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COMPETENCE AS A KEY FACTOR IN CAUSAL MECHANISMS OF CONSTRUCTION DISPUTES

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ABSTRACT

Construction disputes appear ubiquitous in megaprojects, but, they are undesirable due to their negative consequences which include project cost escalation and project delays. Reducing, or better still eliminating, disputes in projects is a desirable indicator of project performance. Much of previous research on construction disputes has focused on identifying general sources of construction disputes and has tended to deal with immediate causes and ignored root causes of construction disputes. Better understanding of construction disputes can be achieved by understanding the entire causation mechanism of construction disputes right from the root cause through to the immediate cause. Such an understanding will facilitate efficient approaches to managing disputes. In this paper we present research undertaken to elucidate root causes of important disputes in one case study of a megaproject in a developing country. Secondary data including project reports, contract documents, minutes of meetings, and project communications were collected and analysed using inductive thematic analysis. Using the concept of a mechanism, we reveal a root cause of construction disputes, namely, limited competence of internal project stakeholders. Hence, we put a spotlight on the need to improve competence of construction professionals in the areas of construction contracts, procurement management, contract administration, and project governance. We argue that focus on the above areas of competence and deployment of these competences throughout the lifecycle of megaprojects will reduce disputes and improve project performance.

Keywords: competence, developing countries, disputes, infrastructure, mega projects

PRACTICAL APPLICATIONS

This paper highlights the mechanism through which significant disputes arose in an infrastructure megaproject. It promotes the idea that avoidance/elimination of the root cause of the dispute can mitigate dispute occurrence and improve overall project performance. The study reveals lack of competence among project delivery stakeholders especially the client, consultant, and contractor as a root cause of construction disputes. The paper demonstrates that improved project performance can be achieved with increased competence of internal project stakeholders not only in the early stages of the project but throughout the project lifecycle.

INTRODUCTION

Megaprojects have a significant impact on society, economy, and environment (Jensen, 2017). It is therefore not surprising that investment in megaprojects is increasing across the globe (Flyvbjerg, 2014). However, performance of megaprojects is often affected by uncertainties including claims, conflicts, and disputes and construction disputes are some of the main factors responsible for the unsuccessful completion of projects (Rauzana, 2016). After their occurrence, construction disputes often take a long time to be settled (Arcadis, 2021) which often results in stagnation of project activities and subsequent project delays. As such, construction disputes require careful management due to their negative impacts on project performance (Arcadis, 2021).

A construction claim is an expression of intent made by one party to a contract to the other for relief or entitlement under any clause of conditions of the contract or otherwise pertaining to, or resulting from, the contract or the performance of the works (FIDIC, 2017). Cambridge Dictionary defines a conflict as an active disagreement between people with opposing opinions. A construction dispute is a situation in which two parties disagree over the assertion of a contractual right leading to a contract decision becoming subject to legal intervention (Arcadis, 2021). Disputes often escalate from issues including conflicts and unresolved claims that could have been addressed promptly (Liyanawatta, Francis and Ranadewa, 2023). As such, studying disputes and investigating their sources will also reveal the destructive conflicts and unsettled claims that are of concern to construction projects. Therefore, it is crucial to investigate disputes and their underlying causes in order to mitigate cost and schedule overruns in construction projects (Nabi *et al.*, 2022).

Many construction disputes can be traced to start during the pre-contract stage (Liyanawatta, Francis and Ranadewa, 2023). Indeed, various studies have identified different causes of construction disputes (Viswanathan et al., 2020). But, much of the available literature suggests that emphasis has been put on immediate triggers of construction disputes with limited focus on a comprehensive mechanism of causation (Nabi et al., 2022). Although construction disputes are inevitable, their occurrence can be reduced or their mitigation rate improved. However, dependence on immediate causal factors of disputes leaves us without a comprehensive understanding of how to further reduce occurrence of construction disputes (Illankoon et al., 2019). This calls for a new/different approach to researching construction disputes.

Efforts have been made to provide another approach especially using causal modelling. However, most of the research such as Tanriverdi et al. (2021) and Viswanathan et al. (2020) have focused modelling based on quantitative data about perception of causation which provides a generalised picture that might not reflect reality of any single project. Hence, there is a gap relating to pinpointed causation mechanisms of specific disputes in specific projects to generate specific mechanisms for specific disputes in specific projects. One new way, which we adopt in this paper, is case-by-case investigation of causal mechanisms of construction disputes using a real case study. This new way provides a holistic understanding of construction disputes and highlights how we can intervene in the most efficient ways and at the most efficient time points in the project's lifecycle. Therefore, the research reported in this paper was aimed at determining causal mechanisms of construction disputes to contribute to the realization of better performance of construction megaprojects. In the following sections we present a review of literature on infrastructure megaprojects and construction disputes; sources of construction disputes; and management of construction disputes. Furthermore, we explain the method used before presenting findings and conclusions.

INFRASTRUCTURE MEGAPROJECTS AND CONSTRUCTION DISPUTES

Megaprojects are large-scale, complex undertakings that generally cost over $1 billion, take several years to complete, include multiple stakeholders, are transformative, and have an impact on many people (Flyvbjerg, 2014). Infrastructure projects are some of the global megaprojects since they are expensive and have a significant impact on society, the economy, and the environment (Jensen, 2017). In the early 2010s, global expenditure on infrastructure was increasing and the trend was expected to continue (Flyvbjerg, 2014). Indeed the increasing expenditure on infrastructure was highlighted by, projections of The World Bank (2022), that estimate that globally, there is need to invest about $94 trillion in infrastructure by 2040 to achieve the expected levels of global GDP growth. Developing economies even need more infrastructure and at least two-thirds of the estimated global infrastructure spending by 2030 is required by developing economies (Garemo, Matzinger and Palter, 2015).

However, infrastructure projects have previously been difficult to manage at the critical front end (Jensen, 2017) and are often characterized by claims, conflicts and disputes (Arcadis, 2021).

Some construction claims and conflicts are unavoidable (Ogburn et al., 2014) and required to contractually provide for unanticipated changes in the project's parameters or inevitable shifts in the client's priorities. Likewise, whereas conflicts are often associated with negativity, the advantages of constructive conflicts have been experienced in projects (Mbatha, 2022). These statements suggest that healthy conflicts and claims can be accommodated on construction projects. However, there are unhealthy conflicts that escalate into adversarial events with disastrous consequences and if not resolved may metamorphose into disputes (Jelodar et al., 2016). This argument is supported by other authors such as in Hietanen-Kunwald and Haapio (2021) who emphasize that the relationship between unresolved conflicts that turn into claims and transform into disputes cannot be underestimated.

