# SME READINESS OF BIM: A CASE STUDY OF A QUANTITY SURVEYING ORGANISATION

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Building Information Modelling (BIM), as an emerging enabling technology, is widely promoted in the UK. For Quantity Surveyor, BIM has the potential to remove many mundane elements of traditional quantity surveying, such as taking off and the production of Bills of Quantities (BoQ), by automating or assisting in these tasks removing human error, increasing efficiency and promoting collaboration. However implementation of BIM in the Construction Industry is not an easy task. This research aims to investigate the readiness of quantity surveying (QS) firms in the UK in implementation of BIM. The paper presents a case study of a SME QS organisation analysing its readiness to adopt BIM and evaluating perceived potential benefits. The case study is analysed at both organisation level and project level to explore the challenges the SME organisation facing inside and out. The key barriers are discussed and identified for SME quantity surveying organisations to implement BIM.

Keywords: Adoption of BIM, Quantity Surveying, Readiness, SME, UK

## INTRODUCTION

Recent years, Building Information Modelling (BIM), as an emerging enabling technology, is widely promoting in the UK. Following this the Government released their Building Information Modelling working party strategy paper in March 2011 which states that the BIM Working Group's aim is to urge the Government construction clients to *"focus on a consistent approach which will generate a consistent demand for the market to address. This will drive a critical mass of improvement upon which we will build over the five year period, by which time we expect all suppliers to the Government Estate to be capable of operating at Building Information Modelling Level 2"* (DBIS, 2011). However, implementation of BIM in the Construction Industry is not an easy task. Evidence suggests that Construction Industry lags behind other industries in the adoption of e-business activities. One of the reasons for low adoption is the fact that 99% of construction enterprises are micro, small and medium organisations. While those 1% large organisations are already using BIM and e-ready in many ways the rest of the industry is struggling to survive in this economic adversity raising doubts in their ability to adopt BIM and to keep up with the government targets.

For Quantity Surveyors, BIM has the potential to remove many mundane elements of traditional quantity surveying, such as taking off and the production of Bills of Quantities (BoQ), by automating or assisting in these tasks removing human errors,

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increasing efficiency and promoting collaboration (Olantju et al, 2009). This research aims to investigate the readiness of quantity surveying (QS) firms in the UK in implementation of BIM. However, the uptakes of BIM in quantity surveying companies are relatively low. There have been several surveys carried out to date on Building Information Modelling usage. The BCIS carried out a survey on behalf of the RICS in April 2011 highlighted the general lack of investment in Building Information Modelling amongst Quantity Surveyors, with only 10% of the 156 respondents said to be 'using BIM regularly'. David Bucknall, Chairman of the RICS Quantity Surveying and Construction Professional group warned: *"The effective adoption of BIM technologies by cost consultants and planners has been slow to date, and should this situation remain, then cost and programme services will not benefit from the productivity and speed of response that a settled BIM process can offer"* (RICS, 2011). As the Government is trying to push all suppliers to the Government estate to achieve at BIM level 2 by 2016, Quantity surveying professionals should not be outside of the loop. It is crucial to identify what the current status of Quantity Surveying firms towards embracing BIM integration.

The paper presents a case study of a SME QS organisation analysing its readiness to adopt BIM and evaluating perceived potential benefits. The case study is analysed at both the organisation and project level to explore the challenges the SME organisation facing inside and out. The key barriers are discussed and identified for SME quantity surveying organisations to implement BIM.

## QUANTITY SURVEYING AND BIM

Quantity Surveyor plays an essential role in the project team (Odeyinka and Doherty 2008, Olantju et al 2009). The role of the Quantity Surveyor entails both numerical representation of component quantities and accurate interpretation of design. Quantity Surveyors are required to have in depth knowledge regarding the main trades, subcontract packages, time and resource and must have the ability to take off drawings and produce accurate estimates (Brook, 2004). As Smith (1995) stated that the objective of an estimate for a project is to provide the most realistic prediction possible of cost and time, no matter what stage the estimate is undertaken. Conventional construction estimating practices have been criticised because there is hardly an estimate without its own peculiarities (Sutrisna et al, 2005). The issues some Quantity Surveyors face when preparing estimates is the lack of historical data on current rates, wastage, labour costs etc, and in these instances, skill and experience are expected to make up for the companies incapability's of recording their historical data (Smith, 1995).

