**Challenges to leaders in promoting innovative and sustainable social housing**

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**Abstract**

UK Government targets to cut carbon emissions by 80% by year 2050. While working towards zero carbon new homes, refurbishment of the existing housing stock is essential as 27% of the UK’s CO2 emissions coming from energy use in homes. Developing a culture of innovation in organisations and industry appears to be vital in triggering innovation and leaders face many challenges. Number of research studies carried out in the social housing sector over a decade (2000-2010) highlight key issues that are important in implementing innovative technologies. The results identify a range of leadership and organisational characteristics that are needed to drive innovation.

**1. Introduction**

The UK government has set a challenging 80% reduction in Carbon Dioxide (CO2) emissions by 2050. The residential sector accounts for around 30% of the total final energy use and produces 157.2 MTCO2e per year, which accounts for 27% of the total UK CO2 level by end-user sector (DECC, 2012). According to the Department of Communities and Local Government the average English home produces 5.8 TCO2 per year (DCLG, 2012). Notwithstanding the government’s plan to increase the UK housing stock by 240,000 homes a year, approximately 80% of today’s dwellings will still be standing in 2050 (Boardman, 2008). Improving the energy efficiency of UK existing housing stock has been made a priority within the UK government’s Energy White Papers (DTI 2003 & 2007) as an effective, clean, safe and cost effective approach to meet the carbon reduction targets (Gaterell et al 2005, Power 2006). However, the uptake of effective energy efficient strategies within the UK is currently not sufficient to achieve the necessary CO2 reduction targets (DECC 2009, SDC 2005). Whilst it is generally accepted that retrofitting low carbon solutions to existing buildings is more complicated than installing them in 'New Build', these complications are largely socio-economic rather than technical (Broadman 2007, WWF 2008). In the social housing sector, the issues faced are not only technical and socio-economic but also organisational and managerial and require innovation in thinking and technology to face the challenges of achieving sustainable housing. Leaders and Senior Managers have to assess risks and priorities actions to meet the demand as well as achieve value for money. Thus, understanding the barriers in promoting innovative sustainable housing and identifying suitable drivers that can overcome them is essential if the UK housing sector is to have any chance of reducing its CO2 emissions to meet Government targets.

Innovation in the current context has to incorporate issues of social, environmental and economic sustainability and organisations, their structure and leadership have a major influence in this process. Developing a culture of innovation in organisations and industry appears to be vital in triggering innovation. The main driving forces are the ideas of stakeholders: customers, management, marketing personnel and production personnel, as they focus on problem fixing and developing new ideas. The lack of proper qualifications, training, access to cutting edge knowledge and technology, fear of taking risks, the culture and mind-sets of the particular organisation could all be contributing factors. For an organisation to be competitive specialist skills, consultancy services and professional expertise are needed. Forward thinking, considering whole life values rather than short-term demands, profits and balancing books are essential in this process. This new way of thinking can be driven by leaders and stimulated by research and development within the organisation or externally, exposure to innovative technology and projects, promoting best practice and specialist training. While some European countries, especially Scandinavian, move forward by bringing their sustainability agenda to the public sector, up until recently the UK seems to have been slow in embracing these ideas. A number of reviews of the construction industry provided waves of re-structuring and re-inventing, but long-term sustainability in improved products and processes for better performance, efficiency and mainstreaming of innovative application of renewable and low carbon technology serving the built environment is yet to come. While funding remains a major constraint there are many other issues that directly or indirectly influence this process (Kaluarachchi et al 2007a). The combination of attitudes towards risk and a wariness of innovative solutions result in organisational barriers to the wider uptake of low carbon technologies. Creative leadership is essential in overcoming these barriers. Another key factor in this process is the ‘Innovation capability of an organisation’, which locates and develops potential innovations that can be transferred into the mainstream (Lawson et al 2001).

This paper presents the results from a number of research studies carried out in the social housing sector over a decade (2000-2010) to highlight key issues that are important in organisational and managerial terms in organisations in implementing innovative technologies in sustainable refurbishment. The research methodology was based on case study monitoring, action research, consultation workshops and in-depth survey of related stakeholders. The aim was to identify barriers and drivers that influence organisations and highlight the challenges leaders face in achieving sustainability targets. The paper will also present the findings of a research study into the level of perceived organisational sustainability, attitudes to risk and innovation amongst social housing providers. A detailed survey was carried out to establish the level of sustainability that was achieved and attitudes towards risk of the responding organisation along with the experiences of sustainable refurbishment of their housing stock.

