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Performance Barriers affecting Graduate Architects in Architectural Firms: A Systematic Literature Review

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Abstract

Graduate architects assist architects in carrying out stage one work (design), stage two work (working drawings) and stage three work (site supervision) in Architectural Firms. Graduate Architects hold a Master's degree in Architecture and are yet to pass their professional examination. The capability of a graduate architect when assisting an architect in managing a project is critical in reducing performance barriers. This research aims to identify the most critical performance barriers that graduate architects face during project implementation. This paper examines the performance barriers that are faced by graduate architects and is a timely study as the increasing population and building construction developments will provide ample opportunities for them to perform better. A systematic literature review of credible sources from different databases, examining key issues related to performance barriers, has been carried out based on bibliographical variables and conceptual categories. Accordingly, a data set of fifty articles and five selected case studies were analysed using thematic analysis. The five most crucial performance barriers identified are external environment factors, poor project documentation management skills, lack of soft skills, inadequate quality assessment management skills, and a shortfall in design management skills. The study's outcome is expected to equip the graduate architects to devise proactive risk mitigation measures that will reduce the impact of these barriers and improve project delivery.

Keywords: Architectural Firms, graduate architect, management skills, performance barriers.

1. Introduction

An architect is a qualified professional who translates building requirements into practical reality. They act as an agent, advisor, or contract administrator for building projects (Ostime, 2019). When an architect starts on a project, they work on three key steps: define, design and refine (RIBA, 2020). The architect is responsible for defining the program after understanding the owner's written narrative statement of needs (Ostime, 2019). This statement is the project brief where the client explains their needs, budget, and requirements to the architect. The second step is the schematic and preliminary design in architectural agreements (RIBA, 2020). The schematic design, in the form of a bubble diagram, shows the flow of spaces to give an overall view of the concept design and is expanded to include alternative exterior elevations.

The design phase represents the required period to take the design and refine the details of appearance, structure, mechanical, electrical and plumbing systems and to select the finishes (RIBA, 2020). This is where the coordination with the various consultants takes place- to avoid any clashing of mechanical, electrical and plumbing (MEP) services with the building design. Building Information Modelling (BIM) is a medium utilised to detect 'clashing' in the building design. The final phase is where the work produced during the earlier designing and refining phases has been developed to such an extent that a contractor can build from the results (RIBA, 2020), whereby the architect translates the conceptual design into a buildable design through construction drawings. Accordingly, the architect will assume the duty as the contract administrator when the contractor is mobilised to the site and commences the construction.

As defined by RIBA, the graduate architect refers to a person yet qualified to be named an architect, albeit providing design or management services in the

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architectural consultancy practice (Demkin, 2001). They act as an assistant to the architect, carrying out tasks such as the submission of drawings, arranging and preparation of schematic design drawings, tender, construction, and contract drawings, coordinating with consultants and surveyors, chairing meetings, conducting site walks, handling discussion with the supplier and contractors (Ostime, 2019). Besides being an assistant, the graduate architect mainly administers the building contract on behalf of the architect during its construction (Chappell & Dunn, 2015).

The graduate architects are expected to perform during their practice- in line with the view that they undergo two types of training during their architectural education: architectural training and the practical training system (Gundes & Atakul, 2017). This practical training emerges as an important opportunity to gain real-world experience in higher education and to bridge the gap between the passive learning environment in academia and the changing demands of the workplace. There are two types of practical training; the first includes work practice in a typical architectural design office, and the second is the construction site internship, where the intern is required to monitor and actively participate in the execution of works (Gundes & Atakul, 2017). The significant contribution of this program is for the architecture students to acquire soft skills such as teamwork, leadership, communication, and problem-solving skills, which in their recruitment of graduates the employer values more than specialist subject knowledge. The program also improves the graduate architects' construction employability skills, enabling them to better fit in the working environment (Gundes & Atakul, 2017).

Khodeir's (2020) research has however highlighted that employers have often given negative criticism regarding the graduates' attributes at the early stage of their careers. Architectural Firms are dissatisfied with the quality of the graduates and have noted that they have to re-train fresh graduates to make them fit for their jobs before starting their practice (Laila Mohamed Khodeir & Nessim, 2020). The best opportunity for practical training of students before they graduate is during six months of Industrial Training in Architectural Firms. This means that Architectural Firms are partly responsible if there is any gross inadequacy during practical training. There is a significant gap between education and practice that is faced by architecture students (Khodeir, 2018). The graduate architects' knowledge from education is insufficient to cope with the career's requirements. Thereby, some graduate architects spent more time exploring, through trial and error in administering building contracts to acquire the necessary skills and experience because of insufficient exposure or lack of guidance while at work (Açici, Ertaş, Aras, & Özdemir, 2014; Hai, 2010).

Previous literature indicated that a graduate architect failed to perform due to the inability to acclimatise to the working environment (Szumlic, 2017). The conditions, scenarios, and case studies described in education are far more idealistic than the real world. Hence, the transition from the safety of an academic environment to that of independent practice turns into a frightening experience, described as 'reality shock' in literature (Serafin, Danilewicz, Chyla, & Czarkowska-Pączek, 2020). The graduate architects are confused in this new environment where they are unsure of how to utilise the knowledge they have obtained from education in practice. This was proven by Alharbi, Emmitt and Demian (2015), who stated that education focused on creating a knowledge base but not on bringing such knowledge into practice. The graduate architects faced various performance barriers when managing a construction project. Therefore, it is crucial to identify the barriers that hinder the performance of graduate architects so that they can resolve them accordingly and perform more effectively in administrating building contracts.