Construction disputes are some of the main factors responsible for delayed completion of projects (Rauzana, 2016). If construction disputes are not promptly resolved, they tend to stagnate and escalate, thus causing project delays, and ultimately may damage business relationships (Illankoon *et al.*, 2019). The average global value of disputes in construction projects increased from $30.7 million in 2019 to $54.26 million in 2020 according to Arcadis (2021). CRUX (2020) shows that the average value of expenditure due to disputes amount to almost 56% of the planned capital cost of megaprojects. The global average length of time between the formalization of disputes and their settlement is 13.4 months (Arcadis, 2021). The above figures demonstrate an unsustainable level of poor performance which needs to be addressed with new approaches such as understanding causal mechanisms of disputes.

SOURCES OF CONSTRUCTION DISPUTES

Construction disputes are initiated by several factors that are inter-related yet most of the previous research has mainly attributed dispute causal factors to individual factors while ignoring their interdependences (Viswanathan et al., 2020). As such, there is a large tendency to ignore the chain of events that lead to disputes while concentrating on single events. Hietanen-Kunwald and Haapio (2021) assert that disputes are often the end of escalation processes and the real underlying causes need to be investigated broadly. To manage the different causes of disputes and reduce their occurrence and recurrence in construction projects, it is essential to look into the relationships between the numerous causal components of construction disputes (Nabi et al., 2022). This shows an emphasis on the need for further research to study the underlying causes of disputes and their escalation process to supplement the existing body of knowledge. Studying the escalation processes of disputes is vital to understanding the root causes of construction disputes and their avoidance (Hietanen-Kunwald and Haapio, 2021).

MANAGEMENT OF CONSTRUCTION DISPUTES

It is in the interest of all project stakeholders that construction disputes are managed effectively and efficiently. Current practices for managing construction disputes follow either proactive or reactive approaches. Reactive approaches to managing construction disputes resolve construction disputes after the occurrence of the disputes (Arcadis, 2021). Proactive approaches for dispute management employ preventive measures to avoid or mitigate the occurrence of disputes (Iskandar, Hardjomuljadi and Sulistio, 2021). Ideally, proactive approaches should be preferred to reactive approaches.

Traditionally, reactive practice relies on litigation as the method for dispute resolution (Illankoon et al., 2019). However, since it shatters partnerships and corporate connections that are required especially in undertaking complex projects (Turner, 2022), litigation is unwanted (Bahemuka, 2021). Litigation is a drawn-out and costly procedure with direct and transaction costs that have a detrimental financial impact on projects and the parties involved (Hardjomuljadi, 2020). Recently, the use of alternative dispute resolution methods (alternatives to litigation) has increasingly become common in construction projects (Arcadis, 2021). Alternative dispute resolution methods are preferable to litigation because of their relatively lower costs and ability to protect the reputations of projects and their stakeholders (Hietanen-Kunwald and Haapio, 2021). The common alternative dispute resolution methods are negotiations, mediation, and adjudication (Arcadis, 2021). Although alternative dispute resolution mechanisms are preferred to litigation (Hietanen-Kunwald and Haapio, 2021), they are not the most efficient. Efficient dispute resolution enables involved parties to avoid losing time, money, and effort in adversarial reactive dispute resolution processes (Hietanen-Kunwald and Haapio, 2021). This is not the case with reactive dispute resolution as resolving disputes after their occurrence involves direct costs and indirect transactional costs (Hietanen-Kunwald and Haapio, 2021). The process of resolving disputes using reactive dispute resolution approaches consumes project resources including time and money (Iskandar, Hardjomuljadi and Sulistio, 2021), and can lead to project delays and cost overruns (Iskandar et al., 2021; Shaikh et al., 2020).

Proactive dispute management focuses on reducing the likelihood of occurrence of disputes (Hietanen-Kunwald and Haapio, 2021). Researchers have suggested different ways of applying preventive measures to construction disputes. For instance, Hietanen-Kunwald and Haapio (2021), suggests proactive contracting. Proactive contract design ensures that business leaders in charge of implementing contracts know what to do and what not to do thereby preventing unnecessary misunderstandings and consequent disputes (Hietanen-Kunwald and Haapio, 2021). Kolosky (2024) suggested that selecting an appropriate procurement strategy mitigates certain construction disputes. As such, proactive dispute management strategies incorporate the activities in early project phases including the pre-tendering phase. Managing construction disputes proactively requires an understanding of the sources of the disputes and a clear understanding of the sources of construction disputes is the first step toward the prevention of their occurrence (Liyanawatta et al., 2023). As such, understanding dispute sources is a prerequisite for proactive dispute management (Hietanen-Kunwald and Haapio, 2021). By proactively managing disputes, limited project resources are conserved and greater emphasis is placed on construction as opposed to dispute resolution (Hardjomuljadi, 2020). Proactive dispute management mechanisms are the most efficient methods to save time, money, and efforts that favour construction practitioners (Hietanen-Kunwald and Haapio, 2021). As such, proactive dispute management should be the desired position of all stakeholders in the construction industry (Hietanen-Kunwald and Haapio, 2021).

In this paper, we present research that demonstrates why and how proactive management of disputes can be operationalised. The paper provides insights about the role individuals and their attributes play in the development and manifestation of construction disputes. It underscores the common maxim that human resources (people, people's competence (knowledge, experience, attitude and skill) are any organisation's most important assets. The paper also shows what some might describe as the dark-side of projects – procurement and contract management practices that go against the grain. Yet, through bringing all the above together in one article, we hope to contribute to an awakening of the construction industry to promote doing the right things at the right times for desirable and sustained industry performance.

METHOD

A desk study, as described in Kyalisiima et al. (2022), was conducted on a single case study to undertake an in-depth investigation (Saunders, Lewis and Thornhill, 2019) of the sources of disputes during the construction phase of an infrastructure megaproject. A desk study was appropriate since there was sufficient and reliable secondary data from the case study project. The desk study involved a critical review and analysis of over 10,000 pages of project documents. The documents included 11 contract documents the employer had with three key project stakeholders, 108 project progress reports, 36 project management consultant's reports, 70 files of minutes of meetings, 6 reports by a panel of experts, 3 project audit reports, and over 200 project letters. Informed consent was sought from the client organization and anonymization of the project and project stakeholders was a priority. Therefore, for this paper, the project and its stakeholders will be kept anonymous and unidentifiable.

The project documents were subjected to inductive thematic analysis with the aid of NVivo 12 software. Inductive thematic analysis involved familiarisation of data, coding, and theme formation and refinement (Clarke & Braun, 2017) that were done concurrently. The procedure of inductive thematic analysis comprised of three steps. In the first step, having identified the dispute (layer 0 in the mechanism), we searched the data for reference to the dispute; we analysed the relevant documents and identified direct and indirect themes; direct themes emerged from the data while indirect themes emerged from our cognitive and logical consideration of the information; we placed the themes on a timeline relative to the time of declaration of the dispute; and this was the first pass of inductive thematic analysis which gave us the first draft of the causal mechanism. In the second step, we took each node/theme sequentially adjacent to the dispute (layer -1 of the mechanism) and searched the data for reference to the node/theme; and we analysed the relevant documents in a similar manner as described in step 1 above to obtain a second and enriched draft of the causal mechanism. In the third step, we proceeded to the next layers (layer -2, layer -3, etc.) and repeated the data searching and analysis until we got convergence to the root cause (lack of competence).

