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ADVANCING THE USE OF BIM THROUGH A GOVERNMENT FUNDED CONSTRUCTION INDUSTRY COMPETENCY CENTRE IN IRELAND

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ABSTRACT

The main aim of this paper is to develop the early case for a new Competence Centre dedicated to industry led research in the Irish construction industry. It incorporates the results of a survey carried out by the Construction IT Aliance (CITA) and also identifies similiar centres carrying out industry led research around the world. Results from the survey show a clear support for the establishment of such a centre in Ireland and, in particular, a strong interest in Building Information Modelling (BIM) as a immediate priority research area. BIM is having a profound effect worldwide on the construction industry. The development and adoption of BIM technologies is in parallel with other major changes relating to project procurement approaches, such as Integrated Project Delivery (IPD), and the general sustainability agenda. Although slow to take off in Ireland to-date, BIM is becoming extremely relevant in other countries, with over 50% adoption in the United States and an average of 36% in Europe. The authors argue that a government funded Competence Centre will facilitate the Irish construction industry in re-establishing itself, domestically and internationally as a competitive entity.

Keywords: Building Information Modelling, Industry, Competence Centre, Collaboration, Integrated Project Delivery, Sustainable Construction.

1. INTRODUCTION

Enterprise Ireland and the Industry Development Agency (IDA) of Ireland have in recent years called for the establishment of Competence Centres. Thus far, eight such centres have been funded. These include the competence areas of Bio Refining and Bio Energy, IT Innovation, Composite Materials, Microelectronics, Applied Nanotechnology, Food and health, Manufacturing Research and Energy Efficiency. Two additional centres are at different stages of completion, namely, Financial Services and Learning Technologies. The objective of the Competence Centre initiative is to fund collaborative entities established and industry led, to achieve competitive advantage by accessing the innovative capacity of the research community. They are to be resourced by highly qualified researchers associated with research institutions who are empowered to undertake market focussed strategic Research and Development (R&D) for the benefit of industry (Enterprise Ireland, 2010). The initiative seeks to foster co-operation between Irish companies and multinationals to work together in the R&D arena. The focus is on research with a direct impact on industry.

The Construction IT Alliance (CITA) has recently joined an industry led consortium consortia, of like minded organisations, to submit an application to the funding bodies to form a new Construction Industry Innovation Competence Centre (CIICC). Whilst there are many competing areas of research interest, CITA has identified BIM as one of a suite of research priority areas that requires urgent investigation as to its application within the Irish construction sector.

BIM, as a process, is having a profound effect worldwide on the construction industry, even leading to new forms of procurement, such as, Integrated Project Delivery (IPD). Although slow to take off in Ireland to-date, BIM is becoming extremely relevant with 50% of the industry in US and 36% in Europe (UK/Germany/France) now reported to be using BIM (McGraw Hill Construction, 2010). There are similar trends in Canada, Australia, Asia, and Scandinavia. In October 2010, the UK government announced that publically procured building projects in the UK will be required to adopt BIM (Morrell, 2010).

While designers, contractors and operators around the world are beginning to collaborate more efficiently using these processes, the Irish construction industry appears blissfully unaware or disinterested, lagging far behind in the adoption of these technologies and working procedures. This puts our industry at serious risk of becoming irrelevant in the global market, particularly at this crucial time when we need to export services and expertise.

This paper seeks to identify the level of support for the setting up of a dedicated Competence Centre focusing on industry led research and, in particular, the level of interest, within the sector, to investigate the greater potential of BIM in the Irish Construction . The results of a survey demonstrate that there is a great deal of interest in the formation of an industry led research centre funded by the Irish government and, in particular, the urgent need for business focused research in the area of BIM.

The paper seeks to achieve three primary objectives:

1. To investigate the level of support for the formation of a Construction Industry Innovation Competence Centre in Ireland.
2. To identify an early indication of the specific areas of research that should be prioritised by any future construction Competence Centre in Ireland.
3. To determine if there is a level of support in the greater use of BIM within the Irish construction industry.

2. CONSTRUCTION INNOVATION

In today's dematerialised global economy, the ability of a country to develop, adapt and harness its innovative potential is becoming critical for its long run economic performance (Krammer, 2009). In a report to BRANZ (an independent and impartial research, testing, consulting and information company providing services and resources for the building industry in New Zealand) by the Technology User's Innovation (TUI) research programme in 2010, it was outlined that innovation centres have four main functions, namely: commercialise R&D, help inventors, promote innovation and carry out research. Innovation centres are an established part of innovation systems for most countries. They play an important role in regional economic development, technology transfer, commercialisation of university research, promoting R&D by firms, and facilitating the development of knowledge-based industry clusters. Successful innovation centres, integrated with national and regional economic development policy are often located adjacent to a leading university with a critical mass of research capability that can facilitate commercialisation and incubation services (Fairweather, 2010).

