



FIG Position Paper: Digital Transformation in Quantity Surveying: Paving the Way for Smart Cities and Professional Evolution.

Asst. Professor Ts. Sr Dr. Nadzirah Hj. Zainordin, CQS, FRISM Head of Research & Postgraduates Studies UCSI University, KL Campus, Malaysia

Ts. Sr Khoo Sui Lai, CQS, FRISM, FRICS Head of Department Quantity Surveying UCSI University, KL Campus, Malaysia

1.0 Overview

The integration of digital tools into the field of Quantity Surveying (QS) is revolutionizing the way professionals approach construction projects. These advanced technologies are enhancing the efficiency, accuracy, and overall decision-making process in the construction and infrastructure sectors. As quantity surveyors embrace digital innovation, they are able to work smarter, deliver more precise outcomes, and ensure the success of projects from inception to completion. Technologies such as Building Information Modelling (BIM), drones, 3D scanning, Artificial Intelligence (AI), machine learning, and cloud-based project management are transforming the practice of quantity surveying.

2.0 Embracing Technology in Quantity Surveying

As the construction and infrastructure industries continue to evolve, embracing digital transformation is essential for quantity surveyors to remain competitive and effective. Technologies such as BIM, drones, 3D scanning, AI, machine learning, and cloud-based project management are not only enhancing efficiency and accuracy but are also reshaping the way QS professionals deliver projects. By leveraging these innovations, quantity surveyors can improve cost estimation, optimize resource allocation, and drive better project outcomes. The future of quantity surveying lies in the seamless integration of these digital tools, which will help professionals navigate increasingly complex projects, reduce costs, and create more sustainable, efficient, and resilient infrastructure. As digital technologies continue to evolve, the role of quantity surveyors will become even more critical in the realization of smarter, more connected cities and built environments. The integration of digital tools is enhancing efficiency, accuracy, and decision-making in the construction and infrastructure sectors. Quantity surveyors are utilizing technologies like:

2.1 Building Information Modelling (BIM): Enhancing Project Planning and Execution

One of the most significant technological advancements in the construction industry is Building Information Modelling (BIM). BIM is a digital representation of the physical and functional characteristics of a building or infrastructure. It is an integrated platform that enables quantity surveyors, architects, engineers, and contractors to collaborate seamlessly throughout the project lifecycle. By using BIM, QS professionals can visualize the entire project from its design phase to its



eventual operation. This 3D modelling approach not only improves communication among stakeholders but also allows for better planning and forecasting. With BIM, quantity surveyors are able to conduct more accurate cost estimates, accounting for every component of the building, from structural elements to MEP (Mechanical, Electrical, and Plumbing) systems. The ability to simulate and visualize potential design changes or challenges in real time ensures that all parties involved can make well-informed decisions regarding cost, time, and resource allocation. This results in fewer errors, reduced project delays, and ultimately, cost savings. Furthermore, BIM's integration with other project management tools allows for a more holistic approach to construction management, enabling QS professionals to monitor changes, update budgets, and track project progress efficiently. This technology paves the way for more accurate predictions, streamlined workflows, and enhanced productivity in the construction process.

2.2 Drones and 3D Scanning: Transforming Site Surveys and Progress Monitoring

Another technology that is reshaping the landscape of quantity surveying is the use of drones and 3D scanning. Drones provide an aerial view of the construction site, enabling surveyors to capture high-resolution imagery and video footage of the area. These aerial surveys can quickly cover large areas and provide up-to-date information on site conditions, topography, and project progress. Drones are particularly useful in monitoring large-scale construction projects, where manual surveys can be time-consuming and costly. By using drones, quantity surveyors can obtain real-time data on construction progress, ensuring that work is being completed according to schedule. Additionally, drones can be used to identify potential issues early in the construction process, such as safety hazards or design discrepancies, allowing for timely interventions. With drones, 3D scanning technology further enhances the accuracy of measurements and assessments. Laser scanners can capture detailed, high-precision data on the physical characteristics of a structure, providing an exact digital replica of the built environment. This 3D model can then be integrated into the project's BIM system, enabling QS professionals to conduct precise quantity take-offs, monitor deviations from the original design, and make adjustments as necessary. The combination of drones and 3D scanning not only streamlines the estimating process but also helps ensure that the project stays within budget and on schedule.

