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A Conceptual Framework for Enhancing Subcontracting Performance in the Construction Industry of Developing Countries

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Abstract

A significant portion of construction work is executed through subcontracting (SC), making a study on SC performance instrumental. The study aimed to develop a holistic conceptual framework to enhance SC performance for the construction industry of developing nations. A systematic literature review (SLR) was conducted to examine the available scholarly literature from Scopus, Web of Science, and ProQuest databases. From the databases, 27 studies were screened for a detailed review. A thematic content analysis was conducted to explore different themes from the screened studies analysed using ATLAS.ti23 software. These themes then served as components to be intricately linked and build the framework. The framework encompasses SC strategy, business constraints, adoption of information technology, uncertainties, and capabilities impacting the four core activities of SC performance: bidding and selection of subcontractors, subcontract management, operations management, and monitoring and evaluation of subcontract works. Adopting the framework's principles will cause a push towards fairness, symmetric information and dependency, mutual trust, and continual improvement efforts along the SC value chain, resulting in the overall growth and competitiveness of the construction industry of developing countries.

Keywords: subcontracting performance; conceptual framework; systematic literature review.

1. Introduction

The construction industry significantly contributes to the economic development of developing countries. It accounts for over 8% of the GDP in developing countries (WEF, 2016). The industry is also a major employer with an estimated average of 7 percent of total global employment or 220 million people (ILO, 2019). The majority of construction project works are executed through subcontracting (SC), with the main contractor focusing on managing, resourcing, coordinating, and controlling the subcontractors involved in the project. Subcontracting (SC) is a business strategy employed by main contractors to address construction market uncertainties and transfer risks, such as completion risks, financial risks, and responsibility for employees (Schaufelberger & Holm,2017). Subcontracting in construction has become increasingly prevalent in recent decades (Zubair et al., 2016; Mbachu et al., 2022) due to the growing complexity of construction projects, the scarcity of skilled labor, the drive to maximize profits, and the need to reduce risk, Studies indicate that in Zambia more than 50%, and in some sectors up to 90% of projects involve subcontracting (Mudzvokorwa, Mwiya & Mwanaumo, 2020). In South Africa, around 70% of building and 30% of civil construction project works are performed through subcontracting (cidb, 2013); while in Nigeria, a minimum of 70% of the projects rely on subcontracting (Okunlola, 2015).

According to cidb (2013), there are three types of subcontractors. The first is a domestic subcontractor, who is appointed at the discretion of the main contractor. The second is a nominated subcontractor, chosen by the employer. The third type is a selected subcontractor, who is chosen by the contractor in consultation with the employer, based on the contract's

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requirements (cidb, 2013). This study focuses on domestic subcontractors that are appointed by the main contractor.

Subcontracting (SC) enhance project performance if properly managed (RICS, 2021). On the contrary, poor SC has been identified as a potential risk for project performance. Previous studies have identified poor SC as one of the reasons for project delays and cost overruns (Osama, El & Wefki, 2023; Daoor et al., 2020). Olanrewaju et al. (2022) also underscored zzzzpoor SC as one of the reasons for poor quality, delay, and project disputes. The subcontracting supply chain has been highlighted as problematic because of antagonistic relationships between the main contractor and subcontractor, poor communication, blame culture, a lack of focus on serving the ultimate end user, and other reasons (Rompoti, Madas & Kitsios, 2020).

Different studies have been conducted on individual SC components including subcontractor selection (Karaman, 2022); the contractor-subcontractor relationships (Tan et al., 2017); conflicts and disputes in SC (Magazi & Kikwasi 2022); payment issues (Daoor et al., 2020), and others. Studer et al. (2021) identified a set of 19 core elements that have a prominent role in construction subcontracting. Despite the different studies conducted on isolated aspects of SC, there remains a significant gap in understanding how these components interrelate within the broader SC performance framework.

This gap undermines efforts to systematically enhance SC efficiency and effectiveness, crucial for timely project delivery and cost management in resource-constrained environments. This study aims to develop a comprehensive conceptual framework to enhance SC performance for the construction industry of developing countries. The specific objective of the study is to explore the core components of SC, the different elements of the core components, and the antecedents affecting the core activities/components of SC.

2. Literature Review

The construction industry is characterized by complexity and time-constrained projects. High complexity, uniqueness of activities, and the amount of required technologies urged construction firms to consider outsourcing strategies, including SC (Fridkin & Kordova, 2022). Subcontracting (SC) is a well-established practice in construction industry (Daoor et al., 2020). It is subletting the obligations of the main contractor stipulated in a separate main contract with the project owner. In some cases, a project owner directly nominates the subcontractor to carry out part of the main contract works (RICS, 2021).

The main contractor can lower its operational costs and improve competitiveness with SC. Subcontractiong is also an efficient and economical means of accessing resources (Daoor et al., 2020). Subcontracting (SC) is invaluable for construction projects as it allows specialization and creates market access to local subcontractors. Due to the mentioned and other benefits of SC, the reliance of the construction industry on SC has increased (Magazi & Kikwasi 2022). However, rather than contributing to better project performance, SC could exacerbate project outcomes (Koshe & Jha, 2016). According to Osama, El & Wefki (2023), one of the primary reasons for the delay of construction projects is poor SC performance. If SC is not managed properly, it could result in project cost overrun and poor quality of work.

Construction project owners demand their projects to be delivered on time, on budget, free from defects, right the first time, and safely by the construction firms involved (Mbachu et al., 2022). The dependence of main contractors on subcontractors to execute the major portion of their work makes construction projects' success highly dependent on SC performance. However, it is not only the subcontractor who is the responsible party for SC performance. The other major project stakeholders, including the contractor and project owner, also contribute their share to the success or failure of SC in a project (Chamara et al., 2015).

Contracting is widespread in construction project management (Schaufelberger & Holm,2017). The execution of construction projects involves contracting (to formally hire) an external organization. This external organization might itself involve other different organizations allied by numerous contractual agreements as illustrated in Figure 1. Initially, the project user or owner contracts with the main contractor sometimes mentioned as the systems development organization (SDO) responsible for the overall project.

