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Proposal for a Construction Industry Digital Competency Centre for Ireland

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Abstract

The Irish construction industry is facing a series of fundamental challenges that is affecting every player in the AEC lifecycle from architects to owners to tenants. Despite technology advances in recent years, the Irish construction industry lags behind other industries in respect to Information Communications Technology (ICT) investments. Despite a pressing need for innovation, procurement and tendering procedures in Ireland largely discourages new ideas and puts further pressure on wafer-thin margins that characterise the construction sector. This paper will reflect on the deliverables of the Construction Information Technology Alliance (CITA) in Ireland, which was formed in partnership between the Dublin Institute of Technology and the Waterford Institute of Technology in 2002. The paper goes on to describe the opportunities and challenges that the Alliance faces in creating a new Construction Industry Digital Competency Centre (CIDCC) in Ireland in 2009. It will, in particular, focus on the business case for such a centre within the Irish construction industry. The ultimate goal of the new centre is to develop ICT standards in the workplace, but also to provide the impetus to ensure that as many stakeholders as possible use these standards and thus build on the ICT competence of the industry.

Introduction

The construction industry in Ireland is very fragmented with a few major building contractors and a few major suppliers. Despite advances in ICT, the Irish construction industry lags behind other industries in respect of ICT investment (Hore and West 2005a). In order to address this problem, the CITA was formed in partnership between the Dublin Institute of Technology and the Waterford Institute of Technology in 2002. CITA is a member based organisation aimed at bringing together

academia and practitioners, with a common purpose to promote the application of ICT in the Irish Construction Industry (Thomas and Hore, 2003). CITA are currently responding to a call from Enterprise Ireland to fund ICT Competence Centres for the Irish construction industry. CITA have approached a number of interested parties within their membership to lead the application.

Since the inception of CITA, the organisation has had many successes in recent years, with receipt of funding for Industry Led Networks in 2006 (€400,000) and Skillnets funding 2008 (€433,000). The organisation was formally incorporated in 2005, and has a very strong network of Special Interest Groups, which collectively require funding in order to realise their full potential.

The purpose of this paper is to share the experience gained by the authors in managing CITA over the past number of years and to identify the main opportunities and challenges that face the organisation in seeking Competency Centre funding. The authors conclude with an outline of the research priorities for the newly proposed CIDCC.

Irish Construction Industry

The Irish construction industry is comprised of a wide range of small, medium and large enterprises and specialist service providers, who collaborate to deliver projects to industrial, commercial, private and public customers. In the most recent DKM "Review and Outlook 2007-2009" report large firms in the Irish construction industry account for 32% of direct construction employment, indicating that the bulk of construction firms are very small". The report noted that there are 63,000 firms with 50 or fewer people employed in Ireland. The majority of these firms have limited resources and have a low level of ICT proficiency (DKM, 2007).

Most construction activity is organised in a series of one-off projects. These projects are of a fixed duration and operate from a temporary location, i.e. the construction site. Traditional construction involves multiple teams from different disciplines and different companies coming together to work on a project.

There are some very serious challenges facing the construction industry, such as, changing economic climate, changing procurement practices, climate change, that are collectively motivating new approaches to how we design, build, operate, and maintain buildings and infrastructure. A recent study by McGraw-Hill Construction, (McGraw-Hill, 2007) indicated the following trends which will impact on the Irish Construction sector:

- Construction activities are becoming increasingly global;
- Driving influences are governance and legislation, environmental pressures, global finance, and new procurement methods ;
- Emerging and transitioning economies are fast becoming attractive building markets as well as formidable foreign competitors;
- Materials prices are continuing to escalate, placing a growing pressure on project costs and encouraging the shift to alternative materials;
- Construction industry leaders in Europe and the U.S. share concerns about the global workforce shortage, and they expect the situation to worsen in the next 5-7 years;
- The market for green building is significant and growing rapidly in both regions thanks to supportive legislation, market differentiation, and the growing pressure of global competition;
- Usage of BIM (Building Information Modelling) is significant and growing, but there remains a dire need for enhanced awareness about the need for interoperability and the benefits of digital design.

