

Competencies Expected of Graduate Quantity Surveyors by the Sri Lankan Construction Industry

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Abstract

Quantity surveying is one of the prominent professions in the construction industry. With the increasing complexity in construction projects, competencies of QSs have become utmost significant. Moreover, new opportunities of the quantity surveying profession reinforce the need to upgrade the competencies of graduates. However, the quantity surveying education system has not attempted to cater the needs of the industry, thus lagging behind the perceived level of achievement. Hence, this study aims at identifying the gap in competencies required by professional organisations and those possessed by graduate QSs.

This study employed a hybrid survey approach. Firstly, external and internal desk studies were conducted to identify the competencies required by professional bodies and the competencies possessed by graduate QSs respectively, which was then analysed using the thematic analysis technique. Secondly, three expert interviews were conducted to validate the findings of the desk reviews. Finally, Bloom's Taxonomy was used to identify the level of competencies possessed by graduate QSs. The analysed data revealed that the graduates possess all competencies required by the professional organisations, except Capital allowance, Corporate recovery and insolvency and Special assessment. Further, they possess Building surveying, Property development and Surveying and levelling, beyond the requirements of the professional organisations.

Keywords: *Competencies, Construction Industry, Graduate Quantity Surveyors.*

1.0 Introduction

Quantity surveying, being an eminent profession in the construction industry, adds value to the contractual and financial management of construction projects in all its stages (Dada & Jagboro, 2012). Today, QSs have slew of roles to play, both within and outside the construction industry. This profession requires indispensable competencies to apply their knowledge to a wide range of contexts. Competencies of QSs have been listed out by professional bodies namely Institute of Quantity Surveyors in Sri Lanka (IQSSL), Royal Institute of Chartered Surveyors (RICS), Australian Institute of Quantity Surveyors (AIQS) and Pacific Association of Quantity Surveyors (PAQS). They ensure that QS practitioners are dedicated to maintaining the highest standards of professional excellence.

This emerging profession has drawn in the attention of many institutions in the country to develop number of quantity surveying degree programs, owing to its increased demand. Academic institutions aspire to yield QSs who are versatile graduates; whereas the professional associations seek to help the graduates accomplish the competencies adumbrated by them and thus attain full professional status. On the contrary, construction industry anticipates forthwith contribution of graduate QSs to routine business functions as well as to its growth. However, QS education systems have not discerned these multidimensional needs and thus the graduate QSs are often reckoned as not being up to the standard expected by the industry (Perera, Pearson, Zhou & Ekundayo, 2011). Though Sri Lankan QSs are well recognised, still there are lashings of competencies absent in them. Further, with the increased needs and complications in the industry, the role of QSs has considerably changed and requires variety of new skills to perform the job successfully (Niroshan, 2012). Therefore, this research focuses on identifying the lacking competencies with the intent of bringing them to the attention of future QSs. Hence, the objectives of this paper are,

1. To ascertain the core competencies required from graduate QSs.
2. To determine the competencies possessed by graduate QSs.
3. To determine the level of competencies possessed by graduate QSs.
4. To identify the substandard competencies of graduate QSs.

This research is limited to the competencies that can be gained from the graduate course of study which is accredited by IQSSL, RICS, AIQS and PAQS, and does not conceive competencies that are attained from work experience.

This paper begins in the following sections with a review of literature on quantity surveying profession. The next section presents the research methodology followed by findings of the study, and finally presents conclusions and recommendations.

2.0 Literature synthesis

1.1 2.1 *What is quantity surveying?*

Quantity surveying has been defined considering different aspects. Financial management aspect has been the root of quantity surveying and still it is the expectation of employing a QS (Fanous & Mullins, 2012). Ashworth, Hogg and Higgs (2013) have defined QS as a professional who “ensures that the resources of the construction industry are utilised to the best advantages of society by providing, inter alia, the financial management for projects and cost consultancy services to the client and designer during the whole construction process” (p.1). Badu and Amoah (2004) defined quantity surveying as the profession having the ability to analyse both cost components and practical physical construction works of a project in a successful way so as to be able to apply the results of his analysis in solving problems peculiar to each project. Further, Brandon (1992) defined quantity surveying as an amalgam of several other disciplines within a unique context of the built environment. With these definitions, quantity surveying can be portrayed as a fusion of several fields such as economics, law, accountancy, management, measurement, information technology and construction technology that acts amongst all sectors of economy. However, the ultimate objective of the profession is to enable the client derive optimum value for the money spent. For that to be attained, QSs have to perform scads of roles and duties, which are addressed in the following section.

1.2 2.2 *Roles and duties of quantity surveyors*

QSs engage in construction projects from initiation to closeout. With the maturation of the profession, its roles and duties have substantially changed. Today, QSs have to perform traditional as well as contemporary roles. Traditionally, they were working only as Consultant's, Contractor's and Client's QSs. At present, they have imbued into other industries like insurance, financial, manufacturing, taxation, valuation (Hemajith *et al.*, 2007), petro chemical, mining, aeronautical, shipping and transport industries (Smith, 2004), which are new-fangled directions of the profession. Duties can be esteemed in different facets. Jeyamathan (2005) has pertained the duties of QSs into their roles and phases of contract. According to Ashworth and Willis (1998), duties of QSs can be considered with the progress of a project, which commences at initial stage of construction and continues throughout the project. Identification of duties by Ashworth and Willis (1998) has addressed the traditional and some of the non-traditional duties of quantity surveyors. Moreover, Fanous and Mullins (2012) have distinguished the duties of QS and categorised them as traditional duties, evolved duties and emerging duties. However, Fanous and Mullins (2012) have not regarded risk management, quality management, feasibility study, taxation advice, expert witness/appraisal, value management (Smith, 2004), premises audit and post occupancy evaluation (Chong *et al.*, 2012) in their itemisation of emerging duties. If they are incorporated into the above classification by Fanous and Mullins (2012), it will give a thorough picture of duties of QSs.