In this qualitative research, we sought to maximise trustworthiness on the four criteria of credibility, transferability, dependability and confirmability outlined in Stahl & King (2020). We addressed credibility through data triangulation by establishing findings through different data types. We addressed transferability by giving a detailed description of the method of data collection used in the study. We addressed dependability by subjecting the emergent themes to peer review by the members of the research team and this was made known from the start. We addressed confirmability by using data generated in the natural setting of the project prior to the conceptualisation of the research.

The Case Study

The case study was a public infrastructure project under construction in a developing country (country Y) and is referred to as "Project Z" in this paper. Country Y is working towards middle-income country status and Project Z was initiated to support the country's economic development. The government of Country Y was represented by a government agency which is the client organisation which is the owner of Project Z and a ministerial body (taking the role of employer). Among other duties, the employer was responsible for the procurement of the contractor and owner's engineer. Project Z was a flagship megaproject with a lump sum cost exceeding $1.5 billion. The project involved multinational stakeholders including the contractor, the owner's engineer, panels of experts, and the lender. The contractor was responsible for engineering, procurement, and construction and was procured under a turnkey procurement strategy. The project had the involvement of two asynchronous owner's engineers during the construction phase. Construction of Project Z commenced in the early 2010s and was ongoing as of January 2024 with more than four years delay.

FINDINGS

We considered the period from commencement of Project Z to a period of about 8 years after commencement of the project construction phase and established that there had been 18 disputes, hereafter referred to as Dispute 1, Dispute 2, …, Dispute 18. Dispute 1 was about work methods and Dispute 2 was about scheduling. Disputes 3 to 9 were about varying the contract price. Disputes 10 to 15 were about interest charges on late payments and disputes 16 to 18 were about scope of work. Findings about each dispute are extensive, hence, we cannot report on each of them within the page limitations of this article. Hence, we choose to focus on disputes 1 and 2 in this article.

The causal mechanisms of disputes 1 and 2 are provided in Fig. 1 and Fig. 2 respectively and the justification of the causal factors in the figures is shown in Tables 1 and 2 respectively. In the figures, the oval and rectangular shapes represent the causal factors whose cause-effect relationship is represented by arrows. The oval shapes represent causal factors identified from secondary data while rectangular shapes represent causal factors identified from researchers' judgement. Time of occurrence is denoted by T0±N where T0 is time at contract formation and N given in months. This notation helps clarify the chronology of occurrence and, hence, provides one key basis for cause-effect relationship that is important in a mechanism. The causal factors are denoted by Dn_1CFn_2 where D symbolises Dispute, n_1 symbolises dispute number (1 or 2), CF symbolises causal factor and n_2 symbolises the numbering of a causal factor. Therefore, each causal factor has a unique code arranged in that format. For instance, D1CF1 symbolises a causal factor numbered 1 responsible for causation of Dispute 1.

Competence

As can be seen in Fig. 1 and Fig. 2, an overarching theme that emerged from inductive thematic analysis of the data which, in our view, explains much of the origin and development of all eighteen construction disputes is lack of competence. Lack of competence was dominant during both contract administration and pre-contract and contract formation phases. Lack of competence manifested for contractor, owner's engineer and employer at different periods in the project. The root cause of disputes in Project Z was the combined contribution of lack of competence for the contractor, employer and owner's engineer throughout the project.

Competence as defined by Health and Safety Executive (2021) refers to a combination of person's training, experience, knowledge, and ability to apply them to carry out work safely. For success at a particular job, IPMA (2006) identifies four dimensions of competence namely; knowledge, attitude, skills and experience. *Knowledge* as defined by Cambridge Dictionary is the state of being aware of or acquainted with something. A*ttitude* refers to a set of emotions, beliefs, and behaviours toward a particular object, person, thing, or event (Cherry, 2023). *Skill* is a special ability to do something while *experience* is the process of acquiring skill or knowledge from feeling, doing, or seeing things. As such, in this paper, lack of competence is lack of any or all the competence dimensions of knowledge, attitude, skill, experience associated with delivering the project in the case study manifested by any of the project stakeholders.

Dispute 1: Choice of work method for an activity

For a particular activity, the contractor wanted to use method A. However, the employer wanted the contractor to use Method B. Several discussions were held at site level and organisational level involving several stakeholders. The discussions did not lead to agreement and, therefore, the issue was declared a dispute. The factors that led to the issue are presented in the following section.

Causal factors for Dispute 1

We have established that the manifestation of Dispute 1 is explained by the mechanism (showing occurrence of the causal factors from the immediate factors to the root cause) highlighted in Fig. 1. The justification of each causal factor is provided in Table 1. The contractor proposed and insisted on a different method from that preferred by the owner's engineer and employer. As such, the activity was delayed by over three years and was carried over to the defects liability period. This denied the employer the opportunity to monitor the performance of the structure for a long time as was initially planned. The disagreement on the work method resulted from three immediate factors i.e., the occurrence of a defect whose repair method was disputed, employer's mistrust of the engineer, and goal conflicts between the employer and contractor. These three factors constitute what is described previously in the paper as level -1 of the causal mechanism.

