

*International Symposium of the CIB W92 on Procurement Systems
“Project Procurement for Infrastructure Construction”
7-10 January, 2004, Chennai, India*

Key Drivers of Sustainable Construction

Tansey, P, Former MSc Construction Management Student, Department of Civil Engineering, University of Strathclyde, 107 Rottenrow, Glasgow G4 ONG

Murray, M, Department of Architecture & Building Science, University of Strathclyde, 131 Rottenrow, Glasgow, G4 0NG, Scotland, UK, m.d.murray@strath.ac.uk

Langford, D, Department of Architecture & Building Science, University of Strathclyde, 131 Rottenrow, Glasgow, G4 0NG, Scotland, UK, d.Langford@strath.ac.uk

Abstract

The construction of any building / project can have a detrimental impact on a local, regional and international environment. Thus, concern for our environs has led to the concept of ‘sustainable development’ and in turn ‘sustainable construction’. Construction companies in many countries are under pressure to align their processes with such an ideology. Pressure from Government legislation and other stakeholder groups have acted as a catalyst for the evolution of the sustainable movement. In construction, the concept of ‘supply-chain-management’ has acted as a catalyst for a deeper analysis of sustainability issues within the procurement process.

This paper discusses research undertaken into one such supply chain in an Irish construction company. The results show some attempt to employ sustainable construction practice, but that this drive was relatively small in relation to what can be achieved overall in sustainability terms. It was also found that most of the sustainable approaches adopted by the different supply-chain groups are in relation to issues like planning/development acts, environmental impact statements, waste management and efficient use of resources, while, only a few suppliers were found to be concerned with the issue of energy efficiency.

Keywords: Sustainable Construction, Supply-chain, Irish Construction Industry

Introduction

Over the last decade the issue of ‘sustainability’ has emerged as a critical, political and technological issue for most societies. In the construction industry this cri de coeur has been translated into sustainable development (SD) and sustainable construction (SC). These terms are often used interchangeably yet they are different and this paper will try

to position each term. From these definitions the paper seeks to address a research question

- What drives a construction companies' supply chain to be sustainable?

Inside this question a number of issues emerge such as the motivation for construction firms to develop sustainable supply chains and what are the implications for the companies using sustainable supply chains. This aspect is particularly important given that the results from a recent survey of contractors revealed that they had little idea of their impact on the environment. The poll of 332 SME's found that only 16% could name any environmental legislation unprompted; 13% had implemented measures aimed at reducing harm to the environment and only 17% had formulated an environmental policy (Contract Journal 2003).

The data used to seek answers from the research question, has been collected from one company and whilst the research is a case study it may be held that the work has a wider validity to a wide range of construction companies. In this environment every future project is evaluated by whether it is 'sustainable' in financial and environmental terms. Indeed, in the future, each company in the construction supply chain will be audited for compliance with sustainable ideology.

Context of the study

The case study was carried out in the Republic of Ireland. One key outstanding feature of Ireland's recent economic performance has to be the phenomenal expansion in the construction industry. Between the years of 1994 to 2000, there has been a 12% increase in construction output per annum, which implies a cumulative rise in the volume of construction output of 117%.

Having sustained substantial growth in the construction industry over the past few years, there is now speculation that it is about to slow down. There is no doubt that the Irish economy and the Irish construction sector are now going through a more difficult and challenging period (February 2003). After seven years of rapid expansion in output and employment, the construction sector is facing a significant downturn this year. The medium term outlook is also more uncertain.

Sustainable Development

In the developed world, public concern for the environment started to emerge in the 1960's and it was not until 1972 that international concern was expressed at the United Nations Conference on the Human Environment, in Stockholm. The idea which emerged from this conference was 'an approach to development aimed at harmonising social and economic objectives with ecologically sound management (Sachs & Francis, 1978).

The concept of 'Sustainable Development' can be traced back to 1987, when the World Commission on Environment and Development (WCED) brought the concept onto the international scene. The WCED (1987) produced a publication entitled. Our Common future (known as the Bruntland report) from which the most commonly used definition of

sustainable development stemmed. In 1992, sustainable development was the central theme of the 'Earth Summit', held in Rio de Janeiro. It was the first conference on the world's environmental future to be attended by heads of State and Government. It called on all Governments to take action at national level and, in particular, to adopt strategies for sustainable development, building on their existing plans and policies.