2.3 *Competencies of quantity surveyors*

Competency is a description of an action, behaviour or outcome which a person should be able to demonstrate, or the ability to transfer skills and knowledge to new situations within the occupational area (Holmes & Joyce, 1993). Any professional should possess an extensive range of competencies in order for him to effectively handle his work in the relevant discipline. Quantity surveying, being a profession perpetually faced up with challenges and new opportunities thereby calls for distinctive competencies to excel in current and future practices. Graduate QSs acquire competencies from formal quantity surveying didactics at the university and the workplace training (Perera, Pearson, Robson, & Ekundayo, 2011). According to RICS and Male (as cited in Nkado & Meyer, 2001), measurement and valuation are the distinctive competencies which are crucial for proper cost management of construction projects. However, Leveson (as cited in Nkado & Meyer, 2001) stated that competencies of QSs reside in financial and contractual control of the project and proposed to develop their interpersonal skills. Nkado and Meyer (2001) identified the competencies of QS as relationship, built environment objectives, technical skills and property economics. Yet, none of the findings emphasise which competencies are essential for exceptional performance of QSs.

2.4 Quantity surveying in Sri Lanka

Rapid changes in construction industry at present call for well qualified QSs to meet the increasing demand and needs of the industry. Sri Lankan construction industry is yet committed with traditional quantity surveying practices (Fanous & Mullins, 2012). They rely on simple IT applications to accomplish their day-to-day routine tasks. Yet, they have not embarked into the modern construction era of the cybernated age.

Expectations of the construction industry and quantity surveying education need to be conceived together for successful carry-over of graduates to the industry (Perera *et al.*, 2011). According to Mahbub (as cited in Zakaria, Munaim & Khan, 2006), present industry expects graduates to possess not only subject knowledge but, to have communication skills, good command in English, commitment, physical and mental endurance, IT knowledge, ability to learn, creativity, leadership, negotiation and self-motivation, which makes them employable. According to Zakaria *et al.*, quantity surveying education offered by institutes is not completely satisfying the needs of the present industry. It is affirmed in a study by Perera *et al.* (2011). Thus, improving competencies of graduate QSs is of the essence.

1.3 2.4.1 Threats confronted by QS profession

Accompanying the maturation of the profession, it calls for development of competencies of graduates so that they can keep step with the potential challenges in future construction industry. At present, major threat to the profession is the increasing discontent of the industry regarding the competencies of graduates. Industry's prolonged concern is regarding the mismatch of learning outcome and industry requirements. They view graduates as lacking knowledge on construction technology and thereby having no apprehension of on-site conditions (Perera *et al.*, 2010). In addition, less precedence is given to management oriented competencies in current practice of profession, whereas this will gain significance in future according to the study carried out by Nkado (2000). Therefore, quantity surveying education system must conceive this deficiency in managerial skills and proactively audit the curriculum.

Further, graduate QSs excel in theoretical knowledge. However, they lack in soft skills and attitudes (Zakaria *et al.*, 2006). Another threat is the involvement of non-construction personnel in providing quantity surveying services (Chandrasiri, 2010). As identified by Chong *et al.* (2012), clients looking for new ways to manage contracts further fortify this threat to the profession. Since IT is the paradigm of today's industry, the emerging developments in technology can automate almost all the roles of QSs. Though not yet implemented in Sri Lanka, BIM is the most raging IT solution that would entirely change the role of all professionals. Thus, it challenges the existence of the profession. To overcome this, QSs need to enhance their skills on QS specific BIM technology (Nagalingam *et al.*, 2013). Furthermore, with the increased number of institutions providing quantity surveying education, there are surplus graduates in the market. Moreover, involvement of foreign professionals in local project is an added reason for lowering opportunities for local QSs. Fewer opportunities within the country are a threat to the profession (Chandrasiri, 2010). All these menaces have placed a challenge on the profession. To confront these challenges and enhance their professionalism and status, they are obligatorily expected to fortify the essential competencies.

2.5 Importance of identifying the competencies expected by construction industry from graduate quantity surveyors

Graduate QSs acquire competencies from formal university education and workplace training. Regulating associations of the profession have adumbrated guidelines regarding competencies to be attained by graduates through their education at the university. However, there is no benchmark as to the level of competencies to be achieved by them. Owing to absence of competency benchmark, there is a mismatch between the expectations of graduate competencies by construction industry and the competencies possessed by graduate QSs. This has led to the industry being dissatisfied of the competencies of graduate QSs (Perera *et al.*, 2011).

On the other hand, competencies to be accomplished by graduate QSs are pulled in different directions by the industry and the education system. Industry expects graduates to directly involve in all quantity surveying functions together with contributing to their growth. It anticipates graduates to possess theoretical knowledge, technical know-how as well as the essential soft skills as they step in to the industry. It does not recognise the potentiality of graduates to develop their professional skills once they are employed. On the contrary, the education systems focus on bringing forth versatile graduates who have the foundation knowledge in all aspects of the profession plus the capability for further development in future. As it does not consider the opposing needs of the industry, graduate QSs are lacking in certain competencies which are expected by the construction industry (Perera *et al.*, 2010).