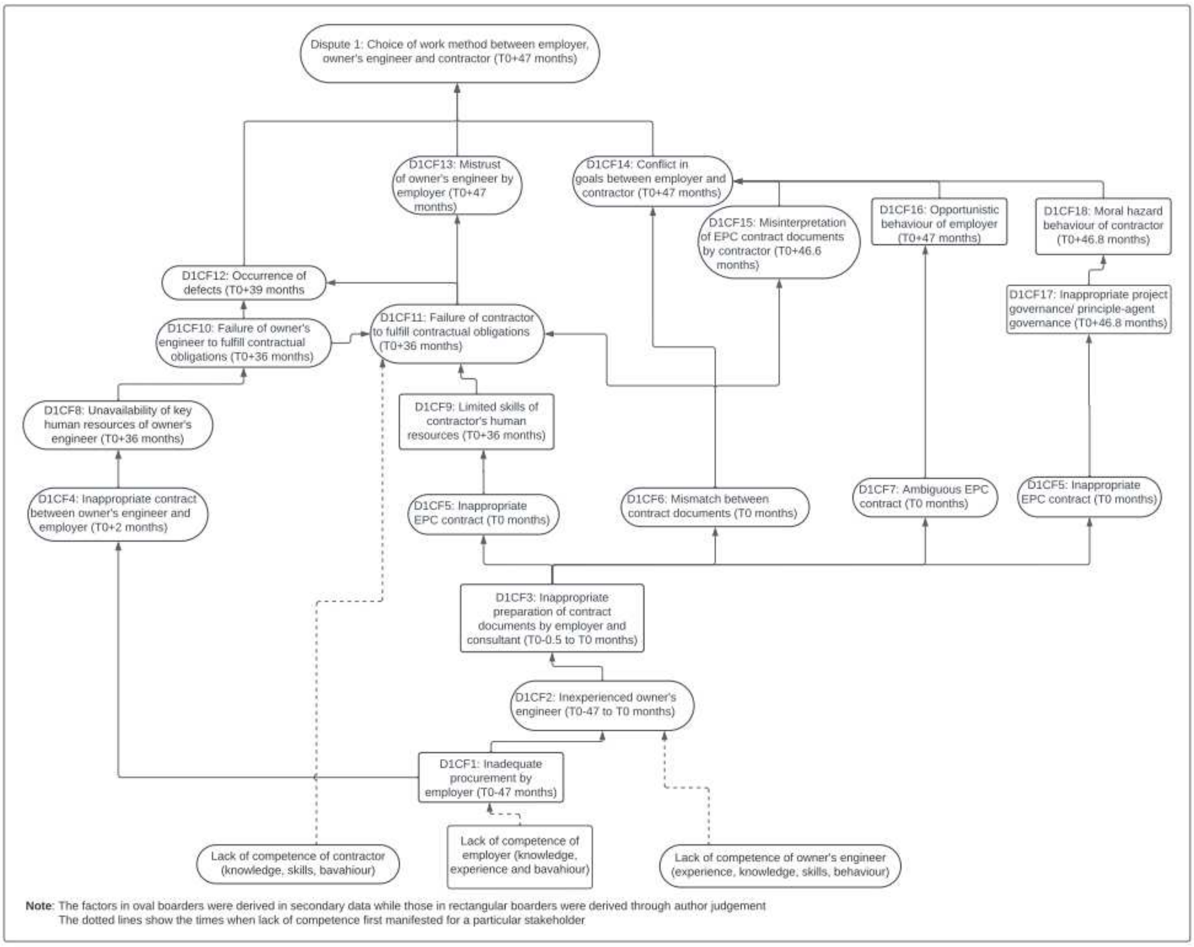

Fig. 1. Mechanism of occurrence of Dispute 1

Table 1. Causal factors for Dispute 1 and their justification

Causal factor	Justification
D1CF1: Inadequate procurement by employer (T0-47 months)	"*the employer appointed an owner's engineer with no experience in large projects" Audit report at time T0+66 months*
D1CF2: Inexperienced owner's engineer (T0-47 to T0 months)	*"there is no evidence of owner's engineer's experience on large projects"* Audit report at time T0+42 months
D1CF3: Inappropriate preparation of contract documents (T0-0.5 to T0 months)	"*requirements for EPC contract were poorly prepared and documented"* Audit report at time T0+66 months
D1CF4: Inappropriate contract between owner's engineer and employer (T0+2 months)	"the value of OE's contract was so small compared to the price of the EPC contract" Audit report at T0+42 months

D1CF5: Inappropriate EPC contract (T0 months)	*"EPC contract is not adequate for such a large and important infrastructure project and is below international best practice"* Audit report at time T0+66 months
D1CF6: Mismatch between contract documents (To months)	*"The hierarchy and listing of engineering standards are contradicting in minutes of meeting and SCC"* Audit report at time T0+66 months
D1CF7: Ambiguous EPC contract (T0 months)	*"…in the GCC, terminology definitions and consistency are missing..."* Audit report at time T0+66 months
D1CF8: Unavailability of key human resources of owner's engineer (T0+39 months)	"*The OE continues to be short in appropriately experienced engineers at all levels and in all disciplines*" PMC site advisory report at T0+40
D1CF9: Limited skills of contractor's human resources (T0+36 months)	*"The Contractor's construction methodology submissions are deficient in engineering detail, and vague on how things are to be done"* PMC monthly report at T0+37
D1CF10: Failure of owner's engineer to fulfil contractual obligations (T0+36 months)	*"OE has agreed to a repair method not in accordance with employer's requirements"* Minutes of Meeting at time T0+41
D1CF11: Failure of contractor to fulfil contractual obligations (T0+36 months)	*"Failure by the EPCC to follow either international standards or employer's requirements*." PMC quarterly report at T0+40
D1CF12: Occurrence of defects (T0+39 months)	*"…works…were found to be defective with tolerances outside that stipulated in employer's requirements"* Project letter by the employer at time T0+44)
D1CF13: Employer's mistrust of owner's engineer (T0+47 months)	*"The employer disagrees with the position of OE on repair method"* Minutes of Monthly Meeting at time T0+49
D1CF14: Conflict in goals between employer and contractor (T0+47 months)	*"…none of the proposals by the contractor is acceptable to the employer"* project letter by owner's engineer at time T0+56 months
D1CF15: Misinterpretation of EPC contract documents by contractor (T0+46.6 months)	*"the contractor continues to misinterpret provisions of contract and…"* Project letter by employer at time T0+48 months

D1CF16: Opportunistic behaviour of employer (T0+47 months)	*"although the there are three repair methods recommended by the standard, the employer declined two and emphasised the most engaging"* project letter by contractor at time T0+56
D1CF17: Inappropriate project governance (T0+46.8 months)	"*There is a poor relationship between the owner's engineer and contractor*" Minutes of Meeting at time T0+48 months
D1CF18: Moral hazard behaviour of contractor (T0+46.8 months)	The contractor uses an ambiguous clause in the EPC contract to justify an inferior work method at time T0+46.8 months.

Causal mechanism that led to occurrence of the defect

One of the immediate factors that led to the dispute was the occurrence of a defect on a major project component. It is the defect whose repair method was not agreed upon by the contractor and owner's engineer that resulted in a dispute. This was seen from a project letter as shown in node D1CF12 in Table 1. The occurrence of the defect resulted from the failure of the owner's engineer to fulfil their contractual obligations. Contractually, the owner's engineer was responsible for supervising of all activities and work packages and ensuring their conformance to employer's requirements. The owner's engineer failed in their responsibilities as several project letters, reports and minutes of meetings show that the owner's engineer failed to supervise the work and this led to misalignment of the major project component. This was an exhibition of lack of *skill* dimension of competence as the owner's engineer lacked special ability to supervise work as contractually required.

