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Article

Identify Building Contract Administration Knowledge for Graduate Architects to Enhance Work Performance

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Abstract: The fundamental roles and functions of graduate architects are witnessing a gradual shift in focus from designing buildings to supporting building contract administration. Construction project stakeholders are recognizing a growing need for graduate architects to improve their professional development within the industry for smooth project delivery. The purpose of this study is to identify the types of knowledge required by graduate architects to be competent when supporting the building contract administration work and to enable them to move a step closer to acquiring their professional qualifications. The study design follows a mixed methodology of quantitative and qualitative data collection and analysis. First, a literature review was conducted to form questions for the survey. After the questionnaire survey, semi-structured interviews were conducted with practitioners in the industry. A total of one hundred and eighty (180) questionnaires were distributed and one hundred and twenty-seven (127) questionnaires were returned. Data collected were analyzed using frequency distribution analysis and relative importance index (RII). Results from the questionnaire survey were triangulated with semi-structured interviews formed by twenty (20) practicing architects. Data collected from semi-structured interviews have been analyzed using thematic analysis. The result of the questionnaire survey and semi-structure interview both agreed that the most significant knowledge require is legal study knowledge. However, both methods have a different conclusion for least significant knowledge where the survey's result showed communication and relationship management knowledge while semi-structured interviews' result showed quality and assessment management less significant. The contribution of this study is perceived as essential for developing graduate architects' competency in work performance and covers the limitations of the existing studies. Academics can use the outcome of this study as a reference in their teaching modules.

Keywords: building contract administration; knowledge; graduate architects; competency; mixed methodology

1. Introduction

The building contract administrator has two distinct functions which act as an agent and a certifier (Cunningham, 2013). Building contract administrator plays a vital component in successful project delivery when they overcome challenges associated with the construction industry, organize roles, responsibilities, and obligations for each project stakeholder, support contracted parties with relevant records, reduce project risks, minimize dispute, ensure parties meet the contractual terms and project objectives (Cook, 2014) [1]. The administrator's task covers orchestrating and motivating various consultants and contractors to deliver the best possible performance both individually and as members of the team (Ostime, 2019;(Ricchini, 1979) [2]. They

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undertake the decision-making, advisory, and information roles in the context of the Pertubuhan Arkitek Malaysia (PAM) forms of contract and contribute to the achievement of the primary project objectives (Tan, Low, Sum, & Chee, 2010) [3].

An architect is appointed as a building contracts administrator in the construction team as has a better understanding of building contract and communication among the team, able to conduct proper planning and monitoring, and consist special skills to lead and handle problems at construction sites (Yadollahi, Mirghasemi, Mohamad Zin, & Singh, 2014) [4]. However, there is a lack of architects in Malaysia, and subsequently, encourage the architect to delegate their supervision and monitoring duties to their representatives – graduate architects which is permitted under Uniform Building By law-5 (UBBL, 2013) [5].

Graduate architects play a vital role in supporting the building contract administrator. It is important to have a competent graduate architect for project smooth delivery. However, previous studies reveal that many construction projects face contract administration issues, due to a lack of proper building contract administration knowledge (Ajator, 2017) [6]. Research carried out by Khodeir (2020) [7] highlighted that employers have often given negative criticism regarding the attributes of graduate architects at the early stage of their careers. Architectural firms are dissatisfied with the quality of the graduates and still note that they have to re-train fresh graduates to make them fit for their jobs before starting their practice (Salleh, Yusof, & Memon, 2016) [8]. There is a gap between education at the university level and the actual skills of architecture students (Laila M. Khodeir, 2018) [9].

The objective of this study was to identify the types of knowledge required for graduate architects to have better performance when supporting the building contract administrator. To achieve this objective, types of knowledge were first identified through a literature review, followed by a questionnaire survey, and lastly semi-structured interviews. After analysis of the data, the result collected from the survey was compared with the result from semi-structured interviews to develop a final list of building contract administration knowledge. Accordingly, providing a list of building contract administration knowledge would significantly contribute to the work performance and competency of graduate architects to support building contract administration work.

2. Literature Review

2.1. Building Contract Administrator

Building contract administrators refer to people that ensure the contract between employer and contractor is executed and adhered to the terms of the contract (Cunningham, 2016) [10]. A construction contract is between two parties which may include the Employer and main contractor or between a supplier and the contractor or supplier and subcontractor (Kavanagh & Miers, 2021) [11]. In practice, a contract administrator will be appointed among the engineers and architects which depends on the type of contract document that is applied (Bin Zakaria, Binti Ismail, & Binti Yusof, 2013) [12].

The primary objectives of an individual to be appointed to administer a building contract include delivering the project safely, to the specified quality standards, on time, and within the employer's budgetary constraints (Rob van Deventer, 1994) [13]. This role should be carried out by a person with expert technical knowledge of the construction process, strong leadership qualities, possesses highly developed interpersonal skills, an understanding of contractual, legislative, and statutory underpinnings, and capable of advising the contracting parties on their contractual rights and obligations and enable implementing the administrative procedures set out in the particular contract (Cunningham, 2016; Hughes, Champion, & Murdoch, 2015) [14].