In turn, the main contractor gets into contract with the secondary parties: subcontractors, vendors, consultants, material suppliers, and contract labor for specific portion of a project; these secondary parties in turn could get into contract with other tertiary parties (Schaufelberger & Holm, 2017). The main contractor is hired by the project user or owner to manage the overall construction project. From a market point of view, where the contractor operates primarily as the buyer, it is responsible for buying materials, equipment, and services necessary for project execution. This position entails evaluating the state of the market, negotiating contracts with suppliers, and making sure the products and services acquired adhere to project requirements, quality standards, and financial limitations(Nwaguru et al., 2022). Project budgets, schedules, and success are all impacted by the contractor's capacity to handle procurement.

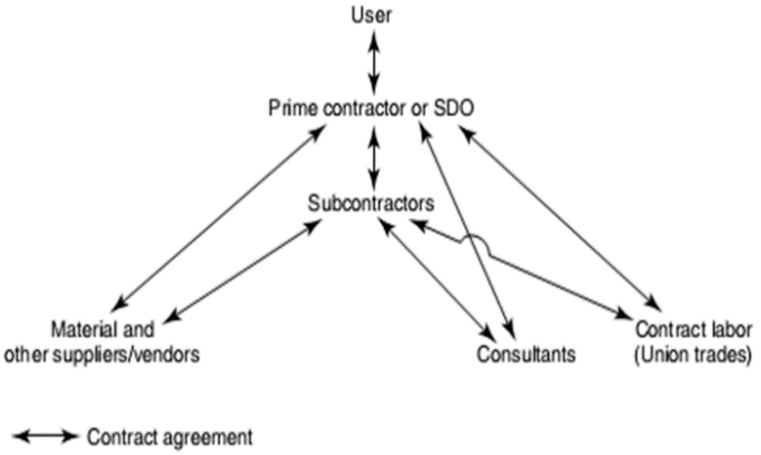

Figure 1: Contracting parties in a project Source : (Nicholas & Steyn, 2017)

Conversely, from an engineering contract perspective, the contractor assumes the role of the seller. In this case, it will be accountable for delivering specified services, products, or completed projects to the project owner or client (Plessis & Oosthuizen, 2019).This includes adhering to regulatory requirements, contractual agreements, and industry standards throughout the project lifecycle. The contractor must manage resources efficiently, maintain quality control, and meet project milestones to meet contractual obligations and satisfy the client. The contractor's tasks are further complicated by the fact that they oversee subcontractors in addition to these other roles. This needs managing subcontract works and making sure they adhere to the conditions, timelines, and established quality standards (Schaufelberger & Holm, 2017).

Clear coordination, communication, and dispute resolution are necessary for effective subcontractor management during project execution. In the current fierce construction market, construction firms put their effort into improving their competitiveness.SC is among these strategies. It is also an effective means of involving medium, small, and micro enterprises in construction project work (Nwokocha & Nwankwo, 2020).

Subcontracting (SC) makes it possible to handle market uncertainties in the construction industry and to transfer risks, including completion and financial risks. It lowers direct costs as well as overhead, enabling the main contractor to work with firms that have reduced overhead and a better understanding of the market dynamics, practices, and processes (Daoor et al., 2020). Additionally, SC makes it easier to complete high-quality work, utilizing specialised subcontractors who possess the required expertise in particular trades. The non-adoption of SC could require a significant amount of manpower and equipment, which may eventually become underutilised. (cidb, 2013).

3. Research Methodology

A systematic literature review (SLR) was adopted to examine the existing scholarly publications on SC performance. A systematic literature review involves comprehensive searches of relevant studies on the subject of study (Saunders, Lewis & Thornhill, 2016). In contrast to traditional reviews; SLR employs a transparent, scientific, and replicable procedure that involves a thorough assessment of the literature based on the analysis of previous studies (Mase, 2020). The different components of the proposed conceptual framework and their relationship were identified at this phase.

The researchers followed the preferred reporting items for systematic reviews and meta-analyses (PRISMA, 2020) to conduct the SLR (Matthew et al., 2021). The data were acquired from Scopus, Web of Science, and ProQuest databases. The query strings and keywords, used for the search were: ("Subcontracting") and ("construction"). Regarding the exclusion criteria, the authors discarded: duplicate articles; and articles written in other than English language. Book chapters and book reviews were also excluded. The filtering involved screening relevant articles based on the following inclusion criteria: Studies done in the context of developing countries were included. Studies on social sciences; engineering; decision sciences; business, management, and accounting were encompassed. Studies conducted from 2000-2023 were included. The procedures followed for the article selection are presented in Figure 2.

The 27 screened studies were then reviewed to determine what has been investigated on the topic of construction SC performance. The studies were analysed to identify the components required to build a conceptual framework to enhance successful SC performance in the construction industry of developing countries.