**2.0 Innovation and Organisations**

Many organisations that have introduced a unique product or service often fail to develop effective long-term strategies to sustain them. Problems in commercialising and mainstreaming new products often arise from poor marketing or organisational structures, rather than a lack of usable technology. An ability to manage innovation as part of the overall corporate strategy is as important as the innovation itself (Barlow, 1999). This ability can be affected by previous experiences, fear of change, impact of innovation on existing organisational hierarchies, work processes or management structures. Investors concerned about risky investment in new techniques or products can also hinder this ability. Managing innovation essentially involves mediating between external forces for change and internal forces for stability and giving leadership in the transition.

Strategies that organisations have developed to stimulate innovation in social housing mainly relate to process, procurement, learning, benchmarking and training issues. Factors of influencing the market, peoples’ pre-conceptions, planning and building regulations and finance can also be identified to a lesser degree. Several developments in Building Process Innovations offer the potential to reduce costs. Innovation in materials technology has influenced a wide range of house building products. These include improved plastics, new ceramic technologies high thermal and acoustic performance and partitions, which allow a wider choice of finishes (Pan et al, 2005). Some house builders have taken a mixed approach of taking advantage of both off-site and on-site production. The mixed approach favours incremental, rather than radical, innovations. Hooper and Nicol (2000) highlight the dominant practice among most large house building companies of continual incremental modifications to existing standard house types, rather than the creation of new designs. Seaden et al. (2003) studied two sets of variables of business environment and business strategies on innovative practices and suggest that innovation leads to improved competitive advantage and greater profitability. However, innovation is risky, requires significant investments and is often resisted within the firm. This justifies the strategies developed by house builders on learning, benchmarking and training.

**2.1 Organisational Capability to Innovate**

Cohen and Levinthal (1990) argue that industrial research and development (R&D) not only generate new information but also improve the ability of firms to absorb knowledge developed outside the firm. The type of staff employed provides an indication of a firm’s capability to develop, manage and utilise new technical knowledge. Other issues equally important are; organizational structure and culture, the nature of internal and external communications, coordination and feedback mechanisms, the ability to codify knowledge and the type and use of information and communications technologies (Cohendet et al, 2000). Companies associated with fast-moving science and technology sectors usually invest more intensively in R&D than most construction organizations. By other industries’ standards investment by government and construction firms in R&D is very low, particularly in the UK; this is not the case in some other countries such as France, Japan or Scandinavia (Gann 2001). It follows, from the argument that lack of internal R&D capability in construction indicates that many firms are unlikely to have the capability to absorb the results of academic research or work published in journal articles (Cohendet et al, 2000). Technological progress across the sector is therefore likely to be slow. When faced with the prospects of technological change, the majority of construction firms are recipients of innovation first exploited in other sectors, or by a few construction market leaders. Even when a firm has the technical competence to absorb new ideas, it may not have the internal structure, systems and cultural attributes necessary to capitalize on research results.

**2.2. Organisational Structure and Communication**

Organisations and their structure have a major influence in the innovation process. Visionaries who have corporate influence can drive innovation and influence the market growth, but will need support from other organisations in stabilising the process and creating the demand that is needed to establish the market. The monitoring of Amphion consortium of Register Social Landlords (RSLs) (2001-2004) to establish high quality housing designed and procured in line with a new procurement agreement illustrate how organisational structure and communication have a marked influence on innovation projects. In this arrangement a strategic partnering contract was set up with a single contractor who developed an award winning modern pre-fabricated timber frame housing system. The RSLs agreed to procure 2000 new house units over a four-year period and the research project exploited the opportunity to study a major innovation programme and identify what key lessons could be learnt. The main aim of the research was to set, monitor and compare the Key Performance Indicators (KPIs) and map the cause and effect relationships within the change programme. The research methodology was based on case study monitoring and action research and a range of questionnaire surveys, detailed interviews with key project personnel, examination of site meeting notes and general feedback reviews were undertaken to identify good and bad practices associated with each project (Kaluarachchi et al, 2007b).