2.3 Artificial Intelligence and Machine Learning: Predicting and Optimizing Project Outcomes

Artificial Intelligence (AI) and machine learning are making a profound impact on the field of quantity surveying by enabling predictive analytics and optimizing resource management. These technologies utilize large datasets and advanced algorithms to analyse trends, forecast project costs, and identify potential risks. By leveraging AI, quantity surveyors can make more accurate predictions about the cost of materials, labour, and overall project expenditures. AI systems can analyse historical data from similar projects, as well as real-time inputs, to provide forecasts that are far more reliable than traditional estimation methods. This helps to reduce the risk of cost overruns and project delays. Machine learning algorithms can also be applied to detect patterns and anomalies in data that might indicate issues such as resource shortages, delays, or unforeseen challenges. AI can be used to automatically adjust cost estimates and resource allocations based on



real-time data, making it easier for QS professionals to make informed decisions on the fly. Moreover, AI and machine learning can automate routine tasks, such as data entry and report generation, allowing quantity surveyors to focus on higher-level strategic tasks that require human expertise. By automating these time-consuming processes, AI and machine learning enhance productivity, improve efficiency, and reduce the likelihood of human error.

2.4 Cloud-Based Project Management: Enhancing Collaboration and Transparency

Cloud-based project management platforms have become an essential tool in modern quantity surveying. These digital platforms allow for centralized access to project data, enabling real-time collaboration across teams, stakeholders, and clients. With cloud-based solutions, all parties involved in a construction project—whether they are on-site, in the office, or working remotely—can access the most up-to-date information, ensuring transparency and improving communication. Cloud-based systems streamline the flow of information, enabling quantity surveyors to track project progress, update budgets, and communicate changes instantly. For instance, if there is a change in project scope or a revision in cost estimates, all relevant stakeholders are immediately notified and can take appropriate action. This level of transparency helps avoid misunderstandings and ensures that all team members are aligned on project goals. Additionally, cloud platforms often come with built-in analytics tools that allow quantity surveyors to monitor key project metrics, such as budget performance, resource usage, and timeline adherence. These insights allow for more proactive decision-making, helping to mitigate risks and keep projects on track.

3.0 Impact on Smart Cities

As cities continue to grow and evolve, the need for smart, sustainable, and adaptable infrastructure becomes increasingly critical. Smart cities, characterized by the integration of digital technologies into their urban systems, are transforming the way infrastructure is planned, developed, and managed. Digital transformation is playing a pivotal role in this evolution, with Quantity Surveyors (QS) at the forefront of ensuring that the construction and operation of smart city infrastructure meets the demands for efficiency, sustainability, and adaptability. The adoption of technologies such as sustainable design tools, real-time data monitoring, and system integration is helping QS professionals drive smarter, more resilient cities. Smart cities require infrastructure that is not only efficient and sustainable but also adaptable. Digital transformation plays a pivotal role in:

3.1 Sustainable Development: Building the Future with Efficiency and Sustainability

One of the primary goals of smart cities is sustainability. Smart city infrastructures must be not only efficient in their operation but also environmentally responsible in their design and construction. QS professionals are increasingly involved in ensuring that smart city projects align with sustainability objectives, making use of digital tools to optimize material usage, reduce waste, and improve energy efficiency. Digital tools, particularly those related to Building Information Modelling (BIM) and energy modelling software, enable QS professionals to design and plan with sustainability in mind. BIM allows for more accurate material take-offs, minimizing over-ordering and waste. Additionally, BIM facilitates the design of energy-efficient buildings and infrastructure, ensuring that



each component of the project contributes to the overall sustainability goals. For example, energy consumption can be optimized through simulations during the planning stage, reducing operational costs and minimizing environmental impact in the long term. Digital technologies also help in selecting the most sustainable materials, considering factors such as lifecycle analysis, carbon footprints, and recyclability. With access to real-time data and predictive modelling tools, QS professionals can make informed decisions about construction methods that reduce energy consumption and contribute to the long-term sustainability of the smart city. Furthermore, QS professionals are involved in assessing and ensuring that infrastructure meets sustainability certifications, such as LEED (Leadership in Energy and Environmental Design), BREEAM (Building Research Establishment Environmental Assessment Method), or other local environmental standards, by integrating these metrics into the digital workflow.

