



BUILDING SURVEYORS' COMPETENCIES IN SUPPORTING SUSTAINABLE CONSTRUCTION ACROSS DEVELOPMENT PHASES: EVIDENCE FROM MALAYSIAN PRACTICE

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Abstract

Gaps in building compliance and maintenance planning often lead to performance issues after project completion. This study examines the competencies required of building surveyors in supporting sustainable construction across development phases in Malaysia. A structured questionnaire survey was administered to construction professionals from various disciplines. The data were then analysed using the Rasch Measurement Model to establish item reliability, dimensionality and competency domains. The findings indicate that building surveyors' competencies can be categorised into technical and non-technical domains. Technical domains related to building pathology, condition assessment, and maintenance management received strong endorsement, reflecting the increasing importance of life-cycle performance. Non-technical domains, including ethics and professionalism, communication, and analytical thinking, were also strongly emphasised as enabling effective coordination and decision-making. The study highlights that building surveyors' roles extend beyond technical execution to encompass sustainable construction across development phases, providing practical insights for industry, professional training, and education providers in supporting integrated sustainable development in Malaysia.

Keywords: Building Surveyor, Competency, Building Life Cycle, Sustainable Development, Construction Industry

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INTRODUCTION

The construction industry is undergoing continuous transformation driven by sustainability requirements, regulatory expectations, and increasing demand for performance across the building life cycle. Construction project success is no longer evaluated solely in terms of time, cost and quality, but also through a broader understanding of project performance that includes the competencies of built environment professionals involved across the development process (Kiani Mavi et al. 2024). In this context, the effectiveness of construction outcomes depends not only on planning and design, but also on the competencies of professionals involved in translating planning intent into built reality. In addition, sustainable construction practices do not inherently guarantee improved environmental performance, as their effectiveness is highly dependent on how they are applied in practice (Onubi et al., 2020).

Within this context, building surveyors represent an important professional group whose roles intersect construction development, quality control, building performance, and end-users' satisfaction through inspection, assessment and technical advisory services. Their roles extend from pre-construction advisory and compliance review to construction stage inspection and post-construction performance management. This broad involvement positions building surveyors as an important link between planning, construction execution and building operation. Their responsibility includes regulatory compliance, defects management, certification processes, maintenance management, building conservation, repair, restoration, and the assessment of both new and existing buildings (Li et al., 2026). These responsibilities also position building surveyors as important contributors to sustainable construction planning, particularly in supporting continuity between planning approval, construction execution and post-occupancy building performance.

Despite this strategic role, existing competency frameworks do not fully capture the integration of technical, cognitive, and professional competencies required across development phases. As a result, the role of building surveyors in supporting sustainable construction management remains underexplored. Existing studies on professional competencies have largely focused on educational outcomes and employability, with less attention given to how such competencies contribute to planning implementation, construction control and post-construction building performance across the building life cycle. Employers and industry stakeholders have also raised concerns regarding the preparedness of building surveying practitioners and the extent to which their competencies align with evolving industry demands, particularly in relation to sustainability, regulatory compliance and life-cycle-based building management.

Many building surveying firms continue to face difficulties in recruiting suitably skilled graduate building surveyors, as the competency level of new

entrants does not always meet industry expectations (Zaheer et al., 2021). These conditions underscore the need for clearer competency requirements that respond to sustainability, regulatory compliance, life-cycle-based building management, and employer expectations. Given the limited research in this area, this study seeks to bridge the gap by analysing the competencies of building surveyors across different stages of the construction life cycle.

LITERATURE REVIEW

Recent Gaps in Competencies Across Building Surveying

Employers increasingly value graduates who possess not only academic knowledge but also strong non-technical skills, including communication, adaptability, and professional behaviour. Aliu and Aigbavboa (2021) highlight that industry employers are seeking graduates with a broader range of generic competencies beyond disciplinary knowledge alone. In Malaysia, concerns over insufficient skills and competency gaps among building surveying graduates continue to affect professional readiness and performance in meeting evolving industry expectations. This issue is not limited to the Malaysian context, as growing demands within the building sector have also put pressure on global employers to recruit competent graduate building surveyors (Zaheer et al., 2021). These conditions indicate the need for further research to clarify the competencies required in building surveying practice and to strengthen the profession's capacity to respond to contemporary industry demands in Malaysia.