2.2. Graduate Architects

Graduate architect (GA) as illustrated by RIBA (Royal Institute of British Architects) refers to a person who qualifies as Part II from an institution accredited by RIBA. They act as assistants for building contract administrators, carry out tasks such as submission of drawings, arranging and preparation of schematic/tender/ construction/ contract drawings, coordinating with consultants and surveyors, chair meetings, conducting site walks, handling discussions with supplier/contractors, etc (Ostime, 2019) [2]. Besides performing the above

tasks, graduate architect mostly support the administration of the building contract during the construction stage (Chappell & Dunn, 2015) [15]. which include the following work:

a. performing all functions and duties of the architectural consultancy practice under the terms and conditions of the building contract;

b. advising the client on the site staff required for the project and estimating the cost and duration of their employment;

c. providing information and preparing instructions to be issued to the contractor as required under the terms and conditions of the building contract to enable the contractor to proceed with the works;

d. examining the works programmed submitted by the contractor and being satisfied that the works can reasonably be completed within the contract period;

e. Inspecting the works at periodic intervals to ensure that the works are being executed following the building contract and to prepare the certificate of practical completion.

2.3. Components of Building Contract Administration Knowledge

Professional competency is attained by the combination of knowledge acquired during training and skills developed through experience (Derrington, 1981) [16]. Table 1 outlines the generic areas of knowledge that graduate architects are expected to acquire from the literature review.

Table 1. Types of knowledge required by the graduate architect during support the building contract administration work identified from the literature review. (Source: Author).

Codes /Types of Knowledge	(Edum-Fotwe & McCaffer, 2000) [1]	(Hendrickson, Hendrickson, & Au, 1989) [2]	(Walker, 2015) [3]	(Jena & Satpathy, 2017) [4]	(Than, Htun, & Oo, 2009) [5]	(Ting, Marzuki, Chuah, Misieng, & Jerome, 2017) [6]	(Wahyuni, Masih, & Rejeki, 2018) [7]	(Allen & Iano, 2019) [8]	(Sunindijo & Zou, 2011) [9]	(Best, 2006) [10]	(Cooper & Press, 1995) [11]	(Cooper, Junginger, & Lockwood, 2009) [12]	(Emmitt, 2006) [13]	(Byrne, 2007) [14]	(Fenn, Lowe, & Speck, 1997) [15]	(Shamir, 2016) [16]	(Avots, 1969) [17]	(Gido & Clements, 2014) [18]	(Lock, 2017) [19]	(Wahyuni et al., 2018) [20]
K1-Project management	*	*	*														*	*	*	
K2-Architecture				*	*	*	*													*
K3-Town Planning										*	*	*								
K4-Civil engineering				*	*	*	*													*
K5-Mechanical engineering				*	*	*	*													*
K6-Electrical engineering				*	*	*	*													*
K7-Structural engineering				*	*	*	*													*

Cont.

Codes /Types of Knowledge	(Edum-Fotwe & McCaffer, 2000) [1]	(Hendrickson, Hendrickson, & Au, 1989) [2]	(Walker, 2015) [3]	(Jena & Satpathy, 2017) [4]	(Than, Htun, & Oo, 2009) [5]	(Ting, Marzuki, Chuah, Misieng, & Jerome, 2017) [6]	(Wahyuni, Masih, & Rejeki, 2018) [7]	(Allen & Iano, 2019) [8]	(Sunindijo & Zou, 2011) [9]	(Best, 2006) [10]	(Cooper & Press, 1995) [11]	(Cooper, Junginger, & Lockwood, 2009) [12]	(Emmitt, 2006) [13]	(Byrne, 2007) [14]	(Fenn, Lowe, & Speck, 1997) [15]	(Shamir, 2016) [16]	(Avots, 1969) [17]	(Gido & Clements, 2014) [18]	(Lock, 2017) [19]	(Wahyuni et al., 2018) [20]
K8-Geotechnical engineering				*	*	*	*													*
K9-Quantity surveying				*	*	*	*													*
K10-Construction contract law														*	*	*				
K11-Construction methods																				
K12-Building materials																				
K13-Landscape				*	*	*	*													*
K14-Interior design				*	*	*	*													*
K15-Financial planning	*	*	*														*	*	*	
K16-Valuation studies	*	*	*														*	*	*	
K17-Environmental studies	*	*	*														*	*	*	
K18-Authority approving process														*	*	*				
K19-Feasibility study										*	*	*								
K20-IT for construction				*	*	*	*													*

Project success is dependent on the performance of the graduate architects who are entrusted to execute the project (Walker, 2015) [17]. Previous studies identified that there are 20 types of knowledge are required by graduate architects to be competent when support in building contract administration work (Alias, Ahmad@Baharum, & Idris, 2012) [18]. Mistakes and pitfalls can be avoided by engaging a graduate architect who is knowledgeable and appropriate for the job. Understanding the types of knowledge required for building contract administration will encourage graduate architects to acquire that particular knowledge for enhancing their work performance (Harmon & Stephan, 2001) [19].

