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UNDERSTANDING CONSTRUCTION INFRASTRUCTURE PROJECT DELAYS IN THE UK

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Delays in construction infrastructure projects is a global issue, which has continued to affect the effective delivery of projects. Research from other countries has not provided effective solutions to ameliorate this and has not been prioritised in UK compared to other project challenges. The research looks at the contribution of middle-level professionals in managing infrastructure projects which has not been covered in any previous research and explore their management experience in dealing with delays risk before it occurs. The study utilised a qualitative approach with 12 middle management professionals interviewed. The research revealed that communication and coordination, planning, site, and project management are the high-end contributors to delays. Risk associated with people and time factors is now a prominent challenge in managing the project interface resulting from inadequate planning and communication. The insights derived from this will help to change the way projects are managed, ensuring that construction industry moves away from the traditional management practices, old methods, upskill the workforce, and engage qualified professionals to do the job using innovative measures.

Keywords: construction; delays; infrastructure; management; projects

INTRODUCTION

A widely accepted set of metrics for considering a construction project as being successful is if it is delivered on time, within the specified budget, according to the quality required by the client and to the client's satisfaction (Oyegoke and Al Kiyumi, 2017). Where a project delay occurs, it could simply be expressed as inability to meet the programmed duration. This could mean when such a project overruns the project duration (Assaf and Al-Hejji, 2006). It can also be expressed as the team not meeting the project schedule (Agyekum-Mensah *et al.,* 2017) whilst Zack (2003) believed that project delay occurs when additional activities delay the project timeline beyond the specified time schedule.

The construction industry has been criticised for the common occurrence of delays; this has had a negative effect on construction projects (Agyekum-Mensah and Knight, 2017) and is considered a global issue (Kog, 2017). Marzouk and El-Rasas, (2014) argued that the combined effect of inadequate planning and resources management

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affecting productivity and profitability because of poor time management. It can create issues with contractors' funding of the project and client paying for completed works (Gebrehiwet and Luo, 2017). Effective time management at pre-contract stage and during the execution of the contract stage is an important success factor of construction infrastructure projects, as it reduces the incidence and effect of delays (Seidu *et al.,* 2022). Hence, this research focuses on the perceptions of middle management professionals with international experience on the causes of construction infrastructure delays. The findings will help in better understanding the factors causing delay and taking the measures necessary to control them. The study adopted middle management professionals as the field study subjects as they directly implement the decisions on the project which might have direct influence on the schedule.

LITERATURE REVIEW

Causes of Construction Delays

A critical review of 27 studies was undertaken, based on real life completed projects undertaken in the UK to gain detailed knowledge of current condition of the projects, considering the underlying causes of delays in construction infrastructure projects. This was reviewed using different subheadings to determine the project challenges related to delays on the project. Eleven common causes were identified; these are categorised into 5 key themes based as presented in Table 1, to support quality risk evaluation process.

Table 1: Primary causes of delays observed in the literature review for the research

Themes	Common Causes of Delay	Source
Natural causes	Weather/climate conditions	Ballesteros-Pérez *et al.,* 2015 ; Hussain *et al.,* 2018 ; Mahamid, 2017 ; Al-Hazim *et al.,* 2017.
People and Time factor	Communication and coordination; Experience and qualifications Rework	Khoshgoftar *et al.,* 2010; Durdyev and Hosseini, 2018; Soliman, 2017
Resource shortage	Construction Equipment Construction Materials Construction Labour	Hamzah *et al.,* 2011; Sambasivan and Soon, 2007; Durdyev and Hosseini, 2018; Fallahnejad, 2013; Gunduz and AbuHassan, 2017.
Finance	Project Finance	Durdyev and Hosseini, 2018; Hamzah *et al.,* 2011; Sambasivan and Soon, 2007; Yang *et al.,* 2010; Tumi *et al.,* 2009; Memon, 2014.
Management skill	Site management Project management; Planning	Gunduz and AbuHassan 2017); 2017; Kog, 2017; Fallahnejad, 2013; Sambasivan and Soon, 2007; Sweis *et al.,* 2008.