2. Research Methodology

This research adopted a systematic literature review to summarise the available evidence with little or no bias. A systematic literature review is a well-planned review to answer specific research questions using an organised and explicit methodology to identify, select, and critically evaluate the results of the studies, including the literature review (Rother, 2007). The adopted review process for this study is based on the recommended Rother et al. (2007) and is summarised in the study eligibility flow chart in Figure 1.

2.1 Review question(s)

The research investigates the types of performance barriers faced by graduate architects when managing a building contract. The review questions are as follows:

1) What barriers hinder the graduate architects' performance when managing a building project?
2) What are the mitigation measures that enable them to perform while administering the building contract?

2.2 Inclusion and exclusion criteria

The inclusion criteria were defined as follows:

1. All articles related to the graduate architects' current practice in the construction industry and the barriers.
2. All available journals, conference papers, or theses related to the performance barriers in managing the construction project during the contract implementation and management phase.

The list was refined by establishing four selection criteria for exclusion:

1. The research was focused on the mitigation measures only.
2. Literature was written in a language other than English
3. Research on the perceived barriers by other non-construction professions was disregarded.
4. Studies of performance barriers in other phases, excluding the construction phase.

2.3 Search Strategy

The initial step was to identify the relevant literature through searches of several databases (ISI Web of

Science, SCOPUS, and Google Scholar), combining the following series of keywords and search terms: 'graduate architect', 'construction industry', 'contract administrator', 'building contract', 'performance barrier' and 'architects'. Publications in the reference lists of the initial database supplemented this literature.

2.4 Screening

The screening process includes the following: -

1. The result obtained from the database search were listed based on relevance.
2. Each article's title and abstract were checked to determine their relevance.
3. Relevant articles were saved to a specific folder using a reference management program (EndNote).
4. The total number of relevant articles and types was recorded.

2.5 Results of the search

The search results were presented in the 'Findings' section.

2.6 Data Extraction

The data extracted from multiple research articles require organisation into themes and categories by the author to be understood. The content is coded based on different themes and is organised based on descriptive metrics for each reported case of performance barrier.

2.7 Quality/rigour evaluation

The sources of articles that have been collected include books, book sections, conference papers, journal articles, and theses that suggest the different levels of rigour which influence the findings. Hence, they are all taken into consideration for this study.

2.8 Synthesis

The content of each article was read, analysed and coded to a theme or subtheme relevant to the research.

2.9 Reporting findings

The findings of the systematic review are reported below.

2.10 Case Studies

Case study research is a fundamental research methodology for applied disciplines, contributing to understanding real-world phenomena. It allows the researcher to explore individuals or organisations simply through complex interventions, relationships, communities or programs and supports the deconstruction and the subsequent reconstruction of various phenomena.

A case study is used to illustrate and assess how the proposal meets the aims of creating purposeful mitigation measures and meeting the profession's demands in a supportive environment that fostered development. Details of the case studies are described in Table 1. The case studies were selected based on the following criteria:

1. Suite apartments or service apartments that are under the residential category.
2. Strata housing– high-rise buildings due to strata housing projects are long-term transactions with high uncertainty and complexity.
3. A project is under the contract implementation and management phase because this is the construction process where the architect's blueprint will be converted into reality.
4. Private development uses the PAM contract, whereby the superintendent officer will be the architect with a contract duration ranging from 30-36 months.
5. The architect had been appointed as the building contract administrator.

Five ongoing housing projects that met the above criteria were selected for this study.

3 Findings

3.1 Search results

The following tables sum up the databases included in this literature study: results from the database search stated in Table 2, the number of selected articles sorted by year of publication indicated in Table 3, and the main sources of articles shown in Table 4.

3.2 Documentation Analysis

Construction documents such as progress reports, request for information, and correspondence between consultants and contractors are a type of archival material that provides two sorts of information- observations of the obstacles faced during the construction stage and the possible mitigation measures.

The contract documents from the case studies shown in Table 5 were collected, thoroughly studied, and analysed to investigate the themes which can be classified and matched to the survey data collected. From the analysis, the types of barriers can be categorised into technical information, social and legal aspects, as shown in Table 6.

3.3 Graduate Architects in Contract Management and Implementation Phase

Graduate architects have been found to be active in managing building contracts ever since they were permitted to do so under By-law 5 in the Uniform Building by-law (UBBL, 2013). However, due to inexperience and a lack of skills, e.g. negligence in supervision, insufficient