Academic programs in architecture cover a significant proportion of the outlined knowledge areas (Tzonis,

2014) [20]. However, the scope that transcends certification requirements covered by the Accreditation Bodies is wider than the subject boundaries (Nicol & Pilling, 2000) [21]. Graduate architects have to confront a view of the changing requirements during practice. Modern building contract administration demands a wide variety of knowledge, coupled with skills that extend beyond the technical aspects of traditional architectural practice (Nicol & Pilling, 2000) [21]. The scope of knowledge areas required to support the building contract administrator will also be influenced by the context of the industry in which the graduate architect work (Tzonis, 2014) [20], as well as the requirements of the Board of Architects in respective countries, i.e. Board of architects in Malaysia (LAM). The type of knowledge requested by LAM was extracted from the examination paper of Professional Architect Part III year 1990 – 2020 and summarized in Table 2.

Table 2. Type of knowledge requested by Board of Architects Malaysia extracted from past year examination paper of professional architect part III the year 1990–2020. (Source: Author).

Year	Legal Study knowledge						Quality and Assessment Management Knowledge	Design Management Knowledge	Contract Documentation Knowledge	Communication & Relationship Management Knowledge
	NLC	TCPA	SDBA	SMA	AA	HDA	UBBL	Strata	PAM	LAM
2010	*	*		*	*	*	*	*	*	
2011	*	*	*		*	*	*		*	*
2012	*	*		*	*	*	*		*	
2013	*	*	*		*	*	*	*	*	*
2014	*	*	*	*	*	*	*		*	*
2015	*	*	*			*	*		*	*
2016 Mar	*	*			*	*	*	*	*	
2016 Sept	*	*	*	*	*	*	*	*	*	*
2017 Mar	*	*				*	*		*	*
2017 Sept	*	*	*		*	*	*	*	*	*
2018 Mar	*	*	*		*	*	*	*	*	*
2018 Sept	*	*	*	*	*	*	*		*	*
2019 Mar	*	*	*		*	*	*	*	*	*
2019 Sept		*	*		*	*	*		*	*
2020	*	*	*	*	*	*	*	*	*	*

Legend:

NLC – National Land Code
TCPA – Town and Country Planning Act
SDBA – Street, Drainage and Building Act
SMA – Strata Management Act
AA – Architect Act
UBBL – Uniform By-Law
Strata – Strata Title
PAM – PAM Contract
LAM – LAM circular
HDA – Housing Development Act

3. Methodology

The research design follows a mixed methodology of quantitative and qualitative data collection and analysis. The quantitative method applied to answer the research objective which is the types of knowledge required by graduate architects to support the building contract administration work. Data collected were analysed using frequency distribution analysis and relative importance index (RII). The qualitative method was applied to triangulate the data. Data collected were analysed using thematic analysis. The result generated from the quantitative and qualitative methods was used to develop a list of building contract administration knowledge for graduate architects. The research methodology for this study was presented in Figure 1.

