An asset management strategy to accommodate a changing climate

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ABSTRACT

Climate change is a significant factor that will affect how people live and work in future. In light of this and of international initiatives on limitations of emissions, the changing climatic conditions will affect the existing building fabric, and inflict a different kind of user demand on corporate property portfolios. A comprehensive literature review has shown that there is an absence of tools and metrics for facilities managers to evaluate the impact of climate change on their organization and develop mitigation and adaptation strategies for their existing and new built corporate property portfolios. There is a little augmentation for accommodating the existing and future climate changes into management of corporate property portfolio. This paper will argue the need to construct a comprehensive strategy for management of corporate property portfolio of large organizations, which will take into consideration climate change mitigation and adaptation.

KEYWORDS: climate change, built asset strategy, facilities management.

INTRODUCTION

The UK climate is changing. Over the next 30 years summers will tend to get hotter, with more days requiring active cooling of buildings, and peak rainfall will become more intensive, leading to short term flooding and disruption to business activities (UKCIP, 2002). What demands will such changes place on existing Buildings? How can large property owning organisations manage their built assets to meet these demands? Can existing asset management theories answer above questions? These are some of the key questions that face facilities managers as they respond to the ongoing debate over climate change.

In considering the above facilities managers will need to consider the implications of climate change at both operational and strategic levels. At the operational level buildings that are at physical risk will need to be identified and preventative measures developed. At the strategic level business practices will need to be modified to take account of changing life-style / work-style patterns. In all cases the facilities manager will need to be aware of the potential benefits that could accrue from a changing climate and not just focus on the problems that may arise. Finally the facilities manager will need to consider to what extent their existing asset management strategy can accommodate the demands of a changing climate and what changes to strategic thinking may be required to manage the move from their current asset position to one which better supports their business needs over the next 30 years. The authors suggest that such a change in strategy will require a fundamental shift in current thinking if it is to be achieved.

This paper presents the arguments for this change in thinking and presents the findings from a comprehensive literature review that shows the need for facilities managers to actively engage in the development of mitigation and adaptation strategies for climate change as part of their broader asset management strategy.

A CHANGING UK CLIMATE

The UK Climate Impact Programme (UKCIP) has produced a number of reports which outline the climatic and business issues facing the United Kingdom over the next 100 years.

With regard to climate change, UKCIP have produced predictions for the UK climate based on four scenarios (low, medium-low, medium-high and high) which reflect differing approaches to CO_2 emissions (Hulme, 2002). Over the next 50 years the UK can expect to see:

- A rise in annual average temperature of between 2^oC and 3.5^oC (this rise will be more pronounced in the southeast of England than in the northwest of the UK);
- A rise in the temperature of UK costal waters;
- A rise in sea levels around the UK with increased flooding of low-lying flood plains;
- A slight decrease in the annual average rainfall;
- A significant decrease in snowfall;
- A delayed onset of 'winter' and an earlier occurrence of 'spring' leading to an extended growing period.
- A change in the seasonal distribution of rainfall with winters becoming wetter and summers drier;
- High summer temperatures will become more frequent with many more days reaching the mid 30^oCs;
- Extreme winter rainfall will become more frequent with many more storms and associated flooding.

In addition to these 'average' predictions the UKCIP model also provides detailed location specific scenarios which individual organisations can use as the basis for predicting the climate change effects on their particular business operations.

IMPACT OF CLIMATE CHANGE ON BUSINESS FUNCTIONS

According to 'Professor Anil Markandya (Metroeconomica, 2004) climate change will affect UK businesses in many ways including:

- Increased heat stress for workers;
- Changes in patterns of demand for goods and services;
- Increased flood risks;
- Water supply constraints;
- Impact on the insurance industry.

