© FEB 2026 | IRE Journals | Volume 9 Issue 8 | ISSN: 2456-8880
DOI: https://doi.org/10.64388/IREV9I8-1714227

Barriers in Adopting Digital Estimation: Evaluating Effects on Quantity Surveyors Across Different Groups – A Comparative Study

JOSEPHINE D. ALBERTO[1], NOEL T. FLORENCONDIA[2], JOEFIL C. JOCSON[3], MARVIN O. MALLARI[4]

[1]*Student, Master of Engineering Management, Graduate School, Nueva Ecija University of Science and Technology (NEUST), Cabanatuan City, Nueva Ecija, Philippines*

[2, 3, 4]*Professor, Master of Engineering Management, Graduate School, Nueva Ecija University of Science and Technology (NEUST), Cabanatuan City, Nueva Ecija, Philippines*

Abstract--- ***The construction industry is experiencing rapid digital transformation, significantly influencing the practice of quantity surveying, particularly in cost estimation processes. Despite the availability of advanced digital estimation tools, their adoption among Quantity Surveyors (QS) remains uneven and limited. This study examines the barriers to adopting digital estimation tools among Quantity Surveyors across different professional groups in the Philippines—consultants, contractors, and developers—using a comparative mixed-methods approach. Quantitative data were collected through structured survey questionnaires, while qualitative insights were obtained through semi-structured interviews. The findings reveal that the most significant barriers to digital estimation adoption are insufficient training, lengthy learning periods, preference for traditional methods, and high operational costs. Technical challenges such as inadequate user guidance and system incompatibility further hinder adoption, particularly among consultants and contractors. Despite these barriers, the study finds that digitalization positively impacts QS roles by improving efficiency, productivity, accuracy, and professional competency, although its influence on decision-making capability remains limited. The study concludes that while digital estimation tools offer substantial benefits, their full potential is constrained by organizational readiness, individual skill gaps, and cost-related concerns. Addressing these barriers through targeted training, management support, affordable technology, and educational integration is essential to advancing digital adoption in the quantity surveying profession.***

Index Terms--- ***Adoption Barriers, Construction Digitalization, Digital Estimation, Quantity Surveyor***

I. INTRODUCTION

The construction industry is undergoing a significant digital transformation, reshaping traditional practices and professional roles. Among these, quantity surveying—long recognized as the backbone of project cost management—has been profoundly impacted. Traditionally, quantity surveyors relied on manual methods for estimating project costs, including hand calculations, spreadsheets, and paper-based measurements. While these methods provided a foundation for cost control, they were time-consuming, prone to human error, and limited in handling complex or large-scale projects. For example, estimating detailed bills of quantities, cost projections, and resource allocation manually could take weeks, often leading to inconsistencies or delays in decision-making.

With the rise of digital technologies, the profession is gradually shifting towards automated and software-based estimation tools that enhance accuracy, efficiency, and collaboration. Tools such as CostX, BuildSoft, WinQS, and QSPlus allow quantity surveyors to generate bills of quantities, cost plans, and measurement take-offs more quickly and accurately. Additionally, Building Information Modeling (BIM)-integrated estimation software, such as Revit with CostX or Vico Office, enables real-time integration of design and cost data, facilitating precise cost forecasting, clash detection, and scenario analysis. Cloud-based platforms and mobile applications further allow project teams to access, update, and collaborate on cost data from multiple

locations, streamlining communication and decision-making processes.

Despite these advantages, the adoption of digital estimation tools is uneven across the profession. Quantity surveyors working for consulting firms, contractors, and developers face varying challenges influenced by their job scope, organizational resources, and project requirements. For instance, consulting QS may focus heavily on client-oriented cost reporting and compliance, requiring tools that provide detailed documentation and accuracy. Contractor-employed QS, on the other hand, prioritizes real-time cost tracking and resource management, benefiting from mobile and BIM-integrated tools. Meanwhile, QS in developer-led projects may need tools that integrate budgeting, cash flow analysis, and project planning for multi-project portfolios.

The transition from traditional to digital estimation represents not only a technological shift but also a change in the professional role of quantity surveyors. Digital tools can enhance productivity, reduce errors, and provide strategic insights, but they also demand new skills, training, and organizational support. Understanding the barriers that hinder this transition—and how these barriers differ across various professional groups—is crucial for aligning education, training, and industry practices with the current demands of the construction sector.

This study aims to investigate the barriers in adopting digital estimation tools among quantity surveyors across different professional groups, providing insights that can inform organizational strategies, professional development, and policy interventions to foster digital integration in the profession.

Statement of the Problem

While previous studies have highlighted general barriers to digitalization among Quantity Surveyors, there is a lack of research distinguishing how these barriers differ across professional groups such as consulting firms, contractors, and developers. Existing research often relies on quantitative surveys with limited response rates and short administration periods, which may overlook nuanced insights into the challenges faced by different groups. Consequently, there is insufficient understanding of how job scope, organizational environment, and professional responsibilities influence the adoption of digital estimation tools.