The innovative timber frame system needed more research and development input prior implementation to reduce defects and the associated costs. The components were over designed to minimise risk which made the product expensive compared to other timber frame housing system in the market. These increased costs and the defects resulted in lack of trust in the contractor and the volume of demand initially forecasted never materialised. As a result the contractor was the subject of several takeover bids by rivals and experienced a number of problems with both, the supply of the timber frame housing system and site personnel, which compromised the quality of construction and resulted in a high turnover of site-based operatives. Key Lessons learnt from the initiative:

* Organisations need to be fully committed to the innovation programme.
* Risk management processes needed to be evaluated, agreed upon and in place prior to commencing the project.
* Innovative processes require a change in mind-set at all levels within the organisations. Effective mechanisms should be put in place to ensure that everyone understands the joint goals and know their part in the overall process. Better communication at all levels in delivering product.
* Training was identified as an essential ingredient in this process. The lack of familiarity with the innovative approach illustrated the need for formal training for all project managers, prior to commencement of new projects. There was also the need for support systems in terms of knowledge and information to be in place for frontline staff.
* Communication and co-ordination, which lead to continuous improvement of services and products, emerged as some of the key drivers of the process.
* Even though the government encourages initiatives, such as that monitored in the research study, there is little flexibility in support systems to assist in sustaining them.
* Continuous improvement process that would feed information from the site and different stakeholders who were involved with the project, was never implemented.

**3.0 Uptake of Innovative Environment Technologies in the Social Housing Sector**

The EPSRC SUE-IDCOP programme (2005-2008) provided knowledge to underpin the improved sustainability of existing buildings. The overarching aim was to find ways to improve the performance of existing building envelopes, which reduce the consumption of non-renewable resources over the whole building life cycle in a way that is economically viable and socially acceptable. There are many innovative environment technologies that are readily available in the market for this purpose. Case study examples here in UK and extensively throughout Europe show that these technologies can be used effectively and economically in new build housing. In UK, there is very little evidence of their use in routine maintenance and refurbishment. The aim was to identify and review the barriers that stakeholders face in promoting innovative environment technologies in social housing refurbishment. A number of stakeholder consultations were undertaken in relation to three sectors in the procurement of social housing: management, development and the maintenance sectors. It was considered under the following criteria: Energy performance, Water performance, Waste management, Durability and Flexibility (Whole life performance), Health and well being of tenants (Quality of life issues).

The results illustrated that:

* The capital costs of most of these technologies are significantly higher than the available budgets and the potential cost savings in utility bills. Also, the tangible benefits of employing renewable technologies are usually long-term and do not result in quick savings. Value for money is a major governing factor in the decision-making process and for the technology to be employed, benefits should outweigh the costs incurred.
* The technology should be proven and fully demonstrated prior implementation. Confidence levels in the new products are low due to high costs in demonstration projects (example- Amphion project) and occupants and organisations are reluctant to take the risks.
* There are quite a lot of products and systems in the market but very little information about their long-term performance, durability and ways in which they can directly reduce cost. More information about whole life performance and cost savings is needed and should be made available to the RSLs.

All the above factors illustrate that there is a demand for more information, effective communication and research and development. Informing and educating tenants and organisations about the long term benefits and whole life cost value seem crucial in implementing innovative technologies. Research and development is essential to bring the cost down and increase market potential.

**4.0 Characteristics of Innovators and Innovations**

Rogers (2003) characterise innovators in his theory of ‘diffusion of innovations’ (Fig 1), where the ideas are not instantly adopted, but instead there are differing rates of adoption of an idea by different participants in a market or industry. There are the ‘innovators’, who find and implement new technologies at their inception and adapt and use these ideas to stay ahead. The ‘early adoptors’, recognise and adopt the new technology or innovations ahead of the mainstream, and adopt it early to gain a competitive advantage. There are the ‘early majority’, who recognise that a shift is happening in their industry and adopt the change at the same time as others do or slightly before. There are the ‘late majority’, who recognise that a shift has occurred in their industry, and make the changes required to adopt the new technology and stay in the mainstream. Then there are the ‘laggards’, a group who are slow to recognise and adopt the new technology and its implications

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Fig 1- The ‘Diffusion of Innovations’ Curve (Rogers, 2003)

Roger's (2003) examined the factors that governed the uptake of innovation, identifying: the degree of relative advantage; compatibility with existing values and practices; simplicity and ease of use; trialability; and observable results as key drivers that influence the speed of uptake of innovative solutions. Earl (1989) applied a similar approach to Roger's when he investigated the uptake of Information Technology in data processing organisations and identified a multiple S curve model to describe uptake of the then innovative technology, attributing positions along the S curve to stages of organisational maturity (Initiation, Contagion, Control and Maturity). By observing organisational characteristics at each stage of the S curve Earl identified operational and strategic policies and management orientations that governed the degree to which IT had effectively been integrated into the business. Hinks et al (2007) applied the S curve model to facilities management, using it to distinguish between sustaining and disruptive innovation. Hinks argued that if innovation follows a continuous S curve (sustaining innovation) then it can only produce innovation that is incremental on what has gone before. As an innovation reaches the end of the S curve journey then the ability of the next incremental improvement to deliver meaningful advantage will diminish and as such its uptake rate will decline. These theories were combined in this project to investigate the uptake of sustainable technologies in the refurbishment of UK social housing.