Construction projects are getting bigger and more complex while the average productivity is not improving enough. It is essential to look at the means available, in order to improve efficiency and effectiveness of the construction industry. Technology is a key driver for innovating existing processes. In general, new paradigms of business practice have been the result of new technology developments in the manufacturing industry. Those in the construction department, however, are accustomed to traditional ways of conducting business. They lack the knowledge of other disciplines that might assist in better ways of running their business. Furthermore, a consensus has been formed that people with the same expertise in the same scientific and technological discipline have their limit in developing new ideas and new technologies in this area. The positive influence from other disciplines can inspire people to significantly improve their business performance, by providing chances to learn new ways of reasoning and problem solving (Kim et al, 2009). Kim et al describes how the importance of the so-called interdisciplinary or multidisciplinary research is increasingly recognised. Multidisciplinary (or interdisciplinary) research is defined as a study that relies on knowledge that has been available for a long time in one discipline that may prove to be a

breakthrough technology that can revolutionise the business practices of another discipline. A big opportunity exists for the significant level of improvement in the traditional construction processes based on learning from other disciplines.

Kim's outlook includes the establishment of Competence Centres or Centres of excellence, particularly in the construction industry. Multidisciplinary research and innovation could be achieved with the establishment of such a centre. A focus on a wide spectrum of multidisciplinary activities in the construction industry could be researched and developed, such as, eMarketing, e-Tendering, Building Information Modelling, Smart building, sustainable construction, innovative materials and products, off-site manufacture, eBusiness, logistics and supply chain management, Integrated Project Delivery (IPD), mobile and wireless technologies, lean construction, facilities management, document management, ICT for energy efficient buildings, knowledge management project management information systems and many more.

3. INTERNATIONAL RESEARCH CENTRES

An important aspect of this paper was to investigate the existence of international examples of construction innovation and/or Competence Centres. Table 1 summarises the results of this research.

Table 1: International Examples of Competence Centres

Location	**Name**	**Governance & Funding**	**Objective of Centre**
Australia	Sustainable Built environment National Research Centre. (Formerly Cooperative Research Centre (CRC) for Construction Innovation.	Government funded	Digital modelling. Industry publications. Environmental sustainability. Safety. Productivity.
New Zealand	Branz	Levy funding Industry funding	Research construction and design. Transfer knowledge to building sector. Good practice guidelines. Sustainability.
Finland	VTT Technical Research Centre	State owned research centre	Multi-technological applied research. Upgrade technology knowledge. Create business intelligence for stake holder. Enhance the international competitiveness.
Belgium	The Belgian Building Research Institute	Industry funded private research institute	Scientific and technical research. Supply technical information, assistance and consultancy to its members. Innovation and development in the construction sector.
UK	Construction Excellence	State owned research centre	Driving change agenda in UK construction. Setting up of think tanks. Deliver improved industry performance.
USA	Centre for Facilities Engineering (CIFE)	Industry funded and governed by Stanford University	Research in virtual design and construction of architecture, engineering and construction projects.

In addition, the authors investigated the existence of dedicated research centres focused on construction sector activity in the Republic of Ireland. A summary of the main research centres is shown in Table 2.

Table 2: Research Undertaken by Third level Institutions in the Republic of Ireland

Third level institutions	**Research Centres**	**Construction Innovation Related Research**
National University Ireland Galway	Energy Research Centre Galway Business innovation Centre	Energy Efficient Technologies. Renewable Resources.
Trinity College Dublin	National Digital Research Centre Trinity Haus (Innovation in Construction, Energy and Design)	Transport, Energy and the Environment. Materials and intelligent systems.
University College Dublin	UCD Urban Institute of Ireland	Energy & indoor Environment. Transport & Infrastructure. Urban Environment.
University of Limerick	Materials and surface Science Institute Stokes Institute	Materials and surface Science. Thermal Management. Energy Efficiency.
Waterford Institute of Technology	Construction industry Research and Knowledge Group. Materials Characterisation & Processing Group.	Current and Emerging ICT. eLearning. Knowledge Management. Structural Health Monitoring.
University of Maynooth	Innovation Value Institute	Innovation Management. Enterprise Architecture.
Dublin Institute of Technology	National Institute for Transport and Logistics. The Futures Academy	Environmental sustainability. New materials and technologies. Construction futures.
Dublin City University	Learning, Innovation and Knowledge Research Centre	Innovation in SME's. Knowledge Management. Digital Participation.
University College Cork	Sustainable Energy Research Group. Informatics Research Unit for Sustainable Engineering	Green building. Integrated Knowledge. Management systems. Clean room design. Integrated building appraisal. Software. Rational use of energy. Multimedia Information systems for building appraisal.

