Institution: University of the West of England (UWE), Bristol

Unit of Assessment: 16 – Architecture, Built Environment and Planning

Title of case study: Improved Performance in the Construction Supply Chain

1. Summary of the impact

The Construction and Property Research Centre (***CPRC***) has had an impact on supply chain collaboration, process improvement, and technology integration in the construction industry, primarily in the South West of England, but also nationally and internationally. Its impact has been enhanced by its leading role in four major regional knowledge exchange initiatives (Construction Knowledge Exchange, Future Foundations, Constructing Excellence and the Environmental iNet). Through these initiatives, ***CPRC*'s** research has contributed to the change in culture of the construction industry from 'adversarial' to more collaborative. This has increased capacity and improved performance of public and private construction clients, construction companies, specialist subcontractors, SMEs and individual professionals. By delivering training and on-line materials, and supporting the sector through numerous business consultancies and 'best practice clubs' it has directly influenced over 700 companies and 1700 professionals leading to streamlined construction processes, costs savings, reduced errors, and increases in efficiency, productivity and profitability.

2. Underpinning research

CPRC's underpinning research was developed in line with the key improvement areas identified in the 'Egan Report' (Egan, J [1988] *Rethinking Construction: Report of the Construction Industry Taskforce,* London, HMSO). The Centre undertook research to understand and promote best practice approaches in dealing with the endemic challenges facing the industry, through supply chain collaboration, process improvement and technology integration. Its research has been carried out in a continually evolving (and mutually reinforcing) series of fundamental research projects and action research partnerships (with industry stakeholders). ***CPRC*** has worked with construction practitioners to identify problems, develop theory, and produce and test practical solutions and tools. The research was started by *Martyn Jones*, then led by *Prof Ming Sun* and is now headed by *Prof Paul Olomolaiye.* Three other ***CPRC*** academics were centrally involved in this research from the early 2000s (see dates below), along with a number of external collaborators (as named on publications).

A key focus of ***CPRC's*** research since 1998 was **fragmentation and adversarial attitudes within the industry (i.e. problems in supply chain relationships and operations),** identified in the '*Egan Report'* as the source of the majority of the problems facing the sector. *Jones* conducted some of the first studies analysing partnering, and assessing progress towards the adoption of a collaborative culture in the construction industry (R1,2). Based on surveys of construction practitioners, he found they have some knowledge of supply chain management, but require a better conceptual understanding and more systematic approaches to change an essentially adversarial culture to a more collaborative one. His research on the delivery of social housing (funded by The Housing Corporation) resulted in a seven step model for developing new supply chain relationships, and guidance on how best to manage their sustainability (R2). In numerous publications, *Jones* focused on encouraging clients and main contractors to rethink their procurement strategies and adopt a best practice partnering approach. *Jones'* research has been widely used to advance knowledge and/or good practice in partnering (e.g. R1 has 161 citations, in academic and industry publications from the UK, Hong Kong, Sweden, Australia and elsewhere).

Meng's and *Vidalakis'* research (supported by a UWE PhD bursary and HEFCE) also studied problems **in construction sector supply chains.** *Vidalakis* focused on the applicability of logistics management in construction, and provided new understandings by studying the logistical functions of builders' merchants (R3). *Meng's* research on the development of supply chain relationships (with *Sun* and others) resulted in assessment procedures to help construction organisations to evaluate their existing associations and to identify key areas for further relationship improvement (R4). Both *Meng* and *Vidalakis* concluded with arguments for the adoption of more collaborative approaches. In 2009, *Olomolaiye* joined ***CPRC***, with a track record of research and industry engagement in construction best practice, undertaking research on the role of fostering deeper engagement between industry and higher education in the construction sector, and on sustainable

assessment criteria for building materials (R5).

CPRC also focused on Egan's other prime concern***: process improvement and technology integration in construction.*** *Sun's* EPSRC-funded research on managing change and dependency in construction projects provided new knowledge on task dependencies, and the strategies practitioners deploy to deal with uncertainty and change. A follow on study (a PhD undertaken by *Olawale,* supervised by *Sun*) included a survey of 250 companies that indentified key factors that inhibit time and cost control during construction projects, including design changes, risks/uncertainties and non performance of sub-contractors (R6). *Olawale* and *Sun* identified 90 mitigating measures that can be used as a checklist to help project managers improve the effectiveness of their projects, which will help to reduce delays, costs, quality defects, client dissatisfaction and damage to the reputation of the industry. Taking this knowledge further, *Sun* (again, funded by EPSRC) developed a change-management toolkit which helps teams to anticipate changes that may affect cost, time and quality, and to evaluate their impacts on a project before implementation (R7). The toolkit can minimize the negative impacts of necessary changes, and avoid unnecessary ones. Based on this knowledge, *Sun* and others also worked on two Knowledge Transfer Partnerships (KTPs). One, in collaboration with Waycon Precast Ltd (a company that produces pre-case concrete lift shafts), looked at process reengineering in the production of its precast concrete elements in order to reduce waste and achieve efficiencies in the production phase. The second, with Management Process Systems (MPS) Ltd (a Cambridge-based company that delivers best practice, information and knowledge management services to the construction industry through IT services via the internet), incorporated ***CPRC's*** research to develop an innovative cost/value measurement methodology for its online contract change management system, to improve contract management and sustainable design.