At the same time, there is only limited number of studies heretofore, concerning the competencies of graduate QSs, as shown in table 2.1.

Table 2.1: Studies related to competencies of graduate QSs

Author	Year	Name of study
Nkado	2000	Competencies of professional QSs for the future career, Competencies of professional QSs in a developing economy, Competencies required by South African QSs
Nkado and Meyer	2001	Competencies of professional QSs: A South African perspective
Shafiei and Said	2008	The Competency Requirements for QSs: Enhancing Continuous Professional Development
Derus, Yunus and Saberi	2009	In Search of Competencies of an Exceptional QS in Public Entity: Building a Theoretical Foundation
Perera, Pearson, Robson and Ekundayo	2011	Alignment of academic and industrial development needs for QSs: the views of industry and academia (UK)
Author	Year	Name of study
Dada and Jagboro	2012	Core Skills Requirement and Competencies Expected of QSs: Perspectives from QSs, Allied Professionals and Clients in Nigeria
Perera, Pearson, Zhou and Ekundayo	2012	Developing a graduate competency mapping benchmark for quantity surveying competencies

However, none of these studies have explored into competency requirements of quantity surveying graduates in Sri Lanka. Hence, there is a deficiency in literature in this regard.

Further, as identified in the aforementioned literature synthesis, future role of QSs will apparently mature from what it is at present. In addition, quantity surveying profession will disseminate into many other industries, without being bounded to construction. All these changes will call for new and diverse skills of graduates to successfully takeover their duties in the future industry. Hence, there is indispensable need for the identification of competencies expected by the industry, with the objective of aligning the industry expectations with competencies possessed by the graduates.

3.0 Research methodology

An extensive literature survey about quantity surveying profession was carried out to emphasise the significance of the research problem. Next step was to execute external desk review with the competency standards established by the professional authorities such as IQSSL, RICS, AIQS and PAQS, which determined the competencies required to be possessed by graduate QSs. Following this, an internal desk review with the QS curriculum being used by a QS degree program accredited by the above professional authorities was done to find the competencies possessed by graduate QSs. Internal and external desk review was conducted using thematic analysis technique. Thematic analysis is considered the most appropriate for any study that seeks to discover using interpretations and it provides a systematic element to data analysis (Alhojailan & Ibrahim, 2012). It is theoretically flexible because thematic analysis can be learned and used without some of the potentially confusing theoretical knowledge that is essential for many other qualitative approaches. Steps involved in carrying out thematic analysis are described in section 4.1.1. Findings of the desk reviews were then validated by three experts, who are a part of quantity surveying course of study that is accredited by IQSSL, RICS, AIQS and PAQS. Following this, the curriculum was analysed by referring to Bloom's Taxonomy, to identify the level of competencies possessed by graduate QSs.

4.0 Data analysis

4.1 External desk review-Identification of competencies required from graduate quantity surveyors

Competencies required from graduate QSs were ascertained by conducting thematic analysis with the Competency standards insinuated by IQSSL, RICS, AIQS and PAQS. Following text gives a brief description of each of the above competency standards.

IQSSL Competencies

IQSSL is the only local professional organisation which has developed a competency standard for QSs. IQSSL competency standard specify the competency areas that are required to be attained by QSs, together with the targeted achievement. It is similar to AIQS competency standard.

RICS Competencies

RICS competencies are sorted into three groups as mandatory, core and optional competencies. Each group is set up based on their prominence to the profession and are outlined at three levels of attainment as given below.

- Level 1 - knowledge and understanding (knowing)
- Level 2 - application of knowledge and understanding (doing)
- Level 3 - reasoned advice and depth of technical knowledge (advising)

AIQS Competencies

According to AIQS (1997), competencies are dissevered into competency units, each of which describes a peculiar element of a QS's role in terms of performance criteria, range indicators and evidence guides.

Competency standard units are categorised into core and specialist units. Core units represent the competencies which should mandatorily be possessed by QSs. Specialist units are functions which can be executed by QSs and many other professionals in the construction industry, but require special noesis beyond what is attained through the quantity surveying degree program.

PAQS Competencies

PAQS competencies are similar to AIQS competency standards except that AIQS competencies are more dilated. PAQS competencies are categorised as core and specialist competencies, each of which is determined in terms of unit of competency, performance criteria, range indicators and evidence guides (PAQS, 2001).

Following steps were followed in conducting thematic analysis. Prior to auctioning thematic analysis, secondary data collected from the above four professional associations were separately tabulated to reduce the complexity.

Step 1

As the first step of thematic analysis, tabulated data was read and re-read several times which lead to data engrossment. Simultaneously, initial ideas were noted down to make the analysis more comfortable.

Step 2

The next step was the initial coding stage where manual coding was done by highlighting the data pertinent to the research question. At this step, similar competencies in all four competency standards were highlighted. Simultaneously, competencies which cannot stand on their own were included under other competencies. For example, Communication skills in RICS competencies were grouped under 'Support competencies'. At the end of this step, coding generated from each competency standards was summarised in a tabulated form, in order to simplify the succeeding step. Repeated patterns in the tabularised summary were given consideration, which is the key for generating themes.

Step 3

Third step is searching for themes, where similar codes identified in the previous step and the data considering the same aspect were aggregated. For example, 'Data management' in RICS competencies, 'Cost information database' in AIQS and PAQS competencies and 'Preparation of cost analysis' in IQSSL competencies were included under the same heading of 'Managing cost data', since they all have the same defined meaning. Table 4.1 shows the combined list of competencies, which was the finding of the external desk review.

