email Ian at ian.holton@britishprecast.org.

Further information is published in the sustainability section of our website and Annual Report.



W www.britishprecast.org

W www.sustainableprecast.com

W www.sustainableconcrete.org.uk

W www.bibm.eu

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Sustainability Matters

Fourth annual report on the precast industry's progress on sustainability



**BRITISH
PRECAST**

March 2009

**MORE
FROM
LESS**

Introduction

This is the fourth report produced by British Precast as part of our 'More from Less' programme to develop a more sustainable precast concrete industry. It highlights the continuing commitment of British Precast and companies in the precast industry to managing impacts responsibly and achieving progress on a broad

range of sustainability issues; a commitment that is reflected in the number of companies that have now signed up to the Sustainability Charter and demonstrated in the practical actions being taken by Members and Associate Members as showcased in the 2008 Sustainability Awards, and quantified in the production of KPI data.

A message from the President

These difficult times for the UK building materials sector have brought sustainability into even greater focus and we should all be proud of the excellent example being set by the British Precast sector. When input costs rise to unprecedented levels and the future flow of orders comes under pressure our historic and current focus on the triple bottom line of economic, environmental and social factors helps us differentiate precast products from inferior alternatives. A changing pattern of demand, whether driven by legislation through planning or building regulations, or an increased focus on lower carbon solutions by consumers will only increase the opportunity for us if we continue to embrace our Sustainability Charter.

British Precast President, David Sarti, Chief Operating Officer, Marshalls plc



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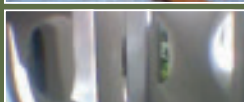
Paving, landscaping and street furniture

Flooring including beam & block and hollowcore



Roof tiles

Cast stone and other decorative products



Piles and foundations

Masonry including blocks and walling



Structural including beams, columns and panels

Drainage including pipes, culverts and manholes



Railway products

Sustainable Construction Strategy for the UK Concrete Industries

The flexibility and versatility of concrete is at a premium in addressing the challenge of achieving more sustainable construction. This strategy, launched on 30th July 2008, is intended to assist the concrete industry to contribute to meeting that challenge, and was produced on behalf of the 10 off-site production industries that collectively supply aggregates, cement, ready mixed concrete, mortar and precast concrete products to the UK construction industry. British Precast was actively involved in the strategy development process and is now working alongside many others in the concrete industry to deliver on the strategy commitments.



Aligned with the Government's Sustainable Construction Strategy announced in June 2008, the strategy establishes a common vision for the concrete industry, and a set of strategic objectives and commitments which will benchmark industry performance and demonstrate continuous improvement for the future in delivering sustainable construction.

Speaking at the launch of the strategy, Jonathan Porritt, Founder Director of Forum for the Future, said: "I am delighted to have worked with the cement and concrete industry over the last year and am pleased at the progress it has made. The industry is now entering an exciting phase in its history, as it moves towards becoming more sustainable."

Martin Clarke, Chief Executive of British Precast, commented: "I believe this is a very important step forward for the industry because we have collectively agreed to put sustainable construction at the heart of our businesses. The discipline of monitoring and reporting against our common sustainable construction goals will help ensure that we achieve real changes in the environmental, social and economic performance of concrete in construction, which is what our markets want and our clients expect."

Sustainable Construction Strategy FOR THE UK CONCRETE INDUSTRIES

We, the undersigned, agree to contribute to the fulfilment of the UK Concrete Industries' vision to be recognised as leaders in sustainable construction; to support the four strategic objectives and to deliver the eight commitments, as outlined in the Concrete Sustainable Construction Strategy dated 14 July 2008 and as summarised here.

We agree as companies to implement these fully, or as trade associations to encourage our members to do so. We will communicate the strategy both internally and externally to try and ensure the commitments become a reality.

As instruments of change, trade associations will facilitate the collection of performance data from members, establish performance benchmarks, agree performance targets with their membership, take part in periodic target setting and reviews at association and industry levels, and contribute to a published annual performance report for the UK concrete industries.

Vision
By 2012, the UK concrete industry will be recognised as the leader in sustainable construction, by taking a dynamic role in delivering a sustainable built environment in a manner that is profitable, socially responsible and functions within environmental limits.