A Guiding Framework for Building Surveyors' Competencies Across Construction Stages

Competencies in the construction industry are generally classified into technical and non-technical domains. Technical competencies relate to discipline-specific knowledge and functional expertise, whereas non-technical competencies refer to interpersonal, communication, behavioural and cognitive capabilities that support effective project delivery (Hasim et al., 2024). Additionally, technical competencies refer to competencies relating to specific areas of expertise and are generally acquired through formal education, training and professional experience. Non-technical competencies, also known as generic or soft skills, refer to abilities and personal attributes that are generally not specific to a particular industry or functional area (Shermon, 2004).

Boyatzis (1982) defined competency as capability or ability, while Shermon (2004) described competence as an ability based on a work task for a job output. Spencer and Spencer (1993) proposed two significant types of competency levels, which are visible and hidden. The knowledge and skill competencies tend to be visible and relative on the surface characteristics of

people, whereas self-concept, trait, and motive competencies are more hidden, and central to personality (Spencer and Spencer, 1993).

The visible competency (knowledge and skills) is referred to as technical competency required by an individual to deliver superior performance in handling tasks. The personal attributes located within the hidden layer consist of motives, traits, and self-concept, including a person's attitudes, values and self-image. These attributes may indicate an employee's probable behaviour and are generally more difficult to alter and develop. These visible and hidden competencies are also known as technical and non-technical or generic skills. Technical competency is a set of competencies relating to a specific area of expertise, which generally is acquired through some form of training, while non-technical competency which is also known as generic and soft skills, usually described as a set of abilities and personal attributes, which generally are not specific to an industry or functional area (Shermon, 2004).

In building surveying practice, both domains are essential because professional effectiveness depends not only on technical knowledge, but also on the ability to communicate, coordinate, and respond to complex project conditions. However, due to unclear competency boundaries, the industry's demand will not be met as there is no clear guideline for universities or colleges to design a curriculum that suits the industry's demands. This highlights the need to identify the current skills and competencies that are highly valued by employers in the building surveying industry in responding to industry demands.

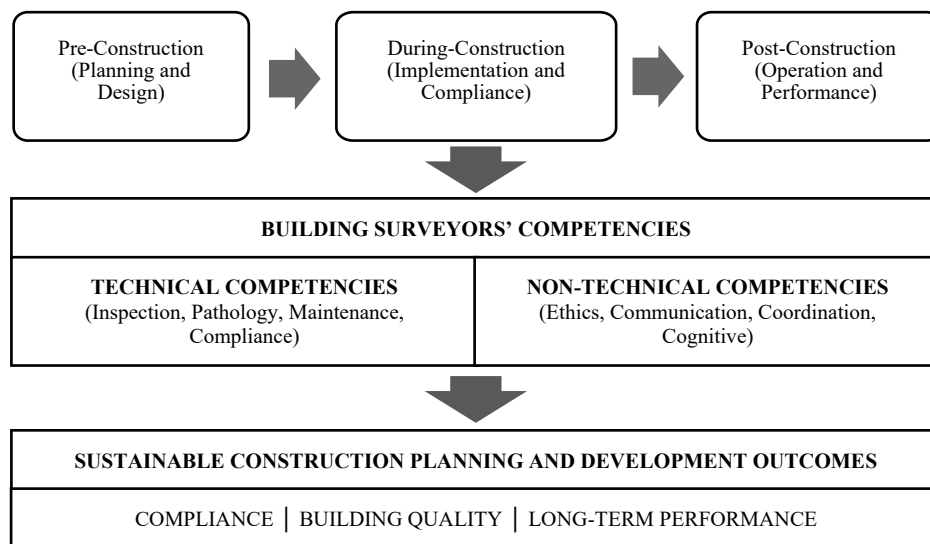


Figure 1: Conceptual Framework of Building Surveyors' Competencies in Sustainable Construction Planning and Development Across Construction Phases

Source: Author's Work

In defining the roles and responsibilities of building surveyors across the pre-construction, construction and post-construction phases, this study proposes a conceptual framework (Figure 1) that positions building surveyors' competencies as a form of planning implementation capacity within sustainable construction planning. The framework recognises that planning effectiveness is not achieved solely through statutory approval or policy formulation, but through the continuous application of professional competencies across the development life cycle. In this sense, the framework provides a structured basis for understanding how building surveyors' competencies contribute to sustainable construction planning and development outcomes.