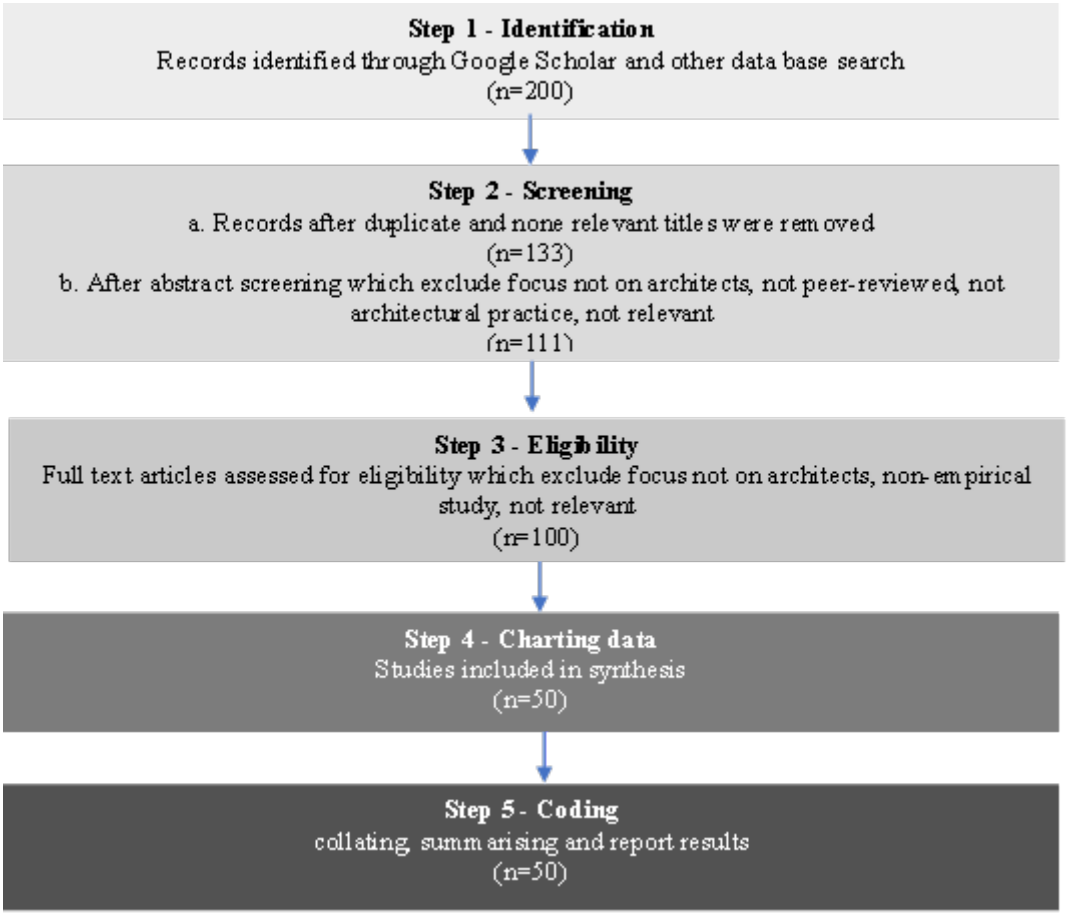

Figure 1: Study eligibility flow chart

Table 1: Case studies selection

Name of Project	Location of Project	Size of Project
Project A	Kuala Lumpur	Three blocks 33 floors apartments
Project B	Kuala Lumpur	Two blocks, 23 floors of apartments
Project C	Kuala Lumpur	One block 31 beds affordable apartment
Project D	Kuala Lumpur	Two blocks 42 floors service apartments
Project E	Kuala Lumpur	Two blocks, 32-45 floors service apartments

Table 2: Result from Database searches

Number of Articles	Web of Science	Scopus	Google Scholar
Deemed relevant	65	56	79

Table 3: Number of Articles by year of publication

Year	Articles
Before 2000	5
2001 – 2010	14
2011 - 2016	17
2017	4
2018	1
2019	3
2020	1
2021	5

Table 4: Source of Articles

Source	No. of articles
Conference proceedings paper	7
Book	8
Theses	4
Journals	
Procedia Social and Behavioural Science	2
Journal of Construction, Engineering Management	3
Engineering, Construction and Architecture Management	2
Journal of Project Management	1
Civil Engineering & Environmental	1
Transaction of Engineering Management	1
International Journal of Sustainable Construction Engineering and Technology	1
Journal of Education and Arts	1
Journal of Performance Constructed Facilities	1
Interdisciplinary Journal	1
Journal of Built Environment	2
Journal of Construction in Developing Countries	1
Journal of Research in Engineering	1
Journal for Theory & Practice of Socio-Economic Development	1
Journal of Construction Project Management	1
International Journal of Project Management	1
Journal of Management in Engineering	1
International Journal of Applied Engineering Research	1
International Journal of Innovation & technology management	1
Procedia Engineering	1
Frontiers of Architectural Research	1
Alexandria Engineering Journal	1
Journal of Legal Affairs & Dispute Resolution in Engineering & Construction	1
Emerging Science Journal	3

Table 5: Details of the selected housing projects for case studies

	Project A	Project B	Project C	Project D	Project E
No. of blocks	3	2	1	2	2
No. of storey	33	23	35	34	32-45
Types of building	Residential	Service apartment	Residential	Service apartment	Service apartment
Gross Floor area (sq ft)	2,280,635	485,199	450,286	692,205	830,090
No. of unit	2000	429	515	584	705
Location	Mukim Setapak	Mukim Kuala Lumpur	Mukim Setapak	Mukim Batu, KL	Mukim Batu, KL
Month of construction	36 months	72 months	25 months	72 months	30 months
Contract period / Completion Date	15 August 2017 – 14 August 2020	15 August 2016 – 15 February 2021	8 June 2018 – 8 July 2020	1 November 2014 – 31 July 2021	3 August 2020 – 5 June 2023
Construction cost	300,000,000	Confidential	80,800,000	638,000,000	161,000,000
Building layout	L shaped	Cluster form	Linear	Linear	Linear
Current status	Completed	Completed	Completed	Completed	Under construction

Documentation of the designer's work, failure to comply with the authority requirement, unclear detailed results, contradictory information, unbuildable details, uncoordinated systems and coordination errors, the graduate architects perform poorly in management, which led to chaos in the construction projects (Mohamed, Ridwan, Saoula, & Issa, 2019).

