# DIGITAL ADOPTION AMONG CONTRACTOR QUANTITY SURVEYORS: INSIGHTS FROM THE MALAYSIAN CONSTRUCTION CONTEXT

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**Abstract**
Digitalisation has transformed Malaysia's construction industry, yet adoption among contractor quantity surveyors (QS) remains inconsistent. This study investigates current digital practices, challenges, and strategies for improving digital adoption within contractor firms. A quantitative questionnaire survey was conducted among 58 QS employed by G7 contractor firms. Data were analysed using descriptive statistics in SPSS to determine the level of digital application, perceived barriers, and preferred solutions. Findings reveal that digital tools are most actively applied in cost reporting, measurement verification and progress payment processes, with cloud computing, Building Information Modelling (BIM), and drones being the most commonly used technologies. Key barriers include reliance on traditional practices, limited training, software incompatibility and high initial investment costs. Respondents identified employer-led training, university industry collaboration and government guidelines as the most effective strategies to enhance adoption. The study provides useful insights for construction firms to strengthen digital readiness in quantity surveying and project management functions beyond site-based activities, supporting Malaysia's transition toward a more efficient and technology-driven Construction 4.0 industry.

**Keywords:** digitalisation, contractor quantity surveyor, Malaysia, Construction 4.0

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## INTRODUCTION

Digitalisation is transforming how the construction industry operates. Through tools such as Building Information Modelling (BIM), cloud computing, drones, and virtual or augmented reality, the construction process has become more efficient, accurate and data-driven (Siddiqui et al., 2023; Bolhassan et al., 2022; Perera et al., 2023). In Malaysia, this transformation is supported by national initiatives such as the Construction 4.0 Strategic Plan and CIDB's MyDigital Kontraktor programme, which encourage contractors to adopt e-tendering, e-procurement, and other digital systems to improve project performance (CIDB Malaysia, 2022; MyGovernment, 2021).

Quantity surveyors (QS) play a vital role in managing the financial and contractual aspects of construction projects. Within contractor firms, QS professionals are responsible for preparing cost estimates, controlling budgets, monitoring progress payments, and managing subcontractors. These responsibilities require handling large amounts of project data, which can be managed more efficiently using digital tools (Zaini et al., 2022). Despite these benefits, previous studies reported that many contractor QS in Malaysia still rely on traditional paper-based methods and manual calculations. This slow adoption limits productivity and reduces the competitiveness of contractor firms (Ismail et al., 2021; Chew, 2023). Most previous studies have examined digitalisation among consultant QS with limited focus on those working specifically in contractor organisations (Akinshipe et al., 2022; Yap et al., 2023). Yet, contractors QS face different work environments, challenges, and expectations. Understanding their digital practices is therefore essential to identify the real obstacles preventing wider adoption and to propose strategies suited to site-based operations.

This study aims to examine how digitalisation can enhance the services of contractor quantity surveyors in Malaysia. Specifically, it seeks to (i) identify the current digital practices used by contractor QS, (ii) determine the challenges that hinder adoption, and (iii) suggest strategies to improve implementation. The study provides useful insights for the construction firms to enhance their digital readiness particularly in quantity surveying and project management functions that extend beyond construction site activities. Strengthening these digital capabilities will enable firms to improve cost efficiency, data integration thereby supporting the broader transformation of Malaysia construction industry towards a more innovative and technology-driven Construction 4.0 industry.