The development of BIM within the UK construction industry will have an impact on all construction professionals (Howard and Bjork, 2008), and it is primarily led by Architects and Designers. In order to keep pace with other members of the design team quantity surveyors need to acknowledge Architects and Designers are not the only professionals that should and do use BIM.

There are many advantages for Quantity Surveyors to apply BIM into their daily business. According to the RICS (2011) BIM enables the Quantity Surveyor to produce quantities in hours/days rather than weeks/months. As Whatmore (2012) highlighted *"one of the key benefits of BIM is that it allows our Quantity Surveyor's to focus more on other value-adding services for their projects-rather than spending up to 80% of their time measuring quantities"*.

Cost estimates can also be improved by the utilization of BIM which enables the ability to extract quantities from the BIM model at any stage and in a form appropriate to the level of estimating detail required (Boom, 2009). Moreover, BIM software can help assist the Quantity Surveyor in various tasks rather than quantification. BIM can aid programme certainty at tender stage, contractors can link their programme to the model upon tender submission, and this should reduce the amount of variations required during the construction phase. The Government Construction Strategy (Cabinet Office, 2011) stated that poor and inconsistent procurement practices, particularly in the public sector, are leading to waste and inefficiency. Hence, BIM can be used to streamline the procurement process by the Quantity Surveyor. Furthermore, BIM provides new opportunities for QS to expand their services to the client. The NBS National BIM survey (2012) concludes that whilst measurement will be automated discretionary skills will still be necessary. According to Saint (2012) in terms of life cycle costing BIM offers this as an opportunity for the Quantity Surveyor to provide further data to the client.

On the other hand, BIM implantation for QS requires new skills and knowledge. Barker (2011) states with BIM new skills are required that will challenge the traditional boundaries of the QS profession, suggesting QS's should be educated in design, 3D modelling and construction technology to be able to resolve construction interface difficulties and cross traditional professional boundaries. However the researches highlight fears amongst the Quantity Surveyors and their reluctant to embrace BIM, because they believe they will be redundant as BIM could carry out many traditional QS functions and replace their works (Matthews, 2011, RICS, 2011, NBS, 2012). It is important to note that there is the argument that BIM software's ability to automate quantities may in time reduce the client's requirements for a Quantity Surveyor.

In 2011, BCIS undertook the first BIM Survey of RICS members in the UK and United States (RICS, 2011). The survey was sent to 8500 RICS members asking about their firms' engagement with BIM. The report analyses the responses from 156 members of the Quantity Surveying and Construction Professional Group (QSs) and 96 members of the Building Surveying Professional Group (BSs). Among 156 QS participants only 10% are recorded to be using BIM regularly and another 29% QS has limited engagement with BIM. The survey report further stated that for QS the biggest barriers to the take-up of BIM are lack of client demand, lack of training, lack of application interfaces and lack of standard. One of main reason of the slow uptake of BIM in QS practice is because most of them are SME companies. RICS survey findings are aligned with NBS study's result. According to an interview carried out as

part of the NBS report (2012), some small practices see BIM as a threat stating that "as a sole practitioner, I generally work on small scale residential projects and do not see any fundamental benefit of changing to BIM; I am concerned about the financial and time commitment from a small practice".

