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Review on QS BIM Competency Framework in Construction Industry

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ABSTRACT

The integration of Building Information Modelling (BIM) into Quantity Surveying (QS) practice is essential for supporting the construction industry's digital transformation. Despite this, the absence of standardised and comprehensive BIM competency frameworks tailored to the QS profession has hindered consistent implementation and professional development. This study addresses this gap by conducting a systematic scoping review to map the existing literature on QS BIM competency frameworks and to identify key areas requiring further investigation. The review involved a comprehensive search of multiple electronic databases and grey literature sources, encompassing peer-reviewed articles, conference papers, technical reports, and industry publications. The analysis identified critical BIM competency domains and thematic trends, while also highlighting methodological diversity and inconsistencies in existing literature. Notably, the inclusion of grey literature enriched the findings by providing practical, industry-informed perspectives that complemented academic discourse. Despite emerging insights, the review revealed substantial gaps—particularly the need for empirical validation and the development of more coherent, adaptable frameworks. This study offers a consolidated foundation for advancing BIM competency development within the QS profession. It contributes valuable knowledge for researchers and practitioners and establishes a reference point for future empirical work aimed at supporting the QS profession's role in the digital evolution of the construction sector and the broader built environment sector.

Keywords: QS; BIM; competencies; BIM Competency Framework; QS BIM Competency Framework

INTRODUCTION

In recent years, Building Information Modelling (BIM) has emerged as a transformative technology in the construction sector, particularly highlighted in the initiatives under the Construction Industry Transformation Programme (CITP) 2016-2020. In addition, a recent initiative by Malaysia's construction sector is Construction 4.0 Strategic Plan (2021-2025) where the objective to transform the Malaysian construction industry by leveraging digital technologies to enhance productivity, sustainability, and competitiveness shown the importance of technologies by years. Its growing popularity among construction professionals—including architects, engineers, and quantity surveyors—can be attributed to the ongoing digital revolution within the industry. The current involvement of Quantity Surveyors (QS) in Building Information Modelling (BIM) is characterised by a significant evolution in their roles within the construction industry. Traditionally, QSs have focused on tasks such as cost estimation, quantity take-offs, and contract management. However, with the integration of BIM technologies, QSs are now engaging in a more collaborative and data-driven approach to project management. BIM provides a multidimensional model that serves as an information hub, facilitating enhanced communication and coordination among all project stakeholders. This collaborative environment allows QSs to work closely with architects, engineers, and contractors to ensure that cost considerations are integrated throughout the project lifecycle, as highlighted in various studies (Kim & Park 2016). Additionally, improved collaboration through centralized platforms enhances communication among project stakeholders, ensuring alignment on costs and timelines while promoting transparency and reducing project delays. Recent discussions among industry leaders highlight that digitalization and BIM present significant opportunities for QS professionals rather than threats (Mamter et al. 2024). By leveraging digital tools, QSs can enhance contract management, cost control, and overall productivity. This transition towards digital methodologies allows them to elevate their contributions to projects, ensuring they remain integral to the construction process by the researcher. QSs are increasingly integrating BIM into their practices, which allows them to enhance collaboration, automate processes, and engage in proactive risk management. As the construction industry continues to evolve with technological advancements, ongoing research is focusing on how QSs can effectively utilize BIM tools while addressing challenges associated with their implementation.

There has been a significant increase in research undertakings in recent years aimed at investigating the trends associated with the adoption of BIM. There has been an increase in research documenting the implementation of BIM in cost management practices, including cost planning, estimation, and quantification within QSs as mentioned by several scholars (Vassen, 2021; Liu et al. 2024; Pishdad and Onungwa, 2024; Al-Mazeedi; 2025). However, these studies did not mention competencies for QS in BIM. The deficiency in the examination of the BIM competency framework for QSs is attributed to the inadequacy of comprehensive and standardized guidelines for evaluating and enhancing the BIM proficiencies and understanding of QSs. For instance, Succar et al. (2012) established general BIM capability concepts, and Sacks & Pikas (2013) identified BIM training topics using Bloom's taxonomy – these works underpin BIM competency discussions broadly. Although certain studies and frameworks have been formulated for the evaluation of BIM competency in general, there is a requirement for a distinct framework that concentrates on the competencies necessary for QSs within the scope of BIM implementation (Dada & Jagboro, 2018; Saka & Chan, 2019). A recent Delphi study by Saka et al. (2020) identified domain-specific BIM skills for quantity surveyors. In addition, a study on QS competencies in Malaysia (Yap et al. 2022) identified communication, ethics, and IT skills as emerging needs.