## LITERATURE REVIEW

### Quantity Surveying in Malaysia: Profession and Contractor Context

Quantity surveying (QS) in Malaysia is a regulated profession under the Quantity Surveyors Act 1967 administered by the Board of Quantity Surveyors Malaysia (BQSM), with professional standards further supported by the Royal Institution of Surveyors Malaysia (RISM) (BQSM, 2022; Royal Institution of Surveyors, 2022). In broad terms, QS practice spans feasibility advice, cost planning, tender documentation and evaluation, contract administration, and final accounts across the project life cycle (Reddy, 2017; Rathnayake et al., 2022). While both consultants and contractors are engaged across pre and post contract stages, their roles differ in orientation and responsibility. Consultant quantity surveyors act on behalf of the client, focusing on cost planning, tender documentation and overall financial governance of a project. Contractor quantity surveyors on the other hand work from contractor's perspective, managing operations such as subcontractor procurement and cashflow reporting to the contractor to maintain project profitability and coordinating quotations, pricing Bills of Quantities (BoQ), managing subcontract packages, and substantiating interim payments with contemporaneous records contractual compliance (Adhikari & Chung, 2018; Ashworth & Higgs, 2023; RICS, 2023). In Malaysia's construction landscape, the contractor QS must reconcile office and site realities (Adhikari & Chung, 2018; Salleh et al., 2020). These tasks demand fast, accurate information flows with consultants, suppliers, and the client team, and they are increasingly shaped by national digital initiatives such as MyDigital Kontraktor and the push for e-tendering and e-procurement (CIDB Malaysia, 2022; MyGovernment, 2021). Consequently, the contractor QS faces a distinct set of competency requirements however, traditional measurement and contract knowledge remain essential, but must be complemented by data handling, platform interoperability, and digital communication skills (Chandramohan et al., 2022; Moyo et al., 2023).

### Digital Practices in Contractor Work Setting: working tools

Based on the literature, there are six key technologies that are transforming how contractor quantity surveyors (QS) deliver their work. Building Information Modelling (BIM) is one of the most important tools, allowing cost and quantity data to be integrated with design information for more accurate estimation, valuation and reporting throughout the project (Olatunji et al., 2021; Omar et al., 2022). Cloud computing supports this process by enabling real-time data sharing between site and office teams, reducing duplication and improving coordination (Liyana et al., 2022). The use of drones or Unmanned Aerial Vehicles (UAVs) has also become common, as they provide quick, precise site measurements and progress records for valuation and verification purposes (Small et al., 2019; Rizal Omar et al., 2022). Meanwhile, Artificial Intelligence (AI) is increasingly applied for predictive costing and automated quantity take-off, although its adoption in Malaysia is still at an early stage (Zhang & Lu, 2021; RICS, 2023). Extended Reality (XR) technologies, including augmented and virtual reality, help QS visualise and verify on-site data more clearly, improving communication among project teams (Nanyam & Makkena, 2021; Wang et al., 2018). Lastly, the Internet of Things (IoT) and e-tendering systems enable real-time monitoring of project information and simplify procurement procedures through digital communication (Gamil et al., 2020; Mahmud et al., 2018). Together, these technologies move contractor QS practice away from paper-based processes toward collaborative, data-driven workflows that enhance accuracy, speed, and decision-making (Akinshipe et al., 2021; Sawhney et al., 2023).

### Barriers to Digital Adoption

Evidence clusters the obstacles into three domains. People-related barriers include limited awareness and training, uneven digital competencies, persistence of conventional routines, and weak cross-stakeholder collaboration (Oke & Arowoiya, 2021; Bajpai & Misra, 2022; Kamde et al., 2021; Moses et al., 2020; Munianday et al., 2023; Ebekozien & Aigbavboa, 2023). Technology-related barriers arise from software complexity, interoperability gaps, cybersecurity and data-privacy concerns and the absence of common standards (Demirkesen & Tezel, 2022; Zahrizan et al., 2022; Bello et al., 2021; Lim et al., 2023; Omari et al., 2023). Financial barrier is high upfront and operating costs, uncertain payback and limited long-term support are also acute for the SMEs (Aghimien et al., 2018; Chai et al., 2022; Bajpai & Misra, 2022; Munianday et al., 2023; Zahrizan et al., 2022).

