

EXPLORATIONS IN SUSTAINABLE CONSTRUCTION AND PROCUREMENT IN WESTERN AUSTRALIA

Peter A Bullen¹ and Peter R Davis²

Faculty of the Built Environment, Art and Design, Curtin University of Technology, GPO Box U1987, Perth, Western Australia 6845

Integration of sustainability initiatives into construction processes such as project procurement requires substantial and innovative change. To achieve this the construction industry needs to move away from traditionally fragmented processes and adopt more collaborative and holistic approaches. Literature suggests a slowness to innovate and a general misunderstanding of the concept of sustainability, as two of the barriers to the industry achieving the changes required. While carrying out separate PhD research into sustainable construction and procurement a link was identified between these areas. As a result, early in 2003, a focus group of professionals within the Western Australian construction industry was held to investigate sustainable construction and its association with procurement. The group, selected from architects and major contractors, also attempted to identify any gaps in contemporary knowledge concerning the issues surrounding sustainable construction. Conclusions drawn from the focus group confirm there are still high levels of uncertainty concerning the meaning of sustainability and how to implement initiatives that will achieve the triple bottom-line objectives of sustainable construction. The study forms part of a work in progress and similar focus groups are planned with client, manufacturer and community stakeholder groups. The information from all of the groups will provide a model to integrate sustainability initiatives into the construction supply chain process.

Keywords: Construction process, focus group, procurement, sustainable construction, Western Australia.

INTRODUCTION

The way that buildings and infrastructure are constructed provides many opportunities for sustainability such as buildings that are less resource-intensive (Government of Western Australia 2002). This potential for improvement exists because of the sheer scale of the construction industry as a major user of natural resources (Rees 1999, Kibert *et al.* 2000) and a major contributor (50% to all waste streams) of waste to landfill (WA Department of Environmental Protection 2001). Sustainable construction involves change to construction methods and resource use but more importantly change to the building process. The level of technical and procedural change necessary may require substantial change to the structure, organization and communication channels of the industry. As construction is an industry based mainly on traditional procurement processes, there are professional barriers to adopting the innovative change sustainability requires. The construction industry globally is slow to innovate and the industry in Australia is even slower to innovate and as a result is lagging behind (Pricewaterhouse Coopers 2002).

¹ p.bullen@curtin.edu.au

² p.davis@curtin.edu.au

Research into whether different procurement strategies may help achieve sustainable construction was considered important as a first step in assessing the viability of process change. A focus group was seen as a reliable way to investigate concerns of WA industry about sustainable construction initiatives including those proposed by the state government. A key issue raised by the industry is the role of innovation in understanding, implementing and facilitating sustainability (Prime Minister's Science Engineering and Innovation Council 2002). The aim of the focus group was therefore to identify and discuss the opportunities and barriers to sustainable construction in Western Australia that innovative strategies may or may not provide.

BACKGROUND

Australia's population is approximately 19.3 million, with a pattern of settlement characterized by high rates of urbanization but low-density cities. Most Australians (about 60.7%) live in the five largest cities, but significant coastal non-metropolitan urban growth is also occurring, particularly in New South Wales, southern Queensland and south-west Western Australia (Department of the Environment and Heritage 2001). Increased residential construction activity is one of the consequences of this urban growth. Coupled to the decline of average household size (2.6 persons in 1996 compared with 3.3 persons in 1976) and the increase in average floor space (3% per annum over the last 7 years) it all adds to the pressures on the environment (APCC 2002). Consequently, incredible damage has been done to the Australian landscape but it has also made Australians unusually environmentally aware and therefore uniquely placed to help avert a looming global environmental crisis. By facing their problems, Australians will be able to develop technological advances that will also be of great use to the rest of the world, as well as themselves (Raven 2002).