Table 4.1: Combined list of IQSSL, RICS, AIQS and PAQS competencies

Competency		Element
1	Cost planning	Analysing alternative design solutions
		Cost controlling during design
		Preparation of cost plans
		Scope audit
2	Cost estimating	Managing cost data
		Preparation of estimates
		Review, evaluation of estimates
3	Strategic planning	Preparation of cost benefit analysis
		Preparation of project brief
		Economic and financial analysis
		Carrying out development appraisal
		Compliance and management studies
4	Contract administration	Progressive financial controlling, reporting and monitoring during construction
		Recommending progress payments/interim valuation
		Managing claims
		Managing variations
		Preparation of correspondences
		Final accounts and reporting
		Managing cash flow during construction
		Administering insurance claims
		Administering, managing of subcontracts and controlling subcontract accounts
Contractual interpretation		
5	Dispute resolution	Resolving disputes
6	Contract documentation	Establishing client requirements
		Measurement
		Preparation of BOQ
7	General procurement advice	Developing resource management plan
		Review procurement systems
8	Tendering process	Review forms of contract, subcontracts
		Managing pre-qualification
		Managing tendering process
		Tender documentation
		Selection of tenderers
9	Government law and regulation	Evaluate, negotiate tenders and award
		Specification writing
		Knowledge on law, regulations and guidelines related to construction
10	Construction technology	Knowledge on construction technologies, process and building materials
		Knowledge of design principals
		Knowledge of principals of construction
		Interpretation of drawings, specification and other documents
11	Resource analysis	Design and installation of services
12	Project management	Analysing and managing resources
		Pre contract planning and programming
		Programme monitoring

13	Risk management	Managing risk
14	Value management	Providing value management services
15	Life cycle cost analysis	Carrying out life cycle cost analysis
16	Budgetary process	Establishing budget
		Coordinating client's cash flow
		Assisting in client's financial control
17	Financial audit	Knowledge on accounting principles, cash flow, cost reconciliation
18	Ethics and professional conduct	Professional practice
19	Feasibility study	Carrying out feasibility study
20	Health and safety	Knowledge on health and safety requirements in construction
21	Capital allowance	Capital allowance
22	Corporate recovery and insolvency	Corporate recovery and insolvency
23	Support competencies	Computer services
		Team working
		Due diligence
		Leadership
		Managing people
		Communication, presentation skills
		Client care
		Economics
24	Sustainability	Knowledge on impact of sustainability in construction
25	Tax depreciation	Tax depreciation
26	Special assessment	Special assessment
27	Quality assurance	Quality assurance
28	Expert witness	Expert witness
29	Business management	Business management
30	Research and development	Research and development

Subsequently, these competencies were grouped under six themes, which were generated by referring to the classifications developed by several scholars who involved in similar studies. Niroshan (2012), Perera (2006) and Willis and Ashworth (1987) grouped the competencies of QSs under four categories namely, Construction Economics, Construction Management, Construction Law and Construction Technology. Further, Perera (2006) emphasised that Information Technology and Business Administration should be included under the above classification. Hence, 'Construction Economics', 'Construction Technology', 'Construction Management' 'Construction Law' 'Construction Information Technology' and 'Business Administration' were selected as the themes under this research.

Step 4

Following this, the above six themes were refined at two levels; primarily with the coded data to ensure they form a consistent pattern, secondly once a coherent pattern was formed the themes were matched against the data set as a whole. This guaranteed that the themes accurately reflect what was evident in the data set as a whole (Braun & Clarke, 2006). In addition, further coding was done at this stage to ensure no codes were missed during previous stages.

Step 5

Next step is defining and designating themes where the essence of each theme was identified as represented in figure 4.1.