### Enabling strategies for Advancing Digital Adoption

Previous literature highlights three main strategies. On people, structured CPD and employer-led training, leadership that actively motivates adoption (including targeted incentives), and university-industry collaboration to embed digital learning are repeatedly endorsed (Kamde et al., 2021; Ebekozien & Aigbavboa, 2023; Höyng & Lau, 2023; Muthusamy & Chew, 2020; Okonkwo et al., 2023; Shojaei &

Burgess, 2022; Cunningham et al., 2021). On technology, national maturity models and clear implementation guidelines/standards are proposed to harmonise processes and reduce interoperability friction (Yusoff et al., 2023; Lojda et al., 2020; Demirkesen & Tezel, 2022; Durant, 2023). On finance, government/professional-body support (grants, tax incentives, advisory services) and trial licensing by software vendors can lower entry costs and de-risk adoption, particularly for SMEs (Rupeika-Apoga et al., 2022; Almatari et al., 2023; Munianday et al., 2023).

## METHODOLOGY

To examine the extent of digital engagement among contractor quantity surveyors, a quantitative survey approach was adopted to gather empirical data from QS professionals employed in G7-grade contractor firms registered with CIDB Malaysia. This focus was chosen because contractor quantity surveyors are directly responsible for managing the financial and contractual dimensions of construction work within these firms. Understanding their digital readiness therefore provides a more accurate reflection of how digitalisation is being operationalised within construction processes. An online questionnaire was distributed between April and May 2024, yielding 58 valid responses. The instrument comprised four sections: demographic profile, digital practices, barriers, and strategies. Each item was measured using a five-point Likert scale, and data were analysed with SPSS v.26 using descriptive statistics and reliability testing, with Cronbach's α values exceeding 0.70 for all constructs, confirming internal consistency.

## RESULTS AND DISCUSSIONS

### Digital Practices Among Contractor QS

Figure 1 illustrates the level of usage of digital technologies among contractor quantity surveyors. The results show that adoption remains uneven across tools, with clear preference for systems that directly enhance coordination and cost management. Cloud computing (M = 3.79) and Building Information Modelling (BIM) (M = 3.53) lead current practice, reflecting their ability to support collaborative document sharing, real-time cost updates, and integrated quantity take-off. Drones (M = 3.24) are also gaining traction, particularly for progress verification and site measurement tasks that require visual documentation and spatial accuracy. In contrast, Internet of Things (M = 2.88), Artificial Intelligence (M = 2.26), and Extended Reality (M = 2.19) remain in the exploratory phase, mainly limited to pilot applications or isolated trials. The overall mean score of 2.98 indicates that only a subset of technologies has reached routine operational use. These findings suggest that contractor QS digitalisation is driven by practicality and immediacy rather than full technological transformation. Adoption tends to concentrate on platforms that simplify documentation flow, cost control, and site coordination—consistent with the QS contractor's role as the operational link between project site and office. This pattern also mirrors earlier observations by Akinshipe et al. (2021) and Seidu et al. (2019), who found that contractor-side professionals prioritise tools with clear time and cost benefits while remaining cautious toward emerging technologies requiring higher investment and training. Sustained digital maturity will therefore depend on targeted upskilling, clearer implementation standards, and management commitment to integrate advanced tools such as AI or IoT into everyday QS workflows.

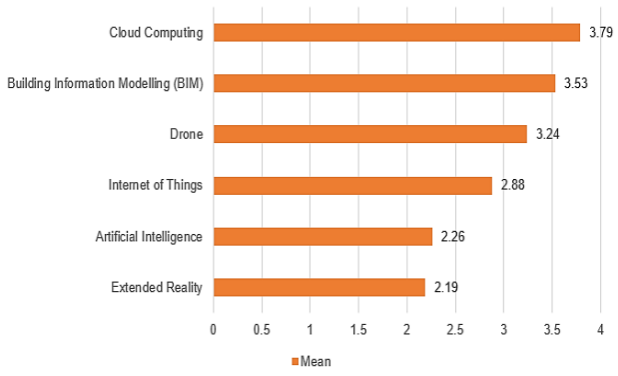


Figure 1: Level of Digital Technologies usage

**Barriers to Adoption**

The survey results show consistently high agreement that digital adoption is hindered across human, technological, and financial dimensions. On the human side (average mean = 4.29), the most significant constraint is the continued reliance on traditional working methods (M = 4.55), reinforced by limited training and education (M = 4.41) and gaps in digital competencies (M = 4.22). Issues of technological awareness (M = 4.19) and weak cross-stakeholder collaboration (M = 4.10) also remain prominent. Technological barriers (average mean = 4.14) centre on interoperability and workflow alignment, with compatibility issues (M = 4.31) and lack of standardisation (M = 4.28) identified as leading concerns, followed by tool complexity (M = 4.12) and data-security risks (M = 3.83). Financial pressures (average mean = 4.14) further constrain uptake, particularly due to high initial investment (M = 4.47) and operating costs (M = 4.38), compounded by limited long-term financial assistance (M = 3.95) and extended return-on-investment periods (M = 3.93).