There are many millions of documents currently exchanged on paper in the construction industry, each having to be re-keyed as they pass between different locations and computer applications (DoF, 2002). Existing standalone software has facilitated improved electronic functionality with the use of Computer Aided Design (CAD), Enterprise Resource Planning (ERP), Project Extranets, Computer Aided Measurement and wide variety of Project management tools. However, the use of these tools is very fragmented and in most instances they are not interoperable. Modern IT developments such as Building Information Modelling and mobile computers are not widely adopted in the construction sector (Hore and West, 2007).

Competency Centres

In its Strategy for Science, Technology and Innovation 2006-2013, the Irish Government proposed the establishment of Competence Centres to address the key issue of building and reinforcing areas of strength within both industry and the academic sphere (DETE, 2004).

More recently a Competence Centre has been described by Enterprise Ireland (EI) as a collaborative entity established and led by industry and resourced by highly capable researchers associated with research institutions who are empowered to undertake market focussed strategic research for the benefit of industry (EI, 2008).

Presently there is a call from EI to establish Competence Centres that will collaborate with relevant centres of expertise on the island of Ireland, as well as establishing strong links with appropriate centres of expertise outside Ireland. Core funding will be committed by the State for five years, subject to performance reviews to ensure rapid and effective start-up and to give freedom to draw in new industry participants. Key criteria for continued funding during the five-year period will include, as well as industry engagement, the quality and long-term relevance to industry of the strategic research undertaken by the Centre.

In its establishment phase, the Centres will undertake a number of research projects, selected by the board in collaboration with the academic partners, to begin collaboration and to create a forum where the views of the participating companies can influence the direction of the research. In time, a Competence Centre will be expected to develop and gradually increase research co-funded by industry – a critically important indicator of relevance – until a significant level of industry funding is achieved. The Competence Centre should ensure its relevance to industry through having a board with a majority of members drawn from the industry members of the Centre. The board will also include leading senior Irish-based academic researchers in the relevant field who are actively collaborating with the Centre.

Enterprise Ireland vision of Competency Centres is shown in Figure 1. The vision includes a centre with an independent industry-driven research and commercialisation agenda, with support from research providers and company consortium. The governance of the Centre would include a Competency Centre Board with an industry Chairman, Enterprise Ireland representative and a Technology Advisory Board.

Figure 1 Enterprise Irelands Vision of a Competency Centre

To join the Centre, companies will be expected to pay a nominal, annual fee (set by the board). This should form the basis for establishing the Centre's industrial membership. The board will develop a policy on the costs associated with the participation of non-member companies. Any Irish-based company can join the centre as a member, subject to board agreement, including companies based in Northern Ireland. Companies based overseas may not become members but may participate in the work of the Centre, subject to board approval. The number of

companies participating should represent a significant proportion of the relevant industry sector or sectors involved, and SME participation (including membership of the board) will be encouraged.

Construction IT Alliance (CITA)

CITA was formed to focus on the promotion of ICT in the Irish construction sector. Having its origins in the Dublin Institute of Technology, CITA is now an independent company whose membership currently comprises in excess of 140 corporations drawn from a broad cross-section of the Irish construction industry, including architects, engineers, contractors, suppliers, clients, ICT companies, government departments, state agencies and third level institutions. The main source of funding originates from membership subscriptions with other income sourced from training courses and sponsorship of events. The main activities involve organising bi-annual member meetings, training courses, information dissemination through the organisations website and online newsletters and promoting the work of its Special Interest Group (SIG) network. The Alliance aims to encourage participants in the Irish construction industry to take full advantage of current and emerging ICT (Thomas and Hore, 2003).

CITA undertook the Construction IT Alliance eXchange (CITAX) project in 2006. The project was funded by Enterprise Ireland under the Industry-led Network Pilot Initiative (2006-2008). The overall aim of the CITAX was to facilitate efficient working between companies in this critical industry by the identification of five modules which clearly demonstrated that significant measurable economic improvements can be achieved by using readily available ICT tools to radically improve business processes in the Irish construction industry (DETE, 2006). The project delivered tangible business benefits to participant companies and provided supply chain optimisation to the wider network. The project was lead by five Enterprise Ireland clients who will specifically focus on the exchange of data between network members in five separate but collaborative modules, namely:-

- Module 1 - Production and exchange of CAD drawings.