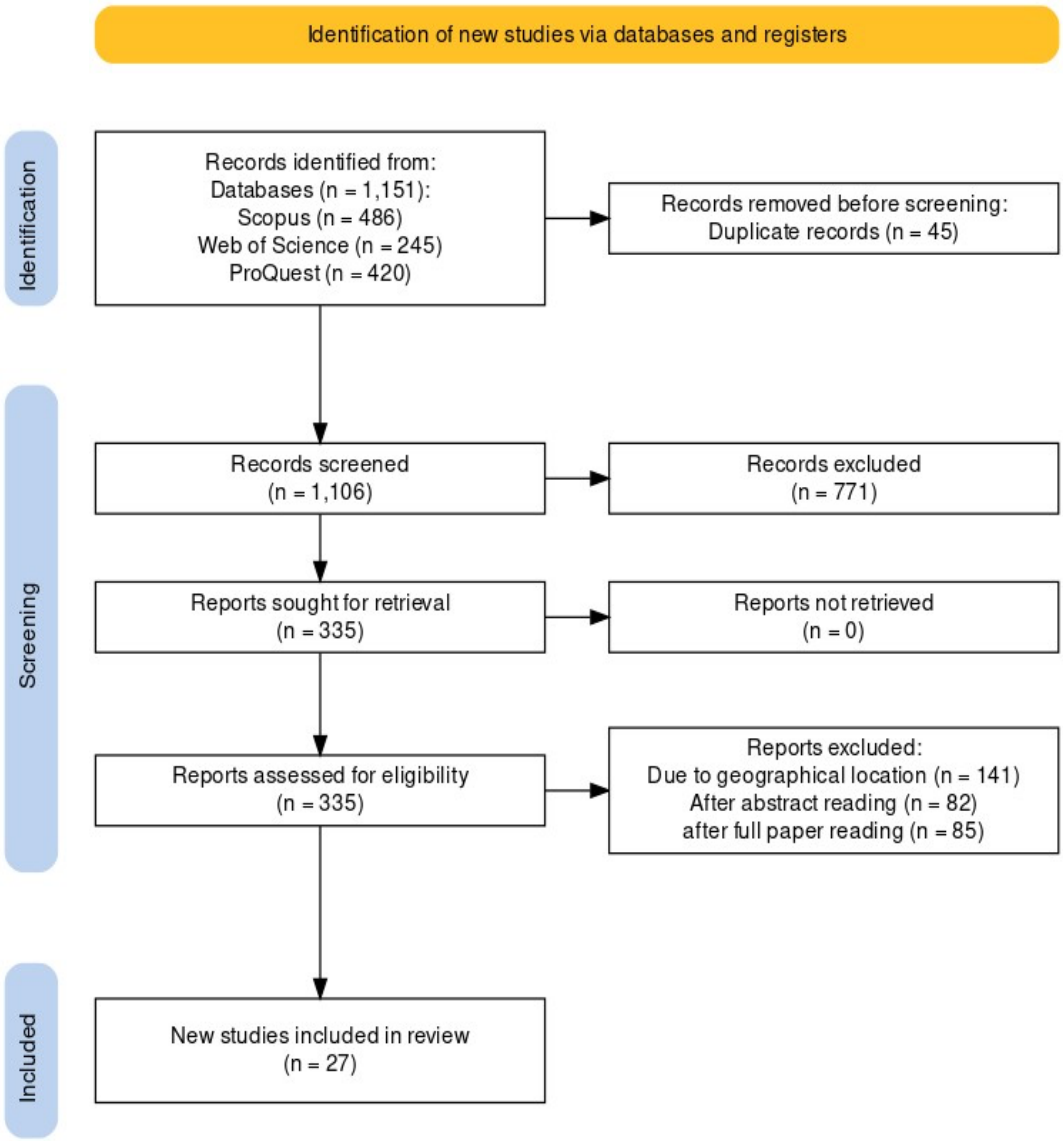

Figure 2: PRISMA 2020 flow diagram

4. Results

The screened articles were analysed with thematic analysis using ATLAS.ti23 software to explore the various components required to construct the intended conceptual framework. To overview the underlying concepts of the articles, initially, a word cloud was generated. Figure 3 illustrates the word cloud generated with a word frequency query. This helped to capture the underlying concepts of the publications included in the SLR in a single view.

For the analysis using ATLAS.ti23, different codes were initially generated from the quotations extracted from the screened articles. Figure 4 illustrates a sample coding procedure. It includes a sample quotation, code, and a source article. Subsequently, meaningful code groups and categories that are associated with the SC performance theme were established.

The network diagram, shown in Figure 5, serves as a tool to visualize the findings that emerged from the reviewed documents and to identify conceptual relationships among the identified SC components. This facilitates the process of building a conceptual framework.

The different elements of the network diagram, which in turn would be components of the proposed conceptual framework, are discussed next.