The problem, therefore, lies in the need to:

1. Identify and evaluate barriers specific to different groups of Quantity Surveyors in adopting digital estimation tools.
2. Understand how these barriers affect their roles, responsibilities, and efficiency in project cost management.
3. Provide actionable insights that can guide training, policy, and organizational strategies for smoother digital adoption.

II. REVIEW OF RELATED LITERATURE

1. Digitalization in Quantity Surveying

The construction industry is increasingly embracing digital technologies to improve efficiency, accuracy, and collaboration in project delivery. Within this transformation, quantity surveyors (QS) are key stakeholders responsible for cost estimation, budgeting, and financial control. Traditionally, QS relied on manual methods such as hand calculations, paper-based measurements, and spreadsheet-based cost estimation (Yap et al., 2023). While these methods provide foundational accuracy, they are labor-intensive, time-consuming, and prone to errors, particularly in large or complex projects.

Digitalization in quantity surveying involves the integration of software tools and technologies, including CostX, BuildSoft, WinQS, QSPlus, and BIM-integrated platforms such as Revit with CostX or Vico Office. These tools enable automated quantity take-offs, real-time cost estimation, and collaborative project planning. The adoption of digital tools enhances accuracy, reduces repetitive tasks, improves data accessibility, and facilitates scenario analysis, thus transforming the traditional role of QS from purely operational to more strategic and analytical (Yap et al., 2023).

2. Barriers to Implementing Digitalization

Despite the advantages, the adoption of digital tools in quantity surveying remains challenging. Yap et al. (2023) identify several key barriers, corroborated by prior studies, which hinder the successful integration of digital technologies:

2.1. Technical Barriers

- Lack of software support personnel: QS often face difficulties due to insufficient technical support, which affects troubleshooting, maintenance, and system optimization (Hong et al., 2016; Haupt & Naidoo, 2016; Eze & Ugulu, 2021).
- Software complexity and user guidance: Digital tools may not be user-friendly, and QS often struggle with insufficient manuals, tutorials, or guidance for effective usage (Agyekum et al., 2015; Hong et al., 2016; Reddy, 2018; Jamal et al., 2019).
- Software incompatibility and collaboration issues: Digital tools may fail to integrate with other systems or cannot adapt to operating system updates, creating workflow disruptions (Stanley & Thurnell, 2014; Reddy, 2018; UPITDC, 2020; McGraw-Hill Construction, 2012).

2.2. Organizational and Management Barriers

- Resistance from management personnel: Organizational leadership may oppose or undervalue software adoption, delaying or limiting implementation (Reddy, 2018; Eze & Ugulu, 2021; Akinshipe et al., 2022).
- Lack of training and skill development: QS often lack formal training in digital tools, making adoption slower and less effective (Cartlidge, 2006; Agyekum et al., 2015; Zainon, 2018).
- High operational and setup costs: Organizations may face financial constraints in acquiring software licenses, setting up digital infrastructure, or hiring technically capable personnel (Reddy, 2015; Emmanuel et al., 2018; Haupt & Naidoo, 2016; Zainon, 2018).

2.3. Individual Barriers

- Reliance on traditional methods: Many QS continue to depend on conventional estimation practices, either due to habit, comfort, or perceived reliability of traditional methods (Agyekum et al., 2015; Jamal et al., 2019; Eze & Ugulu, 2021).
- Time required to understand digital procedures: Learning and mastering digital estimation tools can be lengthy, affecting productivity and motivation (Cartlidge, 2006; Zainon, 2018; Eze & Ugulu, 2021).
- Fear of over-investing or long payback periods: Both individuals and organizations may be hesitant to invest in digital tools due to uncertainties in cost recovery and return on investment (Granjal et al., 2015; Luthra et al., 2018; Ryan & Watson, 2017; Eze & Ugulu, 2021).

2.4. Educational and Data-Related Barriers

- Inadequate integration into university curricula: QS graduates often enter the workforce with limited exposure to digital tools, creating a skills gap in professional practice (Agyekum et al., 2015; Emmanuel et al., 2018; Taher, 2021).
- Data protection and privacy concerns: The shift to digital systems raises issues of cybersecurity, data breaches, and confidentiality, which may limit adoption or cautious usage (Emmanuel et al., 2018; Agyekum et al., 2015; Hussain, 2016; Khanna & Sharma, 2019).

3. Implications of Barriers for Quantity Surveyors

These barriers collectively affect the efficiency, role, and responsibilities of QS in different contexts. Resistance to digitalization may limit the QS's ability to:

1. Perform accurate and timely cost estimation.
2. Collaborate effectively with project teams using integrated platforms.
3. Provide real-time data analysis and scenario-based cost planning.
4. Adapt to technological advancements in construction project management.

Yap et al. (2023) emphasize that overcoming these barriers requires not only technical solutions but also strategic organizational support, targeted training programs, and curriculum reforms to equip QS with the skills necessary for digital adoption.

