Lack of implementing Building Information Modelling in the quantity surveying profession

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Abstract. Quantity surveyors possess an inherent traditionalism when it comes to Building Information Modelling (BIM), preferring to follow current trends and methods rather than taking a proactive approach towards its implementation. This implicates that there is still a lack of understanding of the potential uses and benefits that BIM software will provide the profession. Within this context, the purpose of the research was to determine the reasons why professional quantity surveyors (PrQS) are not utilising BIM to improve their day-to-day tasks and functions.

To conduct the research, a qualitative study was carried out using semi-structured interviews with PrQSs from various QS firms situated in Port Elizabeth. This method of data collection allowed for a more in-depth understanding of why these professionals are not utilising BIM in Port Elizabeth. The research investigated the reasons behind these PrQSs not utilising BIM to improve current methods of managing construction costs on projects. The results revealed that there are challenges that QSs face in the construction industry in terms of their working methods. The results also identified the potential of BIM to help mitigate these challenges with interviewees mentioning several benefits that the BIM software will provide for the QS. Despite BIM’s potential in the QS profession, the results showed that there are still several barriers holding professionals back, the most prominent being the lack of senior leadership support, knowledge of BIM, a lack of full team integration and the cost of implementing BIM. The main limitation of the study was that the number of responses was limited due to the fact that very few quantity surveyors were experienced in, or, had knowledge about BIM. As degrees of regional sentiment, and industry development also had influence on participants’ answers, the findings may not be suitable or be generalised to other provinces in South Africa. The findings will assist all stakeholders in the QS profession, as they will be more informed about potential benefits and challenges to BIM implementation, which will provide them with greater knowledge of how it works and precisely what it is capable of doing.

Keywords: Building information modelling (BIM), quantity surveying, challenges, lack of implementation.

1. Introduction

The construction industry has continued to be one of the slowest adopters of innovative technologies, notwithstanding the strong suggestions that new technologies have the potential to provide competitive advantages by increasing opportunities and lowering costs [20]. It would appear that the South African construction industry is no different.
Quantity Surveyors (QSs) play a crucial role in the construction industry as their core services are centred around the cost management of a construction project from inception stage through until project close-out. However, according to Wong [23] the conventional services provided by QSs are occasionally inefficient, tedious and error prone. In recent years, Building Information Modelling (BIM) has become a central topic amongst QSs because of its potential to improve the productivity and efficiency of their services.

BIM is the process of collaborating and exchanging data in a digital format among all those involved in a construction project, including architects, engineers, surveyors and builders [5]. Harris [12] conducted a survey on various project stakeholders, including QSs, to obtain their views on BIM. Their responses reflected the industry’s inherent traditionalism towards BIM technologies, with many respondents preferring to follow current trends rather than taking a proactive approach towards BIM implementation. Poor connectivity, high costs of software design tools and lack of international BIM certification were believed to be some of the barriers holding respondents back from implementing BIM technologies. This survey also indicates that there is a lack of understanding of the uses and potential benefits of BIM in South Africa.

For the QS profession, BIM presents huge challenges and opportunities, particularly in the early design stages of a construction project [24]. Comprehensive research has been carried out on BIM and how it is not seen as a threat to the QS profession rather providing opportunities to direct professional quantity surveyors (PrQS) towards offering more value added services, as well as providing a more efficient service to the client or end-user [4, 23 and 21].

It is within this context that the purpose of this research was determined; to identify reasons why the South African PrQS, especially PrQSs in Port Elizabeth, are not utilising BIM to improve their services. The objective of this research was thus to determine the benefits and challenges of BIM to QS professionals, as well as how BIM implementation can be improved. Finally, the importance of the study is to add to the already existing body of knowledge on technology, more importantly BIM, and QSs. As a result, QSs will be more informed about the potential benefits that comes with using the software as well as an understanding of the barriers and mechanisms to overcome such barriers.

2. Literature review

2.1 Current working methods employed by PrQS

The QS is held accountable for providing accurate and punctual cost advice across the duration of a project to a host of different parties [5].