Strategic objectives

1. Agree and adopt a common framework.
2. Improve our environmental profiles.
3. Enable our clients to achieve sustainable construction.
4. Communicate our progress and solutions.

Commitments

1. To launch an annual Sustainability Performance Report for the UK Concrete Industries commencing in March 2009.
2. To set targets for Performance Indicators by the end of 2009.
3. To design an industry R&D Programme to reduce CO₂ and other impacts.
4. To design an industry Skills Transformation Programme aimed at positioning the industry to play a leading role in meeting the challenge of sustainable construction.
5. To provide clients with industry data for LCA (life cycle analysis) models.
6. To develop sustainable construction solutions.
7. To provide clients with the knowledge and tools to adopt new solutions.
8. To demonstrate the benefits of concrete in the built environment.

[Signed] on behalf of [Company]

Aggregate Industries
CEMEX
Hanson
Lafarge
Tarmac
Brett Group
Marshalls plc
Trent Concrete

[Signed] on behalf of [Trade Association]

BCA
QPA
BPCF
CSMA
CAA
UKQAA
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National Precast Concrete Conference and Concrete Expo 2009

British Precast's Annual General Meeting, Conference and Best Practice Awards ceremony will take place on 12th May 2009 at Athena in Leicester.

It will be a daytime event which will include a short AGM followed by a seminar, a hot and cold buffet lunch and the Federation's annual awards ceremony presented by a guest speaker. There will also be an exhibition area where Associate Members will be showcasing their latest products and services.

The awards being presented in the afternoon will include projects, innovation, sustainability, and health and safety including the Concrete Targets 2010 award and Outstanding Contribution to Health and Safety.

For more information about the event, the awards, sponsorship opportunities or exhibiting, please contact British Precast on 0116 253 6161 or email info@britishprecast.org. The seminar, lunch, awards ceremony and exhibition are free to attend.

Spreading The Word



The fourth year of our More from Less sustainability programme has seen considerable progress made as highlighted throughout this report. Despite the severe recession that now grips UK construction, the precast concrete sector remains committed to a positive agenda.

In July 2008 we signed up to a series of commitments along with

other cement and concrete sectors. In forming the Concrete Industry Sustainable Construction Forum and four focused working groups we are committed to a very challenging four-year programme. Precast is leading the way in many aspects despite our tight resources. Communicating progress is vital. We are frequent speakers at home and abroad on sustainability topics.

Our own Little Green Book of Concrete was published in 2008 and is now out in US, German and Austrian editions. I was privileged to be asked to provide a keynote speech at the National Precast Concrete Association conference in Ottawa in September 2008.



There was particular interest in our members' Sustainability Charter which is a world first. We have a growing international network of sustainability-focused precasters in regular contact.



Martin Clarke signs up to CISCF commitments

This year we have extended our sustainability award scheme to our supply chain with a new Associates award.

All of our Associates have a role to play in driving forward our sustainability achievements.

Congratulations to the first winners Lafarge Cement UK, Lafarge Aggregates, Inditherm and BASF.

Sustainability Programme

The overall aim of the Sustainability Programme is to demonstrate to key stakeholders that the industry is committed to sustainability and that measurable progress towards a more sustainable precast concrete industry is being achieved.

Launched in March 2007, the programme comprises five measures designed to improve performance across the precast industry on sustainability:

- Key Performance Indicators (KPIs)
- Sustainability Charter
- Responsible Sourcing Certification Scheme
- Best Practice Forum
- Objectives and Targets for Improvement

Following the successful introduction of KPIs and the Sustainability Charter in 2007, the focus of attention in 2008 has been on supporting the development of a Responsible Sourcing Certification Scheme for precast producers. This is a way of providing assurance to purchasers and specifiers through an independent third-party

certification scheme that the sources from and processes by which a precast product has been made have been managed in accordance with an agreed set of sustainability standards. Progress on all three areas is reported in the following pages. This year will see the introduction of regular Best Practice Forum meetings to encourage companies across the industry to share and adopt best practice, and the setting of objectives and targets for improvement, which will provide challenging sustainability goals for the industry to achieve.