© FEB 2026 | IRE Journals | Volume 9 Issue 8 | ISSN: 2456-8880
DOI: https://doi.org/10.64388/IREV9I8-1714227

4. Research Gap

While previous studies identify general barriers to digitalization, there is limited research distinguishing how these barriers differ across professional groups of QS, such as those employed by consulting firms, contractors, or developers. Understanding these differences is essential because the scope of work, project responsibilities, and organizational environment influence both the perception and impact of barriers (Yap et al., 2023).

Moreover, prior research often relies on quantitative surveys with limited responses, which may not capture contextual, qualitative insights such as attitudes toward technology, organizational culture, and informal practices. Therefore, there is a need for a comparative study that combines qualitative and quantitative methods to explore the barriers to digital adoption across different QS groups.

Conceptual Framework

This conceptual framework illustrates the relationship between barriers to digitalization, the professional grouping of quantity surveyors, and the adoption and impact of digital estimation tools.

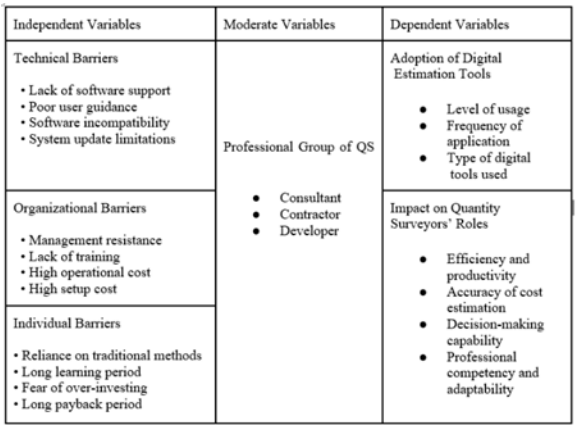
The independent variables consist of three major categories of barriers identified by Yap et al. (2023) and related literature:

1. Technical barriers, which include the lack of software support personnel, inadequate user guidance, incompatibility of software systems, and inability to adapt to operating system updates. These factors directly affect the usability and reliability of digital estimation tools.
2. Organizational barriers, such as management resistance to technological advancement, insufficient training programs, high setup costs, and increased operational expenses. These barriers influence the organizational readiness and willingness to adopt digital technologies.
3. Individual barriers, including reliance on traditional estimation methods, the lengthy learning period required to understand digital systems, fear of over-investment, and concerns regarding long payback periods. These barriers affect the personal motivation and confidence of quantity surveyors in using digital tools.

The moderating variable in this framework is the professional group of quantity surveyors, categorized as consultants, contractors, or developers. This variable moderates the relationship between the identified barriers and the adoption of digital estimation tools, as each group has distinct job scopes, responsibilities, and operational priorities.

The dependent variables are divided into two stages:

- Adoption of digital estimation tools, measured by the level of usage, frequency of application, and types of digital tools employed.
- Impact on the role of quantity surveyors, reflected in efficiency, accuracy of cost estimation, decision-making capability, and professional competency.



This framework supports a comparative analysis by demonstrating how different barriers influence digital adoption across various QS groups and how this adoption ultimately transforms their professional roles.

III. RESEARCH METHODOLOGY

3.1 Research Design

This study adopts a mixed-methods research design, combining quantitative and qualitative approaches to comprehensively examine the barriers to adopting digital estimation tools among quantity surveyors (QS) across different professional groups. The mixed-methods approach is appropriate as it allows the study to capture both measurable trends and in-depth contextual insights regarding digital adoption.

The quantitative component employs a survey questionnaire to identify and compare the perceived barriers to digital estimation adoption among QS working as consultants, contractors, and developers. The qualitative component involves document review and thematic analysis to explore underlying factors that may not be fully captured through structured survey instruments. This approach addresses limitations identified in previous studies, particularly the over-reliance on quantitative data and the lack of contextual understanding of digitalization barriers.

3.2 Research Approach

A comparative research approach is employed to evaluate differences in barriers and digital adoption across the three QS professional groups. The study compares responses from consultant QS, contractor QS, and developer QS to determine how variations in job scope and organizational environment influence digital estimation adoption.

3.3 Population and Sample

3.3.1 Population

The population of this study comprises registered and practicing quantity surveyors working in construction-related organizations in the Philippines, including:

- Quantity surveying consulting firms
- Contracting firms
- Property development companies

3.3.2 Sample and Sampling Technique

A purposive sampling technique is used to select respondents who have direct experience with cost estimation processes. The sample includes QS professionals from each of the three groups to ensure balanced representation.

The targeted sample size follows recommendations from construction management research, ensuring sufficient responses for comparative statistical analysis.

3.4 Research Instruments

3.4.1 Survey Questionnaire

A structured survey questionnaire is used as the primary quantitative data collection instrument. The questionnaire is divided into four sections:

- Section A: Demographic Profile Includes generation, organization type, and level of exposure to digital estimation tools.
- Section B: Technical Barriers Measures perceptions related to software support, user guidance, compatibility, and system updates.
- Section C: Organizational Barriers Assesses management support, training availability, operational cost, and infrastructure readiness.
- Section D: Individual Barriers Examines reliance on traditional methods, learning duration, investment concerns, and perceived return on investment.