RESEARCH METHODOLOGY

This study adopted a quantitative approach using a structured questionnaire survey to examine the competencies expected of building surveyors in supporting sustainable development across construction stages. A quantitative research design enables the systematic analysis of numerical data to describe, explain, predict or control variables or phenomena of interest (Creswell, 2012). The data were analysed using the Rasch Measurement Model in Winsteps. The diagnostic assessment covered person and item reliability, person and item separation, item measure quality, item polarity using point-measure correlation (PTMEA Corr), dimensionality using principal component analysis (PCA) of standardised residuals, and item fit using INFIT and OUTFIT statistics. However, differential item functioning (DIF) was not included in the present analysis because several respondent subgroups were small and unevenly distributed, which would limit stable item-level comparisons. Accordingly, the Rasch findings are interpreted at the aggregate-sample level, while future validation using larger and more balanced professional subgroups should examine item invariance through DIF analysis.

The questionnaire consisted of closed-ended items rated on a four-point Likert scale ranging from 1 (not important) to 4 (very important). A four-point Likert scale was selected to encourage clearer judgement and to avoid neutral midpoint responses, which is considered acceptable in survey-based measurement studies (Tsang, 2012; Garland, 1991). The target population comprised building surveying practitioners and built environment professionals involved in the Malaysian construction and built environment industry. A probability sampling approach was adopted to obtain industry-based responses from relevant professional groups. A total of 138 valid responses were included in the Rasch analysis. This sample exceeded the 100 respondents considered adequate for most purposes and fell within the recommended range of 64–144 respondents for item calibration precision of ± 0.5 logit at a 95% confidence level, based on the Rasch sample-size guideline adopted in this study (Aziz et al., 2013).

ANALYSIS AND DISCUSSION

Respondent Profile

A total of 138 valid responses were obtained from professionals working in Malaysia's construction and built environment sector. The largest proportion of respondents was from private-sector organisations (58.7%), followed by higher education institutions (21.7%) and public-sector organisations (19.6%). Building surveyors formed the largest professional group (34.8%), followed by lecturers (29.7%) and construction project managers (16.7%). In terms of professional experience, 94.2% of respondents had more than three years of experience, including 32.6% with more than 12 years of experience. The profile demonstrates that the sample comprised respondents from varied organisational, professional and experience backgrounds relevant to building surveying and the built environment. Table 1 summarises the respondent profile.

Table 1: Profile of Respondents ($n = 138$)

Characteristic	Category	Frequency (n)	Percentage (%)
Organisation	Public sector	27	19.6
	Private sector	81	58.7
	Higher education institution	30	21.7
Position	Building manager	10	7.2
	Building surveyor	48	34.8
	Construction project manager	23	16.7
	Facilities manager	8	5.8
	Lecturer	41	29.7
	Other	8	5.8
Experience	Less than 3 years	8	5.8
	More than 3-6 years	28	20.3
	More than 6-9 years	38	27.5
	More than 9-12	19	13.8
	More than 12 years	45	32.6

Source: Author's Calculation

Reliability and Validity of the Instrument

Principal component analysis (PCA) of residuals was used to examine the unidimensionality of the instrument (Figure 2). The raw variance explained by the Rasch measures was 35.9%, which exceeded the minimum acceptable threshold of 20%. The unexplained variance in the first contrast was 4.6%, indicating acceptable unidimensionality (Aziz et al., 2013; Sumintono and Widhiarso, 2013). The ratio between explained variance and unexplained variance was approximately 8:1 (35.9/4.6), surpassing the minimum 3:1 criterion for unidimensionality (McCreary et al., 2013). These PCA results were interpreted together with the reliability, separation, polarity, local dependence and item-fit diagnostics rather than as a stand-alone indication of measurement

quality. As suggested by Árnadóttir and Fisher (2008), when the items demonstrate statistical goodness of fit with the Rasch model, the instrument can be said to be unidimensional.

Table of STANDARDIZED RESIDUAL variance (in Eigenvalue units)			
		-- Empirical --	Modeled
Total raw variance in observations	=	316.8	100.0%
Raw variance explained by measures	=	113.8	35.9%
Raw variance explained by persons	=	61.4	19.4%
Raw Variance explained by items	=	52.3	16.5%
Raw unexplained variance (total)	=	203.0	64.1%
Unexplned variance in 1st contrast	=	14.7	4.6%
Unexplned variance in 2nd contrast	=	11.6	3.6%
Unexplned variance in 3rd contrast	=	11.3	3.6%
Unexplned variance in 4th contrast	=	10.3	3.2%
Unexplned variance in 5th contrast	=	9.7	3.1%

Figure 2: PCA of Standardized Residual Variance (in Eigenvalue units)

Source: Author's analysis using Winsteps

The Rasch analysis demonstrated strong internal consistency and reliability. Cronbach's alpha (α) was 0.99 (Figure 3), which indicates that the variables and research instrument are reliable (LoBiondo-Wood and Haber, 2014). The person reliability was 0.95 (excellent), indicating that 95% of the results of the person responses would be repeated if the same respondents answered questions using an equivalent instrument (Aziz et al., 2013). In addition, the item reliability was 0.89 (good), which shows the instrument demonstrates good reliability in measuring what needs to be measured and there are sufficient items to measure an accurate reading.