Although innovative procurement may provide an opportunity to move towards sustainable construction, the construction industry is slow to adopt change. The greatest inhibitor to innovation in the Australian industry is perceived risk. Although the innovation process is facilitated by joint ventures and collaborative efforts, a survey of the Australian construction industry revealed that only 40% of respondents out of a total of 239 had participated in these types of arrangements (Pricewaterhouse Coopers 2002). The survey also examined whether any innovative approaches had been implemented in the last year that had increased sustainability and other outcomes of project delivery. Of the respondents 79% had adopted innovative practices in the preceding twelve months and 74% would continue to do so. Only 26% of respondents did not include any environmental criteria in the procurement process. In direct contrast to the results of this survey, Lenard *et al.* (1996) argue that innovation in the Australian building sector is historically seen as low. Furthermore the industry is unlikely to develop and trial new processes that improve environmental performance without the assistance of government. This barrier to innovation motivated a business-industry forum held to look at designing a smarter innovative future for the Australian built environment (CSIRO 2001a). One of the key issues to emerge was that the various players involved with design and construction know the issues involved and are aware of solutions but further work is required to establish more imaginative approaches to the adoption of known improvements. Innovative change faces many barriers in an industry such as construction where traditional processes are firmly entrenched. Consequently, the change is not confined just to the building process but also the challenge of thinking outside of boundaries dictated by specific areas of expertise. A key issue is how to find innovative responses that satisfy traditional

industry demands and also the new societal demands for sustainable development (CIB 1998). There are views that sustainable development will not become a genuine business concern until the business environment becomes a driver of the social equity issues involved. According to Hoffman (2000) this is the only way that sustainable development will become a genuine business challenge. Despite the many questions for the construction industry, the government of WA (Gallop 2002) is convinced that the industry globally is addressing this change and looking for innovation in sustainability.

SUSTAINABLE CONSTRUCTION

The lack of comprehension surrounding sustainability is created by variations in definitions of sustainable construction and sustainable development. The proposal by Schaller (1993) that sustainability is like truth and justice - concepts not readily captured in concise definitions, accurately outlines the challenge facing us. The interpretation and meaning of concepts must differ between individuals and between societies as a result of variations created by circumstantial variables.

Various definitions of sustainable development are commonly used including:

- Sustainable development is a development that meets the needs of the present without compromising the ability of future generations to meet their own needs (WCED 1987).
- Improving the quality of human life while living within the carrying capacity of supporting ecosystems (Caring for the Earth, IUCN/UNEP 1991)
- The sustainability of natural ecosystems can be defined as the dynamic equilibrium between natural inputs and outputs, modified by external events such as climatic change and natural disasters (Fresco *et al.* 1992)
- Sustainable construction can be defined as the creation and responsible management of a healthy built environment based on resource efficient and ecological principles (Kibert, 1994).

The large number of definitions describing sustainable development is created by the multiple and complex concepts it involves. Any strategies adopted for sustainable development should therefore at least consider the three main areas that the construction industry affects:

- Economic– development and provision of infrastructure and buildings
- Environmental – the impact on resources
- Social – impact on living and working environments of the community.

This approach is supported in Agenda 21, which defines sustainable development, as development that delivers basic environmental, social and economic services to all without threatening the viability of the ecological and community services upon which these services depend. Sustainable construction is a set of processes to deliver built assets such as buildings and infrastructure (GCCP 2000), that would be considered sustainable because they:

- Enhance the quality of life and customer satisfaction
- Offer flexibility for user change in the future
- Provide and support desirable natural and social environments
- Maximize efficient use of resources

The Government of WA (2002) also views sustainable construction as a process that will provide less resource-intensive buildings that are better to live and work in.

PROCESS CHANGE

Increasing stress on natural systems and current norms of sustainable development are generating the need for new approaches to decision-making. These include integrating sustainability issues into the project selection process by considering technical or conceptual factors, but also taking account of the smaller daily value-driven decision-making process. The construction industry and the built environment are counted as two of the key areas that will help to attain a sustainable development in our societies (CIB 1999). The substantial technical and procedural change required to address sustainability issues requires a similar change to the structure, organization and communication channels of the industry. Construction is traditionally based on SMEs, labour intensive methods, high-energy based components and low technical innovation. The industry is generally highly fragmented with a legacy of project delivery processes that are highly inefficient compared to other industry sectors (CSIRO 2001b). There are however, barriers to changing traditional procurement processes, particularly as sustainable strategies at first appear unrealistic, impractical and unrelated to current industry practices. Also, the role of procurement is often seen as the weak link in sustainable building (Nijsten *et al.* 2002). Reasons for this revolve around:

- not including sustainable building in the specification
- a general inability, by stakeholders in the construction industry, to appreciate what sustainability is
- the need for industry to adopt a more systemic approach in project delivery processes
- a need to understand the complex relationship between natural and human resources, economic and social aspects in construction projects.

