THE ROLE OF THE ARCHITECTURAL TECHNOLOGIST IN BIM ENVIRONMENTS

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Abstract. Built environment professionals are expected to work in Building Information Modelling (BIM)-enabled environments. (BIM)-enabled design is examined within the context of interdisciplinary architectural practices from a professionalism perspective. A substantial part of the literature on BIM focuses on its implementation or effect on communication and collaboration. Less research has investigated the challenges facing the architectural technologist and their role in interdisciplinary architectural practices that have implemented BIM. The effective transition to BIM-enabled design will be subject to its role in shaping the architectural practices norms. BIM is considered as a way of working that is changing the design process as well as the identities and structures of the built environment professions. The professionalism lens challenges the prevailing technical perspective that is dominating the literature. Case study work conducted in international architectural firms using BIM-enabled design is presented. The research shows aspects of both traditional and new professionalism.

1. Introduction

The transition to Building Information Modelling (BIM)-enabled design has been the centre of a growing literature for a number of years in both the national policy (BIM Task Group, 2011) and architectural design (e.g. Sebastian, 2011; Nelson, 2017). BIM has also been examined in a wide range construction firms (Jaradat and Sexton, 2016; Dainty, Leiringer, Fernie and Harty, 2017; Li et al., 2019). BIM has been defined in a number of ways over the years. In this paper BIM is defined as the process and practices of architecture that are supported by large integrated digital systems (Bilal; Succar, Sher, & Williams, 2012), used to design, deliver and maintain

buildings and infrastructure. An important development in these literatures is that the movement to BIM-enabled design is increasingly seen as not only been driven by shifts in national government policy, but also as a reorientation of structures and processes (Arayici et al., 2011) involving a redefinition of procurement and design (Taylor & Bernstein, 2009). Most of the research in this direction has so far focused on the translation of BIM requirements by governments into structured levels to guide and co-ordinate sector-wide change and development of technical infrastructure. An underlying policy agenda in the UK, for example, envisioned the implementation of BIM Level 2 (Managed 3D environment held in separate discipline 'BIM' tools with attached data) from 2016 on all publically procured built assets (Bim Task Group, 2011: p. 16). UK Government policies privilege technocratic perspectives which argue that the successful transition to BIM depends on firms' ability to implement new technologies, structures and processes. The same technocratic emphasis is evident in the prevailing BIM-enabled design literatures (Jaradat et al., 2013). Recent research has attempted to criticize and inform policy makers (e.g. Dainty, Leiringer, Fernie and Harty, 2017; Dowsett & Harty, 2018). Policy-makers and scholars, though, do not make transparent the generative role that the architectural profession must play to construct a supportive, mutually-constituted narrative of BIM and the profession itself. This research therefore argues that the successful transition to BIM-enabled design will depend on its conforming to (or shaping) the architectural profession's norms and expectations, rather than BIM simply supporting procurement and design operations with greater technocratic efficiency.

To better understand BIM-enabled design and the architectural professions, the framing perspective in the professions' literature is used in this study. This framing emphasises a shift to a 'new professionalism' in the built environment (Bordass and Leaman, 2013; Samuel, 2019). Professionalism is perceived as a set of values, knowledge and actions applied in institutionalized ways (Abbott, 1988; Elliott, 1972; Freidson, 1994). Professionalism in this paper is considered broadly - across a range of roles within and outside architecture – in the context of BIM-enabled environments. 'New professionalism' in this research refers to emerging aspects of professionalism that have not been traditionally associated with classic professions such as medicine and law. In other words, new professionalism refers to a collection of concepts and engagements that are contradictory to typical features of professionalism. By using the concept of 'new professionalism' this research examines how BIM-enabled design has been understood and practiced in interdisciplinary architectural practices, and how

the purpose and role of the architectural and architectural technology professions and BIM-enabled design have been mutually redefined.

