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Does the Construction Industry have a Future?

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1. Introduction
Thinking about and planning for the future is an integral part of human life. The complexity and uncertainty of such endeavours are dependent on two main parameters, namely the number and diversity of stakeholders involved and affected, and the time horizons selected. An example of its simplest form is the planning people make in the early morning, when they think about their activities for the day, whereas the most complex future planning attempts to look into the long distance future (e.g. 20-50 years time).

The impact of the construction industry on nation economies is undeniable. Construction firms have to be able to respond to fluctuating market demand to survive, and work within a tradition of competitive tendering and small profit margins. Often, construction work has to be performed in inhospitable or difficult environments and displays a poor health and safety record. Construction is also considered to be ineffective at planning for the long-term future, and to lack forward thinking. A number of reports scrutinising the performance of the sector (e.g. Egan, 1998) have called for the industry to extend their orientation by looking ahead, beyond their next projects and to prepare themselves to respond to potential future events and trends.

Recent years have seen the emergence of studies and reports which envision various alternative futures for construction industry resulting from extrapolating technological and socio-economic factors. Thirteen construction related future studies have been critically reviewed as part of large government-sponsored research project – ‘the Big Ideas’ - and reported elsewhere (Harty et al., 2006a). The review reveals that these reports are often less about the future than the present and that their recommendations are not significantly different from those of non-future oriented construction research and reports. Most of these studies fail both to address the complexity and uncertainties of the present and the future, and explore the connections between global, local, construction-specific and more general or macro-level trends and concerns. Hence, the motivation of the ‘Big Ideas’ research project is to develop alternative futures scenarios based on established inter-connections between internal and external factors such as skill shortages in the sector or global demographic trends and those within and outside the control of various construction stakeholders. This paper provides an overview of the project including the identification of future issues and the findings of an initial workshop to capture industry professionals’ perception on five main future issues. Then, examples of two possible future scenarios are presented which integrate inter-connected issues into contrasting scenarios of construction’s potential future.

2. The Big Ideas project
‘Sustained competitiveness in the UK construction sector: a fresh perspective’ or the ‘Big Ideas’ for short, is a government-sponsored collaborative research project between the Innovative Manufacturing Research Centres at Loughborough, Reading and Salford Universities. This 3-year project aims to engage with industry to identify and understand the challenges and opportunities facing the UK construction sector over the next 20 years. The
The research embraces five interconnected objectives as follows:

1. Grounding the project in a thorough investigation of the current structural and cultural configurations and dynamic capabilities of the UK construction industry as a whole

2. Identifying key issues which could shape the construction industry over the next 20 years

3. Establishing a range of possible future scenarios based upon groupings of their interdependencies

4. Creating an interactive IT tool to explore and simulate these future issues and scenarios

5. Developing appropriate strategies and policies at both industry and firm levels to help organisations prepare for the future

3. Key issues for the Future

The authors have been involved in the research addressing the second objective.

The initial stage of our research identified issues and drivers which may influence and be pertinent for the future of construction. They were identified from 13 reports, which constitute a representative sample of many future construction related reports. Two key reasons of inclusion were firstly that the reports were published relatively recently (with publication ranging from 1998 to 2005), and secondly by their potential importance to the sector as assessed by members of the research team. Seven reports focussed on the UK (CIRIA, 1999; Edkins, 2000; DTI, 2001; Fairclough, 2002; DTI, 2002; Foxell, 2003; Landry, 2004), and two make global comparisons (CIB, 1998; Flanagan, 1999). We also included a number of construction futures reports from other countries including Australia (Hampson and Brandon, 2004), the USA (CII, 1999; CERF, 2000) and Europe (ECTP, 2005). The analysis of reports also reached a degree of 'theoretical saturation', where additional reports added little in the way of new issues and insights. The analysis captured the content of the reports mainly in terms of ideas and issues which were considered to be important in the future or which are influencing the current positioning of the sector and which will continue to do so in the future. In total, 339 issues have been identified. These were initially grouped into 6 broad themes, namely technological, environmental, human, economic, governance, and construction industry specific.

The next stage of the research was devoted to analytically extracting clusters comprising related issues. The issues within a single cluster could cut across several of the broad groups described above. Throughout this process, it was also found that several issues could be assigned into more than one cluster denoting that clusters could overlap each other and that possible interconnectivities can occur not only within one cluster, but between a number of clusters. Indeed, the analysis itself is not to develop authoritative clusters and classification systems, but more as a methodological step to move from a long list of issues to more manageable subgroups, using a combination of experiential judgement of the research team and common knowledge of the subjects. Numerous iterations of the process yielded 39 clusters, which could be further grouped in five high level themes, namely ‘People’, ‘The Planet’, ‘Built Environment’, ‘Work’, and ‘Governance’. For a fuller description of the identification and clustering process, readers may wish to consult Soetanto et al. (2006).
The research identified a number of issues which appear frequently in the reports, reflecting their perception as being important in the future. Many are wide in scope and reflect present concerns of the construction industry, and society more generally, and have often been accompanied with media coverage. Five main issues are (i) demographic change (including the problem of an ageing population), (ii) climate change (including issues such as global warming or extreme weather events), (iii) energy crises (especially fossil fuel depletion), (iv) globalisation (for instance positioned as the threat of increased foreign competition), and (v) vulnerability and security (both personal and institutional, for example terrorist threats).

