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A MODELLING OF BUILDING INFORMATION BY WAY OF QUANTITY SURVEYING

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Abstract

Quantity surveying practices may greatly benefit from the use of building information modelling (BIM). Starting with the feasibility and design phases and continuing all the way up to the building's completion, quantity surveyors are in charge of managing the project's budget. Quantity surveyors seem to be behind other professions when it comes to using building information modelling (BIM). The major reason for the limited adoption of BIM is that its potential applications are not widely recognised. The potential of building information modelling (BIM) in the work of quantity surveyors is yet unclear. When building information modelling (BIM) allows for real-time analysis of a building's structure, materials, and performance during design, it will radically alter the current job of quantity surveyors whose work is based on BIM for building procurement. Therefore, in order to better prepare Quantity Surveyors for the challenges of the future, research is being carried out with the overarching goal of investigating the possible expansions of QS duties, as well as the shifting of key responsibilities and tasks of future Quantity Surveyors in a sustainable BIM-based project delivery. In this article, we provide the first results of a literature study that aimed to identify the present and future expectations for Quantity Surveyors in local construction procurement as it relates to building information modelling (BIM) based project delivery.

Keywords: Construction Industry, Capability, Building Information Modelling (BIM), Cost, and Quantity Surveying

1. Introduction

The use of BIM has revolutionised the building industry by streamlining the planning, construction, and administration of structures. During the construction phase of a building's lifespan, BIM provides real-time data on the project's budget, timeline, and quality. The completion of a construction project within the specified time frame, budget, and quality standards is considered a successful outcome. The building sector relies on quantity surveying for cost control services. Quantification, preparing bills of quantities, estimating, and pricing building projects are some of the main services offered by quantity surveyors (QSs). Quantity surveying has become a laborious and error-prone process due to the prevalence of antiquated manual methods, such as 2D computer-aided design and spreadsheet programmes like Excel. Therefore, it has diminished QS performance, which impacts project cost results. On top of that, traditional methods of QSs conducting their

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business are starting to annoy customers. Accelerating the quantification of the building for estimating purposes, producing updated estimates, and construction planning may be achieved with the use of BIM.

These issues may be resolved by automating the process via the use of building information modelling (BIM). Through the use of automation, BIM eliminates several time-consuming steps associated with conventional quantity surveying, including taking measurements, creating takeoffs, and creating bills of quantities (BQ). The possibilities and uses of building information modelling (BIM) in quantity surveying have received little academic attention. Some worry that the Quantity Surveying profession may be in jeopardy if BIM is widely used. Consequently, it's important to comprehend the possible extensions of QS responsibilities in BIM-based project delivery. throughout this light, the study that forms the basis of this article is an ongoing effort to better understand how future Quantity Surveyors will need to adapt to the shifting priorities of building information modelling (BIM) throughout the course of project delivery. The results of this research will aid in preparing Quantity Surveyors for the problems of the future, but in the meantime, this article provides a literature review of the topic, outlining the best ways to further our understanding.

2. Building Information Modelling

The Building Information Model (BIM) is a database that the owner or operator of a building may access and update at any point in time. It is a digital representation of the building's physical and functional attributes as well as information about the project and its history. Using physical geometry (in 2D or 3D) and other functional factors (materials, spatial connection, etc.) as digital representations, BIM creates a virtual image of the building's objects. A building model is defined by the designers by assembling these BIM components; this model integrates the functional and physical information included in the BIM elements. At the end of the building model's lifespan, users may produce all the data needed for fabrication, analysis, construction scheduling (4D BIM), cost estimation (5D BIM), and, finally, facility management throughout operation. Using Building Information Modelling (BIM), a visual model of the building may be created and maintained together with data about it from the design phase all the way through construction and into its operational life. To improve efficiency and effectiveness, save money during design and construction, and decrease operational expenses after construction, BIM often employs real-time, dynamic building modelling software that operates in 3D, 4D (workflow), and, more and more, 5D (quantity surveying).

