

Benchmarking IT in the construction supply chain

Report of a workshop organised by the Construction Productivity Network held at University of Salford on the 8 April 2008.

Speakers	Professor Terrence Fernando Jeremy Hutchinson Nick Bean	Scientific Director, Think Lab, University of Salford Bovis Lend Lease UCI
Chair(s)	Dr. Mark Sharp Dr. Jack Goulding	CIRIA University of Salford

THE ISSUES

Over the last decade, there have been significant investments in ICT (Information and Communication Technology) research in the support of deployment and creation of advanced IT systems with the aim of improving the competitiveness and innovation of the Construction Industry. Part of that research was carried out by industry in the way of 'self-innovation' but the majority of the research was carried out by academic institutions in collaboration with industry.

Industry participation, whilst costly, is extremely important by contributing practical experience to the research and helping to ensure it meets industry needs. The general sought outcomes of such research include; creating and advancing knowledge, maintaining and enhancing professional competence, configuring and generating knowledge for strategic purposes, ensuring knowledge exchange with other countries and industries, and informing and enhancing the quality of graduates.

To be competitive in today's markets, companies need to be innovative and continuously improving. In order to achieve this, the right practices, tools and environments have to be created to unleash creative potential, deliver superior performance and build a sustainable innovative culture. The recently published Fairclough Report highlighted collaboration between academia and industry as a key contributor to this matter. Although academia and industry have worked together for a long time, the question remains 'What specific impact does collaborative research have on industry, and how can it be assessed or measured?' Addressing this question will not only improve industry awareness but will also act as a catalyst to help stimulate a culture in industry which encourages innovation as the core driver for change.

LEARNING POINTS

1. Developing a co-located workspace using Remote Collaborative Visualisation (virtual reality) with instant access to information in different times/ different spaces could improve performance in the construction industry.
2. Using virtual reality could be invaluable, but the pressure of getting people to 'buy into' this could be difficult as direct cost savings or measurements of efficiency are often intangible.
3. Using a variety of IT systems and databases helps to make informed decisions to identify Performance Led Procurement in the supply chain.
4. The challenge in the construction industry is the wide range of projects which makes it difficult to drive through one set of guidelines to make one system work.
5. There are too many Construction organisations providing information on different aspects of the industry. There is a need for one portal which can signpost users and identify links. This would improve efficiency and collaboration.
6. The development and launch of UCI (Uniting Construction Information) will aim to improve the performance of the UK construction industry through sharing and collaboration.
7. More collaboration of information and data is required to allow greater transparency, increase confidence and reduce the need for repetition of information.
8. There is a need for investment to implement IT systems such as Remote Collaborative Visualisation in the construction industry. Additional research is also required to assess if IT systems can provide tangible savings (efficiency, performance etc).

Professor Terrence Fernando, Scientific Director of the Think Lab, University of Salford

- *Professor Terrence Fernando is the Director of the Future Workspaces Research Centre and the Scientific and Technical Director for the Think Lab at the University of Salford. During the last four years, he led a regional research centre on advanced virtual prototyping, involving the Universities of Salford, Manchester and Lancaster. This EPSRC/OST funded (£1.7m) project brought together the key research teams in the region to develop visualisation and simulation technologies for product design*
- *He has a broad background in conducting multi-disciplinary research programmes involving large number of research teams in areas such as distributed virtual engineering, virtual building construction, driving simulations, virtual prototyping, urban simulation, and maintenance simulation*
- *At present he is leading a group of researchers to deliver industrially relevant research projects for the engineering and the construction sectors. As a part of the EU funded Future Workspaces roadmap project, Prof. Fernando brought together over 100 companies and research centres, from areas such as aerospace, automotive, building construction, multi-modal interfaces, system architecture, networking, human factors etc, to define a 10 year European vision for future collaborative engineering workspaces. This work has now led*

to a 12M Euro integrated project to develop collaborative technologies for distributed engineering organisations

- *Prof. Fernando has also played a key role in the MOSAIC SSA project to develop a roadmap for developing mobile workspaces for engineering sectors. His leading role within the INTUITION Network of Excellence project is investigating how VR technology can be developed as a practical tool for various industrial applications.*

Advanced Technology for Supporting Collaboration between Multi-functional Teams

It is important to consider the context of collaboration where there is a need to think of people through support and training. There should be a common vision with agreed aims and objectives, information sharing and good communication to build shared understanding.