Responses are measured using a Sequential Explanatory (Quantitative Survey followed by Qualitative Interviews)

3.4.2 Semi-Structured Interviews (Qualitative Analysis)

Semi-structured interviews are employed as the qualitative research instrument to gain in-depth insights into the barriers to adopting digital estimation tools among quantity surveyors. This method allows respondents to elaborate on their experiences, perceptions, and challenges related to digitalization, which may not be fully captured through the survey questionnaire.

The interview participants are selected using purposive sampling, targeting quantity surveyors from consulting firms, contracting companies, and property developers. Participants are chosen based on their direct involvement in cost estimation processes and their exposure to either traditional or digital estimation methods.

The interview questions are developed based on the barriers identified in previous studies, particularly Yap et al. (2023), and are aligned with the study's conceptual framework. The questions focus on:

- Adoption of Digital Estimation Tools (level of usage, frequency of application, type of digital tools used)
- Impact on Quantity Surveyor's Roles (efficiency and productivity, accuracy of cost estimation, decision-making capability, professional

competency and adaptability)

The semi-structured format provides flexibility for probing and follow-up questions, enabling the researcher to explore emerging themes and contextual factors such as organizational culture, training practices, and workflow adjustments. Each interview is conducted either face-to-face or via online platforms and is audio-recorded with the participants' consent.

The collected interview data are transcribed verbatim and analyzed using thematic analysis. Codes are generated and grouped into themes corresponding to technical, organizational, and individual barriers. The qualitative findings are used to complement and triangulate the quantitative survey results, thereby enhancing the depth, validity, and reliability of the study.

3.5 Data Collection Procedure

This study adopts a Sequential Explanatory Mixed-Methods design, in which quantitative data collection and analysis are conducted first, followed by qualitative data collection to further explain and elaborate on the quantitative findings.

Phase 1: Quantitative Data Collection

In the first phase, a structured survey questionnaire is distributed to quantity surveyors working as consultants, contractors, and developers. The survey is administered online using email and digital survey platforms to ensure accessibility and a wider response reach. Respondents are given an adequate response period to encourage participation.

The quantitative survey aims to identify the prevalence and significance of barriers to adopting digital estimation tools across different professional groups. Preliminary analysis of the survey results is conducted to determine key trends, dominant barriers, and statistically significant differences among the groups.

Phase 2: Qualitative Data Collection

In the second phase, semi-structured interviews are conducted with selected survey respondents. Participants for the interview phase are purposely selected based on their survey responses, particularly those who demonstrate high or low levels of digital adoption or highlight critical barriers.

The interview questions are designed to explain and expand on the quantitative results, allowing respondents to provide deeper insights into why certain barriers are more prominent and how these barriers affect their professional practice. Interviews are conducted face-to-face or via online communication platforms and are audio-recorded with participants' consent.

3.6 Integration of Quantitative and Qualitative Findings

3.7 Ethical Considerations

Ethical principles are strictly observed throughout both phases of the study. Participants are informed of the study objectives and the sequential nature of data collection. Written or recorded consent is obtained prior to survey participation and interviews.

Confidentiality and anonymity of respondents are ensured by assigning codes instead of using personal identifiers. Data collected are stored securely and used solely for academic research purposes.

IV. DATA ANALYSIS AND INTERPRETATION

4.1 Respondent's Demographics

The respondents in this study come from a variety of backgrounds as shown in their professional group, years of experience, organization type, and level of exposure to digital estimation tools.

Figure 4.1.1 presents the distribution of respondents according to their type of organization. The respondents are equally represented among Consultants, Contractors, and Developers, with 10 respondents each, resulting in a balanced sample size across the three groups.

© FEB 2026 | IRE Journals | Volume 9 Issue 8 | ISSN: 2456-8880
DOI: https://doi.org/10.64388/IREV9I8-1714227

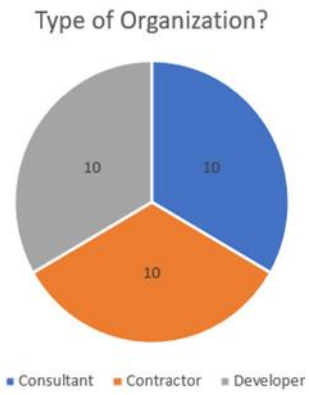


Figure 4.1.1 Professional Group / Organization Type

Figure 4.1.2 shows that the majority of respondents belong to Millennials/Generation Y (12) and Generation Z (11), while Baby Boomers (7) comprise the smallest group. This indicates that the respondent pool is largely composed of younger generations, who are generally more exposed to and familiar with digital technologies. This demographic profile suggests a favorable environment for the adoption of digital estimation tools within the construction industry.