As shown in Fig. 1. and Table 1, failure of owner's engineer resulted from unavailability of key human resources such as a surveyor and experienced engineers for the owner's engineer. According to several reports, the resources contractually provided to the owner's engineer were not sufficient to maintain competent personnel on Project Z. Whereas, the project was mega in scope and complexity that required availability of surveyor by the owner's engineer, owner's engineer did not provide such critical personnel. This resulted in errors in critical project components with critical alignment requirements. Unavailability of key project personnel for owner's engineer was a lack of *knowledge* dimension of competence. The authors argue that the owner's engineer exhibited lack of knowledge to provide appropriate human resources for available tasks and activities.

Unavailability of human resources for owner's engineer resulted from inappropriate contract between owner's engineer and employer as shown in Table 1 and Fig. 1. The contract was of inadequate value and lacked some key professionals such as a surveyor as shown in D1CF4 in Table 1. Inappropriate contract of the owner's engineer resulted from the appointment of an inexperienced owner's engineer to the size and complexity of Project Z as shown for D1CF1 in Table 1. This resulted in owner's engineer providing a bid with insufficient value that was considered as the best evaluated bid by the employer since the main evaluation criteria was cost. This reveals the lack of *experience* dimension of competence by the owner's engineer. The authors argue that should the owner's engineer have had relevant experience, they would have provided the right quotation for the magnitude of work or as minimum turned down the undervalued contract. The employer on the other hand lacked *knowledge* and *skills* dimensions of competence. The authors argue that the employer did not have enough knowledge and skills to undertake procurement for a megaproject.

Causal mechanism that led to conflict in goals between employer and contractor

The second immediate factor for the dispute was the conflict in goals between the employer and the contractor. These were shown in several letters between the two parties and reports by different project stakeholders and an example is highlighted for D1CF14 in Table 1. The proposal by the contractor, referred to in Table 1 for DCF14, was easier to implement and not the best option while the preference by the employer was technically superior. As such, conflict in goals was lack of *attitude* dimension of competence that manifested through lack of behavioural competence by the employer and contractor since each party focused on an option that best suited their interests. The goal conflict resulted from the misinterpretation of the EPC contract by the contractor. In several letters between the contractor and owner's engineer, it was depicted that the contractor and the owner's engineer/employer had different interpretation of the EPC contract, for instance, on what a defect was and the defect repair methods. The EPC contract only stated that "*all repairs … shall be ground and smooth to meet the tolerances set in the specifications"*. This statement was so ambiguous and created room for misinterpretation by different parties, each in their favour. Whereas misinterpretation of contract documents was inspired by the ambiguous contract, some project reports such as that highlighted for D1CF15 in Table 1 suggest that misinterpretation was combination of intentional and inability of contractor's human resources to sufficiently interpret the EPC contract. As such, this violates the *attitude* and *skills* dimensions of competence.

According to audit reports, misinterpretation resulted from the EPC contract that was ambiguous, and had mismatches with other contract documents. The contract had incomplete statements and lacked consistency as shown for D1CF6 and D1CF7 in Table 1. The audit reports also show that mismatch and ambiguity of the contract resulted from inappropriate preparation of contract documents as shown for D1CF3 in Table 1. The EPC contract documents were prepared based on procurement for small projects and were unsuitable for megaprojects. The authors argue that this was exhibition of lack of *knowledge* dimension of competence by the owner's engineer. Similarly, the employer showed lack of *experience* dimension of competence by approving poorly prepared contract documents. Whereas the owner's engineer drafted poor contract documents, they were reviewed and approved by the employer which signifies that the employer lacked sufficient experience in contracts for megaprojects.

The cause of poorly prepared contract documents was manifestation of lack of *knowledge* dimension of competence of employer who procured an inexperienced owner's engineer. The employer inadequately procured an owner's engineer who was also the consultant that prepared the pre-bid documents including the employer's requirements. According to project audit reports, the appointed consultant did not have relevant experience with megaprojects and was only experienced in small projects as shown for D1CF2 in Table 1. The owner's engineer also allocated insufficient time for contract negotiations. Whereas sufficient pre-contract negotiations have been found to reduce the possibility and intensity of contract disputes (Danial et al., 2023), this was ignored on Project Z. The contract negotiation time was inadequate especially for the inadequately detailed draft EPC contract whose General Conditions of Contract were based on World Bank's Standard Bidding Document for Procurement of Small Works not more than USD 10 million. As such, several ambiguous issues in contracts that required clarifications were not addressed due to limited time allowed for contract negotiations. It is prudent that at the time of entering into contracts, owners and their project management teams should pay more attention to pre-contract negotiation and agreement with their contractors to mitigate/reduce contract disputes (Liyanapathirana et al., 2024).

The goal conflict also resulted from the opportunistic behaviour of the employer. Several letters by the contractor show that the employer had opportunistic behaviour in demanding for a superior repair method (see justification of D1CF16 in Table 1). The contractor continuously argued that the employer's opportunistic behaviour was a behavioural issue. This according to dimensions of competence is misuse of *attitude* dimension by the employer. As shown in Fig. 1 and Table 1, opportunistic behaviour of employer resulted from ambiguous EPC contract. Ambiguity of the EPC contract resulted from inappropriate preparation of contract documents by the owner's engineer and employer as elaborated in D1CF3 in Fig. 1 and Table 1. Inappropriate preparation of contract documents was manifestation of lack of *knowledge* and *skill* dimensions of competence by the owner's engineer to establish fit for purpose contract documents for megaprojects. We argue that whereas there are standard forms of contracts such as those published by FIDIC that could have guided the owner's engineer, these were not followed. Similarly, the employer exhibited lack of *knowledge* by approving inadequate contract documents. Inadequate preparation of contract documents resulted from appointment of inexperienced owner's engineer by the employer as shown in D1CF2 and D1CF1 in Fig. 1 and Table 1. Acceptance of role by owner's engineer while they did not have relevant experience is a behavioural manifestation that show the violation of *attitude* dimension of competence. Inadequate procurement by employer on the other hand is exhibition of lack of *knowledge* of employer to undertake successful procurements for megaprojects.

In our judgement, the goal conflicts between employer and contractor also resulted from moral hazard behaviour of the contractor. The contractor exhibited moral hazard behaviour by proposing and insisting on an inferior repair method knowing that they had enough protection from an ambiguous EPC contract as shown for D1CF18 in Table 1. The employer argued that contractor's moral hazard behaviour was unwillingness to use the available information to make right decisions. This shows lack of the right *attitude* dimension of competence by the contractor. The moral hazard behaviour resulted from the principle-agent governance encouraged by the EPC contract. Extant literature including The World Bank (2018) and Turner (2022) have suggested that principle-agent governance system is inappropriate for megaprojects and rather suggest use of principle-steward governance. The inappropriate project governance resulted from inappropriate EPC contract. The root cause of inappropriate EPC contract is elaborated in section "causal mechanism that led to occurrence of the defect".

