Construction Projects Success: Time, Cost, Quality and Safety

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ABSTRACT

The construction industry is complex, and its success depends on time, cost, and project quality. The study sought to investigate construction project success in relation to time, cost, quality, and safety on construction projects in the Ashanti Regions of Ghana. A structured questionnaire was administered among construction professionals (architects, contractors, engineers, and quantity surveyors) within the study area. The findings showed delays in payments of works executed, forceful layoff, and suspension of construction works adversely affected construction time. The construction project cost was attributed to delays in payment to contractors, poor client cash flow, and high cost of plant and equipment. Quality of work was ascribed to poor coordination among workers and frequent absenteeism of skilled workers. It was concluded that governments should provide financial support to construction companies to clear backlogs of unpaid debts to workers. Clients should liaise with contractors to reschedule uncompleted projects (payment plans and added time for the completion of works). Construction companies should provide adequate personal protective equipment (PPE) to minimise on-site health-related hazards.

Keywords: Construction, project success, cost, time, quality, delays, Ghana

INTRODUCTION

The construction industry contributes about 10% of the gross domestic product (GDP) and employs about 10% of the working population in many countries (Akinradewo et al., 2019). The Ghanaian socio-economic development is heavily dependent on the contributions of the construction industry for its economic growth (Owoo & Lambon-Quayefio, 2018; Ofori-Kuragu et al., 2016). The construction industry faces numerous challenges, especially in developing countries (Ofori-Kuragu et al., 2016). Construction projects are always delayed or abandoned while aiming for timely, cost effective and acceptable quality of project delivery (Amewu et al., 2020). Stride et al. (2020) and Alsharef et al. (2021) believed that construction projects experience delays, which often influence cost, time, quality, and safety. Akomah et al. (2010) were of the view that ignorance, lack of education, and training, as well as lack of enforcement of laws relating to occupational safety and health, have contributed to accidents on construction sites. Since safety on construction sites is mandatory for all firms, Akomah et al. (2010) suggested that all firms must have knowledge of legislative provisions on occupational health and safety (OSH) and apply them to minimize fatalities on sites. The study sought to investigate construction project success in relation to time, cost, and quality in the Ashanti Regions of Ghana.

Construction Project Success (Time, Cost, Quality, and Safety)

Projects that are executed within budget (cost), schedule (time), and of acceptable quality are said to be

successful (Olawale & Sun, 2010; Niazi & Painting, 2016; Tabish & Jha, 2012). Lamprou and Vagiona (2018) defined project success criteria as "dependent variables that measure the successful outcome of a project." Non-fulfilment of goals on time, cost, and quality may lead to failure of projects (Ramlee et al., 2015).

Construction Project Time

Biswas et al. (2020) highlighted poor supply chain management of construction materials, worker transportation problems, and labour shortage as the causes of construction delays. Deloitte (2020) highlighted the indefinite suspension of construction works as one of the major causes of delays. Zamani et al. (2021) also highlighted reduced labour and late payments of work done. A report from the International Labour Organisation (2021) pointed to disruptions in the materials supply chain, shortened work hours, and labour shortage as the major factors that influence construction schedule. Disruptions in project operations are associated with challenges in importing materials and plants and recruiting competent workforce (Maldives National University, 2020).

Construction Project Cost

High costs of construction materials, plant and equipment, and labour procurement adversely affect construction budget of many projects (FTI Consulting, 2020). Protiviti (2020) identified construction budget as the costs arising from idle plant and equipment, material, and labour inflation. Stride et al. (2020) mentioned that client and contractor cash flow issues resulting from the breakdown of the financial sector impact project cost. Deloitte (2020) claimed that materials escalation, equipment and labour prices, continuous maintenance of site security, high cost of health and safety measures, poor cash flows, and the loss of construction materials are unwelcoming to project costs. A report from the Maldives National University (2020) indicated that materials, plant, and labour inflation and payment delays to contractors compound costs. Silva et al. (2016) defined construction cost as "the degree of compilation of construction work within the estimated budget. Cost includes all monetary claims in a project arising from variations, litigations, and modifications. A project is said to be successful in terms of "cost" when all activities are carried out cost-efficiently without unwanted extra costs (Heravi & Ilbeigi, 2012).

