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Sustainable housing projects in the UK: a pilot study

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ABSTRACT

Sustainable development contributes to the economic and social advancement of construction projects. Ignoring sustainability during the cost estimating process associated with a construction projects evaluation phase develops a problem of conventional decision methodology used in construction industry. This research investigates the most important factors of sustainable housing projects. It explores and evaluates the factors which have the most cost impact on the setting of reliable sustainable construction project budget estimated at the early stages of the design process. This paper is drawn from an on-going PhD study in this topic area and considers relevant literature taken from the research strands identified above. An approach to the research is set out and consideration is given to the preliminary results from a pilot study that included interviews and questionnaires conducted with experts in the field of project price forecasting and sustainability.

Key words: Sustainable construction, cost estimation, EcoHomes

1 INTRODUCTION:

Sustainable construction can be defined as a construction process which incorporates the basic themes of sustainable development (Parkin, 2000; Chaharbaghi and Wills, 1999). Such construction processes would thus bring environmental responsibility, social awareness, and economic profitability objectives to the fore in the pre project evaluation of built environment assets (Raynsford,2000).

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 looks to achieve economic development to secure rising standards of living, both for people now and for future generations. The government wishes 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 procurement practice (CIEF 2005).

It is asserted that the consideration of sustainability early in a project's evaluation processes is likely to result in less of an increase in capital costs than those made at a later stage and may result in significant savings (BRE, 2001, Elhag and Boussabaine. 2001). All involved in the construction industry are aware of the importance of early stage project price advice on potential business and project design decisions.
The green building movement is gaining momentum around the world. One of the biggest challenges facing developers, designers and planners is how to ensure that our towns and cities are developed and regenerated to be sustainable for the future.
Housing associations in the UK encourage the adoption of sustainable and environmental policies and practices yet there is evidence that in general it is a concept that is still misunderstood and unsupported by many project stakeholders (Sustainable Homes 2004, Harris and Holt 1999).

EcoHome (the Environmental Assessment Method for Housing) is the accepted way to evaluate the sustainability of buildings in the UK.

The main aim of the paper is therefore to explain the EcoHome system and its factors, the approach of the research, the cost of sustainable factors. The paper concludes by illustrating the results of the main questions in a pilot questionnaire which collected data related to practitioners assessments of the most important factors of the EcoHome rating system.

2 ECOHOME SYSTEM:

Environmental assessment methods for building projects are considered as one of the most potent and effective means both to improve the performance of buildings and to promote higher expectations and demand. EcoHome (the Environmental Assessment Method for Housing) which is the homes version of BREEAM (The Building Research Establishment Environmental Assessment Method) was introduced in 2000 and is now becoming an accepted way to evaluate the sustainability of housing projects in UK. It is a flexible standard that rewards positive steps taken to improve the environmental performance of housing in the UK. It supports housing associations and other developers to deliver better quality housing with lower negative impacts on the environment, and lower running costs for residents.

EcoHomes is an assessment method that balances environmental performance with the need for a high quality of life and a safe and healthy internal environment. 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 with 36 points”, “Good with 48 points”, “Very Good with 58 points” or “Excellent with 70 points”. The Housing Corporation is committed to assessing the environmental credentials of its homes and since 2003 to achieving the rating of 'Pass'. It is now a requirement of all funded developments to achieve the 'Very Good' rating. 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. EcoHomes has been developed to be flexible and comprises a number of issues that are covered by the main elements of this system. All of the elements are optional and project teams can choose the ones that most suit the project’s circumstances and priorities for environmental improvement (Wilson and Smith 2005).

Carter’s (2005) work with Housing Association project delivery teams confirmed that a gap that exists between policy and practice in the delivery of sustainable construction projects. Carter’s partly grounded theory of sustainable procurement practice identified the following issues as being key matters that need to be agreed by the project stakeholders when considering a sustainable housing project, namely, design quality, energy efficiency, site selection, funding, transport, supply chain, and recycling. The results of this RICS funded work revealed a departure from the policy interpretation of sustainable development in practice by project stakeholders associated with the procurement of Housing Association projects in Scotland. The difference was found to be ingrained in the housing association development sector. Organisations with their own sustainable development policy documents have had

them developed on the premise of equal weighting to social, economic and environmental aspects of sustainability, yet their detailed perception of sustainability shows an emphasis on social and environmental factors by the practitioners charged with project delivery. However, the research of Ding (2005), which was based on general construction projects in Australia, developed an assessment model that sought to incorporate environmental and social issues into the decision-making process on an objective basis at an early stage of development. However, their proposed sustainability index model was based on four criteria (financial return, energy consumption, external benefits, and environmental impact) and depended on a weighting mechanism to establish if a solution is sustainable.