Professionals who the Board of architects represents regularly critique the incomplete education of the students they employ after graduation. Notably, the graduates' deficiencies are viewed to be related to their insufficient skills, which they also fail to reflect upon during their office work (Szumlic, 2017). As Duffy and Bowe (2010) claim, older architects sometimes lament what they see as a decline in technical skills among their younger

colleagues. Also, schools of architecture report failure by their graduates to meet employers' expectations (Tzonis, 2014). Many have enumerated that the missing skill is the notoriously exhibited incapacity to communicate effectively with professionals at building sites while supervising activities on behalf of the architecture office. In addition, poor technical knowledge and the misunderstanding in professional communication with construction management and the project team retard the construction progress (Celadyn, 2020).

4. Discussion of findings

Numerous barriers were common to graduate architects, including the points shown in Table 7.

4.1 Poor Project Documentation Management Skill

The most crucial performance barriers identified from the literature and case studies are 'poor project documentation management skill'. This theme comprises five barriers: ' PB7-inexperienced', 'PB21-lack guidance proper documentation', 'PB25-conventional management protocol', 'PB28-ineffective management', and 'PB36-incomplete documentation during award'.

Proper documentation of a construction project includes generating sufficient records to affect the history of the construction process. Documentation of an event should consist of "what happened, when it happened, how it happened, when it was discovered, whose responsibility, who was notified, to whom and when was notification is given, what was the impact of the event, what immediate action is required, what longer-term action is required and which party will be responsible for resolving the problem" (Gallo, Lucas, McLennan, Parminter, & Tilley, 2002).

The significant impacts of proper documentation are to have a future case study for problem reference; to date ease for tracking of job history; a reduced possibility of future misunderstandings, disagreements, or disputes by committing important events into writing; to possess supportive documents if mediation, arbitration or litigation is pursued (Senaratne & Mayuran, 2015). Arbitrators gave the example of problems they encountered the most- concerning documentation, where one party failed to provide documentary evidence, which in their opinion, could have altered the outcome of the case (Kangari, 1995). The party with the most comprehensive and detailed records will have the decided advantage in any dispute resolution proceeding (Arditi & Robinson, 1995).

Inadequate and deficient design and documentation directly impact the construction process's smoothness (Aiyetan, 2013). Correspondingly, Tilley et al. (2002) have identified that the lack of briefing by the client and the graduate architects who furnish preliminary detail design has caused constructability problems for the contractor. They have also identified information deficiencies and poor coordination between the design disciplines as the main issues affecting the project documentation. According to Love et al. (1997), rework and non-conformance costs are due to the lack of design and documentation to transfer information during the design process.

The study from DeFraites (1989) has stated another point of view, where a decline in the design fee levels and the reduction in the amount of time for design, especially a complex construction project, have contributed as factors to poor design and documentation performance (Trach, Pawluk, & Lendo-Siwicka, 2019). A preliminary design violates the quality of documentation (Laila Mohamed Khodeir & Nessim, 2020; Love & Edwards, 2004). The situation becomes worse with the appointment of inexperienced staff who lack technical knowledge, which could lead to errors and omissions in the contract documentation (Love & Edwards, 2004). The most frequent causes of severe deviations during design were poor planning or resource allocation and deficient or missing input and changes (Gallo et al., 2002; Jaffar, Tharim, & Shuib, 2011).

To resolve this issue, proper documentation involves and requires the creation of sufficient records to affect the history of the construction process (Fawzy & El-Adaway, 2012; Levy, 2018). Proper documentation means important events are accurately and promptly recorded. The prompt receipt, review, transmission, distribution and tracking of the documents are critical elements of project administration (Rochegova & Barchugova, 2016). Documentation of this process must be complete, accurate, and timely. For example, shop drawing submission, request for information (RFI), material or sample or the method of the submission of the statement should be recorded in the list of submissions, which consists of the tracking number, date as to when the request was created, date sent to the architect, date when a response is required, a brief description of the question and the answer from the consultants, (Oke, Bhekisia, & Aigbavboa, 2016; Heerkens, 2002). A regular review of an outstanding contractor's submission should occur during the site meeting, where the status should be documented accordingly (Agbaxode, Dlamini, & Saghatforoush, 2021; Oke et al., 2016). Close monitoring of the RFI status is required as it will affect either the cost or time, which will generate

Table 6: Identified graduate architects' performance barriers through literature

No.	Performance Barriers	No. of studies
1	External environment factors	8
2	Poor project documentation management skill	16
3	Lack of soft skill	9
4	Inadequate quality assessment management skill	11
5	The shortfall in design management skill	11

Table 7: Performance barriers faced by graduate architects identified from the case studies