Construction Project Quality

Frequent skilled worker absenteeism and postponement of unsatisfactory work, poor materials inspections, and poor coordination among workers negatively affect project quality (Alsharef et al., 2021). Zamani et al. (2021) indicated a lack of labour for jobs at hand as a cause of low construction work quality. Protiviti (2020) pointed out the lack of skilled personnel for the execution of activities and the problem of skilled worker transportation as some factors that take a toe on quality. Mace (2020) stated the low use of offsite construction methods as another. Wang et al. (2020) posited that poor and inconsistent communication among project stakeholders and material suppliers influences quality. More et al. (2017) defined quality as the degree of executing and producing a product that looks and works well, meets the design and materials specifications and satisfies the user with minimum or no calls for rework. Serrador and Turnheb (2014) concurred with this definition by stating that construction project quality was closely connected with the concepts of technical performance, requirements, and the achievement of the functional objectives of the project.

Construction Project Safety

Providing adequate personal protective equipment (PPE) for site workers, training, and regular education of construction employees improves construction project success (Ogunnusi et al., 2020; Stride et al., 2020). The provision of grants, loans, and funding for construction companies motivates contractors to pursue high

safety standards Zamani et al. (2021). The International Labour Organisation (2020) recommended the education and training of construction stakeholders on safety and remedial policies, the provision of health and safety measures, the reduction of excess labour on site, reduction of non-essential trips to multiple construction sites for safety reasons. FTI Consulting (2020) proposed an extension of construction duration as a solution for the recovery of time lost. Protiviti (2020) recommended fast-track project schedules, effective communication between project stakeholders, and installation of good ventilation systems for site accommodation as some important health and safety responsibilities. Biswas et al. (2020) indicated that stakeholders' compliance with the safety guidelines by the WHO, the wearing of safety equipment, the provision of adequate accommodation for site workers, the provision of medical facilities, the use of construction software by construction stakeholders and the provision of financial assistance by governments are beneficial for safety enhancement. Deloitte (2020) highlighted a forecast of cash flows, implementing additional health and safety measures, and evaluating and retaining skilled staff as remedial measures for improved safety.

Mace (2020) also recommended enabling longer working hours through the operation of shifts, prioritising offsite manufacturing, allowing for the extension of construction times, adjustment of payment times and procedures, managing and forecasting material price changes, introducing innovative approaches to procurements, agreeing to parties on incurred costs and re-planning of the construction project as some remedial measures.

METHODOLOGY

A quantitative research design was used for the study based on the aim and objectives developed for solving the research problem Boru (2018). Fleetwood (2020) defined quantitative research design as a systematic investigation of phenomena by gathering quantifiable data and performing statistical, mathematical, or computational techniques as applied in the study. Questionnaires were adopted as instruments for the data collection in the study (Collins, 2021; Bhat, 2020). These were made up of both closed and open-ended questions (Abawi (2014). The researchers chose the Ashanti Region as their study area due to the numerous construction companies in the region. Ahadzie (2007) noted that most construction companies in Ghana are in Accra, the capital (Ahadzie, 2007). The study population comprised all construction companies in the Ashanti region. However, the sample frame consisted of architects, contractors, engineers, and quantity surveyors within the study area. The sample size of the professionals was determined using the formula below and their geographical location (Glen, 2021).

$$s = \frac{(\mathrm{Z} \curlywedge 2) * p * (1 - p)}{(m \curlywedge 2)}$$

$$s = \frac{(1.96 \curlywedge 2) * 0.5 * (1 - 0.5)}{(0.1 \curlywedge 2)}$$

$$n = \frac{0.9604}{0.01}$$

$$n = 96.04 \simeq 96$$

Where s = sample size for unknown population

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Z = 1.96 (Z score based on the chosen confidence level of 95%)

p = sample proportion (50% assumed)

m = limit of error (10%)

This means that the lowest acceptable sample size must be 96, with a confidence level of 95% and a limit of error of 10%. A total number of 120 questionnaires were used based on the statistical theory. Data collected were standardised and validated (Bhat, 2020). The tools employed in the data analysis were descriptive statistics and mean score ranking.

FINDINGS

Characteristics of the Firm

This section presents the findings on the characteristics of the firm. Figure 1 shows that most (34%) of the respondents were engineers, followed by quantity surveyors, contractors, and architects.