3.2 Real-Time Data and Monitoring: Empowering Smart City Operations

Smart cities rely heavily on real-time data to manage various systems, such as water, energy, waste, and transportation. The Internet of Things (IoT) plays a key role in enabling this connectivity, with sensors embedded across city infrastructure continuously gathering and transmitting data. This real-time data provides valuable insights into the performance of urban systems, allowing for proactive decision-making and efficient resource management.

Quantity surveyors are leveraging this real-time data to support cost management and maintenance planning. By utilizing IoT devices, QS professionals can monitor ongoing infrastructure performance and identify areas where intervention is required. For instance, real-time monitoring of energy use can highlight inefficiencies or areas where energy-saving technologies should be implemented. Similarly, sensors on water pipes can detect leaks or potential failures, enabling timely repairs and reducing costly damage. Real-time data also aids in cost forecasting and budgeting, as QS professionals can integrate up-to-date information into their financial models. This helps ensure that projects stay within budget and resources are allocated effectively. Additionally, the ongoing collection of data from smart city infrastructure allows for predictive maintenance planning. Instead of relying on scheduled inspections, QS professionals can use IoT data to anticipate when equipment will need servicing or replacement, optimizing the maintenance lifecycle and reducing unplanned costs.

3.3 Integration and Interoperability: Enabling Seamless Coordination for Effective City Management

For a smart city to function effectively, its infrastructure systems must be fully integrated, allowing for seamless communication between different components, such as buildings, roads, utilities, and transportation networks. Integration and interoperability are essential for ensuring that the city operates as a unified whole, with systems working together efficiently and without disruption. Digital transformation plays a crucial role in enabling this integration. Digital tools such as IoT platforms, cloud-based systems, and data analytics platforms allow for real-time synchronization across different systems. Quantity surveyors are using these technologies to better coordinate projects, facilitate communication between teams, and manage the resource allocation required for



large-scale infrastructure development. For instance, the integration of transportation systems with energy infrastructure can optimize traffic flow, reduce emissions, and improve energy use across the city. Similarly, the integration of water and waste management systems with real-time monitoring can help cities become more resilient to environmental stresses, such as water shortages or waste disposal challenges. Digital technologies allow QS professionals to better understand the interdependencies between different systems and ensure that the planning and execution of one component supports the efficiency and functionality of others. Additionally, digital tools enable enhanced project management by offering real-time tracking of project milestones and resource use. By managing large-scale projects with interconnected systems, QS professionals can ensure that no component of the smart city infrastructure is overlooked, and that resources are allocated efficiently, avoiding duplication or underutilization of assets.

4.0 Evolving the Quantity Surveying (QS) Profession

As technology continues to advance, the role of the quantity surveyor (QS) is undergoing a profound transformation. Traditionally, QS professionals were primarily focused on cost estimation, measurement, and tendering. However, with the advent of digital tools, data analytics, and automation, the profession is evolving into one that requires a broader skill set and a more strategic approach to project management. This evolution is reflected in three key areas: the shift from estimators to data analysts, improved collaboration and role expansion, and the development of new skill sets. As technology continues to evolve, so too does the role of the quantity surveyor:

4.1 From Estimator to Data Analyst: Leveraging Data for Strategic Decision-Making

The most significant change in the QS profession is the shift from being traditional estimators to becoming data analysts. Historically, the role of a QS was centered around estimating costs based on quantities of materials, labor, and other resources required for a project. This process was often based on historical data and industry benchmarks. However, with the integration of digital tools such as Building Information Modelling (BIM), cloud-based project management software, and artificial intelligence (AI), QS professionals now have access to vast amounts of real-time data that can be used to enhance decision-making. Rather than simply providing cost estimates, modern quantity surveyors are becoming data-driven analysts who can evaluate and predict project outcomes with greater accuracy. By analysing project data, including material costs, labour hours, and project timelines, QS professionals can identify trends, assess potential risks, and forecast future outcomes. These insights enable them to make more informed decisions about resource allocation, budgeting, and scheduling, all while minimizing errors and reducing the likelihood of cost overruns or delays. Moreover, the ability to analyse large datasets allows QS professionals to provide valuable predictive insights. For example, by leveraging AI and machine learning algorithms, they can predict potential cost fluctuations based on real-time supply chain data, or forecast the impact of design changes on overall project costs. This level of precision and foresight allows QS



professionals to move beyond traditional estimating and become integral members of the project team, contributing to the strategic direction of the entire project.