**Perceptions of Main Future Issues**

A multi-stakeholder workshop was seen as a useful way of capturing the different perceptions of industry professionals of the ramifications of the five main issues for their organisations. This was arranged during an ECI (European Construction Institute) annual general meeting in November 2005. Workshops offer advantages over individual interviews as they provide opportunities for participants to discuss issues, and share ideas and comments, and the workshop was intended to stimulate free flowing ideas and participation. The workshop was based around the following key questions:

1. How will these issues impact on you and your organisation now and in the future (i.e. the benefits and dis-benefits of the issues)?
2. How much control do you and your organisation have over these issues (if any)?
3. What can you and your organisation do to address these issues (if anything)?

Prior to the discussions, the aims of the project, and of the workshop were presented. The above questions serve only as a guide to direct discussion. Thirty participants, mainly from the UK, were divided into four groups and asked to report back to the whole group at the end of the session. The workshop lasted about one hour. The findings are described in the following paragraphs.

Participants saw the five issues not as separate but interrelated, meaning that a specific issue can not be addressed without considering the possible impact on the other issues. This implies that such attempts require holistic solutions involving various stakeholders in the widest sense. Ironically, they also felt powerless and saw little they can do to solve these ‘problems’ or face and respond to issues. Attempts to influence these issues was also seen as potentially problematic given their interconnectivities and wide reaching scope. Mitigation or avoidance of problems could require wholesale change, for instance in lifestyle and consumption, or in the current practices of the sector. Government was pointed out as having a critical role. It was considered that government should provide leadership to instil vision and initiatives as well as set examples of best practice.

**Ageing population**

Ageing population is an increasingly critical issue in the developed world, especially in Europe. As people age and retire, a new injection of people into the workforce is needed to maintain existing levels and expectations of economy prosperity. At sectoral level, the provision of skilled labour owes a great deal to the image of the industry, which is frequently cited as lacking in appeal to young people. Much work needs to be done to improve perceptions of the industry, mainly by providing better working conditions and improving remuneration for the workforce compared with other sectors. Given the influence of the media, good publicity could elevate the image of construction industry. For instance, the TV programme, ‘Bob the Builder’ could instil in children a positive image of construction work, such as how much fun construction can be for workers.

The use of foreign labour raises questions about quality and working practices (especially health and safety), apart from the social and cultural issues related to integration of foreign and migrant workers into UK society. Other counter-measures mentioned in the workshop were the use of technology to improve productivity (i.e. using less labour), working longer and delaying
retirement, and improving practices on equal opportunities and diversity (i.e. addressing the imbalance between men and women in the industry, and the low proportion of those from ethnic minorities).

**Global warming**
The issue of global warming has exploded in recent years, resulting from and in wide publicity and media interest. It is no surprise that all participants felt that reducing CO₂ emissions was key to alleviating global warming. Depending on where particular individuals stand, global warming is perceived as having both disadvantages and benefits to the construction sector. Increased global warming (or the threat of it) could impose new restrictions on the use of energy and materials on projects. This introduces additional requirements (such as whole life cycle, reducing waste, changing established design codes, increasing costs of insurance) and (client) demands that contractors have to meet. Contrarily, global warming and climate change could create new opportunities for construction, including schemes to construct new flood defences and enhance existing ones, and infrastructure projects exploiting alternative energy sources, such as tidal power, wind turbines and nuclear power stations. It is estimated that decommissioning ageing UK nuclear power stations would cost £56 billions in the next few years (Construction Manager, 2006a), and resurrecting a nuclear power program would see massive investment in the building of new power stations.

**Energy**
The selected solutions of the ‘sustainability problem’ can be placed within a continuum of ‘technical fix’ and ‘conserve at all cost’ (Brandon and Lombardi, 2005). The participants thought that response to energy crises could mean seeking alternative technological solutions but also changing and adapting different lifestyles (for instance in moving towards less energy intensive domestic practices). One participant argued that there are still plenty of fossil fuels, but energy crises can be instigated through cost escalation or political imperative, as well as the gradual exhaustion of natural resources. The political expediency to use alternative energy sources is intensified in light of the instability of many locations where the most of the remaining oil reserve resides. Nuclear power was cited as a prominent solution, but the production of fuel for nuclear fission is not without its environmental impacts, for instance in terms of CO₂ emission (a demonstration of the inter-connectivity between these issues), and disposal of nuclear waste is dangerous undertaking even without considering the poor public image of nuclear power. It also raises issues to do with vulnerability and security of the power stations from for example terrorist threats.