In order to prepare for these affects Professor Markandya has outlined a series of costing methodologies based around climate change risk assessment and business decision making. These costing methodologies involve:

- The identification of key impacts;
    - Using impact matrices to provide an initial assessment of the major impacts on the business and then refining the matrix to assess the lower order or sectoral impacts.
- The identification of key cost elements
    - Using a range of costing techniques (e.g. contingent valuation, avertive expenditure etc) to predict impact on business function;
- Assessing the potential for adaptation

- Using existing investment evaluation techniques modified to take account of increased uncertainty and possible competitive gains and costing the benefits of adaptation to the business function;

Finally Professor Markandya has identified the need for business to take a long-term, strategic view that was both flexible and resilient enough to accommodate extreme conditions in its planning for the impacts of climate change.

In a further report by UKCIP (Willows & Connell, 2003) the costing methodology outlined above was incorporated into a wider business framework (Figure 1) that supports good decision making in the face of climate risk. In this framework a series of toolkits are outlined that allow business decisions to be evaluated at each stage of the implementation cycle and provide the basis of an implementation strategy for dealing with the impacts of climate change.

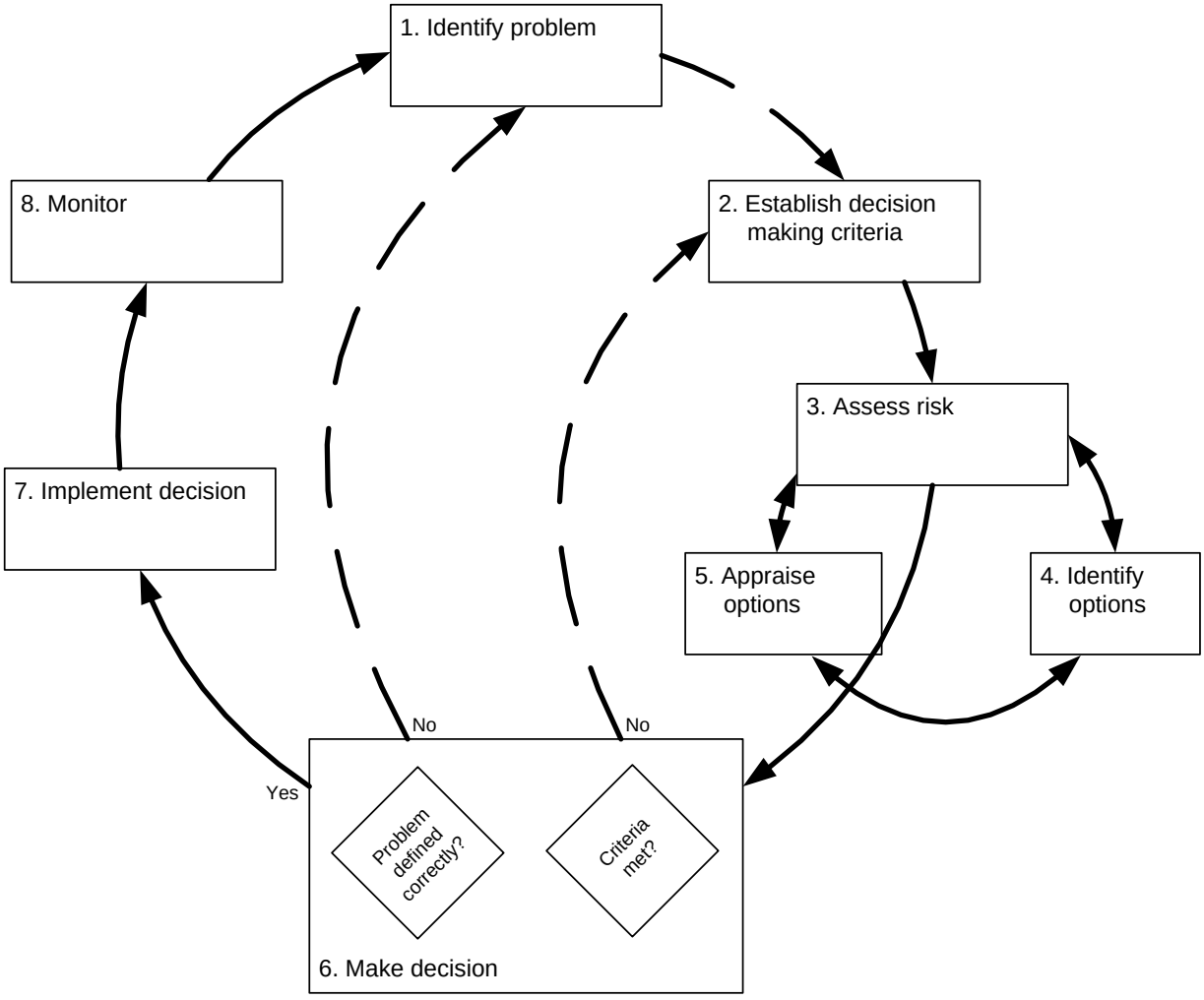

Figure1: Framework for good decision making in the face of climate change.
Source: Willows & Connell, 2003

IMPACT OF CLIMATE CHANGE ON BUILDINGS

The impact of climate change on the design of new buildings is already widely recognized and reflected in guidance readily available for façade design, shading and cooling of buildings, ventilation, mass and thermal inertia, insulation, low energy systems and the impact on the internal environment of buildings (CIBSE, 2004). In addition, studies of the construction process have identified the potential impact that changing seasonal patterns may have on site logistics, ground working, and time delays all leading to reduced productivity and increased construction costs (Gavin, 1998). However, what have been less well studied are the potential impacts that a changing climate may have on existing buildings. The work that has been done has identified potential structural problems associated with increased frequency and severity of storms; increased ground movements as ground water conditions change; material durability issues as