PROJECT PRICE FORECASTING PROCESSES AND PRE-CONSTRUCTION EVALUATION OF SUSTAINABLE HOUSING ASSOCIATION PROJECTS

Ranya Essa[1] and Chris Fortune

School of the Built Environment, Heriot Watt University, Riccarton Campus, Edinburgh EH14 4AS, UK

Clients aim to get the maximum benefit from their construction projects. Many factors impact upon the realization of such benefits including the setting of reliable project budget estimates. Increasingly project budgets need to consider issues related to sustainability if they are to provide meaningful strategic advice for clients to use in reaching their business decisions. Sustainability can be defined as having social, economic and environmental strands. This paper is drawn from a developing PhD study in this topic area and considers relevant literature taken from the research strands identified above so as to make the case for the development of a model that encompasses the main issues related to sustainability, and cost planning. It is posited that such a model would be a useful decision aid or tool for practitioners to use in the delivery of added value services to their clients. The paper concludes by setting out an approach to the research and the preliminary results from pilot interviews conducted with experts in the field of project price forecasting and sustainability.

Keywords: budgeting, evaluation, project price forecasting, sustainability.

INTRODUCTION

The idea of sustainable development grew from numerous environmental movements in earlier decades and was defined in 1987 by the World Commission on Environment and Development (Brundtland Commission 1987) as: Development that seeks to meet the needs and aspirations of the present without compromising the ability to meet those of the future.

UK Governments have recognised the importance of sustainable development to quality of life and the achievement of policy objectives across a wide range of issues (Department of the Environment, Transport and Regions 1999).The government look to achieve economic development to secure rising standards of living, both for people nowadays and for future generations. The government wish to see all housing Associations integrate sustainability into their procurement and development approaches in terms of its triple bottom line approach to create more sustainable housing projects. This will have important implications for all those organisations involved in social housing and will require placing sustainability at the heart of housing practice (CIEF 2005).

It is asserted that the consideration of sustainability early in a project is likely to result in less of an increase in capital costs than those made at a later stage and may result in significant saving (BRE report 2001, Elhag and Bussabaine 2001). All involved in the

[1] re8@hw.ac.uk

Essa, R and Fortune, C (2006) Project price forecasting processes and pre-construction evaluation of sustainable housing association projects. *In:* Boyd, D (Ed) *Procs 22nd Annual ARCOM Conference,* 4-6 September 2006, Birmingham, UK, Association of Researchers in Construction Management, 543-552.

construction industry are aware of the importance of early stage project price advice on potential business and project design decisions. Clients often decide whether or not to go ahead with their projects according to the design team's early stage project price forecast. At this initial stage of the project the construction process is unpredictable because the process is not specified in detail and in practice; such processes can change as the brief or clients' needs progresses. It is clear that the decisions made always take account of the limited nature of the information upon which they are based and as a result the decisions are always subject to risk and uncertainty. It has been claimed that performance at this sub-phase of the building project process model depends on the capabilities of the individuals, rather than that of the organisation (Sarshar *et al*. 2000). In addition recent government policy on the introduction of sustainability as another project criterion for their publicly funded housing projects has added to the difficulties practitioners face in providing a value for money early stage project evaluation service to their clients.

Yet the construction industry has a significant social responsibility in terms of minimising the damage to the social environment. During the construction process, all the organisations who are involved on the project should give assurance to their members of staff to keep them safe, skilled and well valued. Now this concern for wellbeing and safety during the construction process is spreading to include concern for the neighbourhoods who live around the construction sites and who will use the completed products. It has been shown that different building materials can lead to a greater sense of well being than others and that has a crucial impact on the physical (and economic) health and well-being of individuals, communities and organisations. Ensuring that all built developments comply with the highest practicable standards in respect of safety and security, All future projects will be checked against the principles of designing out crime through schemes such as 'Secured by Design'(Halliday 2000).

On the economic impact of the sustainability the client should consider issues related to the substitution of natural for human man made capital as much as possible within the project (Fortune and Weight 2003). Economic sustainability seeks to provide increasing profitability through efficient use of resources (human, materials, financial), effective design and good management, planning and control. This commitment would cause the project manager to seek to ensure that the project contributed to the demand for environmentally friendly goods and services in the local economy and as a result utilised as far as possible suppliers and sub-contractors supply chains that adopted environmentally friendly practices.