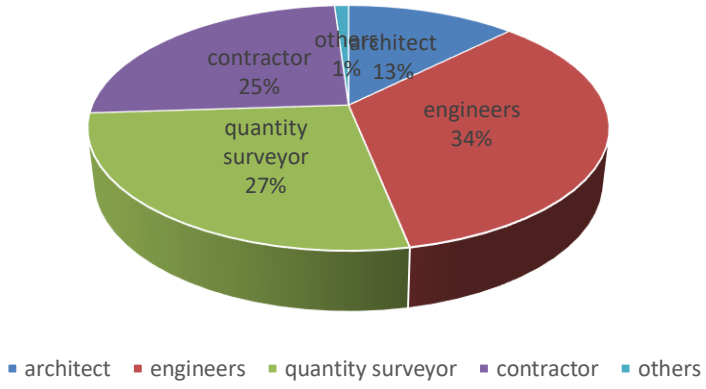

Figure 1: Profession of Respondents

Figure 2 shows that the majority (30%) had spent 11 to 15 years, followed by respondents who had spent between 1 to 5 years. The least (20%) of the respondents had spent 16 years and above at their workplaces.

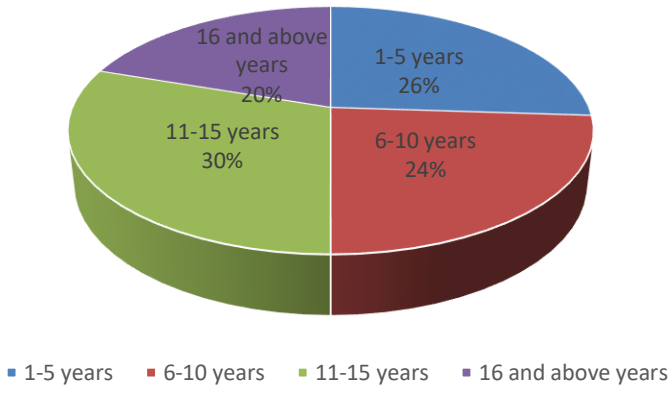

Figure 2: Working experience of respondents

Figure 3 shows that the majority (46%) of the respondents indicated their construction activities were non-residential. This is followed by residential and civil works, respectively.

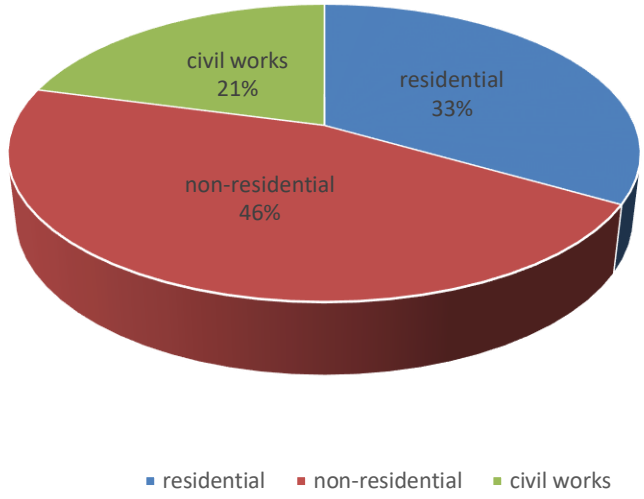

Figure 3: Type of Construction Activities

This section presents the findings on the impact of construction projects on time, cost, and quality. Table 1 shows that late payment of work done leading to low motivation was ranked first based on the mean, with a mean and standard deviation of 4.20 and 0.974. Forceful layoff was ranked second with a mean and standard deviation of 4.16 and 1.170, respectively. Suspension of construction works was ranked third, with a mean of 4.12 and a standard deviation of 0.956. Worker transportation problems was ranked fourth, with a mean and standard deviation of 3.95 and 1.063.

Table 1: Impact on Time of Construction Works

Variables	Mean	Std. Deviation	Ranking
Late payment of work done leading to low motivation	4.20	0.974	1st
Forceful layoff	4.16	1.170	2nd
Suspension of construction works	4.12	0.956	3rd
Worker transportation problems	3.95	1.063	4th
Challenges in recruiting competent workforce	3.87	1.002	5th
Shortage of labour due to illness	3.80	1.287	6th
Shortened work hours	3.70	1.049	7th
Poor materials supply chain management	3.57	1.027	8th

Table 2 shows that delays in payment to contractors are the most crucial impact on project cost. This impact had a mean and standard deviation of 4.43 and 0.655. Poor client cash flow was ranked second based on the mean, with a mean of 4.36 and a standard deviation of 0.847. The high cost of plant and equipment was ranked third, with a mean and standard deviation of 4.28 and 0.766.