Figure 2: Sustainability Maturity Curve (Hinks et al, 2007)

**5.0 Organisational Structure and Perceived Sustainability**

A detailed questionnaire survey was carried out (2009) with a sample of Housing Associations and Local authorities to survey the innovative environment technologies and processes that are implemented in the sustainable refurbishment of UK social housing. The questionnaire, sent to the senior managers and decision makers examined the barriers and drivers to sustainable refurbishment projects and related these to organisational characteristics and management attributes. The questionnaire also sought to measure the level of perceived sustainability by the organisation itself according to four levels of sustainability. The questionnaire comprised 15 questions covering: interpretation of the sustainability agenda; formal policies and business procedures; perceived drivers and barriers to sustainable refurbishment; and the decision making process / business case for action. A total of 500 questions were distributed and 57 responses we received representing the response rate of 11.4 %. Even though the response rate was low, the study had the assurance that all respondents were Chief Executives or Senior Managers who would priorities and make the strategic decisions of organisations.

Respondents were asked a series of questions about their understanding of sustainability and the relative importance that they believed each attribute should contribute towards a sustainability assessment. All respondents identified that sustainability was about balancing environmental, social and economic performance of their housing stock but the relative importance that they attached to each attribute varied depending on where they placed themselves on the organisations and national sustainability agenda. The respondents were asked to rate the sustainable refurbishment actions carried out by their organisation according to four levels.

Level 1- (Low) Actions are uncoordinated one offs, low risk and opportunistic (Initiation)

Level 2- (Low/Medium) Actions are un-coordinated, in multiple projects, high risk (Contagion)

Level 3- (Medium) Actions are co-ordinated supported by formal decision-making process to reduce risk (Control)

Level 4- (High) Actions are strategically planned, supported by formal decision-making process and at medium risk (Mature)

Of the 57 respondents, 17 placed themselves at level 1, 20 at level 2, 14 at level 3 and 2 at the level 4 (Figure 1).

Figure 3 Perceived Sustainability by Organisations

Respondents were presented with potential drivers relevant to their refurbishment decisions and asked to rank these in priority order. The most important drivers were: tenant satisfaction (20.5%); government policy (20%); available funding**/**business support (13.9%); legislative support (9.4%); and education/knowledge (9.4%). With regards to the barriers for sustainable refurbishment: lack of funding [17.7%]; high initial capital cost [17.3%]; long payback periods [13.8%]; value for money [12.1%]; fear of risk [8.3%]; and lack of knowledge [8.3%] were perceived as major barriers. Respondents were also asked to identify the governing factors that determined the level of sustainable refurbishment that they believed was required. Eighty percent of respondents identified the state of their housing stock followed by organisational leadership (56%), return on investment (56%), tenant buy-in (52%), and confidence in the solution (52%) as the most important factors when identifying which sustainable refurbishment project to undertake.

An attempt was made to identify differences in the decision-making hierarchy or implementation routes between organisations at different stages of perceived sustainability levels as in Figure 1. Whilst many management and decision-making attributes are common to all respondents, the degree to which they influence sustainable refurbishment decisions vary. The results illustrated that in Level 1, 2 & 4 decision-making is devolved and reporting/ monitoring is flexible. In Level 3 management approaches were more prescriptive and reporting was more formal (Table 1).

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| Stage | Decision-making process |
| Level 1(Initiation) | Organisations have no executive manager responsible for overall delivery of sustainable refurbishment. The actions are one offs. |
| Level 2(Contagion) | Overall responsibility located at the executive level: a short development time between board level decisions to local implementation: decisions are based on the outcomes of a stock condition process: a long-term plan and vision for their housing. |
| Level 3(Control) | Organisations had developed specific procurement routes for innovative technologies; begun to involve tenants in decision-making; a semi structured options appraisal process in place to distinguish priorities. |
| Level 4(Mature) | A senior-level manager is responsible for the overall delivery of the sustainability activities. High levels of tenant involvement throughout the process; individual project monitoring against a long-term asset management plan. |

Table 1 Organisations’ Decision-making process for innovative Sustainable Refurbishment

**6.0 DISCUSSION**

Case Study 1, Amphion (2001) was set up by a visionary who wanted to achieve real change in the social housing sector. But as the lessons from this experience show, the organisational structure and the support needed to facilitate such an initiative was not present. The report ‘Offsite Modern Methods of Construction in House Building’ (Pan, 2005) stated that the industry has been slow to innovate and adopt offsite technologies, which has inhibited achieving a step improvement in productivity and quality of housing supply. This is all most likely to occur with a combination of government (as potential facilitator, sponsor and major client) and other client and cross-industry support. To date, the level of dialogue and collaboration between designers, contractors and building material producers appears to be limited, and the industry needs to adopt a much more proactive stance on this issue.