These findings suggest that barriers to digital adoption among contractor quantity surveyors are more structural than attitudinal. The persistence of traditional practices and skill gaps points to institutional inertia within firms rather than personal reluctance. Similar patterns have been reported by Bajpai and Misra (2022) and Demirkesen and Tezel (2022), who note that high implementation costs and the absence of shared digital standards slow integration across project teams. Overcoming these constraints requires coordinated support through structured training, clearer interoperability frameworks, and targeted policy incentives to promote consistent adoption within contractor QS environments.

**Strategies for Improvement**

The strategies proposed by respondents closely mirror the barriers identified, reflecting a practical understanding of what is needed to enhance digital adoption. In the human domain (average mean = 4.35), the most strongly supported measure is employer-led training programmes (M = 4.41), which respondents believe would strengthen digital skills and awareness within contractor organisations. This is followed by the development of digital learning platforms through universities (M = 4.34), ensuring that future graduates are equipped with relevant competencies, while leadership incentives and motivation (M = 4.29) are also viewed as key drivers of behavioural change. In the technological domain (average mean = 4.34), respondents emphasise the need to improve overall digital maturity (M = 4.34) and to introduce government-issued guidelines and standards (M = 4.34) to promote interoperability. Additionally, trial access to software (≈ 4.33) is seen as a practical way to encourage experimentation before major investment. For financial strategies (average mean = 4.37), the highest agreement is recorded for governmental and professional-body support (M = 4.40), including funding and policy assistance, followed by vendor-provided trial software (M = 4.33) to reduce entry costs and encourage wider adoption.

These findings highlight that contractor QSs recognize digital transition as a shared responsibility between firms, academia, and government. The strong emphasis on training and policy alignment echoes Muthusamy and Chew (2020) and Ebekozien and Aigbavboa (2023), who stress that capacity-building and institutional frameworks are essential enablers of digital transformation. In particular, the demand for clearer standards and financial facilitation underscores that successful implementation depends not only on individual skills but also on systemic support across the construction ecosystem.

## CONCLUSIONS

This study examined the level of digitalisation among contractor quantity surveyors, the barriers that affect adoption and the strategies that can strengthen digital readiness within contractor organisations. The findings show that digital practices are gradually expanding with tools such as cloud computing, BIM and drones widely used in cost management, documentation and progress verification. However, more advanced technologies such as AI, IoT and XR remain at an early stage of use, indicating that adoption is still focused on practical, short-term benefits rather than digital integration. Barriers identified in this study are mainly structural rather than attitudinal. Limited training opportunities, inconsistent standards and financial constraints continue to slow adoption across contractor firms. These findings emphasize the importance of institutional support and continuous professional development to bridge

skill and system gaps. The strategies proposed by respondents especially employer-led training, university-industry collaboration and government support through clear guidelines and funding provide practical ways to improve adoption and sustain digital transformation in contractor QS practice. Overall, this study highlights the contractor quantity surveyor as a key yet often overlooked player in the digitalisation of the construction industry. It contributes empirical evidence that digital capability in quantity surveying foes beyond software use, it also depends on leadership, collaboration and policies alignment. Strengthening these digital capabilities will enable construction firm to improve cost efficiency and data integration thereby supporting the broader transformation of the Malaysia construction industry towards a more innovative and technology driven Construction 4.0 environment. Future research could include other contractor grades, track changes in digital competency overtime or focus on specific technologies such as AI or integrated cloud BIM system to further advance this transition.

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