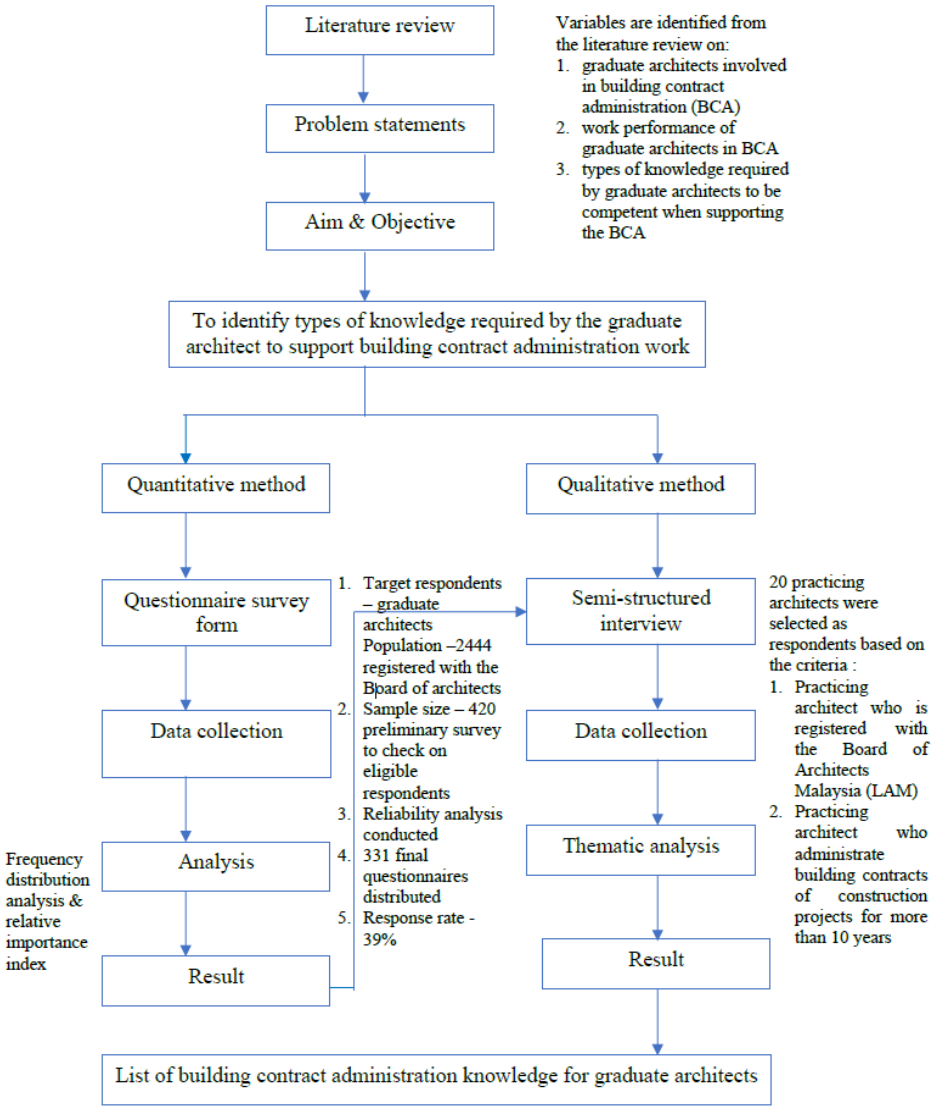

Figure 1. Research process diagram. (Source: Author).

3.1. Quantitative Method - Questionnaire Survey

Previous research studies highlighted that a questionnaire survey is one of the most cost-effective ways to collect and analyse a large number of responses to achieve better frequency distribution analysis of data (Singh, 2006) [22]. This survey was undertaken to ascertain the types of knowledge required for graduate architects during supporting the building contract administration work. A preliminary survey consisting of 10 respondents was conducted online to test the questions prior conduct the final survey. The final online questionnaire comprised of 5 sections was built in Google Forms and distributed with emails. Completing it took approximately 10 min. 5 point Likert scale was selected for this questionnaire design, in which a set of items was proposed concerning a particular attitudinal object for the scaling respondents' method. The scale was

chosen because it allows extreme agreement and disagreement to be expressed.

The results of the responses were analysed using frequency distribution analysis and Relative Important Index (RII) which represents the strength of response from 0.2 to 1.0 for each statement where 1.0 indicate 100% strongly agreed by all respondents and 0.2 is 100% least agreeable (Kothari, 2004) [23]. RII value is calculated based on the formula below:

$$RII = \sum w/(A*N)$$

W is the weighting given to each factor by the respondents (ranging from 1 to 5), A is the highest weight (i. e. 5 in this case) and N is the total number of respondents.

3.2. Sampling

A purposeful sampling method was employed in this research. The criterion for selecting respondents is as follows:

a. A graduate architect who registered with the Board of Architects in Malaysia (LAM)

b. A graduate architect who work 2 years and above in contract administration work;

c. A graduate architect who managed projects during the construction phase

Graduate architects who fulfilled all 3 criteria will be qualified as respondents. There are a total of 2444 graduate architects registered with the Board of Architect Malaysia in December 2020. Based on Krejcie and Morgan's (1970) table for determining sample size, for a given population of 2444, a sample size of 331 would be needed to represent a cross-section of the population (Krejcie & Morgan, 1970) [24]. However, Sekaran and Bougie (2009) noted that the return rates of online survey questionnaires are typically low. A response rate of 30 percent is acceptable for the research (Sekaran & Bougie, 2016) [25]. The response rate for online surveys should not be less than 30 percent to ensure its adequacy (Hoxley, 2008) [26]. Therefore, the minimum sample size for this research should be 100.

3.3. Qualitative Method - Semi-structured Interview

According to Bachiochi &Weiner (2004) [27], the number of respondents for the interview should be between twenty (20) and forty (40) respondents to have sufficient views of the expert. Twenty (20) qualified respondents were identified based on willingness for this study. The selection criteria of the respondents for the interview were as follows:

1. Practicing architect who is registered with the Board of Architects Malaysia (LAM)

2. Practicing architect who administrates building contracts of construction projects for more than 5 years

An interview guide was developed focusing on the following key aspects:

1. Respondent's suggestions on types of knowledge required by graduate architects during supporting the building contract administration work

2. Respondent's suggestions on methods to obtain the relevant knowledge to enhance graduate architects' work performance

Open-ended questions around the aforementioned aspects were used, and follow-up questions such as "Could you please give me an example?" "Could you explain further?" were asked throughout each interview to further explore the meanings attached to the respondent's statements. Pilot interviews with 2 practicing architects were conducted to test the questions before the final semi-structured interviews. All the interviews were conducted in the respondent's workplace within 45 minutes. All data were collected and analysed using content analysis. The result of the interviews was then coded and grouped into similar themes.

4. Findings

Data collected from the quantitative method- questionnaire survey had been analysed using frequency distribution analysis and the qualitative method- semi-structured interviews had been analysed using thematic analysis presented in the subsection below.

4.1. Quantitative Method- Questionnaire

The questionnaire instrument elicited the types of knowledge required by graduate architects during support building contract administration in Malaysia. There are 420 nos preliminary surveys sent with email to search for eligible respondents and found 331nos respondents were eligible. From the survey, as shown in Table 3, there are 127 good responses from practicing graduate architects were obtained out of 331 final questionnaires sent out online. This has given a response rate of 39% which is acceptable based on research done by Sekaran & Bougie (2016) [25].

Table 3. Response rate.