In order to accurately forecast and manage construction costs the QS profession has developed various working methods. In today’s construction industry, QSs utilise conventional ‘measure and value’ methods to manage and administer cost-planning, measure and quantify all elements of a project, control costs throughout construction, offer procurement advice and formulate financial documents [14]. This indicates that existing methods used by QSs are split into two sections, the first section involves accurate measurements of the construction works and then there is the section for the valuation of construction works. These methods employed generally cover a range of QS tasks, which includes cost estimates, bills of quantities (BoQ) and cost control processes. Current working methods are conducted manually by QSs from paper drawings or QS software that are based on 2D computer-aided design (CAD) drawings.

A number of factors that affect the QS profession are mentioned by Frei [9], namely:

- Devaluing of QS services through excessive competition on fees;
- Intrusions by other professions into QS related service areas;
- The cyclical nature of the construction market;
- Insufficiencies in the continuing professional development (CPD) programs delivered by professional institutes;
- The perception that QS services are non-critical to project success and the lack of awareness for the value-adding benefits;
• Alternative procurement techniques which are driven by clients who demand different services to what QSs traditionally believe they should provide;
• Technological advances which threaten to reduce the role of the QS; and
• Published cost information made readily available to users.

Fluctuating client requirements and frustrations with QSs job performance are some of the main factors forcing QSs to pursue higher efficiency systems, as compared to the current working methods. According to Wong [23], BIM plays a crucial role in assisting QSs to conduct their current tasks more effectively and efficiently which will subsequently improve overall project performance. This can be interpreted that there is a clear need in the construction industry for more accurate and efficient cost forecasts as well as better cost management techniques. However, it is evident that the BIM software can be used as a useful tool to help mitigate these issues.

2.2 Views on BIM affecting the role of the QS

BIM is much more than just a computer software package. BIM is a process, facilitated by software, of sharing information among all parties involved in a construction project, as well as acting as a safe domain for information to be stored. The BIM model provides its users with a virtual representation of a building prior to its actual physical construction, which will inevitably lead to better decision-making, improved safety, and enhanced problem solving abilities [5].

The QS profession is, like many other professions, an evolving profession that needs to continue to add value and enhance their professional services in order to meet the ever changing conditions of the construction industry [2].

The QS profession has historically been one of the front runners with regard to adopting new technologies in the construction industry [4]. In past years, new technologies such as electronic calculators and computers have become a fundamental part of the daily services of QSs by ensuring a faster and more efficient professional service for the client [15]. Smith [21] describes BIM as an enormous opportunity for QSs to raise the level of their services and that BIM will not be viewed as a potential threat to the profession.

It is crucial that QSs look to embrace new technologies that will save time, as well as enhance the quality of work provided. BIM has become a central topic amongst QSs because of its potential to improve the productivity and efficiency of their services. According to Wong [23], BIM will eliminate the technical and labour intensive aspects of traditional tasks of QSs. Despite the fact that BIM has the potential to revolutionise the QS profession, numerous calls to embrace the software, thus far have been overlooked.

According to Wong [23] BIM has several benefits to offer QSs, during both the pre-construction and post-construction stage. These includes:

• Speedy preparation of cost appraisals at inception stage;
• Preparation of initial cost plans by extracting quantities from the BIM model;
• Generation of accurate cost estimates for several design alternatives;
• Up to date cost feedback on design changes;
• Up to date cost implications on design changes;
• Elimination of manual re-measurement of design changes;
• Reduced design errors and cost estimate revision;
• Improved visualisation for better understanding of design;
• Ability to automatically generate quantitates for BoQ purposes; and
• Acts as a safe domain for information management.

All these benefits indicates that BIM has the potential to provide the QS profession the opportunity to develop and focus on other tasks that might not have been seen as necessary in traditional practices.

What this means is that with BIM, QSs will slowly but surely move away from their traditional roles. According to Frei and Mbachu [9]; Fanous [10], there are several developing and developed roles for QSs with the addition of BIM into their general scope of works. These include:

Developed roles:
• Property and rental valuation;
• Consultancy services;
• Project management; and
• Risk management;

Developing roles:
• Sustainability;
• Value engineering studies;
• Whole life costing assessment; and
• Strategic management and leadership.