Subsequently, Linacre (2006) and Fisher (2007) suggested that the accepted strata separation value for both person and item should exceed 2.0. Ariffin et al. (2010) mention that the person strata separation is used to classify people while item separation indicates the separation of item difficulty level. The person separation index was 4.45 (rounded to 4.0) (Figure 3), indicating clear differentiation among respondents along the measured continuum (Fisher, 2007; Linacre, 2006). Meanwhile, the item separation index was 2.91 (rounded to 3.0), indicating adequate differentiation among competency items.

SUMMARY OF 138 MEASURED (EXTREME AND NON-EXTREME) PERSON								
	TOTAL SCORE	COUNT	MEASURE	MODEL ERROR	INFIT		OUTFIT	
					MNSQ	ZSTD	MNSQ	ZSTD
MEAN	709.9	203.0	3.76	.28				
S.D.	66.4	.0	2.24	.40				
MAX.	812.0	203.0	9.97	1.82				
MIN.	550.0	203.0	.09	.13	.09	-9.9	.08	-9.9

REAL RMSE	.49	TRUE SD	2.19	SEPARATION	4.45	PERSON	RELIABILITY	.95
MODEL RMSE	.49	TRUE SD	2.19	SEPARATION	4.48	PERSON	RELIABILITY	.95
S.E. OF PERSON MEAN = .19								

PERSON RAW SCORE-TO-MEASURE CORRELATION = .90								
CRONBACH ALPHA (KR-20) PERSON RAW SCORE "TEST" RELIABILITY = .99								
SUMMARY OF 203 MEASURED (NON-EXTREME) ITEM								
	TOTAL SCORE	COUNT	MEASURE	MODEL ERROR	INFIT		OUTFIT	
					MNSQ	ZSTD	MNSQ	ZSTD
MEAN	482.6	138.0	.00	.19	1.00	.0	1.02	.0
S.D.	16.6	.0	.62	.01	.18	1.4	.34	1.2
MAX.	519.0	138.0	1.50	.23	1.48	3.6	2.90	5.2
MIN.	439.0	138.0	-1.52	.18	.60	-3.5	.55	-2.9

REAL RMSE	.20	TRUE SD	.58	SEPARATION	2.91	ITEM	RELIABILITY	.89
MODEL RMSE	.19	TRUE SD	.59	SEPARATION	3.02	ITEM	RELIABILITY	.90
S.E. OF ITEM MEAN = .04								

Figure 3: Summary of Statistics Results
Source: Author's analysis using Winsteps

Item Fit and Item Polarity

Following the item-measure analysis, item-fit assessment was conducted on the 100 competency items with negative logit measures to determine their conformity with the Rasch model. Item fit was evaluated using point-measure correlation (PTMEA Corr), INFIT and OUTFIT mean-square (MNSQ), and standardised Z (ZSTD) statistics. The adopted acceptable ranges were $0.5 < \text{MNSQ} < 1.5$ and $-2.0 < \text{ZSTD} < +2.0$. Twenty-one (21) items initially exhibited at least one statistic outside the specified ranges. Following consideration of the item-fit diagnostics, five (5) items were identified as misfitting and excluded, while the remaining 95 items were retained as the competency set for subsequent interpretation.

Item polarity was further examined using PTMEA Corr to determine whether each competency item operated in the same direction as the underlying construct. Positive PTMEA Corr values indicate that an item is aligned with the construct being measured, whereas negative or zero values may indicate inconsistency with the intended construct. All analysed competency items recorded positive PTMEA Corr values, ranging from 0.39 to 0.65, which fell within the adopted acceptable range of 0.20 to 0.79 (Linacre, 2006; Bond & Fox,

2007). The positive correlations therefore provided further evidence that the retained items operated consistently in measuring the intended competency construct. Table 2 summarises the Rasch measurement diagnostics.