ambient operating conditions change thus exposing systems to climatic conditions that they weren't designed to deal with; and, specifically in low lying areas, the problems of flooding and water penetration. All of these issues will lead to increased repair and maintenance work and consequently increased pressure on maintenance budgets. Thus the challenge facing facilities managers is to develop both mitigation and adaptation strategies to manage the impacts of climate change.

Mitigation is defined as an anthropogenic intervention to reduce the sources of greenhouse gases or enhance their sinks (Metz, 2001). Adaptation is defined as the capacity to which adjustments in practices, processes, or structures can moderate or offset the potential for damage or take advantage of opportunities created by a given change in climate (McCarthy, 2001).

MITIGATION STRATEGIES

The response to climate change within the built environment has to date mainly focussed on strategy building, the production of government guides on risk assessment and decision-making process, and standards for energy efficiency in new buildings. These initiatives primarily address mitigation as they seek to prepare new buildings for climate change. However, there is far less information available on mitigating strategies for the management of existing built assets.

Junnila, S. (2004) used a life of five Service Company's facilities management activity on climate change, acidification, summer smog, eutrophication & heavy metals. Junnila identified that, whilst facility related activities accounted for only a small fraction of the operational costs of the organizations studied, they produced the majority of the environmental impacts. As such Junnila concluded that facilities managers have an important role to play in the development of mitigation strategies. Similar arguments over the impact that facilities managers decisions have on mitigation were presented by Troloar et al. (2001), who suggested the need for strategies which sourced local materials and products in preference to those transported over long distances, have a high recycle content, and have a long life expectancy and by Wyatt, D et al (2000), who identified carbon taxation as a key driver for the development of mitigating FM strategies. Wyatt argued that such strategies would need to adopt a whole life cycle approach to built asset management that sought to address more effective supply chain management, the use of design life engineering and service life planning, life care & the performance life audits and the use of recovery management to increase energy efficiency and reduce waste streams.

