Factors that influence achieving the time performance of high-rise building construction: contribution of the contractor quantity surveyor

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Abstract

High-rise (HR) development projects face significant risks and time constraints. The majority of owners seek the projects to be completed early. Early identification of the factors affecting CTP (Construction Time Performance) would allow to reduce or eliminate time overruns. The contractor plays a significant role in CTP. CQSs (Contractor Quantity Surveyors) have also been receiving increasing attention concerning CTP. The roles performed by CQSs can be utilized to control the factors affecting CTP. Therefore, this study focuses on the factors affecting CTP in HR buildings and the role of the CQS (Contractor Quantity Surveyor) in CTP. The study used a qualitative approach. Semi-structured interviews selected through purposive sampling were used to gather the required information. The data were manually analyzed using content analysis. Fifty-four factors were identified and classified under six categories. A new additional factor was identified. Interviewees endorsed 49 factors that have a substantial impact on CTP. Seventeen roles of CQSs were identified. The identified 17 roles can influence thirty-three CTP-related factors. The study intends to increase awareness of enhancing CTP related to HR building projects.

Keywords: Construction Time Performance, Contractor Quantity Surveyor, Contractor Quantity Surveyor Roles, High-rise building projects

1. Introduction

Over the years, the construction industry has faced many difficulties due to cost and time overruns on different construction projects. Even with modern technology and construction management approaches, cost and time overruns have become a highly common phenomenon linked with practically all building projects (Bentil et al., 2017). One of the most important requirements for modern successful construction projects is on-time completion (Hamzeha et al., 2020). The CTP (Construction Time Performance) of any construction project indicates the success of the project (Olawumi & Chan, 2019). CTP is the deviation between planned and actual completion dates (Walker & Shen, 2002). Construction time is typically linked to and functions with the actual project cost, as an increase in project completion time will add to the overall project cost and reduce project profitability (Meeampol & Ogunlana, 2006). CTP impacts the cost performance of all parties as it impacts the completion date, sequence of activities, and spending on direct and indirect costs (Meeampol & Ogunlana, 2006). Furthermore, if a project is delayed resulting in litigation, penalties, price increases related to inflation, delayed damages, and time extensions will be required (Dolage & Pathmarajah, 2015). HR (High-rise) building projects are rapidly emerging in modern urban areas to...
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meet the enormous demand for living space. HR buildings inexorably dominate the housing trend in the urban real estate market (Nguyen et al., 2020). The demand for dwellings in HR buildings, apartments, and condominiums has been fuelled by economic growth, increasing suburbanisation, and higher consumer expenditure (Saparamadu & Kumanayake, 2021). As a result, many real estate investors and construction companies are pooling their resources and funds to meet these requirements (Nguyen et al., 2020).

HR buildings are one of the most complicated projects, involving many stakeholders over a long period (Basari, 2017). Due to their environments’ complexity and dynamic character, HR building projects are impeded by time restrictions, uncertainty, and potential hazards (Perera et al., 2020). Further, the construction of HR development necessitates significant finance, legal approvals, sophisticated construction techniques, and cooperation from numerous project stakeholders (Santoso et al., 2003).

The financial and economic risks of HR building projects also impact project success in terms of time, cost, and quality (Perera et al., 2020). Time and cost overruns can occur during the pre- and post-contract phases, but most cost and time overruns occur during the construction phase (Frimpong, Oluwoye, & Crawford, 2003). The causes for cost and time overruns are slightly similar in all countries, but their magnitude varies depending on the circumstances of each country (Ndunguru, Niyonyungu & Yang, 2020). Management, environment, and resources highly affect CTP (Widowati & Rachmawati, 2020). Contractor-related delay issues have long been cited as one of the main causes of construction project schedule delays (Famiyeh et al., 2017). The contractor's earnings might increase if the delays are prevented or minimised, enabling contractors to grow their company and aid the expansion of the national economy (Dolage & Pathmarajah, 2015). Project completion time has been the subject of numerous studies (Le-Hoai et al., 2013) and multiple studies have been conducted in various developing nations to investigate CTP in HR residential apartments (Durdyev et al., 2017). Despite the concerns above, research on factors that affect CTP is still being determined and CTP in HR building projects has rarely been investigated from the Contractor's perspective. As a result, this research focuses on the factors affecting contractor-related CTP in HR building projects.

