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Current and Future Trends of Construction Project Performance Models: A Review

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ABSTRACT

The construction industry (CI) has experienced outstanding growth and contributed to economic growth for many countries, with enormous foreign investments that require quality projects. High pressure to reduce the construction cost and time commonly put the industry at risk of lower quality and safety of the construction facilities. Like many other developing countries, Tanzania needs more stringent quality control measures in the construction sector to contribute positively to sustainable growth. This study thus reviews current and future trends in construction industry performance in Tanzania. The literature review on construction projects (CPs) performance is based on information on time overruns from contractors, clients, and consultants of the Tanzanian CIs. Initially, 300 literatures were reviewed and manually screened to about 50 literatures. Results showed that 56% of the 50 reviewed literatures indicate the need to reduce the time overruns in CPs. Further, it was noted that more responsibility in addressing time and cost overrun challenges in the CPs lies on clients, consultants, and contractors. Moreover, planning scheduling factors (PSF) is noted to be the most noteworthy category of factors that greatly influence project performance. In contrast, records and documentation factors (RDF) scored as the second most significant factor in performance in terms of cost overruns. The study, therefore, concludes that contractors, clients, and consultants should have an adequate cash flow plan, properly manage financial resources, advance site management through experts, and institute appropriate planning and scheduling. Thus, these research findings propose factors that lead to time overrun, thus portraying the establishment of robust systems to eliminate time overrun causes.

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INTRODUCTION

Anticipating the future is progressively viewed as a valuable mode to align direct and advance present companies' strategies. Many research projects encounter many construction challenges originating from socio-economic and technological dynamics and effects (Aziz, 2013). This study critically reviewed over 50 studies on construction projects (CPs), highlighting delays or time overruns. Most studies, like Bertelsen (2003) and Mydin et al. (2014),

addressed project constructionists' complexities where two factors are noted to be complex viewpoints in the industry. These include the managerial perception and the operative and technological perception in CPs. If the project's difficulties are not identified at an early stage, it creates difficulties in the operations and management of construction projects that essentially result in project delays (Latham, 1994). However, these present a record of national and international research undertakings in determining factors causing project construction delays (Mack, 1995). The studies carried out between the years 1970 and 2014 in the United States of America, Saudi Arabia, Turkey, United Arab Emirates (UAE), Sri Lanka, Nigeria, Egypt, Hong Kong, Lebanon, Jordan, Malaysia, Ghana, Kuwait, and Pakistan named delays as a serious problem in CPs that affect both developing and developed countries.

In Tanzania, Uganda, South Africa, and Mozambique, research shows that the time overruns are caused by changes in design, delays in paying contractors, information delays, financial concerns, poor project management, and conflicts over the valuation of the finished project (Assaf and Al-Hejji, 2006; Ayman and Al-Momani, 2000; Eliufoo, 2017; Fugar and Agyakwah-Baah, 2010; Kikwasi, 2012). Likewise, Chan (1996) and Kikwasi (2012) indicate that the key delay causes in CPs include changes in designs, payment delays to contractors, poor project management, delays regarding construction information, funding problems, compensation matters, and disagreements. Many CPs are not finished on time or within the allocated budget (Eliufoo, 2017). Furthermore, according to the 2015 World Bank report, about 63 per cent of the 1778 World Bank-sponsored building projects globally from 1994 to 2010 underperformed at an average budget overrun of 40 per cent (Ameh et al., 2010).

Researches, including those performed by Arditi et al. (1985) and Chan (1996) in Europe and Asia, differed from research that was carried out in Australia (Melik and Serhat, 2010; Aziz, 2013). Such researches signified that the modelling method via the fuzzy set theory, together with the uncertainties in the project schedule and cost, thus subsequent from the complex and ambiguous nature of construction works is significant. From 2000 to 2005, most researchers used fuzzy set theory (FST) and statistics to analyse risks in CPs (Melik and Serhat, 2010).