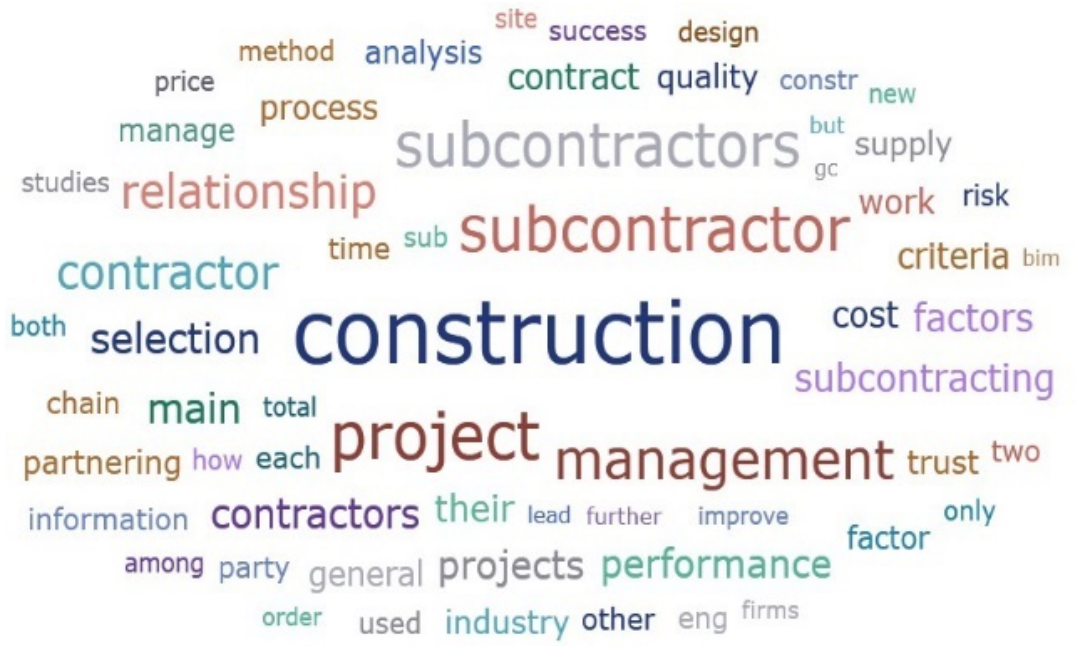

Figure 3: Word Frequency Query Source: ATLAS.ti23 output

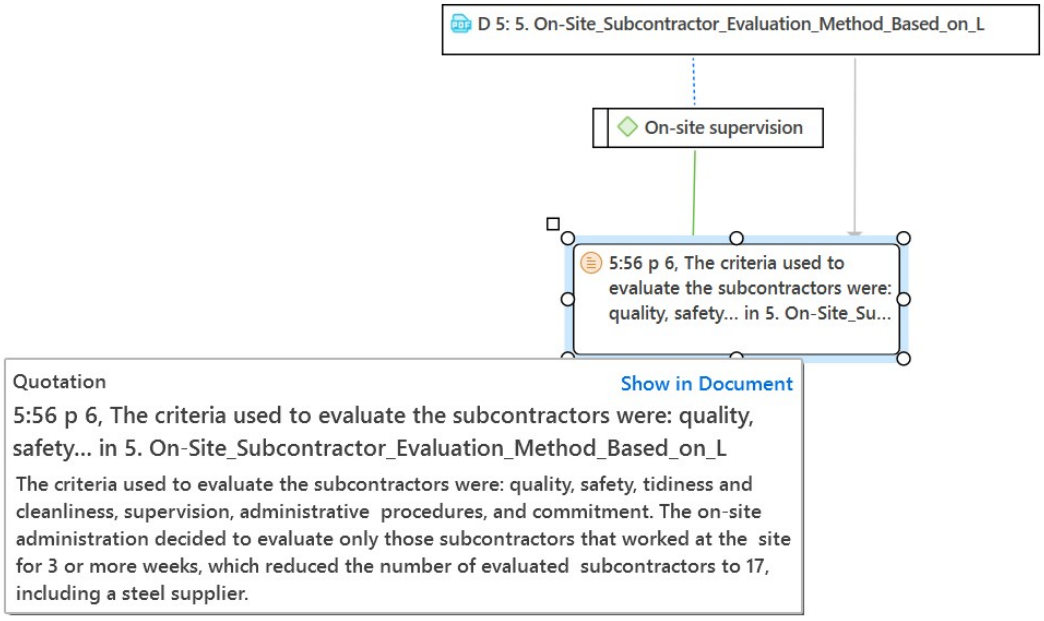

Figure 4: Sample Coding/ partial to fit the page/ Source: ATLAS.ti23 output

5. Discussion of the findings

5.1 Antecedents Influencing SC

The core activities of SC performance are affected by different antecedents directly or indirectly as illustrated in the network diagram (Figure 5). Next, the five major antecedents (colored yellow in the network diagram) influencing the SC core activities are discussed.

5.1.1 Business Environment

Government policies, resources; legal and regulatory frameworks, marketing; socio-cultural conditions, and other related external elements impact SC performance in construction (Eom et al., 2015).

Government policies should open the door to successful partnerships in construction (Rostiyanti

et al., 2020). This, through the involvement of small construction firms, enables more job creation and wealth distribution in the developing context. Cremers and Houwerzijl (2021) also stressed the value of governments in assigning regulatory bodies to facilitate and monitor the policy implementation on SC.

Different developing countries have set a policy for a minimum percentage of project works to be allocated to local subcontractors to promote economic growth and local industry development. South Africa (cidb, 2018) and Zambia (Mudzvokorwa et al., 2020) are examples of this. These policies are designed to enhance local participation, transfer skills, and foster economic inclusion within the construction industry (cidb, 2018).

According to Suresh and Nathan (2020), when it comes to operations in subcontract works, a sudden change in government rules and regulations could make it difficult for the subcontractor/contractor to access resources.