- Module 2 - Production and exchange of trading documentation, such as purchase orders, goods received notes and invoices.
- Module 3 - The pricing of tender documentation electronically and recommendation of a preferred tender for selection.
- Module 4 - The storage, retrieval and general dissemination of project information on construction projects.
- Module 5 - The use of CAD software in the production of bills of quantities.

Figure 2 illustrates, at a high level, the methodology adopted in the project. CITAX has a clearly structured plan, describing tasks, schedules and responsibilities for each of the module teams. The project has been subject to a number of internationally refereed conference papers (West and Hore, 2007a; West and Hore, 2007b; Hore et al., 2007a and Hore et al., 2007b).
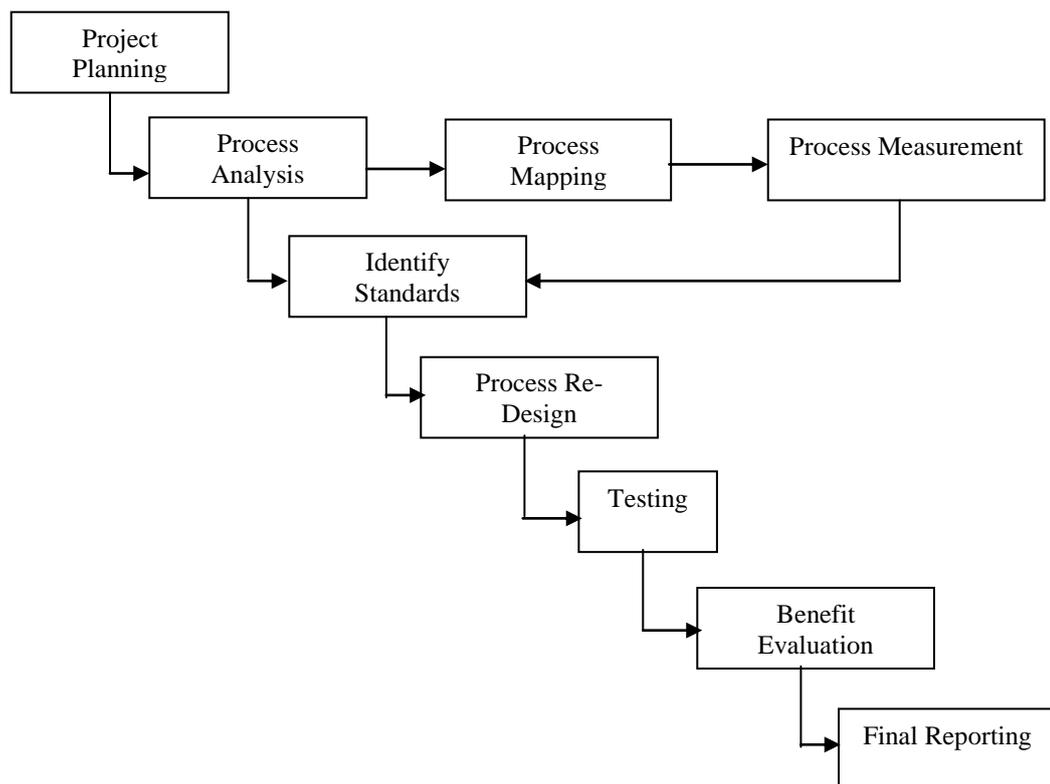

Figure 2 CITAX Methodology

Each module involved a Project Leader drawn from industry together with a cross section of companies from different disciplines, including the support of an academic institution. A listing of the participants in the CITAX project is shown on Table 1.