Table 2: Summary of Rasch Measurement Diagnostics and Item-Retention Results

Diagnostic	Result	Reference/Criterion Use	Interpretation
Cronbach's alpha	0.99	Closer to 1.0	Excellent internal consistency
Person reliability	0.95	Rasch reliability analysis	High person reliability
Item reliability	0.89	Rasch reliability analysis	Good item reliability
Person separation	4.45	> 2.0	Strong person differentiation
Item separation	2.91	> 2.0	Adequate item differentiation
Mean item INFIT MNSQ	1.00	0.5–1.5	Acceptable aggregate item fit
Mean item OUTFIT MNSQ	1.02	0.5–1.5	Acceptable aggregate item fit
PTMEA Corr	0.39–0.65	0.20-0.79: positive values	All items positively aligned with the intended construct
Raw variance explained	35.9%	≥ 20% criterion adopted	Acceptable evidence of unidimensionality
Initial competency items	203	—	Items entering the initial Rasch analysis
Initial competency constructs	21	—	Constructs represented in the initial competency skills set
Items with negative logit measures	100	Item measure < 0.00 logits	Items subjected to subsequent item-fit assessment
Constructs represented after item-measure screening	18	Representation within the negative-logit item set	Constructs represented in the retained item set after item-measure screening
Items initially outside specified fit ranges	21	MNSQ 0.5-1.5 and ZSTD - 2.0 to +2.0	Items requiring further evaluation
Misfitting items removed	5	Overall evaluation of INFIT/OUTFIT MNSQ and ZSTD	Items excluded following item-fit evaluation
Final retained competency items	95	—	Competency items retained across 18 constructs for subsequent interpretation

Source: Author's analysis using Winsteps

Key Competencies Identified by Industry

The item measure analysis was used to identify whether items within the same construct reflected similar difficulty levels or calibration values to detect any

redundant items (Aziz et al., 2013) and thus to interpret the relative level of respondents' endorsement of the competency items. Rasch item measures are expressed in logits on an interval scale, with the item mean centred at 0.00 logits as the reference point. As suggested by Bond and Fox (2007), higher or positive (+) logit values indicate competencies that were comparatively more difficult to endorse, whereas lower or negative (-) logit values indicate competencies that were comparatively easier for respondents to endorse. In this context, the logit measure reflects the relative difficulty of endorsing a competency item rather than the difficulty of performing the competency in practice.

For example, BP01 - Building Pathology recorded an item measure of -1.52 logits, indicating comparatively stronger endorsement among respondents. In contrast, BIM05 - Building Information Modelling Management (BIM) recorded +1.50 logits, indicating comparatively lower endorsement. These values are interpreted relative to the 0.00-logit reference point and are used in this study to support the identification of competencies relevant to building surveyors' contribution to sustainable construction across the development phases.

The item-measure analysis first identified 100 competency items with negative (-) logit values that were more readily endorsed by respondents, while 103 competency items with positive (+) logit values were excluded from the retained set. Three constructs represented only by positive (+) logit items were consequently excluded, namely Managerial and Entrepreneurial Skills (MES) from the non-technical domain, and BIM and Conflict Avoidance, Management, and Dispute Resolution Procedures (CAMD) from the technical domain. The subsequent item-fit assessment identified five misfitting items among the 100 negative-logit items, resulting in a final set of 95 retained competencies. A summary of selected high-priority competencies is provided in Table 3. The findings suggest that, in addressing evolving employer demands and industry challenges, the professional competency requirements for building surveyors encompass a balanced integration of both non-technical and technical competencies.

Table 3: Selected Competency Domains and High-Priority Items Identified by Industry

Competency Domain	Selected High-Priority Items	Item Measure
Non-technical Competency		
BSCOMP 1: Value, Ethics, and Professionalism	VEP01: Demonstrate a clear understanding of the roles, functions and professional significance of building surveyors	-1.42
BSCOMP 2: Communication Skills	CS02: Present ideas clearly and confidently in both oral and written forms	-1.32
BSCOMP 3: Thinking Skills	TS01: Apply critical, analytical, creative and innovative thinking in problem-solving	-1.03
BSCOMP 5: Teamwork Skills	TwS01: Understand team dynamics, roles and	-.77