Causal mechanism that led to employer's mistrust of owner's engineer

We contend that the third immediate factor for the dispute was the employer's mistrust of the owner's engineer. Contractually, the decisions of the owner's engineer were binding and representing the full interests of the employer. However, some project documents in which the employer disregarded the decisions of the owner's engineer (see justification for D1CF13 in Table 1) showed that the employer had reduced trust in the decisions of the owner's engineer. The authors argue that mistrust of owner's engineer by employer was lack of *knowledge* dimension of employer by defying a contractual obligation since the contract assigned responsibilities to the owner's engineer to represent the employer in decision making. The mistrust was due to several decisions of the owner's engineer that had resulted in failure of contractor to fulfil contractual obligations. Case in point was "failure by the EPCC to follow either international standards or employer's requirements as shown for D1CF11 in Table 1. In the EPC contract, it was the obligation of the contractor to ensure provision of sound outputs that meet the employer's contractual requirements which the contractor failed to fulfil.

Failure of contractor to fulfil contractual obligations was lack of *skills* dimension of competence exhibited through contractor's inability to follow available EPC contract documents. According to reports, letters and minutes of meetings, failure of contractor resulted from limited skills of contractor's human resources especially in quality control. In several reports, the project management consultant questioned the technical abilities (skills) of key contractor's personnel including the Quality Control Manager. This was so despite the personnel meeting the contractual requirements for the positions. The contractor's limited skills resulted from the inappropriate EPC contract. According to contract documents, the qualifications of contractor's key human resources would be reviewed and approved by owner's engineer. However, the requirements, lacked some competence attributes and only concentrated on qualifications and experience. Other competence dimensions especially *attitude,* reflected in for instance membership in professional bodies, were ignored. As such, the contractual requirements in the EPC contract were not broad enough to ensure successful acquisition and development of contractor's human resources. The causes for inappropriate EPC contract are elaborated in section "causal mechanism that led to occurrence of the defect".

Dispute 2: Role of activity sequencing in a failure

The contractor wanted to use a particular sequence of activities that involved considering a particular activity (activity P) as a successor to another activity (activity Q). However, the owner's engineer instructed the contractor to take activity P as a predecessor of activity Q. The contractor implemented the instruction and there was subsequent failure. The contractor argued that the failure was due to sequencing and therefore owner's engineer's responsibility. The owner's engineer argued that the failure was due to the contractor's poor design and nothing to do with the logic between activities P and Q. The two parties discussed the issue in several meetings but hit deadlock. The deadlock led to declaration of a dispute. The factors that led to the deadlock are presented in the following section.

Causal factors that led to Dispute 2

We have established that the manifestation of Dispute 2 is explained by the mechanism (showing occurrence of the causal factors from the immediate factors to the root cause) highlighted in Fig. 2. The justification of each causal factor is provided in Table 2. The contractor proposed to install the "major project component" in hydrological conditions and timing different from what the engineer preferred. After several attempts, the contractor followed the instructions of the engineer, and unfortunately, the water flow conditions damaged the "major project component". According to the different documents analysed by the authors, the disagreement resulted from four immediate factors namely inadequate risk assessment by owner's engineer, mistrust of contractor by owner's engineer, goal conflicts between owner's engineer and contractor and contradicting risk allocation between owner's engineer and contractor.

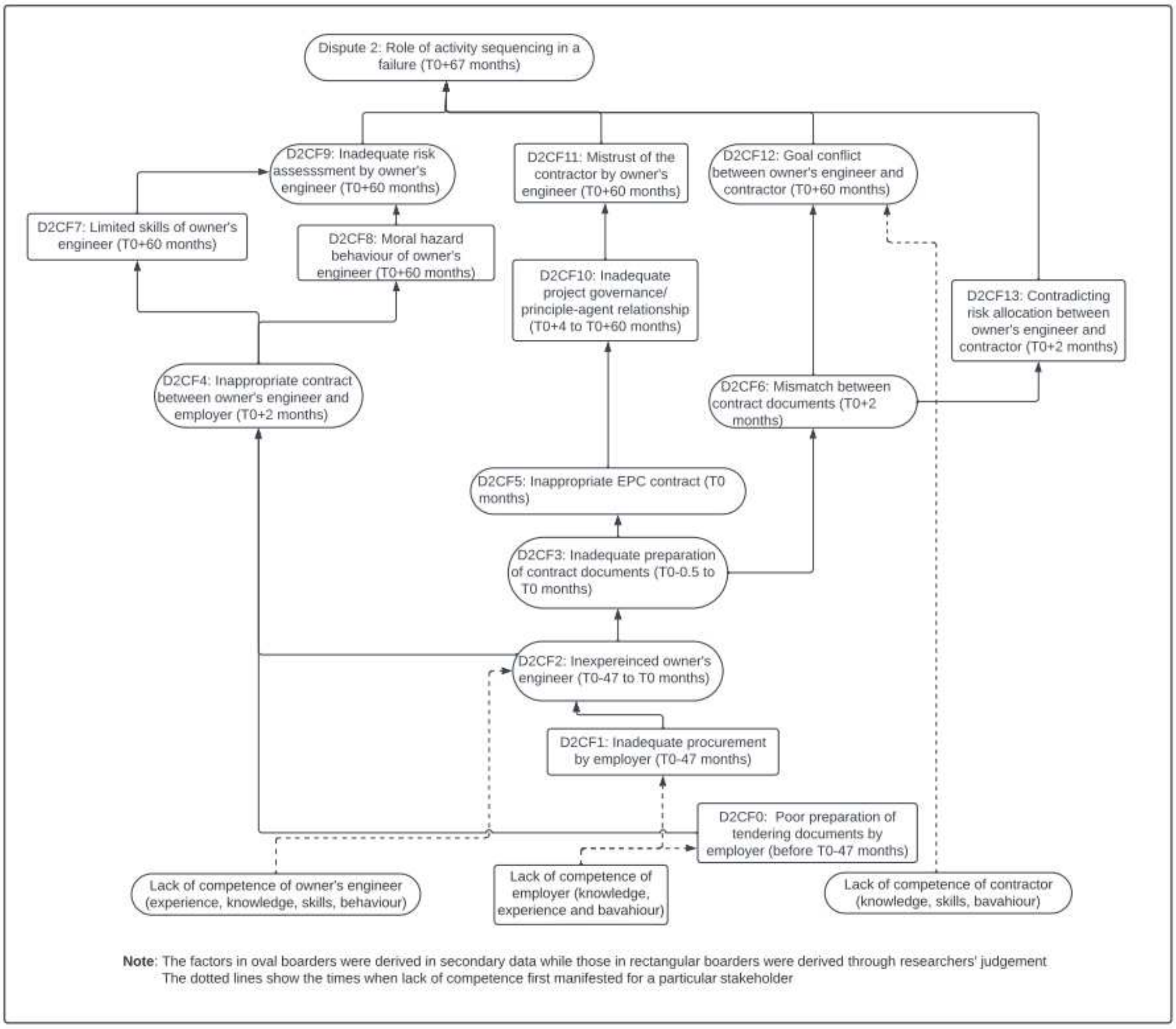

Fig. 2. Mechanism of occurrence of Dispute 2

Table 2: Causal factors and justification for Dispute 2

Causal factor	**Source/ Justification**
D2CF1: Inadequate procurement by employer (T0-47 months)	"*employer appointed an owner's engineer with no experience in large projects" Audit report at time T0+66 months*
D2CF2: Inexperienced owner's engineer (T0-47 to T0 months)	*"there is no evidence of owner's engineer's experience on large projects"* Audit report at time T0+42 months