The scope for taking social and economical issues into account during procurement is more limited than for environmental issues because, by virtue of their nature, they are less likely to be clearly related to the subject of the contract. It is considered that there will be more efficient and effective means of achieving social outcomes than through the procurement process. However, there will be cases where social issues can logically be taken into account.

This research intends to investigate the cost of the most important factors which impact the setting of reliable construction project budget estimates at the early stages of the design process. Literature related to prior work on the processes involved in the principles of sustainable construction practice is reviewed; the paper then identifies the cost of sustainability, the contribution of housing to sustainability, whole life cost model and the use of cost benefit analysis to estimate the cost of the sustainable

factors. The paper ends with a statement of the research problem still to be resolved and a consideration of the approaches available for its resolution.

DOES SUSTAINABILITY COST MORE?

The principal source of constraint on sustainable buildings is cost. The common conception in the construction industry is that 'green' buildings – those designed to be energy efficient and environment friendly- are expensive to build. It remains elusive to know how much more it will cost to build in a sustainable manner, and there seems to be very little evidence that this is always the case (CIEF 2005). These costs only relate to the capital cost of the project, and so they could be more than offset during the operational life of the building due to the reduced running costs, reduced waste, avoidance of risk and future liabilities, and enhanced productivity and learning.

A recent research study (Cyril Sweet 2005) aimed to determine the true financial costs of taking a sustainable approach to building project delivery, to focus on quick wins and inform clients about the implications of timing and site considerations. Showing that it would cost somewhere between 1 and 3% extra to achieve a rating of very good for a house. The study of the Davis Langdon team showed that measures had a zero cost premium, those associated with minimising the environmental impacts of the building account for 2% of the cost premium, and measures that improved the comfort conditions accounted for the remaining 8% of the cost premium. (CIEF seminar report (2005)). The assessment for these studies focused heavily on environmental issues more than social aspects of sustainable construction.

The case study of Sunikka and Boon (2003) which focused on sustainable housing management in five European Union countries (the Netherlands, Germany, UK, France, and Finland) concluded that cost was the primary reason for the slow implementation of sustainable building in daily practice. All five countries included in the analysis recognized a conflict between environmental and economic costs/benefits in project evaluation.

The main barriers to the adoption of sustainable construction methods and energy efficient materials in the Housing Associations schemes are suspected as being the higher capital cost as the use of sustainable technology is expensive, the risks associated with introducing new technologies and market imperfections which do not take account of the environmental and social costs, and the lack of in-house expertise in using sustainable building products and processes and, therefore, additional costs must be incurred buying in the expertise from outside(Dewick and Miozzo 2004).On the other hand, when practitioners have the knowledge about sustainability and try to integrate it into the brief early in the design process, choosing sustainability can have minimal cost implications(RIBA 2005).

CIEF (2005) claimed that despite clients and design teams intentions to deliver sustainable building, the number of fully sustainable buildings being delivered is still relatively low. The key reason for this is that many people regard sustainable development as an end product only and not as a process that delivers a sustainable product.

Ecohome (the Environmental Assessment Method for Housing) is now becoming an accepted way to evaluate the sustainability of buildings in UK. A key assumption in this framework is that achievement of different EcoHome ratings will cost different amounts of money. Buildings are rated on a scale of Pass, Good, Very Good or Excellent. These ratings depend on the differentiations in the levels achieved across

the seven main categories of energy, water, pollution, materials, transport, ecology and land use, health and well-being.

The Housing Corporation is phasing in use of EcoHome rating for all new social housing developments. From April 2006 all affordable homes built with Housing Corporation or English Partnerships financial support will be required to meet the EcoHome 'very good' standard (ODPM 2005).

A recent survey of Carter and Fortune (2006) found that the policies of Housing Associations place a strong emphasis on environmental aspects of sustainability. The survey of H.A. development officers also found that social and economic aspects of sustainability were sacrificed in favour of the environmental aspects in their perception of the differing weightings of issues scales in sustainable policy.

That contradiction gives more support to the need for more research in this topic area and empirical studies are needed to reveal the real cost and benefits of considering sustainability in further construction projects.

HOW HOUSING CAN CONTRIBUTE TO SUSTAINABILITY?

The Housing Corporation has supported twenty six Innovation and Good Practice (IGP) projects focused on sustainable development during 2003 (Housing Corporation 2004). The Housing Forum has forty nine demonstration projects relating to sustainability, the majority of which are social housing projects. There is political and policy support for the concept and the goal of sustainable development, yet there is evidence that in general practice it is a concept that is still misunderstood and unsupported by many stakeholders in the procurement system (Sustainable Homes 2004, Harris and Holt 1999).