The programme was produced as a result of a collaborative research project between British Precast and Loughborough University. The project, which ran between 2004 and 2008, has succeeded in engaging with companies from across the industry and facilitating progress towards a more sustainable precast industry. In view of the success of the project, British Precast has recently embarked on another collaborative research project with the university to improve the sustainability of the precast industry through product stewardship. Further details are available at www.britishprecast.org and progress on this new project will be reported in future editions of this report.

Key Performance Indicators

These indicators provide an overview of the impact of the precast industry on society and the environment, and how that impact is managed. The figures reported here relate to the 2007 calendar year, and notes are included to indicate how performance has changed compared to 2006, the first year for which data was reported. The set of indicators is unchanged from 2006, but it is envisaged that it will be expanded in time to include more of the sustainability issues facing the industry.

Coverage

- Data has been provided by 25 companies relating to 122 production units and approximately 19.9m tonnes of production; there are believed to be in the region of 800 precast production units in the UK and the total production output for the industry in 2007 was estimated to be 38m tonnes
- Thus, despite some contraction in the industry in the course of the year, data has been reported for approximately 47% of the year's production, compared to 45% in 2006, and more companies have supplied data

The following statistics have been calculated from the data supplied:

Productivity

- The 25 companies reporting data employed 9,735 full time equivalent staff
- 1,842 tonnes of concrete was produced per employee compared to 1,648 tonnes in 2006

Quality and satisfaction

- 14.3m tonnes or 80% of reported production was covered by an ISO 9001 certified quality management system or a recognised Manufacturers Quality Assurance Scheme, which is broadly comparable to 2006

Energy, including climate change

- 52.9kWh of energy was used per tonne of concrete produced, of which 54.5% was gas, 20.7% electricity and 24.8% gas oil or diesel. This is equivalent to 13.5kg of CO₂ per tonne of concrete produced
- In comparison, the 2006 data was 54.9kWh and 13.9kg of CO₂ per tonne of concrete produced

Resource use – materials

- 0.175 tonnes of cementitious materials were used per tonne of concrete produced, of which 34% was fly ash and 11% was ground granulated blast-furnace slag
- Compared to 2006, this is an additional 35kg of cementitious material per tonne of concrete produced, but because greater proportions of alternative cementitious materials were used, 5kg less Portland cement was actually used per tonne of concrete produced
- Aggregate usage shows little change from 2006, with 0.754 tonnes of aggregates being used per tonne of concrete produced, of which 83.5% was primary aggregate and 16.5% secondary aggregate
- 2.5kg of packaging materials were used per tonne of concrete product produced, compared to 3kg in 2007. The proportions were unchanged with 82% being timber and 17% plastic

Resource use – water

- 156 litres of water was used per tonne of concrete produced, compared to 163 litres in 2006. The proportions changed

little with 70.4% coming from mains supplies and 29.6% from licensed non-mains sources

Note: water from other sources such as harvesting and recycling is not included in this figure.

Resource use – waste

- 41kg of waste was produced per tonne of concrete produced, of which 12% was disposed of to landfill, 18% was recycled on site and 71% recycled off site
- This is an increase compared to 2006, but reflects more accurate data capture and reporting by companies

Pollution/emissions, including transport

- 14.5m tonnes or 81% of reported production was covered by an ISO 14001 or EMAS certified environmental management system, compared to 75% of reported production in 2006
- Three environmental incidents were reported to external regulatory authorities during the year, which is equivalent to one incident per 6m tonne of concrete produced and a significant improvement compared to 2006
- The majority of concrete was delivered by road, with the average delivery being 28 tonnes and the average delivery distance being 96 miles. These are modest improvements over 2006, but obtaining reliable transport data remains an issue

Health and safety

- 4.8m tonnes or 26.7% of reported production was covered by an OHSAS 18001 certified health and safety management system, which is a slight increase over 2006
- Health and safety data is collected separately through the Concrete Targets 2010 Scheme operated by British Precast; this HSE recognised scheme promotes improvement activities and sharing of information, both within companies and across the industry
- Over 15,000 employees in the industry were covered by the scheme in 2007
- The RIDDOR incident rate was its lowest ever in 2007 at 7.3 incidents per 1,000 employees, compared to 8.4 in 2006 and 19.6 for the base reporting year of 2000, and only 0.2 days were lost per incident compared to 0.36 in 2000