Competency Domain	Selected High-Priority Items	Item Measure
	collaboration working principles	
BSCOMP 4: Information Management and Lifelong Learning Skills	IMLSS03: Source, evaluate and manage relevant information from multiple sources	-.64
Technical Competency		
BSCOMP 15: Building Pathology	BP01: Apply knowledge to diagnose building defects and failure mechanisms	-1.52
BSCOMP 9: Building Control Administration	BCA01: Demonstrate knowledge of regulatory requirements and building legislation, especially the Uniform Building Bylaws 1984, the Street, Drainage, and Building Act 1974, and the Local Government Act 1976	-1.37
BSCOMP 8: Building Maintenance and Management	BMM01: Demonstrate knowledge of building maintenance principles and management practices	-1.32
BSCOMP 7: Building Inspection	BI01: Apply knowledge of construction, pathology, and inspection techniques in site assessments	-1.27
BSCOMP 10: Risk Management and Building Audit	RMB02: Conduct and prepare a report on building conditions assessment, post-occupancy evaluation, and risk analysis	-.86
BSCOMP 16: Fire Safety	FS01: Apply fire safety principles to minimise risk of fire to personal injury or death, physical loss, and adverse environmental impact	-.81
BSCOMP 11: Building Works and Quality Management	BWQM10: Diagnose building defects and recommend appropriate remedial measures including structural survey	-.77
BSCOMP 17: Health and Safety	HS01: Understand health and safety regulations and compliance requirements, including fire safety and workplace regulations	-.73
BSCOMP 14: Conservation and Restoration	CR04: Conduct inspections to identify factors affecting conservation and restoration works	-.64
BSCOMP 18: Sustainability	SuS02: Identify sustainability criteria in construction and building performance	-.44

Among the technical domains, competencies related to building pathology, building inspection, and building maintenance and management recorded the lowest logit values, indicating strong agreement among industry respondents. This suggests that employers place particular importance on competencies associated with defect diagnosis, understanding building failure mechanisms, preparing technical reports, and managing building performance over time. The high ranking of maintenance management competency further reflects the growing expectation for professionals to consider maintainability and operational performance from the earlier stages of planning and construction. In this regard, Sh Said et al. (2025) noted that continuous investment in training and the adoption of emerging technologies can strengthen maintenance competencies,

improve operational efficiency, and enhance overall user experience. Other technical competencies, including building control administration, risk management and building audit, fire safety, health and safety, conservation and restoration, and sustainability, were also rated as important, reinforcing the role of building surveyors in regulatory compliance, quality assurance, building safety, and strategic performance monitoring.

Non-technical competencies were similarly emphasised by respondents. Competencies related to value, ethics and professionalism, communication skills, and thinking skills were among the most readily agreed upon, indicating that industry expectations extend beyond technical execution alone. In contemporary construction and built environment practice, building surveyors frequently operate in multidisciplinary environments involving planners, consultants, contractors, regulatory authorities, and clients. As such, effective communication, sound judgement, and professional conduct are essential in ensuring that technical advice is translated into practical decisions, coordinated action, and responsible professional practice.

Competencies Across Construction Development Phases

Competencies should be viewed as critical resources that enable professionals to perform effectively, coordinate stakeholders, and drive development initiatives towards achieving desired outcomes (Md Rami et al., 2023). When examined across the construction development process, the findings indicate that different competency domains become more prominent at different stages of the building life cycle. Figure 4 illustrates the integration of building surveyors' roles across the construction development phases.

At the pre-construction phase, building surveyors' competencies are primarily associated with planning, regulatory compliance and early technical advice. Relevant technical competencies include Pre-Construction Building Inspection (BSCOMP 7), Building Control Administration (BSCOMP 9), Fire Safety Compliance (BSCOMP 16), Health and Safety Regulatory Knowledge (BSCOMP 17) and Sustainability Planning and Life-Cycle Cost Consideration (BSCOMP 18). These competencies enable building surveyors to contribute to early decisions concerning building condition, statutory requirements, safety, maintainability and sustainability before construction proceeds. Non-technical competencies such as communication, analytical thinking and information management also support coordination between planners, consultants, and approving authorities.

During the construction phase, the competency emphasis shifts towards implementation, inspection, quality assurance and compliance monitoring. Key technical competencies include Building Control Administration (BSCOMP 9), Building Works and Quality Management (BSCOMP 11), emerging defect diagnosis through Building Pathology (BSCOMP 15), Fire Safety Inspection and Compliance

(BSCOMP 16) and Site Health and Safety Supervision (BSCOMP 17). Through these competencies, building surveyors support the translation of approved plans and statutory requirements into compliant construction works while identifying defects, quality deficiencies and safety issues during implementation. At this stage, teamwork, leadership, and professional communication support coordination among contractors, consultants, and regulatory bodies. Effective leadership in the construction industry requires context-sensitive capabilities that address the complexity, fragmentation and uncertainty inherent in project environments (Yang et al., 2026). The effectiveness of such sustainable leadership is also shaped by critical thinking, ethical judgement and stakeholder engagement (Abdullah et al., 2025).