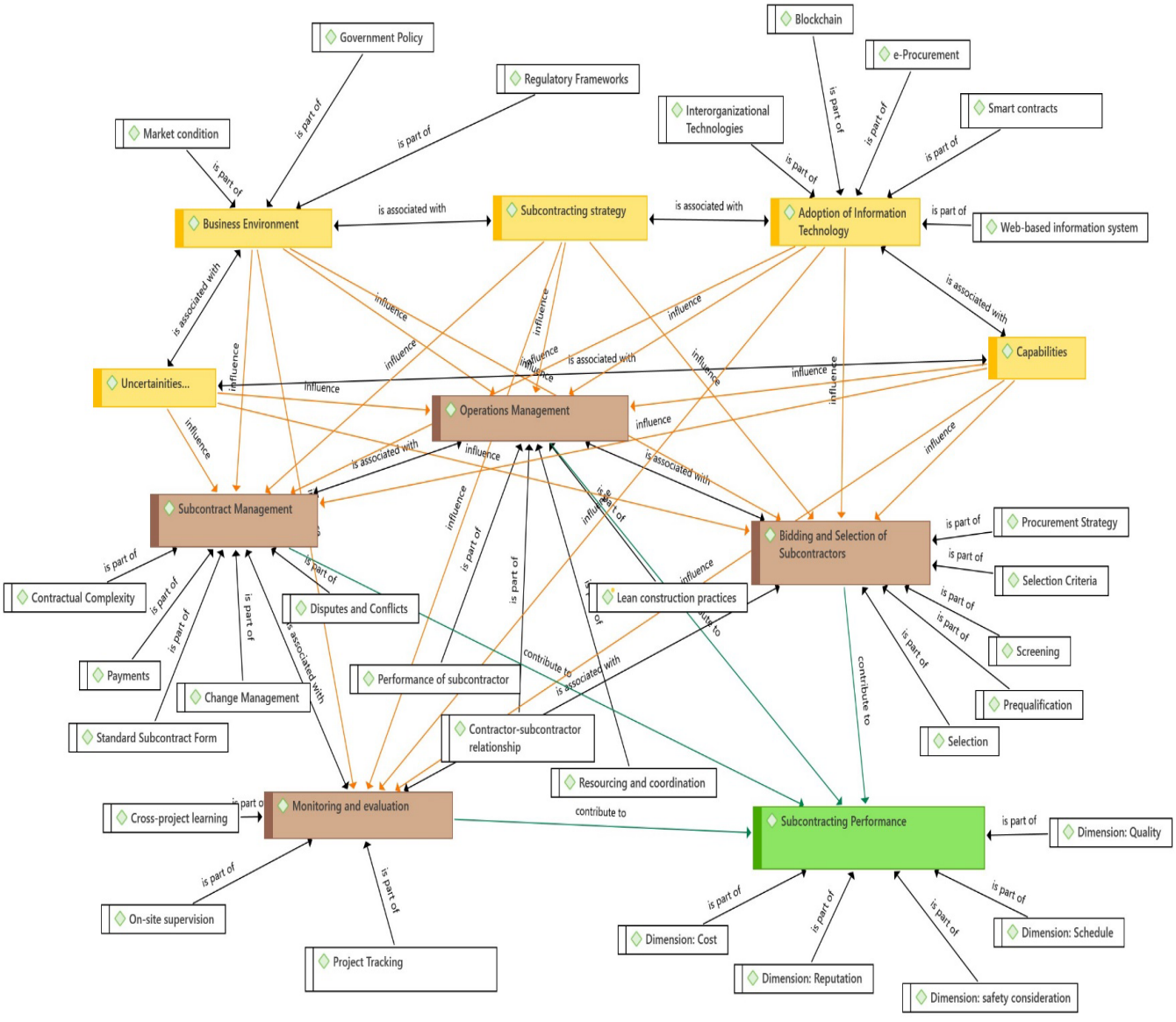

Figure 5: Network Diagram of SC Performance
Source: Literature Analysis by the Authors (ATLAS.ti23 output)

5.1.2 Adoption of information technology

The adoption of information technology is among the identified antecedents that affect the performance of construction SC by bringing higher collaborative working efficiency (Lew et al., 2018; Tan et al., 2017). This includes adoption of E-procurement, inter-organizational technologies, smart contracts, blockchain, and a web-based information system.

5.1.3 Uncertainties/Risks

Uncertainty has been recognised as the major source of project complexity, and one of the primary purposes of project management is dealing with uncertainty (PMI, 2017). It refers to changes in a project's environment that are difficult to precisely foresee. Uncertainty encourages opportunistic behaviour and increases transaction costs.

With SC, the contractor might combine or split jobs, reducing uncertainty in each package and creating value. However, unlike certain and consistent situations, the contractor's alliance management skill may be challenged to deal with uncertainties. SC dispersion increases project interfaces, making it more difficult for the contractor to integrate various subcontractors in uncertain contexts (Shi et al., 2023).

When multiple subcontractors operate on the same project, the contractor needs to make a clear identification of tasks and assign them. Furthermore, uncertainty may disrupt the initial sequence, procedures, and duty allocation, complicating the contractors' ability to adjust. The contractor must ensure that all parties collaborate amicably through strong coordination (Le & Nguye, 2024).

5.1.4 Capabilities

Construction projects vary in their technical requirements, scope, and scale which impacts the capabilities needed from subcontractors and contractors. For instance, complex projects with specialized technology and complicated designs require subcontractors with advanced technical and management capabilities (El-khalek et al., 2019).

Subcontractors should work on the improvement of their internal working systems and enhance their capabilities to adapt to uncertain project environments (Deep et al., 2024). The overall performance of the project can be positively impacted by the subcontractors' capability. Acquiring a higher level of technical expertise and resources would enable them to carry out their given responsibilities efficiently (Kshaf et al., 2022). Also, the contractor's capability to coordinate the subcontractors is critical for successful subcontracting (Chen et al., 2021).

5.1.5 SC Strategy

Making a strategic decision to practice SC in a project and study on its general arrangement is a critical initial step before selecting subcontractors and fully entering into operations (Shi et al., 2023). An SC strategy is a long-term plan developed by the main contractor for selecting and managing its subcontractors (Eom et al., 2015). Assessing the previously discussed influencing factors: business environment, adoption of information technology; uncertainties, and capabilities, provides invaluable inputs for crafting a realistic SC strategy. In addition, Nwokocha and Nwankwo (2020) posit that the contractor should evaluate its internal weaknesses and strengths in the preparation of the strategy.

5.2 Core activities of SC

The antecedents discussed in the previous section: uncertainties/risks; business environment; capabilities of parties; adoption of information technologies, and subcontracting strategy influence the four core activities/components of SC: bidding and selection of subcontractors; subcontract management; operations management, and monitoring. These relationships are illustrated in the network diagram with brown colour (see Figure 5).

5.2.1 Bidding and selection of subcontractors

Subcontractor selection decisions are of prime importance in construction SC (cidb, 2013). The selections are exercised by main contractors multiple times on every single project. The approaches of main contractors on subcontract procurement have changed recently towards adopting a more long-term and strategic partnership philosophy (Eom et al., 2015). The bidding and selection processes have a direct impact on SC performance in construction (Fridkin & Kordova, 2022).

The bidding and selection of subcontractors need to commence with the preparation of the procurement strategy. The procurement strategy for subcontract works sets out how the various subcontract works will be procured (Schaufelberger & Holm, 2017). It involves reviewing and setting requirements (e.g. the division of the main contract works into various subcontract works, quality, scope, time, and cost), and assessing such requirements against associated risks. It is a 'live' document subject to revision as circumstances require (RICS, 2021).

A strategic choice between a qualification-based selection of subcontractors and an open bidding system should be made for the selection of subcontractors. The recommended practice is to initially screen a few subcontractors with a prequalification criterion and then invite them to submit a bid (quotation) for the scope of work (Schaufelberger & Holm, 2017). The initial screening is commonly performed based on criteria such as experience, technical capability, health and safety, quality performance, management capability, reputation, timely delivery, past performance (Eom et al., 2015; Karaman, 2022).

A web-based subcontractor evaluation system in which subcontractors are evaluated and selected based on pre-set criteria is recently being practiced (Abbasianjahromi et al., 2014). If the selection of subcontractors is properly conducted, it contributes to the establishment of a productive SC relationship, fostering collaboration, and minimizing disruptions in project execution (Olanrewaju et al., 2022).

5.2.2 Subcontract management

A subcontract is defined as a commercial contract (for the provision) of labor, works, and materials between a main contractor and a subcontractor (Cremers & Houwerzijl, 2021). Subcontract management is in the post-award life cycle phase of contract management, and it is in the "perform contract" domain among the standard project management processes (PMI, 2017).