The lack of standardized BIM competencies among QSs creates uncertainty and challenges in their education and training, which can result in inefficiencies and potential errors in cost management during projects (Wong et al. 2011). Many QS professionals report feeling unprepared to utilize BIM technologies due to insufficient exposure during their academic training and a lack of ongoing professional development opportunities (Yan & Cheng, 2021). Moreover, the absence of a structured framework that clearly defines the necessary competencies for QSs operating within a BIM environment exacerbates these issues. Current educational programs often do not adequately prepare QSs for the specific challenges posed by BIM, leading to inconsistencies in skill levels across the profession (Fung et al. 2014; Ali et al. 2016). The absence of a clear framework outlining the necessary competencies for BIM utilization means that QSs may not be aware of the specific skills they need to develop, resulting in a workforce that is ill-equipped to meet industry expectations. This disconnect not only affects individual career trajectories but also impacts overall project outcomes, as quantity surveyors play a crucial role in ensuring accurate cost estimation and effective project management. Addressing these competency gaps is essential for enhancing the role of QSs within BIM projects and ensuring that they can contribute effectively to improved project outcomes. Thus, this research is essential for developing new skills and competencies that will prepare future QS professionals for a BIM-centric environment. Therefore, this paper conducts a scoping review to map existing QS BIM competency frameworks and identify research gaps.

METHODOLOGY

QS BIM competency frameworks encompass a wide range of competencies, methodologies, and applications within an emerging, interdisciplinary field (Kwong 2019; Mayouf et al. 2019). A scoping review is ideal for mapping the full extent of the literature, including diverse study designs, conceptual papers, technical reports, and grey literature (Mak & Thomas 2022; Pham et al. 2014). Given the emerging and interdisciplinary nature of the topic, a scoping review methodology was deemed most appropriate to capture the variety of research outputs, conceptual models, and practical applications in the field. The methodology adopted follows established frameworks by Arksey and O'Malley and is further refined according to recommendations by Levac et al. (2010) and adheres to best practice guidance for scoping reviews. QS BIM competency frameworks touch on numerous competencies and practices, drawing from engineering, construction management, and information technology. This interdisciplinary nature has been highlighted in recent work that underscores the dynamic evolution of roles in quantity surveying as BIM technologies mature (Kwong, 2019; Mayouf et al. 2019). A scoping review is ideal for mapping the full extent of the literature, including diverse study designs, conceptual papers, technical reports, and grey literature. The review seeks to answer the following research questions:

1. What is the current existing QS BIM competency framework as identified in the literature?
2. What gaps exist in the current research that could inform future investigations or framework enhancements?

To address these questions, a systematic scoping review methodology was employed. This approach, aligned with established frameworks and best practice guidelines, helps not only in mapping the existing conceptual underpinnings of the QS BIM competency framework but also in identifying critical research gaps that could drive future enhancements to the framework. The initial stage involved a careful clarification of the research questions and scope, ensuring that they were appropriately broad to capture the breadth of the literature while remaining specific enough to yield meaningful insights. This stage also encompassed the identification of key concepts related to quantity surveying, BIM, and competency, as well as an exploration of their interrelationships. A preliminary search of the literature was conducted to gain a comprehensive understanding of the existing knowledge base and to refine both the research questions and the inclusion/exclusion criteria.