Item	Description	Frequencies
1	Number of questionnaires sent out	331
2	Total returned questionnaire	130
3	Incomplete questionnaire returned	3
4	Complete questionnaire returned	127
5	Valid percentage returned	39% > 30%

4.1.1. Profile of respondents

An analysis of the graduate architects' profile in Table 4 showed that 50% have construction experience spanning 5-9 years, and 45% of the graduate architects have construction experience of over 10 years. This suggests that the respondents have sufficient industry experience to provide valuable insights into graduate skill expectations and observed competencies. Further, the result showed that 60% of the graduate architects have 5 or above housing projects suggesting that the graduate architects are actively engaged in supporting the building administration practice. The results of the graduate architects' profile revealed that 36% were 30 years and below, 31% of the respondents were in the 31 – 40 years age bracket, and 33% were above 40 years of age. Regarding the duration of employment, 10% have had 1 – 5 years of support building contract administrator experience, 65% between 6 – 10 years, and 26% of the respondents have worked supporting in administering building contracts for more than 10 years. Hence, the respondents are conversant with the knowledge required to support the building contract administration work.

Table 4. Respondents' profile.

Years of Experience in Architectural Practice	Frequency	% of total
Below 5 years	6	5%
5–9 years	63	50%
10–14 years	31	24%
15 years or above	27	21%
Total	127	100%
Age	Frequency	% of total
25–30 years	46	36%
31–40 years	39	31%
41–50 years	24	19%
Above 50 years	18	14%
Total	127	100%
Number of housing projects	Frequency	% of total
Below 3	26	20%

Cont.

Years of Experience in Architectural Practice	Frequency	% of total
3	16	13%
4	9	7%
5 or above	76	60%
Total	127	100%
Years in support building contract administration work	Frequency	% of total
1–5 years	13	10%
6–10 years	82	65%
11–15 years	1	1%
16–20 years	30	24%
Above 20 years	1	1%
Total	127	100%

4.1.2. Analysis of Questionnaire Survey Data

(a) Types of knowledge required by graduate architects during support the building contract administration work

Concerning the types of knowledge required by graduate architects during supporting the building contract administrator as shown in Table 5, the respondents' RII value showed that legal study knowledge (RII=0.8890) is important, followed by quality and assessment management knowledge (RII=0.8780), design management knowledge (RII=0.8772), contract documentation knowledge (RII=0.7988) and communication and relationship management knowledge (RII=0.7670). There is a need to instill legal study knowledge to reinforce graduate architects on the understanding of contract documents, certification process and guidelines, and authority submission process to secure the architect's integrity (Sebastian & Davison, 2011) [28]. Legal study knowledge covers certification, contract, and authority matters (Murdoch & Hughes, 2002) [29]. Respondents chose the 'authority submission process' as compulsory knowledge to graduate architects when supporting the building contract administration work. This is due to the building approval process in Malaysia being complicated and time-consuming which is consistent with the literature (Rahim, 2004) [30]. Rahim (2004) stated that there is a lack of coordination between the internal authority department which caused confusion and complication to the submission process, i.e. incident occurred when the authority officer was unsure about the scope of work and submission requirement.

The second type of legal study knowledge selected by respondents is construction law. Construction law covers certification and contract documents etc (Murdoch & Hughes, 2002) [29]. The majority of complaints relating to the certification problem are related to graduate architects failing to advise architects accordingly and causing wrongful certification (Byrne, 2007) [31]. Respondents perceived that graduate architects need to improve their legal study knowledge by familiarizing the certification guidelines in the Act, roles, and responsibilities of a certifier to minimize these incidents.

Malaysia has a long history of payment disputes in the construction industry (Fenn et al., 1997) [32]. Types of disputes include underpayment, late payment, or non-payment issues which lead to delay or abandonment of construction projects (Cheung, Suen, & Lam, 2002) [33]. The Government of Malaysia enforced a law in parliament known as the Construction Industry Payment and Adjudication Act, 2012 (CIPAA) to provide speedy and cost-effective dispute resolution for payment issues in the construction industry (Shamir, 2016) [34]. Graduate architects should familiar with CIPAA to advise the disputing party to utilize it when necessary.

The findings underscore the need to instill communication and relationship management knowledge by graduate architects. This result agrees with Zerjav & Ceric (2009), that communication skills are essential to produce effective communication however it relies on interpersonal skills which also depends on the speaker's qualification and cultural background. In addition, the effectiveness of communication also would be seriously

hampered by a lack of appropriate data channels, improper channels, and inaccurate data transfers. Clear communication keeps projects from failing (Wasserman, Sullivan, & Palermo, 2000) [35]. It is to the advantage of everyone involved in construction to be able to communicate clearly and efficiently as the greater the empathy between individuals the better the communication and the greater developer satisfaction with the end product (Hoezen, Reymen, & Dewulf, 2006) [36]. However, respondents selected this theme as the least required knowledge by graduate architects as they preferred more on contract documentation knowledge which recorded everything in black and white that may assist them to interact with others, communicate with prospective clients, lead a team, follow instructions, and complete task on time rather than communication and relationship management knowledge (Jena & Satpathy, 2017) [37].

Table 5. Analysis of the types of knowledge required by graduate architects during administering building contracts in Malaysia.

