"Leveraging Innovative Technologies, Tools, and Methodologies for Enhanced Efficiency and Quantity Surveying Practice"

– QS Otonye Bekangama Ekine FNIQS, RQS, MICIArb.
Principal Consultant, Cost Masters Associates Limited

Abstract:

The QS profession in Nigeria has undergone a radical change with the adoption of such innovative technologies, tools, and methodologies that contribute to improved efficiency and accuracy. The most important recent development has perhaps been the adoption of BIM: the collaboration using real-time data to understand all aspects of the project life cycle and, hence making informed decisions. BIM has specifically changed designing and construction by enabling better coordination, accurate cost estimation, and sharing of data among the stakeholders in the project in real time (Khosrowshahi & Arayici, 2012). Integration of BIM also decreases such costs by up to 20% because of fewer design conflicts and better project control, (Abubakar et al., 2014).

The use of drones and Geographic Information Systems (GIS) for site surveys has improved data accuracy and reduced the time required for pre-construction activities, enhancing project feasibility assessments (Sacks, Koskela, Dave, & Owen, 2010). It also enhances site surveys and data collection by increasing the accuracies of drones and GIS use, thereby enhancing project scope validation and reducing human errors (Olubodun & Kolo, 2019).

Several cost management applications have made estimating costs, tendering, and contract administration easier for quicker decision making which reduces risks that may lead to an error in decisions (Ashworth & Hogg, 2013).

The adoption of project management techniques and methodologies such as Agile Project Management methodologies, and its Nigerian version created by The Chartered Institute of Project Managers of Nigeria (CIPMN) "Delivering Unified Controlled Agile Project" (DUCAP) has introduced flexibility in managing construction projects, allowing Quantity Surveyors to respond swiftly to changes in scope and design, increase their capacity to work remotely, foster collaboration among stakeholders, and increase project delivery speed. thus, enhancing project performance.

Along with these technologies, are other emerging methodologies like lean construction which also go a long way in providing ways to enhance the efficiency and sustainability of QS practice in Nigeria (Aje et al., 2021).

These technologies and methodologies are reshaping the QS profession in Nigeria, enabling professionals to provide more value in terms of cost control, risk management, and project delivery.

Furthermore, the adoption of cloud-based platforms in the construction industry is not only offering countless benefits such as cost savings, improved collaboration, centralised data storage etc, it is also enhancing operational efficiency and facilitate informed decision-making processes

The role of AI is also making tremendous inroads into QS practice. With the help of AI-powered machine learning algorithms, cost overruns can be predicted along with project timelines very accurately for better budgeting and risk management (Olawumi et al., 2020). Besides, AI-driven tools automate routine tasks related to quantity take-offs and cost estimation, freeing up professionals to attend to strategic decisions and client relationships (Adamu & Mohammed, 2021).

To achieve this full potential, it is imperative to constantly train and upgrade QS professionals to current and changing technologies and methodologies. Certainly, the innovations listed herein will invariably continue being part of Nigeria's evolving construction industry as it focuses on heightened efficiency in quantity surveying practice.

Conclusion: Innovative technologies, including the use of BIM, AI, drones, and cloud-based tools, etc will continue in transforming the QS profession here in Nigeria. In adopting these technologies, the QS professional is guaranteed efficiency, accuracy, and project results. This could place them in front as key contributors in this growth in infrastructure development within the country.

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1. Introduction

The QS profession plays a very important role in the construction industry for the completion of projects within budget, on time, and to specified quality standards. In Nigeria, the construction industry recently became so dynamic and complex that QS professionals are bound to embrace more innovative technologies, tools, and methodologies in order to remain more effective and efficient.

Digital transformation through the integration of BIM, AI, drones, GIS, cost management software, cloud-based platforms, and project management principles has transformed the QS profession beyond recognition. These innovations have brought about more accurate cost management, better project delivery times, and generally improved collaboration among the stakeholders.

This paper discusses how these recent developments in technology and methodologies are reorganizing the practice of QS in Nigeria by focusing on their influence in respect to cost management, risk mitigation, project efficiency, and overall productivity.

2. The Role of Technology in Quantity Surveying

Traditionally, the Quantity Surveyor was responsible for cost estimation, measurement, contract administration, and risk management, often relying on a high degree of manual methods.

The integration of technology has dramatically changed both the scope of QS practice, and the methods used for better accuracy, faster decision-making, and more collaborative projects.

Herein, we present several key technologies and tools that are influencing or will influence the profession.