Researches indicate that risk analysis and management have been known for more than two millennia (Edwards and Bowen, 1998), and the development trends of analysing risks grew during the 1990s, from 1995 to 2000 research results. Among these, Abd-Majid and McCaffer (1998) and Melik and Serhat (2010) used an FST to analyse uncertainty in Hong Kong projects. The researches by Akhund et al. (2017) and Melik and Serhat (2010) show future research directions for project performance analysis. The FST delivers an alternative to probability theory for managing ambiguity while handling imprecision, aiding decision-making (Melik and Serhat, 2010; Zaki and James, 1989). It can form a foundation to forecast the upcoming development of investment analysis models (Aziz, 2013).

The reviewed 50 papers focused on four areas, namely background and its research gap, methodology used, findings presented and the conclusion and recommendations on time overruns, where delays in project performance were reported to be critical. About 56 per cent of the 50 reviewed literatures related to the study findings showed the need for a concrete model to remove or reduce time overruns in CPs. This study reviewed the current and future trends of construction project performance, aiming to propose a model to reduce or remove time overruns in CPs.

LITERATURE REVIEW

About 300 literatures were collected. After the manual screening (Kigombola et al.,

2022), only 50 literatures were found to be relevant and were thoroughly read and analysed. These were carried out against research background and research gap, methodology used, findings presented, and the conclusion and recommendations on time overruns. About 56 per cent of the 50 reviewed literatures related to the study findings showed the need for a concrete model to remove or reduce time overruns in CPs.

Development of risk analysis in construction project performance

Risk analysis (RA) in construction project performance is always critical. Abd El-Razek et al. (2008) and Ermias et al. (2016) optimised that RA and management are essential parts of the decision-making process in the construction industry.

The current trend of construction project performance model

It is important to map and understand the historical trends to the expected potential outcomes; nonetheless queries raised in the previous sections, the drive for performing future research in the construction project performance model involves thinking about the way companies and other stakeholders shall respond to a range of probable variations in future.

It is being proposed that it is not only the important scenarios but also the way scenarios (among other issues) can be utilised by construction industry actors to inform decisions regarding their tasks (Abd El-Razek et al., 2008). The usefulness of scenario generation is positioned not within the final scene itself but within connections between the current and potential future. For improved understanding, one needs to link the historical experiences and the potential future; the relative abilities of construction companies and professionals to change, mitigate or effect change processes should be explored to consider the treasured strategies for suitable interventions.

Development and use of technology in project performance

The escalating practice of applying information and communications technology (ICT) among the wider community in the country could be used to the advantage in the CPs. ICT is now mostly being used to coordinate construction activities and introduce techniques and materials. Nevertheless, the potentiality implications of the ICT deployment depict an ideal picture (Al-Khalil and Al-Ghafly, 1999) of the standard off-the-shelf building process, thus leaving no room for creativity, originality or aesthetic quality. The growing encroachment of ICT-focused processes is reconciled with the ability of construction to produce innovative designs and aesthetically attractive buildings. This also attaches to assumptions about technological advance as an inherently positive process and that greater technology is used to connect and improve working performance (Akhund et al., 2017).

Future trends of CPs

Studying the future trend of the construction project is necessary and accepted as a widespread norm for accessing and mapping the possible future experiences, practices, and potential challenges and counting the opportunities they bring. Several recent research on the future-oriented direction of the construction industry (Abd El-Razek et al., 2008). Even though there is a slight divergence in layout and approach, two significant ideas inform such a scenario.

Firstly, research reinforces or replicates the current rhetoric that the construction sector is less productive or somehow laggard than it should have been; thus, some improvements are required. This is a somewhat paradoxical position because of the long history of the argument within the construction sector (Ayman and Al-Momani, 2000) and, more recently, the reports by Al-Khalil and Al-Ghafly (1999), Arditi et al. (1985) and Assaf et al. (1995).

Furthermore, they recognize at least the possibility, if not the certainty, of wide-scale change over the coming decades that could meaningfully change the current contexts in which construction work is undertaken.

Factors including climate change, decreasing natural resources and demographic alteration could present new prospects and problems for the construction industry in the future decades. There is now the deployment of ICT within construction itself. Thus, ICT act as a medium of inter-companies' coordination and collaboration, collectively with the apparent necessity for sustainable doings, and also can renovate to execute construction activities. Such developments recommend that radical together with incremental change may be needed. Nevertheless, such trends recognise possible issues that can influence the future construction status, aiming to consider specific inferences for the industry's current activities. Table 1 explains the trend of past researchers by identifying causal factors in project delays.