Using the example of the aerospace industry, what is the motivation for distributed working? Currently BAE has 150 sites throughout the world with an international network of 1,500 suppliers in more than 30 countries. Teams are permanently or semi-permanently based in Toulouse, but people are still needed to move around the world. In the future could it be more efficient for the work move to the people where distributed meeting and working is common

There are a number of ways in which to view this collaborative approach.

- Firstly there is the 'Data View' which brings different people with different software and systems. The challenge is to work out how this information can be collaborated and ask where there may be clashes or overlaps.
- Secondly, there is the 'Project Management View' where the challenge is to bring multi-functional teams together often through meetings or telephone conversations.
- Thirdly, there is the 'Conceptual Technology View' where Product Life Cycle Data Management is needed to bring people and data together in a collaborative space.
- Fourthly, there is the 'Time-Space View' where 'same place/same time' or 'different place/different time' can be used to achieve collaborative working.

From this point the focus should be Co-located collaboration (same place, same time) and Distributed collaboration (different places, same time). It is important to consider how we can create spaces to share ideas.

Co-located collaboration can include examples of co-located workspaces such as:

- The Think Lab at Salford University where presentations (same place, same time) or media conferencing (different place, same time) can take place
- A Disaster Management Lab where satellite data can be transmitted to a control room which acts as a hub to coordinate virtual reality information
- The Microsoft coffee table where PDA, images and data can be demonstrated to others in a shared space

- An urban planning project which is currently operating in the Black Country. Terrain data and information from Ordnance Survey can be represented as 3D information and through virtual reality viewed and shared by others in 'different time and different space'. It can be used to show phases of development, landscapes, and land use as a way of communicating ideas. This data is made available by using the virtual environment where pictometric data can be shared through regional projects which will feed into the regeneration agenda. This data is made available through multi-user interaction via your laptops; tablet PCs, PDAs in private and public workspaces.

Distributed collaboration is where collaboration can be achieved in different places but at the same time. People can be linked through large scale conferencing which can share information between participants about virtual artefacts in order to achieve understanding. This sharing and interacting with virtual artefacts can collaborate at three different levels.

- First level: CAD Data (accurate geometry) which includes multi-CAD collaboration (oneSpace.net) and PDM/PLM Systems (e.g. 3-D Live, DMU Navigator and TeamCentre)
- Second level: Graphical Data from CAD data to include polygons, SceneGraphs particularly if companies are not happy to share CAD data directly.
- Third Level: Pixel Data which sends graphic commands to remote VIZ services. This sharing of data at pixel level is called Remote Collaborative Visualisation which was demonstrated by David Yip during the presentation.

Remote Collaborative Visualisation is important as there is added security when companies do not want to share direct data. With the data explosion it is then possible for this information to be shared. The demonstration showed how one machine can generate images for different computers in different parts of the country which talk to each other and therefore information is shared and there is effective collaboration. It uses DCV which is faster than Citrix. Almost instantly laptops can pick up information from the main work station which holds the main copy of the information and then distributes this information to any number of machines. This software allows instant access to see data in different locations. The laptop only requires a low specification. In the automotive industry a main menu can allow other users to take a flight or view an object in 3D to collaborate design ideas.

This system has potential in the construction industry as it includes many potential technologies which will improve efficiency. There is the need however to work closely with end users.

Jeremy Hutchinson, Regional Head of Procurement & Supply Chain, Bovis Lend Lease

- *Jeremy Hutchinson is a qualified Chartered Procurement and Supply Chain Management professional specialising in construction, infrastructure and civil engineering.*

- *He has undertaken a number of senior roles most recently as the Regional Head of Procurement and Supply Chain at Bovis Lend Lease, and before this as Sourcing and Supply Chain Manager at Taylor Woodrow Plc, and through a number of procurement roles at AMEC including estimating, purchasing to more involved commercial support, procurement and supply chain management.*
- *At AMEC, Jeremy was part of a team who worked with Birmingham University on establishing a generic supply chain model to use to identify and target improvements.*

Using IT Systems to Make Informed Decisions

It is essential to have good links in a supply chain as this is a process of activities transforming raw materials into finished goods and services for use by an end customer irrespective of corporate boundaries.

Supply Chain Management is important as this can maximise added value, whilst reducing total cost across the entire trading process, through exercising control from a strategic position.