3. Building Information Modeling in Quantity Surveying

BIM is a game changer that is confronting QS professionals everywhere in the world, including Nigeria. The development of intricate digital models of buildings using BIM integrates all data on all aspects relating to the project, from design and materials, energy performance, cost estimates, among others. It provides a

single platform for real-time collaboration between architects, engineers, QS professionals, and contractors (Khosrowshahi & Arayici, 2012).

BIM enables the QS professional to take direct quantities from the model, hence reducing possible errors and improving cost estimate accuracy. Integration of 3D models facilitates a better view of the project, thus enabling the early detection of design clashes and other constructability problems. Abubakar et al. (2014) indicated that the application of BIM to various projects in the Nigerian construction industry could reduce project costs by up to 20%, mainly by minimizing design conflict, rework, and delays.

Moreover, BIM provides a full overview of the entire lifecycle of the project by enabling QS professionals to make contributions into sustainability assessments and facilities management upon completion. This will contribute to increased value out of QS services beyond traditional pre-construction and construction.

4. Drones and Geographic Information Systems (GIS)

Site surveys have been totally revamped by the use of drones and GIS. Traditional surveying methods are extremely time-consuming and hard work, as well as always vulnerable to human error and even impassable terrain (Sacks et al., 2010). Drones equipped with high-resolution cameras and sensors capture highly accurate, aerial data in vast areas in a fraction of the time needed for manual surveys.

Real-time topographical data acquired by the drones can be integrated with GIS to provide high-precision maps and models of the site. This is going to render the project scope validation more accurate and ensure that decisions in respect of it are fully informed. As Olubodun and Kolo (2019) illustrated, the capability of drone and GIS technologies to reduce the occurrence of inaccurate site data will minimize the risks arising out of such data.

It provides more reliable information to QS professionals in terms of cost estimation, progress tracking, and validation of quantities. In addition, drones have been useful in terms of continuous

monitoring during the construction activities to support the identification of possible problems in the process and offer compliance with the project plans accordingly.

5. Cost Management Software

Software solutions have become a necessary tool for the QS professional, whose functions range from estimating, tendering, and contract administration to financial reporting. The most prevalent cost management software in Nigeria includes:

- Microsoft Excel: Suitable for manual computation
- Masterbill: An enterprise software that includes tools for bills of quantities, estimating, CAD measurement, BIM measurement, and more.
- Planswift: A construction software tool that helps with estimating and streamlining project
- Bluebeam Revu: A desktop and cloud-based collaboration software that allows users to mark up, measure, and share documents in real time
- Workmate: A software used by Quantity Surveyors to ease the task of taking-off, preparing bills of quantities and also preparing rates
- Candy: An integrated construction project control system featuring estimating, planning, and costing.
- CostX: A state-of-the-art 5D BIM cost estimation, measurement, and reporting system.

the use of these software solutions, has introduced several key benefits, such as:

- Automated Processes: Software tools allow QS professionals to automate most of the repetitive tasks that they need to do in terms of quantity take-offs, bill preparation, and cost analysis. This reduces the risk of human error and accelerates the processes of the project workflows (Ashworth & Hogg, 2013).

- Real-time Data: The cost management software provides real-time monitoring of costs and budgets, hence enabling

the QS professionals to present updated financial information to their clients.

- Smarter Decision-making: By performing scenario analysis and forecasting, QS professionals can look at how changes in projects will affect the finances of the project and thereby help a client make informed decisions.

With the increased complexities in the Nigerian construction industry, cost management software is one of the important tools that enable projects to be completed within the set budgets and times.

6. Project Management Techniques and Methodologies

6.1. Agile Project Management Methodologies

Agile methodologies, though originally designed for the software development industry, are finding their way into the construction sector. Agile project management focuses on flexibility, collaboration, and iterative progress. As such, agile is especially applicable to construction projects.

Agile methodologies offer several advantages to Quantity Surveyors:

- Agility: Agile methodologies let QS professionals respond fast to whatever change comes up, be it in the project scope or its design. This minimizes disruptions since the cost estimate evolves in real time.

- Collaboration: Agile encourages continuous communication amongst all project stakeholders. It is reflective of the collaborative nature of the QS contemporary practice.

- Value Addition to Project Performance: By emphasizing iterative progress and continuous improvement, agile methodologies help the QS professional in project performance and delivery by ensuring projects are less delayed or have cost overruns.

Agility is an important development in the profession of Nigerian Quantity Surveyors, especially in projects with various interests and when frequent changes in design occur.

6.2. Delivering Unified Control Agile Project (DUCAP)

DUCAP is a project delivery methodology created by the Chartered Institute of Project Managers of Nigeria (CIPMN). DUCAP is tailored to Nigeria's unique environment and global best practices for project delivery and designed to help project managers in Nigeria deliver projects in a way that's suitable for the country's diverse environment.