Most studies on infrastructure projects classify weather or climate conditions as a substantial cause of delays. Studies on project schedule performance have suggested that the effect of climate conditions needs to be considered throughout the planning stage of the project (Ballesteros-Pérez *et al.,* 2015). Similarly, Hussain *et al. (*2018) and Mahamid, (2017) stated that it is a challenge which can affect the project at both the design and construction stages. For example, in Jordan, Al-Hazim *et al. (*2017) identified bad weather conditions relating to the condition of the terrain as a major cause of delays in meeting deadline and site closure due to other environmental factors as the second most important basis for both time and cost overruns in infrastructure construction, which project stakeholders can neither foresee nor measure. Most of the forms of contract used on construction projects include probable delays caused by climate or adverse weather conditions in the contract provisions as suggested by Apipattanavis *et al. (*2010). For example, the NEC4, JCT and FIDIC contracts have force majeure clauses. The weather is treated as a relevant event

entitling contractors to extension of time under the JCT form of contract and a compensation event where the NEC contract applies. This is a measure put in place after the occurrence, it does not deal with the root cause before it occurs which is where management experience plays an important role to ascertain the natural events that can affect the project duration and proffer measures before they happen.

A study by Khoshgoftar *et al. (*2010) indicated that there is a lack of communication among the many stakeholders who participate in project delivery. This occurs throughout the design and construction stages, and indeed in all stages, from the initiation to the handover to the client. Project stakeholders tend to have disagreements that are related to the flow of information from one organisation to another during the project's life cycle and with appropriate coordination among the stakeholders. These internally related delays have a negative effect on the project's schedule performance. As exemplified by Durdyev and Hosseini (2018), and Soliman (2017), poor communication, coordination and disagreements are the second, third and fourth most cited causes of delays in the literature due to these challenges. Morledge and Smith (2013) suggested that project coordination should emphasize the scheduling and allocation of suitable resources for every work activity and provide clear instructions and technical details to site management teams for project success.

The Project Management Institute (PMI) (2017) described planning as the preparation of a plan of action to lead a project to completion. Also, Opeoluwa *et al. (*2019) defined Planning as instituting the most effective sequence of events necessary to complete a project including allocation of resources that will ensure the success of the construction project. Effective project planning has a role to play in the success of any project (Zwikael and Sadeh, 2007). Project planning involves detailing a set of directions to equip the project team with exactly what the project entails, the time during which it must be carried out and the resources necessary to achieve the project milestones successfully (Meredith and Mantel, 2006). Ineffective/improper planning is also cited as one of the most probable causes of delays in construction projects (Fallahnejad, 2013; Sweis *et al.,* 2008). Durdyev and Hosseini, (2018) argue that construction delays in the project's milestones certainly impede project schedule performance and this is not excusable since the activities leading to the planned milestones are managed by the contractor. With poor planning due to inexperience or inadequate expertise in project planning, the workers will be expected to perform more intensely, and worksite supply management issues will increase, resulting in further delays and poor labour performance that will inhibit the success of the project (Jalal and Shoar, 2017; Kog, 2017).

Financial issues such as payment delays were identified in many studies as significant causes of delay (Hamzah *et al.,* 2011). Yang *et al. (*2010) found that financial problems occurred in projects where different procurement methods were used. For instance, in Libya, Tumi *et al. (*2009) found that financial issues ranked as the main cause of delays arising from organisational or operational procurement challenges. Shehu *et al. (*2014) noted that construction delays in Malaysia are mostly related to financial issues faced by the contractor, while Fallahnejad (2013) considered payments to the contractor as one of the ten most important causes of project delays. Further research into this cause (Memon, 2014) concluded that this is because clients often have insufficient financing for the work. Hence, poor cash flow management, late payments and financial instability among the key stakeholders involved in the project contribute to project delays.

