BIM Vs Traditional Quantity Surveying And Its Future Mapping

[1]Manish Nigam, [2]Abhishek Dixit, [3]Kshitij Kumar sachan
[1] Associate Professor, [2] Assistant Professor. [3] Assistant Professor
[1,2,3]PSIT College of Engineering, Kanpur, U.P. (INDIA), 209305

***Abstract*- Over the past eras, growths of innovative technological concepts are promptly increasing, in order to achieve competitive productivity and performance. Building industry identifies technology as vital. Although the building industry is broadly identified as unique and conservative, at the same time construction industry has to have varied according to these innovative technological variations. In addition to that these technological variations may have potential to influence everyone's professions in different ways. Although, the concept of Building Information Modeling (BIM) is slightly practiced in Indian construction industry yet, it is likely to become the project delivery standard in future. Introduce with the vision "sustainability by building smarter", BIM will improve the performance of building professionals. The current knowledge does not adequately explain how the functions of a Quantity Surveyor are affected by BIM. This paper presents a study on comparative effectiveness offered by BIM for the traditional functions of a Quantity Surveyor. The study is interesting because the new knowledge will help to develop strategies for professional development and update the education curricula to train the Quantity Surveyors to. Face future challenges. As a visual database of building components, BIM can provide accurate and automated quantification, and assist insignificantly reducing variability in cost estimates. Exchanging data is a challenging aspect of AEC information technology. BIM applications are evolving and standard formats to organize and share building information are far from fully mature as well.**

***Index Terms* - Building Industry; Building Information Modeling; BIM; Quantity Surveying**

I.INTRODUCTION

A Quantity Surveyor is an expert in the art of costing a building at all its stages who offer expert advices on construction costs. It is inevitable that, the advices are vital for life cycle costing, cost planning, procurement and tendering, contract administration and commercial management. Moreover a Quantity Surveyor may be involved as a specialist in one area or generalize in several over the course of a project (RICS, 2012) and he known as a Construction Economist, a Cost Manager, a team of professional advisers to the construction industry as well. As advisers they estimate and monitor construction costs, from the feasibility stage of a project through to the completion of the construction period. After construction they may be involved with tax depreciation schedules, replacement cost estimation for insurance purposes and, if necessary, mediation and arbitration . Building Information Modeling (BIM) offers a potentially transformational technology through its capability to provide a shared digital resource for all participants in a building's lifecycle management, from preliminary design through facilities management. As a visual database of building components,BIM can provide accurate and automated quantification, and assist in significantly reducing variability in cost estimates. Exchanging data is a challenging aspect of AEC information technology. BIM applications are evolving and standard formats to organize and share building information are far from fully mature as well. Software applications can employ several methods for exchanging data – XML, APIs, ODBC among them The method used depends on the phase of the project, detail required, and type of interaction needed between BIM and an external application. Costing exercises can be conducted throughout the project lifecycle with BIM. The level of detail in the model will vary depending on the project phase. Firms employing BIM will need to develop methods and standards for object development that support the level of detail required for useful estimates, as well as provide a framework for providing consistent information for the BIM components tallied by cost estimators.