At the post-construction phase, competencies become increasingly oriented towards building operation, performance, and long-term asset sustainability. Relevant technical competencies include Maintenance and Facilities Management (BSCOMP 8), Building Audit and Risk Assessment (BSCOMP 10), Building Insurance Evaluation and Damage Assessment (BSCOMP 13), Conservation and Restoration (BSCOMP 14), Advanced Building Pathology and Defect Analysis (BSCOMP 15), and Operational Sustainability Advisory (BSCOMP 18). These competencies support building performance monitoring, maintenance planning, defect diagnosis, risk assessment, conservation and sustainability-related advice throughout the operational life of the building. As highlighted by Ayob et al. (2025), building maintenance plays a fundamental role in ensuring that facilities continue to function as intended and support operational needs throughout their service life. This phase therefore highlights the continuing role of building surveyors in safeguarding asset value, user safety, and operational sustainability.

Across all three phases, Value, Ethics and Professionalism (BSCOMP 1), Communication Skills (BSCOMP 2), Thinking Skills (BSCOMP 3) and Information Management and Lifelong Learning (BSCOMP 4) operate as cross-cutting professional competencies. Rather than being confined to a particular development phase, these competencies support professional judgement, stakeholder coordination, information-based decision-making and continuous professional practice throughout the development life cycle. Figure 4 therefore illustrates building surveyors' competencies as an integrated life-cycle mechanism across pre-construction, construction and post-construction rather than isolated skill sets applied at discrete project milestones.

Taken together, the identified competencies support sustainable construction through three interrelated outcomes: regulatory compliance, building quality and long-term building performance. At the pre-construction phase, competencies in building inspection, building control, fire and health and safety requirements, and sustainability planning support informed decision-making, statutory compliance and consideration of maintainability before construction begins.