Performance Led Procurement is a fundamental process adopted to ensure the 'Added Value' in Supply Chain Management is achieved.

Tools are needed to Support Performance Led Procurement. These need to be fact-based to ensure good decision making and to have a view of key supply chain activity across the whole business. Tools help to understand a company's financial exposure and to identify performance of the supply chain across the whole business.

Benchmarks and accreditation need to be set and at each stage performance improvement is needed to optimise profits. Companies need to start with supply chain capabilities and see how this cascades down.

Tools are necessary to have business information held in one place such as the web and to prevent companies asking the supply chain for the same information from each project

Tools which already exist include the web which enables a good database of information (personnel, legal, financial) which helps to build confidence. Other tools include SpeCC and the supply chain database (via Hive) which tries to invest in high performers to include information such as company details, BLL rating and peer reviews.

Tools relating to workload and capacity can be internal or external. Internal includes Core Trade Comparison (CTC) which contains information on all UK Projects and Core Trade Analysis (CTA) which automatically extracts all the data from the CTC, identifies all contractors, shows workload over future years and identifies current financial exposure.

External Core Trade Comparison (CTC) includes information received from BLL key supply chain who receive the BLL pipeline every quarter and data entered into external CTC and split into trade specific worksheets. The external Core Trade

Analysis (CTA) includes data automatically extracted from the external CTC, it identifies all contractors, actual and potential workloads based on awarded and tendered information from CTC and also shows workload over future years.

IT Systems can be used to make informed decisions to benefit the industry by ensuring transparency of performance and levels achieved, by providing the support and justification to demonstrate decision making and enabling high performers to be targeted which results in supply chain investment in the areas of strength thus maximising added value.

The use of the Performance Led Procurement and the associated tools/systems allows the supply chain to be higher influencing and higher impacting, buying smarter and delivering 'the right product, on time, first time.'

Nick Bean, UCI

- *Nick Bean is a project manager with CIRIA; his areas of expertise include geospatial engineering and construction IT*
- *He has experience in producing the flood plain maps for the Environment Agency and managing dam-break projects for United Utilities and Thames Water. Nick has experience in providing guidance to engineers about geospatial engineering and data management. He is currently involved in a European proposal for the management and sharing of marine aggregate data*
- *Nick is involved in the Uniting Construction Information Technology (UCI) initiative, a DTI/BERR funded project to unite construction information technology. Nick is also chair of the joint ICE/ICES Geospatial Engineering board.*

IT in Construction – an Industry Perspective: Uniting Construction Information (UCI)

Currently there are a huge range of Construction IT organisations such as CIRIA, BSRIA, COMIT, the ncctp etc. from different sectors (government, academia and industry) all offering help, advice, research, examples of best practice in using ICT in construction and this creates overlap and a confusing array of options.

The solution is to establish a consortium – a virtual enterprise including all these organisations to represent the broad sectors of government, academia and industry. This consortium will provide a pivotal role in signposting users to the appropriate organisation.

The consortium would be called Uniting Construction Information (UCI) which will

- consist of organisations in the UK provide information and advice on the use and application of IT.
- provide a healthy level of overlap between their services.
- provide a coordinated service to industry through collaborative working, with the government and the academia.

The UCI vision is to improve the performance of the UK construction industry. Its mission is to establish an effective network of organisations in construction and this needs to be based on trust, sharing, collaboration and integrity.

The UCI will be launched in April 08 by a number of satellite events across the country and it can be visited at www.UCINet.info

DISCUSSION

The Chair(s), Dr. Mark Sharp and Dr Jack Goulding then opened the meeting to discussion.

Dr. Mark Sharp is the Process and technology lead scientist at CIRIA the largest independent research organization in the UK and CPN manager. His research interests are in Built Asset Management and Process Modeling. Mark coined the phrase 'Bundled Complexity' (theory) which is now gathering a following as an international research paradigm in its own right. Mark joined CIRIA from a London University where he had been researching complex models of asset management via advanced disparate fuzzy mechanisms. Mark also is involved with various research organisations and sits on the boards of Conseil International du Batiment (CIB), Construct IT and is also associated with various professional bodies including the CIOB and RICS.