ADAPTATION STRATEGIES

Hasegawa (2004) has also noted that the debate to date has focused mainly on mitigation issues, with less attention being given to the development of adaptation strategies. In an attempt to redress the issue Hasegawa suggested the need for further research into the complex composite of various kinds of climate change impact and the development, by government, of policy aimed specifically at the various stakeholder groups. In arguing for increased policy Hasegawa saw the need for clear evidence to support some level of government intervention, a view that was also reported by Luc Salagnac, J (2004) who argued that more work is needed to understand the detailed implications of climate change, especially at the local level and to provide sufficient evidence for policy-makers to make decisions with confidence. Luc Salanac also recognised that economic instruments may not be as important in adaptation policy as they are in mitigation policy. Finally Hasegawa warned against designing short-sighted policies either in terms of time scale and choice of instruments.

Liso et al (2001) emphasized the need to identify areas of vulnerability in construction industry and to develop appropriate adaptation strategies as both the functionality of the existing built environment and design of future impacts are likely to be altered by future climate change impacts. Liso further argued that measures aimed at adjustment and alterations in rules and specifications within the building sector constitute only partial adaptation and that there is an immediate need for information and research, both with respect to sensitivities in built environment and technical solutions to climate impacts on buildings and a move towards holistic policies and strengthened institutional capacity if effective adaptation is to be implemented. The argument for a holistic approach was further emphasised by Camillei et al (2001) who suggested that pre-cautionary measures taken before the full impact of potential problems were manifest could provide cost effective protection from some of the likely impacts of climate change. Indeed Camillei went on to argue that, as adaptation at the design and build stage is generally much cheaper than during the maintenance or refurbishment periods, adaptive measure should be integrated with mitigation measures.

Whilst it is clear from the above that Facilities Managers have an important role to play in the development of an organisations mitigation and adaptation strategies, what is less clear is how exactly they can perform their role. What form should an FM climate change mitigation and adaptation strategy take? What should the balance be between hard FM issues (e.g. building fabric) and soft FM issues (e.g. workplace ergonomics)? Where is the evidence base to inform and support the development of mitigation or adaptation strategies? What is the risk of doing nothing over the next 20 years? Do existing models allow the development of mitigation or adaptation strategies? These are some of the questions that need to be addressed.

A NEW APPROACH TO BUILT ASSET MANAGEMENT

The traditional approach to built asset management involves taking stock of the condition of an organisation's built assets and then using some form of life cycle analysis combined with a strategic asset management policy to plan asset maintenance, refurbishment, acquisition and disposal. Whilst this approach continues to be used by many organisations it does have some major weaknesses as far as long term strategic asset management is concerned. These weaknesses stem from the theoretical basis on which the life cycle modelling is based.

In essence life cycle modelling is an incremental process in which you start from a given position along the time-performance line and project maintenance and refurbishment actions forward to return the built asset to a pre-defined level of performance (Figure 2). However, rarely are future demands built in to the modelling process, and even when they are they tend to look no more than 3-5 years ahead. As such the maintenance / refurbishment cycles are invariably playing catch-up to the changing building demands. This in turn results in creeping obsolescence, which eventually renders the building a liability to the organisation. What is needed if the model is to form the basis for the development of mitigation and/or adaptation strategies is a more effective assessment of the changing demands placed on a building over a normal refurbishment cycle.

For most buildings in the UK the refurbishment cycle is about 25 years. If organisations could project their building demands forward then, with a clearer view as to their long term needs, it would be possible to develop a maintenance and refurbishment strategy by looking back from where they want to be, to where they are today. In this scenario climate change issues could be introduced into the performance evaluation process with maintenance and refurbishment actions planned because they are integral to achieving long term building performance goals rather than in response to short term building problems. Further, because this approach would integrate maintenance and refurbishment planning into an overall asset management strategy it should improve the confidence of building owners in the ability of their built assets to deliver against their business performance targets over the long term and ultimately prove more cost effective.

The logic outlined above, in which one is viewing maintenance expenditure as a means to add future value to a built asset rather than a recurrent expenditure liability, is an innovate approach to solving the problems of maintenance / refurbishment planning and represents a fundamental (step) change in current thinking.