In social housing there is a general lack of understanding as to what sustainable development means (Blair and Evans 2004) and although the policy level commitment is well defined there remains a need for a structured approach to integrating policy and practice through the procurement system(Carter and Fortune 2006).

WHOLE LIFE COST AND VALUE MODELS

Traditional cost models are based on either two or three dimensions (i.e. measuring area or volume); more recently, they have started to include time as a fourth dimension, leading to whole life cost models that now include capital, replacement, maintenance and occupancy costs. There is some evidence that life cycle cost models are finding some use but they are far from being widely adopted. Fortune and Cox (2005), in their latest snapshot of current practices, indicate that there is only minimal use of project price forecasting models that seek to evaluate the sustainable impacts of proposed project designs. Increasingly in government funded housing association projects there is an expectation that the housing associations professional advisors will undertake an evaluation of the sustainable benefits of a project prior to its formal commissioning. The evaluation of sustainable benefits are expected to consider the impact of the project in relation to the social, economical and environmental benefits that the project will bring to the local community in which the proposed project is to be situated. The evidence of recent survey data of practice related to this area of service delivery reveals that there is a gap or knowledge shortfall in sustainable project evaluation practice and that sustainable cost models were found to be not in widespread use Fortune and Cox (2005). This gap is central to the thrust of this proposed PhD study.

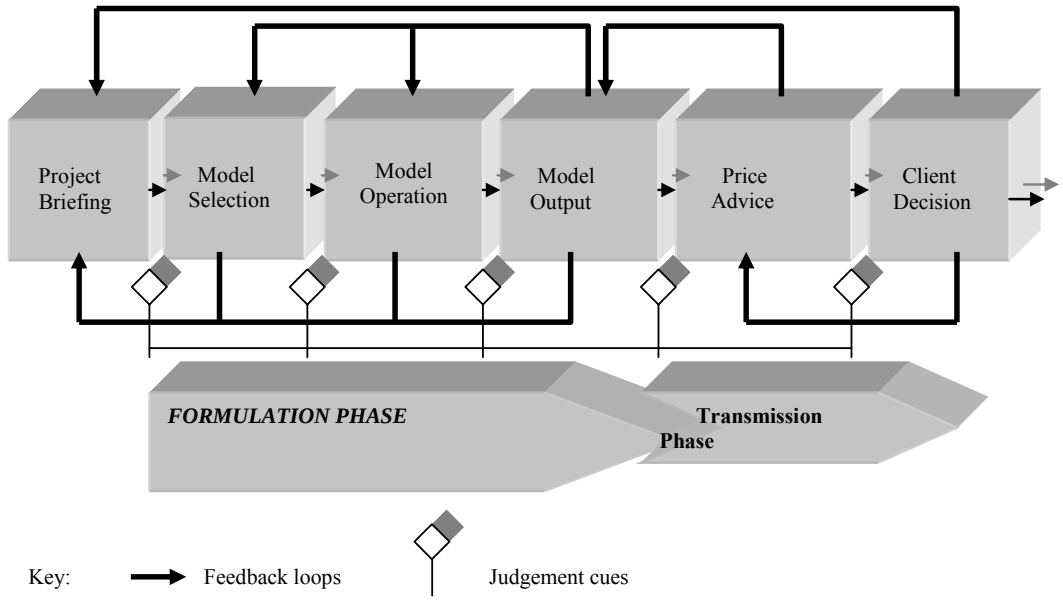

Figure 1 Model of building project price advice process (Fortune and Cox 2005)

Fortune and Cox (2005) argued that at each stage of the process there is a need for feedback and professional judgement to be exercised. Their model (see Fig.1) indicated that the formulation phase of the process can be further sub-divided into iterative stages of project investigation, model selection and application.

Adding social, economical and environmental considerations into these models adds further complexity, particularly as they need to be able to incorporate and value both subjective and arbitrary measurements alongside the physical; the application of a different weighting for any of these aspects will obviously produce a different result for the whole life value of the material or project option chosen (CIEF 2005).