**Globalisation**
Generally, globalisation benefits the economies of the developed world, especially in terms of consumption, where the price of manufacturing goods is becoming more affordable than ever before. Although the shift of production to low cost economies will continue in foreseeable future (Landry, 2004), participants perceived that globalisation will eventually bring about a level playing field as the economies of developing countries improves. For some, globalisation represents potential threats, but concentration on developing a highly skilled workforce and supporting infrastructures provide opportunities for (West) European countries to focus on higher technology development and research. Participants also suggested the possible benefits of a move to smarter ‘intellectual services’ to remain competitive over regions with cheaper labour costs. The aim was not perceived as being about competing, but about collaborating in mutual beneficial ways. In comparison to manufacturing, the construction sector is not seen to be as severely impacted by the shift to low cost economy because the workforce has to be where the building is erected. Since the EU expanded to include former Soviet bloc countries in May 2004, more than 292,000 East Europeans have worked in the UK (Construction Manager, 2006b). As a whole, globalisation brings its own consequences for the quality of products, workforce issues (for instance
health and safety practices or the integration of the workforce) as well as wider challenges to do with social and cultural integration.

**Vulnerability and security**

Vulnerability and security issues manifest themselves at personal, corporate and national levels. Vulnerability and security is often seen as an accumulation or consequence of the previous issues, representing a manifested struggle between the have and the have-nots of the modern globalised world. Participants suggested that most remedies (especially at national levels) were out of their hands and require greater leadership and action by governments (for instance to control terrorist threats). Designing more secure facilities and moving some work into more secure locations through techniques such as modularisation were perceived to be practical ways to alleviate this problem.

The next section presents two example scenarios of the construction industry in 2026.

### 4. Scenarios for Construction

The scenarios have been developed by building on the common themes of increased construction related legislation, increasing use of a variety of technologies and changes in construction education. They are deliberately positioned as two extreme views where the same issues have resulted in considerably different futures. Providing two extremes in this way is a common feature of future scenarios methodology and highlights another important issue regarding such studies – that the implications of factors such as technological change can be positive or negative depending on an organisation’s or individual’s position within construction as a whole. The scenarios offered here (and summarised in Table 1) go a little way beyond many of those contained within the future reports reviewed, in thinking through the different outcomes which might result from a similar combination of future events and influences. The methodology underlying the development of such scenarios within the Big Ideas project is presented in Harty et al. (2006b).

#### Construction in 2026: Scenario 1

Increased legislation and regulation of both building performance and the activities of construction, at national, international and global levels over the last two decades have opened up new markets for UK construction firms. Common standards allow expansion of the national construction sector into a global arena. Construction professionals who are able to navigate this legislation are in great demand. A significant shift towards a holistic, lifecycle based approach has brought together design, construction and facility management. It has also integrated a previously fragmented landscape. Work allocation has shifted from short-term construction to long-term service provision. This has also allowed construction firms to expand their competencies into new areas of facility operations and management.

Shifts in technology have also produced some radical changes. New materials and ways of producing them have heralded the long anticipated switch from construction being a primarily site-based industry, to an off-site one. Greater economies of scale drive down the costs of building, as well as ensuring that sustainability is addressed through energy efficient, clean materials and processes. Today’s buildings are able to monitor, clean and maintain themselves using smart cladding systems, nano technology and intelligent computers. The predictability offered by manufactured components has replaced the uncertainties of previous bespoke methods. On-site technology has also introduced benefits. Robotic machinery working in hazardous areas has improved construction’s health and safety record to an impeccable standard. Common ICT systems coordinating work has made the construction process more transparent, allowing clients to gain a better understanding of construction methods, and to take a proactive role in design.

Education has played its part. The training of construction professionals is directed at producing more flexible and adaptable people, who have an understanding of the whole construction process, from design to FM and who are
aware of the benefits of using new materials and ICT enabled processes.