The effectiveness of construction professionals, including QSs (Quantity Surveyors), depends on various criteria, including their credentials, managerial abilities, leadership qualities, ethics, and motivation (Jongo et al., 2019). QS (Quantity Surveyor) has the expertise to effectively analyse both the construction work and the cost components of a project (Badu & Amoah, 2004). Further, QSs are responsible for the financial and commercial aspects of construction projects (Cunningham, 2014). QSs estimate and monitor construction costs, spanning from the first feasibility assessment of a project through its ultimate completion during the construction phase. Following construction, QSs may also engage in tax depreciation schemes, replacement cost calculation for insurance reasons, and, if required, mediation and arbitration. Professional QSs are in high demand due to their critical role in guaranteeing successful and efficient completion of construction projects. The role of a CQS (Contractor Quantity Surveyor) extends further than the day-to-day running of a building project, covering subcontract formation, forecasting of costs and values of the project, cash flow forecasting and the collation of the operation and maintenance manuals of the project. QSs have received increasing attention regarding CTP (Meeampol & Ogunlana, 2006). There is a need for more research on the contribution of CQS to the HR building CTP. In order to analyse the contribution of CQSs to CTP in HR building projects, this study focused on the factors affecting CTP, the significance of
CTP in HR buildings, CQS roles in HR building construction, and CQS roles that enable to control of CTP in HR buildings.

2. Literature Review

2.1. Importance of High-Rise Building Construction Time Performance

One of the most important goals of construction projects is to complete the projects on time without any or minimum obstacles during the process (Rauzana, 2016). The risks associated with HR buildings are higher than those associated with conventional buildings (Perera et al., 2020). Compared to horizontal structures, HR buildings have more critical routes (Fedorov et al., 2018). Authors further assert that any delay on one floor or a specific region will automatically influence the following floors, causing a delay in the overall project. Therefore, extensive planning and effective project management are essential to ensure the success of HR building projects (Juan, 2018). In addition, HR construction projects necessitate more construction logistics, security, complicated services vertical circulation systems heavy equipment and vertical MEP works than low-rise construction projects (Fedorov et al., 2018; Juan, 2018). Furthermore, the most recent industrial and technological advances can be witnessed in HR projects (Dwijendra et al., 2021). Time performance is one of the most crucial indications of project success, as HR-building projects serve as an operating foundation for other enterprises (Zhang & Zuo, 2016). In addition, its unique characteristics and massive investment demand beset the time and cost overruns (Shoar et al., 2022).

2.2 Factors Affecting Construction Time Performance

HR construction projects are difficult to complete on time (Do et al., 2021). HR buildings rely largely on human factors along with science and technology (Do et al., 2021). Several HR building projects are inefficient due to delays, cost overruns, poor quality, a lack of safety, unattractive aesthetics, and unfavourable reputations of builders and subcontractors (Basari, 2017). Fifty-four literature identified factors that affect HR building projects are grouped into six categories: owner, contractor, consultant, contract, contractual relationships, and external factors (Sunjka & Jacob, 2013; Agbenohevi, 2017; Hisham & Yahya, 2018). The client is the main participant throughout the construction process. Most of the owners seek quick project completion; nonetheless, they must carefully undertake appropriate research to determine the contract duration (Hwang & Low, 2012; Zidane & Andersen, 2018). The Owner's failure to hand over the construction site to the contractor at the inception of the project may lead to critical delay at the initial stage of the project (Assaf & Al-Hejji, 2006). In addition, the owner is responsible for ensuring that funds are made available on time because failure to do so could cause project delays or extensions (Hwang & Low, 2012).

It has long been acknowledged that contractor issues are the primary cause of construction delays (Famiyeh et al., 2017). Contractor-related delay factors include inadequate project planning and scheduling, contractor inexperience, frequent subcontractor changes, outdated technology, inappropriate construction methods, a lack of staff, poor communications and misunderstandings, mistakes made in the early stages, rework required due to errors, and other factors (Agbenohevi, 2017; Haslinda et al., 2018; Widowati & Rachmawati, 2020; Fashina, Fakunle, & Opiti, 2020; Lindhard et al., 2020). These factors can be classified into four categories: materials, equipment, workforce, and project management performance. The contract type and scope of work heavily influence how a contractor responds to various events (Gebrehiwet & Luo, 2017). Similarly, a contractor's ability to finish a project on time depends on available resources and the contractor's decision-making capacity (El-Gohary & Aziz, 2013).
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Famiyeh et al. (2017) claim that consultant delays would occur during the drawing preparation, contractor and client acceptance and approvals of design drawings, payment verification, and inspection processes. These delays can be caused by a variety of factors, including unskilled consultancy staff, insufficient qualifications, the absence of consultant site staff, underestimation of project costs, insufficient communication and coordination skills, and poor planning (Agbenohevi, 2017; Zidane & Andersen, 2018). Consultant inquiries and inspections during construction typically slow the project's progress (Braimah & Ndekugri, 2009). In addition, building codes and regulations, inflation in raw material prices, or the exchange rate can harm a building project (Durdyev et al., 2017; Fakunle et al., 2020). Also, some factors are beyond the construction participants' control (Omar et al., 2020). In such harsh conditions, contractors may face several complications, which generally decline the construction process (Sheikh et al., 2020). Therefore, each project member of an HR building project is expected to recognize and practice effective management techniques that will enhance performance in their specific construction-related duties (Meeampol & Ogunlana, 2006).