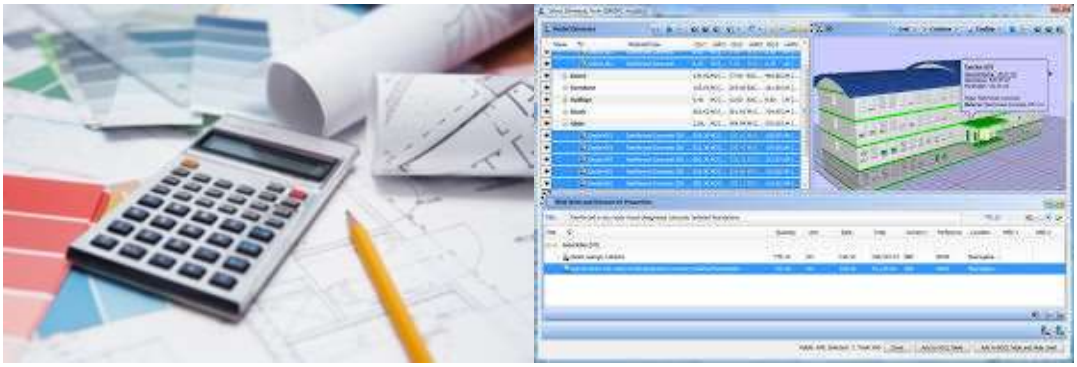

Fig 1 Traditional cost Estimation Vs BIM based Estimation

II. BIM, Cost Estimates and Project Phasing

Cost estimation for building projects traditionally starts with quantification – a time-intensive process of tallying components from printed drawing sets, or more recently - CAD drawings. From these quantities, estimators utilize methods from spreadsheets to costing applications to produce the project cost estimate. This process is prone to human error and tends to propagate inaccuracies that creep into the tallies. Currently, quantification is also time-consuming – it can require 50% to 80% of a cost estimator's time on a project.2BIM offers the capability to generate takeoffs, counts and measurements directly from a model. This provides a process where information stays consistent throughout the project and changes can be readily accommodated. Building information modeling supports the full project lifecycle and offers the capability to integrate costing efforts throughout all project phases. The information in a model and type of cost estimate needed depends on the phase of the project – ranging from high level schematic models during preliminary phases, to detailed estimates as projects enter construction.

2.1 Preliminary Cost Estimates

Architects typically do not provide cost estimates on projects as part of their standard services, but the native capability of BIM to quantify and calculate is changing the nature of project deliverables for all participants. Conceptual or "top-down" estimates are the first serious effort to predict the cost of a project and align decision-making with those estimates. Project information at these early stages is usually general and at a high level (e.g. number of occupants, gross square feet area, and enclosed volume).Preliminary costing is generally based on templates from past project experience, or on standard square foot costs based on project type, region, or type of construction. Preliminary estimates, unlike those created during later stages, are prepared using concepts (e.g. "hospitals cost Rs x/sq. ft." or "corporate space standards require x sq. ft. for this project"), and avoid counting of individual pieces.