Table 1: Factors causing delays as determined by the literature

No.	Factors	Study area	Source
1	Considerable extra work, change of orders frequently, changes in design delays, public agencies' and contractors' financial problems, resources shortages	America	Arditi *et al.* (1985)
2	For non-excusable delays, the contractor has entitled to neither damages nor time extensions from the client. There are three factors for excusable delays: unforeseen events, events without fault or negligence, and events beyond the control of the contractor	Australia	Zaki and James (1989)
3	Payment for the accomplished CPs, material shortage, errors in the estimated, price fluctuations, poor contract management	Malaysia	Mansfield *et al.* (1994)
4	Disputes in the subcontractors' schedule, delays in making decisions, an executive bureaucracy, changes in design delays, payment problems, approval of shop drawings	Nigeria	Assaf et al. (1995)
5	Delays in making decisions, poor site supervision and management, changing orders by the client, unforeseen ground circumstances, compulsory project variations	Jordan	Chan and Kumaraswamy (1997)
6	Delays in getting work permits from the authorities and government, cash flow difficulties, presence of the low-bid tendering system	Lebanon	Al-Khalil and Al-Ghafly (1999)
7	Using non-professional designers, increase in project quantities, late deliveries, economic conditions, site conditions, weather changes, user changes	South Arabia	Ayman and Al-Momani (2000)
8	Order variations by the client during construction, difficulties in financing on the part of the contractor, shortage of labour, ineffective scheduling and planning, delay in progress payment	UAE	Assaf and Al-Hejji (2006)
9	Lack of proper supervision and management, shortage of qualified labours, delays in making decisions, inadequate and poor planning, slow drawing preparation and approval	UAE	Faridi and El-Sayegh (2006)
10	Mistakes during the construction stage, deficiency of	UAE	Sambasivan and

No.	Factors	Study area	Source
	communication between parties, equipment availability and failure, shortage in qualified labour, lack of material, problems with subcontractors, inadequate client's finance and payments for completed work, unqualified contractor, contractor's poor site management, inaccurate planning contractors		Soon (2007)
11	Inadequately skilled labours, unskilled labour, poor planning and scheduling from the contractor, many changes in orders from the owner, financial challenges faced by contractors	Malaysia, Asia	Sweis et al. (2008)
12	Poor management, partial payments during construction, design changes by the owner or his agent during construction, delays in payment by the owner, financing by the contractor during construction	UAE	Abd El-Razek et al. (2008)
13	Delays in the design and financial problems	Kuwait	Soliman and Arlasheed (2010)
14	Fluctuation of prices or the rising cost of materials, poor management, shortage of materials, minimising the complexity of projects, delay in completion of projects by contractors, delay in honouring certificates, poor supervision, difficulty in accessing bank credit, minimising the costs of projects	Ghana	Fugar and Agyakwah-Baah (2010)
15	Lack of equipment and materials, financial problems, poor project experience, poor site management, improper planning, natural disasters, e.g., earthquakes and floods	Pakistan	Haseeb et al. (2010)
16	Shortage of bitumen, extreme weather, land acquisition and resettlement, variation and scope changes, disputes, shortcomings in the contract document, errors in detail designs, inaccurate feasibility studies	Sri Lanka, Mexico and Ecuador	Jeykanthan and Jayawardena (2012)
17	poor communication between client and consultant, poor communication between the client and contractor, delay in inspecting and testing, delay in approving chief changes in the work's scope by the consultant, inadequate consultant experience	Egypt	Aziz (2013)
18	Design issues, material deficiency, external factors, contractor organisation attributes, lack of experienced labours	Jordan	Samad and Sepasgozar (2015)

Causes for delays in different countries are recorded, documented and described. Both developed and developing countries face construction projects delay due to several factors, as described in Table 1. Ameh et al. (2010) examined delay causes for CPs in the United States of America. The causes found include weather changes, inadequate skilled labour supply, and sub-contractors.