2.3. The Contractor Quantity Surveyor's Role in Construction Industry

QSs add value to construction projects primarily through financial and contractual management during the pre-construction, construction, and post-construction stages. QSs further contribute to the overall performance of construction projects by acquiring, developing, and deploying appropriate competencies (Dada & Jagboro, 2012). QS serves as an economist and a cost accountant on all aspects of a project throughout its lifecycle (Perera et al., 2020). The quantity surveying profession is constantly confronted with new market challenges and opportunities. These are frequently overlooked, owing to a lack of relevant skills and competencies (Dada & Jagboro, 2012). QSs are classified as Client QSs or Contractor QSs based on whom they work (Badu & Amoah, 2020). Contractors are among the most important project participants, and their behavior is increasingly scrutinized to improve the construction performance (Liu et al., 2019). Furthermore, the contractor has the responsibility to complete the work according to the contract (Suprapto et al., 2015). Typically CQSs are responsible for overseeing the project budget, managing costs, and managing contracts from the initial stage to completion (Seah, 2009).

The literature identified thirteen (13) roles of CQS, including estimating and tendering, sub-contractor and supplier selection, project planning, site organisation activities, interim valuation preparation, sub-contractor payments, variations, extra works, negotiation and preparation of claims, final accounts, arbitration and litigation, progress monitoring and cost control, work studies and documentation and record-keeping (Cunningham, 2014; Olanrewaju & Anahve, 2015; Smith, 2018; Yogeswaran et al., 2018; Badu & Amoah, 2020; Anugwo & Okorie, 2021).

2.4. Contribution of Roles of CQS on High-Rise Building Construction Time Performance

QS's involvement in procurement, cash flow management, and planning heavily impacts the CTP (Noor et al., 2020). Cost and schedule overruns are more common in large-scale and long-duration projects than in small-scale and short-duration projects (Senoucia et al., 2016). Improved contractor performance increases customer satisfaction, market competitiveness, and reputation for the quality of work (Ajibade, 2006). As a result, a potential contractor must offer qualified staff members with project management duties who can also control costs and timelines throughout construction. The project team employs the master program as a planning and monitoring tool (Juan, 2018). Contractors
coordinate resources to fulfil client demands and finish building projects on schedule (Ajibade, 2006). The project delay will lead to liquidated damages resulting in the cost of the extension and disruptions of some activities (Chong et al., 2012). Effective management of plants and equipment promotes project execution and aids in project delivery promptly (Aje et al., 2009). Therefore, the time limit is critical to CQS as every contract has time-bound projects to deliver. The CQS must ensure that the project is progressing on time. CQS also involved in resource planning and should effectively utilise the company’s assets and resources. The literature highlights factors affecting CTP. Nevertheless, a research gap exists in identifying elements affecting the CTP of HR building projects. CTP is crucial to CQSs as they must contribute to improving overall project performance. However, the contribution of CQS to CTP in HR building construction has rarely been examined. Therefore, this study analyses the CQS contribution to CTP in HR building projects and the roles of CQS that can be utilised to control the factors affecting CTP in HR building projects.

3. Methodology

Qualitative research is used to investigate the facts-based inquiry technique focuses on a particular group of individuals and allows for a wide range of topic choices and opinions and viewpoints of people (Maxwell, 2005; Creswell, 2014). It can be utilised for in-depth research on a vast subject (Austin & Sutton, 2014). The interview is a popular technique for gathering qualitative data because it serves as a guide for determining the data collection and verifying the literature findings (Bacon-Shone, 2015; Yin, 2011). According to Du Toit and Mouton (2013), interviews conducted in this sort of study allow researchers to confirm if the respondents’ perspectives match the findings of the literature review. This study primarily examined the factors influencing CTP and the responsibilities of CQS in an HR building. Semi-structured interviews provide much more scope for discussing and recording the respondent’s opinions and views (Husband, 2020). Qualitative research strategy has been chosen as the ideal method to validate the factors and CQS roles identified through the literature and to relate how the identified CQS roles can be used to mitigate the CTP in HR building projects through semi-structured interviews. Purposive sampling is an excellent strategy for obtaining data from specialists in the field under study (Etikan et al., 2016) and is used to select the professionals per Table 1.