Code	Performance barriers summarised from case studies	Project A	Project B	Project C	Project D	Project E	Code	Performance barriers summarised from case studies	Project A	Project B	Project C	Project D	Project E
PB1	Miscommunication				*	*	PB22	Insufficient design details	*		*		
PB2	Slow decision	*		*			PB23	Design & detail error	*		*		
PB3	Lack coordination				*	*	PB24	Lack of info in drawings				*	*
PB4	Delay reply queries	*	*	*			PB25	Conventional management protocol	*	*	*	*	*
PB5	Poor contract management knowledge	*		*		*	PB26	Impractical design	*		*		
PB6	Lack Information				*	*	PB27	Incomplete design info				*	*
PB7	Inexperienced	*	*	*	*		PB28	Ineffective management	*			*	
PB8	Construction complexities	*		*			PB29	Poor design management	*		*		
PB9	Design degrade				*	*	PB30	Error during design	*		*		
PB10	Discrepancy contact form	*		*		*	PB31	Complex details	*		*		
PB11	Searching for Alternative building material	*	*	*			PB32	Non-compliance to specification	*	*	*		
PB12	Inadequate site inspection	*	*	*			PB33	Lack of understanding of clients' requirement				*	*
PB13	Confirming alternative materials	*	*	*			PB34	Design changes	*		*		
PB14	Alternative design proposal	*	*	*			PB35	Poor info use				*	*
PB15	Unaware legal policy	*		*		*	PB36	Incomplete documentation during the award	*	*	*		
PB16	Unclear building contract	*		*		*	PB37	Poor site supervision & inspection	*				
PB17	Inappropriate performance measurement	*	*	*			PB38	Uncertainty advising other stakeholders				*	*
PB18	Poor specification	*		*			PB39	Attending to client-driven design changes	*		*		
PB19	Non-integrated project delivery	*	*	*			PB40	Low priority to quality performance measure	*	*	*		
PB20	Keep track of inspection.	*	*	*									
PB21	Lack of guidance and proper documentation	*	*			*							

A variation in the order proposal. If the contractor proposes a construction detail or the graduate architect requests a change during the site visit, this should be documented in the revised construction drawings (Rochegova & Barchugova, 2016). An email requesting an inspection is a verification that the inspection has been conducted, and a report of the results of the inspection should be documented (Levy, 2018; Stanton, 1990). All cost estimates for extra work must be confirmed in writing to avoid misunderstanding the amount of the quotation or the scope of work involved (Rochegova & Barchugova, 2016). All variation orders should be numbered sequentially for ease of identification, tracking, and so forth (Heerkens, 2002).

4.2 Inadequate Quality Assessment Management Skill

The second crucial barrier identified through this study is inadequate quality assessment skills. In this category, there are barriers such as 'PB4-delay reply queries', 'PB13-delay confirm alternative material', 'PB14-unsure alternative material proposal', 'PB17-inappropriate

performance measurement', 'PB19-none integrated project delivery', 'PB20-keep track of inspection', 'PB37-poor site supervision and inspection', and 'PB40-low priority to quality performance', 'PB11-searching alternative building material' and 'PB32-non-compliance to specification', as well as 'PB12-inadequate site inspection'.

Several factors hamper the construction quality of buildings; these include the fact that the site management has not been allocated sufficient time for quality management, which the consultants provide. Consequently, time limitation has restricted the contractor's ability to achieve quality; among the project stakeholders, a low priority is given to quality performance measures, and the scarce involvement of the architect in the project has also hindered quality achievements (Asadi, Wilkinson, & Rotimi, 2021; Tilley, 2005).

Incidents of a graduate architect who seldom carried out a site visit and was unsure what item to inspect during an inspection had caused design detail to be overlooked, which ended with a variation order with additional cost (Weinberger, 2005). Some architects don't have a clear idea of what to expect or look for when they go on-site inspection (Mohammadi, 2021).

Nevertheless, the unfamiliarity of design detail by the graduate architect will cause the contractors to make their own decision, which is to use the most straightforward method and the shortest time to resolve a design problem, whereby the majority will sacrifice aesthetics and functionality (Nicol & Pilling, 2000; Rounce, 1998). Hence, basic knowledge of the construction method and material specification is important for the graduate architect (Tzonis, 2014).

Problems arise when there are unclear technical requirements of the materials, construction techniques during quality control (Pooworakulchai, Kongsong, & Kongbenjapuch, 2017), and no proper guidelines on the workmanship quality (Love & Edwards, 2004). Graduate architects face difficulties inspecting workmanship quality due to the lack of detailed guidelines for reference (Mahdavinejad, Ghasempourabadi, Ghaedi, & Nikhoosh, 2012).

To improve quality management, additional drawings and details may be issued from time to time during the contract (Heerkens, 2002). The graduate architect should give greater attention to the following quality management practices: the requirements of the clients and end-users, producing correct and complete drawings and specifications, coordinating and checking contract documentation, conducting design verification, controlling changes, and committed to providing quality service (Levy, 2018; Mahdavinejad et al., 2012).

The modification of the design, quality or quantity of the works, the correction of discrepancies between the contract documents, the removal of materials from the site, the opening up of covering work, the condemnation, replacement and remediation of defective work, the postponement of work, the dismissal of incompetent or misconducting personnel, and any other matters that are related to the contract shall be formalised with an instruction (Agbaxode et al., 2021). Moreover, an intensive review of plans and specifications is a must between the consultants to counter-check discrepancies and for practicality (Heerkens, 2002). All parties must thoroughly examine the documents to uncover problems at the early stage, which reduces the impact and associated costs (Tilley, 2005). Conducting a regular site inspection is necessary to discover poor workmanship. Site inspection allows the detection and rectification of defects and non-compliance work in an early stage (Pressman, 2006). Visits may be at regular intervals, programmed to coincide with particular events on-site, or unannounced spot checks (Weinberger, 2005). According to Ling (2004), a site inspection checklist developed for all architectural components will ease supervision and monitoring. Prompt notification to the contractor of acceptable work, materials, or equipment will improve the workmanship quality on site (Ling, 2004). Sample panels and mock-ups will be required to be submitted to the graduate architects for study and to change complicated details before production work begins so as not to impede the progress (Heerkens, 2002).