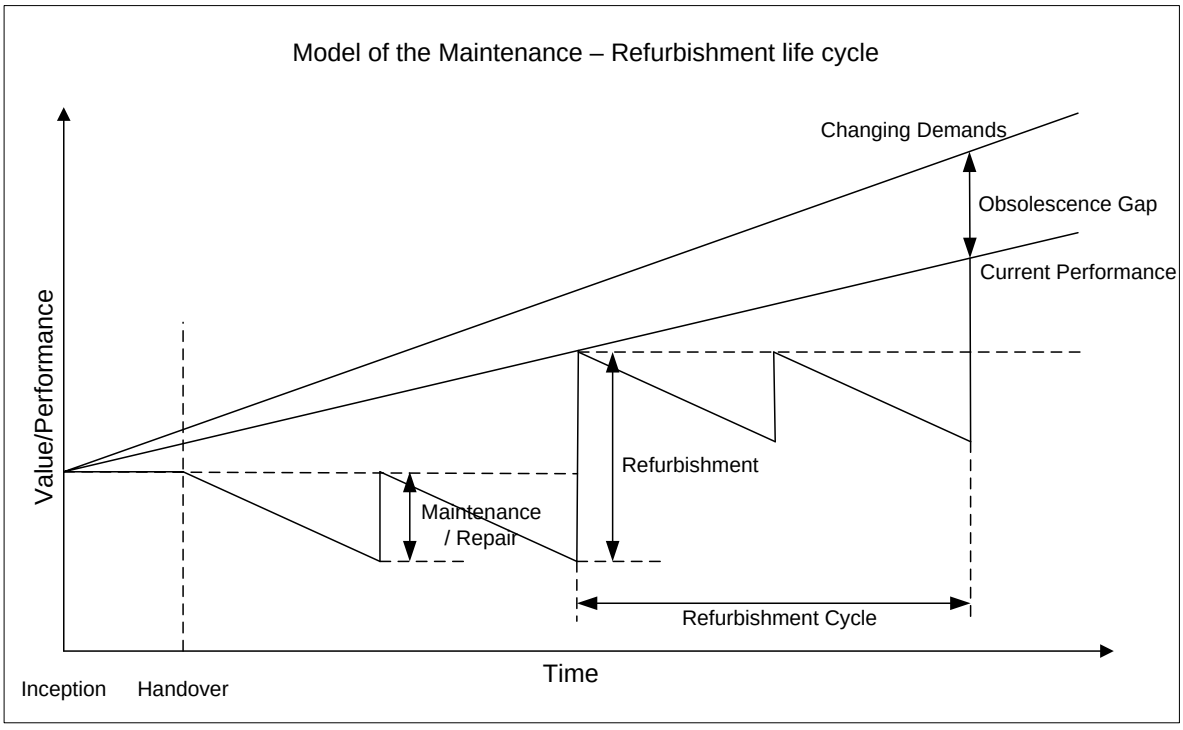

Figure 2: The building maintenance/refurbishment lifecycle
(Source: Adapted from Finch, 1997)

ACHIEVING A STEP CHANGE IN THINKING – THE RESEARCH CHALLENGE

In moving from the theoretical model outlined above to one which informs the development of mitigation and adaptation strategies a number of key issues will need to be considered:

- How will climate change affect the value/performance of Buildings?
    - Physical demands (heating, cooling, fabric performance, flooding etc)
    - Operational demands (working environments, work patterns, occupation patterns etc)
    - Business demands (business function, operating costs, customer expectations etc)
- What can be done at an individual building level to address changing demands?
    - Physical adaptation of the building fabric
    - Investment in mitigating technology
- Are all buildings capable of mitigation/adaptation?
    - Disposal and acquisition of built assets
- How can mitigation/adaptation activities be programmed into an asset management strategy?
    - How do you prioritise maintenance/refurbishment actions?
    - What are the costs?
    - What are the benefits?