Face-to-face semi-structured interviews were conducted with professionals working in contractor organisations who possessed theoretical and practical knowledge. The identified potential interviewees were contacted through emails and phone calls, and the interviews were carried out through online video conferencing. The interviewees were required to have compulsory qualifications of a minimum of five (5) years of construction industry experience and a minimum of three years of experience in HR building projects or a minimum of two years of experience in a similar research area. In addition, they were expected to fulfil three additional qualifications given in Table 1. The interviewees were chosen based on their accessibility and were required to fulfil at least three additional criteria from Table 1. Participants from various age groups were chosen for the sample as ideas could be generated depending on their varying experience levels. This sample has varying levels of exposure to the study's focus areas. Importantly, the chosen sample also competed with varying degrees of industry practices, assisting in the proper circumstances to raise the Contractor's CTP.
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Each interview lasted between 65 to 70 minutes. The interviews were utilised to validate the information gathered from the literature. Data saturation was reached after 15 interviews since previously gathered data were replicated in the gathered fresh data (Saunders et al., 2018). Saturation is a well-accepted benchmark that determines the size of a qualitative study (Guest & MacQueen, 2008). According to Hsieh and Shannon (2015), content analysis identifies the collected data and highlights significant ideas, characteristics and results. Manual content analysis is used as a data analysis technique.

4. Research Findings and Analysis

Factors Affecting HR Buildings Construction Time Performance

Fifty-four (54) delay factors that potentially affect the CTP of HR building projects were identified from the literature and classified into six categories. Mismatches between design and budget are highlighted as an additional factor from the interviews. Figure 1 shows the factors affecting CTP.
Figure 1. Factors Affecting Construction Time Performance in HR Buildings
Figure 1 shows that the majority of interviewees agreed with the factors listed in the literature in the context of HR building projects. Elements agreed upon by more than half of the interviewees (roughly eight interviewees) were determined to be the most significant factors. According to the above graph, more than half of respondents believe that 49 of 54 factors have a significant impact on the Contractor’s CTP. Although the factors affecting CTP are common in all projects, their impact can be significant when compared to other projects. Factors such as outdated technology, poor communication, poor testing and inspection, underestimation of project complexity, mistakes in the preliminary stage (soil investigation), work accidents, and obtaining municipal permits all have a significant impact on CTP in HR. There is significant investment uncertainty in HR buildings, according to Ptuhina et al. According to Ptuhina et al. (2015), there is significant investment uncertainty in HR buildings. Hong et al. (2011) also noted that HR buildings exhibit significant uncertainties in costs and duration due to the complexity of their structural work. Additionally, the alteration in elevation within these buildings leads to the development of chronic physiological stress and fatigue among the workers. Therefore, managing the financial and economic risks associated with these buildings merits more focus (Generalova & Generalov, 2015). Furthermore, simulation methodologies are frequently used, because traditional scheduling methods cannot account for the uncertainties associated with HR apartment construction projects (Fedorov et al., 2018).

Variations initiated by either client or consultant in HR building projects invariably result in poor time performance when added to midstream during construction. The most efficient way to minimise variations is for the client to provide a fully completed and presented project brief. Clients should also allow appropriate time for design consultants to create and document the complete and detailed design. Early understanding of the roles and responsibilities of clients and consultants can help to ensure that the initial design is modified as little as possible. It can help to reduce non-compliance with the client’s objectives and designs that result from a poorly written brief. An accelerated project timeline will result in an unrealistic contract duration, which may raise labour performance expectations and cause frequent site management disruptions due to delays in tool, equipment, and material delivery.

High labour performance standards may necessitate working overtime, resulting in physical exhaustion and worker demotivation. Poor workmanship will eventually have an impact on labour performance and output quality. Hiring a subcontractor with more credentials and expertise is recommended in an HR building project, even if spending more on hiring inexpensive subcontractors will result in project delays in the long run. Clients frequently view subcontractors as an extension of the principal contractor. The scope and duties of subcontractors must be communicated before the start of work on the construction site. Accidents caused by poor site safety can reduce work rates and efficiency, resulting in work disruptions and project schedule delays. Compared to other construction projects, the risk of accidents due to height is higher in HR projects. Also, respondents pointed out that selecting appropriate construction methods and new technologies is crucial to HR building projects.