Code	Mitigation Measures	Frequency						Relative Important Index	Average Index	Level of Importance	Rank
		1	2	3	4	5	Total				
	Legal Study Knowledge										
K18	Authority approving process	0	0	7	42	78	127	0.911811	0.888977	Most important	1
K10	Construction contract law	0	1	18	46	62	127	0.866142			
	Communication and relationship management knowledge										
K7	Structural engineering	1	4	21	53	48	127	0.825197			
K3	Town planning	0	7	23	47	50	127	0.820472			
K6	Electrical engineering	1	6	24	53	43	127	0.806299			
K5	Mechanical engineering	1	5	29	51	41	127	0.798425			
K9	Quantity Surveying	3	4	31	45	44	127	0.793700	0.766929	Least important	5
K14	Interior design	2	9	34	50	32	127	0.759055			
K13	Landscape	2	12	29	54	30	127	0.754331			
K8	Geotechnical engineering	4	15	41	38	29	127	0.714960			
K4	Civil engineering	10	24	45	29	19	127	0.636220			
K20	IT Construction	1	8	41	42	35	127	0.760630			
	Contract documentation knowledge										
K1	Project management	0	1	8	44	74	127	0.900787			
K16	Variation study	1	9	29	57	31	127	0.770079	0.798819	4th important	4
K15	Financial planning	3	11	31	44	38	127	0.762205			
K17	Environmental studies	1	10	34	49	33	127	0.762205			
	Design management knowledge										
K3	Architecture	0	7	23	47	50	127	0.900787	0.877165	3rd important	3
K19	Feasibility studies	2	0	12	61	52	127	0.853543			
	Quality assessment and management knowledge										
K11	Construction methods	0	1	9	56	61	127	0.878740	0.877953	2nd important	2
K12	Building materials	0	1	12	51	63	127	0.877165			

4.2. Qualitative Method- Semi-Structured Interviews

The semi-structured interviews elicited the types of knowledge required by graduate architects during

supporting the building contract administrator in Malaysia. There were 20 respondents selected for these interviews. The average duration of the semi-structured interviews is 45 mins.

4.2.1. Profile of Respondents

A total of twenty semi-structured interviews were conducted and the demography of the interviewees are provided in Table 6. 60% of the interviewees are local graduate with a mean age in the range of 30–40 years. They have working experience of > 0 years in supporting the building contract administrator and work in their current architectural practice for >10 years.

Table 6. Demography of interviewees.

Respondent Code	Age Range	Education Background	Years of Working Experience	No. of Years Working in the Current Workplace
A1	50–60	Local grad	>10	>10
A2	20–30	Local grad	6–10	<5
A3	30–40	Local grad	>10	>10
A4	50–60	Overseas grad	>10	>10
A5	30–40	Local grad	>10	>10
A6	30–40	Local grad	>10	>10
A7	30–40	Local grad	>10	5-10
A8	20–30	Local grad	6–10	<5
A9	40–50	Local grad	>10	>10
G10	30–40	Overseas grad	>10	5–10
A11	30–40	Overseas grad	>10	<5
A12	40–50	Overseas	>10	>10
A13	30–40	Overseas grad	>10	5-10
A14	30–40	Local grad	>10	>10
A15	30–40	Local grad	>10	5-10
A16	20–30	Overseas	6–10	<5
A17	30–40	Local grad	>10	<5
A18	40–50	Overseas grad	>10	<5
A19	30–40	Local grad	>10	<5
A20	20–30	Overseas grad	6–10	<5

4.2.2. Analysis of Semi-structured Interviews

Types of knowledge required by graduate architects during supporting the building contract administration work.

All respondents have agreed that legal study knowledge is important for graduate architects, for instance, A13 stated: “It is the consultant’s responsibility when dealing with authority matters. If the graduate architect who supports the building contract administrator is unfamiliar with authority matters, the entire project will be ruined” [A13]. Similarly, the rest of the respondents felt that legal study knowledge is important for graduate architects, especially during advice to clients on the project time frame.

Results in Table 7 showed that respondents felt that contract documentation knowledge after legal study knowledge is important to graduate architects when supporting the building contract administration work. The perception of contract documents is important as referred by respondent A4: “Dispute normally occurred when

documentation is incomplete. This incident could have been prevented if graduate architects have contract documentation knowledge to manage the project properly during construction commencement" [A4].

Over half of the interview respondents indicated that communication and relationship management knowledge and followed by design management knowledge is important for graduate architects, for instance, A7 stated: "Learning communication and relationship management will assist the graduate architects to join the discussion and 'merge' into the project team and inevitable assist in their design management as they understand the project stakeholder's requirement better" [A7].

40% of the respondents agreed that quality assessment and management is the least significant knowledge required by graduate architects. This result is different from the results collected from quantitative analysis. With regards to quality assessment and management knowledge, A1 indicated that: "This kind of knowledge can be easily obtained if you know how to ask the right question to the right person" [A1].

Table 7. Architects' opinions about types of knowledge required by graduate architects during supporting building contract administration work.