Dr Jack Goulding is the Deputy Director of the Research Institute for the Built and Human Environment at the University of Salford. He is a Chartered Construction Manager by profession and member of several high profile bodies, committees, and boards within the UK and overseas. From a research perspective, he has worked on and led several national and international projects in the areas of IT, VR, strategy development, and Open Manufacturing, and has authored over seventy publications in these areas. He is the Editor of Construction Innovation: Information, Process, and Management; and has worked with several large construction organisations and SME's to develop, optimise and leverage their business strategies.

Q? How do you negotiate new IT systems with training partners and the supply chain?

A Companies negotiate with their peers and this is used as a tool to demonstrate value. The construction companies dictate how it should work, then lever them to adapt to their system but there is no one straight answer. We try and talk synergies, use the sector for learning and knowledge to demonstrate value added to clients. We also use the expertise of clients to improve performance. So in some ways it's a carrot and stick process. The scale of using IT of virtual reality will be invaluable but the pressure of getting people to buy into this system is challenging.

Q? Are you prescriptive about the software which the supply chain uses?

A There are some we don't use but we are pro-active with most systems so no we are not prescriptive.

But the problem is that construction companies have such a diversity of projects. Governments in countries like Denmark are imposing standards but this is the death of standards as projects are so different. You can only impose the lowest common denominator like BIW but other standards cannot be dictated. You cannot build a business around the 20% you've dictated. The main contractors won't use software because of the range of projects.

Yes, there are a range of projects so trying to drive through a set of guidelines is difficult. We can try to make systems work but it's almost impossible – there will be a transition period.

Investment is needed to help implement systems. We could not manage the diversity of projects without the help of BIW.

SMEs provide a service but they can not match the diversity of projects. They need help and so some SMEs are getting together with big developers to move it forward.

Q? How can we take virtual reality and apply it to specific areas like urban regeneration?

A When companies work in a distributive network, the work may transfer to virtual reality but 50% of our work is repair and maintenance, so we need to be able to send people to the site. In countries like Sweden the warehouse can be sent to the company to be maintained so perhaps virtual reality could take over?

No, in the fixing phase people must be sent to the site. One of the problems is we do not have the data available in the construction phase to be able to transfer it to virtual reality. We have millions of houses and sites with only limited historical data available unless someone with funding decides to collect and input this data it is not going to go anywhere.

We could use a 3D scanner to digitise sites but this is a long way off. We could set this as requirement for future build though.

Q? There must be ways of using virtual reality to be more effective. What models does the hospitality industry use as they refurbish their sites many times over in a life time.

A This needs to look at the lifecycle of fittings like carpets and lighting but this is a short term lifecycle and it mostly takes place due to things being old fashioned. It is far more difficult to take into account the lifecycle of buildings and structures, as some buildings have a 150 year lifecycle; it is no longer a 60 year life cycle.

You also need to take into account the social changes which affect the design of buildings, like 60 years ago we were building houses with toilets outside so we can forecast too far ahead.

Q? How do we see IT driving this? Big developers are using intelligent databases and virtual information is being used by academia and certain sectors such as aerospace. How does it go forward? Is there a research project here?

A In order to drive this forward, a large amount of data and information is needed to input into a virtual reality system. In the whole urban context and built environment, social issues such as crime and security as well as terror attacks will influence design so a formation model is needed to feed into the design process.

Q? How can this virtual information reflect quality of life?

A There needs to be stakeholder agreements and there needs to be investment to push forward this building formation model strategy.

Q? How do you demonstrate added value of selling virtual reality to the client? How do you deliver savings to the bottom line?

A In the aerospace sector it is more straightforward as they do not have the diversity of projects as in the construction industry. Processes are more complicated in construction as there is a lack of historic data.

Q? Could you contemplate a project without BIW?

A Supply chain management is difficult so BIW is essential. Systems give the opportunity to collaborate, but do these make us more efficient? It is very difficult to see where value added can be proved. If we could use virtual reality to market to the investor, this is perhaps where the value is added, but not all clients are happy with this as people do not buy houses off the web! Clients want to see what they are buying. It is not cost effective to include virtual information. The clients get a transparent model anyway, to give more virtual information would be too expensive.

Q? There seem to be links of collaboration but how do we manage this? Funding is needed to set up these links including dissemination of information. If there is an idea here, how can we take this forward?

A We perhaps need ongoing projects which measure the effectiveness of IT. Are there 'before and after' projects which attempt to measure value added? We need funding to assess who is doing what – perhaps £50,000 would fund a research project along these lines.