2.3 Future implementation of BIM
BIM is a multi-dimensional technology that promises to provide the QS profession with more value added services for its clients. However, there are still several barriers that need to be overcome before the complete implementation of BIM can be achieved. These include:

• Interoperability: “The ability of two or more systems or components to exchange information and to use the information that has been exchanged” [11]. With different parts of the world employing different standards and measuring systems, this is a particularly challenging area for QSs who need to be able to rely on the technology to provide accurate information in a format they can use.

• Education and training: As Eastman, [6] explain, the transition to BIM is not an easy process. It requires a clear understanding of the BIM technology as well as the related processes to manage this. A massive barrier to the implementation of BIM is the lack of skilled personnel and ability to teach new users the fundamentals of the BIM workflow [16].

• Cost of implementation: BIM implementation requires organisations to purchase the relevant software and hardware and train their staff in the use of that software. A big barrier to the implementation of BIM is the high initial cost of the software [3 and 7].

• Lack of senior leadership support: one of the biggest obstacles of BIM implementation is the lack of support from senior leaders. Senior leaders in companies are taking a conservative approach when it comes to implementing BIM rather than being proactive in adopting new technology [17].

According to Oesterreich and Teuteberg [19], it can be concluded that the barriers of BIM implementation can be primarily rooted to social behavioural actors in the construction industry rather than the technical issues that may occur. Mechanisms that should be employed to improve the sentiment towards BIM implementation in the construction industry are as follows:

• Organisations should implement formal training not just on the BIM software but rather on the change management and process-orientated issues in order for employees to get a more holistic understanding of BIM.

• The introduction of BIM into the curriculum of universities.

• The development of industry-wide standards requires the participation of representatives from all industry groups.

• To increase the availability of the BIM software.

• The company's management should create a strategic vision around BIM, actively explaining the rationale behind its adoption and be transparent about the costs and benefits of the software in order to make employees feel the need for it.

• Through informal networking and mutual support, employees can overcome the knowledge barrier behind implementing BIM in their workplace.

In today’s dynamic marketplace, QS firms are looking to their members to stay knowledgeable of new technologies, developments and innovations in the built environment. Through CPD programmes, members are able to broaden their knowledge base and promote professional growth. QSs can broaden
their knowledge base on BIM by attending organised events such as BIM conferences/seminars, formal workshops or even BIM lectures administered by the SACQSP. These initiatives will assist QSs to adapt their skills and services in order for them to accommodate BIM into their current scope of works.

3. Methodology
A qualitative study was carried out with the intention to conduct the research in the form of semi-structured interviews with PrQS from various QS firms situated in the Port Elizabeth area. This method of data collection allowed for a more in-depth understanding of why PrQS are not utilising BIM in Port Elizabeth. The aim of this type of research method is to observe or question social actors in depth and then develop explanations of what is discovered [8].

The survey strategy was seen as the most suitable option as this research will be utilising a semi-structured interview approach to collecting data. The data obtained in the survey approach was used to suggest possible relationships between answers and to produce a framework for these relationships. A set of interview questions was prepared for the interview process with relevant QSs. The interview questions were based on and structured according to the relevant sub-questions and objectives of the research in order to ensure appropriateness and rationality of the interviews. An interview guide was established to help guide participants through the interview process.

The sampling method that was used for this study was the self-selection sampling method. Self-selection sampling allowed individuals to identify their desire to take part in the study. Interviewees were contacted via email requesting for them to partake in the research. Any responses to the e-mail interview request sent out were evidence of their desire to participate in the study. For those that responded, an interview time and venue were set up. For convenience purposes, interviews were held at the offices of each participant. A total number of five PrQS participated in the study.