Likewise, in Hong Kong, Chan (1996) found the following delay factors: necessary variation works, slow decision-making involving variation, unforeseen site conditions, and poor risk management. Therefore, the noteworthy factors contributing to delays in CPs include inadequate contractor experience, necessary work variations, client-initiated variations,

low speed of decision-making involving all project teams, poor site supervision, and unforeseen soil conditions.

The key factors affecting the performance of the contractors, as per Chan's (1996) study, included equipment issues, identified materials, and labour-related delays. Other factors include changes in the original design, inadequate planning, poor labour productivity, and poor resource utilisation; these were the delays found in Indonesia.

As per DTI (2004), the delay causes for the CPs in Saudi Arabia include site supervision, site, environmental conditions, government regulation, early planning, design, client's administration, and contractor's performance, among others. In Nigeria, the CPs' delay factors include material shortage, variations in the site circumstances, poor contract management and payment and financial status for the accomplished projects (Edwards and Bowen, 1998).

Eliufoo (2017) researched the cause of delay mainly by considering the three major project actors, i.e., contractors, clients and consultants for houses in Nigeria. Among the delay causatives were the slow process of making decisions, financial problems, variation of orders, scheduling and planning-related problems, and material management issues.

The National Audit Office investigated influential causes of time overruns in Malaysian private housing projects. Their study was a survey that utilised a questionnaire. The frequently found critical factors for cost overrun were poor-quality works, mistakes in construction, poor contractor coordination with other construction stakeholders, variations in the contract agreement, the slow approval process of key changes, financial problems, partial design documents, poor contractors' experience, poor management by the contractor at the site, and unpredictable weather conditions (Fairclough, 2002).

Nevertheless, Faridi and El-Sayegh (2006) reported the major factors for time overrun, including financial problems in paying the contractor and cash flow. Further studies also identified major causes of delays in CPs for the Malaysian construction industry (see Table 2): the ranking was based on the consultant's perspectives. Memon et al.'s (2011) study contribute to the trend of cost overrun causes encountered by several countries.

Table 2: Comparison of Causes of Time Overrun among Various Countries

Proponents	**Major Causes of Delay in CPs**				
	Rank 1	**Rank 2**	**Rank 3**	**Rank4**	**Rank 5**
Memon *et al.* (2012)	Financial difficulties and cash flow issues encountered by contractors	Poor contractors' site management	Insufficient contractors' experience	Insufficient workforce	Ineffective contractors' scheduling and planning
Le-Hoai*et al.* (2008)	Poor supervision and site management	Poor project management assistance	Financial challenges by the client	Financial challenges by the contractor	Changes in the design
El-Razek*et al.* (2008)	Financial challenges by the contractor when constructing	Misutilisation of contractual management or professional construction	The client delays paying the contractor	Preparation of material samples and shop drawings	Coordination challenges between various project actors
Assaf and Al-Hejji (2006)	Category of construction project bidding and award	Insufficient workforce	The client delays paying the contractor	Ineffective scheduling and planning of projects by the	Order variations by the client when constructing

				contractor	
Flyvbjerg (2005)	Poor supervision and site management	Experience and qualification of the project workforce	Inadequate project staff	Inadequate workforce	Inappropriate monitoring and evaluation coordination and management
Frimpong et al. (2003)	Monthly payment difficulties	Poor contract management	Contractor's financial challenges	Planning and scheduling deficits	Cash flow when constructing

Source: Memon et al. (2011)

Fugar and Agyakwah-Baah's (2010) study reveals that contractors are responsible for time overrun issues in CPs. To achieve project completion on time, contractors should manage their cash flows effectively and utilise available financial resources. Table 3 presents studies of various models carried out in different countries. For example, the case study undertaken in Egypt unveiled that results from effective planning and scheduling are essentially required. At the same time, the project schedules should be regularly updated, and skilled workforces should be employed to facilitate effective project management. The study in Iran (Fugar and Agyakwah-Baah, 2010), which developed a comprehensive model, came up with financial problems associated with contractors and clients, which resulted to causes in project delays. Again, the novel model to evaluate and measure the construction project success from a contractor company's viewpoint was carried out in Brazil. Besides, it provided effects of delays in CPs for the study performed in Korea. The case study conducted in Tanzania also came up with results of time accomplishment escalated at two hundred per cent of the initially estimated duration (Gidado, 2004). However, these results show that used models embody a reliable tool for measuring project performance for consultants, contractors, and clients regarding their weaknesses and strengths.