Following the clarification of the research questions and scope, the next stage involved identifying relevant studies through a systematic and comprehensive search strategy. This strategy included the use of keywords and controlled vocabulary terms to capture literature related to quantity surveyors, BIM, and competency frameworks across multiple electronic databases, such as Scopus and relevant industry-specific repositories. The final search string included combinations of terms related to "Quantity Surveyor," "Quantity Surveying," "BIM," "Building Information Modeling," "Building Information Modelling," "Competence," "Competency," and "Competencies." The search strings were adapted in Scopus' database to account for variations in indexing and search functionalities. To ensure comprehensiveness, a search syntax was developed including keywords and Boolean operators like "AND" and "OR." For example, a segment of the search string used in Scopus was: ("quantity surveyor" OR "Quantity Surveying" OR "BIM" OR "Building Information Modeling" OR "Building Information Modelling") AND ("Competence" OR "Competency" OR "Competencies"). From the database search in Scopus, a total of 508 studies were identified. Followed by initial filtering of the identified studies based on their titles and abstracts which resulted in 25 studies screened. The 25 studies were sought for retrieval which resulted in 17 studies retrieved. Finally, the studies were assessed based on three main criteria. Firstly, studies were excluded if they discussed BIM competencies without proposing, structuring, or conceptualising a transferable framework suitable for quantity surveying practice. Secondly, studies were excluded if their primary focus was on operational competencies, job market trends, or practical employment practices without addressing competency development, education, or training structures for BIM practice enhancement. Thirdly, studies focusing narrowly on stakeholder groups unrelated or not transferable to quantity surveying practice were excluded. In addition to the database search, two records from websites, one record from organisation and seven records identified from citation searching were included. A PRISMA flow diagram will be used to document the study selection process. The inclusion and exclusion criteria are as follows:

TABLE 1. Inclusion and exclusion criterion

Inclusion Criteria	Exclusion Criteria
Addresses aspects of BIM competency specifically within the context of QS.	Lacks structured competency framework development.
Presents a framework, model, or evaluation of QS BIM competencies.	Focuses on operational or employment practice rather than competency development.
Published in peer-reviewed journals, conference proceedings, or reputable grey literature sources.	Overly narrow stakeholder focuses with limited transferability.
Provides clear methodological descriptions or conceptual discussions relevant to competency development.	-

Following study selection, the next stage involved charting the data from the included studies. A data charting form was developed to extract relevant information from the included studies (Peters et al. 2020). The following information was extracted from each included study:

author(s), year of publication, study design, purpose of the study, definition of QS BIM competency, components of the QS BIM competency framework, methodological approach used to develop or evaluate the framework, key findings, and identified gaps.