Module 1 Design	Module 2 Trading	Module 3 Electronic Tendering	Module 4 Project Collaboration	Module 5 Computer Aided Measurement
Lead: CCH Architects	Lead: Sentrio Technologies	Lead: Bruce Shaw partnership	Lead: John Paul Construction	Lead: M McNamara & Co.
HKR Architects Nicholas O'Dwyer VMRA Consulting Engineers Paradigm Technologies Dublin Institute of Technology Local Government Computer Services Board Delap & Waller	CRH plc Ascon Limited COINS RGC Technologies Kingspan Limited PVF Limited Trinity College PN Software	Building Software Services PJ Hegarty Limited John Paul Construction Limited Mulchay McDonagh & Partners Dublin Institute of Technology	Michael McNamara & Co. PJ Hegarty IFS Limited Primark Boyd and Creed	Building Software Services Boyd Creed Sweett Dedicated CAD Systems Waterford Institute of Technology Healy Kelly Turner Townsend Bruce Shaw partnership

Table 1. CITAX Participants

A significant milestone for CITA was the inclusion of the CITAX project as a Best Practice Example of Sectoral eBusiness Policies in Support of SMEs in the EU, which was published by the European Commission in 2007. One of the key findings of the report was that the essence of eBusiness is the substitution of paper-based processes with automated or semi-automated digital processes (EC, 2007).

The project is almost complete. Preliminary findings from the project demonstrate that there are significant opportunities for increased efficiency and effectiveness in the industry through:

- Accelerating the industry adoption of CAD standards, electronic commerce, electronic tendering, electronic collaboration and computer aided measurement within the Irish construction industry.
- Accelerating the industry adoption of product data standards sets that will support electronic commerce activity within the Irish construction industry.
- Accelerating the adoption of interoperable building information model-based software through testing and demonstration.
- To establish methods that facilitate the harmonisation of existing building information modelling efforts, shape future developments, and bring consistency to the construction industry's efforts to integrate the supply chain with common information models.
- To assist the Irish construction industries in developing and implementing interoperability standards and work process improvements that reduce the life cycle time, costs and risks through planning, design, purchase, fabrication, installation and operation of equipment used in the development and execution of construction projects.

Proposed Construction Industry Digital Competence Centre

CITA has shown in the CITAX project that it has the experience to initiate, manage and deliver projects that will make a substantial difference within the construction industry and for the industry's customers. The evidence for this can be seen in the work it is undertaking on the CITAX Project with major players in the industry. The approach taken by CITA from the outset was to ensure that the application was industry-led.

With this in mind CITA arranged to meet senior people in a number of major organisations within the Irish construction industry. Table 2 identifies the companies

that CITA engaged with in recent months together with the research interests indicated at the initial briefing of the individual firms.

Company	Nature of Business	Date of meeting	Research Interests
SIAC	Major Civil and Building Contractor	15th April 2008	Electronic Tendering Electronic Document Management System Integration
ARUP Consulting Engineers	Engineering Consultancy	21st April 2008	Project Collaboration 3D Modelling
John Sisk & Son	Major Civil and Building Contractor	15th April 2008	3D Modelling Handheld Devices Document Management
Murray O'Laoire Architects	Architects and Town Planners	24th April 2008	3D Modelling CAD Layering
Varmings Consultant Engineers	Service Engineering Consultants	22nd April 2008	Collaboration Software 3D Modelling CAD Layering
Jones Engineering	Specialist Building Services Contractor	24th April 2008	Planning Tools CAD Layering 3D Modelling Lean Construction
Bruce Shaw Partnership	Construction Project Managers and Cost Consultants	29th April 2008	Electronic Tendering Electronic Measurement Knowledge Management
Lafferty Design	Architects and Project Managers	30th April 2008	3D Modelling Platform Integration CAD Layering
HKR Architects	Architects and Town Planners	6th May 2008	3D Modelling Document Management
Mercury Engineering	Specialist Building Services Contractor	12th May 2008	Data Management 3D Modelling Collaboration Software eCommerce
Davis Langdon PKS	Construction Project Managers and Cost Consultants	13th May 2008	3D Modelling Computer Aided Measurement Knowledge Management

Table 2. Research Interests

CITA are required to set out a prioritised set of research themes. It is expected that three to five clear research themes would be set out, and the starting priorities for research for the consortium indicated. The themes need to be sufficiently broad to encompass the interest of all the companies in the consortium and be attractive to a wide range of companies outside the original group. The research priorities should be accompanied with recent technology trends, the rate of change in these trends and the scale of opportunity for companies. It will be open to applicant consortia to set out a broad technology framework if they focus on a small number of project areas that will allow potential research partners to put forward a plan of specific research projects based on those areas.