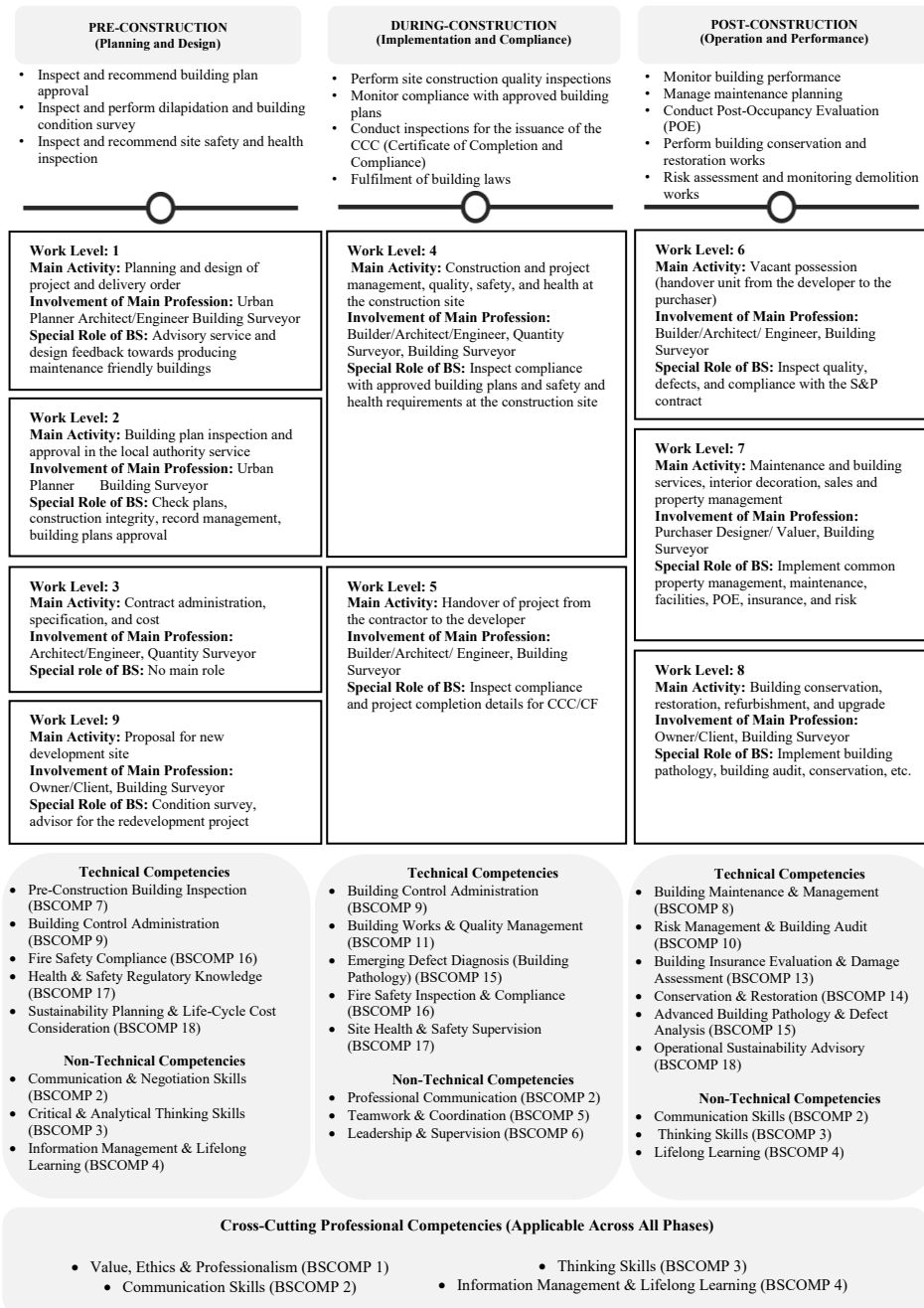


Figure 4: The integration of building surveyors' roles across the construction development phases
Source: Author's Work

During construction, competencies in quality management, compliance monitoring, defect diagnosis and safety inspection contribute to the delivery of building works in accordance with approved requirements and acceptable performance standards. At the post-construction phase, competencies in maintenance management, building audit, risk assessment, building pathology, conservation and sustainability advisory support continued building functionality, asset performance and service-life considerations. Sustainable construction is therefore supported not by a single sustainability-specific competency, but through the combined application of technical and non-technical competencies across the building life cycle.

From a sustainability perspective, the competency framework provides a life-cycle basis for understanding how building surveyors can contribute to construction outcomes beyond project completion. Competencies associated with compliance and inspection can contribute to addressing the risk of non-compliant or deficient work, while building pathology and quality-management competencies support the identification and resolution of defects. Maintenance, audit, risk-management and sustainability competencies subsequently support the continued performance and maintainability of buildings during operation. Cross-cutting competencies in ethics, communication, analytical thinking and information management enable these technical functions to be coordinated effectively among clients, consultants, contractors, regulatory authorities and building users.

CONCLUSION AND RECOMMENDATIONS

The findings suggest that building surveyors' competencies are not confined to a single stage of construction, but extend across the entire development life cycle, namely the pre-construction, construction, and post-construction phases. This indicates that the role of building surveyors goes beyond inspection or post-completion functions, involving broader and more continuous professional contributions throughout the development process. At the pre-construction stage, the importance of regulatory knowledge, inspection capability, and sustainability-related competencies highlights the strategic value of early professional input, particularly in shaping long-term building performance, compliance, and maintainability. During construction, competencies such as defect diagnosis, fire safety inspection, and statutory enforcement remain critical in ensuring that regulatory and design requirements are effectively upheld.

The findings also reinforce the view that sustainable construction is not achieved solely through design innovation, but through continuous monitoring, evaluation, and enforcement during implementation and beyond project completion. In the post-construction phase, competencies related to maintenance management, risk assessment, building audit, building insurance, pathology, conservation, and sustainability become increasingly significant, reflecting the

reality that building performance continues long after handover. At the same time, non-technical competencies such as ethics, communication, and professional judgement remain relevant across all phases, supporting the view that technical practice is strengthened by strong professional conduct and effective stakeholder engagement.

The identified competency set is aligned with current industry expectations and contributes a structured framework that is valuable for both professional practice and higher education. For practitioners, it offers a benchmark for competency development and professional growth throughout their careers. For universities, it provides a useful reference for curriculum design, review, and accreditation, while also supporting more consistent approaches to graduate training and assessment. Although the competency set was empirically derived from the responses of building surveying and built environment professionals and subsequently examined using the Rasch Measurement Model, the resulting phase-based competency framework was not subjected to a separate post-analysis validation by a dedicated panel of subject matter experts. This represents a limitation of the present study.

Future research should further validate the proposed framework with experienced practitioners, professional bodies, and relevant industry experts (subject matter experts) to assess the relevance, clarity and practical applicability of the identified competencies across the pre-construction, construction and post-construction phases. Such validation may further refine the framework before its wider application in professional practice, training and competency-based education. The contribution of these competencies to sustainable construction is therefore understood through their collective support for regulatory compliance, construction quality, maintainability and long-term building performance across the development life cycle. The findings do not imply that competency alone determines sustainability outcomes; rather, they demonstrate the professional capabilities through which building surveyors can contribute to achieving such outcomes.

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DISCLOSURE STATEMENT

The authors declare that there are no conflicts of interest.

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