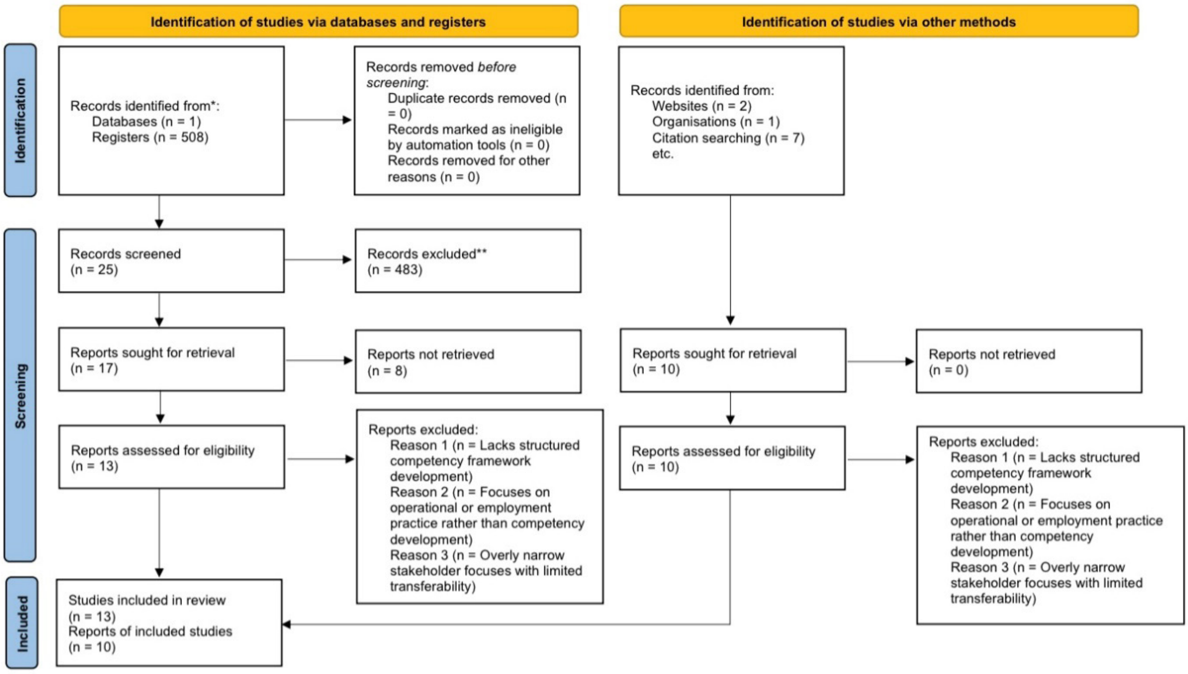

FIGURE 1. PRISMA flow diagram of QS BIM Competency Framework

The extracted data were then collated and synthesized to provide an overview of the QS BIM competency frameworks. The synthesis involved categorizing the competencies, comparing methodological approaches, and identifying thematic patterns. The narrative synthesis was complemented by tabular summaries that highlight key attributes and differences across studies. This included descriptive numerical analysis, providing an overview of the number of studies, publication years, types of publications, and geographical distribution; thematic analysis, identifying and synthesizing key themes related to QS BIM competency frameworks; framework comparison, comparing and contrasting the different frameworks identified in the literature, including their components, development methods, and evaluation approaches; and gap identification, identifying gaps in the literature and areas for future research. The findings of the scoping review will be reported. The report will include a clear description of the review methods, a summary of the included studies, and a discussion of the key themes, methodological approaches, and gaps in research. Implications for practice and research will also be discussed.

In summary, the scoping review methodology is chosen because it provides a structured yet flexible framework to comprehensively map the diverse and emerging body of literature on QS BIM competency frameworks, ensuring that the review captures the full complexity and breadth of the topic while identifying areas for future research.

FINDINGS AND DISCUSSION

MAPPING OF EXISTING FRAMEWORKS

The BIM Competency Guidelines provide a structured framework for professionals in the construction and QSs industries, outlining essential knowledge, technical skills, and activities required for effective BIM implementation. The guidelines are designed to facilitate the acquisition of both theoretical understanding and practical proficiency in BIM-related processes, with a focus on technical execution, collaborative practices, and compliance with industry standards. From the methodology provided in Figure 1, 23 studies included for this research which tabulated under Table 2.

TABLE 2. BIM Competencies Framework from Past Research

Source	Framework /Model	Primary Focus	Category
Succar (2013)	BIMe Initiative Competency Table	General BIM competencies	Conceptual paper
Dakhil et al. (2019)	Succar's Integrated Competency Model	BIM maturity and competencies	Study design
Guerriero et al. (2017)	BIM4VET Project Framework	BIM curriculum in vocational education	Technical report
Giel & Issa (2014)	NBIMS Capability Maturity Model	Building owners' BIM capabilities	Study design
Hasan et al. (2021)	Critical Success Competencies for BIM	Client organizations' BIM implementation	Study design
Raja Mohd Noor (2024)	Competency Requirement for Effective BIM Modeller	Competencies for BIM Modellers	Study design
Mohd Fuzi (2024)	Malaysian BIM e-Submission Framework	Competencies for BIM e-Submission	Study design
Ali et al. (2016)	Educational Framework for Quantity Surveyors (QS)	QS education in the context of BIM	Conceptual paper
Hashim et al. (2021)	Competency requirement for QS graduates	QS graduates in QS consultant firms in BIM competency	Study design
Saka & Chan (2019)	Knowledge, skills and functionalities requirements for QS in BIM work environment	QS in academics and practitioners with abundant hands-on BIM research or working experience.	Study design
Guo et al. (2022)	BIM competence for AEC	BIM competencies in tertiary institutions and AEC industry.	Study design
Kassem, Abd Raoff & Ouahrani (2018)	Integrated competency framework	BIM specialist roles (BIM Manager, Information Manager, BIM Coordinator, BIM Technician)	Grey literature
Nguyen (2021)	BIM competency in targeted job titles	Job titles; BIM manager/ coordination, BIM designers and technicians, BIM consultant, including quantity surveyor (QS) and general construction/project management (PM)	Study design
Obi et al. (2022)	PBL in BIM modules	Undergraduate students in built environment	Study design
Dada and Jagboro (2018)	Competence-based measure	QS in educational training; professional capabilities; and professional development.	Study design
Chandramohan, Perera & Dewago (2022)	Competencies required to perform the diversified roles of professional QSs	Chartered QSs in Sri Lanka construction industry.	Study design
Yap et al. (2022)	Basic/core competencies and evolving competencies of QS	QS involved with contractors, consultants, clients and students.	Study design
Perera et al. (2017)	Professional competency-based analysis	QS in industry and academia.	Study design
Anh et al. (2023)	BIM competency in personnel recruitment	BIM modeller, BIM manager, BIM coordinator.	Study design
Chamikara, Perera and Rodrigo (2018)	QS competencies in sustainable construction	QS employed in contractor, consultant or client organizations.	Study design