Sustainable Construction

The discipline, 'Sustainable Construction' stems from the concept of Sustainable development. After the Bruntland report (1987), many countries described the term 'sustainable construction' as the responsibility of the construction industry for attaining 'sustainability'. But with so many different opinions and definitions on 'sustainability', how was the construction industry going to tackle the issue?

In 1994 the first International Conference on Sustainable Construction was held in Tampa, Florida, United States of America. During the conference it was proposed that sustainable construction should mean 'creating a healthy built environment using resource-efficient, ecologically based principles (Kilbert, 1994). This definition was clearly too vague and therefore needed to be changed. A clear and precise definition, was needed, one which could be easily adapted to the construction industry.

After the conference, the term 'sustainable construction' was extended to describe a process that starts well before construction in the planning and design stages and continues after the construction team have left the site. Wyatt (1994) described the term to include managing the serviceability of a building during its lifetime and extends to its eventual deconstruction and the recycling of resources to reduce the waste stream usually associated with demolition.

The definition above, in a sense, includes a 'cradle to grave' approach that is vital in order for the industry to be sustainable and also for everyone in the supply chain to be involved with the issue. If the construction industry wants to be sustainable, then this definition probably offers the best approach to doing so. The only problem is that the definition does not totally adhere to the concept of 'sustainable development' because it does not offer an equal balance of economic, social and environmental issues. However, a generic criterion for sustainability practice would include the following: -

1. Waste management systems
2. Environmental management systems
3. Whole life costing
4. Life cycle assessments
5. Health and safety systems
6. Respect for people attitudes
7. Sustainable procurement and
8. Environmental supply chain management

Whilst it is recognised that issues 1-7 have an important role in shaping how sustainable a construction project and its process is the focus of this paper as on the supply chain

management issues. The sustainability issues have primary drivers from external agencies such as Governments (see Figure 1). The secondary drivers of sustainable construction lie mainly within the framework of the construction organisation and are shown in Figure 2.

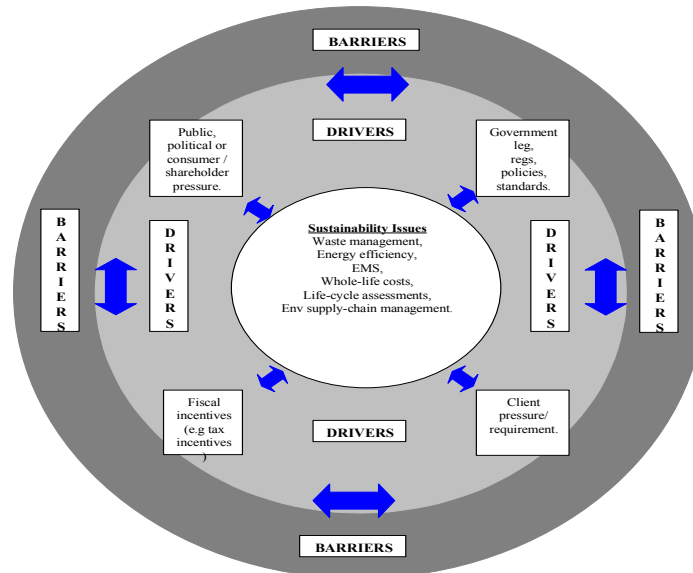


Figure 1 Relating Barriers – Primary Drivers – Sustainability Issues

What are the barriers?

- Lack of hard data in relation to the commercial and business benefits of sustainable construction
- The recent construction boom (most construction professions don't have time to examine sustainability aspects of projects!)
- Lack of awareness of the terms 'Sustainable Development' and 'Sustainable Construction'
- Lack of Government legislation, regulations, policies and standards in relation to sustainable construction
- Lack of fiscal incentives

The Irish Governments current 'lowest tender wins' attitude to contracts

Environmental Supply-Chain Management

Most large construction companies have a high number of suppliers; equally most are seeking to reduce this number by strategically partnering or engaging in other collaborative arrangements. Clients are seeking similar relations with these construction suppliers. The driver for this revised business model is to increase value and reduce waste. Given that a significant portion of total construction costs are attributed to procurement (i.e. transactional costs) the elimination of waste would fulfil the ambitions of the sustainable construction movement.