A stumbling block to addressing these problems is that the major part of decisions are made during the initial phase of the building process (Reed *et al.* 2000, Persson 2002). Most of the sustainability impact of the project is also determined at the same time. One solution is to steer the building process to gain an overall perspective of the complex relationship and find the main thread of the sustainability aspects of the project. Persson (2002) proposes a model which incorporates a sustainability program and a process of documenting decisions during the building process which change the conditions for sustainability targets on a continuous basis.

Innovation is seen as the key which can fit flexibility typical of complex processes such as sustainability (Vollenbroek 2002). However, to be successful in managing sustainable development the multi-level dimension of sustainability must be recognized and rather than finding specific solutions we must learn to act at different levels and work with many actors. Until recently we have not been able to produce innovation essential for facing complex systems and to improve technology that suits sustainable processes rather than solutions (Conte 2002). The relationship between procurement and sustainability was seen as fundamental by (Pollington 1999) to identify and implement:

- the process of realizing the construction
- the life cycle implications through the specification of performance as stated in the procurement documentation.

Future studies of procurement, in the context of sustainability, should bring together the triple bottom line issues of social, cultural and environmental sustainability. Agenda 21 should study the capacity of alternative procurement strategies to take account of sustainability concerns. Pollington (1999) identified the need for Agenda 21 to provide research leading upwards to policy makers and downwards to individual procurement decision makers. The call was partly answered by a guide produced by the Construction Industry Research and Information Association containing an action plan based on a whole project approach relating to procurement. The plan enables sustainability aims to flow downwards through the briefing process, a sustainability management system, the design and construction phases and the operational phase of the building (Addis 2002). The advantages of this plan are that it:

- ensures sustainability pervades the entire project
- ensures sustainability technologies are incorporated into buildings
- provides a client focused approach
- helps the client articulate sustainability goals

RESEARCH METHOD

The problem statement revolved around the concept of sustainability, how the construction industry in Perth Western Australia define it, rationalize it in an operational sense and use a dynamic systems approach in procurement and/ or supply chain management to achieve sustainability in a meaningful way. The purpose of the research was explorative, (Sarantakos 1993, Hussey and Hussey 1997) because the literature reveals few examples that describe how companies manage sustainability. There has also only been limited research into the role of procurement in sustainable construction (McDermott 1999). It was decided in the planning stage of the research that the concept of sustainability was novel when applied to the Western Australian construction industry. Consequently a focus group interview was determined to be the most effective way to clarify the research question (Stewart and Shamdasani 1990, Krueger 1994, Kumar 1996, Hussey and Hussey 1997). Focus interviews are used to gather data relating to the feelings and opinions of a group in a non-threatening environment (Krueger 1994, Hussey and Hussey 1997). In focus interviews the interviewer provides the stimulus and the interviewees, who are familiar with the situation, are provided with relative freedom to discuss the issues (Sarantakos 1993, Hall and Hall 1996).

The issue that was set out to the participants was:

‘Achieving sustainable construction will inevitably require changing current project and decision-making processes. The level of change required to address sustainability may be quite substantial. As a result, there may be many opportunities and several barriers to adopting necessary change.’

The composition of the group is important, and must be representative of the population associated with the research and consistent with the research objectives (Stewart and Shamdasani 1990). To meet this criterion the focus group’s composition was architects and general contractors. Upon completion of initial research, four discussion points were prepared based on knowledge found in the literature. The purpose of the discussion points was to provide the direction for the focus group meeting and to allow the industry to clarify the direction of beneficial research on broad aspects of construction sustainability (Stewart and Shamdasani 1990, Krueger 1994). A purposive/ judgmental sample of thirty six stakeholders from the Perth

construction industry was selected in line with several writers, who are; (Sarantakos 1993, Creswell 1994, Kumar 1996). The sample comprised similar numbers of contractors and architects together with representation from a public procurement administrative body and a construction industry association representative. Of the thirty six initially selected and invited, seven were able to participate and as expected provided a manageable group able to scrutinize the issues in depth.

Due to the dynamic nature of a focus group discussion, it is difficult to identify substantive answers that are specific or mutually exclusive to one particular question. Accordingly, the discussion section of the paper uses content analysis to allow an understanding of aspects that relate to the core variables of sustainable construction (Hussey and Hussey 1997).