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RICS (2017)	RICS Associate Assessment Competency Guidelines	Competencies, knowledge and skills required for QS	Grey literature
NZIQS (2018)	Australia and New Zealand BIM Best Practice Guidelines	BIM adoption and effective implementation among QS	Grey literature
JKR (2024)	JKR QS BIM Competency Guidelines	BIM competencies level for QS	Grey literature

From Table 2 shows 23 related BIM competencies framework related to this study. However, out of the 23 journals initially identified, only three were selected for inclusion in this study as they were deemed the most directly relevant to the research objective concerning the Quantity Surveyor (QS) Building Information Modelling (BIM) competency framework. The inclusion criteria focused specifically on studies that explicitly addressed the intersection of QS roles and BIM competencies, rather than general BIM adoption or broader construction industry applications. The majority of the excluded journals, while informative, either discussed BIM in a general context, focused on other professional disciplines, or lacked direct reference to competency frameworks applicable to QS practice. The three selected studies demonstrated clear alignment with the core themes of this research, such as competency domains, role-specific skills, and framework development, making them the most suitable to support the construction of a targeted and discipline-specific competency framework.

TABLE 3. Existing QS BIM Competency Framework

	RICS Associate Assessment Competency Guidelines (2017)	Australia and New Zealand BIM Best Practice Guidelines (2018)	JKR QS BIM Competency Guidelines (2024)
Requirements	Demonstrate knowledge and understanding of the technical, process and collaborative aspects of the use of BIM on projects. Develop and apply management systems to facilitate the use of BIM on projects including unified control and reporting procedures.	Need to understand how to interpret BIM Execution Plans (BEP), prepare their own BEP and report unsuitable /unusable data before co-ordination and drawing production for milestone hold points.	Acquire basic knowledge on BIM and basic function of Revit. Attain knowledge and skills in usage of Cost X estimating software with BIM modules for the purpose of reviewing the adequacy of 3D model information and preparing list of quantities. Performing work & quantity measurement of 3D models using Cost X Software.
Knowledge	• BIM strategies and implementation • Various technical options and solutions for information modelling • Collaborative processes necessary for BIM adoption • Standard classification systems and their use in infrastructure • Relevant internationally recognised management standards such as Construction Operations Building Information Exchange (COBie)	• Understanding design modelling process and development • Identifying quantities for the appropriate estimating level (e.g. room boundary, AIQS and NZIQS Elements to objects) • Manipulating models to acquire quantities usable for estimation • Interrogating and validating the extent and reliability of the digital model and its information content • Ability to adjust a cost plan to suit data available in the model over the duration of evolving design phases • Ability to operate in the Common Data Environment (CDE) • Identify placeholders or model issues, and a systematic, methodical approach to follow or establish procedures.	• Understanding BIM concept, basic principles and terminologies. • Ability to operate in BIM software. • Understanding function of BIM Project Execution Plan (BPEP). • Reviewing information adequacy in the BIM model (BIM integrity model review). • Managing BIM documentation for measurement. • Ability to extract and manipulating data in BIM model for measurement purpose. • Ability to generate information automatically using BIM models approved by specific discipline. • Developing BIM Project Execution Plan (BPEP). • Strategise the needs of BIM execution. • Guidelines and compliance.

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Activities	Preparing a BIM execution plan Designing and implementing of a BIM management process Analysing comparative BIM solutions.	N/A	Fundamental and development of BIM BIM for QS Basic overview and introduction of Revit software Exporting 3D model from Revit (.rvt) to DWFx format. Create new project and new building, adding 3D models/ drawings and 3D models/drawings viewing and navigation. Measurement using object mode techniques for architectural and structural works. Import quantities from BIM models/template. 3D measurement mode for architectural and structural works. Preparing and import quantities from Model Maps. Crating, export and import workbooks and generating report, preparing Bills of Quantities (BQ).

REQUIREMENTS FOR BIM COMPETENCY DEVELOPMENT

The documents establish fundamental requirements for professionals engaging with BIM processes. It emphasizes the necessity for individuals to demonstrate knowledge and understanding of technical, procedural, and collaborative aspects of BIM implementation. This includes the ability to interpret and prepare BIM Execution Plans (BEP), review and manage data suitability for project milestones, and apply standardized control and reporting procedures. Additionally, the guidelines underscore the importance of software proficiency, particularly in industry-standard tools such as Revit and CostX. A basic understanding of BIM concepts, coupled with hands-on skills in 3D modelling and quantity measurement using CostX software, is identified as a core competency. This ensures that professionals can not only navigate BIM models but also extract, manipulate, and validate information within a Common Data Environment (CDE) for cost estimation and project coordination.