Subcontract management could also be explained as contract management of subcontracts. It incorporates ensuring quality performance of work, responding to requests for information, issuing change orders when needed, and promptly paying subcontractors for accepted work (Schaufelberger & Holm, 2017).

Standard forms of subcontract

Fair allocation of project risk and responsibilities through the conditions of a contract is pivotal for coordination, uninterrupted execution of works, dispute resolution, and maintenance of positive relationships among contracting parties (Zubair et al., 2016). To fulfill this, the construction industry has for a long time recognised the benefit of using standard forms of contract, which contain conditions that apply to a wide range of construction projects (RICS, 2021). Similarly, different types of standard forms of subcontract have been developed or adopted for SC. Standard forms of subcontract could be used as an "off the shelf" contract, with minor revisions, for the contracting in SC (Zubair et al., 2016).

FIDIC(International Federation of Consulting Engineers) Conditions of Subcontract for Works of Civil Engineering Construction, 1994 (FIDIC 1994) and The Red Book Subcontract-Conditions of Subcontract for Construction for Building and Engineering Works, Designed by the Employer, First Edition 2011 (FIDIC 2011), and other standard forms of subcontract prepared by different professional associations have been used as model in the formulation of the general conditions of subcontracts in different countries (Zubair et al., 2016).

Payments

In traditional contractor-subcontractor relationships, issues related to subcontractor payment are among the major impediments to construction subcontracting (Mudzvokorwa et al., 2020). A cause of this problem is the commonly employed conditional payment provisions in subcontracts including the 'pay-when-paid' and 'pay-if-paid' conditions which severely affect subcontractors as they are not in a better position to absorb the financial burden than the main contractor (Rostiyanti et al., 2020). The second challenge is an underpayment, which is paying the subcontractor below the certified amount (Mudzvokorwa et al., 2020).

Conflicts and Disputes

Construction projects are temporary endeavors with multi-stakeholders where conflicts often occur. Specifically in SC, conflicts and disputes arise due to poor communication, contractual problems, limited resources, payment delays, coordination issues, design issues, and other different reasons (Shivanthi et al., 2019). Sub-subcontracting (multi-layer SC) without the consent of the main contractor and poor coordination are also other possible sources of a contractual dispute (Lew et al., 2012).

Conflict mitigation is significant for building sustainable relationships in SC. Explicitness and elaborateness of a contract, and contractual complexity, reduce task conflict and relationship conflict in SC (Wang et al., 2023). The use of standard subcontracts has been identified as an effective tool to minimize disputes related to risks and uncertainties (Shivanthi et al., 2019). Timely contractual enforcement also plays a crucial role to reduce conflicts and disputes in SC relationships (Wang et al., 2023).

5.2.3 Operations management

Prior studies have identified poor operations management as a major factor that affects SC performance (Yong, 2015). The same study explained that the operational failure was caused due to the main contractors' financial problems; delay in subcontract progress payment; interruption and termination of work by the contractor, absence of continuous follow-up of subcontracted works; and lack of coordination of the different subcontractors.

Contractor –subcontractor relationship

The traditional contractor and subcontractor relationship is typically designed as an antagonistic and transient structure with low-efficiency collaboration. This relationship must transition from a traditional adversarial pattern to a

cooperative and collaborative long-term relationship (Olanrewaju et al., 2022).

In construction SC, the uneven status of transaction parties makes weaker parties vulnerable to unfair treatment (Wu et al., 2023). Subcontractors in such situations tend to absorb the pain rather than take appropriate measures as per the conditions of their contract due to asymmetric dependence. The "pay-when-paid" clause in some subcontracts exemplifies the power imbalance between a contractor and subcontractors. This clause shifts financial risk to subcontractors, who only get paid once the contractor receives payment from the project owner, often causing significant cash flow issues (cidb, 2013). Such an asymmetric dependence condition readily leads to interest conflicts, increasing information asymmetry and negatively impacting SC performance. This aggravates the unfairness perception by subcontractors. Unequal status and information asymmetry are considered a normal trend in construction SC (Ivic & Ceric, 2023).

Subcontractors, as the weaker party in contractor-subcontractor relationships, experience a pricing power disadvantage and uneven value allocation, which reduces their perceived fairness. Furthermore, stronger parties' compulsive decision-making practices, lack of clear communication, and unwillingness to share information all undermine the perception of fairness (Tan et al., 2017). In such a scenario, main contractors tend to micromanage and interfere with the decision-making of weaker subcontractors to ensure profit maximization(Kshaf et al., 2022). In a contractor-subcontractor collaborative environment, the main contractor may go beyond fulfilling the contractual obligations regarding subcontractor payment and bonds. This includes offering additional incentives such as waiving the bid bond, giving priority to the subcontractor advance payment, and raising the percentage of progress payments (Wu et al., 2023).

An excessive power control imbalance is also common in traditional contracting practices but not relational contracts – leading to a perceived lack of trust and hindering contractor-subcontractor cooperation (Chen et al., 2021). Designing and implementing a reliable conflict resolution process is crucial for sustaining the contractor-subcontractor relationship in construction SC (Wang et al, 2022).

Performance of work

Subcontractors are expected to deploy the required resources for a project according to their contractual conditions and specifications (Ng & Skitmore, 2014). Executing construction works below the standards stipulated in the technical specifications of the contract will hamper the SC relationship (Basaran, Aladag & Isık, 2023). Weak management practices, especially financial and cash flow management, and lack of a working system by the subcontractor affect its ability to execute project tasks.

Resourcing and coordination

In many developing countries, a shortage of construction materials, components, and other resources poses a serious problem. Establishing an agile supply chain in SC could respond flexibly and promptly to changes in the external environment (World Economic Forum, 2016). Once the subcontract is awarded and construction begins, the project manager and the project core team must collaborate closely with the subcontractor to schedule and coordinate their work, ensuring the project is completed on time, within budget, and under contract requirements(Schaufelberger & Hol, 2017). Since most of the construction work is being performed by subcontractors, efficient resourcing and coordination of their work is crucial (Basaran, Aladag & Isık, 2023).