DISCUSSION

Prior to discussing the four questions the group considered various definitions of sustainable construction cited in the literature. It was generally agreed that the more relevant definitions consider the triple bottom line objectives of economics, environment and social outcomes. The group also felt that definitions were affected by the stage of development of the industry and country, the type of industry and country referred to. It could also be further affected by variables peculiar to individual localities particularly in a country as diverse as Australia.

Question 1. Think about contemporary procurement strategies. How do they affect the sustainability of construction?

All members of the group viewed client involvement as crucial to the decision-making process. Although clients consider capital and running costs of projects, they also often balance pay back with environmental considerations. In the decision-making process clients will have different views. There are two types of clients; the initial project client and then the end user. The end user is now starting to show a greater awareness of sustainability issues and their needs are changing to reflect some of those issues. This change may start to influence the decision-making process particularly at planning stages. The group felt this process was usually market driven and that in effect the market decides the level of sustainability in a construction environment. Major clients are perceived to be more involved with sustainable projects, whilst minor clients are only occasionally interested. This may be a result of the public relations strategy of companies to project a corporate image that shows a sympathetic attitude towards sustainability issues.

It was felt that in Australian design, HVAC was one of the more important issues particularly as it represents a major impact to the life-cycle costs of a building. Although passive construction techniques go some way to address this issue, legislation is required to drive the other issues of sustainability home. Interest in sustainable construction needs to be fostered in industry generally. The field of sustainability needs to become more holistic and wider than environmental issues such as waste reduction. The view cited by Hall *et al.* (2002) that the Australian industry is unlikely to develop and trial new design processes without the assistance of government was generally supported by the focus group. Members of the group felt that tax credits somewhere in the supply chain may prove useful and there was a definite need for incentives to encourage the industry to do the right thing. The WA Dept of Housing has incorporated sustainability as a tender selection criteria and members of the group felt that although this may be construed as an incentive, they

were unsure of its use and weight/ merit. The proposed performance based revision of the Building Code of Australia was also felt to be a crucial vehicle to achieve sustainable construction, particularly in the areas of energy use reduction and improved insulation and air-handling techniques.

Question 2. How would you describe contemporary supply chain management approaches and their impact on sustainable construction?

Integration of the construction process was felt to be important to sustainability in many ways. An example supported by the focus group was that building projects cannot be completed in the usual way as a linear sequence of tasks undertaken independently by architects, builders and engineers etc. CSIRO (2002). The group agreed that the industry is fragmented/ compartmentalized and there was a need for involvement within the construction team (management of the supply chain process). Currently the process appears to be supply driven but from a design perspective the specification was considered an important issue. Key issues identified while discussing this question were that:

- There was a need for client education.
- There needs to be flexibility in design guidelines (either required or requested).
- There is a need for collaboration of professionals in the project team, including the client, at the earliest possible stage of the construction process.
- This should certainly start at the feasibility stage and preferably even earlier at the planning stage.

Schemes such as energy star ratings for domestic appliances help in making informed decisions. It would be feasible to adopt similar comparisons in other fields, whether it is the efficiency of motor vehicles or the amount of energy used to make a brick.

Question 3. Are you familiar with any alternative procurement solutions that will improve project performance and enhance sustainable construction? (NB question not formally posed to panel)

Generally for WA projects the focus group members felt that in tendering, alternative solutions were not solicited or supported. Sustainability in tender is often used as a marketing tool rather than an honest attempt at addressing associated issues such as social or economic factors. It was felt however that local authority requirements need to be raised in a social sense rather than a cost sense. Cheap products and services generally take priority over other issues and this point came back to the authorship and ownership of the specification document. Emphasis needs to change from short-term initial savings to strategies that provide real long-term economies. The focus also needs to widen from growth in terms of financial achievement to outcomes that address triple bottom line objectives. There needs to be ownership of the problem with overall education and stakeholders should play an active role in the supply chain. It is in the construction groups' interest that a holistic view of the supply chain complete with collaboration should be the focus. There was a general consensus among members of the focus group that communication between the stakeholders should be improved.

Question 4. Generally, how do you feel about the concept of sustainable construction?