Another important cause of project delay is a lack of materials; without the appropriate materials, the design cannot be converted into a physical reality. Hamzah *et al. (*2011) and Sambasivan and Soon (2007) cited material delivery delays as one of the causes of construction project delays. Causes associated with construction material delays are design changes, supply delays, changes in material prices, supply management, political issues, theft, material damage, testing failures and untrustworthy suppliers (Durdyev and Hosseini, 2018). Fallahnejad (2013) found that client-related material issues and order changes are major causes of delay. Good cash flow management safeguards continuous supply of materials in construction projects, helping avoid materials supply challenges (Gunduz and AbuHassan, 2017). Variations in design requested by the client team are linked to material delay on site. Changes in the project scope delay the project during the construction stage if not properly managed as these changes often result in rework, which affect the relationships between the stakeholders (Pourrostam and Ismail, 2012; Memon, 2014).

In countries where much of the project resources are imported, lack of construction equipment and plant have been found to be one of the main causes of delays. Kazaz *et al. (*2012) concluded that this cause of delay not only results from the market unavailability of the required equipment or plant but is also a consequence of poor servicing and maintenance problems. Lack of construction labour is also cited as a common cause of delay, especially where the project involves innovative construction technologies. Construction is a labour-intensive sector, and the nature of traditional construction works requires skilled labour to undertake the work (Durdyev and Hosseini, 2018). However, the construction industry in many countries is experiencing a lack of skilled workers, sometimes causing contractors to employ inexperienced workers (Kadry *et al.,* 2017; Niazi and Painting, 2017). For instance, the sudden increase in the volume of construction projects due to the boom in countries in the Middle East has resulted in a shortage in construction labour as many projects are being developed simultaneously (Gunduz and AbuHassan, 2017). A survey by the Civil Engineering Contractors Association (CECA, 2022) revealed that contractors in UK have issues recruiting skilled operatives, this has been ongoing for years with a major gap to fill between the level of skills needed and pipeline of projects. Currently, the US has a shortfall of 430,000 workers which will increase due to the prediction of over 40% of construction workforce will be retiring in the next decade (Katara, 2022).

Skilled and experienced management personnel is another factor that has an impact on projects and causes delay. Project schedule performance is affected by internal stakeholders who often lack experience and qualifications in project management and specifically, planning, including resources scheduling (Newton, 2015). For instance, Kadry *et al. (*2017) noted the impact of some issues regarding unavailability of skilled stakeholders who are in demand for construction projects. Consequently, Memon (2014) noted that contractors with insufficient experience tend to employ unskilled or inexperienced labour, and use outdated construction tools and processes thus, impacting on project performance. Using an inexperience manager to lead the delivery of infrastructure project can cause clients failure to meet scheduled payments to the contractor as stated in the contract or postponement of payments due to misinterpretation of the contract (Sepasgozar *et al.,* 2015). If this is not challenge from the onset, clients can be carried away to set impracticable deadlines for design and construction teams (Kog, 2017). This will eventually lead to poor site or strategic management when they cannot detect, forecast and resolve any challenges causing

delays (Durdyev and Hosseini, 2018). Even contractors may not be able to supervise key stakeholders (mainly subcontractors) and clients selecting contractors who proffer the lowest price bid, thereby, neglecting to select a contractor with the knowledge necessary to complete the project (Kog 2017). On the other hand, the skill and expertise of the contractor is also a major factor. Overall, the impact of project stakeholders is a significant cause of project delays. Thus, this study explored the views of professionals working on construction infrastructure project to understand the common theme causing delays. In this way, project stakeholders will be aware of the causative factors before and when it happens.