Cost benefit analysis

Cost benefit analysis in a simplified form is being considered as one of the potential techniques that could be used to evaluate the benefits of the factors of sustainability in order to support the selection of the sustainability features of the project decision. It is the assessment of costs (initial and recurring) and the comparison of benefits and costs. To compare the alternatives, benefits and costs must be comparable which means they need to be measured in the same units, over the same period of time. To estimate benefits, first, it is necessary to identify the benefits for both the customers and the organization that provides the service(s) to the customers. After the benefits are identified, it is necessary to establish performance measures for each of the identified benefits. The final step is to estimate the value of the benefits. If a benefit cannot reasonably be assigned a monetary value, then it should be valued using a more subjective, qualitative rating system (which assigns relative numerical values for the competing alternatives). All benefits for the full system life cycle for each competing alternative must be included (Watkins 2003).After the costs and benefits for each year of the system life cycle have been estimated, they are then converted to a common unit of measurement which is used to properly compare the competing alternatives. That is accomplished by discounting future financial values, which transforms future benefits and costs to their present value. For example, the valuation of the benefit of cleaner air could be established by finding out how much less people paid for housing in more polluted areas which otherwise was identical in characteristics and location to housing in less polluted areas. Generally the value of

cleaner air to people as revealed by the hard market choices seems to be less than their not literal valuation of clean air. Some measurements of benefits require the valuation of human life. It is sometimes necessary in CBA to evaluate the benefit of saving human lives. There is considerable antipathy in the general public to the idea of placing a financial value on human life as society wants better facilities for health, education and environment. So the existing price mechanism which is purely set on profitability and perfectly copes with the situations where financial costs and returns are the only considerations can be seen to be not suitable to estimate the cost. Economists recognize that it is impossible to fund every project which promises to save a human life and that some rational basis is needed to select which projects are approved and which are turned down. These choices can be used to estimate the personal cost people place on increased risk and thus the value to them of reduced risk. This computation is equivalent to placing an economic value on the expected number of lives saved.

When the costs and benefits for each competing alternative have been discounted, it is necessary to compare and rank the discounted net value (discounted benefit minus discounted cost) of the competing alternatives. When the alternative with the lowest discounted cost provides the highest discounted benefits, it can be seen to be clearly the best alternative. Most cases may not be that simple and other techniques must be used to determine the best alternative. The work of Ding (2005) argued that CBA is used to show whether the total benefits of a project exceed the total costs in order to determine a preferred option. But monetary value, when applied to environmental assets, is difficult, if not impossible, to ascertain. Completely replacing a monetary market approach with non-monetary techniques has limitations. The non-monetary approach ignores the financial matters in the evaluation framework. This may contradict the ultimate principle of a development, as financial return is fundamental to all projects because a project may be environmentally sound but very expensive to build. Therefore, environmental issues and financial considerations should accompany each other as parts of the evaluation framework when making decisions. The outcome of the CBA model using this approach alone can be subject to value laden errors that, if used incorrectly, could lead to a less sustainable solution being adopted.

RESEARCH APPROACH

The nature of data in any research is directly related to the philosophical viewpoint of the research. The data may be quantitative or qualitative but the presence of data is an essential part of empirical research. The concept of quantitative data is one of quantity, and it is expressed numerically. The use of numbers brings a structure to data and essentially involves the use of measurement, either counting or scaling.

Qualitative data is empirical information that is not numerical. Carter and Fortune (2004 cited Mason 1996) argues that qualitative data is generated rather than collected. Interviews, documents, visual images can all be used as a source of data, but it is the researcher's epistemological position that determines how that data is generated.

Aim of the research

This research aims to develop a fresh way of thinking in terms of evaluating a sustainable housing project at its feasibility stage. The work seeks to shift the focus during this stage of a project's life cycle, and to manage the service ability of the building during its lifetime from inception to eventual deconstruction, so that it will

not just address the financial impact of the project but also consider its sustainable impact. The research aims to develop a model that will link project price forecasting and the evaluation of sustainability together so as to set budgets at the feasibility stage of social housing projects. The model will suggest an alternative approach for assessing the feasibility of construction projects by considering the wider agenda related to the sustainable benefits of a project and not just the cost consequences of its design and production acquisition. The context for the work will be socially owned housing projects developed by Housing Associations based in Edinburgh and Scotland generally. However, given the gaps in knowledge identified above, the consideration of sustainability during this work will be related to the consideration of the economical and the social impact of the project and the work will not address the assessment of a projects environmental benefits.

Objectives

1. Identify the social and economical factors of sustainability typically found in Housing Association (H.A.) new build construction projects.
2. Establish which of the social or economical impacts of sustainability is the most important for H.A. new build construction projects.
3. Develop a framework to assess the benefits of the factors identified above.
4. Incorporate the framework in (3) above into the process of forecasting the price and evaluating the project at its feasibility stage.
5. Develop a sustainable benefits evaluation model and test it.