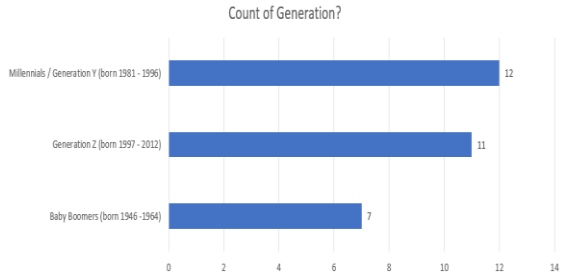


Figure 4.1.2 Respondent's Generation

4.2 Technical Barriers

Among the technical barriers shown in Fig. 4.2.1, the most significant issue is insufficient user guidance for digital estimation software, with a total count of 9, making it the highest technical concern overall. This is followed by system incompatibility with other organizational systems (8) and system update limitations that hinder continuous use (7). The least reported technical barrier is the lack of adequate software support, with a count of 4.

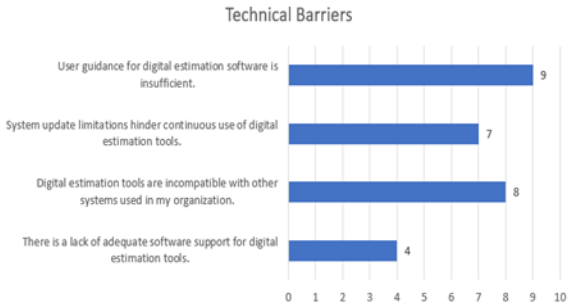


Figure 4.2.1 Technical Barriers

From a role-based perspective, contractors report the highest counts across most technical barriers, particularly for insufficient user guidance (6) and system update limitations (5). Consultants show the strongest concern regarding system incompatibility (5), while developers report comparatively minimal issues, with their highest count being 2 for system update limitations. Overall, the findings indicate that usability, integration, and system continuity are more critical technical challenges than software support, especially for contractors and consultants.

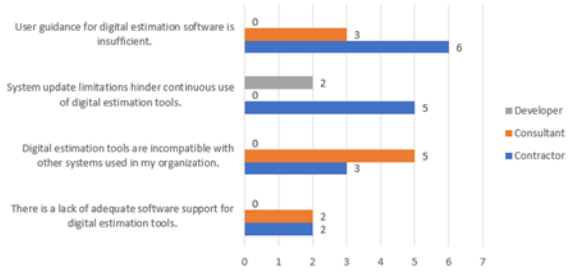


Figure 4.2.2 Technical Barriers per group

4.3 Organizational Barriers

Figure 4.3.1 shows that the most prominent organizational barrier to adopting digital estimation tools is insufficient training, with a total count of 14, making it the highest-reported issue. This is followed closely by the high operational cost of digital estimation tools (13). The initial setup cost is a moderate concern (8), while management resistance is the least cited barrier overall (6).

© FEB 2026 | IRE Journals | Volume 9 Issue 8 | ISSN: 2456-8880
DOI: https://doi.org/10.64388/IREV9I8-1714227

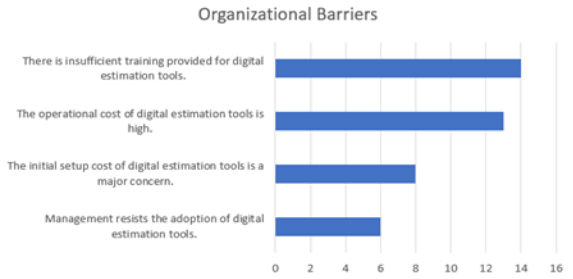


Figure 4.3.1 Organizational Barriers

Looking at role-based responses in Fig. 4.3.2, consultants consistently report the highest counts across most barriers. For insufficient training, both consultants and contractors report the highest count (6 each). The high operational cost and initial setup cost barriers are dominated by consultants (7 each). For management resistance, consultants again report the highest concern (5), while developers show minimal concern across all barriers (highest count only 2). This suggests that cost- and training-related barriers are perceived most strongly by consultants, whereas management resistance is comparatively less significant overall.

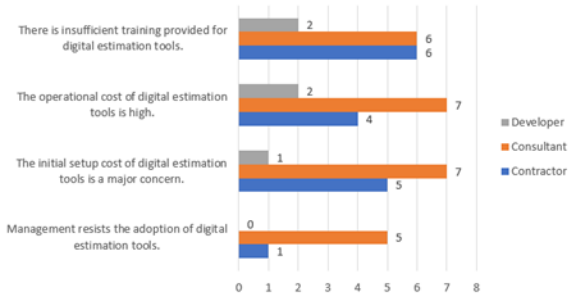


Figure 4.3.2 Organizational Barriers per group

4.4 Individual Barriers

For individual barriers shown in Fig 4.4.1, the most dominant issue is that digital estimation tools require a long learning period, with the highest total count of 16, making it the strongest individual-level barrier. This is followed closely by a preference for traditional estimation methods over digital tools (15). Concerns about over-investing in digital estimation technologies are moderate (6), while the long payback period is the least reported barrier (4).