It is evident from the data presented in Tables 1 and 2 that the vast majority of research centres are located in third level institutions, where there is a readily available body of researchers at hand to carry out the research activity. It is also evident the funding models for these centres vary from fully government funded, industry funded, or a combination of both.

4. INVOLVEMENT OF THE CONSTRUCTION IT ALLIANCE

While much research has been carried into the use of ICT in construction in certain countries, such as, the USA, UK and Scandinavia, this area has largely been overlooked by Irish research institutions. Although much of the international research and work of these national centres is of use to Irish firms, the lack of specific research and an equivalent organisation prior to 2001 was regarded as a

contributory factor in the slow progress towards harnessing the potential of ICT in the Irish construction sector.

It was recognised that a number of countries had already established centres to identify and promote best practice in use of ICT in construction (such as Construct IT in the University of Salford in the United Kingdom). As a direct response to this gap of construction innovation activity CITA originated as a research project in the Dublin Institute of Technology with the vision of harnessing the potential of ICT in the Irish Construction Industry. CITA's aim is to encourage participants in the Irish Construction Industry to take full advantage of current and emerging ICT. Presently CITA is a company limited by guarantee incorporated since November 2005. It is owned and directed by its membership of in excess of 220 corporations drawn for a broad cross-section of the Irish construction industry, such as architects, engineers, contractors, suppliers, clients IT companies, government departments, state agencies and others. It has a strong academic membership drawn from Dublin Institute of Technology (DIT), Trinity College Dublin (TCD), Waterford Institute of Technology (WIT) and University College Cork (UCC).

CITA, with the support of Enterprise Ireland has a proven track record in research. One such project was the Construction Information Technology Alliance eXchange (CITAX) (2006-2008). This project aimed to facilitate efficient working between companies in construction by using readily available ICT tools to radically improve companies in the construction process in the Irish construction industry. The Enterprise Innovation Network (EIN) project (2008-present) is another project currently managed by CITA. It seeks to promote information technology, research and innovation in Small and Medium Enterprises (SME's) in the construction industry, In addition, the CITA Skillnet project is a dedicated training network, which includes a fully accredited master degree in Construction Informatics.

Because of its successful record since 2001 and its broad membership profile, CITA is uniquely positioned to act as a central mediator between all the relevant organisations on the formation of a newly proposes Competence Centre. CITA has already established a BIM LinkedIn group through its EIN network, with a particular interest in investigating the benefits of BIM and ideas for the general advancement of BIM for the Irish construction industry.

The Irish construction industry needs to consider the example set by our counterparts in the market, who have taken a proactive role in formulating policy and agreements around BIM. The Irish construction industry desperately needs to issue a joint policy on BIM; a statement to indicate to the public and private sector (especially potential clients in other markets), that Ireland is forward thinking. The CITA BIM group intends to take an active role in leading the development of BIM in Ireland. Some of the objectives and contributions of the CITA BIM Group to the Irish construction industry to-date include;

- Help develop a policy/statement on BIM to make members more aware of the importance of BIM.
- Carry out a survey/analysis of current state and the needs/requirements of the members.
- Coordinate with and advise other member organisation regarding issues related to BIM.
- Through research and information sharing, investigate the benefits of BIM, and provide ideas for the general advancement of BIM for our industry.
- Gather information on hardware/software and interoperability of programmes, particularly between disciplines, to support IPD.
- Arranged an "Open Day" demonstration with the main software vendors for members.
- Secure access and financial support to quality training, software and hardware on behalf of members, particularly subsidised training to upskill both employed and unemployed members.
- Support communications with the Irish construction and property professional bodies in relation to BIM, to help promote some joined up thinking in the wider construction industry, on this subject.
- Support communications to government, enterprise bodies and foreign clients, to "sell the BIM benefits & capabilities" of the industry in Ireland.