Sustainability theory is not well understood and means different things to different people. There is a general lack of knowledge among stakeholders in the construction industry concerning the triple bottom line outcomes of sustainability. Sustainable

construction should make consideration of long-term outcomes and perhaps the more fundamental questions such as should a particular building be there in the first place? People must be forced to take notice of the effects of construction on the natural environment (an example given is the public awareness of the hole in the ozone layer). The group also felt there was a need for cultural awareness – difference in expectation and the approach taken. The existing lack of awareness creates a need for legislation that leads to the creation of systems or policies/ practice improvements. Currently the only consideration given to sustainability at the time of tender was generally the requirement for an environmental management plan.

Despite the obstacles and barriers that currently exist in the industry for sustainable construction, the focus group concluded that:

- It was a good idea in theory
- It was a far-reaching concept that was wider than we anticipated
- It was difficult and complex to implement
- It seems to be a generation issue – we are not currently dealing with an informed market.
- There needs to be a carrot and stick approach to the problem.
- The client and public need more information on the topic.

An increase in public awareness was felt to be the key to improving sustainability and optimizing demand on resources. All stakeholders involved with the construction process need to be educated that sustainable development is based on relating growth of the built-environment to the finiteness of natural resources. It appears that as a society we espouse the Australian way of life but for economic expediency make decisions that ultimately result in a waste of resources contrary to the aims of sustainability.

CONCLUSIONS

Discussion within the focus group tended to concentrate on green issues to the exclusion of the wider social and economic implications, which indicated a tendency to adopt a product rather than process approach towards sustainability. It also appeared to indicate a lack of understanding about the concept of sustainable construction. One group member did not agree and maintained there would only be low levels of knowledge and awareness about sustainable construction if the subject was clothed with esoteric language, as too often occurs.

In the last twenty five years there has been very little change in the Australian construction industry in the area of procurement methods. Traditional procurement methods are still the most commonly used, clients expect designers to do more work for less fees and builders are forced to work on increasingly tighter margins to satisfy the quest for economic growth. Alternative procurement methods to the open or competitive tendering process should be considered as the latter waste a considerable amount of contractor time and resources. If the builder is not part of the team, they cannot contribute to selecting the best design solution or materials and therefore lose the opportunity to form a sustainable construction process.

Although design and construct procurement can offer a better opportunity for sustainability, it will only do so if the tender selection criteria is not based solely on cost. The meaning of sustainability is simple and clear, but if we question the current ability of WA industry to develop sustainably, the short answer is no but this does not mean that sustainable construction should not be the aim.

REFERENCES

- Addis, B. (2002) Delivering sustainable construction. *In: Pettersen T.D. (ed.), 3rd International Conference on Sustainable Building, 23-25 September 2002, Oslo, Norway, EcoBuild, Vol.1,321.*
- APCC (2002) *Perceptions of the construction industry in Australia.* Australian Procurement and Construction Council, Deakin West, ACT
- CIB (1999) *Agenda 21 on sustainable construction.* CIB Report Publication 237. Conseil International du Batiment.
- CIB Working Commission W82 (1998) *Sustainable development and the future of construction.* CIB Report Publication 225. Conseil International du Batiment.
- CSIRO (2001a) *Buildings reinvented: designing a smarter, innovative future.* CSIRO Building, Construction and Engineering, South Victoria, Australia.
- CSIRO (2001b) *Building and construction industries supply chain project (domestic).* Department of Industry, Science and Resources, Canberra, ACT.
- CSIRO (2002) *Sustainability network update- no.6e.* CSIRO Sustainability Network, Glen Osmond, South Australia.
- Conte E. (2002) A technology policy for sustainable building. *In: Pettersen T.D. (Ed.) Procs 3rd International Conference on Sustainable Building, 23-25 Sep 2002, Oslo, Norway, EcoBuild, Vol 1,236.*
- Creswell, J. (1994) *Research design: qualitative and quantitative approaches.* London: Sage Publications.
- Department of the Environment and Heritage (2001) *State of the environment 2001 report.* CSIRO Publishing, Victoria Australia.
- Department of Environmental protection WA (2001) *Waste management bill 2000.* Government of Western Australia, Perth, WA.
- Fresco, L.O., Kroonenberg, S.B. (1992) Time and spatial scales in ecological sustainability. *Land Use Policy*, **9**, 155-168.
- Gallop, G (2002) *Government plans ahead to avoid future crisis.* Media Statement, the Government of Western Australia, Department of the Premier and Cabinet
- Government of Western Australia (2002) *Focus on the future: The Western Australian state sustainability strategy.* Department of the Premier and Cabinet, Perth, WA.
- GCCP Sustainability Action Group (2000) *Achieving sustainability in construction procurement.* Government Construction Clients Panel, Office of Government Commerce (office of HM Treasury) Construction Team, London, United Kingdom.
- Hall, H. and Hall, I. (1996) *Practical social research.* Hampshire: Macmillan Press.
- Hall, M., Chandra, S. and Prasad, D. (2002) Linking the GB Tool to the Design and Decision-making Process. *In: Pettersen T.D. (Ed.) Procs 3rd International Conference on Sustainable Building, 23-25 Sep 2002, Oslo, Norway, EcoBuild, Vol 1,180.*
- Hoffman, A.J., (2000) *Integrating environmental and social issues into corporate practice.* Environment, June 2000, 42(5), p22, Heldref Publications.
- Hussey, J. and Hussey, R. (1997) *Business research.* Basingstoke: Macmillan Press Ltd.
- IUCN/UNEP (1991) *Caring for the Earth: a strategy for sustainable living.* IUCN, Gland, Switzerland.

