

CIB2007-277

Towards Sustained Competitiveness in UK Construction: A Multi- Methodological Approach

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ABSTRACT

The world in which we live and work is a rapidly changing place, and only by looking ahead can we prepare ourselves today for what might happen in the future. An ongoing three-year research project at the universities of Loughborough, Reading and Salford is now at the half-way stage and the three institutions have worked together in a complimentary and collaborative manner in order to fulfil the project objectives and produce some initial preliminary research findings. The objective of the research is to identify and understand the challenges and opportunities confronting the UK construction sector over the next 10 to 20 years and to investigate ways to mitigate and/or exploit them. To date, 24 workshops have been conducted and nearly 70 causal maps and future scenarios produced. In addition, case histories have been developed to reveal the unique contexts of a range of collaborating organisations and what this means for their strategy and competitiveness. A series of system dynamics models have been developed which convert a firm's characteristics into a 'competitiveness index', which can then be used to help firms understand and hence be more successful in the unfolding landscape of the construction marketplace.

KEYWORDS: Futures, Case Histories, Competitiveness, Mapping System Dynamics

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1.1 INTRODUCTION

In most countries the construction industry contributes significantly to national GDP and provides employment to a large number of the working population. It has also frequently been berated for both its failure to meet customer demand and for poor performance (Latham, 1994). Many people inside and outside of the industry (Egan, 1998) perceive that the industry particularly lags behind in adopting innovative new technologies, working practices and processes. Construction is considered to be ineffective at planning for the long-term future, and to lack forward thinking (DTI, 2001).

Recent future-oriented reports and studies in construction have called for the industry to expand their business planning horizons by looking beyond their next projects to prepare themselves for potential future events and trends (Harty *et al*, 2007).

Existing futures studies generally look ahead or envision what the future will look like (Soetanto *et al*, 2006). These studies do not necessarily aim to predict what will happen, but try to encourage debate about the issues that will affect the future so that they can be prepared for. They are considered as an early warning system, a way for people and businesses to visualise the future some years (10 or 20 years) from now (CIRIA, 1999). A criticism of many future studies is that they tend to start 'from scratch' as if there were no previous work within the area (Flanagan, 1999). As a result, there is little effort to build cumulatively on this body of previous work or to evaluate improvements which could be made to the future methodologies.

Despite these weaknesses, existing futures studies do however recognise at least the possibility, if not the certainty, of wide-scale change in the next 10 to 20 years which could significantly alter the current contexts in which construction work is undertaken (Harty *et al.*, 2006). Factors both internal to the industry (such as new materials and construction techniques) and external (such as climate change and demographic change) could introduce new problems (and opportunities) for the construction sector in the coming decades. These developments suggest that radical as well as incremental change may be both required, and/or thrust upon us. The only thing that is certain, is that the future will be different.

1.2 'BIG IDEAS' PROJECT AND RESEARCH METHODOLOGY

'Sustained competitiveness in the UK construction sector: a fresh perspective', or the *'Big Ideas'* for short, is a UK government-sponsored collaborative research project between the Innovative Manufacturing Research Centres at the Universities of Loughborough, Reading and Salford. The objective of this 3-year project is to engage with industry to identify and understand the challenges (and opportunities) facing the UK construction sector over the next 10 to 20 years. The project is founded on the contention that research in support of the competitiveness of the UK

construction sector needs a fresh impetus, and that there is little evidence to suggest that previous research has improved the competitiveness of the construction sector as whole. That is, previous efforts have been sporadic, piecemeal and have failed to take account of the structural and cultural fabric in which the construction sector operates. This calls for a need to reconnect the current research agenda with the actuality of the construction sector. The research embraces four inter-connected work packages (WPs) as follows:

- WP1: Identifying key issues which could shape the construction industry over the next 10 to 20 years and establishing a range of possible future scenarios based upon groupings of their interdependencies;
- WP2: Grounding the project in a thorough investigation of the current structural and cultural configurations which shape the manner in which strategic competitiveness is enacted in practice;
- WP3: Creating an interactive IT tool to explore and simulate a number of these future issues and scenarios;
- WP4: Developing appropriate strategies and policies at both industry and firm levels to help organisations prepare for the future.