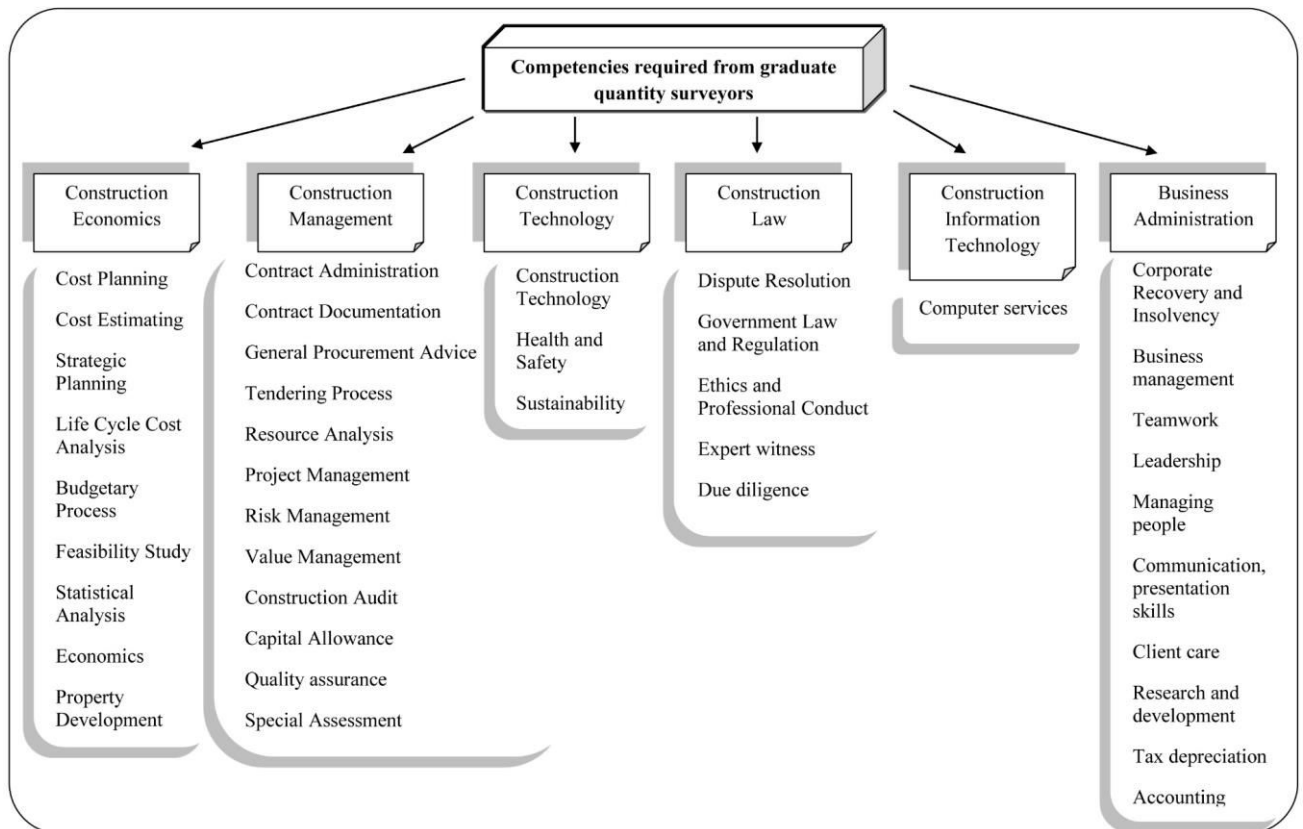


Figure 4.1: Competencies Required from Graduate Quantity Surveyors (Findings of External Desk Review)

Each of the above themes can be defined as shown in figure 4.2:

Construction Economics

- The application of economic principles to construction industry with the aim of economising the construction process from inception through completion, for the entire life of the building. It involves advising the client regarding the best ways to achieve value for money

Construction Technology

- The branch of knowledge pertaining to construction processes, construction materials, plant and equipments and construction technology together with the relevant health and safety requisites, related to building and civil engineering construction

Construction Management

- The overall planning coordinating, managing and execution of construction projects, from inception to completion, to maximize efficiency. Construction management is focused on managing time, cost and quality of construction projects

Construction Law

- The consideration on different aims of the law to the context of the construction industry, yet it is not a discrete branch of law.

Construction Information Technology

- The use of computers and telecommunication systems for creating, storing, retrieving, and transmitting information, to make the QS tasks simpler

Business Administration

- The managing of business using the principles and application of economics, marketing and planning

Figure 4.2: Definitions of themes

Combined list of competencies prepared under external desk review (Refer table 4.1) consists of 30 competencies, each of which includes number of competency elements. Each competency element incorporates its entire process from the beginning to the end. For example, 'Managing variations' covers all activities involved with it, such as requesting for proposal, evaluating the variation, obtaining approvals, determination and issuing variation orders. In addition, this list consists of both core and specialised competencies that are required from QSs. Thus, it cannot be expected that a QS should mandatorily possess all of the competencies mentioned in table 4.1. Hence, the above combined list consists of some competencies that are seldom exercised by QSs, for example, Capital allowance, Corporate recovery and insolvency, Special assessment and Tax depreciation. Further, it comprises of competencies that does not form the primary chore of QSs, but essential for the successful execution of their duties. The competency group identified as 'Support competencies' is composed of such competencies. For example, communication skills, client care, computer services, team working, due diligence and leadership. The remaining competencies forms the principal branches of knowledge required from QSs.

Classification of competencies under the themes, as shown in figure 4.1, demonstrates a broader picture of the competency requirement. According to it, competency of Construction economics and Construction management are the subject areas extensively expected from QSs. In addition, Business administration also gains prominence due to the classification of support competencies under it. Further, the field of Construction technology and Construction information technology proves its grandness by being identified as separate themes.

4.2 Internal desk review - Identification of competencies possessed by graduate quantity surveyors

Competencies possessed by graduate QSs were identified through reviewing the curriculum used by a quantity surveying degree program accredited by IQSSL, RICS, AIQS and PAQS. This was also attained with the use of thematic analysis which includes five steps similar to the process described in section 4.1. Learning outcomes in the curriculum were classified under the competency list formed under external desk review. Additional competencies that were not identified in desk review I, yet attained through the quantity surveying degree program were also named during the process. Building surveying, Surveying and levelling and Property development were such competencies. Though these three competencies were not required by the professional bodies from graduate quantity surveyors, they are addressed in the degree program, at a basic level. Figure 4.3 represents the competencies attained through the quantity surveying degree program as classified under the previously generated themes.