4.2. Contractor Quantity Surveyor Roles in High-rise Buildings

The contractor is accountable for completing the project on time. A CQS is critical for cost administration, especially in HR building projects. Delayed project delivery will entail costs for the Client, and the Contractor will be held liable for any costs incurred due to their delays. CTP is crucial for the CQS since it directly affects project success. The interviewees believed that CQSs working in HR building projects...
attempt to improve CTP to maintain the goodwill and reputation of the company in the industry. Further, it also avoids unnecessary workloads, ensures future project achievements, maintains a good relationship with the client and consultant, ensures the cash flow as planned and ensures that the project is implemented and completed as scheduled. The literature identified 13 roles of CQSs in HR building projects, and four additional roles identified by the interviewees were given in bold letters. Figure 2 shows the roles of CQS in HR building projects.
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Figure 2. Roles of Contractor Quantity Surveyors Working in HR Building Projects

As illustrated in Figure 2, most interviewees resonated with the roles outlined in the literature. All 15 interviewees agreed that the main roles of CQSs working in HR building projects are estimating and tendering, selecting subcontractors and suppliers, conducting interim valuations, making subcontractor payments, measuring variations and extra works, preparing and negotiating claims, preparing final accounts, monitoring project progress and controlling costs, conducting work studies and maintaining documentation and record-keeping. All the interviewees except 15 agreed that CQSs working on HR building projects need to attend arbitration and litigation work. Nine interviewees agreed that CQSs have to attend site organisation and related activities, while eight agreed that CQSs need to attend project planning. I4, I5, I6, I10, I12, I13, and I15 argued that project planning is not a role of CQSs but the role of an Engineering staff. Further, I1, I2, I3, I7, I8, I9, I11 and I14 mentioned that CQSs are not directly responsible for the project planning, although CQS could facilitate it. On the other hand, I4, I5, I6, I18, I9, I13, and I15 argued that site organisation and related activities are not expected from CQSs. In addition, I1, I4, I6, and I7 introduced additional roles, including identifying procurement strategies, contractual communication, coordination with other professionals, and programme management.

4.3. Contractor Quantity Surveyors' Contribution to High-rise Building Construction Time Performance

Initially, interviewees were inquired about the feasibility of CQS to control the highly influential factors identified in HR building projects. According to the findings, the CQSs are unable to control poorly defined scope, insufficient contractor experience, outdated technology, mistakes in the preliminary stage (soil investigation), material shortage, low material quality, poor materials procurement programming, equipment availability, labour supply, labour productivity and insufficient consultant experience. Furthermore, the interviewees were specifically questioned about HR building projects involving the roles of CQS that can be used to control the identified factors. CQS can control thirty-three (33) factors, according to data provided by respondents, and are considered for further analysis. Even though CQS has control over contract-related factors such as inaccuracies and inconsistencies in contract documents and modification orders, respondents did not endorse any roles. Table 2 provides CQS's
roles applicable to control factors affecting CTP in HR building projects.
Table 2 - The Roles of CQS that are Applicable to Control Factors Affecting CTP in HR Building Projects

<table>
<thead>
<tr>
<th>Factors</th>
<th>Applicable Contractor QS’s roles</th>
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<tbody>
<tr>
<td></td>
<td>R1</td>
</tr>
<tr>
<td>Owner-related factors</td>
<td></td>
</tr>
<tr>
<td>Finance and payment of the completed work</td>
<td>✔</td>
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<tr>
<td>Variations (design changes/extra work)</td>
<td>✔</td>
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<tr>
<td>Unrealistic contract duration.</td>
<td>✔</td>
</tr>
<tr>
<td>Poor communications</td>
<td>✔</td>
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<tr>
<td>Slow decision-making by owners</td>
<td>✔</td>
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<tr>
<td>Owner interference</td>
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<tr>
<td>Contractor-related factors</td>
<td></td>
</tr>
<tr>
<td>Poor communication and misunderstanding</td>
<td>✔</td>
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<tr>
<td>Poor site management</td>
<td>✔</td>
</tr>
<tr>
<td>Construction methods</td>
<td>✔</td>
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<tr>
<td>Preparation and approval of drawings</td>
<td></td>
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<tr>
<td>Sub-contractor</td>
<td>✔</td>
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<tr>
<td>Improper planning</td>
<td></td>
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<tr>
<td>Mistakes during construction</td>
<td>✔</td>
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<tr>
<td>Work accidents</td>
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<tr>
<td>Underestimation of project complexity</td>
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<tr>
<td>Financial problems (difficulty in accessing credit)</td>
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<tr>
<td>Labour disputes</td>
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## Consultant-related factors