These four Work Packages (WPs) are all complementary and inter-linked, as shown in Figure 2.

1.2.1 WP1: Where are we going?

The initial stages of this WP involved reviewing the many construction futures reports which had been published in the last 8 years, the majority from the UK but also some international work (Harty *et al.*, 2007). More than 300 separate issues were identified from this literature and content analysis was used to group these in high-level 'clusters' of related issues (Soetanto *et al.*, 2006). These issues were used as a basis for identifying emerging themes in the data collection exercise, which was aimed to capture people's perceptions and interpretations of future events in industry workshops, in the form of causal maps (Eden and Ackermann, 2001). Causal maps, constructed by two to four individuals in a group setting, exhibit 'cause and effect' relationships between events (and also concepts, factors, barriers and enablers). From this, emerging future scenarios for a particular theme can be identified. These workshops, lasting from between 1½ to 3 hours, have yielded detailed maps of issues, drivers and barriers, together with an associated recorded verbal narrative of the maps (Harty *et al.*, 2006b). To date, separate 24 workshops and interviews have been conducted, generating nearly 70 different causal map future scenarios. The majority of the workshops have been organised jointly with construction institutions and their members, such as the Institution of Civil Engineers (ICE), Constructing Excellence (CE), Health and Safety Executive (HSE), Chartered Institute of Building (CIOB), European Construction Institute

(ECI), Construction Industry Council (CIC) and the Department of Trade and Industry (DTI).

The workshop data produced has then been converted into pictorial maps (using the software Decision Explorer™) and an associated textual explanation of the scenarios. This then permits further analysis and validation of the data.

The purpose of these scenarios is not to predict which is going to happen, but to generate open discussion and to stimulate learning amongst practitioners and policy makers so that plans can be put in place to ensure that the industry progresses towards the more 'desirable' future, whilst simultaneously being aware of the risks associated with the 'less-desirable' scenario. When discussing possible future scenarios, it should also be remembered that one individual's 'desirable' outcome can often be another's 'undesirable' outcome. Even successful strategies may have unintended consequences for the businesses that they effect.

1.2.2 WP2: Where have we come from?

The environment that contracting firms operate in is constantly changing, with multiple challenges. Firms are faced by the apparent paradox between recursiveness and adaptation (Jarzabkowski, 2003). Providing both a stable yet challenging environment for professionals is important. Likewise, offering clients and the supply chain security and low risk, yet also demonstrating an innovative approach to projects also finds relevance. Such concerns are compounded by an industry continually seeking change whilst attempting to reduce uncertainty.

Whilst mindful of these issues the research team at the University of Reading have engaged with regional contracting firms in the UK to understand how they operate within such an environment. Such firms undertake the majority of construction work in the UK, yet their voices go relatively unheard. Within this population, the research has focussed upon what each firm has, what each firm does, the shared activity of the managers within each firm and the firm's historical development. As such, WP2 draws upon the broader strategic management literature of strategy-as-practice (Johnson *et al.*, 2003) and its cousin dynamic capabilities (Teece *et al.*, 1997). Semi-structured interviews have been carried out across the management structure of the case study firms. These have been transcribed and coded using Nvivo 7 software. A coding template, informed by the broader strategic management literature highlighted, was used to understand it's relevance in practice.

What has been evident is that each firm has a unique story, whereby competitiveness has been enacted very differently depending upon context. An example is provided by the 40 year development and diversification of a civil engineering firm, whereby it's strategy and procurement are intertwined. The firm, partly through serendipity and partly as a response to changing market forces, now has a number of divisions including social housing; maintenance, and building. However, this

diversification has occurred far more through evolution than by any long term strategic plan. The firm has had the capability to respond to changes in market demand and has been able to reconfigure the resources and capabilities it has in order to behave opportunistically. The firm has adapted to numerous procurement methods whilst pro-actively developing new methods in order to offer clients additional benefits. Generally, contracting firms currently operating, and particularly those with a longer history still operating are extremely good at adapting to changing structural issues within the industry.

In addition, these firms have the capability to reconfigure the manner in which they work, often very quickly, although usually opportunistically rather than strategically.