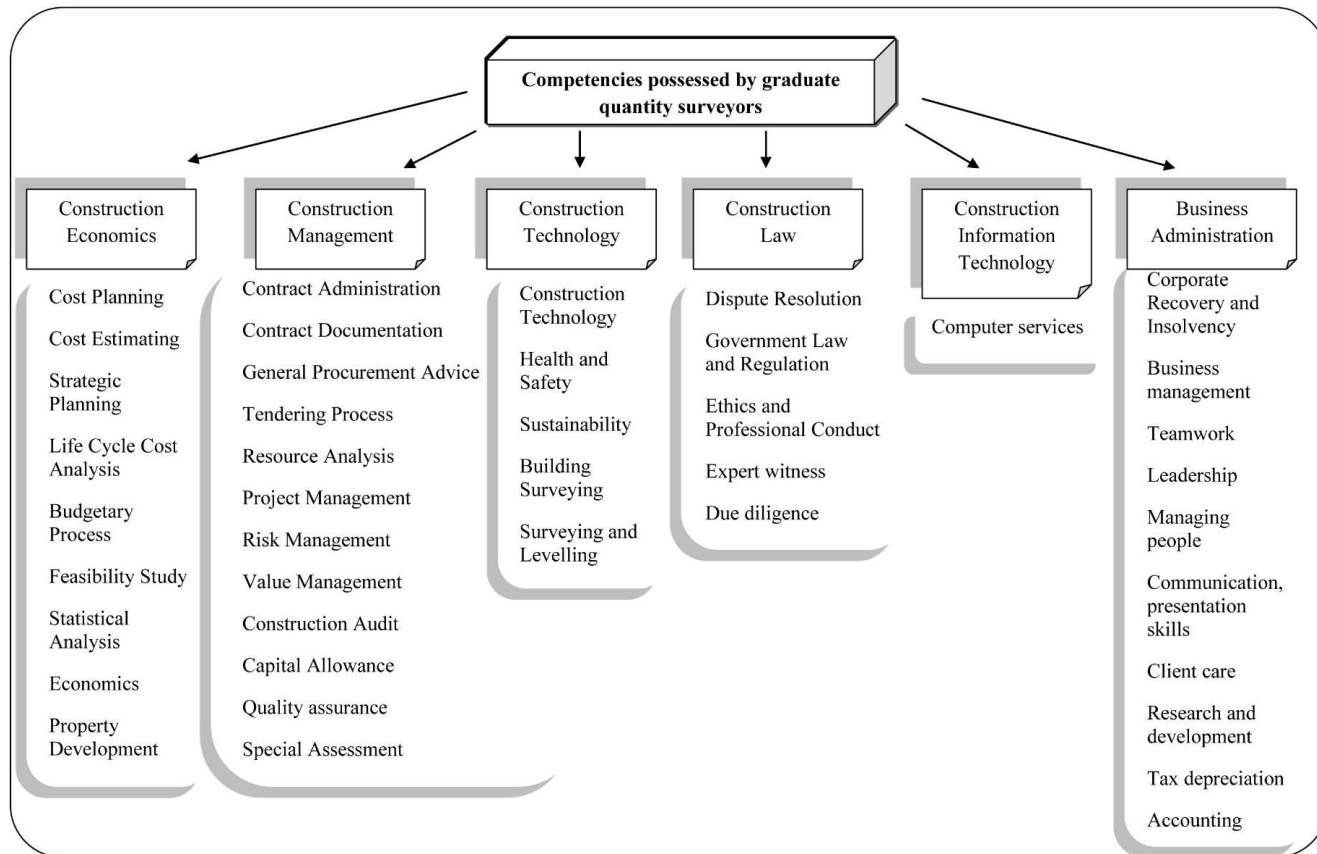


Figure 4.3: Findings of Internal Desk Review

4.3 Expert validation

The validated outcome of the findings of internal desk and external desk review is subjected to minor changes after conducting interviews with three experts in the academia. They are qualified in the area of this research academically as well as professionally. Table 4.2 provides the details of experts who involved in validating the findings.

Table 4.2: Details of Experts

	Designation	Years of experience
1	Senior Lecturer	21
2	Senior Lecturer	17
3	Senior Lecturer	13

Firstly, the proposed changes for the findings of external desk review disclosed the importance of identifying Financial auditing and Technical auditing separately rather incorporating both under the competency Financial auditing. Further, another expert has pointed out the mandatory and optional components of the competency 'Business administration'. Teamwork, Leadership, Managing people, Communication, presentation skills and Client care were identified to be mandatory and the remainder to be optional. Thus, it was expressed that all the competencies in this category cannot be expected to be possessed by all the graduate Qs.

Secondly, the proposed changes for the findings of internal desk review found the principal problem encountered while grouping the learning outcomes in the curriculum. It was the absence of learning outcomes directly explaining some of the competencies. In order to solve this problem, it was proposed by the experts to include such learning outcomes under all competencies which it describes, by replicating under more than one competency. All the changes proposed by the experts were incorporated to make the findings of this paper more sensible in table 4.1, figure 4.1, 4.2, and 4.3.

4.4 Identification of the level of competencies possessed by graduate quantity surveyors

Levels of competencies possessed by graduate Qs were identified by referring to Bloom's Taxonomy, which is a system used to design instruction or learning processes. It addresses three domains of educational activities such as cognitive, affective, and psychomotor. Cognitive domain has been conceived to determine the level of each competencies possessed by graduate Qs. Cognitive domain involves knowledge and the development of intellectual attitudes and skills.

4.4.1 Rationale of using Bloom's Taxonomy

Curriculum comprises of student learning outcomes which describes the knowledge, skills, and attitudes that students acquire through successful completion of a course. However, competency is an integration of knowledge, skills and attitudes. Thus, learning outcomes in the curriculum is a direct measure of competencies possessed by graduates. Further, as identified by Bloom (1956), cognitive domain of Bloom's Taxonomy involves knowledge and the development of intellectual attitudes and skills, thus competencies. As a result, it is crystal clear that Bloom's Taxonomy can be used to identify the level of competencies possessed by graduate Qs.

