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BUILDING INFORMATION MODELING AND QUANTITY SURVEYING PRACTICE

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تعتبر صناعة التشييد على نطاق واسع فريدة من نوعها. نظم نمذجة بناء المعلومات لديها القدرة لتطوير الممارسات الحالية و جعل قياس الكميات من رسوم التشييد تتم بطريقة آلية. هناك أيضا مخاوف أن مثل هذه التطورات قد تهدد استمرار مهنة مسح الكميات. هذه الدراسة تستكشف العلاقة بين نظم نمذجة بناء المعلومات ودور مساحي الكميات في صناعة التشييد. هذا البحث يوضح أن نظم نمذجة بناء المعلومات تتحدى الأدوار التقليدية لمساحي الكميات وأهميتها لصناعة التشييد. نحن نوصي بتطوير مناهج منقحة لمساحي الكميات وإجراء المزيد من البحوث في النظم الموحدة للقياس.

The construction industry is widely acknowledged as unique and conservative. Building Information Modeling (BIM) systems have the potential to revolutionize current practices and to automate the measurement of quantities from construction drawings. However, there are fears that such developments could threaten the viability of the quantity surveying profession. This study explores the relationship between BIM systems and the roles of quantity surveyors in the construction industry. We argue that BIM challenges traditional roles of quantity surveyors and their relevance to the construction industry. We recommend the development of revised curricula for quantity surveyors and further research into standard systems of measurement.

Keywords: Building Information Modeling, construction, Information Technology, quantity surveying.

1. INTRODUCTION

The construction industry has considerable potential to drive economies. There is robust evidence to show that an innovative and efficient construction industry contributes to a stable global economy[1,2]. However, the construction industry is notoriously conservative and slow to adapt to change as illustrated by the following examples:

- The construction industry has made several attempts to eliminate wastage, cost overruns, mismanagement, and disputes. These failures have undermined public enthusiasm and support for the industry[3,4].
- The industry has remained one of the slowest adopters of innovative technologies despite strong evidence of the correlation between investment in Information Technology (IT) and improved performance[5].
- The industry is, by and large, ineffective in fostering hammonious work environments. One of the single largest determinants of project failure may be that construction professionals expose themselves to conflicts of interest. For example, a professional discipline may decide to protect their own professional interest rather than accept a duty of care to protect the industry[6]. Interestingly, such failures have increased the erosion of discipline boundaries, largely as a result of an increasing demand for multi-skilled professionals.

New technologies have the potential to provide competitive advantages by increasing opportunities and lowering costs[7]. Evolutionary developments in the construction industry can be viewed as a function of Technology, Process and People[8]. Technology refers to improved soft and hard methodologies. The contruction process involves operational flows through which construction development processes permeate (including project planning, design, construction, maintenance, management and disposal). Critical to these development processes are human resources that formulate, maintain, manage and implement the

technologies and processes. Figure 1 illustrates the anatomy of construction development processes.

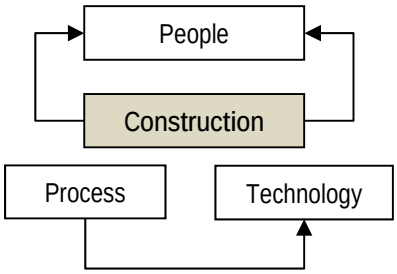

Figure 1. The anatomy of the construction development process

It has had a significant impact on the construction industry. It has initiated improvements in design and project monitoring and has lowered costs, and improved accuracy, speed and safety. Arguably IT provides the catalyst necessary to address some of the challenges of uncertainty, mismanagement and disputes[9]. Interestingly, there is empirical evidence which shows that IT applications for construction professional service delivery are continually being encouraged by the public through their high expectations for professionalism and improved ethical behaviour[10].

Quantity surveying is an important discipline within the construction industry. A service underpinning quantity surveying practice is the measurement buildings and preparation of bills of quantities. The Australian Institute of Quantity Surveying[11] identifies measurement/quantification as a basic ability required of a quantity surveyor. This service remains an expectation of the quantity surveying profession regardless of the technologies and approaches used to achieve it. Measurement relies on coordinate data which are usually provided in the form of construction drawings. Advances in drawing technology have the potential to impact on the ways in which bills of quantities are prepared. Since the advent of computer aided drawings (CAD), researchers and practitioners have been working to exploit CAD data to generate bills of quantities. Whilst this holy grail has been realised in research environments (for example, Cooperative Research Centre for Construction Innovation projects 2002-056-C and 2005-008-C), commercial opportunities and challenges are still to be addressed. From a layman's perspective, Building Information Modeling (BIM) may be considered as the current state of art in CAD developments. It is currently being implemented by a significant number of architectural and engineering practices, and has the potential to revolutionise the quantity surveying profession. An effective definition of BIM is provided by Schwegler[12] as the process of creating an information database for a project in which lifecycle information is expressed in an interoperable manner to create, engineer, estimate, illustrate and construct a construction project.

BIM opens opportunities for multiple disciplines to share and exchange data[9]. Gao and Fischer[13] report extensively on the dramatic growth in relevance, use, value and commercial opportunities of BIM in contemporary construction.

Apart from the usual barriers which constrain change, an additional factor impeding BIM adoption is an inherent conflict of interest within and between discrete construction disciplines. BIMs potential to facilitate multiple functions (e.g. preparing bills of quatities automatically from BIM data) may be a major disincentive to innovation as it straddles professional boundaries which currently exist. This is the crux of this paper–what opportunities and challenges does BIM present to the quantity surveying profession?