4.2 Improved Collaboration and Role Expansion: Integrating into the Broader Project Team

The digital transformation of quantity surveying is also enabling greater collaboration between QS professionals, architects, engineers, contractors, and other stakeholders. In the past, quantity surveyors typically worked in isolation, primarily focusing on cost estimation and post-contract management. However, with the adoption of collaborative technologies such as BIM, cloud-based project management platforms, and real-time data-sharing tools, QS professionals are now playing a more integrated role in the entire project delivery process.

BIM, for example, allows for seamless communication and collaboration among all project stakeholders, enabling everyone to access and contribute to a single, unified model of the project. This collaborative environment allows QS professionals to provide valuable insights from the earliest stages of planning, such as assessing the cost implications of design changes or recommending more cost-effective construction methods. Additionally, as the project progresses, QS professionals can continue to monitor costs, track changes, and ensure that the project stays within budget. The role of the QS is expanding beyond cost estimation into a broader, more strategic function. QS professionals now provide critical input into project planning, design, and execution, helping to streamline workflows, reduce waste, and ensure that resources are allocated efficiently. By taking a more integrated approach, QS professionals are able to contribute to project success at every stage, from initial concept to post-construction. Furthermore, as smart city projects become more prevalent and involve increasingly complex infrastructure systems, the need for collaboration and coordination becomes even more essential. Quantity surveyors are playing a central role in ensuring that different systems—such as energy, water, waste, and transportation—are managed effectively and that costs are kept under control throughout the lifecycle of these projects.

4.3 New Skill Sets: Adapting to the Digital Future of Quantity Surveying

With the rapid pace of technological advancement, digital transformation in the quantity surveying profession requires professionals to acquire new skills and knowledge. In addition to traditional expertise in cost estimation, measurement, and contract administration, QS professionals must now become proficient in digital tools, data analytics, and emerging technologies. One of the key skills required in the modern QS role is proficiency in digital tools such as BIM software, 3D modelling applications, and project management platforms. These tools not only enhance the accuracy of cost estimates but also improve the efficiency of project delivery. QS professionals must also be familiar with the integration of these tools into the broader construction ecosystem, ensuring that they are used effectively in collaboration with other stakeholders. Data analytics is another critical skill for the future of quantity surveying. With access to large volumes of project data, QS professionals must be able to analyse and interpret this data to make informed decisions. This requires an understanding of statistical methods, data visualization techniques, and predictive analytics. Additionally, familiarity with machine learning and AI algorithms can help QS professionals identify patterns and predict project outcomes with greater precision. Emerging technologies such as



blockchain are also beginning to impact the QS profession, particularly in the areas of contract management and supply chain tracking. Blockchain can improve transparency, reduce fraud, and ensure the integrity of project data, all of which are crucial in large-scale construction projects. As blockchain technology continues to evolve, QS professionals will need to stay up-to-date with its potential applications in the industry. Lastly, as the role of the QS expands, professionals will need to develop strong communication and leadership skills to effectively collaborate with other project stakeholders. Being able to translate data-driven insights into actionable recommendations and communicate them clearly to clients, contractors, and other team members will be essential for success.