4.3 Shortfall in Design Management Skills

The third significant barriers that are measured within the literature that constitute design management include- ‘PB2-slow decision’, ‘PB18-poor specification’, ‘PB22-insufficient design detail’, ‘PB29-poor design management’, ‘PB31-unworkable detail’, ‘PB34-constant design changes’, ‘PB39- attending to employer drive design changes’, ‘PB23-design and detail error’, ‘PB8-construction complexities’, ‘PB26-impractical design’, and ‘PB30-error design drawing’.

Many quality and efficiency problems have been experienced during the design process due to inadequate design management (Wang, Tang, Qi, Shen, & Huang, 2016). According to Tzortzopoulos and Formoso (1999), poor design management contributes to poor design process performance, with the following being the main problems: poor communication, unbalanced resource allocation, lack of adequate documentation, lack of coordination between disciplines, deficient or missing input information, erratic decision making (Lopez, Love, Edwards, & Davis, 2010; Tilley, 2005). From a construction perspective, design is a complex process (Enshassi, Sundermeier, & Zeiter, 2017; Tilley, 2005). Graduate architects spend inadequate or inappropriate effort planning and controlling the design process (Tilley, 2005). Subsequently, the design team lacks a common direction; thus, information cannot flow efficiently between the parties to resolve design problems (Levy, 2018). Levy (2018) stated that incidents of delays in completing design tasks or missing information in design documents appeared when graduate architects failed to plan the information flow concerning the various tasks.

The architect should be able to step in and advise accordingly when a defective design causes variation (Warnock, 2019). There are circumstances where the contractor has highlighted unworkable design yet has obtained further input on the next course of action from the architect (Jaffar et al., 2011). This case occurs when there is a poor design or an incomplete design by the project's designer, poor management expertise, various technological and social issues, site-related problems, and

the application of improper tools and techniques (Gunduz & Elsherbeny, 2020). The scarcity of professional construction knowledge or relevant professional foundations had rendered the graduate architect who ran the building contract unsuitable in making the appropriate resolutions (Pooworakulchai et al., 2017) and had caused lots of trials and errors at the site, which subsequently delayed the entire work progress.

In this regard, the graduate architect should focus on four factors- planning and executing, resolving disputes, optimising design and promoting techniques (Wang et al., 2016). This factor indicates the need to understand and commit to the client's interest. A feasible design plan should be prepared to meet the client's requirements (Wang et al., 2016). Clients should freeze the project's scope as early as possible to minimise the risk of cost and an increase in the schedule (Heerkens, 2002). While executing the design plan, adequate resource input is necessary to achieve the required design quality and time schedule (Levy, 2018).

Resolving disputes is a type of design-related claim management whereby the client raises additional requirements during the construction, and the variations are not adequately recorded. (Wang et al., 2016). The graduate architect should appropriately deal with design-related claims with the support of well-managed design documents (Arditi & Robinson, 1995).

The third factor, optimising design, is related to the cost of design options (Rounce, 1998). This primarily relies on design change management through approaches such as value engineering (Wang et al., 2016). Constructability and value engineering (VE) exercises should be undertaken after the baseline scope has been developed (Rounce, 1998). VE study should be undertaken with the entire project team, including the contractors and relevant subcontractors, to improve project constructability and reduce the potential of change at a later stage (Douglas III, 2003).

The fourth factor is promoting techniques, which comprises advanced technologies in design changes for cost reduction (Wang et al., 2016). The graduate architects may utilise BIM to improve coordination among the project stakeholders since using general and conventional two-dimensional CAD drawings does not support a truly collaborative approach (Arayici et al., 2011). These drawings are not integrated and usually pose a clash of information. Building Information Modeling (BIM) is a set of interacting policies, processes and technologies generating a methodology to manage the essential building design and project data in digital format throughout the building's life cycle (Arayici et al., 2011). It assists the project stakeholders to visualise what is to be built in a virtual environment and to identify potential design, construction or operational clashes and problem, which invariably improves the quality of design, and construction and reduces rework.

The graduate architect should manage the design team by providing them with an assessment of the design status and the potential for change. Important changes should be reviewed and authorised through a systematic and structured scope. At the same time, the client should 'sign off' work as the design progresses and be alerted to the consequences associated with initiating a change (Levy, 2018; Nielsen, 2010).

4.4 Lack of Soft Skill

From the study, the lack of soft skills emerged as the fourth barrier to the graduate architect, according to previous studies. This theme consists of 'PB1-miscommunication', 'PB6-lack information', 'PB3-lack coordination', 'PB9-design degrade', 'PB24-lack information on drawings', 'PB27-incomplete design information', 'PB33-lack understanding of the client requirement', 'PB35-poor information use', and 'PB38-uncertainty advise from other stake holders'.

Communication is one of the fundamental aspects of the construction industry and is the key to project success (Sahlstedt, 2012; Zerjav & Ceric, 2009). Communication covers all tasks related to producing, compiling, sending, storing, distributing and managing project records (Oke et al., 2016; Romano & Nunamaker, 2001). It also includes an accurate report on project status, performance, change and earned value (Emmitt & Gorse, 2009; Hayes & Westrup, 2014). However, communication among project stakeholders is not always concise and effective, which is unsuccessful and has resulted in poor communication (Hoezen, Reymen, & Dewulf, 2006).