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<th>✓</th>
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<tbody>
<tr>
<td>Delays in preparation and approval of drawings</td>
<td></td>
<td></td>
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<td>✓</td>
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<tr>
<td>Waiting time for approval of tests and inspections</td>
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<td>✓</td>
<td>✓</td>
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<tr>
<td>Poor contract management</td>
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<td>✓</td>
<td>✓</td>
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<tr>
<td>Slowness in giving instructions</td>
<td></td>
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<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Absence of consultant's site staff</td>
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<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Poor communications</td>
<td></td>
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<td>✓</td>
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<tr>
<td>Delays in payments</td>
<td>✓</td>
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## Contractual relationship-related factors

<table>
<thead>
<tr>
<th>Factor</th>
<th></th>
<th>✓</th>
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<tbody>
<tr>
<td>Major disputes and negotiations</td>
<td></td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Poor communication between the parties</td>
<td></td>
<td>✓</td>
<td>✓</td>
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</table>

## External factors

<table>
<thead>
<tr>
<th>Factor</th>
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<tbody>
<tr>
<td>Work accidents</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Unforeseen ground conditions</td>
<td>✓</td>
<td></td>
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<tr>
<td>Inflation</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Weather condition</td>
<td>✓</td>
<td></td>
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<tr>
<td>Regulatory Changes and Building Codes</td>
<td>✓</td>
<td></td>
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<tr>
<td>Problems with neighbours</td>
<td>✓</td>
<td></td>
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**R1- Tendering and estimating, R2-Selecting subcontractors and the suppliers, R3-Project planning, R4-Site organisation activities, R5-Preparing interim valuation, R6- Preparing subcontractor payments, R7-Variations and extraworks, R8-Preparing and negotiating claims, R9-Final Accounts, R10-Arbitration and Litigation, R11-Progress Monitoring and cost control, R12-Work Studies, R13-Documentation and Record-Keeping, R14-Procurement strategy, R15- Contractual communication, R16-Coordination with other professionals, R17-Soft skills.**
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According to the above table, CQS’s roles including documentation and record-keeping (R13), site organisation and activities (R4), coordination with other professionals (R16), and contractual communication (R15) mainly manage most of the owner-related factors in HR building projects. The CQS contributes to six owner-related factors in an HR building project through proper documentation and work records and by properly organising the site and involving activities, it can contribute to five owner-related factors. The selection of sub-contractors and suppliers (R2) and project planning (R3) are the main roles of the CQS in contributing to most of the contractor-related factors in HR building projects. The CQS can manage three contractor-related factors by selecting suitable sub-contractors and suppliers. Also, the CQS can contribute to contractor-related factors by carrying out effective project planning. Therefore, when considering the contractor-related factors, those two highlighted are the main roles of CQS contributing to the time performance. The main roles of the CQS in contributing to most contractor-related factors in HR building projects are the selection of subcontractors and suppliers (R2) and project planning (R3). By selecting appropriate subcontractors and suppliers, the CQS can manage three contractor-related factors. In addition, by carrying out effective project planning, the CQS can contribute to contractor-related factors. As a result, when considering the contractor-related factors, the two (2) highlighted roles of CQS in contributing to time performance are the most important.

Contractual communication (R15) and coordination with other professionals (R16) are the main roles of the CQS in contributing to most of the consultant-related factors in HR building projects. The CQS contributes to six consultant-related factors by performing the contractual communication at the right time. Also, by coordinating with other professionals, the CQS can manage five consultant-related factors. Therefore, when considering the consultant-related factors, those highlighted two (2) are the main roles of CQS contributing to the time performance. Variations and extra works (R7) and documentation and record keeping (R13) are the main roles of the CQS in contributing to most of the contract-related factors. But they contribute to only one factor. Therefore, the contribution of CQS is less when considering contract-related factors. Documentation and record-keeping (R13), coordination with other professionals (R16), and arbitration and litigation (R10) are the main roles done by the CQS in contributing to most of the contractual relationship-related factors. However, the above roles contribute to only two or one factor. Therefore, the contribution of CQS is less when considering contractual relationship-related factors. Procurement strategy (R14) is the main role played by the CQS in contributing to all the external factors. Therefore, CQS can contribute to five external factors.