2. The Technocratic View of BIM and Professionalism

The technological element of BIM, i.e. the digital technologies and associated tools used for adoption and implementation, forms a central core of the prevailing BIM research (e.g. Arayici et al., 2011; Davies & Harty, 2013). Implementing BIM involves using a variety of digital technologies and tools as well as data interfacing and adoption concerns (Tse, Wong, & Wong, 2005) which create interoperability issues and technical complexities in adopting BIM (Jardim-Goncalves & Grilo, 2010). A number of emerging traditions of research within this technical perspective focus on integration, interoperability and standardization (Laakso & Kiviniemi, 2012), to solve issues of integrating project information amongst several disciplines (Wu & Hsieh, 2012). Similarly many researchers studied data capture using laser scanning techniques and visualization web-based tools (Manferdini & Remondino, 2012). Other studies paid attention to the modelling concepts of BIM (Nederveen, Beheshti, & Gielingh, 2010) to clarify conceptions and present practical approaches to implementation and use (Jung & Joo, 2011; Bilal Succar, 2009). However, a growing body of research brings attention to the limitations in emphasizing a technological perspective only (e.g. Dainty, Leiringer, Fernie and Harty, 2017s), and considers technical as well as non-technical issues including processes, people (e.g. Gu & London, 2010) and the socio-cultural environment (Y.; Arayici, et al., 2011). Earlier research also addressed the integration of BIM and collaborative working in terms of how BIM interrelates with construction processes (Grilo & Jardim-Goncalves, 2010). Less research has considered the instrumental role of the architectural or architectural technology professions in shaping the articulation and implementation of BIM in interdisciplinary architectural practices.

2.1. TRADITIONAL VERSUS NEW PROFESSIONALISM

Earlier definitions of professionalism mostly referred to the ‘institutionalization of expertise’, e.g. by establishing professional associations to regulate practice (e.g. Abbott, 1988: p. 324-5; Elliott, 1972). Similarly Freidson (2001) focused on the professionalization of occupational groups within a wider system of professions. Researchers also made a distinction between organizational professionalism, with its focus on control used by managers, and occupational professionalism that has an interest in the self-regulation of occupational groups (Evetts, 2005, 2010). A form of hybridized professionalism in public domains was suggested by Noordegraaf

(2007) which includes: 1) linkages between work and organized action, 2) mechanisms for legitimating work, and 3) searches for occupational identities. Noordegraaf (2007) investigated the contradictory attempts of managers who were trying to weaken professional control in service delivery, but at the same time seeking to become professionals themselves by imitating classic professions.

The concept of professionalism was traditionally based on generic characteristics which can be gleaned from the literature. Key elements of traditional professionalism include bodies of knowledge (Elliott, 1972; Larson, 1977; Sharma, 1997), with professionals as experts who have a body of technical and tacit knowledge (Evetts, 2003; Sharma, 1997). The codification of professional knowledge makes a profession distinctive (Larson, 1977) and legitimates professional work (Abbott, 1988). Professionals, including doctors and lawyers, apply extremely specialized rather than tedious manual labour (Noordegraaf, 2007). Another classic defining aspect of professionalism is barriers to entry to a profession (Elliott, 1972; Freidson, 2001). A profession refers to the group as well as the professional work of that group. Professionals form professional institutions to legalize occupational practice (Noordegraaf, 2007), and specify professional ethics (Larson, 1977; Sharma, 1997). Professional institutions organize professional work by requiring an academic degree and professional license; they also supervise professional conduct and discipline members who do not adhere to these codes of ethics (Noordegraaf, 2007). Ethical codes are described as individual obligations that serve to create trust, as expert services cannot be easily judged by the client (Bowen, Pearl, & Akintoye, 2007). Other relevant aspects of professionalism also include serving the public good or a wider perspective of the long-term public interest (Elliott, 1972; Evetts, 2003).

A great deal of autonomy, or independence and control over work, is also a typical aspect of professionalism (Evetts, 2003; Sharma, 1997). Professional autonomy is connected with skill and refers to the attempts of professionals to perform their jobs as they see appropriate (Freidson, 1994), and on the basis of professional judgement in defining problems and control over solutions (Abbott, 1988; Evetts, 2003). Despite the diverse range of definitions of professionalism in the literature, key features of traditional professionalism include: a distinct body of knowledge, service orientation and sense of identity, barriers of entry to a profession, a supportive professional community, ethical codes and public interest, autonomy and prestige.

Professionalism has been described as ‘a social construct that changes over time. At its core lie two key notions: trust and the exercise of judgment based

on specialist knowledge' (Duffy & Rabeneck, 2013: p. 1-2). Some researchers have reinterpreted professionalism in a broader fashion beyond the classic professionals only, such as medical doctors, but also included occupational groups such as managers and engineers (Evetts, 2003; Fournier, 1999). Similarly, Sharma (1997) argues that architecture, amongst other occupations, meet the requirements of professions as their practitioners are experts in the modern economy, and have specific service character and ethics, in addition to autonomy and prestige (Sharma, 1997). The redefinition of professionalism has inevitable consequences including changes in the work and in relations between practitioners, their employers and clients, as well as in the work priorities and processes (Evetts, 2011).