The Housing Corporation is phasing in use of EcoHome rating for all new social housing developments. From April 2006 all schemes accessing funding from the Housing Corporation's National Affordable Housing programme are required to meet the EcoHome 'very good' standard (ODPM 2005).

A recent survey by Carter and Fortune (2006) found that the policies of Housing Associations placed 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 a project's 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.

3 THE COST OF SUSTAINABLE FACTORS:

One of the major obstacles to the wider adoption of more sustainable housing projects is the perception that these incur considerable additional costs. 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). Typically this concern for costs only relates to the capital cost of the project, and so such costs could be more than offset during the operational life of the building due to its reduced running costs, reduced waste, avoidance of risk and future liabilities, and enhanced productivity and learning.

A recent research study (CyrilSweet 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. This research showed that it would cost somewhere between 1 and 3% extra to achieve a rating of very good for a house. An alternative the study of the Davis Langdon consultants showed that sustainable design measures had a zero cost premium.

Other work revealed that sustainable features 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) focused on sustainable housing management in five European Union countries (the Netherlands, Germany, UK, France, and Finland) and 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 the introduction of 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 by buying in the expertise from outside (Dewick and Miozzo 2004).However, 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 buildings, 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.

However a definitive cost for achieving compliance with the EcoHomes “Very Good” rating is difficult to be established, due to the many varying factors affecting each and every organisation in delivering EcoHomes. To solve this issue, this research aims to indicate cost factors which can be established for use as a benchmark for housing projects. Whilst cost is an important factor, Wilson and Smith (2006) claimed that the key to achieve very good EcoHomes ratings is process: early planning combined with committed partnership working, supported by detailed design brief and robust supply chain.

4 RESEARCH APPROACH

The nature of data in any research is directly related to the philosophical viewpoint of the researcher. 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) argued that qualitative data was 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.

4.1 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 a construction project by considering the wider agenda related to the sustainable benefits of a project and not just the cost consequences of its design and production. The context for the work will be socially owned housing projects developed by Housing Associations.

5 PILOT SURVEY

McQueen and Knussen (2002) suggested that piloting, in whatever form, is important so as to know whether the proposed methods of collecting data may produce information that can be used to achieve the intended goals.

A pilot questionnaire survey was conducted according to the results of the preliminary interviews in the pilot study and also to assess the impact of the main EcoHome factors on the budget setting for the project. This survey required the respondents to establish which factors of the EcoHome rating system as well as other additional factors of sustainability chosen from the literature reviewed could be 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 were also invited to identify if they considered any other additional factors of sustainability as being important.

Hence, a pilot questionnaire was administrated among a random sample of thirty Housing Associations, architects and quantity surveyors companies with experience of sustainable housing. The intention was` to test the clarity and the relevance of the questions listed in the questionnaire and to get some feedback on its design, layout

and context. The respondents to the pilot study were asked to complete the questionnaire and make comments on the content. Twelve questionnaires were returned within less than one month of being sent out, making the total response rate of 40 per cent.