Initial findings suggest there is a strong resonance between how strategy is enacted and the strategy-as-practice literature, whereby strategy is seen as a pattern within a stream of goal-directed activity (Jarzabkowski, 2005). Whilst many of the findings from WP2 will be used to inform work packages three and four, the findings will have individual merit. Understanding how the structural and culture forces impact upon the activity of strategy will provide the case study firms a previously unseen insight into their operations.

1.2.3 WP3: How are things interconnected?

Findings from WP1 and WP2 are being used by the University of Salford for the development of grounded models of sustained competitiveness of the UK construction sector, predominately using system dynamics (SD) methodology. SD methodology is a time series simulation that incorporates non-linear relationships and allows the feedback of information at each time step, to show the inter-relationship of activities and bodies within a given system.

WP3 have also interviewed a number of organisations that build social housing and/or manage social housing projects, with the aim of understanding their mental models of the construction industry. These interviews have investigated both how the public housing industry works, how it has changed in the past and how it is expected to change in the future. The adopted approach enables the complex interrelationships between issues to be investigated in a methodical rather than an intuitive way. The modelling of 'What-if?' scenarios should provide insights into the issues facing the construction industry over the next 10-20 years. These dynamic model simulations will consequently enable construction organisations to improve their strategic approaches to envisaged change and sustained competitiveness.

By analysing the data from WPs 1 and 2, a high-level map of a firm's resources and factors that impact upon them was constructed (Quigley et al, 2006). WP3 converted this map into a series of models, from a variety of theoretical perspectives, which convert a firm's characteristics into a competitive index (CI). This metric can then be used to help indicate which

firms in the construction sector are most competitive, and correspondingly win more of the available contracts.

The example model in Figure 1 shows construction contracts flowing into the market, where they are won by companies dependent on the relative 'competitive index' of each firm (firm A, B and C). Each firm has a maximum 'WIP (Work In Progress) Capacity Constraint', and any level of WIP above this will lead to tardiness in completing and/or starting contracts. A firm's competitive index (CI) is affected by tardiness in either the starting or completion of any contract.

The model starts in equilibrium, and changes in the CI of each of the 3 firms can be made to investigate the impact of a firm's competitiveness on market share and the number of new orders won. An increase in a firm's relative CI will result in more contracts won until the firm's WIP Capacity Constraint is reached, at which point tardiness in starting and completing contracts results. This leads to a decrease in a firm's CI and hence the number of new contracts won compared with their competitors. This cycle continues to repeat itself with a decreasing magnitude, as the model tries to find its original equilibrium.

Future work in WP3 involves modelling the different areas of the UK construction sector and how these are expected to change in the future. This work will enable the models to give insights into behaviour that firms can adopt that may help in them being both competitive and sustainable. This work will then be expanded to look at how the UK construction industry as a whole can be competitive and sustainable in a changing environment.

1.2.4 WP4: How do we get to where we want to be?

The three partners will work together in the final 12 to 18 months of the project to deliver WP4, which is just beginning. This final WP will use soft systems methodology (SSM) and SD as a participatory means of identifying the desirable and feasible changes arising from the first three WPs. SSM is best understood as a process of enquiry; its use in conjunction with SD modelling combines an interpretive standpoint, accepting of multiple perspectives, with a recognition of dynamic causal interconnectivity. This guiding framework provided by SSM will ensure that the implementation

strategies devised in WP3 fully take into account the contextual reality of the sector as explored in WP2 and the future scenarios identified in WP1. The combination of SD and SSM is powerful because it counters the main criticisms when the two methodologies are used in isolation (Checkland, 2001).

Systems models will be derived from semi-structured interviews and compared to the SD models in industry workshops. The differences between the models and opinions will provide the structure and substance for an organised debate. Such a process is important when discussing strategies for moving the industry from where it is now to a desired future

state. The debate will also accommodate opinions from different interest groups, which is vital in a sector long characterised by conflicting agendas and a myriad of representative bodies.

Contribution to development

These models, interviews and opinions will consequently form the data from which the WP deliverables will be developed. These include a 10-year research agenda for the academic community, EPSRC and IMRCs, strategic guidance for industry and individual companies for the implementation of innovation-based competitiveness and an improved capacity for strategic planning aimed at individual companies within the sector.