	Responses from Architects	Number of Responses
What types of knowledge are required by graduate architects during supporting the building contract administration work?	Legal study knowledge	20
	Communication and relationship management knowledge	11
	Contract documentation knowledge	12
	Design management knowledge	10
	Quality assessment and management knowledge	6
	Familiarize yourself with the latest certification guidelines and requirements	15
	Prioritizing the communication and relationship management based on the construction industry's needs and incorporating it into education	5
How to obtain the relevant knowledge to enhance graduate architects' work performance?	Improve clarity in contract documents	12
	Use simple language	14
	Conduct post-occupancy evaluation	8
	Education and training	17
	Conduct site walks more often	10
	Obtain the inventory list of building materials and construction methods for assessment	6

5. Discussion

Types of knowledge required by graduate architects during supporting the building contract administration had been categorized into 5 themes, i. e. legal study knowledge, contract documentation knowledge, communication and relationship management knowledge, quality assessment, and management knowledge, and lastly design management knowledge. The importance of this knowledge to graduate architects had been ranked differently based on data obtained from the questionnaire survey and semi-structured interviews as per stated in Table 8.

Table 8. Result from the ranking of the important types of knowledge to graduate architects during supporting the building contract administration work.

Types of Knowledge	Rank in the Questionnaire Survey	Rank in Semi-Structure Interviews
Legal study knowledge	1	1
Contract documentation knowledge	4	2
Communication and relationship management knowledge	5	3
Quality assessment and management knowledge	2	5
Design management knowledge	3	4

5.1. Legal Study Knowledge

Both questionnaire survey and interview respondents agreed that legal study knowledge is crucial for graduate architects when supporting the building contract administrator. Questionnaire survey respondents chose the 'authority submission process' as the most important knowledge to graduate architects which is also agreed by interview respondents, for instance, G17 stated that: "Understanding the flow of submission process will be a big advantage during project planning" [G17]. However, the authority submission process in some countries is not well defined which caused confusion (Rahim, 2004) [30].

This is consistent with the literature when there is a lack of coordination between the internal authority department and graduate architects unfamiliar with the submission process (Rahim, 2004) [30]. The developer is unable to predict the time frame for their building development, for instance, G13 stated that: "Our client unable to launch their project as the submission process seemed eternity" [G13]. Subsequently, time and cost overspent and many development projects had been abandoned. Therefore, graduate architects must understand the authority submission process to advise the client accordingly (Derrington, 1981) [16]. Interview respondent G8 suggested: "More road shows and seminars should be organized for graduate architects to understand the latest authority's requirement" [G8].

5.2. Contract Documentation Knowledge

Questionnaire survey respondents and semi-structured interview respondents have different opinions regarding the importance of contract documentation knowledge to graduate architects during supporting the building contract administrator. Questionnaire survey respondents have different opinions about the importance of contract documentation knowledge. Questionnaire survey respondents voted this type of knowledge in 4th ranking. Interview respondents voted high ranking for this type of knowledge as they perceived that contract documentation is interrelated with construction disputes which can be prevented. This is aligned with a previous study done by Agbaxode (2021) which emphasized the importance of complete documents to avoid litigation cases in construction. Previous studies also stated the importance of contract documents to prevent rework (Simpeh, 2012) [38].

According to interview respondents, graduate architects found contract documents difficult to understand due to the usage of jargon language and complicated phrases. Understanding contract documentation is important as it will directly affect project management (Mohamad & Madon, 2006) [39]. Project management in construction range from the operational activities of architectural and engineering construction companies to the development of infrastructure in every country and it emphasizes the relationships among various operational activities during the project life cycle (Walker, 2015) [17]. Interview respondent, A9 suggested that: "Use simple language in contract documents will prevent unnecessary misinterpretation" [A9].

5.3. Communication and Relationship Management Knowledge

Both questionnaire survey respondents and interview respondents have different opinions about the

importance of communication and relationship management knowledge to graduate architects during supporting the building contract administrator. Questionnaire survey respondents voted that this type of knowledge is least important to graduate architects while interview respondents voted this type of knowledge is important.

Interview respondents felt that communication and relationship management knowledge is important to graduate architects as this will enable them to convey messages and understand clients' requirements better. This perception is aligned with a study done by Anumba &Evbuomwan (1997) [40] which stated that graduate architects who are familiar with communication and relationship management will gain a better understanding of each scope through different expertise to reduce the severity of problems brought along through ineffective communication. This may directly influence the quality of service provision, and the quality of the finished building and help to reduce the potential for conflict during a project's life cycle (Rahman & Gamil, 2019) [41]. The greater empathy between individuals the better the communication and the greater the client satisfaction with the finished building (Emmitt & Gorse, 2006) [42]. Interview respondent, A2 suggested: "Educators may incorporate communication and relationship management as a subject in the curriculum by prioritizing terms based on industry demands as communication and relationship management scope is huge and is impossible to learn all of it" [A2].

5.4. Quality Assessment and Management Knowledge

Questionnaire survey respondents voted high ranking for quality assessment and management knowledge while interview respondents have vice-verse opinions. Interview respondents felt that this type of knowledge is more for contractors rather than graduate architects. This is consistent with the literature where the contractor is the one who executes the work on-site (Allen & Iano, 2019) [43]. This knowledge consists of quality management, the ability to solve a technical problem, and technical skills. The unfamiliarity of construction detail by graduate architects will cause the contractor to make their own decision to use the easiest method and shortest time to resolve a design problem in which the majority will sacrifice aesthetics and functionality to become questionable. Graduate architects should acquire this knowledge for quality assessment, to protect the owner's interest against substandard materials and bad workmanship (Allen & Iano, 2019) [43].