From the financial perspective, the upfront cost associated with BIM software purchases and training is relatively high and SME QS companies will struggle to obtain the extra investment during the current negative economic condition (Matthews 2011, RICS, 2011 and NBS, 2012). According to the NBS National BIM Survey (2012), 63% of Quantity Surveyors agreed that 'BIM is too expensive for us to consider at the moment' with 48% agreeing that they would consider BIM following the downturn. With a realistic cost of a BIM workstation including software cost and training is estimated at £10,000 per organisation (NBS, 2012). Erland Rendell from Davis Langdon stated that all staff would require BIM training with approximately 1 in 20 employees requiring extra training to become software 'Experts' this level of training is estimated to cost £5,000 per person (Matthews and Withers, 2011). Within 40,000 RICS Quantity Surveyors, this could add another bill of at least £10million to the industry. To summarise the literature findings, table 1 outlines the benefits and barriers for quantity surveyors to embrace BIM.

Table 1: Benefits and Barriers of BIM to the Quantity Surveyor

| Benefits of BIM to the Quantity Surveyor | Barriers of BIM to the Quantity Surveyor |
|---|---|
| Improved Efficiency | Removed need for a Quantity Surveyor |
| Accurate Measures | Liability Concerns |
| Coordination of all design information | High Cost/ Extra Capital Investment |
| Visual Aid | Less familiarity with Project |
| Cost Plan Production | Lack of application interfaces |
| Automatic Schedule Production | Software Complexity |
| Cost Effective | Lack of standards |

## RESEARCH METHOD

RICS has conducted a comprehensive survey about BIM among QSs and BSs. The survey findings presented the industrial attitudes and overall barriers in adopting BIM. However, RICS survey did not carry out any qualitative study which lack of in-depth analysis from the organisation perspective and didn't identify the role of QS in future

BIM project team management. Hence it is necessary to conduct further investigation based on RICS study. The authors intend to undertake a case study of a SME Quantity Surveying firm within the North East, England in both organisational and project levels. An on-going live projects which has been adopted BIM is also selected to draw a better understanding of the role of QS in the project team management. The case study approach will allow the authors to gain a deeper understanding of BIM and its potentials and limitations of implementing to quantity surveying services. Semi-structured interview was used as the main data collection tool. As Easterby-Smith et al (2002) described that conducting an interview provides the opportunity for the researcher to probe deeply to uncover new clues, open up new dimensions of a problem and to secure vivid, accurate inclusive accounts that are based on personal experiencing.

In the organisation level, in order to draw a whole picture of the organisation's perspectives, all level of staff were invited to interviews they are Managing Director; Director Associate Director; Senior Quantity Surveyor; Assistant Quantity Surveyor; Trainee Quantity Surveyor. The above 6 interviewees have been purposely selected given their individual roles and varied level of experience, which should be reflected through their responses to the interview. The authors feel that by interviewing an employee at each level within the organization structure then a fair well-rounded conclusion can be drawn from the data and difference in opinion analysed. In the project level, 6 key members of the design team are been interviewed. They are Client, Architect, Contractor, Quantity Surveyor, Project Manager and Facility Manager. These interviews were conducted to collect the insights from different stakeholders and their views about the QS role in BIM project management. All interviews were recorded and transcript manually. The data are coded and mainly analysed as the section below. The average length of interviewees is about 1.5-2 hours.

## DATA ANALYSIS

The case study company is a regional firm which is based in North East, England. Their business mainly focuses on cost, project management, development consultancy and environmental assessment. They have a wide range of clients in both public and private sectors and different type of projects from housing, health, education, and commercial sectors etc. They are a small enterprise with less than 20 staff.

### Organisation Level

As described in previous section, 6 people were interviewed from the top managing director to trainee quantity surveyor. Total 39 questions were asked about the interviewee's experiences and opinions in implementing BIM into the organisation. Questions have been break down to 6 sections: Interviewee Background, BIM background, In House Measurement, Benefits & Barriers of BIM, Investment and the future role of QS in BIM.