Table 3: Different Models of time overruns in Construction Projects (Haseeb *et al*., 2011)

Established/applied model	Country	Source
The model developed to assess the CPs' delays	Cairo, Egypt	Soliman and Arlasheed (2010)
Established the comprehensive model to assess the CPs' success by contractors	Tehran	Donyavi and Flanagan (2009)
Developed a model to assess contractor performance in the construction industry	Brazil	Ingle and Mahesh (2020)
Applied construction management assessment model by using risk index modelling in the construction phase	Nigeria	Ameh and Osegbo (2011)
Established the variation mitigation model to improve the construction performance of public building projects	Tanzania	Mhando et al. (2018)

METHODOLOGY

The study reviewed about 50 literatures, including journal articles from developed and developing countries. The formats of future construction reports differ, but they can be grouped into four broad categories. The first gathered assessments from

industry practitioners concerning material, machinery, finance-related and manpower-related factors. The process also determined factors grouped to obtain frequencies of occurrences. The report then presents feedback and recommendations for future actions (Heravi and Ilbeigi, 2012). The second type encompasses the assertion and speculation of academics or industry professionals. They are less grounded in contemporary issues and replicate views from single individuals. The assessments from the second category are often written to describe the future scenario, for example, an estimated life of the construction industry year, i.e., 2025 (Akhund et al., 2017). The third type of review involves the published reports frequently prepared around precise themes, for instance, demographic, technological, economic, etc. (Fornell and Larcker, 1981). Table 1 shows the studies concerning CPs undertaken in various countries, whereby reports are differentiated in areas and scope of researches. The fourth phase analyses the results and discusses them by coming up with a prediction of the future trend of construction project performance models.

RESULTS AND DISCUSSION

About 300 literatures were collected and screened, and only 50 literatures were thoroughly read and analyzed, of which the results showed that; about 56 per cent of construction delays were caused by human-related factors.

From the literatures, about 86% of the factors causing delays in most construction projects are related to humans. These factors are ranked in percentage using a pie chart which denotes the need for a concrete model to remove or reduce the time overruns in most public construction projects. Figure 1 depicts the summary of the factors which cause delay in construction while Figure 2 shows factors of time overrun.

Figure 1: Summary of the factors which cause delay in construction.

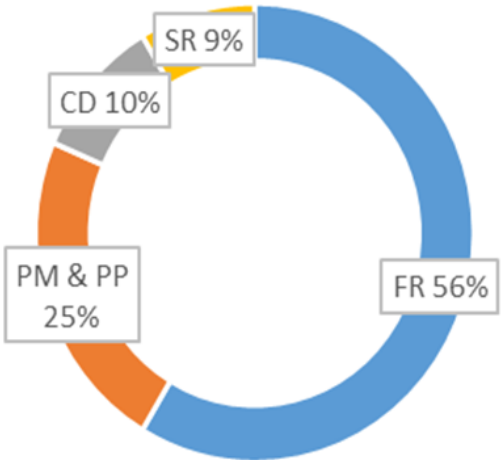

Figure 2: Factors of time overrun. Notes: FR – Financial Resources, PM & PP – Poor management and Poor planning, CD – Change in design and drawings, and SR – Shortage in resources.

Based on the results, the development of potential future scenarios is evident. The related factors associated with materials, resources and management and planning, workforce and financial matters are recommended to be treated in the viable model to avoid time overruns. However, some recommended methods have been introduced to minimize causes of project delays, but the problem has continued to occur for many decades ago. There are many proposed models in construction projects, such as Building Information Modelling, but nothing has been achieved since 15 centuries, and time overrun still exceeds 50 per cent to 100 per cent (Gidado, 2004; Fugar and Agyakwah-Baah, 2010).

Based on the literature reviewed, possible future scenario is presented revealing the contingent nature of implications of positive and negative future changes in construction project performance (Haseeb et al., 2011).

Based on the gathered reports of twenty-three construction-related factors on project delays, this study critically reviews key themes and areas of divergence or agreement applied to develop potential future scenarios. This study shows most related factors associated with materials, machinery, workforces and financial matters. Most recommended methods have been introduced to minimize causes of project delays, but the problem has continued to occur for many decades.