CORE KNOWLEDGE AREAS IN BIM IMPLEMENTATION

The competency framework defines several key knowledge areas that form the foundation for effective BIM adoption. These include:

1. BIM Strategies and Implementation – The guidelines highlight the need for professionals to develop strategic approaches to BIM adoption, ensuring its integration within existing project management and design workflows.
2. Technical Solutions for Information Modelling – A critical aspect of BIM competency involves understanding various modelling techniques, classification systems, and internationally recognized management standards such as Construction Operations Building Information Exchange (COBie).
3. Collaborative Processes in BIM Workflows – Given that BIM relies on multi-disciplinary collaboration, the guidelines stress the importance of coordinating workflows, managing data integrity, and ensuring interoperability across different software platforms.
4. Cost Estimation and Quantity Measurement – The ability to identify, extract, and manipulate quantities from BIM models is essential for accurate cost estimation. The framework outlines methods for integrating BIM-based estimation tools, aligning them with industry standards such as AIQS and NZIQS.
5. BIM Documentation and Data Management – The guidelines emphasize competency in managing BIM documentation, ensuring data reliability, and validating model integrity. This includes operating within a Common Data Environment (CDE) and systematically identifying and resolving modelling issues.

PRACTICAL APPLICATION AND ACTIVITIES

The guidelines outline various activities that support the practical application of BIM competencies. These include:

1. Developing and implementing a BIM Execution Plan (BEP) to establish project-specific workflows and coordination strategies.
2. Designing and managing BIM processes, ensuring compliance with best practices and industry standards.
3. Analysing and comparing different BIM solutions to determine the most effective tools and methodologies for project execution.
4. Performing 3D model measurement and quantity extraction using software tools such as Revit and CostX.
5. Generating and managing project reports, including Bill of Quantities (BQ) and cost plans, by leveraging BIM-based estimation methods.
6. These activities ensure that BIM professionals not only understand theoretical concepts but can also apply them in real-world project settings.

The BIM Competency Guidelines serve as a comprehensive framework for professionals seeking to develop expertise in BIM. By covering fundamental knowledge, technical skills, and practical activities, the guidelines provide a structured approach to competency development. However, improvements such as clearer categorization of competencies, inclusion of assessment methods, and emphasis on collaboration and soft skills would enhance the document's effectiveness. A more refined structure that distinguishes technical competencies, software proficiency, and procedural knowledge would further improve its clarity and applicability.

STRENGTH AND LIMITATIONS OF EXISTING FRAMEWORKS

The BIM Competency Guidelines outlined in Table 2 provide a structured framework for professionals seeking to develop expertise in Building Information Modelling (BIM), particularly in the field of quantity surveying and project management. The document encompasses various aspects of BIM competency, including technical knowledge, collaborative processes, software applications, and industry standards. While the guidelines demonstrate a well-structured approach to competency development, several areas require further refinement to enhance clarity, coherence, and practical applicability.

One of the primary strengths of the guidelines is their comprehensive coverage of BIM competencies. The document systematically outlines the essential knowledge areas, including BIM strategies, implementation methodologies, and various technical options for information modelling. Furthermore, the inclusion of key software applications such as Revit and CostX ensures that professionals are equipped with both theoretical understanding and practical skills relevant to the industry. Another notable strength is the alignment with internationally recognized management standards, including the Construction Operations Building Information Exchange (COBie), as well as classification systems such as AIQS and NZIQS. By referencing these globally acknowledged standards, the guidelines ensure their applicability and relevance to best practices in the field of BIM. This alignment further enhances the credibility of the framework and facilitates its adoption across different regions and industry contexts. Moreover, the guidelines follow a logical structure, progressing from fundamental BIM knowledge to more advanced applications. This structured approach allows learners to gradually develop their expertise, ensuring a solid foundation before engaging with more complex BIM processes. The document also highlights the integration of BIM with cost estimation and quantity surveying, an essential aspect for professionals working in the field. By emphasizing measurement techniques and cost estimation using BIM software, the guidelines demonstrate a strong connection between theoretical knowledge and industry practice.