Results founds that within the organisation, most people (5 out of 6) have moderate or little knowledge of BIM only the director have more knowledge about it. Some of their on-going projects have started to adopt BIM, but still in every early stage. None of them has used the BIM software before. The BIM software they heard about is only REVIT. The main job in house is measurement, the QS team (senior, assistant and trainee QS) have a heavily role in measurement, spending over 50% of their times in the single activity and they believe that their measurement works has some human errors and inaccuracies.

Staff agreed that BIM could bring a number of benefits such as improve efficiency, improve accuracy and free up resource (time). However, 'Cost' was highlighted as the biggest barrier within the organisation to adopt BIM. As the Associate Director states:

"Cost is the major issue for SME QS firms especially given that fact we are just recovering from the recession and several companies have gone into administration".

This finding is different to RICS Survey result where it shows that lack of client demand is the biggest barriers for BIM implementation. However, in practice, it requests the organisation to invest first and then they could demonstrate their capabilities in BIM to attract more clients. The current situation is that UK construction industry is in double dip recession, many public sector projects have been cut off and the case organisation is more concerning how to survive rather that put more investment in training or new business. The company has not yet invested in either BIM software or related training. The research shows that not all employees are convinced that BIM would be a worthwhile investment for the company, half interviewees states that they do not believe that BIM benefits outweigh the capital cost.

The following three key barriers are 'Not enough internal resource', 'No client/consultant demand' and 'Level of training required'. This agrees with findings highlighted within the literature review which states that SME firms are concerned about the financial and time commitment from a small practice (NBS, 2012). And also there are some risks to implement BIM at the current stage. One of the key risks is 'Liability issues'. As the Managing Director states that

"Clearer definition about legal ownership of information and roles and responsibilities of the supply chain are needed"

Moreover, both 'Data input responsibilities' and 'reduced need for a Quantity Surveyor' were recognised as risks by 4 out of the 6 interviewees. The Director also states that "Reduction in the amount of measurement required by the surveyor as some elements will become automated" is a key risk to the Quantity Surveyor and the Managing Director stated that there is a risk that the "Role of the Quantity Surveyor will be required less". This confirms the findings within RICS Survey and other literature.

Interestingly, this study found that most of interviewee did not fear that QS will be replaced by BIM, only 1 interviewee expressed some concern over this issue stating

“Yes there is a concern that the ‘traditional role’ of the QS would be replaced. The QS would have to learn to adapt in line with the moving technologies and adapt their role in order to remain relevant”.

Interviewees urged that the professional body RICS has the responsibility to deliver more BIM relevant training or CPD events. The director states *“In my opinion if BIM is so important to the RICS then the RICS should set aside a section of the RICS member fees to host BIM training for SME Quantity Surveying practices”*. There was also the opinion that *“Standardisation of software and agreed working practices”* would promote BIM use.

**Project Level**

The project that was selected to study was the refurbishment works of a University Building. Building Information Modelling software has been utilized for this project. This pilot BIM scheme started onsite in February 2012. The contract sum for these works is circa £4 million. Although there was no extra cost for the use of BIM on this specific project due the University having a fixed framework agreement in place, the lead designer was expected to provide 4D visualisations as part of the works. It is important to note that the University are a public sector organisation and are keen to implement BIM on this specific project given the Governments 2016 BIM targets.

There are total 41 questions in the project level interviews. The interview questions have been divided into 6 sections: interviewee background, BIM related experience and knowledge, main drivers and barriers, BIM implementation, BIM and QS and the future of BIM. In this project, Architect is the most knowledgeable person of BIM, the follower is contractor and project manager, however, QS, facility manager and the client have little knowledge about BIM. Both Architect and Contractor's company have long term experience in BIM practice. Within the project team, all stakeholders are provided some BIM trainings.

During the interview, each interviewee was asked what they perceive to be major benefits of BIM to the specific project. Results show that ‘visual aid' appears to be the most popular responses by 4 out of the 6 professionals. The other two key benefits are coordination of all information and efficiency. As the Client states,

“In this particular project the benefits were noticed during the stakeholder engagement. We as a University found this very useful as it allows us to provide a visual of how the building will look as some stakeholders are unfamiliar with construction drawings”.

