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THE IMPACT OF BUILDING INFORMATION MODELLING (BIM) ON PROFESSIONAL ROLES, RELATIONSHIPS AND SKILLS IN THE ARCHITECTURE/ENGINEERING/CONSTRUCTION INDUSTRY

Kathryn Davies, School of Architecture and Planning, University of Auckland

SYNOPSIS

Building Information Modeling (BIM) is a relatively new approach for improving construction productivity and performance. Research in BIM has commonly focused on technical implementations and process change; little work to date has addressed the impact on and changes required of practitioners involved. The aim of this project is to explore how BIM implementation influences the roles and relationships of industry participants, in relation to new roles created as a result of BIM, and adjustments made to existing roles which occur with BIM adoption. By understanding how BIM affects industry participants, this research can offer guidance for companies establishing a BIM environment either through recruitment or training, or for individuals interested in a career in a BIM-active role. It can also provide recommendations for educators as to what curriculum development is required to fill BIM role/skill gaps, and highlight best practice around roles and relationships that will help facilitate more effective use of the technology and process solutions that BIM offers.

These objectives are addressed using a comparison of BIM environments in NZ/Australia, UK, and US, with a two pronged research approach in each region. New BIM roles are examined through a survey of individuals with a formal job description involving BIM (eg BIM manager, BIM co-ordinator) or acting as a BIM leader in their company. In parallel, case studies of BIM-mediated projects are used to explore the impact of BIM on practitioners with 'traditional' project roles (eg project manager, project architect), who do not have a specific BIM focus but who are working within a BIM project framework. Currently the majority of the New Zealand and Australia data have been collected. The project analysis for both strands uses a grounded theory approach. A qualitative software programme, NVivo was used to help in organizing and coding data.

Findings from the study to date suggest that BIM adoption in NZ/Australia is occurring in a highly hybridised process, rather than through a distinct transition as predicted by many proponents. Roles are evolving slowly as teams form and reform on different projects. Cross-pollination of ideas and experiences has a significant impact on how relationships change around BIM, and the development process is very dependent on individuals who may be champions or dampeners of change. Some companies that are considered BIM-active appear to be heavily reliant on the guidance and cohesion provided by single person. This suggests a fragility in the process that the industry may need to overcome. There is a high degree of uncertainty regarding what processes actually constitute BIM use. Pockets of innovation and activity exist that are not disseminated and transferred, both as a result of this ambiguity and because of fears around loss of commercial advantage and intellectual property issues.

KEYWORDS: Building Information Modelling, interactions, process innovation, professional roles, relationships

INTRODUCTION

Building Information Modelling (BIM) offers the possibility of prototyping of building design and construction options in a simulated system, before construction begins, leading to potential improvements in productivity, product quality and sustainability. Implementation of BIM is intended to transform the way the industry operates. As a result, skill sets and competences that have developed over many years need to be re-evaluated as the needs of industry change. Roles and relationships of participants are clearly important to BIM adoption, as one of the most commonly cited changes is the increase in collaboration and shift to integrated project teams (Owen, 2010). This project seeks to explore the changes in roles, relationships and related skills that are associated with BIM use. This aspect of change, with its focus on the "people issues" involved in BIM implementation, has been largely overlooked in BIM research to date.

RESEARCH AIM AND OBJECTIVES

The key question for this research is: What impact does the adoption of Building Information Modeling (BIM) have on professional roles and relationships in Architecture, Engineering and Construction (A/E/C)?

Two secondary questions have been identified to help address this primary question:

1. What new roles have developed in the industry as a result of the introduction of BIM?
2. How does BIM affect relationships and interactions between project participants?

Issues examined under the umbrella of these research questions include BIM adoption frameworks; authority and decision-making in a BIM environment; spheres of responsibility of BIM-specialist roles, and how they relate to traditional industry roles; skills requirements for BIM specialists, and how organisations appoint and develop individuals in these roles; how BIM affects formal and informal interactions between project participants; and differences in roles and practices between different disciplines.

RESEARCH METHODS

To explore the evolution of the role, a three part comparison across three regions makes use of the differential in BIM adoption between New Zealand and Australia, where BIM is a recent and relatively limited introduction to design and construction practice; the United Kingdom, which is responding to the UK government mandate 2016 deadline with a rapidly developing BIM market; and the USA, where BIM is now a well-established and mature part of much of the construction sector.

BIM-specialists - Comparative cross-sectional survey

The introduction of BIM has led to the creation of a formal BIM-specialist role within many companies. This role is still poorly defined, with considerable variation in how it is employed in practice (Barison & Santos, 2010). There is further evidence to suggest that the role evolves as companies and sectors develop in BIM maturity (Becerik-Gerber & Kensek, 2010).

For each of the three regions, 20-25 BIM specialists will be interviewed, who have a formal job description involving BIM or are identified by their peers as the BIM champion or BIM leader in their company. Snowball sampling has been adopted within each region, where initial respondents are identified through industry networks, and these respondents provide

contact details or suggest avenues for recruitment of further participants. Individuals interviewed to date work for architects, engineers (structural and MEP), project managers, general contractors, documentation specialists, facilities managers, sub-contractors and fabricators. This diversity allows for exploration of differences in BIM roles and performance expectations that may be evident between different industry groups.

Traditional industry roles - Revelatory case studies

The impact of BIM is not limited to the creation of new industry roles, but has also changed the way in which organisations and project groups operate (Merschbrock, 2012). Case studies have been used as a vehicle to investigate this aspect of BIM adoption in the three regions and at three levels of analysis: the participating individuals and their roles; the project and its structure and relationships, in the context of the BIM model; and the larger organisational level of the companies involved in the project, and how their higher order management and planning operates in the context of BIM projects. Each case study begins with an examination of project documentation to provide a framework for all three units of analysis: at the organisational level it indicates the degree of involvement of the contributing organisations in the BIM planning and development stage; at the project level it provides the formal definition of project responsibilities and allows an evaluation of how processes and relationships function in practice, as compared with that intended at the planning stage; at an individual level these documents establish the formal project roles, and also provide a record of who has contributed what to the project as a whole. Interviews are then carried out with project participants to add detail, particularly at the individual level of analysis but also to contribute to the data concerning the project.

PRELIMINARY FINDINGS

Findings from the study to date suggest that many of the role changes currently taking place are technical in focus, resulting from new technology in need of operators. Many organisations use a hybrid environment where a 3D model is used within a project for internal development and design, but all documentation and exchange processes take place in a more traditional 2D or hard copy format. BIM roles are thus filling the role previously (or concurrently) filled by CAD or manual production of documentation. Additional roles or skill sets are required for projects and to obtain the additional benefits accruing from more advanced use BIM offers. In more integrated implementations, BIM managers or specialists act also as monitors and co-ordinators, and take on more of a process role. As teams develop expertise with other project partners on different projects, cross-pollination of ideas and experiences takes place which builds up the skill set of the workforce. This has a significant impact on how relationships change around BIM, but it is very dependent on influential individuals who are either enthusiasts who champion the adoption and extension of BIM use, or, in some cases, vocal sceptics who dampen the enthusiasm and restrict or slow down implementation. In some companies a single person is the influencer who provides the guidance and cohesion required for BIM. If that person were unavailable or left the company, the ongoing BIM development would be put at risk, indicating that the industry progress towards a more BIM outcome is still fragile. Many interviewees, although identified as BIM leaders, expressed uncertainty regarding what constitutes appropriate BIM use, and suggested

that many in the industry are wary of sharing knowledge and skills because of fears that commercial advantage will be lost.

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