Table 2: Impact on Cost of Construction Works

Variables	Mean	Std. Deviation	Ranking
Payment delays to project contractors	4.43	0.655	1st
Poor client cash flow	4.36	0.847	2nd
High cost of plant and equipment	4.28	0.766	3rd

High cost of construction materials	4.27	0.649	4th
Poor contractor cash flow	4.25	0.845	5th
Cost incurred from idle plant and equipment	4.19	0.720	6th
High cost of labour procurement	4.11	0.840	7th
Loss of materials due to exposure on-site	4.04	0.896	8th
Labour inflation	3.89	0.886	9th

Table 3 shows that suspension of construction works had more impact on construction project quality with a mean and standard deviation of 4.17 and 0.931. Poor coordination between workers due to social distancing was ranked second based on the mean, with a mean of 4.05 and a standard deviation of 0.925. Frequent absenteeism by skilled workers was ranked third, with a mean and standard deviation of 3.94 and 1.108, respectively. Inadequate labour for jobs at hand was ranked fourth, with a mean of 3.80 and a standard deviation of 1.233.

Table 3: Impact on Quality of Construction Works

Variables	Mean	Std. Deviation	Ranking
Suspension of construction works	4.17	0.931	1st
Poor coordination between workers due to social distancing	4.05	0.925	2nd
Frequent absenteeism by skilled workers	3.94	1.108	3rd
Inadequate labour for jobs at hand	3.80	1.233	4th
Unavailability of offsite construction methods	3.79	0.957	5th
Postponed or cancellation of materials and work done inspections	3.75	1.167	6th
Poor and inconsistent communication between project stakeholders and material suppliers	3.62	1.144	7th

Table 4 shows that providing additional personal protective equipment (PPE) and other safety facilities for site workers was ranked as the most important measure or way to curb the impact on a construction project. This measure had a mean of 4.56 and a standard deviation of 0.608. Education and training of workers on preventive measures on-site was ranked second with a mean and standard deviation of 4.52 and 0.659, respectively. Development of pandemic control plans and procedures on site was ranked third, with a mean of 4.49 and a standard deviation of 0.659. Enforcement of social distancing on site was ranked fourth, with a mean of 4.38 and a standard deviation of 0.850. Providing adequate accommodation for site workers was ranked fifth with a mean and standard deviation of 4.36 and 0.578.

Table 4: Impact on Safety of Construction Works

Measures	Mean	Std. Deviation	Rank
Inadequate personal protective equipment (PPE) and other safety facilities for site workers	4.56	0.608	1st
Irregular education and training of workers on preventive measures on-site	4.52	0.659	2nd
Inadequate accommodation for site workers	4.36	0.578	3rd
Operation of worker shifts	4.21	0.782	4th
Lack of evaluation and retention of skilled staff.	4.20	0.841	5th
Extension of construction duration	4.17	0.805	6th

Reduction of time on essential trips to multiple sites	3.90	1.047	7th
Limited labour on a particular task	3.88	0.988	8th

Summary of Findings

Findings showed that late payment to contractors led to low motivation, forceful layoff, and suspension of construction works, which were adversarial to project time. Payment delays to project contractors, poor client cash flow, and high plant and equipment costs seriously impacted project costs. The suspension of construction works, poor coordination between workers, and frequent absenteeism by skilled workers were the factors that impacted project quality. Inadequate PPE and safety facilities on site, irregular education, and training of workers on preventive measures on site were the major variables that influenced project safety.

CONCLUSION AND RECOMMENDATIONS

The study sought to investigate construction project success in relation to time, cost, quality, and safety in the Ashanti Region of Ghana. Contractors experienced late payment of work done, and the suspension of construction works led to worker layoffs, which impacted the work schedule. Clients faced poor cash flow, and the high cost of plant and equipment also affected project costs. Poor coordination between workers and frequent absenteeism of skilled workers adversely affected project quality. Meanwhile, project safety was associated with inadequate PPE and safety facilities on site, irregular education, and training of workers on safety preventive measures. It was recommended that governments provide financial support to construction firms to clear the backlogs of unpaid debts to workers. Clients should hold meetings with contractors to amicably re-plan the rest of the projects, including payment plans and the added time for project completion. Skilled workforce should be motivated to boost their morale and encourage them to show up at work. Construction companies should provide adequate personal protective equipment (PPE) and other safety facilities, regular training, and education for workers on preventive measures to minimise the occurrence of hazards on sites.

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