Employment policies including training

- 7,107 or 73% of reported employees were covered by formal training and development policies, and an average of 14.1 hours of training was provided per employee. Thus a similar number of employees were provided with a greater amount of training than in 2006

Respect for people and their local environment

- 39 factories operated formal local liaison schemes during the year, equivalent to one scheme per 4.25 factories, which is little changed from 2006

The precast industry is well established and its production processes closely monitored and managed. Consequently significant variations in the impacts of the industry year on year are unlikely. In fact, the consistency between the two sets of KPIs produced so far is an encouraging sign that a robust performance benchmark from which objectives and targets for improvement for the industry can soon be established. While those areas in which performance improvements were detected, such as energy and water use, although they were relatively small, they still indicate that companies in the industry are being managed responsibly and with sustainability in mind.

Sustainability Charter

The aim of the Precast Sector Sustainability Charter is to encourage member companies of British Precast to go beyond legislation and take voluntary actions to make their products and operations more sustainable. In order to meet this aim, a set of sustainability principles has been developed based on the key sustainability issues facing the precast industry, as identified by British Precast following consultation with the industry and examination of the priorities and concerns of its primary stakeholders.

Since the charter was launched on 29th November 2007, 18 companies have made a formal declaration to adopt the principles into their normal business and working practices; these companies are recognised as 'Charter Signatories'.

To ensure that signatory companies are complying with the spirit of the charter and taking voluntary actions to improve their performance on sustainability, British Precast has developed a set of performance requirements against which companies are to be audited; these are shown in the table opposite. 'Charter Member' status will be awarded to those companies demonstrating the required level of commitment across a broad range of issues, and will be reviewed bi-annually. The first round of audits is nearing completion and the results will be announced in 2009. Initial indications are that companies are finding the audit process a useful way of sharing knowledge and identifying potential areas for improvement, and that there are some clear sustainability 'champions' in the industry.



Current Charter Signatories:

- Aggregate Industries
- Bell and Webster
- Brett Landscaping and Building Products
- Buchan Concrete Solutions
- Carter Concrete
- Coltman Precast Concrete
- Cornish Concrete Products
- FP McCann
- H+H UK
- Hanson Building Products
- Litecast
- Malling Products
- Marley Eternit
- Marshalls
- Milton Precast
- Roger Bullivant
- Tarmac
- Trent Concrete

Responsible Sourcing Certification Scheme

The original intention of British Precast was to develop a stand-alone third-party certification scheme for precast products and producers during 2008, as a natural extension to the Sustainability Charter. However, in February 2008, BRE Global, the UKAS accredited certification arm of the Building Research Establishment (BRE), signalled its intention to develop an overall framework standard for the assessment of responsible sourcing that would be applicable to all construction products. Following consultation with its members, British Precast opted to work within this emerging framework standard.

BRE Environmental and Sustainability Standard BES 6001 was launched in October 2008, following extensive development and consultation with a wide range of industry stakeholders, including British Precast, many precast companies, and other companies and representative bodies from across the concrete industry. This standard now provides a direct route to certification for responsibly sourced construction products.

Rather than develop a certification scheme within the framework offered by BES 6001, British Precast decided that its members'

interests would be best served in the short term by producing a guidance document on the requirements of BES 6001. However, depending on the success of BES 6001, demand from the market place for responsibly sourced products, and demand from its members, the option to develop a certification scheme may still be pursued. In the meantime, an industry working group was established to produce the guidance document, working in conjunction with BRE Global and, latterly, in collaboration with other representative bodies from across the concrete industry.

The guidance document is now available; copies can be downloaded from www.britishprecast.org. It indicates how compliance with the requirements of responsible sourcing in BES 6001 can be demonstrated for a wide range of products including aggregates, cements, precast concrete and ready mixed concrete using established practices and procedures in the concrete industry, and how higher levels of compliance can be demonstrated by adopting practices and procedures that are considered "best practice" across the construction industry. In addition, it provides background and guidance to be used by assessors in the process of confirming third-party certification against BES 6001.