All of the companies agreed to jointly lead the expression of interest phase of the application. The following is a summary of the priorities identified by the lead companies.

- A consistent set of CAD layering standards.

- Interface software to convert non-standard design to industry layering standard.

- Building information modelling protocols and standards.

- Set of protocols, software and standards which enable electronic issue of tender documentation, computational checking, distribution to sub-contractors, preparation of tender, query and revision handling, submission and assessment of tenders.

- A consistent set of non-proprietary data standards for all trading transactions.

- Technologies that can support or enforce the implementation of standards.

- New technologies that can deliver information in a usable way to site staff will change working practices, minimise risk, and lead to more responsiveness from building contractors during the construction process. This will involve hardware as well as software developments as new types of devices will be required for site staff.

- New collaborative technologies need to be developed to facilitate better exchange and organisation of information between participants on construction projects.

It can be seen from the above list of research areas that there is abroad range of areas from which the promoters of the new centre will have to choose from. There are, however, three core research themes that the lead companies have identified at the early phase of discussions, namely:

- Building Information Modelling

- Document and Knowledge Management

- Project Collaboration

It will be intention of CITA to further explore these areas with the lead companies and perhaps to expand the themes to maximum of five for the duration of the initial phase of funding.

The major aim of the centre will be to achieve industry-wide implementation, because it is in this industry application that the value will be achieved for the participants. The key objective of the Centre will be to create standards and ICT products that will facilitate interactive working in a fragmented industry with many independent specialists. The lead companies will need to encourage the critical mass to adopt the standards and tools that emanate from the research themes chosen, to ensure that all participants in the industry will follow the leadership of these companies. Industry-wide adoption will be necessary to fully exploit the potential of the output from the Competence Centre.

It is intended that the companies involved will become more streamlined, with improved working practices that will make them more competitive both in the Irish market and internationally. In addition to delivering on the specific standards identified above, the Competency Centre will deliver:

- Clear business cases which will underpin the argument for implementation across the industry.

- International best practice knowledge, examples and standards.

- A deep knowledge base on construction industry software and information technology development.

- Industry process knowledge.

- Promotion of integration and efficient processes.

CITA has a great deal of experience in achieving many of the above deliverables on discrete Special Interest Group areas (Gunnigan et al., 2004; Hore and West, 2004; Hore et al., 2004; Hore and West, 2005b; Hore and West, 2005c and Hore and West, 2005d).

There will however be a number of technological challenges of this group:

- develop tools, protocols and standards which are non-proprietary and which facilitate interaction between participants in the industry;
- define and promote standards in data communications;
- through piloting, measurement and demonstration to promote building information modelling across the industry and
- identify and design services and products which will enable the participants in the industry to work collaboratively through the supply chain in Ireland and internationally.

Conclusions

The Competence Centre model should provide a forum for interaction between industry and the research infrastructure in Ireland, give access to specialist equipment, and be a top-quality environment for training people in postgraduate skills with direct relevance to industry, which will be eager to employ them. The Competence Centre should over time build in the State a competence in the relevant technologies and be recognised for the quality and industrial relevance of its research. The Centres have the potential to be drivers of technology change in sectors that are critical to the health of the economy. They will provide new, highly skilled people, insights into

technology trends, access to knowledge of importance nationally and internationally, and early use of valuable intellectual property.

The Irish construction industry will be the test market for this initiative, and Irish companies will be the first to utilise it, both in the Irish market and abroad. However, if the outcomes of the R&D activity deliver on expectations, the IDCC will become a leader in the field of digital construction with the potential to exploit this position through licensing of technologies, and from revenue generation initiatives. It will enable consortia to work more collaboratively and efficiently in Ireland, and thus enhance the prospects for Irish consortia bidding for overseas projects. It will also foster the development of software tool and products which will find an international market place, based on success in the Irish market- place. CITA is ideally positioned to lead the application for the expression of interest phase of the application. A great deal has been learned from the initial engagement of the leading organisations, who collectively keen to see the CIDCC realised.

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