D2CF3: Inappropriate preparation of contract documents (T0-0.5 to T0 months)	*"The technical specifications, requirements for EPC contract and contract documents were not detailed enough and had deficits, places of misinterpretation that led to a long minutes of contract negotiations with several clarifications."* Audit report at time T0+66 months
D2CF4: Inappropriate contract between owner's engineer and employer (T0+2 months)	"the value of OE's contract was so small compared to the price of the EPC contract" Audit report at T0+42 months
D2CF5: Inappropriate EPC contract (T0 months)	*"…EPC contract model is based on the World Bank's works contract…EPC contract is not adequate for such a large and important infrastructure project and is below international best practice"* Audit report at time T0+66 months
D2CF6: Mismatch between contract documents (To months)	*"The hierarchy and listing of engineering standards are contradicting in minutes of meeting and SCC"* Audit report at time T0+66 months
D2CF7: Limited skills of owner's engineer (T0+60 months)	"*The OE continues to be short in appropriately experienced engineers at all levels and in all disciplines*" PMC quarterly report at T0+61
D2CF8: Moral hazard behaviour of owner's engineer (T0+60 months)	Authors revealed that owner's engineer was simply accepting/ approving contractor's proposals since their contractual liability had come to an end.
D2CF9: Inadequate risk assessment by owner's engineer (T0+60 months)	There is no robust risk assessment as pre-requisite for the high-risk activity in method statement of T0+60 months
D2CF10: Inadequate project governance (T0+4 to T0+60 months)	"*There is a poor relationship between the owner's engineer and contractor*" Minutes of Meeting at time T0+48 months
D2CF11: Mistrust of contractor by owner's engineer (T0+60 months)	In a project report letter at time T0+63, owner's engineer expressed mistrust that the contractor may not honour the promise of undertaking the activity as a successor activity.

D2CF12: Goal conflict between owner's engineer and contractor (T0+60 months)	Project letters by contractor and owner's engineer at time T0+60 months show different goals targeted by the contractor and owner's engineer.
D2CF13: Contradicting risk allocation between owner's engineer and contractor (T0+2 months)	*"clarification is sought on contradicting responsibilities between OE and contractor"* Minutes of negotiations at T0+2.5 months

Causal mechanism that led to inadequate risk assessment by owner's engineer

One of the immediate causal factors for the dispute was inadequate risk assessment by the owner's engineer. Some reports by the Panel of Experts revealed that the owner's engineer did not prioritise risk management in Project Z. The reports revealed that there was no risk register for the project for the first 80% of the Engineering, Procurement and Construction contract duration. This was an indication that the owner's engineer was not guiding the contractor into undertaking of risk assessments for project activities. Moreover, D2CF9 in Table 2 shows that risk assessment was missing in an approved method statement. Although the risk register should be formed in the pre-contract stages of the project and updated throughout the post-contract project phase (The World Bank, 2018), this was not the case for Project Z. We contend that inadequate risk assessment / management by owner's engineer is manifestation of lack of *knowledge* dimension of competence to consider risk management as core process for a megaproject. The owner's engineer also exhibited lack of *skills* to undertake risk assessment for major project components.

According to one of the reports by the Panel of Experts and several project letters, inadequate risk assessment by the owner's engineer resulted from moral hazard behaviour and limited skills of the owner's engineer's personnel. Although the owner's engineer's contract did not explicitly mention the requirements of risk management by the owner's engineer, the Panel of Experts asserted that it was international best practice for the owner's engineer to assume that role. In our judgement, at the time of misguidance of the contractor, the owner's engineer was winding up their supervision contract with the employer and developed moral hazard behaviour as shown in D2CF8 in Fig. 2. and Table 2. As such, there was no evidence that the decisions of the owner's engineer at the time were being done in the interest of the employer as contractually required. Therefore, the owner's engineer exhibited deficiencies in *attitude* dimension of competence especially inappropriate behaviour of acting in their own interests. As shown in Fig. 2., limited skills and moral hazard behaviour of owner's engineer resulted from inappropriate contract between the employer and owner's engineer. The contract between owner's engineer and employer was inappropriate for the magnitude of work of Project Z as shown in D2CF4 in Table 2. This resulted from inadequate preparation of contract documents by employer. Inadequate preparation of contract documents by employer showed deficiency in *skills* dimension of employer as the employer failed to establish adequate contract documents. Inadequate preparation of contract documents resulted from appointment of an inexperienced owner's engineer by the employer according to D2CF2 and D2CF1 in Table 2. Although, the contract document was drafted prior to procurement of owner's engineer, the owner's engineer reviewed the draft and held contract negotiations before signing the contract documents. As such, an experienced owner's engineer would have identified that risk management was a core contractual task that would have been included at least in the minutes of negotiations. This showed deficiencies in *experience* dimension of competence by owner's engineer. Similarly, the procurement of an inexperienced owner's engineer is inability of employer to procure a competent owner's engineer which is lack of *skills* dimension of competence. The authors judged that inappropriate contract also resulted from poor preparation of tendering documents including the contract by the employer as shown in D2CF0 in Table 2. This was manifestation of employer's lack of *knowledge* and *experience* in drafting tendering documents for megaprojects.

Causal mechanism that led to mistrust of contractor by owner's engineer

In our judgement, the second immediate causal factor for the dispute was mistrust of the contractor by owner's engineer. Several project letters between the contractor and the owner's revealed that the owner's engineer had lost trust in promises by the contractor especially regarding postponing the scheduled predecessor activities. According to the activity schedule of Project Z, installation of "a major project component" was a predecessor activity for subsequent activities and the contractor had rescheduled it as a successor activity. However, the owner's engineer could not trust the commitment of the contractor who had not fulfilled earlier promises and therefore declined the contractor's proposal as shown in D2CF11 in Table 2. Mistrust of contractor showed inappropriate behaviour of owner's engineer that falls within *attitude* dimension of competence.