Sustainable Principles and Performance Requirements

<i>Sustainability principle</i>	<i>Performance Requirement</i>
Develop products that improve the quality and sustainability of the built environment	Demonstrate interaction with users and specifiers in order to improve the quality and sustainability of the built environment
Liaise effectively with local communities to foster mutual understanding and respect	<ol style="list-style-type: none"> 1. Evidence of systems in place for logging feedback 2. Report on meetings held and/or attended 3. Evidence of charitable activity
Manage all waste streams effectively and minimise waste disposed of to landfill	Waste management plan and evidence of improvement
Measure, report and improve performance on sustainability issues	Report KPI data to British Precast and benchmark own performance* Internal environmental incident log and evidence of transport data analysis
Minimise pollution and emissions associated with production and transportation	Internal environmental incident log and evidence of transport data analysis
Operate in a responsible manner to protect employees, contractors and visitors	<ol style="list-style-type: none"> 1. Participation in the Concrete Targets 2010 scheme* 2. Operate health and safety management system/policy to agreed minimum requirements and commit to implementing a health and safety system complying with the requirements of OHSAS 18001
Operate in efficient and financially sustainable manner without compromising legal, quality or sustainability principles	Commit to implementing a third-party certified Environmental Management System (EMS) to ISO 14001, EMAS or, for SMEs, BS 8555*
Operate to highest ethical standards necessary to develop a skilled and competent workforce	Evidence of appropriate employment and training policies in place
Operate to the highest quality standards necessary to satisfy customers and consumers	Commit to implementing a third-party certified Quality Management System (QMS) to ISO 9001 or a recognised Manufacturers Quality Assurance Scheme
Protect and enhance the natural environment adjacent to or affected by precast production	Biodiversity Action Plans and knowledge of the Wildlife and Countryside Act, where appropriate
Recognise that competition encourages development of more sustainable products and practices	Demonstrate an awareness of the strengths and weaknesses of competing products and materials
Use energy more efficiently and reduce carbon footprint	Energy reduction plans and evidence of improvement
Use primary materials more efficiently and promote the use of secondary materials	Resource management plans and evidence of improvement
Use water more efficiently and minimise demand on mains water supplies	Water management plans and evidence of improvement
Work constructively with others to deliver sustainable policies and practices	Evidence of participation in relevant British Precast or product group committees and evidence of case studies and/or specific promotional/educational activities

* Mandatory performance requirements

Sustainability Best Practice Awards 2008

British Precast continues to promote and encourage best practice in sustainability and the annual Sustainability Best Practice Awards are part of our successful programme. This year, dozens of entries were received from our Full Members, whose projects covered such areas as minimising waste, recycling, reducing greenhouse gases and CO₂ emissions, working with the community and reducing energy use.

The winning entries from Aggregate Industries and Forticrete in the Site category, and Tarmac Topblock and Marshalls Landscape Products in the Corporate category, are featured here; these innovative projects demonstrate clear sustainability benefits and are examples of best practice that could easily be adopted by many other businesses across the industry.

The Winners



Aggregate Industries Working with the local community

Aggregate Industries has taken great strides to improve conditions for the local community that lives around their Hulland Ward site in Derbyshire.

The site, near Ashbourne, employs around 500 people and handles 800,000 tonnes of finished products and around 64,000 lorry movements a year. This raised many issues for the local community, including the amount and speed of lorries passing through the area, and the lack of clear signage for lorry turnings that created problems on the local roads.

Aggregate Industries decided to tackle the issues in three ways; improve the traffic situation, develop links with local schools, and support local charities.

To improve the traffic situation the company worked with the local parish council and Highways Department to undertake a detailed traffic survey. Hauliers were then asked to drive with more consideration through Hulland Ward village and the signage was also improved so that lorries were able to follow alternative routes, which has resulted in less disruption to the village.

The company developed links with local secondary schools and colleges by organising educational site visits, which are linked to geography and business studies. Links were also developed with tertiary colleges where students developed designs for the company's products at the Chelsea Flower Show.

Charities are supported through the company's staff accident reduction incentive scheme; for each of the three separate factories which have an injury free month, £250 is donated to a local cause nominated by an employee.