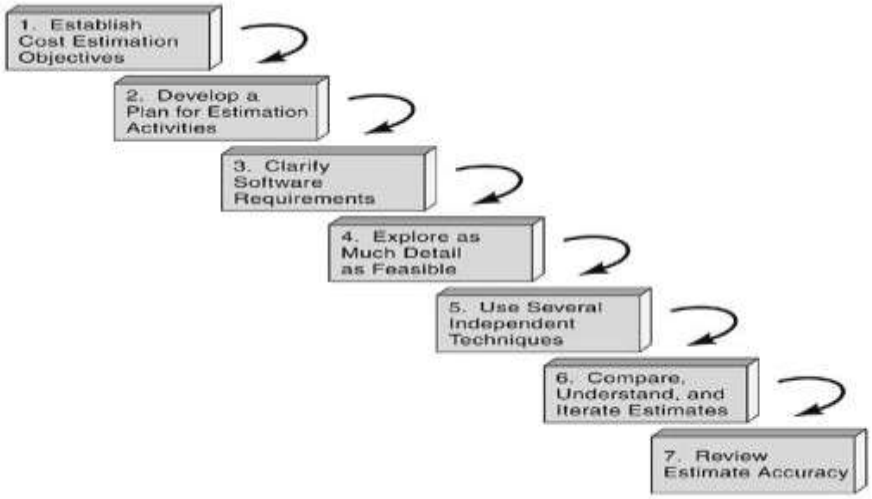

Fig 2

2.2 Steps in Estimating

Standard CAD, and now BIM, applications have the capability of modeling data far in excess of what is needed at preliminary project phases. Detailed modeling can confuse decision-making and scenario planning rather than assist it. Determining what the building information model "is" during the planning and schematic phases of a project involves delineating what information is required to support the decision-making processes at the early stages of a project. Schematic BIM models are based on simple geometries and need to be flexible and lightweight enough to support many iterations and changes inherent in early project phases. Models at this project stage are generated from functional rules and programmatic requirements rather than geometry and specifications. Standard objects or assemblies ("cells" or "blocks" in CAD) at this phase are generic endless detailed in nature – to be replaced later in the project as the project develops through design development and construction document phases. Software applications that develop preliminary building models and costing estimates may not necessarily be the same tools used to support the design development and documentation processes that follow (more typically thought of as "BIM"). The same process change that occurs now during project development will still exist in fully automated projects, but improved decision support tools are being developed to assist project professionals earlier on. Preliminary applications should have the capability to export developed information to full-fledged BIM modelers.

2.3 Detailed Cost Estimates

Detailed estimates, also known as bottom-up, fair-cost, or bid estimates, are prepared from well-defined design and engineering data. These estimates are generally carried out for bid evaluations, contract changes, work scoping, permits and approvals. As project development progresses from schematic design through contract documents, quantification and costing become dependent on developing objects in the building model in increasing levels of detail and complexity.

2.4Capabilities of BIM

Building Information Modeling (BIM) is the latest technology in the built environment utilizing data models. It is a multi-dimensional model that acts as a communication and information resource over the lifecycle of a construction project (Gee, 2010). Olutanji et al. (2009) says relevant literature highlights BIM as three- or four-dimensional drafting applications that generate data-intensive plans. 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. Muzvimwe

(2011 as cited Shangvi, 2012) summarize that following BIM applications which are capable to provide the services on a construction project.

Table:1 BIM Applications which are Capable to Provide the Services on a Construction Project

3D BIM (Design)	They can create three dimensional (3D) models of the buildings from which the design can be visualized at any stage of the project. Moreover, 3D models are useful for design coordination and clash detection of services in a building .
4D BIM (Scheduling)	Certain BIM applications possess the capability of linking the components of the model to the construction schedule. This process of adding the parameter of time to the 3D model is termed as 4D simulation. The 4D model is used for planning and tracking construction activities.
5D BIM (Cost)	The 5D model is an integration of design (3D) and schedule (4D) with the costs associated with the components of the model. It is primarily used for cost estimation.
6D and 7D BIM	Due to the large scale research and development, the repertoire of BIM tools now covers applications related to life cycle management and sustainable design which are referred to as 6D and 7D.

III. IMPACT OF BIM ON QUANTITY SURVEYING PROFESSION

Technology is developing rapidly by improving all its subsectors across the world and making all the real life functions easier than they were. The construction industry which identifies technology as vital, has been sensitive to these technological changes. Ashworth and Hogg (2007 as cited Gee, 2010) emphasized that the Quantity Surveying profession is, like many other professions, an evolving profession that needs to continue to change to meet the ever changing conditions of the building industry. The history of Quantity Surveying and the way Quantity Surveying tasks were performed provides enough substantial evidence to show how Information Technology has changed the way the Quantity Surveyor.BIM has the potential to influence every characteristic of the construction industry together with construction professionals. BIM consists of 3-dimensional design functions (3D), programming and scheduling functions (4D) and cost estimating functions (5D). Olatunji et al. (2009) specified that, 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. BIM has the potential to automate measurement and facilitate the preparation of accurate estimates. Building Information Modeling has the capability to automate a quantity take-off, which will reduce the time and costs required to estimate a project; however, the industry is not using BIM for estimating. BIM software is compatible with estimating software, such as Innovaya Composer, which converts BIM files, making them compatible with Timberline's estimate and quantity data (Sattineni and Bradford, 2012). According to Gee (2010), BIM's capabilities of automating the production of bills of quantities, which is one of the Quantity Surveyors fundamental tasks, will have both positive and negative effects on the Quantity Surveying industry. Hergunsel (2011) reported that two main elements of a cost estimate are quantity take-off and pricing. Quantities from a Building Information Model can be extracted to a cost database or an excel file. However, pricing cannot be attained from the model. Cost estimating requires the expertise of the cost estimator to analyze the components of a material and how they get installed. If the pricing for a certain activity is not available in the database, cost estimator may need a further breakdown of the element for more accurate pricing. Autodesk (2007) argues that as BIM tools are capable of automating the tedious task of quantifying, they allow the estimators to dedicate their valuable time on other cost sensitive tasks as pricing and factoring risks. Baldwin and Jelling (2009) emphasized that traditionally followed Quantity Takeoff and bill generation is a very time consuming process that are prone to error. Moreover, it is perceived that the following factors undermine the accuracy of the manual Quantity Takeoff.