METHOD

The research relied on both primary and secondary data sources. The primary research data were obtained from a selected sample of 12 professionals who had worked in the United Kingdom with further experience working in other countries and had performed different project roles across the globe (United States, Chile, Europe, India, Africa, Middle East). These participants were selected from those who responded to an invitation of expressions of interest placed on LinkedIn for professionals with experience on infrastructure projects. The secondary data was collected from a literature review, it provides the background information against which the findings from the interview responses are compared.

The interviewees were selected to represent a cross-section of different roles often present in construction projects. Professionals from different fields will have different opinions, from their experiences of delays, and this also adds value to the research (Naoum, 2013). The literature review indicated that those in the roles selected for the interviews are the key players in terms of the causes of delays on infrastructure projects. The participants were selected from both the public and private sectors, and from small, medium, and large sized organisations. The interview was the most practical method for obtaining the data required for the study, it will adequately help evaluate the quality of the information (Sandelowski, 1995).

Table 2: Overview of participants' current roles and organisational experience

Participants	A	B	C	D	E	F
Role	Construction Project Manager	Development Manager	Design Manager	Integration Manager	Programme Manager	Project Control Engineer
Project	Residential/ Social Housing	Bespoke Development	Transportation - High Speed Rail	Remodelling - Rail	Infrastructure, Power station	Civil Engineering
Participants	G	H	I	J	K	L
Role	Bridge Design Manager	Fund Monitoring Surveyor	Concrete Materials Specialist	Construction Project Manager	Laboratory Manager	Sub Agent
Project	Transportation	Fund Provider	Civil Engineering	Civil Engineering	Infrastructure	Airport

The results were examined in a descriptive way which was an exploratory method for analysing the information from the industry's middle management professionals (Naoum, 2013). For reliability and validity of the result, each of the participants was provided with a summary of their interview for verification and validated against the result.

FINDINGS AND DISCUSSION

Causes of Construction Infrastructure Delays

Construction infrastructure project delays are still major issues in the industry, with the developed world during project regeneration or extending old project, this is due to

the complexity or type of project including stakeholders, organisations involved, climate/environmental effect creating massive public or political interest (Flyvbjerg, 2011). Most of the construction infrastructure projects delays are due to inexperience in managing the risk and project goals. Ineffective identification and managing the various causes of delays has been described as "a disaster" in managing construction infrastructure project (Durdyev and Hosseini, 2018). Effective project delivery cannot be devoid of project knowledge management, collaboration, culture changes which must involve possible planning and scheduling control measures with the cooperation and understanding of those stakeholders directly accountable for managing the planning process.

Managing projects must not be based on managing the aftermath of delays but on managing forecast causes of delays. An effective delays analysis process must be put in place to identify various causes and the management tools available for managing project especially with any inherent risk identified which is fundamentally a continuous process. This process must be undertaken by experienced personnel with risk management and delay assessment abilities. The interviews set a practical approach in assessing the veracity of information on delays, it revealed the causes of construction infrastructure delays considering the key categories outlined in the literature review as discussed in detail below.

Natural Causes

Adverse weather and climate conditions were mentioned as being among the top causes of construction infrastructure delays. Either, it is civil or critical activity, the weather can be the major factor in doing the work. The interviewees are concerned that communication and coordination are primary causes of delays, with the assertion that delays from planning usually occur in projects where the stakeholders do not communicate well or due to ineffective management of project interface.

Finance

Project financing was recognised as a factor causing project delays. However, some of the interviewees believed this is not a problem in some projects where the project funding is secure. One stated: that 'A lot of project financing is organised at the front-end of the development. So, a lot of the mechanisms and processes and procedures are all agreed and carried out quickly. It is very rare that the construction finance is the reason for what is happening on-site.' In Libya, Tumi *et al.,* (2009) found that financial issues ranked as the main cause of delay. In the United Kingdom financial issues are medium to low contributors of delay according to the participant H, G and J, it is not an issue in the United Kingdom but is a high contributor in other countries.