Forticrete Innovative use of recycled materials

The pioneering approach of Forticrete's Dewsbury manufacturing plant in the use of recycled materials for the production of concrete blocks has set a standard that is unrivalled in the industry. Over the past 12 years, Forticrete has reclaimed and re-used 2m tonnes of recycled materials, thereby reducing primary aggregate consumption and associated CO₂ emissions.

The vast majority of this material is reclaimed ash, which is excavated from huge deposit sites created during the industrial revolution, when there was no use or value in this by-product of coal. By extracting, processing and re-using the material, Forticrete has enabled many of these brownfield sites to be returned to use, with some buildings incorporating the very materials that were once dumped in the ground beneath them.

In addition, the company reclaims and re-uses clinker ash from railway sidings and former industrial sites, a variety of 'slags', and also recycles 30,000 tonnes of 'rejected' concrete blocks, bricks and pipes from its own and other manufacturers' operations every year.

Although Forticrete is not the first company to use reclaimed ash, their commitment to its use for the volume production of concrete blockwork and innovative approach to the development and use of a wide range of different materials is unique.

Since the first trials of the use of recycled ash materials, Forticrete's personnel in Dewsbury have been heavily involved in the substantial amount of trialling and product testing, in-house and via third parties, including approvals by the National Accreditation of Measurement and Supply (NAMAS). With the initiative's effectiveness confirmed, the use of these materials has become part of the culture at Forticrete.

This level of recycling - the company's Newlite product, for instance, is manufactured from 90% recycled material - has many benefits: the regeneration of brownfield sites, the effective and cost-effective replacement of quarried or manufactured aggregates, the provision of lightweight aggregate with a sustainable supply, and a huge reduction in CO₂ emissions.



Tarmac Topblock Takeback scheme

During 2007 Tarmac TopBlock launched a major initiative in conjunction with waste management company Hippowaste to recycle site waste. Under the scheme customers purchase 1m³ heavy duty plastic bags into which broken and off-cut blocks are sorted. When 10 of the Hippobags are filled they are collected and transferred to the nearest Tarmac recycling depot or plant for processing into recycled aggregate.

This simple, cost-effective scheme facilitates and encourages the recycling of block waste, reduces the need for virgin aggregates, helps customers to manage on-site waste, and reduces the amount of material sent to landfill. By offering traceability of the waste and collection by a fully certified waste handling company, Tarmac's scheme also directly assists with the audit trail for a site waste management plan, the subject of potential legislation in 2008.

To make customers aware of the service and for them to understand the detail, step by step guides on how the system works were distributed. There is also a factsheet available.

The scheme has sustainability benefits for both customers and suppliers and provides a valuable contribution to Government waste, recycling and landfill reduction targets for 2012 and 2015.



Marshalls Landscape Products Sustainability and carbon impact reduction

Committed to reducing the amount of greenhouse gases and carbon produced as a result of its operations, Marshalls Landscape Products invests in researching, developing and implementing new, environmentally friendlier, innovative mix designs, and sourcing materials responsibly.

The company maintains a strict policy of producing products intended for a long life with low maintenance. The products have a very low risk of pollution and, in the majority of cases, can be easily recycled at the end of the construction's useful life. The company's new 'eco-friendly' concrete block paving has a 39% smaller carbon footprint than its traditional counterpart, and work and investment continues to be dedicated to optimising the mix design of all products.

In partnership with the Carbon Trust, the company has carbon labelled all its domestic products using the standard developed by the Trust to calculate the embodied carbon emissions. From this an online carbon calculator was launched, enabling users to measure the CO₂ impact of hard landscaping products, and encouraging them to 'offset' the impact of the CO₂ with soft planting. It even recommends how many trees would need to be planted to give the desired offset, and provides links to organisations that specialise in this field.

Marshalls' plan for good practice in energy reduction has been rolled out across its manufacturing sites, where the use of energy and the production of the resultant greenhouse gases are carefully monitored. As a result of the measures, Marshalls continues to show a consistent reduction in kilograms of CO₂ produced per tonne of production year on year.