4.4.2 Analysis based on Bloom's Taxonomy

Bloom's original Taxonomy has six categories. Each category in it was given a score level depending on the chronological order of attainment. With that, knowledge, comprehension, application, analysis, synthesis and evaluation were given the scores of 1, 2, 3, 4, 5 and 6 respectively. And then, each learning outcome in the curriculum was given a level by referring to Bloom's Taxonomy. It was done by considering the verb in each learning outcome and assigning to it a level, based on the category of the verb. Following figure 4.4 summarises the verbs attributable to each level within the cognitive domain.

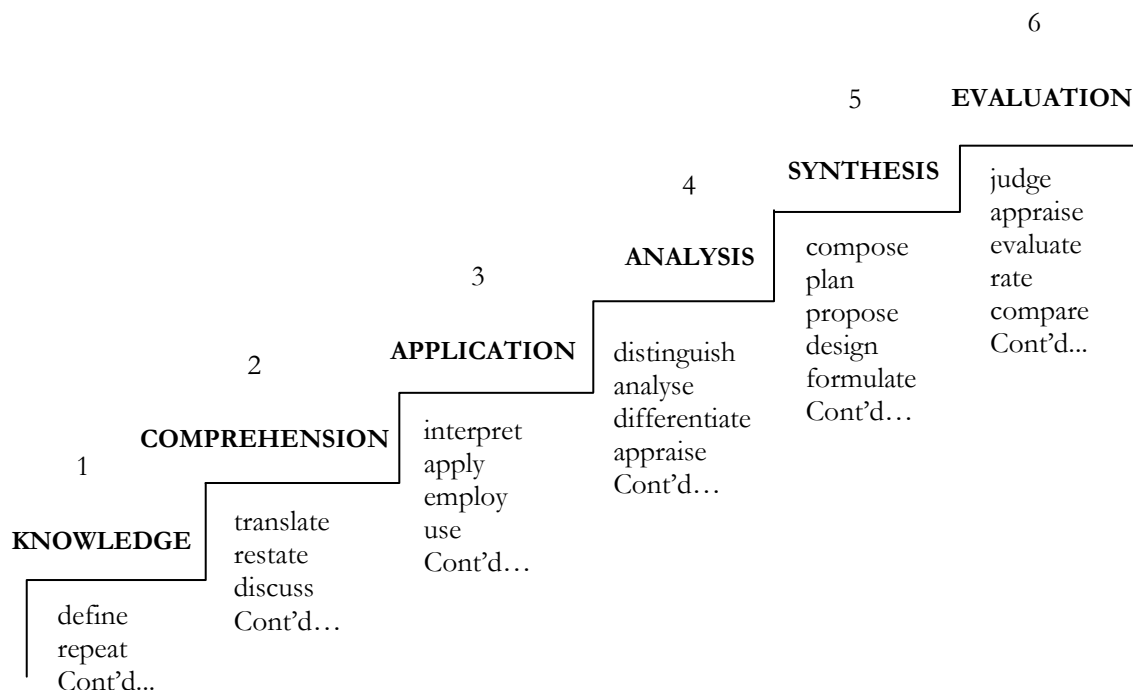


Figure 4.4: Verbs in each level of Cognitive domain

Source: Munzenmaier & Rubin, 2013

For example, if the learning outcome is ‘manage the post contract quantity surveying duties’, the level attributable to this learning outcome is 5, since the verb ‘manage’ is under Synthesis, which has been assigned a score of 5.

Subsequently, the individual learning outcomes were grouped under the list of competencies identified from the curriculum. For that, the following formula was used.

$$\text{Competency Level} = \frac{\sum(\text{Credit Value per Learning Outcome} * \text{Level})}{\sum \text{Credit Value per Learning Outcome}}$$

Employing the same method, level of each competency possessed by graduate Qs was calculated, as represented in Figure 4.5.