Resource shortage

Construction labour was regarded as a medium contributor to delays. A statement made by Participant H refer to, 'The quality of construction labour can affect stakeholders' mitigation processes' while agreeing that qualified labour was needed to do the work. If the project site is not professionally managed, it will cause delay, with most of the participants affirm it as a high contributor to delays. However, construction materials were not seen as a major cause of delays by participants; they affirm as a low contributor except Participant D who rated it as a high contributor because of unforeseen circumstances in 2020 where some factories were shut down due to the Global Shock (the COVID-19 Pandemic), where some project were put on hold as a result of the bureaucratic process that must be follow when acquiring

materials abroad due to the effect of Brexit in place whereas construction equipment was seen as a medium contributor to project delay. ’

People and time factors

Poor communication, coordination and disagreements were also cited as causes of delays in the literature (Durdyev and Hosseini, 2018; Soliman, 2017). It may take years to progress schemes through planning, and communication plays a vital role. In addition, if the site is untidy and the site and project are being mismanaged by the main stakeholders, there will be severe delays. Also, rework was not a major contributor to delay by interviewees where any error or discrepancy in design and specification were spotted in time and corrected.

People factors are other contributors to delays. Participants A, B and E cited several examples such as the technical team delaying drawings; poor communication with building control and warranty providers; and temporary joint ventures with diverse cultures, behaviours, and people. In addition, inadequate coordination, risk allocation and design; lack of innovation, lack of communication between managers resulting in time losses and an exhausted workforce; inadequate planning in the early stages; and contractors starting construction without an approved design also cause substantial delays. The necessity of redesigning in the construction stage due to material complexity because of stakeholder miscommunication at an earlier stage may also cause delays. Also, lack of experience and qualifications also greatly affect project schedule performance and often award projects to contractors with insufficient experience. Another participant concluded that 'lack of skill and inexperience are main contributors to project delay', and further reiterated that 'many of the top managers are now retiring while there is no direct replacement from the middle management team, resulting in relying on less experience members who need to be upskill to the required standard'.

Management skills

It is evident from this research that communication and coordination, planning, site management and project management are high to very high contributors to delays to construction projects. More projects now are larger and usually undertaken by multiple companies which complicates the communication and coordination among different teams and different companies. It is essential to manage resources effectively otherwise, valuable time is lost in the construction process. Sometimes it takes 2-3 years to get schemes through planning, and communication play a vital role. If the any of the main stakeholders does not have the management skill require to manage an infrastructure project which can result in site/project mismanagement causing severe delays.

Project management skills emerged as a main contributor with Participants D, F, K, and L stating it as a medium contributor and Participant H echoing that, ‘If the project is mismanaged from the consultant’s side, the developer or the client’s side such as engaging an inexperience manager, they’ll experience some delays and those can be severe.’ It is more about experience and qualifications as rated by participants as contributors to delay. One participant commented that ‘It is usually a team that deals with that so someone will be experienced, and he will be dealing with more major issues. Some will be less experienced and will follow the more experienced with effective communication.

CONCLUSION

Based on the evidence from the participants in the field study, communication and coordination, planning, site management and project management are high and very high contributors to delays. Project finance, construction equipment, experience, qualifications, and construction labour vary from high to medium contributors. Weather and climate conditions, rework and construction materials were rated as low to very low contributors. According to this research, delays can be attributed to the fact that projects are becoming larger, complex and are usually completed by 2 or more companies, which complicates the communication and coordination among different teams from different companies.

It is evident that the effects of construction project delays are mostly lost profit, delays, and disruption claims. The underlying causes of delays are likely to increase in the light of lost profit claims or delay and disruption claims. Most projects are faced with claims to recover lost profits or delay claims (compensation events) or no claims when the cause is minor, or the contractor's incorrect estimations result in unexpected costs that cannot be claim. It is essential to mention that the level of communication and coordination between the main stakeholders leads to these effects, which is linked to the use of traditional management practice instead of adopting an innovative practice measure and to get more qualified professionals involved from the bottom up.

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