Data collection for this research:

There are many methods to collect data. It is important that the most appropriate method is selected for a particular piece of research. A study carried by EIRASS into the effects of data collection methods identified factors that influence data quality and validity (Carter 2004 cited Ettema *et al* 1996). Type of population, sample control, non-response, type of questions, complexity of questionnaire and available resources are some features affecting the value of the data.

Qualitative data is non-numerical and usually takes the form of people's words or the researcher's description of what has been observed or experienced and seeks to gain insights and understand people's perceptions of the world. Interviews, questionnaire, participant observation and existing data are used to generate qualitative data.

Generating quantitative data for this research is based on the need to work with those directly involved in decision making in Housing Associations new building projects to identify the most important factors of sustainability which affect setting the budget at the feasibility stage. Four groups of professional organizations architects, quantity surveyors, and the development directors of Housing Associations will be invited to participate in the pilot study by being interviewed and completing a questionnaire.

Pilot study

The aim of conducting interviews for the pilot study was to get a real-life data which would help the model to provide sustainable solutions. The interviews provided social discourse which helped the research to understand the meaning of sustainable building in the construction industry.

Yet our work is looking at the currency system in terms of project evaluation which is cash paid and whole life costing from the prospect of budget maker, so we asked our

interviewers to provide research with data of sustainable buildings and we will try to compare it with the data of a non-sustainable building to be find the aspects of sustainability and its costs. Then we will discuss the additional costs in more detail, to identify which sustainable features cause the most significant cost increases.

The topic of the conversation with clients was to identify the most important factors of sustainability which they really considered in their sustainable projects. The factors that emerged were (Energy efficiency, Transport, Recycling, Design quality, Site selection, Supply chain, Funding), and for QS, consultant and Architects it was about how they incorporate sustainability and project price.

Experts from BCIS, Cyril Sweett, The Communities Scotland, and Gaia Research were also interviewed for the pilot study and their views obtained on the more significant features of sustainability that affected project development processes.

Results

The results show that the evaluation of sustainable building projects is still unclear and that most practitioners need to have their awareness raised and give more attention to issues related to sustainable project delivery. Many variables need extensive research and analysis to enable them to provide sustainable solutions for their project. It emerged that the Eco-Home score was the only tool used to achieve the cost consultations. It was also apparent that the EcoHome score achieved depends on many available solutions to get the rating. Another finding of the interview results was that many practitioners focused on the achievement of the rating and not on the process by which it was achieved. It was apparent that practitioners needed to be persuaded to use Eco-Home system and so the (ODPM 2005) design guide declared that from April 2006 all new social housing developments should get 'Very Good' EcoHome rating.

Practitioners made it clear that green schemes for commercial clients still need to provide value for money and this was more important than sustainability. There are as yet no formal social and economical requirements for any project evaluation process. The practitioners found it very hard to decide how to weight the social factors in any sustainable projects they differ from one project to another and also are really different from the environmental factors which are relatively easy to be scored. On the other hand, clients want to build sustainable houses in a social environment rather than non social environment.

The practitioners confirmed that there is no basis for considering sustainability in the form of the cost evaluation as elemental cost analysis is for a whole building. However, they suggested that there was a value in breaking things down. They felt that their Housing Associations clients wanted to receive an added level of detail in the advice that they provided to them that addressed sustainability issues. Clients want to see if they pay more what they are going to get as they are paying now less and getting less.

The results of the pilot study also called into question the capability of practice to provide data that addresses the potential benefit evaluation of sustainable house building projects. However, before re-considering the proposed research approach, it was resolved to conduct a further pilot study using a questionnaire survey.

Questionnaire survey

According to the results of the interviews of our pilot study and to assess the impact of main factors of EcoHome factors on the budget of the project, a pilot questionnaire survey is to be conducted. This survey requires the respondents to establish which factors of EcoHome rating system and the additional factors of Carter and Ding (see literature reviewed above) are considered to be the most important for Housing Associations looking to develop new housing projects, and to evaluate the cost significance of these important factors at the early stage of budget setting for sustainable housing projects. They are also invited to mention if they consider additional important factors of sustainability.