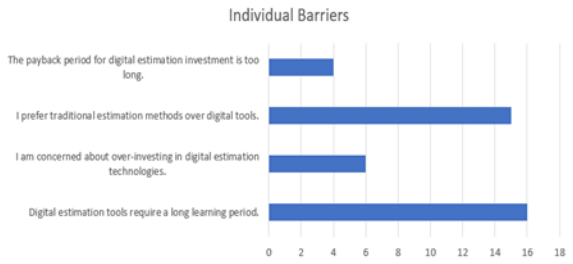


Figure 4.4.1 Individual Barriers

Role-based results shown in Fig. 4.4.2 that contractors and consultants perceive individual barriers most strongly. Preference for traditional methods is highest among consultants and contractors (7 each), while the long learning period is most prominent for contractors (7), followed by consultants (5) and developers (4). Developers report minimal concern overall, with their highest count being 4. These findings indicate that resistance driven by learning effort and habitual reliance on traditional methods outweighs financial concerns at the individual level.

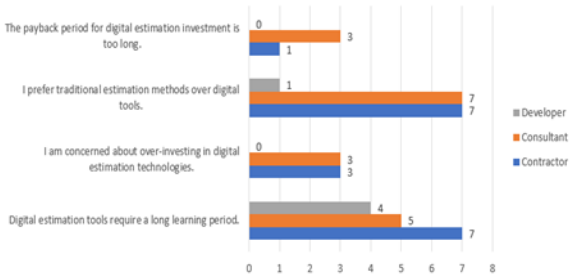


Figure 4.4.2 Individual Barriers

4.5 Adoption of Digital Estimation Tools

The results presented in Fig. 4.5.1 indicate that Spreadsheets/Excel continue to be the predominant digital estimation tool, with 28 respondents reporting its use. In contrast, more specialized estimation software such as PlanSwift, CostX, BIM–Revit, and Bluebeam Revu are utilized by only a small number of practitioners. This suggests that, despite the availability of advanced digital tools in the industry, Quantity Surveyors still favor spreadsheet-based estimation due to its familiarity, flexibility, and user-friendliness. The strong reliance on Excel also reflects a tendency to adhere to traditional or semi-manual estimation practices, where digitalization is implemented at a basic level—a trend that aligns with the barriers identified in Fig. 4.4.2. Overall, these

© FEB 2026 | IRE Journals | Volume 9 Issue 8 | ISSN: 2456-8880
DOI: https://doi.org/10.64388/IREV9I8-1714227

findings imply that the adoption of advanced digital estimation tools remains limited, potentially due to factors such as training requirements, cost considerations, and reluctance to move away from established manual methods.

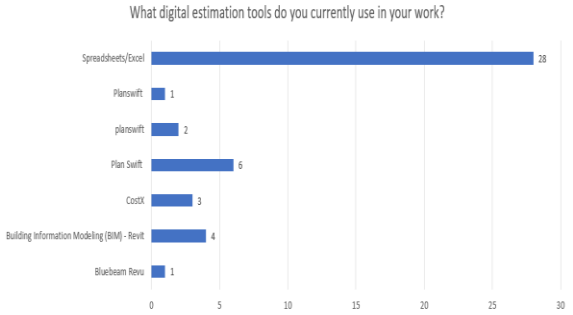


Figure 4.5.1 Level of exposure to digital estimation tools

4.6 Impact on Quantity Surveyor's Roles

The findings below shown in Fig. 4.6.1 indicate that digitalization has a clearly positive impact on QS roles, with the strongest effect on efficiency and productivity. This factor records the highest overall count (18), showing it is the most significant benefit of digital tools. This is followed by improvements in professional competency and adaptability (14), then accuracy in cost estimation (10). The least impacted area is decision-making capability, which records the lowest count (5), suggesting that while digital tools support decisions, their influence here is comparatively weaker.

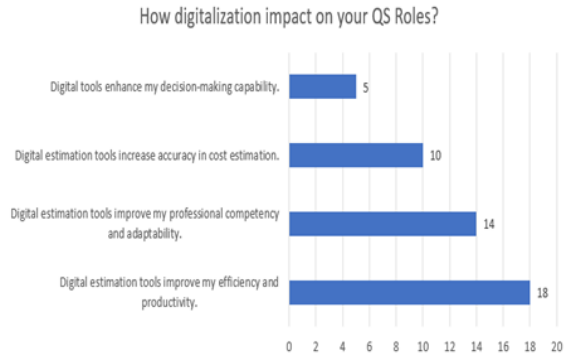


Figure 4.6.1 Impact on Quantity Surveyor's Role

Across stakeholder groups, the same pattern is evident in Fig. 4.6.2. The highest counts are consistently seen in efficiency and productivity (Developer 7, Consultant 7, Contractor 4) and professional competency and adaptability (Developer 6, Consultant 6, Contractor 2). Accuracy in cost estimation shows moderate impact (Developer 4, Consultant 4, Contractor 2), while decision-making capability remains the lowest across all groups (Developer 1, Consultant 3, Contractor 1). Overall, the results confirm that digitalization primarily enhances operational efficiency and skill development in QS practice rather than strategic decision-making.