Based on the literature reviewed, a possible future scenario is presented, revealing the contingent nature of the consequences of negative and positive future variations in construction project performance (Haseeb *et al*., 2011). About 56 per cent of the 50 reviewed literatures related to the study findings show the need for a concrete model to remove or reduce time overruns in CPs.

World construction industry to 2030: The future perspective

The given reality of the construction industry (CI) is aware of digitization (Haseeb et al., 2011). Digitisation: this will be driven by technologies such as building information modelling, augmented reality (AR), virtual reality (VR), and mixed reality, among other advanced leveraged technologies. AR arguments involve a set by incorporating digitalised components into a live view, usually through the smartphone's camera. In contrast, VR is a totally immersive experience which substitutes a real-life environment with a simulated one. Autonomy: there shall be a shift whereby CI shall be automated, mainly by prioritising safety. One of the technologies shall be drones, as they shall play a key role in eliminating the site presence of manpower and increasing data collection accuracy. Sustainability: this will go beyond compliance with regulations and become a people's movement as greater awareness of limited resources will be realised. Standard prefabricated and modular concepts will improve compatibility among building and infrastructure projects, enhance productivity, improve economies of scale, and accelerate the industrialisation of the CI.

New business models (NBMs): the CI is experiencing an important criterion shift and is concentrating on producing new technological and data-driven business models. Also, NBMs foster improved collaboration between stakeholders and enhanced the productivity of the CI. Social trends: with ageing workforces and digitisation, the CI will have to adapt better workforces' management strategies to accommodate urbanisation. Economic trends: if the economic trends are unstable, thus, such a situation challenges the way to overcome age-old productivity in the sector, leading to the adoption of exclusive solutions to attract further investments (Haseeb et al., 2011).

Possible Future Scenario

Common ICTs systems coordinating works have made the construction process highly transparent, letting clients understand construction methods better and take a proactive role in design. It is also stipulated that effective planning and scheduling are required, project schedules should be regularly updated, and qualified workers should be employed to properly manage construction projects. Robotic machinery in this study is seen as future modelling of CPs; robotic working in hazardous areas has improved construction safety and health record to flawless standards (Heravi and Ilbeigi, 2012).

Summary

Based on the reviewed literature, especially Tables 1 to 3, it is revealed that the researchers have written different measures to minimise issues of time overrun in CPs, including developed countries and developing countries. There is a need to use these measures instead of concentrating on increasing unnecessary time overruns in CPs. CI stakeholders should use skilled workforces and professionals to interpret what is supposed to be done. Therefore, by so doing, enhancement of great performance in the CI in terms of value for money will be achieved. About 300 literatures were collected. After the manual screening, only 50 literatures were thoroughly read and analysed based on background and research gap, methodology used, findings presented, and the conclusion and recommendations on time overruns.

CONCLUSION AND RECOMMENDATION

Concluding remarks

The revealed time overruns from conducted case studies, as witnessed in the literature, reflect what the projected best model attempts to expose for contractors, clients and consultants. They should have a suitable cash flow plan, properly manage financial resources, improve site management by employing skilled workforces and institute proper scheduling and planning. Results from this research can assist in discerning dynamic factors which lead to time overrun issues, ultimately leading to opportunities for developing robust systems to reduce time overrun problems. Additionally, results showed that about 56 per cent of the 50 reviewed literatures related to the study findings showed the need for a concrete model to remove or reduce the time overruns in CPs. This study also indicates that the literature findings comprise construction models that embody a reliable tool to measure project performance for consultants, contractors, and clients regarding their weaknesses and strength.

Recommendations

The reviewed documents show that Fit Viability Model is a unique and wide-ranging quantified model that reflects variances between past, current and future trends of project performance models in CPs. Based on this research, it is suggested that construction project stakeholders prepare for future scenarios that precisely and accurately define project time factors.
It is further suggested that there should be adequate instructions or guidance for

construction companies and professionals other than embracing current industry trends and encouraging future studies to be improved over the complex CPs. Finally, there is a need to use these studies effectively because most of the measures mentioned the problem of construction stakeholders during project implementations.

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