Despite these strengths, the document exhibits several weaknesses that may hinder its effectiveness. One key limitation is the lack of clear categorization of competency areas. While the guidelines attempt to delineate different aspects of BIM competency, there is noticeable overlap between sections such as "Knowledge," "Requirements," and "Activities." This ambiguity may lead to confusion regarding the intended structure of the competency framework, making it difficult for learners and practitioners to navigate the document effectively. A more distinct categorization of competencies—such as separating technical skills, software proficiency, and process-oriented knowledge—would enhance the document's clarity and usability.

Additionally, the guidelines fail to specify proficiency levels for each competency. The document outlines various learning outcomes without defining whether they are intended for beginners, intermediate learners, or advanced practitioners. This omission makes it challenging to assess the depth of knowledge required at different stages of professional development. The inclusion of a structured competency progression—such as classifying competencies into Basic, Intermediate, and Advanced levels—would provide clearer guidance for learners and better support professional development pathways. Furthermore, the guidelines lack explicit details regarding assessment methods. There is no indication of how competency will be evaluated whether through practical projects, examinations, industry certifications, or other evaluative measures. The inclusion of assessment criteria would enhance the document's effectiveness by providing measurable indicators for competency evaluation, ensuring that learners can demonstrate their proficiency in a structured manner.

Another limitation of the document is its limited emphasis on soft skills and collaborative competencies. While the guidelines comprehensively cover technical aspects of BIM, they do not sufficiently address the importance of communication, problem-solving, and interdisciplinary collaboration—key competencies in real-world BIM project execution. Given that BIM adoption requires seamless coordination among various stakeholders, incorporating soft skills and teamwork-related competencies would enhance the document's relevance to industry demands. Lastly, the document contains redundancies and repetitive entries, particularly in sections related to fundamental BIM concepts and software operations. For instance, competencies such as "Understanding BIM concepts, basic principles, and terminologies" and "Ability to operate in BIM software" appear multiple times throughout the document, creating unnecessary repetition. A more concise and streamlined presentation of competencies would improve the document's readability and ensure that each competency is articulated in a distinct and meaningful manner.

COMPARATIVE ANALYSIS OF FRAMEWORKS

Based on TABLE 4, the gaps can be identified based on these four-competency domains which are Knowledge, Skills, Abilities and Functionalities (KSAF). For Knowledge competency, RICS (2017) and Australia & NZ (2018) focus on general BIM concepts and high-level understanding, such as modeling strategies, standard classification systems (e.g., COBie), and basic terminology. Both guidelines offer deep contextual knowledge relevant to quantity surveying-specific practices or cost estimation integration with BIM. JKR QS (2024) addresses this by incorporating QS standards (e.g., AIQS/NZIQS object classification) and model validation theory specifically tailored for quantity measurement. JKR fills the knowledge gap by embedding BIM within the QS context and extending understanding to data reliability and digital model interrogation.

TABLE 4. Comparative Matrix of BIM Guidelines Based on Competency Domains

Competency Domain	RICS (2017)	Australia & NZ (2018)	JKR QS (2024)
Knowledge	Understanding of BIM principles, strategies, modeling concepts, classification systems (e.g., COBie).	BIM concepts, terminologies, and project execution fundamentals.	BIM concepts, measurement principles, model integrity, and QS-specific standards.
Skills	Operating BIM tools, identifying model elements, interrogating models for data extraction.	Revit basics, 3D model navigation, quantity importing/exporting.	Proficient in Revit & CostX, automated BQ generation, workbook handling, model editing.
Abilities	Collaborate using BIM, validate model data, assess reliability of digital models.	Review adequacy of BIM information, conduct 3D measurements.	Strategize BIM execution, manage stakeholder input, validate interdisciplinary BIM data.
Functionalities	Develop BEP, report on data quality, estimate quantities at various design stages.	Prepare BPEP, export models, generate quantity reports.	Full BEP development, model map creation, data-driven BQ preparation, manage measurement documentation.

Skills competency for Australia & NZ (2018) introduces Revit operation and basic 3D model manipulation but lacks advanced digital quantity take-off and software interoperability training. RICS (2017) includes general skills in model interrogation and reporting but does not focus on tool-specific applications. Both guidelines provide introductory-level software skills but fall short on advanced, tool-integrated quantity surveying functions. JKR QS (2024) closes this gap by requiring operational proficiency in Revit and CostX, including automated measurement, model editing, and report generation. JKR strengthens the skills domain by making software proficiency measurable and tied directly to BIM-based QS workflows.