- Errors associated with moving data between files
- Risk of double counting
- Risk of missing elements
- Multiple 2D drawings themselves are likely to contain many errors compounding the problem further more Paul et al. (2011) denote that BIM software can help assist the Quantity Surveyor in various tasks rather than quantification. BIM can aid program me certainty at tender stage, contractors can link their program me to the model upon tender submission, and this should reduce the amount of variations required during the construction phase. As a summary it can be illustrated that there is considerable impact of BIM on the profession of Quantity Surveying.

3.1 USAGE OF BIM AS A QUANTITY SURVEYING TOOL

The use of Building Information Modeling (BIM) in the construction industry is on the rise. It is widely acknowledged that adoption of BIM would cause a seismic shift in the business processes within the construction industry and related fields (Sattineni and Bradford, 2012). The manual process requires a great deal of time for revising the BOQ to accommodate design changes. Hence, the BOQ is often out-of-date. Ashworth (2010) considers that the speed of response and the ability to reduce manual errors have led to the wide spread use of software applications for performing QTO and estimating. The 5D model created by BIM has the potential to perform an automatic analysis of all materials and components and to derive their quantities directly from the model (Baldwin and Jellings,2009). Eastman et al. (2008), consider that proponents of BIM are very useful for VM as the speed of response of BIM tools provides an excellent opportunity to perform VM throughout the design period. Baldwin and Jelling (2009) reported that Consolidated Contractors Company used BIM to generate bulky monthly payment applications, cost reports and estimated that by utilizing BIM in the Dubai Mall project. That tasks which would possibly have required 25 full time QSs were carried out by employing 8 modelers and 2 BIM engineers. BIM suggest that a detailed building model would provide a

greater certainty over the quantities of material, and therefore, BIM would produce a more reliable cost estimate compared to the traditional process (Eastman et al., 2011). Mons white (2011 as cited in Shangvi, 2012) denote that large clients who have their in-house cost database can directly derive their estimates during the early stages of the project using BIM based estimating tools such as DProfiler. Therefore, they can afford to do without the services of the QS. According to Eastman et al. (2011 as cited in Shangvi, 2012), below table provides an overview of the capabilities of BIM applications pertaining to the traditional quantity surveying tasks.

Table 2: Capabilities of BIM Applications Pertaining to the Traditional Quantity Surveying Tasks

Traditional Quantity Surveying task	BIM tools capable of performing that task
Quantity Take-off	Autodesk QTO, BIM Measure from Causeway
BOQ Preparation	Cost OSTM, Nomitech
Cost Estimation	DProfiler, Beck Technology
Cost Planning	Vico Cost Planner
Cost Reporting	Vico Office Client
Cost Control	Vico Cost Explorer
Material Procurement	Quantities of material can be obtained using BIM tools for QTO
Payment Applications	Bentley
Life Cycle Costing	Integrated Environmental Solutions Virtual Environment

3.2 UNCERTAINTY OF BIM AS A QUANTITY SURVEYING TOOL

Building Information Modeling "BIM" is becoming a better known established collaboration process in the construction industry (Hergunsel, 2011). However, as per the viewpoints of Ogunsemi et al. (2010), there is a second line of thought within the construction industry which suggests that, BIM is not completely trustworthy as a Quantity Surveying tool as nonconformity of the output data from BIM with the standard methods of measurement. Furthermore Buckley (2008 as cited in Shangvi, 2012) argued that, BIM tools are not advanced enough to be capable to substitute the experience and expertise of the QS. Furthermore Bruce Buckley does not endorse this practice of preparing a cost estimate without the involvement of an estimator and estimator's knowledge and experience are absolutely essential to adjust the estimate in accordance with the specific conditions of a project. Moreover Buckley point out that BIM tools are not programmed to perform such adjustments by themselves. Olatunji et al. (2010) have doubts over the reliability of QTO performed by BIM applications as BIM tools simply provide theoretical quantities based on the attributes of the model without any allowances for wastage, lapping etc.