- Kibert, C.J. (1994) Establishing principles and a model for sustainable construction. *In: First International Conference of CIB TG 16 on Sustainable Construction*, Tampa, Florida, 6-9 November 1994, Vol.1, 3-12.
- Kibert, C.J., Sendzimir J. and Guy, B. (2000) Construction ecology and metabolism: natural system analogues for a sustainable built environment. *Construction Management and Economics*, **18**, 903-916.
- Krueger, R.A. (1994) *Focus groups: a practical guide for applied research*. 2 edn. London: Sage.
- Kumar, R. (1996) *Research methodology: a step by step guide for beginners*. Australia: Longman.
- Lenard, D., Bowen-James, A. (1996) Innovation: The Key to Competitive Advantage. Research report 9, Construction Industry Institute, Brisbane, Australia.
- McDermott, P. (1999) *Strategic and emergent issues in construction procurement*. International Council for Building Research Studies and Documentation, Spon, London.
- Nijsten, R.J.M.F. and Nijland, J.R.P. (2002) Green Procurement: strategy and practice. *In: Pettersen T.D. (Ed.) Procs 3rd International Conference on Sustainable Building*, 23-25 September 2002, Oslo, Norway, EcoBuild, Vol 1,240.
- Persson, U (2002) Managing sustainable construction-a steering model for the building process. *In: Pettersen T.D. (Ed.) Procs 3rd International Conference on Sustainable Building*, 23-25 September 2002, Oslo, Norway, EcoBuild, Vol 1,287.
- Pollington, C (1999) Legal and procurement practices for sustainable development. *Building Research and Information*, **27**(6), 409-411.
- Pricewaterhouse Coopers (2002) Innovation in the Australian Building and Construction Industry: Survey Report. Department of Industry, Tourism and Resources, Manuka, ACT.
- Prime minister's Science, Engineering and Innovation Council (2002) Australian Industry's Sustainable Competitiveness. Department Education, Science and Training, Canberra, ACT.
- Raven, P. (2001) CSIRO, Media Release Ref 2001/99, Apr 2001, <http://www.dbce.csiro.au>
- Reed, W.G. and Gordon, E.B. (2000) Integrated Design and building process: what research and methodologies are needed? *Building Research and Information*, **28**(5/6), 325-337.
- Rees, W.E. (1999) The built environment and the ecosphere: a global perspective. *Building Research and Information*, **27**(4/5), 206-220.
- Sarantakos, S. (1998) *Social research*. Australia: Macmillan.
- Schaller, N. (1993) The concept of agricultural sustainability. *Agriculture, Ecosystems and Environment*, **46**, 89-97.
- Stewart, D.W. and Shamdasani, P.N. (1990) *Focus groups theory and practice*. California: Sage Publications, Inc.
- Vollenbroek, F.A. (2002) Sustainable development and the challenge of innovation. *Journal of Cleaner Production*, **10**, 221-223.
- World Commission on Environment and Development, (1987) *Our common future*, Oxford University Press, Oxford.