In terms of data capture, the interviews were recorded using a sound recorder application on a Huawei P10 Lite cell phone. This data was transcribed into a word document format before being categorised based on the similar ideas, repeated words or statements. The main categories and subcategories were identified and linked together, with the links supported with interviewee quotations, and finally themes were generated. This method of data treatment is known as thematic analysis. Once data was captured and analysed the discussion around the findings commenced.

4. Results and findings

4.1 Current working methods employed by PrQS
The first objective of the study was to develop an understanding of the current working methods employed by the PrQS on a daily basis. This entailed looking at the roles and experiences of each PrQS over the course of their professional career, the current working methods which they employ on a daily basis and, lastly, the challenges experienced using these working methods. Interviewees were asked about their viewpoints on the QS profession and how it has changed over the course of their professional career. The responses highlighted that there were a number of prominent themes, the first of these being “information availability”. Four interviewees mentioning that there is less information available for QSs to perform their functions efficiently, with the same four interviewees also mentioning that this brings unnecessary stress and pressures into their working environment. A further four interviewees also emphasised that there is an increased need for QSs to perform their duties quicker and more efficiently in order to fulfil unrealistic expectations of clients. Increased complexity and cost of construction projects has meant that the expertise of QSs are needed more now than ever before. He goes on to say that increased client expectation has become a general challenge among QS firms [18].

Interviewees were then asked to describe their current working methods used for managing construction costs on projects. It was identified that participants had experience and technical knowledge on how to operate various QS software packages, namely, WinQS, QS Plus International and Dimension X (DimX). It was also evident that the majority of the respondents had been performing tasks manually
apart from two, who have been measuring off 2D CAD drawings using the DimX software. The two themes identified included the reasons for using either conventional or non-conventional working methods as well as the challenges experienced using current working methods.

As mentioned by interviewees, the most prominent reasons for using the Dim X software was that it is very productive, with users being able to complete projects quicker and with fewer staff members being involved from the outset whilst it also provides sufficient information to its users if drawings are designed correctly. The top two reasons chosen for using conventional methods were that “the firm employs this working method” and “familiarity with the method”. The following quotes from interviewees support this:

- “The office does things manually, when I was employed by previous companies I did work off 2D drawings using Dimension X and other programs which works really well but the office procedure here is very much all manual.”
- “I think you also have to understand the basics very well before using computer aided methods and if you don’t understand the basics you going to get a big mess coming out of a computer and we’ve seen that before. So we (are) almost inclined to put a graduate onto a manual form of measurement at the start just until they are settled and following a rhythm.”
- “With DimX and WinQS as a program that we use on projects for bill production, we probably cut our production time by half and the amount of people we can put on the projects is half so there is definite benefits to it.”

Table 1 revealed that the most prominent challenge with using current working methods is the lack of information provided to the QS.

| Themes                        | Interview 1 | Interview 2 | Interview 3 | Interview 4 | Interview 5 | Count |
|-------------------------------|-------------|-------------|-------------|-------------|-------------|-------|
| Lack of information provided to the QS | X           | X           | X           | X           |             | 4     |
| Time aspect                  | X           | X           | X           |             |             | 3     |
| Education and training (DimX) |             | X           |             | X           |             | 2     |
| Interlinking issues (DimX)   |             | X           |             |             |             | 1     |

Three more themes were identified from this section of questions, namely, “time”, “education and training” and “interlinking issues”. The most prominent interviewee quotes are listed below in support of these themes.

- “The information that we get from drawings has almost deteriorated completely. It’s just a layout, with so many square meters of warehouse or so many square meters of office blocks and that’s it and you (the QS) has to produce a bill of quantities off this and manage it from there.”
- “It’s perhaps the speed that you have to do things has changed, it’s not that what we have to do is different it’s just that the time that people give you to do something has decreased. People want answers quicker, they want quicker turnarounds.”
- “I taught myself how to use it, we bought one license and I got the manuals and I taught myself how to use it. And then I showed the director here, then we bought a further three licenses.”
- “I think a lot of the younger guys will be very frustrated because they are going to feel like the technology is there, but the older guys are not using it.”
This indicates that despite the availability of technology in today’s construction industry, professionals still struggle with collaborating and communicating with the remainder of the project team, whether it’s getting the drawings out on time or just updating project stakeholders on the progress of the work. This challenge of insufficient information has made it difficult for QSs to compile accurate bills and cost forecasts for clients.