Our interpretation of the project documents is that mistrust was a result of inappropriate project governance in Project Z. The contract documents, project audit reports and other project documents revealed that the relationship between the contractor and owner's engineer was purely principle-agent relationship (referred to D2CF10 in Table 2). As defined in Koskinen (2021), principle-agent relationship is an arrangement in which one entity legally appoints another to act on its behalf. This was the case in Project Z whereby the EPC contract considered the contractor as an agent and the owner's engineer as the principle as per audit reports. Therefore, as is common with principle-agent relationships, Project Z suffered from agency problems especially information asymmetry and goal conflicts that inspired the contractor to act in their interests and not that of the employer (Chohan, 2020). As shown in Fig. 2, we suggest that this relationship resulted in mistrust of the contractor by the owner's engineer. Many scholars such as Turner (2022) agree with several Project Z documents that showed that principle-agent relationship was not fit for a megaproject that Project Z was.

Project audit reports and reports by project management consultants and panels of experts attributed inappropriate contractor-owner's engineer's relationship to the inappropriate EPC contract for Project Z. As shown in D2CF5 in Table 2, the EPC contract documents were inadequate and of low quality for the magnitude of Project Z. This resulted from inadequate preparation of the contract documents by the employer and owner's engineer as per D2CF3 in Table 2. Inadequate preparation of contract documents involved allocation of insufficient time for preparation of tender documents, contract documents and subsequent contract negotiations. We suggest that poor/ inadequate preparation of contract documents was manifestation of lack of *knowledge and skills* dimensions of competence of owner's engineer to draft appropriate contract documents.

Causal mechanism that led to conflict in goals between owner's engineer and contractor

The third immediate factor for the dispute was conflict in goals between the owner's engineer and contractor. Some of the project letters by the contractor and owner's engineer showed that there was difference in goals between the two parties. Whereas the contractor's interest was safe installation of the "major project component" after making risk assessment, the interest of the owner's engineer was compliance to the approved work schedules. The owner's engineer therefore lacked *skill* dimension of competence required to consider schedule and quality holistically and concentrated on schedule with ignorance of quality.

Project audit reports and correspondences between the contractor and owner's engineer as shown in D2CF6 in Table 2 showed that the conflicting goals resulted from mismatch between contract documents. The contract documents of Project Z had mismatches and were contradicting each other (see D2CF6 in Table 2). Mismatches in contract documents resulted from inadequate preparation of contract documents by the employer and owner's engineer as shown in D2CF3 in Table 2. The audit reports show that preparation of contract documents for Project Z was inadequately done and did not match with international best practice. This shows violation of *skill and knowledge* dimensions of competence by the owner's engineer as we argue that owner's engineer was not familiar with contracts for large and mega projects. The employer was not acquainted with best international practice on contracts for large projects since they did not query the output of owner's engineer. This was lack of *knowledge* dimension of competence. The owner's engineer also allocated inadequate time for contract negotiations as described in section "causal mechanism that led to mistrust of contractor by owner's engineer". This revealed the lack of *experience* dimension of competence.

One of the audit reports (referred to D2CF2 and D2CF1) shows that inadequate preparation of contract documents resulted from inadequate appointment and procurement of owner's engineer. According to the contract between the employer and owner's engineer, the owner's engineer was responsible for drafting tender documents, tender specifications and project supervision. As such, it was the responsibility of the owner's engineer to draft contract documents and it was due to their lack of competence that the documents turned out to be deficient, and with significant omissions. We identified that by inadequate procurement, the employer show-cased deficiencies in *knowledge and skills* dimensions of competence. This was seen from several reports including audit reports in which it was mentioned that the employer appointed an unexperienced owner's engineer. One of the audit reports (referred to in D2CF1) showed that the complexity, size and cost of Project Z required an owner's engineer ranked within the best 10 to 15 best firms in the line of work. However, the owner's engineer that was appointed by the employer had no evidence of having ever involved in a medium to large project. As such, the owner's engineer did not meet the minimum requirements for the job. We argue that it was the obligation of owner's engineer to accept work for which they had technical and financial capacity. Since the owner's engineer failed to turn down a contract for work they were not capable of undertaking, this showed behavioural incapacity of the owner's engineer which relates to the *attitude* dimension of competence.

Causal mechanism that led to contradicting risk allocation between owner's engineer and contractor

Project correspondences revealed that the fourth immediate factor for the dispute was the inadequate risk allocation between the contractor and owner's engineer. The contract documents (referred to in D2CF13 in Table 2) gave contradicting tasks/responsibilities to the two parties. For instance, in the EPC contract, it was the obligation of the contractor to establish work schedules for the project and the owner's engineer had the obligation to review and approve the work schedules. As such, the owner's engineer reserved a right to refute contractor's proposals. However, the EPC contract and the contract between owner's engineer and the employer put all the risk on decisions by both the contractor and owner's engineer on the contractor. This was unfair risk allocation encouraged in the contracts. We contend that unfair risk allocation was due to lack of *knowledge* dimension of competence to allocate risks to parties best suited to handle them. As elaborated in D2CF6 in Table 2, unfair risk allocation resulted from mismatch between contract documents.

CONCLUSIONS

Disputes 1 and 2 arose from a combination of factors at different time points. However, each of the factors is linked to deficiencies in at least one dimension of competence from one or more of the three stakeholders (contractor, owner's engineer and employer). Crucially, the deficiencies can be traced from the beginning of the project. Hence, we can say that project Z started wrong (from a competence perspective) and, no wonder, it went wrong (at least as far as disputes 1 and 2 are concerned).

We uphold that avoidance of competence deficiencies especially during the pre-contract and contract formation phases would result in better contract documents, better contract administration and mitigation of the disputes at Project Z. The findings therefore portray the importance of ensuring project stakeholders especially the project management team to have sufficient competence attributes. This work implies that there is need to promote training and continuous professional development of human resources through the lifecycle of construction projects to improve the competencies of the project's human resources. Therefore, there is a need to emphasize proper human resource planning to ensure adequate estimation, acquisition, and development of human resources during the lifecycle of megaprojects. From the research undertaken and reported in this paper, we contend that the competence of internal stakeholders of infrastructure projects is an antidote to contract disputes in infrastructure projects.

Whilst much of the extant research generalized and categorized sources of construction disputes in general terms based on interviews or questionnaires, the research undertook an in-depth case study analysis using secondary data. As such, the research contributes to the body of knowledge by suggesting a causal mechanism for the occurrence of individual disputes. This complements the existing body of knowledge in which the causal factors for construction disputes are mentioned. We believe that the identification of occurrence mechanisms of individual disputes shall result in appropriate solutions for mitigation of disputes in construction projects.

DATA AVAILABILITY STATEMENT

Some or all data, models, or code generated or used during the study are proprietary or confidential and may only be provided with restrictions (the client organization asked for anonymity of the project and its stakeholders).

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