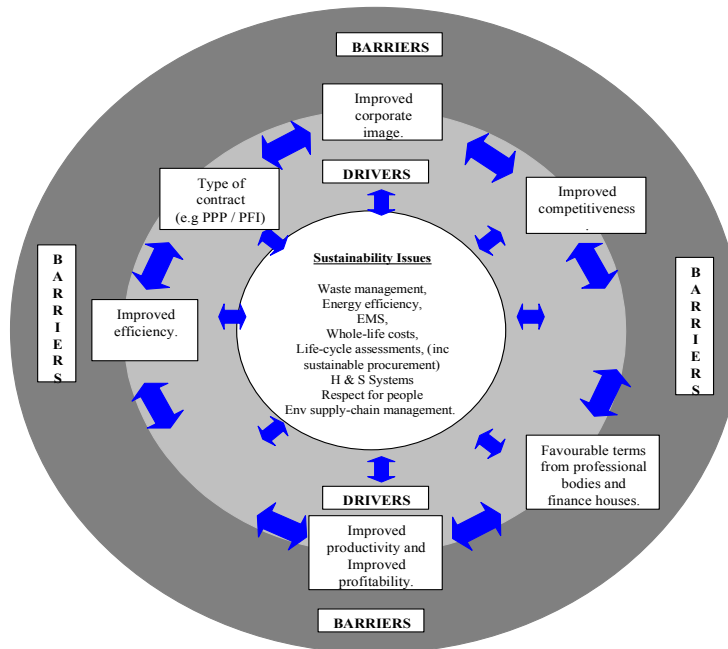


Figure 2 Relating Barriers – Secondary Drivers – Sustainability Issues

A typical supply-chain cycle consists of a ‘cradle to grave’ process. The cycle itself is made up of various stages; Cradle – raw materials extraction – conversion – manufacture – storage and transport – construction – use and maintenance – disposal – Grave (Boag, 1998). The supply-chain process also involves various groups, namely, suppliers, clients, designers/ consultants and contractors. However, traditionally this supply chain has been separated rather than integrated and as such acts as a cultural barrier to ‘project sustainability’. Bowen et al (1998) also recognise the importance of environmental supply chain management: -

Continuity of supply – Suppliers who do not manage their environmental performance may be at risk of disruption due to non-compliance, pressure group action and other liabilities. This, in turn, could put their ability to supply at risk as a result of costs associated with compliance affecting the business viability or even force closure.

Environmental management systems – Supply-chain management is a vital part of any environmental management systems (EMS). The co-operation of suppliers is necessary for incorporating environmental concerns into an organisation’s operational processes and strategic planning.

Risk Management – Examining and managing the effects of the supply-chain can greatly reduce the risks to both the environment as a result of pollution and the risks to an organisation as a result of legislative non-compliance.

These issues impact risks to a company from its supply-chain, some will be low risk others being high risk suppliers. To appraise the risk it will require the active

involvement of all supply-chain participants including suppliers, clients, designers and contractors.

The Research Study

The research used a case study approach since the boundaries between the phenomena (drivers of sustainable supply chains) and context (the case study firm) are not clearly evident (Yin 1994). The single case study was selected but the research involved multiple organisations within the supply chain of one firm. Each organisation in the supply chain was questioned about the extent to which the primary and secondary drivers elicited from the literature review were evident in practice. Moreover the research would enable 'how' supply chains become or did not become sustainable and 'why' they did or did not.

The case study organisation is a large construction company offering a wide range of contracting services. It has a large civil engineering division and has acted as a joint venture partner in several major projects in Ireland that have included international construction companies. Its turnover is approx 200million Euro and employs over 400 people and its client base includes Government, parastatal agencies and private clients in the industrial construction sector. A questionnaire survey was set up and the respondents were 4 suppliers, 5 clients, 6 designers/ consultants and two constructors who were joint venture partners with the firm central to the case study. The questionnaire was simple and asked each constituent one question.

- From the position of a client/ supplier/ designer/ joint venture partner, which of the following factors drives you to be sustainable?

The primary and secondary drivers identified earlier were then listed and the respondents were invited to say Yes – this factor drove them to be more sustainable or No it did not. Each respondent was then telephoned to engage practitioners in a discussion about the results of the survey.