Key staff: *Martyn Jones*, Principal lecturer, 01-01-77 – 31/07/12; *Dr Christos Vidalakis*, RA/RF, 12/11/07 – 12/08/12; *Dr Xiannai Meng, PhD student, 1/10/05 – 19/06/08;, Prof Ming Sun*, 01/09/02 – 31/03/12; *Prof Paul Olomolaiye*, 01/11/09 – date; *Dr Yakubu Olawale, PhD student* 01/10/05 – 13/07/10.

3. References to the research

R1. Saad M, Jones M, James P (2002) A review of the progress towards the adoption of supply chain management (SCM) relationships in construction. *European Journal of Purchasing and Supply Management*, 8(3), pp. 173-183. http://dx.doi.org/10.1016/S0969-7012(02)00007-2

R2. Jones M and O'Brien V (2003) *Best Practice Partnering in Social Housing Development*. Thomas Telford Ltd, London. http://dx.doi.org/10.1680/bppishd.32194

R3. Vidalakis C, Tookey JE and Sommerville, J (2011) The logistics of construction supply chains: the builders' merchant perspective. *Engineering, Construction and Architectural Management*, 10(1), pp. 66-80. http://dx.doi.org/10.1108/09699981111098694

R4. Meng XH, Sun M and Jones M (2011) Maturity model for supply chain relationships in construction. *Journal of Management in Engineering*, 27(22), pp. 97-105. http://dx.doi.org/10.1061/(ASCE)ME.1943-5479.0000035

R5. Akadiri P and Olomolaiye P (2012) Development of sustainable assessment criteria for building materials selection. *Engineering, Construction and Architectural Management*, 19(6) pp. 666-687. http://dx.doi.org/10.1108/09699981211277568

R6. Olawale Y and Sun M (2010) Cost and time control of construction projects: inhibiting factors and mitigating measures in practice. *Construction Management and Economics*, 28(5), pp. 509-526. http://dx.doi.org/10.1080/01446191003674519

R7. Sun M, Fleming, A, Senaratne, S, Motawa I and Yoeh ML (2006) A change management toolkit for construction projects. *Architectural Engineering and Design Management*, 2(4), pp. 261-271. http://www.tandfonline.com/doi/abs/10.1080/17452007.2006.9684621 **- Available through UWE.**

Key grants

- **Managing Change and Dependency in Construction Projects**, EPSRC (System Integration Initiative), £205k, 2001-04, GR/R31874/01, *Sun* PI.
- **Concept to Completion Design Tools for Sustainable Buildings**, Technology Strategy Board (TSB), £259k, 2010-12, *Sun* PI.

- **IT in Support of Business Process Reengineering,** TSB and Waycon Precast Ltd, £117k, 2006-08, *Sun* PI.
- **Contract Change Management Software,** TSB and MPS Ltd, £101k, 2006-08, *Sun* PI.

4. Details of the impact

CPRC has had an impact on supply chain collaboration, process improvement, and technology integration in the construction industry, primarily in the South West of England, but also nationally and internationally. It has achieved significant changes in the construction industry's culture by disseminating its research through numerous means: at a 'macro' scale, through major knowledge exchange activities and at a 'micro' level through working with individual businesses and engaging in KTPs. It is worth briefly describing the formal KE vehicles for the Centre's research, to demonstrate the scale and intensity of activity.

On the strength of ***CPRC*'s** research track record and reputation it was, in 2004, invited to act as the regional hub for the two initiatives designed to bring about the required changes in the construction industry: **Construction Knowledge Exchange** (CKE) and **Constructing Excellence South West** (CESW). **CKE** was funded by the Higher Education Funding Council for England (£383k, to 2009); **CESW** was funded by the South West Regional Development Agency and Department for Trade and Industry (£1.1M, to 2012). In 2009, ***CPRC*** also began to champion **Future Foundations**, a partnership of regional and sub-regional stakeholders to promote sustainable construction. In 2010, UWE secured the **Environmental iNet** (note: *Olomolaiye* is ***CPRC*** lead, and was instrumental in the development of West Midlands Centre for Constructing Excellence) funded by the South West of England Regional Development Agency and the European Regional Development Fund (£1.07M to 2013), with an ERDF-funded extension to 2015 (£350k). The **iNet** is an initiative to support environmental goods and services businesses in the Region, and has already assisted over 100 SMEs in the construction industry.

The remit of these KE initiatives is wider than that of ***CPRC*'s** research (including, for example health and safety issues). However, the key foci are improving collaboration and streamlining processes, which has meant that ***CPRC*** has influenced the overall message and culture of these programmes and disseminated its research to considerable effect.