1.3 WORK PACKAGE INTERCONNECTIVITY

The interconnectivities between the WPs is illustrated in Figure 2. WPs 1, 2 and 3 all contribute to one another, and all three then feed into the final work package, WP4.

Interconnectivity 1: Understanding the activity of strategy, what managers do and how firms are able to reconfigure the resources they have to changing environments (developed by WP2) is being utilised by WP3 to help them build their model of a '*sustained competitive construction sector*' and to develop an industry sector competitiveness index using Systems Dynamics (SD). Additionally, the broader structural and cultural developments which influence the historical path of the firms inform the wider industry level understanding offered by the SD model.

Interconnectivity 2: The future scenarios and causal maps identified and developed in WP1 will feed into, and be used for, the futures SD modelling

in WP3 to enable complex interrelationships between issues to be investigated in a methodical manner. This will help place the firm level issues into a wider context geared toward possible future scenarios.

Interconnectivity 3: The government construction futures reports reviewed and analysed in WP1 have been used by WP2 to investigate whether the development paths of UK regional contractors have been influenced by these initiatives. Likewise, how the actions of those contractors has played a role in influencing the broader structural drivers within the industry is discussed.

The three partners will then work together towards the end of the project to combine the outputs of the 3 WPs, together with soft systems methodologies and industry interviews and workshops, in order to deliver WP4. The implementation strategies developed in WP3 will take into account the contextual reality of the sector as investigated in WP2 as well as the future scenarios identified in WP1.

In addition to the internal connectivities, the Big Ideas has also benefited from, and will continue to do so, close cross-pollinating linkages with a number of other construction futures research projects and teams, in particular:

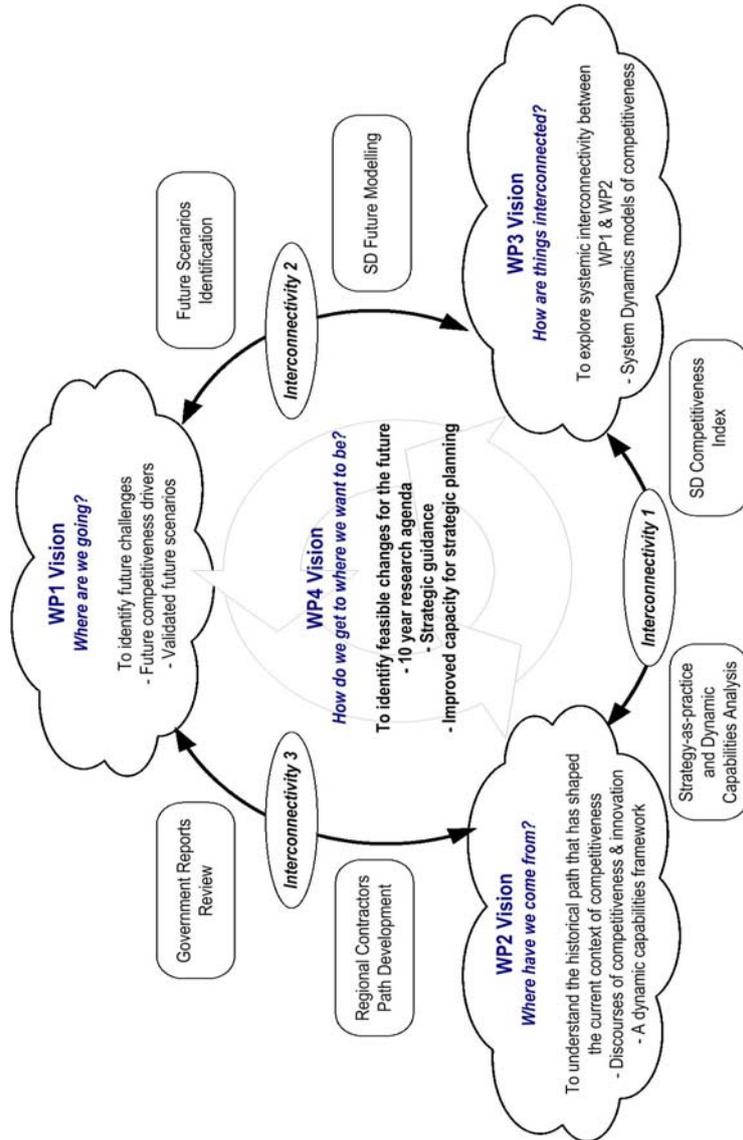
- DTI OSI Foresight SEMBE (Sustainable Energy Management in the Built Environment) (www.foresight.gov.uk/Energy/Energy.html)
- BRE/Defra/AEA Technology: Developing a Strategic Approach to Construction Waste- 20 Year Strategy (BRE, 2006)
- ECI Construction Futures Task Force (www.eci-online.org)
- HSE (Health & Safety Executive) Horizon Scanning Unit (www.hse.gov.uk/horizons/)