These issues form the basis of ongoing research at the University of Greenwich. The project is funded by the Royal Bank of Scotland

SUMMARY

The UK's climate is changing. Both buildings and working practices will need to change if they are to meet the new demands placed upon them. Facilities managers need to understand the impacts that climate change may have on their organisations and develop mitigation and adaptation strategies as part of their long term facilities solutions. However, what form should FM climate change mitigation and adaptation strategies take? What should the balance be between hard and soft FM issues? Where is the evidence base to inform and support the development of mitigation or adaptation strategies? Do existing approaches to maintenance management allow the development of mitigation or adaptation strategies? In addressing these questions facilities mangers will need to move their thinking from a 3 to 5 year time span to one which incorporates change over 25 to 30 years. This will require a fundamental step change thinking to view maintenance expenditure as a means to add future value to a built asset rather than a recurrent expenditure liability.

REFERENCES

CIBSE (2004) *Understanding and adapting buildings for climate change*. CIBSE.

Camilleri, M., Jaques R. and Isaacs, N. (2001), "*Impacts of climate change on building performance in New Zealand*", Building Research & Information, Vol. 29 No. 6, pp. 440-450.

Finch, E (1997) *"A sea change in facilities management"*, in Alexander (ed) Facilities Management Theory and Practice, E & F Spon, ISBN 0-419-20580-2, pp 42-55.

Garvin, S., Phillipson, M., Sanders, C., Hayles, C. and Dow, G. (1998), *"Impact of climate change on building"*, BRE, Construction research communication Ltd, Watford.

Hasegawa, T. (2004) *"Climate change, adaptation and government policy for the building sector"*, Building Research & Information, Vol. 32 No. 1, pp. 61-64.

Junnila, S. (2004), *"The environmental significance of facilities in service sector companies"*, Facilities, Vol. 22 No.7/8, pp190-198.

Liso, K., Aandahl, G., Eriksen, S. and Alfsen, Knut H. (2003), *"Preparing for climate change impacts in Norway's built environment"*, Building Research & Information, Vol.31 No. 3-4, pp. 200-209.

Luc Salagnac, J. (2004), *" French perspective on emerging climate change issues"*, Building Research & Information, Vol. 32 No. 1, pp. 67-70.

McCarthy, J., Canziani, O., Leary, N., Dokken, D. and White,K., (eds) (2001*), "Climate change 2001: impacts, adaptation, and vulnerability", Contribution of Working Group II to the third assessment report of the Intergovernmental Panel on climate change.* Cambridge University press.

Metroeconomica (2004) *Costing the impacts of climate change in the UK*. UK Climate Impacts Programme, ISBN 0-9544830-1-4.

Metz, B., Davidson, O., Stewart, R., and Pan, J., (eds) (2001), *"Climate change 2001: Mitigation. Contribution of Working Group III to the third assessment report of the Intergovernmental Panel on Climate change.* Cambridge university press.

Treloar, G., Fay R., Ilozor B., Love, P. (2001), *"Building materials selection: greenhouse strategies for built facilities"*, Facilities, Vol. 19 No. ¾, pp.139-149.

Willows R & Connell C (2003) *Climate adaptation: Risk, uncertainty and decision-making*. UK Climate Impacts Programme.

Hulme, M., Jenkins, G.J., Lu, X., Turnpenny, J.R., Mitchell, T.D., Jones, R.G., Lowe, J., Murphy, J.M., Hassell,D., Boorman, P., McDoland, R. and Hills, S. (2002) *Climate Change Scenarios for the United Kingdom: the UKCIP02 Scientific Report*, Tyndall Centre for Climate change Research, School of Environmental Sciences, University of East Anglia, Norwich, UK.120pp.

Wayatt, D., Sobotka, A. and Rogalska, M. (2000), *"Towards sustainable practice"*, Facilities, Vol. 18 No.1/2, pp. 76-82.