Although there is a lot of activity by this group, there is an over dependency on volunteerism and a lack of dedicated funds for approved researcher activity into BIM in Ireland. For the effort of this group to succeed, there has to be proactive support from all levels of the construction industry. The establishment of a Competence Centre would assist organisations like the CITA BIM Group to achieve their objectives by giving them a multidisciplinary innovation and research hub enabling them to research, communicate, train and educate a wide spectrum the Irish construction industry on BIM and other innovative processes.

5. THE SURVEY

A survey was conducted with leading organisations within the Irish construction industry to establish what specific areas of research the newly propose Competence Centre should focus on. The benefits to companies on the setting up such a centre were assessed, as well as, the impact that focused research would have on the construction industry. It was identified that a focus on BIM would bring greater efficiency to the construction sector. The survey sample consisted of 20 construction related organisations that supported the proposal for the establishment new Competence Centre dedicated to the Irish Construction industry. A 70% respond rate was achieved from the survey.

Table 3 presents the main findings from the survey. As can be seen from the findings, all respondents believe that the establishment of a dedicated research centre will have a positive impact for construction related companies in Ireland for a host of different reasons. They results indicated that a focus of research, particularly in the area of BIM, will bring much efficiency to the construction sector now and into the future.

Table 4: Main Survey Findings

Research Focus	**Organisational benefits**	**Impact of Research on Industry**
Building Information Modelling Integrated Project Delivery Software development Software as a Service Cloud Computing Energy Efficiency Green Economy Quality Control in building design Collaborative construction Lean Construction Whole Life Costing	Central location to network and collaborate with like minded professional Enhanced Business Development A shared knowledge and learning resource for construction innovation technologies Strengthen the link between academia and industry Training and education resource Better management of resources	Improved information production and exchange Reduction in waste and construction costs Development of expertise for global market Development of products and software for the construction industry Greater productivity and stakeholder input Promotion of innovation and technology on international market

6. CONCLUSION

This paper has presented a review of the relevant literature in respect to innovation, innovation centres and the specific role they play, in particular, the role of construction innovation centres. International examples of construction innovation centres were investigated. It shows that the establishment of such centres are prominent in countries, such as, the New Zealand, Australia, Finland, UK, Belgium and the

US and that these centres are proving a success in increasing efficiency, knowledge sharing and innovation capacity in the respective industries. The paper further outlines that an industry led proposal for the establishment of a new dedicated Competence Centre is viable and a much needed resource in Ireland. The survey conducted by CITA, conveys strong support for the establishment of such a centre and that a specific focus area of BIM should be at its core.

Whilst there is support for an interest in BIM research, the results indicate that the level of knowledge, use and proficiency are very low within the sector, which further supports the case for a dedicated research centre funded to focus on priority research themes, the results of which will provide greater competitive advantage to the Irish construction industry. It is recognised that it will be difficult for most Irish construction organisations to realise the potential of the opportunities in international construction. This is because of their relative inefficiency, small scale operations and limited R&D, technology and financial resources.

Success will depend on achieving internationally competitive levels of efficiency in delivery, common standards and collaboration to build scale, specialisation in depth in critical areas and market research. Industry leaders are aware of the magnitude of the challenge. Repeated industry surveys, conducted by CITA, have confirmed the key importance attributed to standards, lean construction, collaboration tools and document/knowledge management systems, in order to achieve these objectives.

There was widespread agreement that the sector would be capable of a much higher level of achievement than it is currently achieving, if it could unleash its full innovative potential. The sector has historically suffered from inconsistent profitability, invested too little in capital and, mainly due to its fragmented structure, it has invested too little in human resources and R&D. Real R&D expenditure has fallen and to a large extent the industry continues to rely on 1970's technologies. It remains largely configured around the traditional project model in which trades people, professionals, contractors and clients work in short term, lowest bid contractual arrangements that entail high financial risk and a danger of leading to increased litigation. If the sector is to achieve its full potential then substantial and systematic changes in its culture and structure are needed. This is turn, will require a range of innovations in business processes, as well as in technologies and products.

The vision for a dedicated Competence Centre will be to facilitate the Irish construction industry in re-establishing itself, domestically and internationally as a competitive entity. This vision can be achieved through the Competence Centre initiative led by Enterprise Ireland and IDA Ireland. This collaborative entity will be led by industry and focus on addressing technology threats and opportunities facing them in the medium term.

The development of a research centre funded by the Irish government that learns lessons from the experience of other national centres and government policies is necessary if the Irish construction industry wants to regain its competitiveness on the international stage.

The focus of research would include best-in-class technologies and processes in seeking to meet the new challenges in design procurement, assembly and construction and operation, which are considered fundamental to re-establishing growth within the Irish construction Industry.

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