Results

These are discussed under two sub-headings; primary drivers and secondary drivers.

Primary drivers:

The dominant drivers for the supply chain participants were Government legislation, client pressure and public concern along with the attitudes of external stakeholders in the firm. The telephone discussions held with the respondents indicated a number of factors which prompted the responses. In respect of Government legislation a number of issues were flagged up; these included

- Environmental legislation in relation to dust and noise promoted more sustainable behaviour.
- Planning legislation and EU legislation drives firms towards greater concern for sustainability.

- The demand by planning agencies for environmental impact statements

In respect of client requirements the pressure mounted by clients was dependant upon who the client was. With local authority clients the key factors were waste management and planning constraints.

Curiously one respondent noted that large private multinational clients were far more concerned with sustainability issues than the Government were. The client sample would not of course be subject to client pressures but this group were asked whether compliance with local agenda 21 was driving sustainable practices. Despite every effort of Government throughout the world (with the exception of the USA) the use of guidelines for the application of local agenda 21 seem rather flighty. Disappointingly the suppliers believed that clients applied more pressure in respect of product quality and durability. Environmental performance was rather a secondary issue.

Table 1: Primary Drivers for Adopting Sustainability Practices

Respondents	Suppliers	Clients	Designers/ Consultants	Joint Venture Partnering
Drivers				
Government Legislation /	75% agreed	75% agreed	100% agreed	100% agreed
Client Pressure / Requirement	100% agreed	60% agreed (Local Agenda 21 was the issue raised with this group)	84% agreed	100% agreed
Fiscal Incentives	100% disagreed	100% disagreed	100% disagreed	100% disagreed
Public, Political or other external pressure	100% agreed	100% agreed	84% agreed	100% agreed

With respect to incentives the picture is uniform. The question is not whether incentives would change concern for sustainability but more that there were no tax incentives, in Ireland to promote sustainable behaviour. However should final incentives be introduced by Government then firms in the supply chain would respond out of self interest and concern for sustainability.

Finally the matter of public pressure was dismissed in the telephone interviews. Public awareness of environmental issues is on the increase but in high profile jobs Government exerted direct political pressure in respect of environmental awareness.

Secondary Drivers:

Discussing each of the drivers in turn.

- Image: Firms, which projected a corporate image of being practitioners of sustainable construction, were looked upon more favourably by clients and the public. To quote one of the respondents *“by being known as an environmentally conscious contractor and being capable of adopting sustainable approaches we improve our overall corporate image. This particular image has helped us to pre-qualify for a number of contracts, more so on an international scale”*.
- Improved competitiveness: In the minds of many of the respondents whose primary business is construction (i.e. suppliers, designers and joint venture partners) competitiveness is linked with image – an environmentally conscious approach signals potential improvement in competitiveness. The case is less clear with clients who may see competitiveness in their primary function as more important than the construction projects they commission.

Most of the respondents recognised the connection between sustainability and efficiency. Years of discussion about the value of energy, the drive to eliminate waste and improve resource utilisation, have influenced attitudes.

- Improved productivity: Clients and designers/consultants and J.V. partners were less able to see productivity benefits from more sustainable approaches. The telephone interviews revealed that the reason for this was that respondents were less able to identify ways of measuring productivity improvements whether they are signed up to the sustainable construction campaign or not.
- Improved profitability: Clients and designers did not see improved profits being derived from sustainability. Suppliers saw sustainability as a vehicle to improve efficiency and productivity, which would improve profitability. For designers adding in sustainable dimensions to designs absorbed more design hours and so diminished profitability. For the j.v partners the linkage between profits and sustainability was evident *“we generally adopt sustainable approaches to construction if improved profitability can be demonstrated.*
- Favourable terms from finance houses: Here the responses are very variable. Suppliers and joint venture companies were well disposed to seeing relationships with finance houses as a driver of sustainable behaviour. Clients and designers/consultants were less convinced. The reason for this division is that project funding for clients is less dependent upon criteria for building in sustainability. Designers, unless the very largest, are unlikely to seek funds from finance houses beyond their bankers who are unlikely to impose environmental criteria as a performance test. However insurance companies are increasingly becoming conscious of the environmental effects of the end product and are encouraging behaviour to satisfy environmental ends. This will affect the behaviour of joint venture partners.