Figure 4.6.1 Impact on Quantity Surveyor's Role per group

4.7 In what ways has digital adoption changed your role or responsibilities as a Quantity Surveyor?

The qualitative responses indicate that digital adoption has generally enhanced efficiency, accuracy, and productivity in the role of Quantity Surveyors, though its impact varies across organization types. Among consultants, most respondents reported that digital tools streamline work through automated quantity take-offs, ready-made formats, formulas, and improved cost accuracy, allowing them to focus more on analysis and strategic functions. However, several consultants noted no significant change in their roles due to lack of time for training and limited management support, particularly because of the high cost of digital tools, highlighting organizational and leadership constraints that hinder effective adoption.

For contractors, responses were mixed and reflected a more cautious or limited use of digital tools. While many acknowledged the potential benefits—particularly faster and more accurate quantity take-offs and improved efficiency—several contractors reported minimal or no usage of digital software, expressing a preference for manual computation or lack of exposure to digital tools. This suggests that

digital adoption among contractors remains at an early or transitional stage, heavily dependent on skill mastery and familiarity with the technology.

Among developers, respondents emphasized that digitalization improves their ability to handle complex estimations, enhances productivity, and supports better analysis and decision-making. Nevertheless, challenges such as the steep learning curve, software incompatibility, and a generational gap between digitally inclined younger professionals and senior leaders who prefer manual methods were also highlighted.

Overall, the findings suggest that while digital adoption positively transforms the QS role by reducing manual work and improving efficiency, its full impact is constrained by training availability, organizational readiness, management support, and alignment of systems and work practices.

4.8 What strategies would you recommend to improve digital estimation adoption among Quantity Surveyors?

The responses indicate that the most recommended strategies to improve digital estimation adoption among Quantity Surveyors center on training, cost reduction, management support, and system integration. Across all organization types, respondents emphasized the need for easier, shorter, and more accessible training, with consultants and developers highlighting time constraints and steep learning curves as key deterrents. Subsidized seminars, in-house workshops, mentoring, and early exposure through integration of digital tools into academic curricula were commonly suggested to build competence and confidence in using digital estimation software.

Cost-related concerns also emerged strongly, particularly among consultants and contractors, who recommended cheaper or free software options, standardization of tools, and company investment in digital systems to encourage wider adoption. Additionally, respondents stressed the importance of strong management commitment, clear policies, and leadership-driven digital transformation to ensure consistent implementation. From a technical perspective, suggestions such as linking real-time material price databases, adopting advanced platforms like 5D, 6D, and 7D BIM, and standardizing digital estimating processes were viewed as ways to improve accuracy, efficiency, and competitiveness. Overall, the findings suggest that successful digital adoption requires a combined approach of organizational support, affordable and user-friendly technology, continuous training, and alignment between industry practice and education.

V. CONCLUSION

This study investigated the barriers to adopting digital estimation tools among Quantity Surveyors across different professional groups in the Philippines—consultants, contractors, and developers—and assessed the impact of digitalization on their professional roles. The findings demonstrate that although digital tools are recognized for enhancing efficiency, productivity, and accuracy, their adoption remains largely at a basic level, with most respondents still relying heavily on spreadsheets such as Excel rather than advanced estimation software.

The results show that individual barriers, particularly the long learning period and reliance on traditional methods, are the most dominant challenges affecting digital adoption. Organizational barriers, especially insufficient training and high operational costs, further limit effective implementation, while technical barriers such as poor user guidance and system incompatibility also contribute to resistance. These barriers are more pronounced among consultants and contractors, whereas developers generally report fewer challenges, likely due to broader organizational resources and strategic use of technology.

Despite these constraints, the study confirms that digital estimation tools positively transform the role of Quantity Surveyors by reducing manual workload, improving efficiency, and enhancing professional competency and adaptability. However, the relatively low impact on decision-making capability suggests that digital tools are currently used more for operational support rather than strategic cost management. Overall, the findings highlight that digital adoption in quantity surveying is still in a transitional stage and requires coordinated efforts at

the individual, organizational, and educational levels to achieve full integration.

VI. RECOMMENDATION

Based on the findings of this study, several recommendations are proposed to enhance the adoption of digital estimation tools among Quantity Surveyors.

First, construction organizations should prioritize continuous training and capacity-building programs to address the long learning period and limited technical competence associated with digital estimation tools. Structured training, in-house workshops, mentoring systems, and access to certified courses can help Quantity Surveyors build confidence and improve proficiency, thereby reducing reliance on traditional estimation methods.

Second, strong management support and organizational commitment are essential to drive successful digital transformation. Management should establish clear policies that encourage the use of digital estimation tools, allocate sufficient budgets for software acquisition and training, and integrate digital systems into standard operational workflows. Leadership-driven digital initiatives can significantly influence employee acceptance and consistent application of digital technologies.

Third, cost-related barriers should be addressed by improving the affordability and accessibility of digital estimation software. Organizations and software providers may consider flexible licensing schemes, shared platforms, or standardized tools that reduce both initial setup and operational costs. This approach is particularly important for small- and medium-sized firms that may lack the financial capacity for full digital implementation.

In addition, improving the usability and compatibility of digital estimation tools is recommended. Software developers and organizations should ensure that digital tools are compatible with existing systems, particularly BIM and project management platforms, to enable seamless collaboration. Enhanced user guidance, tutorials, and readily available technical support can further mitigate technical barriers and promote sustained usage.