IV CONCLUSIONS

Costing applications will need to select a method depending on project phase and the detail required, and develop in-house standards and procedures for aligning their models with the estimating processes. Industry standards for data exchange – IFCs in particular and frameworks for information classification(e.g. Omni Class, Uni Format) are integral to industry interoperability. As many standards are still developing, so are BIM applications. Professionals using BIM will have to adopt strategies to integrate and change as these technologies mature.BIM offers the promise of a central detailed database for a range of project applications, and its visual capabilities for all of them should be a notable advantage when considering how professionals can change and manage building information throughout a project. As new technology, BIM assisted cost estimating will not obsolete estimators; rather, it promises to free them to focus on higher value task than counting, returning increased value to project processes. Technology is developing rapidly by improving all its subsectors across the world and making all the real life functions easier than they were. The construction industry which identifies technology as vital has been sensitive to these technological changes. According to the literature, Building Information Modeling (BIM) is one of the technologies that have been creating a buzz in the construction industry over the last few years which have potential to effect of Quantity Surveying profession. However, the technology itself provide list of benefits as well as a certain degree of risk which Building Information Modeling offers the capability to develop project cost information with more accuracy throughout the entire building lifecycle. The key to successful use of BIM-based costing will Bethe development of processes and methods within organizations. The level of detail required in building model will vary depending on project phases, from preliminary (macro) costing models to very detailed models required for micro costing activities during the construction phase Data exchange between BIM and costing applications can be accomplished in several ways – APIs, ODBCand IFCs among them. The manner chosen will depend on the software developer's intent. Professionals using BIM depend on the situation its being used. The review of current knowledge synthesized numerous benefits of BIM for QSs to offer effective service. Finding the validity of these conclusions empirically will be the next step of this study. However, in the absence of real cases of proper use of BIM in Sri Lanka, a positivists approach is not possible. Thus, the research will involve triangulation and interpretation of information from multiple sources to draw sensible conclusions.

REFERENCES

[1] Fanous, A., 2012.Surveying the field: changes in quantity Surveying [online].Coventry University,Smashwords. Available from:http://www.smashwords.com/books/view/215763 [Accessed 12 April 2013]

[2] Gee, C. 2010. The influence of building information modelling on the quantity surveying profession. Undergraduate Dissertation. University of Pretoria.

[3] Gu, N., Olatunji, O.A., and Sher, W., 2009. Building information modelling and quantity surveying practice.

Emirates Journal for Engineering Research, 15(1).
[4] Specifying and Cost Estimating with BIM, Robert Paul Dean, AIA, CSI, CCS, and Susan McClendon, RA, CSI, CCS. Archi-tech, April 2007
[5] 1-2-3 Revit: BIM and Cost Estimating, Rick Rundell, Cadalyst Magazine, August and September 2006.
[6] New Tools Deliver BIM Data, H. Edward Goldberg, Cadalyst Magazine, December 2003
[7] Preconstruction Management Software Trends and Strategy, Riverguide Inc., October 2006.
[8] Smith, D., 2007.An introduction to building information modelling. Journal of Building Information Modeling[online], Available from: http://www.wbdg.org/pdfs/jbim_fall07.pdf [Accessed 10 April 2013]
Succar, B., 2008. Building information modelling framework: A research and delivery foundation for industry
[9] stakeholders. Automation in Construction, 18(1), pp. 357-375.
[10]Whoo, J.H., 2007."BIM (building information modeling) and pedagogical challenges". Proceedings ofthe 43rd ASC National Annual Conference, Flagstaff, AZ., April 12-14.