A growing body of literature is considering professionalism in the built environment (e.g. Bordass & Leaman, 2013; Hill & Lorenz, 2011). Built environment professionals are ethically obliged to protect society and the built environment (Hill & Lorenz, 2011) by providing fair services and avoiding dishonest activities. Professions need a high level of conduct to ensure that the public have confidence in the quality of the services they provide (Poon & Hoxley, 2010). The concept of public good symbolized in values of trust and judgement is called for, to address the demands of sustainability in the built environment (Duffy & Rabeneck, 2013). The concept of professionalism remains valid despite a diminishing role of professional institutions (Hughes & Hughes, 2013). The professional institutions in the built environment enabled architects, surveyors, and engineers to hold significant positions of esteem and influence, within the domain of the built environment as well as broader society (Hughes & Hughes, 2013). Ethical codes specified by professional institutions are considered to govern the use of specialized knowledge, exercised by professionals in the built environment. Sadri (2012) argues that professional codes for architects appear to protect professional interests and ignore responsibilities towards humanity. These wide-ranging obligations at times compel professionals to challenge or confront what the 'client' or the 'market' needs (Hill & Lorenz, 2011; Hill, Lorenz, Dent, & Lützkendorf, 2013). Ethical obligations of the built environment professional involve thoughtful judgements case by case within the world, rather than direct observance to pre-defined codes (Farmer & Radford, 2010; Till, 2009).

A new professionalism in the built environment was recommended as a response for a need to examine the evolving nature of professionalism, and its role in the wider society (Bordass & Leaman, 2013). A shared vision and the common good are suggested as the heart of a new professionalism, which unifies all built environment professionals along with their institutions and educational systems. However, the conception of a 'new professionalism' that

crosses the existing boundaries amongst building professions is seen to be challenging, in terms of the intertwining of processes of professionalization and institutionalisation on the one hand, and the influence of practice on the other hand (Bresnen, 2013). Despite the increased interest in examining professionalism in the built environment, the broader concerns associated with how professionalism is enacted in interdisciplinary practices and the role of the architecture profession have not been sufficiently studied.

The defining attributes of traditional professionalism, classically associated with professions such as medicine and law, are examined against concepts of new professionalism in the general literature as well as in the context of the built environment. Key characteristics of traditional and new professionalism are summarised in Table 1.

TABLE 1Key Characteristics of Traditional and New Professionalism based on the Literature

Traditional professionalism	New professionalism
1. Based on the professionalization of occupational groups (Abbott, 1988; Freidson, 2001; Larson, 1977)	A shift of focus to an increased use of the discourse of professionalism in a wide range of occupations and organizational work places (Evetts, 2003; Fournier, 1999; Sharma, 1997)
2. Typical professional groups include classic professions such as medicine and law (Abbott, 1988; Elliott, 1972; Freidson, 2001)	Occupational groups outside health and law and include, for example, managers and engineers (Evetts, 2005; Fournier, 1999; Sharma, 1997)
3. Distinct bodies of knowledge, service orientation and sense of identity (Elliott, 1972; Larson, 1977; Sharma, 1997)	Suggested shared vision and unity in some educational systems such as in the built environment (Bordass & Leaman, 2013)
4. Barriers of entry to a profession, significant role of professional institutions (Abbott, 1988; Elliott, 1972; Freidson, 2001)	A diminishing role of professional institutions (Hughes & Hughes, 2013)
5. Ethical codes and public interest (Abbott, 1983; Larson, 1977; Sharma, 1997)	Strong emphasis on the common good, by for example making an interdisciplinary body of knowledge about

	buildings and their use (Duffy & Rabeneck, 2013)
6. A great deal of autonomy and prestige (Abbott, 1988; Freidson, 1994; Sharma, 1997)	Managerial control and decreased autonomy (Evetts, 2005, 2010, 2011)

2.1.1. Summary and Research Question

The technocratic view has dominated most of the literatures on BIM. Using a professionalism lens to understand BIM contests the prevailing technocratic perspective. Scholars take various views to define professionalism, as the notion of professionalism varies over time and involves several dimensions. Despite the numerous viewpoints taken to interpret professionalism, major defining characteristics are frequently mentioned. Yet new forms of professionalism continue to emerge in different domains within and outside classic professions. This paper considers professionalism within and outside classic professions, as the empirical work focuses on BIM-enabled design in interdisciplinary architectural practices, and is guided by the following research question:

How is the role of the architectural technologist played out within the contexts of BIM-enabled design?