DUCAP helps project managers by:

- Providing tools and templates for project delivery
- Teaching project managers how to manage culture, religious, and political sensitivity in project delivery
- Teaching project managers how to manage project sustainability
- Allowing project managers to create a bespoke project management methodology by combining attributes from different methodologies

6.3. Lean Construction Methodologies

Lean construction aims at maximizing value and minimizing wastes in each construction stage. The concept places great emphasis on collaboration in planning, efficiency in resource management, and continuous improvement. The concept has considerable relevance to the QS profession. The application of lean construction principles by QS professionals can contribute to better project outcomes by making sure that resources put into a project are well used and delays avoided as much as possible.

Aje et al. (2021) provide that the increasing orientation of the construction sector in Nigeria toward the delivery of value to clients, with increasing frequency, has occasioned the adoption of lean construction methodologies. The QS professional will thus be instrumental to the introduction of lean practices by ensuring mechanisms for cost control are in place and unselective

expenditure avoided to attain the delivery of the project on time and within the budget.

7. Cloud-Based Platforms for Collaboration

Cloud-based platforms are increasingly being used by the construction industry to ensure easy collaboration among stakeholders. These platforms ensure that QS professionals, clients, and contractors can view real-time data of a project, share documents, and hold easy conversations irrespective of their location. Such a collaboration environment reduces delays in decision-making and ensures that all parties consider the latest information.

Cloud-based tools, such as project management software and document-sharing platforms, ease workflow and hence improve project delivery times. They allow the integration of data from disparate sources, enabling the QS professional to carry out project cost management and progress tracking, and report on the same with greater efficiency. This shift toward cloud-based platforms is particularly helpful in the Nigerian construction industry, where members of project teams may be located at dispersed locations.

8. Artificial Intelligence (AI) in Quantity Surveying

Artificial Intelligence in recent times has been a critical tool for QS professionals, especially in the realms of cost estimation, risk management, and project scheduling. AI uses historical data in combination with machine learning algorithms to predict overruns in costs, potential delays, and risks that may be inherent within projects with accuracy. The predictive capability allows QS professionals to make more enlightened decisions early in the project life cycle and enable proactive mitigation of those risks.

According to Olawumi et al. (2020), an AI-driven system can process huge volumes of data more efficiently than human teams and provide accurate cost estimates based on historical data from similar projects. The systems further automate routine tasks like quantity take-offs and progress monitoring, freeing QS professionals to focus on higher value-added activities such as strategic planning and client interactions.

Further, the project management AI tools are also responsible for providing real-time insight into the projects' performances so that QS professionals can assemble resources, adjust schedules, and make necessary changes to keep the project in the right direction. AI reduces the likelihood of human error in calculations, thereby providing more accurate estimates of time and cost by a more significant margin. Adamu & Mohammed (2021)

9. Challenges and Opportunities

While these are indeed great technologies and methodologies, a QS professional in Nigeria faces certain challenges while trying to adopt:

- Training and Upskilling: Inability due to lack of technical expertise in innovative technology adoption is one of the primary issues. CPD is vital in retaining the capabilities of the QS for offering full potential of BIM, Drones, cost management software, and Agile methodologies (Ashworth 2015).

- Cost of Technology: Many of those technologies require high technology investments, including BIM platforms or drones that may be out of the budgets of some firms. The saving that it will eventually provide by developing time and cost efficiencies is well worth an investment into these technologies.

- Industry Adoption: Although some firms in Nigeria have adopted these technologies, the overall industry-wide adoption has been rather limited. This is where industry associations like NIQS come in very handy to foster the implementation of international best practices and provide needed training to their licensed QS practitioners.

Irrespective of the challenges above, the benefit of digital transformation outweighs the challenges, and that the Quantity Surveying profession should be fully digitalized

10. Conclusion

The QS profession in Nigeria has reached a turning point, as new technologies, tools, and methodologies have made improved

efficiencies and productivity achievable. The use of Building Information Modelling, Artificial Intelligence, drones, Geographic Information Systems, cloud-based platforms, and project management principles are rapidly modernizing traditional QS practices. Such developments will empower the QS professional to realize more accurate cost management, improved project delivery timelines, and enhanced collaboration throughout the stages of construction.

These innovations will keep QS professionals in Nigeria abreast of their profession in a world that is faced with fast and changing changes within the construction arena. Furthermore, such technologies do not only enhance the efficiency of QS practices but also contribute to the greater aspect of developing sustainable and efficient infrastructure in Nigeria.

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