3. Quantity Surveying using BIM

In the building sector, quality specialists are vital. One of the duties of a quantity surveyor is "to ensure that the resources of the construction industry are utilised to the best advantage of society by providing the financial management for projects and a cost consultancy service to the client and designer during the whole construction process," as stated in a 1971 report by RICS. Starting with

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the feasibility and design phases and continuing all the way up to the building's completion, they are in charge of the project's budget. At every step of a project, a Quantity Surveyor is responsible for financial control, cost management, and contractual administration. There are two distinct phases to their service delivery: before and after a project is built. Quantity surveying is a crucial part of pre-construction planning as it helps with things like creating cost plans and timetables, estimating costs, evaluating bids, and preparing bills of quantities. Contrarily, quantity surveying services include alternative dispute resolution (ADR), prepare financial statements, settle final accounts, evaluate variations, analyse interim payments, and general contractual assistance once construction is complete.

Measurement and production of bills of quantities are the QSs' primary services. In order to estimate costs, one must first do quantity takeoff (QTO) and then add cost data to the QTO list. Quantity taking off refers to the procedure of calculating the amount of different construction components. Using CAD drawings in a traditional way for quantity takeoffs (QTOs) entails picking out certain pieces, having the programme calculate the take-off dimensions automatically, and then entering the amounts into a QTO list. Estimators must devote a considerable amount of time to this step in order to generate the QTO for the whole drawing. Because the QTO method relies on human activities for both measuring and choosing, mistakes and omissions are inevitable. But, by automating these laborious processes, BIM technology offers a possible remedy for the aforementioned issues.

Building Information Modelling (BIM) is a software application and related set of procedures for improving design, construction, operations, and maintenance by creating, inserting, sharing, and managing data in a centralised model. By integrating all the designs and information from many design professions, BIM operates on an integrated platform where information describing the complete building is stored. Prior to the actual building, it may be used as a simulation model to replicate real-life situations and identify possible difficulties in a virtual environment. Early detection of conflicts and difficulties allows for the implementation of corrective measures to minimise their impact.

Owners, designers, contractors, and engineers are just a few of the many stakeholders that are making growing use of BIMs throughout a project's lifetime. In order to better visualise their designs, designers have started making extensive use of building information modelling (BIM). For planning and scheduling purposes, as well as to track the performance and development of building projects, contractors have been using BIM. But it's only very lately that QSs have started to feel the effects. Contractors in the construction sector must promise owners a price before they have a good idea of how much it will cost to complete a project. A greater degree of precision in contractor cost estimates is required since the calculations must be performed prior to the project's actual commencement. It is simpler to record object quantities in BIM and the QTO with BIM drawings will be more accurate with fewer mistakes and omissions since BIM models contain object-based within-built parametric information. The complexity of construction works is increasing, and customers are becoming more unsatisfied with the traditional methods used by QSs to conduct their profession. This is why QSs must abandon their wasteful practices immediately. Accurate quantity

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extraction from a BIM may be done in a flash. You may report component counts, space area and volume, material amounts, and more in multiple schedules using applications that use BIM. For the purpose of cost estimate, these amounts are appropriate. The obvious benefit of this automated method for quantity takeoff is the significant time savings compared to the time-consuming process of manually extracting these numbers from 2D drawings. It is also feasible to integrate this amount takeoff with estimating tools automatically.

Integral to building information modelling (5D) is the field of quantity surveying. 5D Building Information Modelling combines the 3D Building Information Model with the 4D Construction Schedule and the cost of the contract for use in quantity surveying. Built-in Modelling (BIM) automates the generation of quantities and take-offs, which in turn helps to save the time and money needed to produce an estimate. Quicker data analysis and cost estimate preparation is possible without the requirement for laborious manual take-off or the possibility of human mistake during the estimation process. When it comes to cost estimate, the realm of quantity takeoff is where BIM really shines. Software programmes allow estimators to extract quantities from the BIM for the purpose of cost estimating. All the way through the design process, a BIM may help with estimates. Early on in the design or project lifecycle, BIM may provide metrics like total area and volume. By relating the building's overall volume to a price per cubic metre, for instance, these numbers may provide estimations that are precise enough. As the model develops, it becomes feasible to extract precise amounts of every structural component (beams, columns, floors, etc.). More precise estimations, which will be required in subsequent phases of the project, may be based on these numbers.