2. BUILDING INFORMATION MODELLING SYSTEM

Notwithstanding Schwegler[12] definition of BIM (noted above), BIM means different things to different people. A more all-encompassing description is provide by Succar[14] in Figure 2.

Relevant literature highlights BIM as three- or four-dimensional drafting applications that generate data-intensive plans[15]. In contrast to two dimensional drawings where sets of lines and surface areas are rendered through soft and hard intelligent features, BIM systems store data related to each 'object'. The implication of this on the construction process is that construction designers and constructors are able to model real life situations before moving to site. Tse et al.[9] note that this presents significant opportunities for the construction industry. Latham[3] reports that design deficiencies and associated constructability constraints are the single largest factors responsible for the poor performance of the construction industry. It is likely that conflicts in design and construction may be favourably impacted upon by BIM.

BIM has the potential to automate measurement and facilitate the preparation of accurate estimates[16]. The Cooperative Research Centre for Construction Innovation has reported successful attempts to produce Bills of Quantities automatically using Industry Foundation Class (IFC) data. There are many possibilities for applications of BIM in the Architectural, Engineering and Construction (AEC) industries, but a hallmark of BIM is that is should allow contractors to receive design documents which incorporate accurate quantities and specified materials in electronic format[17].

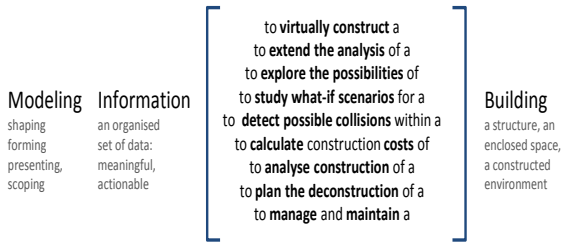

Figure 2. Some common interpretations of BIM[14].

The Roles of Quantity Surveying in Construction

Quantity surveyors are ubiquitous in the construction industry[18]. Conventionally, quantity surveyors' services include the preparation of preliminary estimates and feasibility studies, cost plans and schedules, and bills of quantities. Quantity surveyors draft and compile documentation for construction contracts, and prepare and analyse construction contract tenders. They also provide advice on contractor selection and financial management of all construction works and allied reporting, including auditing, planning cost and indexing. They provide construction project management services as well as value management, facilities management, management contracting, construction dispute resolution, research, and other forms of consultancy services[19].

The appeal of quantity surveying services depends largely on the ability of professionals to address core client expectations and the manner in which such services are marketed. Masidah and Khairuddin[20] argue that some of the professional services rendered by quantity surveyors might be unnecesary and undesirable. However, measurement and pricing of construction works are important functions provided by quantity surveyors. This is central to the contention that BIM's potential to automate quantity measurement might threaten clients' requirements for quantity surveying services. Notwithstanding this, a number of quantity surveying services transcend measurement and an assessment of costs–they are facilitated by such data. Clearly the potential for BIM to influence the quantity surveying profession is considerable.

What does BIM mean for the Quantity Surveying profession?

Conventional construction estimating practices have been criticized because there is hardly an estimate without its own peculiarities[21] and current estimating processes are seen by some as too rigid. However, BIM measurement represents an approach that could have a marked impact on preconstruction processes. Such measurement and its link with estimating are very real possibilities, but there are considerable challenges still to be overcome. Chief amongst these is the need to filter BIM data so that they comply with the rules prescribed in relevant Standard Methods of Measurement (SMM). SMMs proliferate throughout the world, and more than one may operate within a single country. For example, in the UK measurement of building works is governed by SMM7, whilst measurement of civil engineering works is under CESSM3. Similarly in Australia measurement of building and civil works are governed by separate SMMs. Multiple SMMs mean that the financial returns to software developers from country-specific BIM-SMM filters are limited. This is a major issue–the market required to support the development of such filters is modest, and the investment required to develop robust filters is considerable. As already mentioned, the development of such filters has so far been restricted to research projects. Arguably there is a case for re-engineering measurement procedures and there are precedents for maverick approaches which disregard SMMs. For example, in the US in the 1980's Timberline Software provided facilities which integrated CAD data with their house-building estimating software. The approach they adopted was to construct estimating performance data that aligned with the quantities generated by the CAD software used. Could this approach be extended to current practice? In other words, could BIM objects effectively generate alternate SSMs? This approach is simple but, to the authors' knowledge, such approaches have only been used in discrete market sectors where SMM-based bills of quantities are rarely used.

Clearly BIM presents opportunities and challenges. BIM remains a nascent ideal whose realization is probably many years off. However, the rewards are high as the time taken to measure buildings will be markedly reduced, leaving more time for estimating calculations.

3. CONCLUSION

BIM is a major challenge to the services conventionally provided by quantity surveyors and other construction disciplines. The adoption of BIM may redefine traditional professional boundaries in construction (not just for quantity surveying). By the year 2020 these boundaries may have shifted. Given this possibility, it is prudent to review quantity surveying curricula, and it will interesting to see how two independent surveys of quantity surveying tertiary education currently under way in Australia make reference to this. Is the current trend to adopt BIM sustainable? Will the percieved potential of BIM be realised in the future? Will the construction industry have the stamina to confront traditional barriers and adopt technological innovations that challenge existing industry practices? The answers to these questions may become apparent over time, or they may be informed by further studies, based on robust research methodologies and empirical data analysis. We trust the latter approach will prevail.

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