At **international and national levels *CPRC***, through its various initiatives, has channelled the combined voice of the sector in the region, acting as the 'melting pot' for best practice (S1, p.3, 1.7) and industry champion for 'Rethinking Construction'. It has had an impact through its participation in the National Board of Constructing Excellence, affecting policy formulation and implementation through its advice to the international Sustainable Construction and Innovation through Procurement (SCI)-Network. In addition, *Jones'* work on collaboration partnerships was the basis of recommendations to the 'Construction Reform Movement' and led to the development of 'Construction Best Practice Clubs' (CBPCs - comprised practitioners) across the UK. These clubs became one of the main KE vehicles for 'Constructing Excellence'. *Meng's* and *Vidalakis'* findings were also built into the Constructing Excellence National Demonstration Programme.

At the regional scale, *Meng*, *Vidalakis, Sun* and *Olomolaiye's* research findings were fed into local networks, training initiatives, business assists, films, online information portals and other means of communication appropriate for industry (e.g. S2). Through CESW and CKE ***CPRC*** delivered workshops and provided training to 1700 individuals and supported 778 businesses. It carried out specific assistance to 400 construction related businesses, in the form of consultancies and in-depth organisational assists, which are largely productivity and effectiveness reviews. Approximately 20% of these companies have national and international projects, so have a reach wider than the South West. The Centre has also led a network of seven CBPCs, helping over 30 local companies to adopt best practice and enabling the development of a 'same team' culture amongst stakeholders.

An independent review of the ***CPRC***-hosted CESW initiative, based on a survey of participants (large firms, sub contractors, professional service firms and public sector organisations), (S1)

found that it had led to:

- **increased levels of confidence in the Region's prospects for growth** by supporting the development of a stronger and more professional industry through strengthening supply chains, improving its image and developing local networks (S1, p.6);
- **a positive impact on the behaviour and processes employed within construction firms**: 75% of respondents reported better working practices and processes (S1, p.6);
- **improved awareness and understanding, and practical experience of supply chain integration:** 62% of respondents (S1, p.43);
- **improved awareness and understanding, and practical experience of collaboration with other firms/organisations:** 71% of respondents (S1, p.43);
- **modernised working practices and processes:** 67% of respondents (S1, p.49); and
- **increased profitability**: 51% of respondents (S1, p.49).

Since this review, these impacts have continued, with partners reporting that the ***CRPC***/CESW collaboration has: 'achieved remarkable levels of supply chain integration and collaboration'; and 'up-skilled our supply chain and provided essential support to SMEs' (S3). Bristol City Council reports that the collaboration resulted in its award of 'Client of the Year' at the South West Built Environment Awards, 2011 (S3). CESW's Director testifies that ***CPRC's*** input was 'substantial and critical in supporting us to achieve better supply chain integration (and) improved project and management performance…. Allowing the industry to access best practice and innovative approaches to construction procurement' (S4). The **iNet** has subsequently provided a similar platform for companies in the region: 100 construction SMEs have benefitted from 1700 hours of support in workshops or bespoke engagement. Partners have reported the development of 'a collaborative culture with businesses and local authorities', and have benefited from 'access to, and use of, quality research undertaken by the University' (S5).

At the micro scale, ***CPRC*** has **improved construction processes and helped firms integrate IT solutions**. The Centre's KTP with Waycon Precast Ltd. on the reduction of waste in the production of precast concrete elements led to: savings on outside contractors [text removed for publication]; increased efficiency [text removed for publication]; reduction in errors [text removed for publication]; and capacity to expand in new business areas [text removed for publication] (S6). Similarly, the KTP with MPS Ltd. produced a means of quantifying the tangible and intangible benefits of the contract change management system. The Director of MPS testified that the KTP provided '…MPS with a toolkit and a methodology to demonstrate the business benefits of using collaborative IT systems to support contract change management. Our customers can now measure the return on their investment' (S7).

Overall, through the development of new knowledge, and sustained engagement with the construction sector, ***CPRC*** has helped develop a more collaborative industry culture with improved systems and processes, ultimately leading to increased performance and profitability.

5. Sources to corroborate the impact

S1. Adroit Economics Ltd (2009) Evaluation of Constructing Excellence South West, Adroit Economics, Cheshire, Link. **– Available through UWE.**
S2. Best Practice films from CKE and Future Foundations http://www.buildsw.org.uk/clientsdvds
S3. Procurement Officer, Bristol City Council, Testimonial on the impact of ***CPRC's*** role in CESW. **– Available through UWE.** [1 on REF Portal]
S4. Regional Director, Constructing Excellence South West, Testimonial on the impact of ***CPRC's*** role in CESW. **– Available through UWE.** [2]
S5. Team Manager, Economy and Enterprise, Bristol City Council, Testimonial on the impact of the Environmental iNet, available from UWE. **– Available through UWE.** [3]
S6. IT in Support of Business Re-engineering: Exemplars of Industry-HEI engagement (Case Study), Construction Knowledge Exchange. **– Available through UWE.**
S7. Management Process Systems Ltd: Quantifying the Business Benefits of Contract Change Software (Report, 0870). **– Available through UWE.**