Lean construction

Implementing lean construction principles offers an effective solution for optimizing operation management in SC. A lean approach would be beneficial for this as it decreases uncertainty and complexity by reducing non-value-adding activities and waste throughout the entire SC value chain(World Economic Forum, 2016). This reduces transaction costs. The lean approach brings improvements not only in cost and delivery time but also in safety and quality (Le & Nguye, 2024). By integrating lean practices at every stage of subcontracting, construction projects can achieve significant improvements in cost-effectiveness, timeliness, safety, and overall project outcomes.

5.2.4 Monitoring and evaluation

For monitoring and evaluation of subcontractors during the construction stage, different studies have suggested different criteria. For example, Lew et al. (2018) recommended five main categories of criteria: awareness of the environment, health and safety; communication and relationship; progress of work, resource management; and workmanship. The monitoring and evaluation should be conducted regularly and continuously (RICS, 2021).

Project Tracking

Regular and continuous project meetings are effective in strengthening the partnering spirit of the different stakeholders in SC and resolving impediments in real-time (RICS, 2021). It is essential to understand the concerns of

subcontractors and the proper work sequencing to ensure their success.

For this, the project core team needs to establish a cooperative relationship with the subcontractors and their crew by conducting frequent coordination and progress meetings to discuss their concerns (Schaufelberger & Holm, 2017). Standup and progress meetings coupled with mutual goals will help foster subcontractor relationships that are built on trust (PMI, 2017). The use of different project management information systems would enable to have real-time information for project tracking and for making early informed decisions(Englund & Graham, 2019).

On-site Supervision

The quality and efficiency in construction can be attributed to the performance of subcontractors assigned to complete actual works (Basaran, Aladag & Isık, 2023). To ensure this, subcontractor performance appraisal on-site is instrumental. This needs to be done with preset evaluation criteria. Then feedback should be forwarded to the project core team to take remedial actions on the identified performance gaps.

A preset evaluation criteria that is outlined in the quality management plan of the contractor, serves as a strategic tool for monitoring and evaluating subcontractor performance against defined quality standards and project objectives. By integrating these evaluation criteria into daily on-site supervision, the contractor can oversee subcontractor activities more effectively, identify potential deviations early, and proactively address issues to maintain project quality and adherence to schedules (Karim et al., 2006). This collaborative approach not only enhances communication and coordination between parties but also fosters a culture of continuous improvement, where feedback and lessons learned are integrated into future project phases.

Cross-project learning

Cross-project learning is a process or practice of capturing the learning from projects so that it is available for use by other projects. Cross-project inter-organizational learning seldom occurs in a competitive relationship (Cao & Wang, 2014). However, contractors and subcontractors with a partnership approach could benefit from cross-project learning.

5.3 Conceptual Framework

The discussed components, in the previous sections, of SC performance and their relationships were illustrated in the network diagram Figure 5. However, the network diagram in Figure 5 is too complex. Accordingly, a conceptual framework is developed as portrayed in Figure 6, demonstrating the linkage of bidding and selection, subcontract management, operation management, and monitoring & evaluation components toward a successful SC performance. The internal and external environmental components including SC strategy; adoption of information technology; uncertainties; and capabilities are also illustrated in the framework. The different elements within the components are also illustrated in the framework.
The conceptual framework is developed to be used by contractors, subcontractors, and other project stakeholders for crafting and implementing their corresponding policies, strategies, structural arrangements, and processes to enhance SC performance at projects.

The conceptual framework illustrated in Figure 6 could be used to enhance SC performance in construction projects. Initially, the main contractor needs to revisit its own capability, and the capability of the subcontractors and other project stockholders involved. Regarding the business environment, the market conditions in the industry and the government policies and regulatory frameworks related to construction and specifically to SC should be assessed. Also, the potential risks in SC including health and safety risks, quality assurance risks, availability of material and skilled manpower, political instability, and other risks need to be identified.

According to the proposed model, the main contractor should make a strategic decision on the prioritization, selection, and implementation of the specific information technology appropriate for managing SC in a construction project. A well-crafted SC strategy would be vital for the contractor to get the roadmap on how to address the discussed components that influence the four core activities of SC(Nwokocha et al., 2019). A proper selection of qualified subcontractors is pivotal for successful SC and project success as illustrated in the proposed framework.

Olanrewaju et al. (2022) emphasized that poor subcontractor selection can result in costly claims, delays, litigation, cost overruns, poor quality, and loss of profit. Preparing a procurement strategy is crucial in understanding how the various subcontract works will be procured. The subcontractor selection should be followed by effective subcontract management. Employing explicit contracts is the first critical step toward successful subcontract management.