- Type of contract: Again views were divided. Joint Venture partners saw PPP/PFI type projects often required high standards of sustainable construction.

Table 2: Secondary Drivers for Adopting Sustainability Practices

Respondents Drivers	Suppliers	Clients	Designers/ Consultants	Joint Venture Partners
Improve corporate image	75% agreed	100% agreed	84% agreed	100% agreed
Improve competitiveness	75% agreed	100% disagreed	84% agreed	100% agreed
Improved efficiency	75% agreed	80% agreed	84% agreed	100% agreed
Improved productivity	75% agreed	40% agreed	17% agreed	50% agreed
Improved profitability	75% agreed	100% disagreed	100% disagreed	100% agreed
Favourable terms from finance/houses	75% agreed	100% disagreed	34% agreed	100% agreed
Type of contract	X	20% agreed	50% agreed	100% agreed

Conclusions & Recommendations

Sustainable construction should be an important component of creating a sustainable development. However, no clear consensus of such a link seems to be the case today.

It is evident from the research carried out, that the supply-chain of the case study firm shows to an extent, some sort of drive towards sustainable construction, but, it was found that this drive is relatively small in relation to what can be achieved overall in sustainability terms. It was also found that most of the sustainable approaches adopted by the different supply-chain groups are in relation to issues like planning/development acts, environmental impact statements, waste management and efficient use of resources, while, only a few suppliers were found to be concerned with the issue of energy efficiency.

Given the fact that the case study firm is one of the biggest contractors in Ireland, and that their supply-chain represents a substantial cross-section of the industry, it would indicate that the research results give a representative sample of the likely views outcome of the industry as a whole. Therefore, it can be concluded that the Irish construction industry is mildly indifferent to the concept of sustainable construction.

It is also evident from the research conducted, that the Government needs to make greater efforts in promoting sustainable construction. Ideally, it needs to promote the concept through fiscal incentives, improved codes and standards and policy development. Also

evident, is the fact that more needs to be done in relation to increasing awareness of the sustainability aspects involved with PPP / PFI contracts.

Clearly, the results indicate a lack of progression to towards sustainable construction but also a general lack of understanding of what sustainable construction is about and how it can benefit partners within the supply chain. Inadequate understanding and promotion of the concept 'Sustainable Development' is evident in the research sample.

It is also evident from the literature review on sustainable development that it involves the integration of economic, social and environmental factors in order to promote a better quality of life both now and for future generations, and that it will inevitably entail some draw down of natural resources. This message needs to be proselytised across the construction industry.

REFERENCES

- CIF News & Update. February 2003. No.12.
- Contract Journal (2003) SME'S Unaware of Impact on the Environment, 2 July, pp.1
- Boag, K. (1998). Environmental Policy / Waste Strategy Manager, South Lanarkshire Council, Community Resources.
- Bowen, F.E, Cousins, P.D and Lamming, R.C. (1998). *The Role of Risk in Environmental-related Supplier Initiatives*. Proceedings of the International IPSERA Conference.
- Business in the Environment, (1999). UK Government HMSO,
- International Union for the Conservation of Nature and Natural Resources (IUCN) (1980). *The World Conservation Strategy*. Gland, Switzerland.
- Kilbert, C.J (1994). Proceedings of First International Conference of CIB TG 16 on Sustainable Construction, Tampa, Florida, 6-9 November, pp 3-12.
- Sachs & Francis, (1978) ???????
- Solow, R. (1993). *An Almost Practical Step to Sustainability*, reviewed in Resources, 110, Resources for the future, 1616 P Street, NW Washington DC 20036-1400.
- The Brundtland Report (1987). *Our Common Future*-Report of the 1987 World Commission on Environment and Development. Oxford University Press 1987.
- UK Government Construction Clients Panel (2000) *Achieving Sustainability in Construction procurement*.
- Wyatt, D.P (1994). *Recycling and Serviceability: the twin approach to securing sustainable construction*, in first international conference of CIB TG on Sustainable Construction, Tampa, FL, 6-9 Nov, pp 113-122.
- Yin, (1994). *Case Study Research, Design and Methodology*, Second edition