There are several causes for owner delays in finance and payment for finished work. They are as follows: poor financial management by the client, withholding of payment by the client, delay in valuation and certification of interim payment by the consultant, the Contractor's invalid claim, inaccuracy of valuation for work done, insufficient documentation and information for valuation, and delayed work by the subcontractors. As a result, CQS should communicate with the site and update the daily site progress. CQS must also properly claim the work items in interim bills at the end of each month, keep all necessary documentation, and do the cost estimation properly. Variations, whether proposed by the client or the consultant, always result in poor time performance in HR building projects when added midstream during construction. The most successful way to reduce the variations is to obtain a completed detailed client project brief at the initial stage. Clients should provide design consultants ample time to create and document the complete and detailed design. Early awareness of the roles and duties of...
clients and consultants can guarantee that the original design is changed as slightly as possible. According to I6, CQS is not involved in improving time performance during the design stage of HR building projects as the CQS does not involve the design stages. CQS should notify the variation, prepare the variation order as soon as possible, and identify and obtain the necessary resources for the variation without interfering with HR project performance. CQS can collaborate with the engineering team, offer guidance, and promptly notify or notify and verify the procedure in the event of an improbable event during the planning stage. Additionally, the CQS should guarantee that the project is moving forward following the programmed schedule. The majority of respondents claimed that CQS could not significantly control owner interference.

Early understanding of the roles and responsibilities of clients and consultants can ensure that the original design is changed as little as possible. CQS is not involved in improving time performance during the design stage of HR building projects, according to I6, because CQS is not involved in the design stages. CQS should notify the variation, prepare the variation order, and identify and obtain the necessary resources for the variation as soon as possible, without interfering with HR project performance. In the event of an improbable event during the planning stage, CQS can collaborate with the engineering team, offer guidance, and promptly notify or notify and verify the procedure. Furthermore, the CQS should ensure that the project is proceeding according to the planned timeline. According to the majority of respondents, CQS could not significantly control owner interference.

In HR construction projects, new building technologies are critical. During the planning phase, CQS should inspect the construction method. Using prior cost information, CQS can guide various construction techniques. Additionally, CQS required to hire subcontractors who suggest time-saving measures. According to the respondents, underestimating the project's complexity is another important element that impacts the Contractor's CTP. In order to properly estimate, CQS must take the complexity of the project into account. If there are any delays in approval, CQS must notify the appropriate parties. CQS must keep track of the project's development and promptly prepare the monthly cash flows. CQS must submit interim payment applications on time with adequate supporting documentation. In addition, CQS must estimate costs and keep track of the progress of subcontractors' work. The contract documents for any construction project will almost certainly contain errors and discrepancies. To reduce the delay caused by change orders, the CQS should prepare the variation as soon as possible. On the other hand, external factors typically occur without warning. All respondents agreed that external factors have an impact on the Contractor's CTP, particularly in HR building projects. Therefore, employing an appropriate procurement strategy can facilitate the uninterrupted construction process.

5. Discussion

HR building projects are time-consuming and fraught with risk due to their complexity and dynamic nature (Basari, 2017). More than 53% of projects are behind schedule, and more than 66% have experienced cost overruns due to the inability to make actual construction progress (Han et al., 2018). Cost and time overruns caused delays and losses for the parties involved (Haslinda et al., 2018). HR buildings are mostly used for business and residential purposes and must be sold as soon as possible to generate income. Also, project delay in HR building projects affects project costs influencing the work, resulting in project disruptions, extension costs and liquidated damages. Fifty-four factors influencing CTP of HR building projects were identified in the literature and under six categories; owner, contractor, consultant, contract, contractual relationships, and external factors.
Interviewees endorsed 49 factors that have a substantial impact on CTP. Poor communication is one of the most important owner-related factors influencing CTP in HR building projects. Whereas, variations (extra work/design changes), unrealistic contract time, owner interference, pending payments, improper planning, underestimation of project complexity, inadequate contractor experience, poor site management, poor construction methods, financial issues, poor material procurement programmes and poor communications, and misunderstandings are the most important contractor-related factors. Furthermore, poor communication and contract management are significant consultant-related factors influencing the CTP of HR building projects. Out of fifteen, ten interviewees agreed that the contract and contractual agreements impact the CTP of HR building projects. Most interviewees agreed that external factors, unforeseen ground conditions, and conflicts with neighbours impact the CTP of HR building projects, whereas only a few agreed on weather conditions, regulatory changes building requirements, and inflation. Mismatches between design and budget were added as an additional factor and were endorsed by six interviewees. More than half of the interviewees (about eight interviewees) identified 49 issues as having a substantial impact on CTP, except poor feasibility and project analysis, receiving municipal approvals, rework, insufficient workers, and mismatches between design and budget. Although the aforementioned factors are common to all construction projects, their impact on the CTP of HR building projects may differ from their impact on the CTP of other construction projects. Factors such as outdated technology, poor communication, poor testing and inspection, underestimation of project complexity, mistakes in the preliminary stage (soil investigation), work accidents, and obtaining municipal permits all have a significant impact on CTP in HR projects compared to other construction projects.