Associate Members' Sustainability Champions 2008

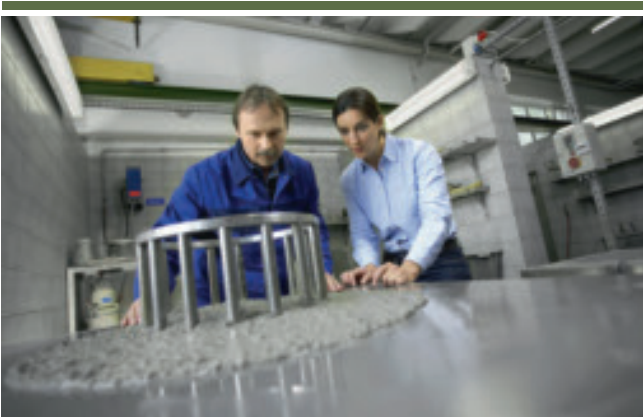
Four Associate Members of British Precast have been awarded the title of Sustainability Champions 2008 after developing projects that reduce their industrial impact on the environment and the communities we live in, while enabling their precast manufacturing customers to become more sustainable.

Lafarge Cement UK, with two winning entries, BASF Construction Chemicals, Inditherm and Lafarge Aggregates UK each won the accolade in British Precast's Associate Member Sustainability Best

Practice Awards 2008, which were started this year to reward excellence in projects that focus on social, economic and/or environmental benefits.

These five innovative projects tackled energy management, improving the efficiency of the supply chain, and reducing waste and pollution, with the potential to make a huge positive impact on the precast sector's environmental and sustainability targets.

The Winners



BASF Construction Chemicals *Energy Management*

BASF's 'Energy management' project demonstrates that the use of the company's products can save three times more greenhouse gas emissions than the entire amount caused by the production and disposal of them.

To achieve this and other ambitious environmental targets, BASF continues to develop innovative technologies and materials for sustainable climate protection, spending around €400m, or one-third of its total research and development budget, in the areas of energy efficiency, climate protection, resource conservation and renewable raw materials.

To emphasise the strategic importance of climate protection, BASF believes it is the first global industrial company to appoint a 'climate protection officer', whose role is to co-ordinate BASF's long-term climate protection strategy.

In areas such as construction, automobiles and industrial production, BASF products help its customers to save more than 250m tonnes of CO₂ worldwide.

And in the field of concrete, BASF has developed concepts for greater sustainability in the production of precast elements and manufactured concrete products, optimising processes and the use of energy.



Inditherm *Accelerated concrete curing technology*

Heating solutions company Inditherm has developed and patented a flexible carbon polymer technology that provides a highly efficient method of delivering heat with completely uniform temperature characteristics. The technology is used for applications as diverse as warming premature babies, patients undergoing surgery, chocolate manufacturing processes, football pitches and construction projects.

The technology is based on a flexible polymer sheet which is impregnated with carbon in a manner which gives completely homogeneous electrical properties. This allows it to develop heat very efficiently when a low voltage is applied to it.

It maintains completely uniform heating over a large surface area, has high thermal transfer characteristics by conductive heating, is completely safe due to low voltage operation, and has environmental advantages due to low power consumption.

The concrete manufacturing process can benefit from this technology through faster curing times, reduced cement and additive content, and reduced energy costs, which can directly contribute to a reduction in environmental impact and improvements in sustainability in the precast industry.



*Lafarge Aggregates
Recycled glass sand*

Lafarge Aggregates have used their expertise in recycled aggregates to create EnviroSand, made from locally sourced waste glass packaging. It outperforms regular quarried sand, has a lower bulk density and is free-draining so can be used in the rain. The production of EnviroSand helps meet the UK's recycling targets by diverting glass from landfill and recycling it into a product that is clean, non-toxic and inert while preserving stocks of primary aggregate. Because it is sourced and produced locally, it minimises the amount of truck movements and road congestion.

It has been used successfully in several precast applications, and as the demand for sustainable construction solutions rises, this usage will almost certainly increase.

Following on from the development of EnviroSand, Lafarge Aggregate's team produced EquineSand, a recycled glass sand designed especially for use in equestrian ménages, which presents a cost-effective, sustainable alternative to the silica sand traditionally used. Based on the same principles of production as EnviroSand, EquineSand undergoes further, rigorous testing to ensure it is shard free and safe for equestrian use.