<table>
<thead>
<tr>
<th>Nature of Change</th>
<th>Scenario 1</th>
<th>Scenario 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Increased legislation and regulation</strong></td>
<td>Opens up international / global markets for UK firms by providing common standards</td>
<td>UK market opened up to foreign competitors</td>
</tr>
<tr>
<td></td>
<td>New competencies of construction professionals in ensuring compliance</td>
<td>Professionals become legislators rather than creative workers</td>
</tr>
<tr>
<td><strong>Whole life cycle approach</strong></td>
<td>Reintegration and consolidation of fragmented industry</td>
<td>Only a few large firms survive; SME’s all but gone</td>
</tr>
<tr>
<td></td>
<td>Consistent levels of work and income</td>
<td>Construction becomes a loss leader for FM and service provision</td>
</tr>
<tr>
<td><strong>Education in construction</strong></td>
<td>The same building is constructed again and again</td>
<td>Construction seen as an objective and IT driven process, at expense of creativity and inspiration</td>
</tr>
<tr>
<td></td>
<td>Traditional skills based on-site are lost</td>
<td>Professions as they stand are lost, replaced by ‘jack of all trades’</td>
</tr>
<tr>
<td><strong>Technology 1: Shift to more standardisation and off-site construction</strong></td>
<td>The industry rhetoric comes true</td>
<td>The same building is constructed again and again</td>
</tr>
<tr>
<td></td>
<td>Economies of scale can be generated</td>
<td>Traditional skills based on-site are lost</td>
</tr>
<tr>
<td></td>
<td>Standardised components reduce risk in construction</td>
<td>Construction work is colonised by manufacturing firms, both from UK and abroad</td>
</tr>
<tr>
<td><strong>Technology 2: Use of common Information Sharing platforms</strong></td>
<td>Construction process much more transparent and errors and delays resulting from communication problems eliminated</td>
<td>Competitive edge and distinctiveness / individuality of firms and professionals lost</td>
</tr>
<tr>
<td></td>
<td>Clients take a proactive role in design</td>
<td>Design becomes the reproduction of client expectations and internal innovation is stultified</td>
</tr>
<tr>
<td><strong>Technology 3: Automation and robotics</strong></td>
<td>Health and safety greatly improved by use of robots in potentially hazardous environments</td>
<td>Tradesmen are replaced by robots and traditional skills are lost</td>
</tr>
<tr>
<td></td>
<td>Higher accuracy and standards of work achieved</td>
<td></td>
</tr>
</tbody>
</table>

**Table 1 Summary of two scenarios**

**Construction in 2025: Scenario 2**
Increasing legislation and regulation at national, international and global levels over the last two decades has opened up the UK market to intense competition from foreign competitors at the expense of UK based firms. Common standards have tightly constrained construction practices, and construction professionals’ main activities consist of wading through this extensive regulation. A significant shift towards a holistic, lifecycle based approach has integrated design, construction and facility management and has resulted in the survival of a small number of large firms which manage the whole of the construction and FM process. Specialist SME’s have all but disappeared from the sector. Construction itself has become a loss-leader into more stable and predictable FM and service provision. Shifts in technology have also produced some radical changes. New materials
and ways of producing them have heralded the long anticipated switch from construction being a primarily site-based industry, to an off-site one, pushing site-based skills into terminal decline. This is causing severe difficulties in maintaining and repairing older buildings. The increased use of manufactured components has also allowed firms from outside the traditional construction sector to enter and increase competition further, resulting in a move away from bespoke and individual buildings, much to the detriment of the built environment generally. On-site technology has also brought about change. The use of robotic machinery to undertake work in hazardous on-site areas has sealed another nail in the coffin of the traditional trades. Coordination of design and construction activities by powerful, common ICT systems has led to even more standardisation of process, at the expense of the subjective and creative abilities of construction professionals. Novelty and innovation are severely stilted.

Education has played its part. The training of construction professionals is directed at producing people with an understanding of construction as an IT driven process, where accountability is directed towards standards and regulation rather than the aesthetically driven architects and engineers of the past. Traditional disciplinary distinctions have gone.

5. Conclusion: Way Forward
The initial stages of the ‘Big Ideas’ project suggest that addressing and/or alleviating problems associated with future issues requires active participation from individual stakeholders and an understanding of the complex interconnections between issues. This would make possible a holistic view of potential chains of causal relationships which permit stakeholders of the future to introduce well-informed policies and intervention strategies whilst also considering their potential knock-on effects. Interestingly, the findings of workshop suggest that future issues are stakeholder-sensitive, that is, depending on their stand-point a future issue could be an advantage or disadvantage. For instance, ‘global warming’ might lead to stricter regulations, but also more development of infrastructures for introducing and exploiting alternative energy sources. Developing scenarios of possible construction futures will stimulate discussion, debate and raise questions amongst multiple construction stakeholders. This exercise could certainly bring positive benefits in terms of engaging the sector in processes to shape a better future for all.

The next stage of the research will develop a number of alternative future scenarios based on verified future issues and validated interconnections between them, using a series of multidisciplinary workshops across various stakeholders of the future of construction. The information produced through the research will be used to develop an interactive IT tool which can be used by industry stakeholders to simulate scenarios and enhance their abilities to think about longer time horizons. Ultimately, this could allow them to have better control over their futures.

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