CQS is responsible for completing the construction project on schedule since it influences project success. Seventeen key roles of CQSs were identified from the literature and interviews. The identified 17 roles can influence thirty-three CTP-related factors. Tendering and estimating, project planning, progress monitoring and cost control, variations and extra works, subcontractor’s payments, site organisation and activities are considered to be specific for the CQSs working in HR building projects. Considering project planning in HR buildings, construction project stakeholders are numerous and diverse, and the concept of stakeholder involvement within the industry is complicated (Bal et al., 2013). Depending on the nature of the project and its specific requirements, only certain groups may be required to participate in all project phases. According to Zidane and Andersen (2018), while most owners desire their projects completed as quickly as possible, they must conduct adequate research to determine the schedule, thus unrealistic contract time can be mitigated. Time and cost overruns in construction projects are thought to be primarily caused by ineffective and inaccurate progress monitoring in HR buildings (Templier & Pare, 2018).

Realising and comprehending cost determinants enhances cost estimators’ abilities, which, when combined with reasonable cost-forecasting techniques, results in more accurate and reliable cost estimates (Elhag et al., 2005). Thus the role of CQS in tendering and estimating is crucial. The CQS is also responsible for the subcontractors’ payments. Subcontractors work on numerous projects at once. Due to the ‘hyper-specialised’ nature of the subcontractors, the project management strategy developed fixed construction schedules with significant time buffers between subcontractors (Sacks & Harel, 2007). On the other hand, change orders and variations are known to be detrimental to HR building projects. For construction workers, variation continues to be a significant challenge (Osman et al., 2017). In contrast, variations or change orders
frequently present owners and contractors with significant challenges, resulting in price overruns and expensive disputes (Moselhi et al., 2005). The site organisation and activities of a construction site play a crucial role in mitigating accidents and enhancing the overall safety performance (Schwatka et al., 2012), and CQS can play a crucial role in controlling site organisation and activities.

6. Conclusions and Recommendations

The construction industry has recently grown dramatically, particularly in the property development sector, as the number of HR construction projects has increased. Time performance is a key indicator of project success since HR structures can serve as operating platforms for various businesses. CTP is crucial. Though there are several studies related to CTP, this study aimed to identify the factors that influence achieving the CTP of HR building construction and the contribution of the CQS in mitigating the identified factors. Initially, through an extensive literature analysis factors influencing CTP of HR building projects and the roles of CQS in the HR building projects. Fifty-four factors were classified into six major categories. Semi-structured interviews were used to rank the impact of these factors on the CTP of HR buildings. More than 50% of the interviewees endorsed 49 of 54 factors significantly affecting CTP in HR building projects, and were considered for further analysis. Outdated technologies, underestimation of project complexity, soil investigation, work accidents, obtaining permits from the municipal council, poor communication and poor testing and inspection were considered the most significant factors that affect the CTP of HR buildings. On the other hand, insufficient contractor experience, improper planning, poor site management, construction methods, underestimation of project complexity, financial issues, poor communications and misunderstanding, poor procurement programming of materials, poor contract management, poor communications, and issues with neighbours all have a significant impact on the Contractor's CTP in HR building projects.

QSs are responsible for project financial control, cost management, and contractual administration. Thirteen roles of CQS were identified through the literature, and four additional roles were identified through interviews. 33 out of 49 factors can be controlled by CQS in HR building projects and are considered for further analysis. Interviewees were asked to match the CQS roles that are applicable to mitigate the impact of these factors. Site organisation activities and documentation and record-keeping can be utilised to control most of the owner-related factors, whereas proper contractual communication and coordination with other professionals can be used to control most of the consultant factors. Most of the contractor-related factors can be controlled through tendering and estimating, selecting subcontractors and suppliers, proper project planning, site organisation activities, progress monitoring and cost control, proper contractual communication and coordination with other professionals. Factors related to contractual relationships can be mitigated through documentation and record-keeping, arbitration and litigation and coordination with other professionals. On the other hand, proper selection of procurement strategy can control all the external factors that impact the CTP of HR building projects. Although, CQS can control contract-related factors such as errors and discrepancies in contract documents and modification orders; nevertheless, the respondents did not endorse any roles.

The study was limited to CQS and HR buildings. The study's outcomes would assist construction industry practitioners in increasing CQS's CTP in HR building projects. Professionals can analyse the aspects that have a substantial impact on CTP. Contracting organisations can use this as a formal guideline to achieve CTP and
avoid delays. If the variables were detected early on, they may be minimised or controlled, reducing the likelihood of future occurrences. The increased CTP in HR building projects raises the contractor’s revenue, allowing them to develop the organisation and contribute to the country’s economy.

7. References


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