When compared to the time-consuming and error-prone manual taking-off method based on drawings, BIM offers many advantages. It is time-consuming and prone to mistake to manually modify and update all drawing views whenever changes occur. It takes a lot of effort and time to manually update the amounts to fit the new design. It would be very tedious for the QSs to continually verify for any changes, additions, or deletions. The procedure is laborious, but the stakes are high in the event that the alterations go undetected. By using parametric change technology, which coordinates and maintains consistency throughout modifications, BIM exceeds CAD in its ability to handle design changes quickly. When you make a modification in one drawing view, it will reflect in every other view automatically. Whenever there is a change to the design, the QSs can simply see the changes made to the drawings and the quantities are instantly updated.

There are two advantages to using BIM. To start with, it can automatically generate precise figures that may be used for cost assessment. Secondly, it is feasible to establish a connection between the design and associated expenses in such a way that the estimated costs are updated in tandem with the design. The estimating process is further affected when estimators include BIM into cost calculation. As a result, BIM has altered the workflow of quality specialists, which in turn affects the effectiveness and efficiency of professional services. Due to the automation capabilities of BIM, QSs may boost their effectiveness and productivity by using it to do these repetitive chores.

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4. Capabilities of BIM

The capacity of building information modelling (BIM) to carry out activities in quantity surveying practices to improve work performances via BIM adoptions is outlined in this research.

In order to provide the starting point for the construction budget, QSs conduct feasibility studies by creating a cost assessment. In order to weigh the pros and cons of embarking on the project, clients need get expert cost advice from QSs. Now that the design team has established a budget range in the feasibility stage, they may begin to create the design in more depth. After the design and scope of work have been refined, it is the responsibility of the quality specialists to provide a more thorough cost estimate. The first structured cost plan is the preliminary cost plan, which is being prepared by QSs with the purpose of confirming the budget that was set during the feasibility stage. At this point, the design was evolving in response to the growing body of evidence. The cost plans are given in an elemental cost style, including the precise building materials, finishes, specifications, and quantities of each element. To keep the plans up-to-date, QSs do further cost studies and estimates. At this point, QSs can't conduct accurate cost estimates without the designers' drawings, details, and requirements. Since project cost is directly proportional to the design of the building, design and scope changes that occur midway through the design process are a key contributor to budget overruns. If modifications and alterations to the design go unnoticed, it might have a significant effect on the project budget.
Currently, one of the most essential services offered by QSs is the creation of bills of quantities (BQs). Among the many difficult and time-consuming tasks involved in BQ preparation, quantity takeoff stands out. Accurately counting and measuring every object in the design demands a great deal of the QSs' time, energy, and concentration. One feature of building information modelling (BIM) that helps to automate quantity takeoff is the ability to alleviate the monotony and repetition that comes with this process.

5. Important of Implementing BIM in Quantity Surveying Practices

Over the last few decades, quantity surveying has grown into a rapidly expanding field. There is an immediate demand for an impartial quantity surveyor due to the growing complexity of construction projects and the growing dissatisfaction of employers with the procedures currently employed to regulate and settle project costs. From the beginning to the end of a building project, quantity surveying is an essential component. In modern times, quantity surveyors are seen as expert advisors who "contribute significantly to the fiscal and contractual administration of building projects throughout the pre-construction, construction, and post-construction phases." Accurate and skilled use of extensive information is essential in the field of quantity surveying. Additionally, it necessitates the accurate numerical representation of designs as well as their interpretation and comprehension (BIM Journal, 2009). Quantity surveyors are involved in a wide range of tasks, including but not limited to: cost estimating, value management, tendering, cost planning, feasibility studies, and dispute settlement. Following is a synopsis of some of the tasks performed by quantity surveyors in the context of cost management.