The client also adds: “BIM can benefit us from understanding the design more”.

As same as at organisation level, capital cost the biggest barriers of BIM implementation. In this project there is no extra funding to support the usage of BIM, but instead to pay more consultant fees to Architect, that is one reason why Architect has higher motivation in BIM than other stakeholders. The Project Manager believes that the current economic climate is not a good time to uptake BIM. As he states: “In

the current economic climate I feel that the initial costs are probably too high for small consultancies, hopefully we will see a change here when the market picks up again".

Another key barrier is 'different level of understanding of BIM software and technologies', and more training is needed at the project level. A number of interviewees agree that "there is a lack of understanding of the software and a general lack of training across the design team". These findings confirm key barriers identified within the literature review where the RICS BIM Survey (2011) states that 70% of respondents agree that 'lack of training'.

Within the project team, most interviewees believe that BIM could help QS to take quantities and do cost planning more effective and accurately and none of project team members believes that QS could the BIM manager in the future. This data reveals that all interviewees feel that the Quantity Surveyor only has a traditional 'quantifying' role within BIM. But, nobody agree that BIM will replace Quantity Surveyor. As the client explained that:

"No, BIM is similar to an 'adjustable spanner' it will do the job required, but there will always be a need for an expert"

Finally, the project teams agreed that BIM is crucial in the industry and by using BIM they will have more works in the future, however the main challenges is lack of awareness in the industry and project team need more training and investment.

## CONCLUSIONS

No doubts, implementing BIM is the current trend in the construction industry. The benefits of BIM is enormous, to provide better coordination of project team, improve efficiency and accuracy of the project and so on. All construction professionals need to improve their knowledge and skills in BIM and apply BIM into their daily practice. The UK central government is promoting BIM and demands more for public sector projects. There are vast of research studies have been carried out on BIM to date is both in theory and its applications. A number of industry-wide surveys were conducted to assess the current engagement of BIM in practice. The results found that although the government is pushing hard, but slow uptakes in the industry, particularly in QS services. Most QS companies in the UK are small or medium enterprises, so this study is to use case study approach to investigate the readiness of SME QS practice in adopting BIM.

The case study was conducted at two levels: both organisation and project levels. The results find that Quantity Surveyors still play a 'traditional quantification' role in practice. Their main job is 'measurement' and 'cost planning'. This role doesn't change in projects with or without BIM. However in the organisation level, quantity surveyors are aware these limitation and they are keen to make changes to fit the industry needs.

BIM is relatively new to QS; most of quantity surveyors are lack of knowledge and training. From the organisation perspective, The QS Company does not yet ready to implement BIM and the motivation from inside of the QS firm is low. Although they are aware the benefits of BIM, but those benefits are unclear and the challenges are heavy. The biggest barriers are capital cost of BIM, both software and training and moreover, the current economic climate does not allow them to make more investment in BIM due to lack of demands and lack of internal resources. There are also some risks in BIM such as liability issues. The professional body such as RICS need provide more training for QS. In the project level, Architect has a strong motivation than other stakeholder due to higher consultant fees and this case study project clearly demonstrates leadership of Architect in BIM implementation. For the client, the main benefits are a good visualisation of the project with better understanding of the design. Most people are agreed that capital cost is the biggest barriers and QS is not act as the BIM manager in the project team.

In conclusion, SME QS firms are facing substantial challenges in implementing BIM, and they are far behind than other professional. To change this situation, more BIM relevant trainings and education are needed and should be provided by the professional bodies and higher education institutes. On the other hand, the government should set up a special group to support SME for BIM adoption and provide financial incentives for BIM implementation; otherwise, there is a concern that the government target would not be able to be achieved in 2016.

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