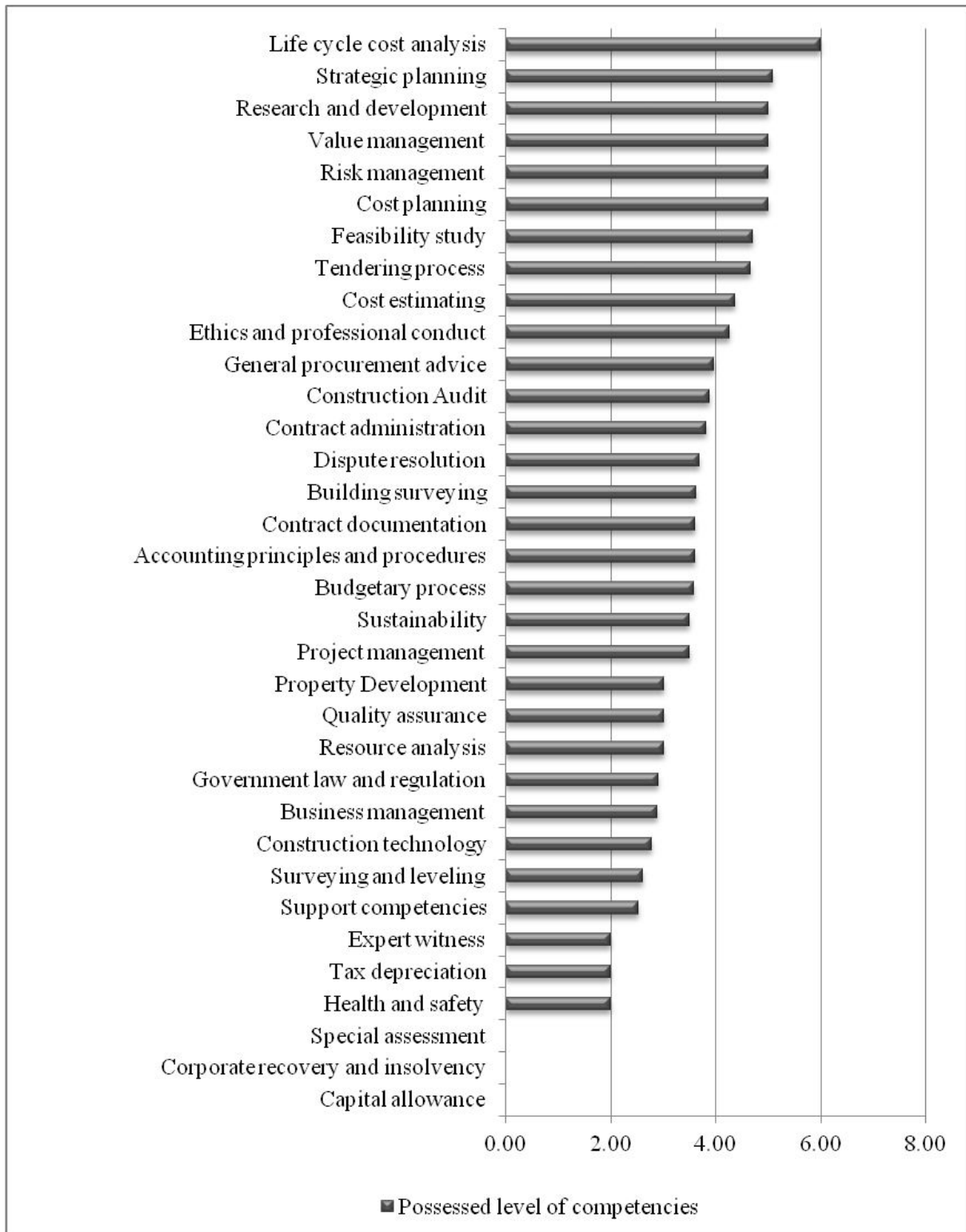


Figure 4.5: Level of competencies possessed by graduate quantity surveyors

From Figure 4.5, it is clear that Capital allowance, Corporate recovery and insolvency and Special assessment are not possessed by graduate QSs. Further, Cost planning, Risk management, Value management, Research and development, Strategic planning, Ethics and professional conduct and Life cycle cost analysis are possessed by them at a higher level. Hence, the third and fourth objectives of this study are accomplished.

4.4.3 Limitations of the study

The research has undergone with the following limitations.

- There is no weightage given in the curriculum, for the learning outcomes. Thus, learning outcomes within one module were considered to have equal credit values.
- When grouping the learning outcomes under the list of competencies, some learning outcomes were categorised under two or more competencies. For example, 'apply the capital budgeting techniques for financial decision making' was grouped under Strategic planning. However, it is an integral component of Feasibility studies too. Hence, the above learning outcome was categorised under both Strategic planning and Feasibility studies.

5.0 Conclusions and recommendations

As described at the outset, though the quantity surveying education system focuses on producing versatile graduates, the construction industry expects graduate QSs to diversify themselves that go beyond the original scope of the curriculum. Further, new opportunities and expectations of the industry reinforce the need to upgrade the competencies of graduate QSs so that they can withstand the threats and challenges that confront them. Hence, this study comparatively analysed the requirement and the possession of the competencies of graduates by the construction industry.

The external desk review conducted to ascertain the competency standards insinuated by IQSSL, RICS, AIQS and PAQS substantiated the competencies required from graduate quantity surveyors under 30 topics. These competencies were then grouped under the six themes, being 'Construction Economics', 'Construction Technology', 'Construction Management', 'Construction Law', 'Construction Information Technology' and 'Business Administration', to provide a broader perspective. Under the internal desk review, the analysis of the curriculum used by a QS Degree program accredited by the above local and international professional organisations revealed that all the required competencies, except Capital allowance, Corporate recovery and insolvency and Special assessment, were possessed by graduate quantity surveyors. In addition, Building surveying, Surveying and levelling and Property development were possessed by them, though not required by the professional organisations. The analysis of the curriculum referring to Bloom's taxonomy found that Cost planning, Risk management, Value management, Research and development, Strategic planning, Ethics and professional conduct and Life cycle cost analysis were possessed by the graduate QSs at higher levels. Further, Health and safety, Tax depreciation and Expert witness were possessed at lower levels. With that, the aim of this research was accomplished.

Finally, the study recommends certain developments for the local and international professional organisations as well as to quantity surveying education institutes. The development of a qualitative benchmarking system by professional bodies to indicate the level of competence required from graduate QSs. That could be used by the educational institutes to appraise the quality of their degree program. Next, the curriculum used by quantity surveying education institutes must be proactively audited to address all the competencies outlined by the relevant local and international professional associations addressing the aforementioned important subject areas. Further, it would be a great assistance to quantity surveying education institutes to upgrade their curriculum, if this research can be extended to identify the competencies expected from graduate QSs by the construction industry, and to map it with the competencies possessed by them. The outcome of this would be an important aid for the graduates to acquire competencies that are expected out of them by the industry.

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