3. Research Approach and Methods

The fieldwork discussed in this paper represents one aspect (professionalism in BIM environments and the role of the architectural technologist) of a larger research study investigating BIM-enabled design in interdisciplinary architectural practices in the UK and USA. The research approach is based on interpretations of qualitative data. Professionalism in BIM-enabled design is the unit of analysis within the context of interdisciplinary architectural practices. Data were collected from semi-structured interviews as well as other complementary materials, including pre-interview questionnaires, observations, documents, and web-based research to help interpret the interview data. The participants were mostly design professionals who have architectural and architectural technology backgrounds.

Thematic coding was used to analyse interview transcripts while other materials collected were read thoroughly to help interpret the interview data. All the interviews were transcribed verbatim and qualitative analysis software, NVivo, was used to facilitate the systematic analysis of large volumes of data.

Key aspects of professionalism, gleaned from the literature are compared and contrasted against the case study findings. The analysis was structured around: 1) concepts of professionalization; 2) typical professional groups; 3) bodies of knowledge; 4) entry to a profession and the role of professional institutions; 5) professional codes of conduct and public interest; and finally 6) autonomy and prestige.

4. Findings: Changing roles of built environment professionals

Using advanced BIM technologies enabled people who are not qualified architects for example, as well as others who do not have architectural backgrounds, to find a route to architecture and take control of BIM projects in some cases. These non-architects also took over certain tasks that used to be assigned to architects only, as this interviewee indicated:
'The tools available open up building design to a lot more people who are not architect… A lot of people in the design team who are not architects are able to take control of a project and do things that maybe historically only the architect would be given responsibility for.', Design Applications Manager "Firm 3 (London)".

Qualified architects, who are members of professional institutions such as the Royal Institute of British Architects (RIBA) and the American Institute of Architects (AIA), will still be needed in architecture practices and may not be required to get involved in BIM projects as architects are trained to design space that extends beyond buildings and their use. However, there seemed to be a skeptical view by some BIM practitioners regarding the significance of becoming a registered professional or a member of a professional institution in architecture or architectural technology. Some BIM practitioners argue that they may not need to become chartered if a desired role can be secured in leading architecture practices, by developing specialized BIM skills and becoming experts in certain tools:
'I'm very specialised in at least one programme, my specialty is the programme Revit. I've been working in it since 2004 approximately… I probably will not become an architect', BIM Coordinator and Specialist "Firm 2 (London)".

The title "architect" used to have a considerable position many years ago. Architects invest a lot to become licensed professionals in the hope that architecture would be a rewarding profession. Questions arise regarding the distinctiveness and future of built environment professions, and some traditional roles as leaders of project teams. The anticipation is that

architecture practices will become part of a larger team that is providing design-build services:
'Well I hope we're still around. I hope we still have a role. This is pessimistic but I'm one of those who think we will go to more integrated companies that are design- build', Senior Vice President and Operational Manager "Firm 5 (Dallas)".

BIM was seen as one of so many other influences that are leading the move towards more integrated companies, in which architects and architectural technologists might not necessarily play leading roles. There is also a shift of focus away from concepts of profession and professionalization in the context of BIM-enabled design in interdisciplinary architectural practices which is in contrast to traditional professionalism.

5. Discussion and Conclusions

Key aspects of professionalism, extracted from the literature are compared and contrasted against the case study findings. A number of new professionalism features, which are inconsistent with traditional aspects of professionalism arise in interdisciplinary architectural practices using BIM-enabled design. The case study findings show that there is a shift to 'loosely-linked professionalism'. In loosely-linked systems BIM-related roles were taken up by those who either have architectural background but not qualified architects or architectural technologists yet, or who do not have architectural background. Those who had no architectural background but have developed an expertise in using BIM tools and processes played major roles in BIM projects. Integrated cross-training in educational systems was suggested by practitioners to enable fresh graduates including architectural technologists to work on interdisciplinary BIM projects. In BIM-enabled design the emphasis became on a broader perspective of collaborative work rather than individual autonomous professionals.

Acknowledgements

This research was funded by the Engineering and Physical Sciences Research Council (EPSRC), funder of the author's PhD research which was based in the Design Innovation Research Centre (DIRC) at the School of Construction Management and Engineering, University of Reading. The author also acknowledges Prof Jennifer Whyte, who was the Director of DIRC and first PhD supervisor, and other people who were involved in the PhD research including Prof Martin Sexton.

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