Here again, Nyamagere [18] mentions that QSs are now given less information at the ‘expression of interest’ stage of a project, and that QSs need to somehow arrive at a probable and reasonable figure without detailed information, all at their expense.

4.2 Views on BIM affecting the role of the QS

Another objective of the study was to identify how each QS understands and feels about BIM improving their current situation within the construction industry. However, before the discussion around BIM and the QS could commence, it was important to first get the viewpoints of the interviewees with regards to their understanding of the BIM software.

- An understanding of BIM and its benefits is vital for informed decision-making about its implementation. Due to participants’ uncertainty of what BIM is, there were different definitions that were established during the interview process. The most prominent answer from interviewees with regards to the understanding of the software was that BIM is a tool for sharing information between the different project stakeholders. Three more definitions were established by interviewees, these include: “BIM refers to a 3D software”, “BIM is a database for information” and “BIM is a design tool”. The differing responses from interviewees shows that there is still a lack of knowledge of what BIM really is. In the literature, Hong [13] talks about how past experience with BIM is vital for determining the level of understanding of BIM technologies, which is reinforced by this study, with only one participant having had experience using the software.

Interviewees were asked whether they believe BIM will affect the QS in today’s construction industry. Whilst answering this question interviewees identified potential benefits BIM will be able to provide for the QS profession (shown in Table 2). These benefits included improved communication, greater speed of working, improved visualisation, ability to automate quantities and clash detection.

| Themes                        | Interview 1 | Interview 2 | Interview 3 | Interview 4 | Interview 5 | Count |
|-------------------------------|-------------|-------------|-------------|-------------|-------------|-------|
| Improved communication        | X           | X           | X           |             |             | 3     |
| Greater speed                 |             |             |             |             |             |       |
| Improved visualisation        |             |             |             |             | X           | 2     |
| Automatic quantities          |             |             |             |             |             |       |
| Used for clash detection      |             |             |             |             |             |       |
| purposes                      |             |             |             |             |             |       |

4.3 Future implementation of BIM

A final objective was to develop an understanding of why QSs are not utilising BIM to improve the efficiency of their services, as well as how awareness towards BIM implementation can be improved. In considering the various themes that have emerged through the interview process, a group of questions were posed to identify the barriers encountered by QSs when implementing BIM, how technologies like
BIM can be implemented in QS firms and finally, how QSs can broaden their knowledge base about the software. Barriers mentioned by interviewees include the lack of senior leadership support; knowledge of BIM; interoperability; cost of implementation; education and training; the BIM model not being designed properly; and finally, licensing issues with the software. Table 3 details the breakdown of the responses to these questions.

Table 3: Challenges with implementing BIM

| Themes                        | Interview 1 | Interview 2 | Interview 3 | Interview 4 | Interview 5 | Count |
|-------------------------------|-------------|-------------|-------------|-------------|-------------|-------|
| Lack of senior leadership support | X           | X           | X           | X           |             | 4     |
| Knowledge of BIM              | X           | X           | X           | X           |             | 4     |
| Lack of full team integration | X           | X           | X           |             |             | 3     |
| Cost of implementation        |             | X           | X           | X           |             | 3     |
| Education and training        | X           | X           | X           |             |             | 3     |
| BIM model not designed properly | X           |             | X           | X           |             | 3     |
| Licensing issues              |             |             | X           |             | X           | 1     |

However, the overall perception of the software is a positive one with the professionals stating that BIM will not be a threat to them but can actually be used to benefit the profession. The following quotes were mentioned by respondents in relation to this:

- “QSs are definitely the right people to be using it.”
- “I’m definitely not opposed to it (BIM) at all and ones got to change. You’ve got to move with the times and if you don’t move you going to stagnate.”