A random sample of thirty Housing Associations is to be selected with experience of sustainable housing to test the clarity and the relevance of the questionnaire. The respondents will be asked to complete the questionnaire and make comments on the content. At the end of this pilot study, all comments received will be used to provide the final shape of the main survey.

CONCLUSION

Literature indicates that the financial benefits of green buildings include lower energy, waste disposal, and water costs, lower environmental and emissions costs, lower operations and maintenance costs, and savings from increased productivity and health.

The relation between sustainability and housing is two-way. Incorporating principles of sustainability into housing development, maintenance and refurbishment will not only make a significant contribution to the achievement of general sustainability objectives, but will also provide important advances in the quality, durability and cost effectiveness of housing.

Given the nature of the problem discussed above it can be seen that the research is to identify how the sustainable social housing projects can be evaluated at pre-construction stage. To solve the problem the research aims to develop a decision aid to allow practitioners to make effective value for money (VFM) decisions. Each of the evaluation tools reviewed above contains useful features that could be of benefit to practitioners operating in the real world. This research seeks to develop a decision aid that can combine the best features of the identified models, which are seminal to this study. Such a model would be an effective tool that could work with existing building project price forecasting tools to deliver real benefit to practitioners and their clients at the pre-design stage of project development.

REFERENCES

Blair F and Evans B (2004) Environmental science, sustainability and politics, *Transactions of the Institute of British Geographers*, June 2004, **29**, 234.

Brundtland Commission (1987) *United Nations World Commission on the Environment and Development*, p43.

BRE report (2001) *Quantifying the business benefits of sustainable buildings*, Project Report No 203995

BRE and Cyril Sweett (2005) *Putting a price on sustainability*, Watford: Building Research Establishment.

Carter, K and Fortune, C (2006) *Sustainability and building projects in the UK social housing sector*: *a study of perceptions and practice* (in press).

Carter, K and Fortune, C (2004) Issues with data collection methods in construction management research. *In* Khosrowshahi, F (Ed.), *Procs. 20th Annual ARCOM Conference*, 1-3 September 2004, Heriot Watt University. **2**, 939-46.

CIEF seminar report (2005*) Socially responsible construction*/: key design aspects (Glasgow)

CIEF seminar report (2005) *Whole life sustainability: Costing, assessment and valuation*. (Glasgow)

Department of the Environment, Transport and Regions (1999)

Dewick P and Miozzo M (2004), Network and innovation: sustainable technologies in Scottish social housing, *R&D Management* **34**, 3.

Ding G K C (2005) Developing a multi-criteria approach for the measurement of sustainable performance, *Journal of building Research and Information* **33**(1), 3-16.

Elhag T and Boussabaine A.H (2001) Tender price estimation using artificial neural Networks *Journal of Financial Management of Property and Construction* **6**, 193-208.

Fortune C and Cox (2005) Current practices in building project contract price forecasting in the UK. *Engineering, Construction and Architectural Management* **12**(5), 446-457.

Fortune C and Weight D (2003) Building project price forecasting .*In*: Kelly, J, Morledge, R, Wilkinson, S (eds.) *Best value in construction*. Oxford: Blackwell, 116-28.

Halliday, S P (2000) *The green guide to the architects*. London: RIBA Publications.

Harris P T and Holt G D (1999) The management of sustainable social housing refurbishment strategies in the west midlands region of the UK. *In*: Hughes, W (ed.) *Procs 15th Annual ARCOM Conference*. **1**, 203-10.

Housing Corporation (2004) *Sustainable Development Report* 2004 Leeds: Housing Corporation.

News archive 2005, RIBA www.riba.org http://www.architecture.com/go/Architecture/Debate/Sustainability_3119.html?q=archive%202005[accessed 1May 2006]

ODPM(2005) *Proposals for introducing a Code for Sustainable Homes*. Office of the Deputy Prime Minister: London.

Sarshar, M, Haigh, R, Finnemore, M, Aouad, G, Barrett P, Baldry D and Sexton M. (2000) SPICE: a business process diagnostics tool for construction projects Engineering, *Construction and Architectural Management* **7**(3), 241-50.

Sunikka, M and Boon, C (2003) Environmental policies and efforts in social housing: the Netherlands .*Building Research and information* **31**(1), 1-12.

Sustainable Homes (2004) *Promoting Sustainable Action in Housing* (Spring 2004) issue 18.

Watkins T (2003) Introduction to Cost Benefit Analysis, Available at http://www2.sjsu.edu/faculty/watkins/cba.htm [Accessed 10 July 2005]