1.4 FUTURE WORK

The work for WP4 will now progress in the final year of the project, the main aim of the work package being to improve the capabilities of construction firms for strategic planning. This is an area considered as weak within the sector, an argument borne out by the analysis of the case studies conducted within WP2, and is especially pertinent given the range and significance of potential challenges the sector may face over the coming years, identified within WP1.

Using the insights emerging from WPs 1-3 a strategic planning tool will be developed, and then this will be piloted with specific construction firms or clusters of firms. In addition, areas where academic research can support and further develop this capacity over the next ten years will also be identified. The specific deliverables for WP4 were outlined in section 1.2.4.

Figure 2. Big Ideas project WP inter-connectivities (courtesy of C.Kao and R.Soetanto)



One of the crucial aspects of WP4 is to effectively utilise the outputs and insights from the other WPs. WP1 is producing useful maps of important future issues, including their interconnectivities. This is useful in identifying potential challenges to work with for WP4, and also to give some

appreciation of interconnectivities and potential 'knock-on' effects of dealing with specific issues. The further development of a range of scenarios incorporating a number of interconnected issues and events will also be useful when working with industry to prepare them for different potential futures. The case studies produced by WP2 and the conceptual positioning of them will provide the grounding from which to begin to develop the planning techniques themselves, the strategic plans of industry collaborators resulting from them, and also frame the support activities to assist in the realisation of these plans. In a similar way to WP4, WP3 is taking outputs from WP1 and 2 to produce models of construction sector activities. By using the system dynamics simulations alongside the WP4 SSM modelling, this overcomes the criticism of using either in isolation (in term of being either too hard and abstracted, or too soft and descriptive).

SD simulation could also provide an alternative method of exploring the longer term consequences of strategic changes developed through the planning tool. The centrepiece of the dissemination strategy will be a major two-day conference to which leading researchers, industrialists and policy makers will be invited. The conference will be themed around the development of the 10-year research agenda to respond to the systemic map of issues emerging from this study.

1.5 CONCLUSIONS

This project has been, to date, a good example of how three Universities and Departments are working together to produce a body of work that is greater than the sum of it's parts. It provides an example of how WPs can be truly integrated, even if carried out at different locations, and how the cross-pollination of information between partners can contribute to the overall success of the project.

- **Where are we going?** 24 workshops and interviews have so far been conducted, generating nearly 70 different possible causal map future scenarios showing how the construction industry may develop in the future
- **Where have we come from?** A strong resonance seems to exist between how strategy is enacted within firms and the strategy-as-practice literature, whereby strategy is seen as a pattern within a stream of goal-directed activity
- **How are things interconnected?** A high-level map of a typical construction firm's resources (and factors that impact upon them) has been constructed which can be used to investigate different alternative future scenarios

In the final year of the project, the WPs will begin to produce realistic guidance for the UK construction industry, policy makers, government and clients which is grounded in the reality of the sector. This will consequently

provide them with the background, information, tools and techniques required for the companies and individuals to investigate, debate and consequently make more educated decisions regarding their future strategies.

1.6 ACKNOWLEDGEMENTS

The 'Big Ideas' is a collaborative research project between the Universities of Loughborough, Reading and Salford and is funded by the EPSRC. The authors are particularly grateful to the research teams at the 3 institutions who in addition to the authors of the paper include, S.A.Austin, B.Dangerfield, A.J.Fleming, N.Gilkinson, C.Gray, S.D.Green, C.F.Harty, W.P.Hughes, C.Kao, P.McDermott, L.Ruddock, A.D.F.Price and A.Thorpe.

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