5.5. Design Management Knowledge

Both the questionnaire survey and interview respondents have the same consensus for design management knowledge. They agreed that this type of knowledge is not the most important compared to other types of knowledge. Management of architectural design is essential to deliver design intent and optimising value to a wide range of project stakeholders (Best, 2006) [44]. Interview respondent A3 suggested: "Graduate architects may improve their design management knowledge from post occupancy evaluation where you receive feedback from end users regarding the building design" [A3].

The link between knowledge about how buildings are designed and used and the practical world of design and construction decisions exists in programming and post-occupancy evaluation (POE) (Wang, Tang, Qi, Shen, & Huang, 2016) [45]. However, often voluminous results of POE studies lie unread on graduate architects' shelves or are published in academic journals seldom consulted by practitioners (Meir, Garb, Jiao, & Cicelsky, 2009) [46]. Subsequently the new building programs, far from integrating feedback from completed and occupied buildings, usually takes the form of a rapid summary of square footage requirements and projected growth in the number of users (Chohan et al., 2011) [47]. Therefore, the design process is reinventing the wheel or reusing ideas designers have developed on their previous projects.

6. Conclusion

Analysis results in Table 9 showed that there are 5 types of knowledge required by graduate architects during supporting the building contract administrator. The types of knowledge required by graduate architects from the questionnaire survey and semi-structured interviews have slight differences in ranking. However, both the survey and interview respondents agreed that legal study knowledge is the most important knowledge for

graduate architects during supporting the building contract administration. This result agrees with Rahim (2004), that part of the legal study knowledge which includes the authority approving process is the most required knowledge by graduate architects as it affects the overall master program planning. Their finding is parallel with findings by Marzukhi (2020) [48], who confirmed that authority submission is a lengthy process and various forms and permits need to be submitted and obtained respectively before construction.

Both questionnaire survey and semi-structured interview respondents have different opinions on the ranking of importance for contract documentation knowledge, communication and relationship management knowledge and quality assessment, and management knowledge. However, survey respondents and interview respondents agreed that design management knowledge is not the most important knowledge for graduate architects during supporting the building contract administrator compared to other types of knowledge. This is parallel with the previous study which stated that contract documentation knowledge is more important than design management knowledge for graduate architects during supporting the building contract administration work (Walker, 2015) [17].

Overall, the researchers agreed with the result obtained from semi-structured interviews as the ambiguities that existed in the assessment tool had been clarified to improve the precision for the assessment. This study could well serve as a guideline and reference for a graduate architects to enhance their work performance when supporting the building contract administrator and indirectly minimized project delays caused by contract administration issues. It would produce graduate architects with sound professional practice capabilities that align with their interests so that they are managed to support the building contract administrator of this era. In addition, this study also contributes to the body of knowledge on the features of job satisfaction for graduate architects and assists companies in formulating strategies to enhance the performance of graduate architects.

However, more research needs to be conducted to examine the method of graduate architects to gain these types of knowledge to improve their work performance, obtain their professional qualifications, and better project delivery.

7. Study Limitations

The low overall response rate due to respondents who received the electronic version of the survey turned out to be more time-consuming and difficult than anticipated despite the results of the pilot work. The data was collected electronically. The absence of hard data may have contributed to the respondents' inability to rank order the frequency. In addition, survey respondents are probably more familiar with rating scales than ranking ones. The respondents more frequently used the extreme values, 1 and 5, in particular as ratings of the perceived occurrence of the various obstacles, root causes, and mitigation measures.

Table 9. Summary list of knowledge required by graduate architects when supporting building contract administration work.

Types of Knowledge	Description
Legal Study Knowledge	
K10-Construction contract law	This knowledge is required to minimize disputes among the project team
K18-Authority approving process	This knowledge is required to advise the developer on the time frame for master planning for the development
Quality assessment and management knowledge	
K11-Construction methods	This knowledge is required to assess contractor construction following the spec
K12-Building materials	This knowledge is required to assess the contractor's submission compliance with the spec
Design management knowledge	
K3-Town Planning	This knowledge is required to ensure building design fit in surrounding
K19-Feasibility study	This knowledge is required to study the viability of certain plot land for the benefit of current development

Cont.

Types of Knowledge	Description
Contract documentation knowledge	
K1-Project management	This knowledge is required to ensure the project is complete within the time, cost, and quality specified
K15-Financial planning	This knowledge is required to control project costing
K16-Valuation studies	This knowledge is required to weigh the viability of each option before the decision
K17-Environmental studies	This knowledge is required to furnish appropriate design according to the site context
Communication and relationship management knowledge	
K3-Town Planning	This knowledge is required to ensure building design fit in surrounding
K4-Civil engineering	This knowledge is required to ensure infra enhance building design
K5-Mechanical engineering	This knowledge is required to allocate appropriate rooms for services
K6-Electrical engineering	This knowledge is required to allocate appropriate rooms for services
K8-Geotechnical engineering	This knowledge is required to furnish design according to the site context
K9-Quantity surveying	This knowledge is required to minimize variation orders and cost control
K13-Landscape	This knowledge is required to allocate appropriate planting areas in the design
K14-Interior design	This knowledge is required to accommodate the user's preference for space layout
K20-IT for construction	This knowledge is required to utilize BIM for checking possible clashing of services

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