5.0 Key- take-aways

As the construction and infrastructure industries continue to evolve, embracing digital transformation is essential for quantity surveyors to remain competitive and effective. Technologies such as BIM, drones, 3D scanning, AI, machine learning, and cloud-based project management are not only enhancing efficiency and accuracy but are also reshaping the way QS professionals deliver projects. By leveraging these innovations, quantity surveyors can improve cost estimation, optimize resource allocation, and drive better project outcomes. The future of quantity surveying lies in the seamless integration of these digital tools, which will help professionals navigate increasingly complex projects, reduce costs, and create more sustainable, efficient, and resilient infrastructure. As digital technologies continue to evolve, the role of quantity surveyors will become even more critical in the realization of smarter, more connected cities and built environments. The impact of digital transformation on smart cities cannot be overstated. Technologies such as sustainable design tools, real-time data monitoring, and system integration are helping shape cities that are not only efficient but also adaptable to the evolving needs of urban populations. Quantity surveyors play a vital role in harnessing these technologies to ensure that smart city infrastructures are built to be sustainable, cost-effective, and well-coordinated.

As smart cities continue to develop, the demand for digital expertise in quantity surveying will only grow. By embracing digital tools, QS professionals are not only helping to build the cities of tomorrow but are also contributing to the creation of resilient, sustainable urban environments that are capable of meeting the challenges of the future. Through smart integration, data-driven decision-making, and sustainable practices, the digital transformation of quantity surveying is helping pave the way for the next generation of smart, connected cities. The evolving role of the quantity surveyor reflects the broader trend of digital transformation in the construction and infrastructure industries. As technology continues to reshape the way projects are designed, managed, and delivered, QS professionals must adapt by acquiring new skills, expanding their roles, and embracing data-driven decision-making.

From cost estimation to data analysis, from working in isolation to collaborating as integral members of the project team, the QS profession is becoming more dynamic and impactful. By



embracing digital tools, fostering collaboration, and continuously developing new skill sets, quantity surveyors will continue to play a key role in the successful delivery of projects in an increasingly complex and interconnected world. The future of quantity surveying is not just about numbers—it's about leveraging technology to drive smarter, more efficient, and more sustainable construction practices. As QS professionals evolve alongside technological advancements, they will continue to be at the forefront of shaping the built environment of tomorrow.

References

1. Abanda, F. H., & Nkeng, M. (2020). The impact of digital technologies on the construction industry: A case study of the role of quantity surveyors. *Journal of Construction and Building Materials*, 233, 117453. <https://doi.org/10.1016/j.conbuildmat.2019.117453>
2. BIM Forum. (2016). *The BIM Execution Plan Guide* (Version 2.0). Retrieved from <https://bimforum.org>
3. Bryde, D., & O'Connor, P. (2017). Building Information Modeling (BIM) and the future of construction. *International Journal of Construction Management*, 18(3), 1-13. <https://doi.org/10.1080/15623599.2017.1318903>
4. Chong, W. K., & Lee, C. S. (2018). The role of quantity surveyors in the adoption of BIM. *Construction Innovation*, 18(4), 494-510. <https://doi.org/10.1108/CI-03-2017-0030>
5. Kassem, M., & Martens, B. (2019). Artificial intelligence in construction cost estimation: A review of applications. *Automation in Construction*, 104, 132-144. <https://doi.org/10.1016/j.autcon.2019.04.010>
6. McKinsey & Company. (2020). *Digital transformation in the construction industry: The new construction era*. Retrieved from <https://www.mckinsey.com/industries/engineering-and-construction/our-insights/digital-transformation-in-the-construction-industry>
7. Sacks, R., & Eastman, C. (2016). *Building Information Modeling: BIM in Current and Future Practice*. John Wiley & Sons, Inc.
8. Tommelein, I. D., & Ballard, G. (2018). The influence of digital technologies on construction project planning and management. *Construction Management and Economics*, 36(2), 120-135. <https://doi.org/10.1080/01446193.2017.1396573>
9. Udom, N. D., & Chien, S. (2019). IoT-based construction project management: Integrating real-time data for enhanced decision-making. *Smart Cities*, 2(2), 255-273. <https://doi.org/10.3390/smartcities2020017>
10. Wells, W. S., & Henshaw, J. (2017). Blockchain technology in the construction industry: A review of applications and potential. *Journal of Construction Engineering and Management*, 143(6), 04017030. [https://doi.org/10.1061/\(ASCE\)CO.1943-7862.0001303](https://doi.org/10.1061/(ASCE)CO.1943-7862.0001303)