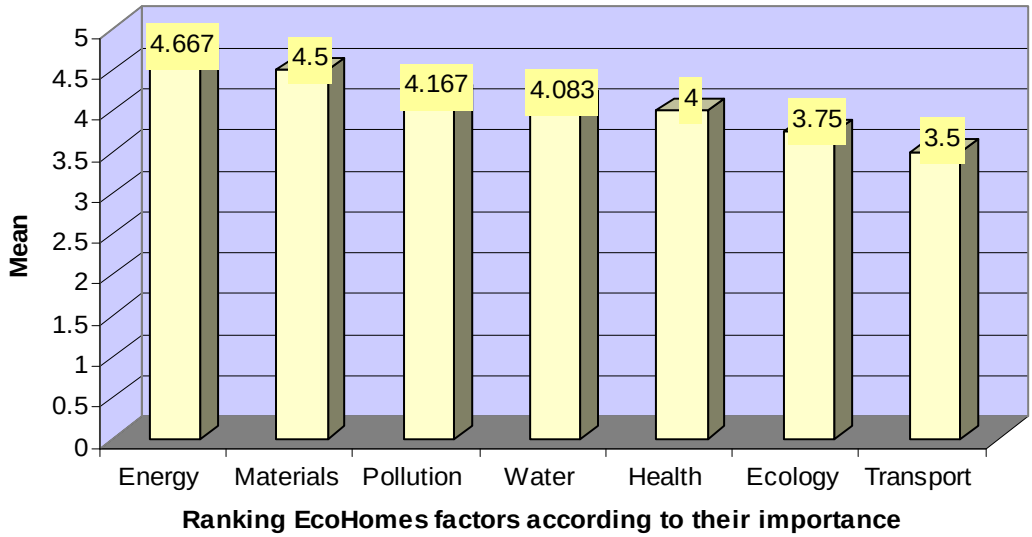
6. RESULTS AND DISCUSSION

The first question on the questionnaire asked whether the respondents used the EcoHome system as a means of evaluating potential new housing schemes for their sustainability. The results showed that 75% of the respondents are using EcoHome. 44.4% of the responses from Housing Associations are using EcoHome, 33.3% are Architects, and 22.2% are Quantity Surveyors.

Respondents were asked to indicate the factors that they thought would be the most important for new housing projects seeking to achieve an EcoHome rating of “very good”. The respondents to the questionnaire were asked to assess the importance of the factors on a five-fold Likert scale which ranged from not important (1) to extremely important (5).

The responses from the questionnaire are presented in the Table 1. The respondents ranked EcoHome factors as energy, materials, pollution, water, health and well being, ecology and land use and finally transport.
All EcoHome factors had a higher proportion of their responses in the neutral position on the Likert scale. This is indicated by the rating of *important.*

Table 1 Ranking EcoHome factors according to their importance

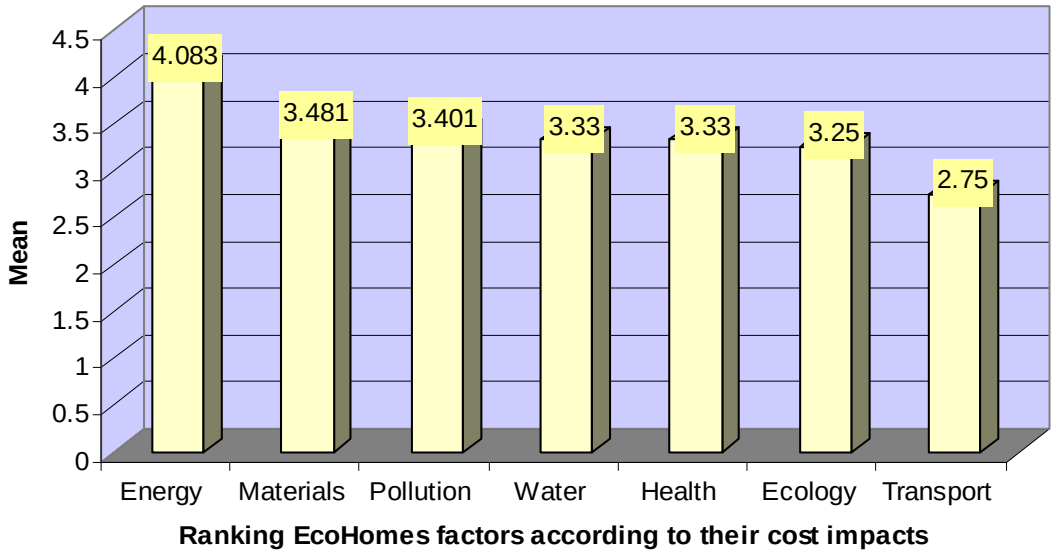


Ranking these factors according to their importance confirmed that the consideration of social and economical issues is still given less attention than environmental issues by practitioners when they are considering issues for their importance in terms of the sustainability of housing projects.

These results indicate that practitioners still concentrate on providing low energy buildings as the principal way to combat climate change and deliver sustainable housing projects. The survey showed that there was no real consideration of social issues in the assessment of sustainable housing projects. This confirms the thrust of this research which seeks to take social and economical issues more into account as well as environmental issues.

Respondents were then asked to indicate on a five point Likert scale which factors they thought would have the greatest cost impact if they were to be implemented on a new housing project that was seeking a rating of “very good” on the EcoHome point system.

Table 2 Cost impact of EcoHome factors



The results show that the most important factors of the EcoHome system from the previous question are the same as *those rated as having* the *greatest* cost impact on the budget of the project.

However, the ranking of these factors were different between the two questions related to *water* and *pollution. Ecology and land use*, *health and well being* had also

different ranking according to their cost impacts.
Energy *was ranked first* among the other factors *rated as having* the maximum cost impact. *This contains that* the *primary* aim of sustainable building is to save energy and get the maximum benefits of the physical performance of the building components (e.g. insulation performances of walls and widows) and the service systems of the building.