Next, under abilities competency domain, RICS discusses abilities in validating models and collaborating, while Australia & NZ touches on reviewing model adequacy and performing 3D measurements. Neither RICS nor Aus/NZ frameworks emphasize strategic application of skills in stakeholder collaboration, data coordination, or model planning. JKR QS (2024) advances this area with competencies in stakeholder engagement, strategizing BIM execution, and interdisciplinary data validation. JKR addresses the gap in applied abilities, preparing QS professionals to perform BIM tasks in dynamic, multi-party environments.

Lastly, functionalities competency for RICS and Australia & NZ frameworks both reference the BIM Execution Plan (BEP) but lack in-depth, hands-on engagement with model measurement outputs, template-based quantification, or automated Bill of Quantities (BQ) generation. Limited focus on function-specific deliverables like model-based quantity verification, structured workbooks, and integration with QS documentation standards. JKR QS (2024) introduces robust functionalities such as model mapping, automated quantity extraction, and digital BQ generation using CostX. JKR fills the functionality gap by aligning BIM execution tasks with actual QS deliverables and making digital workflows integral to measurement and reporting.

Thus, JKR QS BIM Competency Guidelines (2024) effectively bridge several competency gaps left by RICS (2017) and Australia & NZ (2018) by introducing contextual depth, software-integrated skill sets, project-specific abilities, and quantification-focused deliverables tailored for quantity surveyors. This makes JKR the most advanced and domain-specific among the three. These gaps can be referred to in TABLE 5.

TABLE 5. Gaps in Guidelines based on Competency Domain

Competency Domain	Gap in RICS (2017) & Aus/NZ (2018)	Addressed by JKR QS (2024)
Knowledge	Lack of QS-specific BIM concepts and data model integrity	Incorporates model interrogation and QS classification
Skills	Basic software uses only (Revit), no measurement integration	Advanced use of Revit + CostX for quantification
Abilities	Limited application in real BIM projects and planning	Execution strategy, stakeholder collaboration
Functionalities	Weak linkage to practical BIM deliverables for QS tasks	BEP development, quantity extraction, digital BQ

A comparative analysis of the RICS (2017), Australia and New Zealand (2018), and JKR QS BIM Competency Guidelines (2024) reveals notable gaps in the domains of knowledge, skills, abilities, and functionalities, which are critical to the effective integration of Building Information Modeling (BIM) within quantity surveying practice. While the RICS and Australia/New Zealand guidelines provide foundational understanding of BIM principles, classification systems, and basic software operation, they fall short in delivering QS-specific contextual knowledge and model validation concepts. Furthermore, both frameworks offer only introductory-level software skills—primarily centered on Revit usage—without extending to advanced digital quantity extraction or interoperability across platforms. The domain of professional abilities also remains underdeveloped, with limited emphasis on stakeholder coordination, interdisciplinary data management, and strategic BIM execution. In terms of functionalities, both guidelines address BIM Execution Plans at a conceptual level but lack hands-on application in areas such as model mapping, automated quantity take-off, and digital bill of quantities (BQ) generation. In contrast, the JKR QS BIM Competency Guidelines (2024) directly respond to these deficiencies by embedding cost estimation workflows within BIM processes, integrating Revit and CostX as core tools, and emphasizing the strategic, procedural, and deliverable-oriented capabilities required of quantity surveyors in a digital construction environment. Thus, the JKR framework not only bridges existing gaps but also sets a precedent for domain-specific BIM competency development aligned with industry demands.

CONCLUSION

Therefore, a comprehensive mapping of the literature on QS BIM competency frameworks, elucidating key themes, methodologies, and research gaps in this emerging field. By systematically integrating evidence from peer-reviewed articles, conference proceedings, and grey literature, the review underscores the interdisciplinary nature of QS BIM competencies and highlights the evolving role of BIM in quantity surveying practices.

In summary, this scoping review not only advances understanding of QS BIM competencies but also serves as a foundational reference for researchers and practitioners aiming to enhance the integration of BIM in quantity surveying. Future research building on these insights can contribute to the development of more robust and validated competency frameworks, ultimately supporting the digital transformation of the construction industry.

DECLARATION OF COMPETING INTEREST

None.

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