Finally, future researchers are encouraged to expand the scope of this study by involving a larger and more diverse sample of Quantity Surveyors across different regions. Longitudinal research designs may be employed to examine changes in digital adoption over time and to evaluate long-term impacts on productivity, accuracy, and decision-making. Further studies may also explore the integration of digital estimation tools into academic curricula and assess the potential of advanced technologies such as 5D–7D BIM and artificial intelligence in transforming quantity surveying practice.

REFERENCES

[1] Agyekum, K., Ayarkwa, J., & Acheampong, A. (2015). Barriers to the adoption of information technology in the quantity surveying profession. *International Journal of Construction Management, 15*(1), 1–12. https://doi.org/10.1080/15623599.2015.1012134

[2] Akinshipe, O., Aigbavboa, C., & Oke, A. (2022). Digital transformation in the construction industry: Drivers and barriers to implementation. *Journal of Engineering, Design and Technology, 20*(2), 523–540. https://doi.org/10.1108/JEDT-04-2021-0205

[3] Al-Yahya, M., & Panuwatwanich, K. (2018). Digital technology adoption in construction project management. *Engineering, Construction and Architectural Management, 25*(6), 812–831. https://doi.org/10.1108/ECAM-02-2017-0035

[4] Cartlidge, D. (2006). *New aspects of quantity surveying practice*. Butterworth-Heinemann.

[5] Emmanuel, O., Owolabi, J., & Omuh, I. (2018). Challenges of ICT adoption in construction cost management. *Journal of Construction Engineering and Management, 144*(3), 04018002. https://doi.org/10.1061/(ASCE)CO.1943-7862.0001441

[6] Eze, E. C., & Ugulu, R. A. (2021). Digitalization barriers in quantity surveying practice. *International Journal of Construction*

Management, 21(9), 891–903. https://doi.org/10.1080/15623599.2019.1696956

[7] Granjal, J., Monteiro, E., & Silva, J. S. (2015). Security challenges and solutions for cloud computing adoption. *Journal of Internet Services and Applications, 6*(1), 1–15. https://doi.org/10.1186/s13174-015-0020-8

[8] Haupt, T., & Naidoo, K. (2016). Barriers to ICT implementation in construction organizations. *Journal of Construction Project Management and Innovation, 6*(1), 1354–1368.

[9] Hong, Y., Sepasgozar, S. M. E., & Ahmad, I. (2016). Barriers to implementing digital technologies in the construction industry. *Journal of Construction Engineering and Management, 142*(5), 04016009. https://doi.org/10.1061/(ASCE)CO.1943-7862.0001094

[10] Hussain, A. (2016). Data security and privacy challenges in digital construction systems. *International Journal of Information Security Science, 5*(2), 25–34.

[11] Jamal, K., Mohammad, M. F., & Hashim, N. (2019). ICT adoption challenges among quantity surveyors. *Built Environment Journal, 16*(1), 45–58.

[12] Khanna, A., & Sharma, D. K. (2019). Cybersecurity issues in digital construction environments. *Journal of Engineering and Technology Management, 52*, 1–12. https://doi.org/10.1016/j.jengtecman.2019.01.001

[13] Luthra, S., Mangla, S. K., & Chan, F. T. S. (2018). Adoption of smart technologies in construction: Barriers and enablers. *Technological Forecasting and Social Change, 142*, 1–14. https://doi.org/10.1016/j.techfore.2018.09.003

[14] McGraw-Hill Construction. (2012). *The business value of BIM in construction*. McGraw-Hill.

[15] Reddy, K. P. (2015). Cost implications of ICT adoption in construction firms. *International Journal of Construction Management, 15*(4), 273–284. https://doi.org/10.1080/15623599.2015.1075194

[16] Reddy, K. P. (2018). Management resistance to digital transformation in construction. *Journal of Construction Economics and Building, 18*(3), 1–15.

[17] Ryan, J., & Watson, R. (2017). Return on investment considerations for digital technologies. *Information Systems Journal, 27*(3), 297–330. https://doi.org/10.1111/isj.12124

[18] Stanley, R., & Thurnell, D. (2014). System integration challenges in construction ICT adoption. *Automation in Construction, 45*, 15–23. https://doi.org/10.1016/j.autcon.2014.05.002

[19] Taher, M. (2021). Digital skills gap in construction education. *Journal of Engineering Education Transformations, 34*(3), 45–52.

[20] UPITDC. (2020). *Digital infrastructure challenges in construction projects*. Uttar Pradesh Infrastructure Development Corporation.

[21] Yap, Q. Y., Abdul Majid, A. S., Aziz, N. M., & Lee, W. Y. (2023). Digitalization among the quantity surveyors: Strategies to embracing the change. *Journal of the Built Environment*, 20(2), 45–60.

[22] Zainon, N. (2018). Challenges in implementing digital technologies in quantity surveying practice. *Journal of Construction in Developing Countries, 23*(2), 85–101.