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When it comes to managing the budget for a construction project, one of the most important tools is the bill of quantities. One of the features that developers of BIM technology take pleasure in as the fifth dimension of BIM is the automated preparation of bills of quantities. One of the ways BIM technology has improved its ability to be collaborative and integrative is by automating bills of quantities. By automating the generation of bills of quantities, human error is reduced and the time-consuming old take off techniques are eliminated.

Building information modelling (BIM) technology may extract precise measurements and areas that can be used for cost estimate purposes throughout a project's design process. It also helps with the identification and communication of linkages between quantities, costs, and locations, as well as the separation of construction regions and components' contributions to the overall cost. The ability to comprehend and account for cost-determinants enhances the skill set of cost estimators. This, together with the precise amount take-off generated by BIM, allows for the estimation of trustworthy and precise costs at the first phases of design.

Designers, estimators, and clients may all engage in value management all through the design process when cost estimating is integrated with a building information modelling (BIM) tool. Without the requirement for the estimator to manually take-off values, the cost estimate may be automatically updated when design modifications are made to the BIM using numbers retrieved from the amended model.

As a result of the openness and accessibility of project documents and information, competitive tendering and bidding using BIM models may narrow the potentially dangerous gap between project participants. Building information modelling (BIM) produced more precise bill-of-quantities and far higher-quality construction data than traditional working drawings. As an added bonus, prospective builders may learn how to use the BIM for measuring and quantity extraction. Bidders have the opportunity to fix model inaccuracies throughout the tender process, leading to more precise offers.

5.1 Challenges of BIM

• Sharing the model with parties outside of the design team, such as subcontractors, the owner, and the facility manager—this is where building information modelling (BIM) really shines. Crucial is making the model available to them and giving them the ability to add and connect other data.
• Model viewing (in-office and on-site) — How can a subcontractor see a specific area of the model to fix a problem without requiring them to install software? How can we make it easy for people to work together on that? When they're really at the place, how can they use the tablet to see it?
• Connecting models to other data sources—Many project docs, such as specs, drawings, and requests for information (RFIs), reside outside of the model. How can we make this model more comprehensive by connecting these documents? A 3D model may be required by the owners, but in order to have a complete view, it has to be connected to all the other data that has been generated and collected for the project.

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• Keeping track of approvals and audit trails - It may be challenging to get and document approvals when dealing with models that are created by multiple authoring tools and are continuously changing. Keeping track of who did what and when may be quite challenging when there are hundreds of choices made around the model over its lifetime. When building information models (BIMs) approach 50 MB or more in size, it becomes very challenging, if not impossible, to distribute data in a safe and efficient manner. File transfer protocol (FTP) sites lack the necessary access control and audit trail capabilities, while email is unable to manage such large files.

5.2 The Influence of BIM on Quantity Surveying Profession

Constant innovation in the construction sector necessitates that the quantity surveying profession, like many others, adapt to new circumstances. Quantity surveyors are indispensable to the building industry because of the crucial roles they play in estimating costs, conducting feasibility studies, soliciting bids, budgeting costs, managing values, and resolving disputes. Building information modelling (BIM) offers quantity surveyors a number of useful features for managing costs, in addition to the usual project management and scheduling tools. Building information models are more trustworthy for owners to conduct quantity take-offs and estimates, and they provide quicker cost feedback on design modifications due to their accuracy and computational nature (Eastman et al. 2008). Without human intervention, the model determines the amounts of all materials and components. It promises to streamline some of the typical duties of quantity surveyors and do away with the monotony and repetition that comes with them. Thus, building information modelling (BIM) can be utilised to automate the production of bills of quantities, which in turn can generate cost estimates at different stages of a project, quickly revise costs in response to design changes, determine maintenance costs, and assess post-construction space planning or renovation options. Automating the creation of bills of quantities would allow quantity surveyors to create deliverables with much greater efficiency, speed, and accuracy.

A quantity surveying company may gain a competitive edge by using building information modelling (BIM) software to improve the accuracy and efficiency of their work. However, the quantity surveying profession will be touched by BIM in some manner if the implementation is to be a success. The role of quantity surveyors will be restructured as a result of the new responsibilities that will fall on them as a result of the changes brought about by the cost management functions of building information modelling (BIM). Quantity surveyors will also be required to concentrate on different aspects of the cost management process. Some of the dangers and obstacles that the QS profession faces while using BIM are listed below.