Respondents were then asked to consider each of the important factors and their likely cost importance in £/m^2 for a typical new housing project that has been rated as" Very Good" on the EcoHome point scale. Assume a base for a new housing project to be £800/m^2

As the general definition of sustainability touches upon nearly all areas of economic, ecological and social development, a neoclassical economist theory which is a part of the theory base of the research will be considered. This means that sustainable factors will be valued in monetary units.
This question draws on the experience and perceptions the respondents have in estimating the likely cost impact of EcoHome factors. Only 20% of the responders were able to answer this question. From Table (3), it can be seen that practitioners have differing minimum and maximum estimates of costs of the EcoHome factors. This result is interesting and justifies the work in general as it reveals an unsatisfactory state of professional expertise and judgement related to this emergent area of practice.

Table 3 Estimated costs of EcoHome factors

	N	Minimum	Maximum	Mean	Std. Deviation
Energy cost	6	3.00	250.00	68.1837	65.96674
Water cost	6	1.00	100.00	19.3265	25.60549
Pollution cost	5	1.00	150.00	28.4043	33.40767
Materials cost	5	1.00	200.00	40.4130	45.69443
Transport cost	3	4.00	250.00	41.3333	56.05329
Ecology cost	4	2.00	120.00	29.3250	32.26365
Health cost	5	1.00	100.00	22.6383	23.81945

The standard deviations of all the listed factors were extremely high compared to the mean. As a result the means in this question could not be used to estimate the cost of each factor.

Finally the respondents were asked whether they thought that the EcoHome points scoring system was workable as a basis for evaluating sustainable construction projects.

The majority of 66.7% of the respondents who use EcoHome points system considered it as a workable basis for evaluating sustainable construction projects. However, 33.3% of EcoHome users who involved in the survey found it unworkable.

The respondents who use the EcoHome point system seemed to agree that it was a workable system but many had comments about its workability.
Housing associations had the highest percentage (62.5%) in favour of using the EcoHome system among these three main construction types of organisations. However, it was noticeable that architects (25.0%) and quantity surveyors (12.5%) had much low levels of using the EcoHome point system as bases to the evaluation of potential new housing projects.

7 CONCLUSION

The EcoHomes point system, which is a straightforward, flexible and independently verified environmental assessment method for new homes, is designed to help tackle climate change, resource use and impact on wildlife and balance these issues against the need to provide safe and healthy homes. It is claimed that its use will help reduce the environmental impact of a development through good and informed decisions in its seven main factors.

The organisations responding to the questionnaire were representative of built environment professionals involved with the delivery of sustainable new housing projects in the UK. One important contribution of this survey is that researchers have gained useful insights into the importance of the differing sustainability factors which are used in the EcoHome system. However the survey was also a pilot study and so these findings highlighted the way to redesign the initial survey for the next step of the research.

Ranking these factors according to their statistical weights among all types of construction organisations revealed the ranking of these factors as following: *energy*, *materials*, *pollution*, *water*, *health and well being*, *ecology and land use*, and finally *transport*. This result located environmental factors higher than the social factors of sustainable housing projects. This result was achieved even though social sustainability was now increasing in importance both through legislation and by virtue of a growing interest in the principles of Corporate Social Responsibility policies and Socially Responsible Investment (Hall 2005).These results confirmed that within the construction organisations surveyed there was a gap in their knowledge of how to

consider social issues of sustainability. However, no clear economical factors of sustainability emerged among the main seven factors of the EcoHome system. This is one of the negative points in this system. It is interesting to note that in spite of the weakness of the EcoHome system on the social and economical side, experts confirmed the workability of EcoHome system as they considered it as being a solid foundation upon which to develop a more applicable measure.

Ranking EcoHome factors according to their cost impact on the budget of the project show that the most important factors of the EcoHome system were the same factors which had the most cost impact on the budget. As the results confirmed the ranking of these factors according to their cost impacts to be in this order were: *energy*, *materials*, *water*, *pollution*, *ecology and land use*, *health and well being*, and finally *transport*.

Inviting experts to estimate the costs of each one of the factors in this system revealed that practitioners were not able to give similar estimations to the cost of EcoHome factors. This is another main justification of the need for cost estimating model.

From the information gathered from the pilot study, a number of minor revisions were made to the grammar, structure and format of the question one for the administration of the main survey. The changes included putting examples for each factor of EcoHome to make the cost estimations easier and clearer; also a sub question was added to ask experts to specify their responses whenever they reply negatively about using EcoHome or not as an aid when developing new housing projects. As a result of this study it was resolved to send a total of 600 questionnaires to the three main groups of respondents across the UK.

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