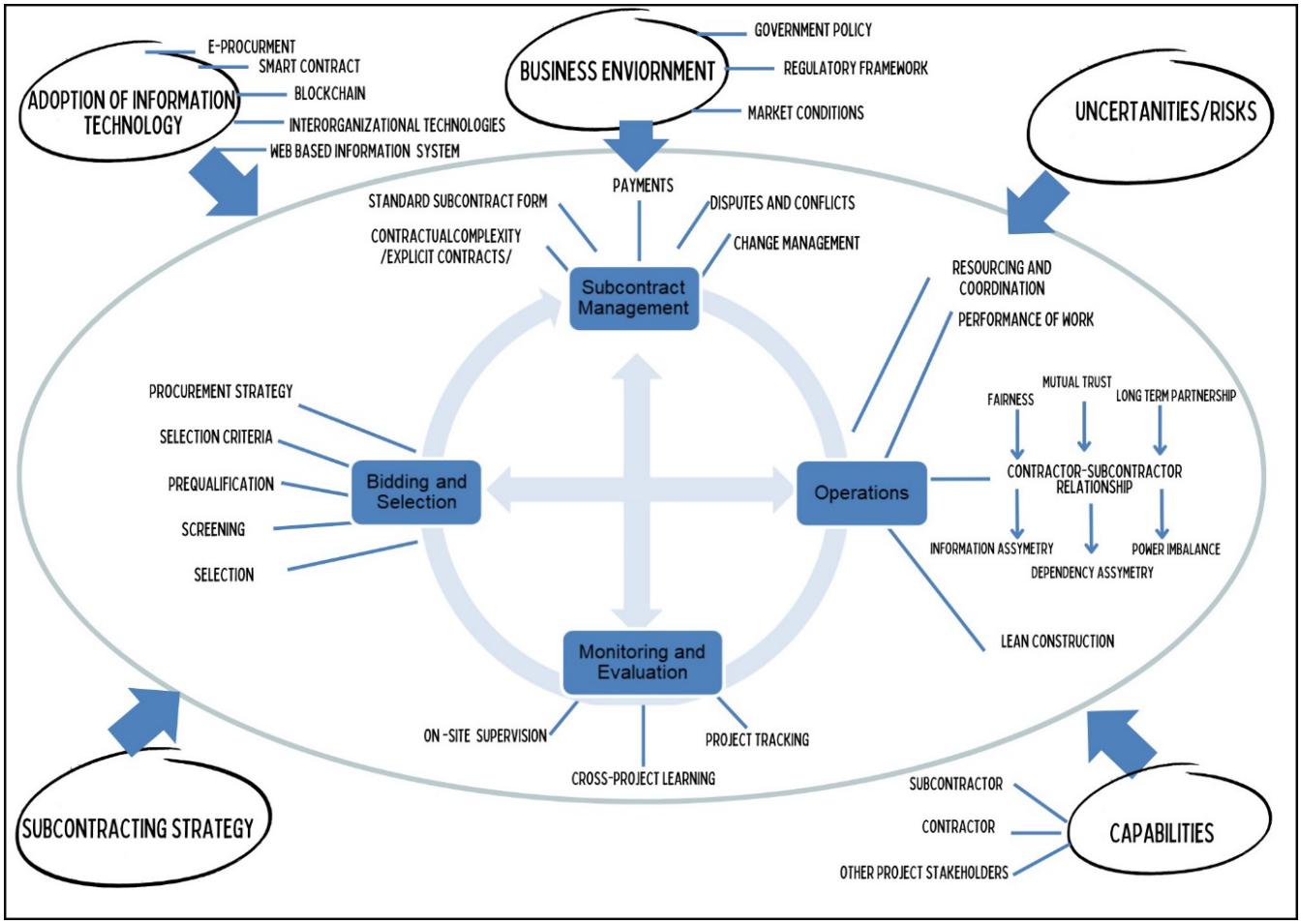

Figure 6: Conceptual framework for enhancing SC performance in the construction industry of developing countries

Standard subcontract forms, at the industry level, are commonly utilized in public construction projects. Setting standard procedures for managing changes and prompt accrual of subcontract payment for certified work are also tasks within subcontract management. Disputes and conflicts in SC need to be settled according to the conditions and procedures stipulated in subcontract agreements. Nonetheless, trust also plays a crucial role in the negotiation and resolution of disputes in SC (Wang et al., 2023).

Regarding the operation management in SC, the framework highlighted that subcontractors should execute contractual obligations, while main contractors need to provide support in resourcing and coordination, especially in resource-constrained environments. Implementing lean construction principles is recommended in the framework to optimize operations, reduce waste, and enhance efficiency and quality across the SC value chain (Le & Nguyen, 2024).

Shifting from adversarial to collaborative contractor-subcontractor relationships is a crucial step toward a successful SC (Studer et al., 2021). This demands fair pricing, transparent communication, and mutual trust. Designing transparent communication channels and fostering mutual trust to mitigate information and dependency asymmetry in contractor-subcontractor relationships is crucial for improving collaboration and enhancing overall project performance in construction (Wu et al., 2023).

The framework positioned monitoring and evaluation of subcontractors as another core activity in SC. It involves setting criteria and evaluating the performance accordingly. Regular monitoring ensures performance gaps are identified and addressed for project success. Progress meetings aid real-time issue resolution and stakeholder collaboration, while on-site supervision ensures accountability and quality. This approach fosters trust and enhances overall project efficiency (Tan et al., 2017).

The contractor, project owner, and subcontractor can each utilize the proposed framework to enhance SC performance by focusing on their respective

roles. For instance, contractors can implement IT solutions for streamlined bidding, selection, and performance management while fostering trust through fair contracts and adopting lean construction principles to reduce waste and improve quality.

Project owners can ensure qualified subcontractors are selected and encourage collaboration, transparency, and timely project delivery by promoting fair contract terms and regular performance monitoring. Subcontractors can leverage the framework to upskill their workforce, adopt better project management tools, and maintain open communication with contractors to enhance operational efficiency and ensure fair treatment through standardized contracts and prompt payments. Together, these stakeholders can create a more transparent, efficient, and collaborative construction process.

To support the proposed framework for enhancing SC performance in the construction industry of developing countries, governments can enact or modify policies in several key areas. First, procurement regulations need to promote a transparent bidding process, standardized subcontract agreements, and local content policies to ensure fair subcontractor selection and effective management. Vocational training programs and skill development grants will build subcontractor capabilities. Additionally, establishing specialized construction arbitration courts and requiring mediation before litigation will improve dispute resolution. Governments should also invest in better supply chain infrastructure, regulate material markets to stabilize prices, and incentivize sustainable construction practices. Through implementing these policy measures, governments can create a conducive environment that aligns with the framework, improving SC performance, fostering collaboration, and boosting the competitiveness of the construction industry.

6. Conclusions

Designing a conceptual framework for improving subcontracting (SC) performance in developing nations' construction industries is an important step toward overcoming the inherent SC performance disparities. The framework offers a structured approach for the contractor, subcontractors, and other project stakeholders to navigate and respond appropriately to the dynamic and unpredictable subcontracting and construction environment.

The study has identified the different components influencing core SC activities. The emphasis on SC strategy formulation, effective subcontractor selection, subcontract management, technology adoption, operational optimization, relationship building, and strong monitoring and evaluation systems highlights the multifaceted aspect of subcontracting performance.

The implementation of the proposed framework demands a joint effort from the main contractor, subcontractors, regulatory authorities, and other project stakeholders. It needs a push towards fairness, symmetric information and dependency, mutual trust, and continual improvement efforts along the SC value chain. By adopting the framework's principles, stakeholders can improve SC, project performance, and ultimately contribute to the overall growth and competitiveness of the construction industry of developing countries.

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