*Lafarge Cement
Waste management and recycling*

Lafarge Cement's 'Waste management and recycling' has a three-pronged approach: minimising the creation of waste as part of its process; utilising society's waste and by-products material in its processes; and helping to reduce product wastage for customers.

This means it is beneficial to the environment, community and customers, including the precast industry.

By tackling one of its major wastes, cement kiln dust, by reusing it in the cement making process, the company reduced the amount of waste disposed of from 193,000 tonnes in 1993 to just 14,000 tonnes in 2006. Meanwhile, investment in dust filtering and abatement equipment and better process management has led to Lafarge reducing dust emissions by over 70% at its seven UK cement works, which has helped improve air quality at the sites. The company also reuses and recycles its defunct equipment and buildings where it can.

Lafarge is also the largest user of waste, such as bone meal, used tyres and fuel ash, in the cement-making process, resulting in less fossil fuels being used, and now sells its cement products in plastic packaging, which is 39% more environmentally-friendly than traditional paper bags, with more options for storage and virtually no cement wasted.



*Lafarge Cement
Sustainability approaches towards product supply chain*

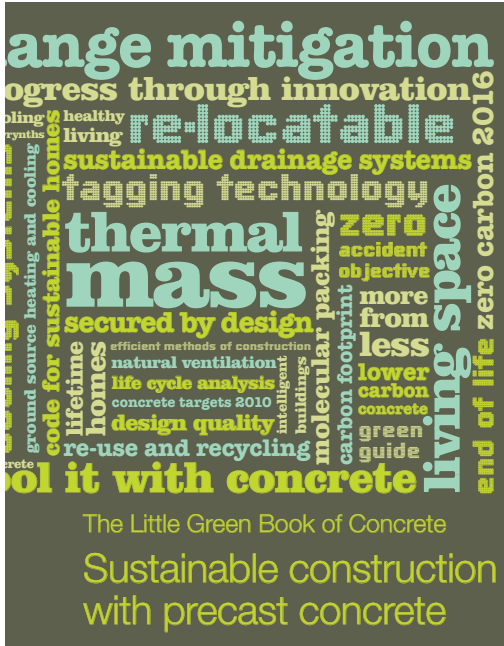
'Sustainability approaches towards product supply chain' focuses on maintaining robustness in its role as a supplier while minimising the environmental impact.

Again this takes a three-pronged approach: investment to ensure a reliable service to its customers; commitment to use sustainable methods to supply product; and mechanisms to ensure reliability of supply to customers.

A recent investment of £100m purely on its supply chain has led to the development of a rail infrastructure which enables cement, fuel and materials to be transported in rail wagons rather than in lorries on the road. The company now moves around 27% of its total product volumes by rail to 12 of its 14 depots, which means a reduction in pollution of over 750,000 tonnes of CO₂ and, of course, less congestion on the roads.

As part of this project Lafarge Cement has also installed mechanisms to ensure reliability of supply to its customers. These measures look at delivery times, order completion and correct paperwork, and has led to 94% of bulk orders being delivered on time this year.

Little Green Book of Concrete



Since our Little Green Book of Concrete was published in August last year, 40,000 copies have been distributed worldwide.

The Little Book provides the architect, designer, engineer, client, financier, insurer and environmentalist with a summary guide to the sustainability credentials of precast concrete. It explains how the industry is becoming more resource efficient and environmentally aware and how its products can contribute to achieving greener construction.

It is relevant to all concrete producers and will be of interest to clients, designers, merchants and contractors as well as precast industry staff. For copies and enquiries, please email:

info@britishprecast.org.

Comments and Further Information

British Precast welcomes your views on this report and our approach to developing a more sustainable precast industry. You can give us your comments by writing to Abdullahi Aliyu at British Precast or email him at abdullahi.aliyu@britishprecast.org

Further information is published in the sustainability section of our website and in our publications *Moving the Industry Forward* and *Annual Report*.

Print Commitment

At British Precast we aim to be sustainable in everything we do, and that includes our print. All our publications are printed on recycled paper that has a minimum of 50% post-consumer waste content and is FSC certified and we only use vegetable based inks. We audit all our printers to ensure they have ISO 14001 or equivalent standards and have their own sustainability strategy.

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