The questionnaire survey identified a number of organisational and managerial characteristics that differentiated organisations’ attitudes and approaches to sustainable refurbishment where innovative environment technology was implemented. These characteristics also relate to the groupings identified by Rogers (2003) in his ‘Diffusion of Innovation’ theory. The organisations perceived to be at Level 1 (Initiation Stage) sought to achieve an equal balance between the three sustainability attributes (socio, economic and environmental). Decisions on whether to include sustainability in a refurbishment project were primarily tactical, with little senior management or tenant involvement. No systematic monitoring of the performance of the sustainable refurbishment was undertaken and no long-term strategies or plans existed. This group could easily fall into the category of ‘laggards’ (Figure 1). Organisations who placed themselves at Level 2 (Contagion Stage) placed high importance on the economic and social attributes of sustainability. Management of projects tended to be at the executive level with some monitoring of post project performance being undertaken against embryonic long-term plans. Some tenant involvement in the decision-making process were identified. This category shows signs of ‘late majority’, who recognise that a shift has occurred in their industry, and make the changes required to adopt the new technology. Those organisations at Level 3 (Control Stage) of the sustainability maturity curve placed high importance on social and environmental attributes of sustainability when making sustainable refurbishment decisions. There are similarities with the ‘early majority’ category and long-term sustainability plans had been developed and decisions about which projects to pursue were beginning to be devolved to local managers. Organisations that placed themselves at Level 4 (Mature stage) placed highest importance on the social attribute of sustainability and although they had a formal sustainability policy in place, this tended to be only one of a number of policies that they used to inform their sustainable refurbishment decisions. In interpreting the social needs of their tenants, these landlords demonstrated a community focus with long-term strategic objectives informed by tenant involvement informing all stages of the sustainable refurbishment decision Making process. This category mostly shows sings of ‘early-adaptors’ moving towards ‘innovators’ as they aim to attain their sustainable goals. Their vision was strategic and their monitoring was against long-term benchmarks.

**7.0 Conclusions**

All case studies illustrate that challenging leadership, organisational structure and management, commitment of all parties, a changed mind-set and better communications all levels are crucial to drive the sustainability actions. Knowledge transfer, sharing of best practice, training of personnel were essential to make the initiatives successful.

From the results of the questionnaire survey it would appear possible to differentiate management characteristics of UK social landlords in their attitudes toward sustainable refurbishment depending upon the level of sustainability they perceived their organisations to be. In general, the more advanced level the organisation is perceived to be in sustainability, the more locally focussed the decision making. Further, given the existence of organisational characteristics it should be possible to develop a profiling tool that allows landlords to recognise their position in the sustainability scale and develop appropriate interventions that could accelerate the journey from their current position to a more advanced level. Given the current low-level of sustainable housing refurbishment this could increase the speed of uptake of innovative technologies and support the UK in achieving lower carbon emissions associated with the social housing sector. The existence of barriers, particularly financial, cannot be underestimated and a solution to provide access to funding is needed alongside management interventions. The Green Deal, if effectively applied to social landlords, has the potential to provide such fiscal stimulus and as such the need to develop tools to assist with the other aspects of the sustainable refurbishment decision making process need to be developed. In developing these tools consideration should be given to where organisations place themselves in achieving sustainability targets, with solutions being developed that match the characteristics for each level to be achieved. In this way UK social landlords will truly benefit from their investment in Low and Zero Carbon technologies.

Innovation requires skill changes and new technical and practical knowledge. A change in industry, employee culture and mind-set is also essential if the anticipated requirement for improved quality, accuracy and precision is to be achieved successfully. This change in mind-set will require training, an explanation and understanding on the part of the workforce as to why the change is required, and clear leadership at all levels and from all industry participants including clients. The results also identified a range of leadership and organisational characteristics that are needed to drive innovation. It concluded that it is possible to profile UK social housing providers and develop management instruments to accelerate their journey along the sustainable innovation path that in turn will accelerate the uptake of sustainable refurbishment programmes.

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