Zerjav and Ceric (2009) posit that most construction professionals know communication in construction projects is reasonably inefficient compared to other industries. Factors of poor communication include the fear of communicating, delayed notification of the change, lack of sector experience, individual barriers, slow information flow among parties, the lack of an effective communication system and platform, lack of confidence, informality, improper communication channel, a lack of mutual trust among team members, poor communication management, inaccessibility of project information, incorrect delivery of instructions or technical information, the lack of communication procedure and training, poorly detailed drawings and complexities of the construction industry (Gamil & Rahman, 2017). Most construction practitioners have policies relating to written communication, but guidelines for verbal communication are generally less regulated. Poor communication and communication overload among the project stakeholders are shown to directly correlate with the project delivery outcomes, adverse events and undesirable additional costs or time (Emmitt & Gorse, 2006).

To combat these, a practical guide to arm the graduate architect with effective tools is crucial to ensure a satisfactory exchange of information in the context of contract administration. Accordingly, a structured approach to communication has significant advantages (Dainty, Moore, & Murray, 2007). When confronting an issue, the graduate architect may use the approach of introduction, situation, background, assessment and recommendation (Dainty et al., 2007). This tool can be useful for the graduate architect as a means of communicating with project stakeholders about the change in design or details and prompts them to state the current situation, give relevant background, state assessment or study findings and recommendations in any situation (Anumba & Evbuomwan, 1997). This means of

communication involves the usage of construction terms. There are a lot of circumstances where graduate architects cannot keep up with the conversation due to unfamiliarity with common building jargon (Sak, 2021). Hence, understanding construction terms or terminology is essential to enable them to navigate the construction industry and communicate without obstruction among the project members (Sak, 2021).

4.5 External Environmental Factors

According to the study, external environmental factors are an insignificant barrier to graduate architects. This theme comprised four types of obstacles: ' PB5-poor contract management knowledge', 'PB10-discrepancy of contract forms', 'PB15-unaware legal policy', and 'PB16-unclear building contract'.

Fraudulent certification has happened in the following scenarios- when the contract administrator has signed a certificate which they did not prepare or supervise, has over-certified a housing project which is incomplete or prematurely certified vacant possession which is unfit for occupation or is without the supportive documents (Abotaleb & El-Adaway, 2017). Incidents of wrongful certification have occurred due to the graduate architect being unaware of the architect's legal responsibilities and scope of duties (Abidin, 2012). These incidents occurred due to an increase in building developments while there was a limited number of architects in the country. Thus the architects were unable to commit hands-on to a lot of projects. Therefore, they have to rely on the graduate architect to furnish site progress information and prepare the certificates.

Besides certification, it was found that the graduate architects also faced the problem of understanding a contract document (Mohamed et al., 2019). This issue occurs when the contract documents are too thick and consist of many legal jargons and phrases that are irrelevant to the associated materials, the use of difficult languages, unclear specifications that are illogical in nature, being unfamiliar with the form of contract that is used, and requirements that are not clear and are too general, and so on (Mohamad & Madon, 2006; Ndekugri & Rycroft, 2014).

This will lead to misinterpretation and misunderstanding of the facts in contract obligations that cause construction risks such as disputes, claims, litigation, shoddy works, and reworks (Ajator, 2017; Bell, 1958). The detrimental effects cause project delays, undermine team spirit, and increase project costs. Therefore, it is necessary to understand the contents of the contract documents as this will significantly influence the smooth and good performance of the construction project.

A proper understanding of the contents of the contract documents is essential to the enhancement of contractual relations and assurance of the intended deliverance of the product. The graduate architects must check on contract documents to see whether the content matches the contract drawings or specifications and an understanding of the sales and purchase agreement before the commencement of the administration work (Bin Zakaria, Binti Ismail, & Binti Yusof, 2013; Kavanagh & Miers, 2021; Ostime, 2019). To improve the legal knowledge of the graduate architects, some suggestions have been made: the drawing must be clear and checked by all parties, clarity in the contract documents for better understanding, contract documents are to be written in simple language, contract documents must be precise, objective and practical, the regulatory requirement has to be clearly explained, bill of quantities are to be clearly and objectively detailed, minimise the use of complicated legal phrases, the general condition of the contract has to be made familiar (Kasi, 1998; Mohamad & Madon, 2006).

5 Conclusion

Graduate architects who take part in administering the building contract during the construction stage have increased in recent years as the rate of building construction and development in Malaysia has grown tremendously. The graduate architect will be dominant in managing building contracts under construction if the architect has been given authorisation. The role of the contract administrator will drive the success of the project implementation. Hence, the capability of a graduate architect as a contract administrator is critical in reducing the challenges encountered. Accordingly, identifying these barriers is essential in sourcing mitigation measures as resolutions.

This study aims to identify graduate architects' most crucial performance barriers to graduate architects in their career development in project management through a comprehensive perspective of the literature and case studies on the subject. Correspondingly, a thematic analysis has been conducted through a literature search along with selected case studies. A group comprising five types of barriers has been identified and summarised in Table 8. Each barrier has been described in detail in Appendix, and a specific list of references has been provided.

To uncover the underlying barriers, five main groups of barriers are manifested, where the most crucial performance barrier that has been identified is the limitation in project documentation skills. The second critical performance barrier to graduate architects is the inadequate quality of assessment management skills, followed by a shortfall in design management skills. The fourth barrier that has been identified is the lack of soft skills. In contrast, external environment factors are an insignificant barrier to the graduate architect during the contract administration phase.