The interviewee statements are further reinforced by literature, with several authors, namely, Maritz and Sigle [15], Smith [21] & Wong, Salleh and Mohd-rahim [23], agreeing with or sharing the same opinion with regards to BIM implementation challenges that were mentioned during the interview process. Next, interviewees identified ways that QSs can broaden their knowledge base on BIM and awareness towards BIM implementation. Table 4 illustrates the factors that need to be considered when looking at implementing BIM on a wider spectrum.
Table 4: Factors that need to be considered when looking at implementing BIM on a wider spectrum

| Themes                      | Interview 1 | Interview 2 | Interview 3 | Interview 4 | Interview 5 | Count |
|-----------------------------|-------------|-------------|-------------|-------------|-------------|-------|
| Results from the use of BIM| X           | X           | X           | X           | X           | 4     |
| Standardising BIM           | X           | X           | X           |             |             | 2     |
| Clients requesting the use  |             | X           | X           |             |             | 2     |
| of BIM                      |             |             |             |             |             |       |
| Education and knowledge     | X           | X           |             |             |             | 2     |
| Cost of BIM                 | X           |             |             |             |             | 1     |

The interviewees mentioned that if they get proof that the software works and someone demonstrates the benefits to them, they will most certainly change their mind-set when it comes to implementing the software. This is more so the case with the senior members of staff, because they are the people running the business, so they will only start looking at BIM if they can see that it is going to benefit them in the future.

The interviewee statements are supported by Aibinu, Ph and Venkatesh [1] stating that if an individual shares the benefits and demonstrates the ease of use of the BIM software, it is seen as a potential driver for its adoption.

5. Conclusion

The research was aimed at bringing to light the benefits and challenges that BIM will bring to the QS profession, as well as how awareness towards BIM implementation can be improved. Semi-structured interviews were employed to collect the data before thematic analysis was employed to identify the PrQS professions opinion of BIM.

The research examined the reasons behind PrQSs not utilising BIM to improve current methods of managing construction costs on projects. The results revealed that there are a few challenges that QSs face in today’s construction industry in terms of their working methods. The results also identified the potential of BIM to help mitigate these challenges with interviewees mentioning greater speed, improved visualisation, automatic quantities and improved communication as benefits that the BIM software may provide the QS.

Despite BIM’s potential to benefit the QS profession, the results showed that there are still several barriers holding professionals back, the most prominent barriers being the lack of senior leadership support, knowledge of BIM, lack of full team integration and the cost of implementing BIM. This lead to QSs perception that for them to start implementing BIM on projects, they first need to perceive the results of it being advantageous to an organisation.

The BIM revolution is well on its way in the construction industry with it gaining more traction in recent years. However, in South Africa and more so Port Elizabeth, professionals are lagging when it comes to implementing new technologies such as BIM.

It is also worth noting that the overall perception of BIM amongst QSs is that of a positive one with many interviewees mentioning that BIM can be used to their advantage and QSs should not fear the software but rather embrace it to reap the potential benefits that may come with it.

6. Recommendations

Quantity surveyors need to start accepting BIM and to start learning how to use the software to judge it’s worth for implementation on specific projects. The construction industry is a very demanding industry, especially at present with the country’s economy in ruins. QSs need to start looking for quicker
and more efficient ways of doing things in order to meet expectations of clients, who are extremely demanding themselves. One of the interviewees made the following comment that supports this statement:

“I just think QSs get asked to do more for less and I just think a lot of the firms don’t know how important it is to start now to start moving with the times, you cannot keep doing more for less if you don’t start reducing the time that you spend on projects. And the only way to do that, in my opinion, is with new software like BIM.”

All project stakeholders and especially clients need to be made aware of the software. The mentality of project stakeholders needs to change around BIM so that there can be a push for a more holistic implementation of the software. There is no point just having the QS and architect on board, the whole project team needs to be fully committed to it for it to be successfully adopted.

In terms of BIM awareness, QSs should attend more BIM seminars and presentations, which could be arranged by the ASAQS or local ASAQS Chapters in the form of CPD events, to enable them to stay knowledgeable on how the software works and how BIM implementation could benefit the profession as a whole.

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