The software and computer systems used for estimating have become vital due to the reliability, precision, and efficiency with which computerised estimating tools and procedures generate estimates for deliverables and sub-deliverables. Integrating the cost control process into the collaborative model-based working environment is becoming more important as BIM becomes more integral to the design phase of a building project. Perfect building information modelling (BIM) workflows begin with creating a 3D model of the client's proposal and continue with

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automated generation of resource needs, cost estimates, product specifications, bills of quantities, and lists of product specifications. Standard file formats like.dxf,.dwf,.dwg, and.pdf do not allow for the transmission of suitable degrees of object intelligence across models while collaborating on a project. Making a building information model (BIM) worthwhile requires two things, says Bazjanac (2010): first, software that can load the BIM with data that other programmes can utilise, and second, software that can import and export data from a BIM. The majority of software uses proprietary file formats, which continues to be a challenge for quantity surveyors even in an integrated system environment where all project consultants operate. To work with the most recent BIM software, quantity surveyors will have to make some adjustments to their traditional computerised estimating and costing tools.

Quantity takeoff and bill production is a laborious and error-prone operation that consumes a lot of time and energy from the quantity surveyor, even though it is only a minor component of the cost management process. Because it incorporates 5D simulation, BIM can automatically produce values based on the model and data collected inside it. Put simply, it has the capability to automate a crucial conventional activity in quantity surveying. Because of this, the quantity surveyor will need to modify his duties somewhat. There are certain drawbacks to automating bills of quantities that must be considered. One of the most common things that quantity surveyors do is create bills. With this process automated, they may reduce the size of their production staff while still getting more done. The scale of quantity surveying practices will decrease as a consequence of a decrease in the number of staff members required. Overcoming these challenges will require quantity surveyors to think outside of the box, provide more value to their clients, and improve the quality of their professional services.

Software tutorials, seminars, and workshops may help those who lack experience or understanding with more advanced programmes and practices quickly get up to speed. Training courses are often offered by software providers to businesses that use their products. In addition to learning how to use the new software, employees will require training on how to adapt to new roles and responsibilities, new processes within the company, and new ways to put the data retrieved from the building information modelling (BIM) system to use. There is always a price to pay for cutting-edge innovation and maintaining a competitive edge. Software is often rather costly, so replacing it requires careful consideration and a well-planned budget. Companies often face significant time restrictions as they switch to and adopt new procedures and technologies.

6. Conclusion

Among the most obvious and important outcomes of incorporating BIM into quantity surveying is the impact on the quantity surveyor's conventional duties and the organisation of quantity surveying companies. There will be good and bad consequences for the quantity surveying business as a whole due to BIM's capacity to automate the creation of bills of quantities, one of the essential jobs of quantity surveyors. As a result of automated bill of quantities creation, quantity surveyors will be able to participate in the early design phases of a building project, raising designers' awareness of

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cost implications and facilitating early cost management. Employers will be satisfied with the cost-effective building since designers will be able to design to a budget instead of quantity surveyors pricing to a design. Quantity surveyors will be able to devote more time to developing and focusing on other activities that employers will greatly benefit from, thanks to the time saved by BIM capabilities. These activities may not be considered vital in conventional practices, but they will undoubtedly be valuable. In a building information modelling (BIM) based construction project, quantity surveyors may provide new services, such as coordinating the extensive and ongoing data interchange amongst the many consultants. Quantity surveyors have had to adapt to the ever-changing demands of the construction sector, which is driven by technological advancements. Although building information modelling (BIM) is a boon to the construction industry, this report's research shows that quantity surveyors will need to constantly reinvent themselves and expand the range of services they offer to keep their dominant position as construction cost managers. To have a better grasp of the QS's future responsibilities, it is necessary to do an in-depth analysis of the data that will be accessible to him from BIM at various project stages, as well as the data that the QS can offer at each step. This is the next step for the present investigation.

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