This paper provides insights into the contemporary issues that are relevant to graduate architects' management of construction projects. The presented findings would assist the graduate architects in planning better, sensible, and efficient measures to ease a crisis. By taking care of these potential barriers in their present and future projects, graduate architects can reduce the additional cost and time implications and eventually increase the possibility of the project's success in the market.

This review benefits the project delivery for the architecture practitioners and the construction team. By understanding the performance barriers faced by graduate architects, solutions can be sorted out. Through timely

project delivery, the graduate architects will move a step closer to acquiring their professional qualifications and ease the tension among the construction team.

Limitations of this study are that although much effort has been employed to produce a comprehensive and exhaustive review, further studies are required on identifying knowledge, skills, roles, and responsibilities in construction projects for better professional practice development in building contract administration.

Table 8: Tabulation of the types of barriers, root causes and solutions

Problem	**Types of barriers**	**Root Causes**	**Solutions**
Graduate architects unable to perform during administrating building contract	Poor project documentation management skill	a. information deficiencies and poor coordination b. incomplete design c. deficient planning or resource allocation	a. creating sufficient records b. regular review of contractors' submission c. all changes should be formalised with instructions/letters
	Inadequate quality assessment management skill	a. insufficient time for quality management b. insufficient information provided by consultants c. no proper guideline on workmanship quality d. unclear technical requirements of material, construction techniques during quality control e. unsure what item to inspect during the site walk f. unfamiliar design detail	a. pay greater attention to clients' requirement b. producing correct and complete drawings and specification c. conducting design verification d. controlling changes e. intensive review of drawings for counter checking f. conduct a regular site walk g. submission of mock-up sample
	The shortfall in design management skill	a. unbalanced resource allocation b. lack of coordination between disciplines c. deficient or missing input information d. erratic decision making e. failing to plan information flow	a. planning and executing b. resolving disputes c. optimising design d. adopts BIM in design
	Lack of soft skill	a. fear to communicate b. delay notification of change c. lack of sector experience d. individual barrier e. slow information flow among parties f. lack confidence	a. adopt a structured approach to communication b. understanding construction terms/terminology
	External environmental factors	a. Unaware of the architect's legal responsibility and scope of duties b. difficult to understand contract document c. misinterpretation and misunderstanding of facts in contract obligations	a. drawing must be clear and checked by all parties b. the clarity in contract documents/contract documents written in simple language c. the regulatory requirement to be clearly explained d. to ensure contract documents match with contract drawings and specifications

Declaration of Interests

The authors report that there are no competing interests to declare.

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Appendix

Definition of the performance barriers

PB1- Miscommunication in terms of verbal/graphic

PB2- Slow decision-making/weak design

PB3- Lack of coordination between tasks when there is zero communication, and team players work in isolation

PB4- Delay reply to contractor queries/submission due to lack of technical knowledge

PB5- Poor contract management knowledge that unable to resolve the dispute between clients/consultants/ contractor

PB6 - Lack of documents/info which obstructed construction work progress

PB7 - Improper relevant training or is inexperienced when managing building contract

PB8- Complexities in the construction process where the work sequence on-site is unclear and caused complications during construction

PB9- Degrading design due to budget constraints and cost-saving purpose

PB10- Discrepancy in contract forms when there is a discrepancy between drawings and BQ

PB11- Searching for alternative building materials when developers intend to save cost

PB12- Inadequate examination of the site when site inspection is not carried out regularly

PB13- Difficulty in the selection of alternative materials which match with the original design intended

PB14- Design alteration proposed due to the client's requested

PB15- Unaware of latest Government policy/regulations as constantly changed and updated

PB16- Unclear about building contract / unfamiliar with the clauses in the contract

PB17- Inappropriate performance measurement where the architect is unable to assess the workmanship quality due to a lack of base standard

PB18- Poor specification when detail provided is unworkable

PB19- Non-integrated project delivery when the outcome of the end product is not similar to the original design

PB20- Keep track of inspections/work done on-site to track construction progress

PB21- Lack guidance on proper documentation and procedures when filing is not done properly and no record of correspondence

PB22- Insufficient design details, e.g. missing drawing details, specifications

PB23- Conventional management protocol - Stickiness of old methods / common practice

PB24- Impractical design caused difficulties during implementation / over-design scaled model displayed

PB25- Lack of information exchange platform/communication breakdown

PB26- Unsure of alternative methods/material submitted by contractors

PB27- Incomplete design information when some detail drawings or specifications are missing

PB28- Ineffective management where everything decision based on protocol and inflexible during decision making

PB29- Poor design management when the designer produced an unpractical design and the project team is yet to review it and advise accordingly

PB30- Error during design, such as detail provided is not workable or impractical design

PB31- Complex details where details were copied and pasted from a foreign designer, which is unworkable in the local context

PB32- Non-compliance to specification when unfamiliar with the original design intended

PB33- Lack of understanding of the client's requirement due to lack of experience and unfamiliarity with the current market's needs

PB34- Design changes when architect failed to comply with authority requirement / as per client's request

PB35- Poor info use when the correct information failed to convey to the right person

PB36- Incomplete documentation during award when tender drawings and documents are prepared within a tight time frame

PB37- Poor site supervision and inspection when an architect is unsure what to inspect during the site walk

PB38- Uncertainty in advising other stakeholders when lacking knowledge and experience

PB39- Attending to client-driven design changes when the architect is unable to make a firm decision and advise the client accordingly

PB40- Low priority to quality performance measure due to budget constraints and no standard of workmanship being set