A conceptual framework for effective contracting in construction supply chains

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ABSTRACT

Construction supply chains are characterised by lack of trust and poor collaboration due to the short-term, project-based organisational structure of the construction industry. The lack of collaboration and trust among construction supply chain stakeholders affects the transparency and exchange of information, as well as the efficiency of the supply chain. Existing literature has shown that collaboration problems can be overcome through better integration, partnering and contractual governance. The latter requires some form of compatibility analysis and matching between the stakeholder profile and the appropriate contract type. This paper aims to develop a conceptual framework that will assist General Contractors in dealing with the complicated relationships and risks in construction supply chains through effective contracting. The methodology employed for the purposes of our analysis is based on constructive literature review, qualitative correlation of existing research and combination of concepts drawn from the fields of construction supply chain management and stakeholder analysis. The construction supply chain is viewed as a network of stakeholders organised around a General Contractor. Borrowing principles and tools from Stakeholder Analysis, a matching mechanism is developed with the aim to facilitate General Contractors in determining the suitable contract type for different profiles of construction supply chain stakeholders. The main conclusion of this paper is that stakeholder theory and contractual management can be effectively used to tackle opportunism and its negative impacts on construction supply chains.

KEYWORDS: Construction supply chain, Effective contracting, Stakeholder analysis, Stakeholder theory.

INTRODUCTION

The construction industry is susceptible to risks, as far as time and costs are concerned. Cost underestimation or poor time scheduling are not always to blame for such failures. Conflicts that frequently arise within the Construction Supply Chain (CSC) affect its smooth operation, the performance and final outcome of the construction project (Vrijhoef *et al*., 2001). The CSC differs from other industrialized supply chains (SC) due to its temporary nature which stems from its certain lifespan ranging from the day of project initiation to the day of project completion (Vrijhoef & Koskela, 2000). Unfortunately, during this short lifecycle, it is rather

difficult for CSC actors to build mutual trust and collaborative relationships in order to achieve effective cooperation (Egan, 1998; Latham, 1994). Moreover, due to the lack of standardization, it is rather difficult to design a certain workflow that could help monitoring the execution of construction projects (Dallasega *et al*., 2020). As a result, SC conflicts are quite usual with certain cost and delay implications that deteriorate the CSC performance (Dainty *et al*., 2001; Vrijhoef & Koskela, 2000).

Another important characteristic of construction projects, pertain to the operational configuration of the CSC. In particular, at the "heart" of the construction project, there is a main or General Contractor (GC) serving as the project "orchestrator" or coordinator. The GC chooses suppliers and subcontractors and supervises them in cooperation with various types of architects/engineers, consultants (e.g., project management experts, surveyors), as well as governmental/licensing authorities. All these actors should be aligned with view to achieving better performance and strategic CSC alignment (Quang & de Castro, 2017). The GC has to manage multiple relationships with several subcontractors and suppliers, whose behaviour is affected drastically by the adopted procurement procedures. Despite the impact of these relationships on collaboration and trust building across the CSC, they have not been adequately examined in the existing body of research (Bemelmans *et al.*, 2012). The main conjecture of this paper is that the risks associated with poor CSC relationships and collaboration can be reasonably mitigated through effective contracting. Contracts may serve as safeguards against opportunism (Ke *et al*., 2015). At the same time, they encourage trust-building, collaboration and information sharing, while simultaneously specifying obligations and rights that go with the associated risks (especially financial risks) (Chow *et al*., 2012; Wong *et al*., 2008). There are several types of contracts that may fit more or less with different profiles of stakeholders. Therefore, a main challenge is to properly match different CSC stakeholders with different contract types. In doing so, GCs should identify the profiles of CSC stakeholders and determine the best match with a given contract type depending on the characteristics and terms of each contract type. In this context, Stakeholder Analysis (Freeman, 1984; Mitchell *et al*., 1997) provides an effective tool for stakeholder identification and classification that has not been previously investigated in CSC. Borrowing principles and tools from Stakeholder Analysis, the ultimate goal of this paper is to develop a conceptual framework that will assist GCs in understanding and managing relationships and risks in CSC through the selection of proper contract types.

The remainder of this paper consists of five thematic sections. Section 2 describes the applied methodology, while Section 3 presents the basic concepts and characteristics of CSC. Section 4 reviews the alternative types of construction contracts among CSC stakeholders, while Section 5 demonstrates the application of Stakeholder Analysis in the context of supply chain decision making. Section 6 presents the proposed framework for effective contracting in CSC. Finally, the paper concludes with some main findings and future research directions (Section 7), while it is complemented by the list of references.

METHODOLOGY

This paper proposes a conceptual theoretical framework, resulting from constructive literature review. For the purposes of our study, we identified three relevant fields of interest. The main field is construction supply chain and the collateral fields are contracts and stakeholder theory. Initially, we gathered existing literature through Google Scholar with the key emphasis placed on peer-reviewed articles in academic journals in the broader area of

logistics and supply chain management, procurement management, as well as construction management. The main keywords used for each field were organised around three major streams of research: i) construction supply chain, collaboration in construction, information sharing/ transparency in construction, trust building in CSC, CSC performance, relationship management, general contractor, conflicts in CSC, ii) effective contracting, procurement methods in construction and iii) stakeholder theory, stakeholder analysis.

We initially analysed the collected information of the main field of interest and identified the key actors/stakeholder profiles and problems of CSC already presented in existing literature. Then, we proceeded with the synthesis of concepts from CSC, with information from the collateral fields of research, based on logical correlations and compatibility assessment. In that sense, data analysis showed that we face several problems in the main field of interest, that is, CSC. In the respective field of supply chain contracts, we recognized that effective contracting could tackle such problems, while stakeholder theory was found to provide useful stakeholder analysis tools that would assist decision making in effectively selecting the appropriate/compatible contract types for the identified profiles of supply chain actors. The key methodological steps involved in the development of the conceptual framework for effective contracting in CSC are schematically illustrated in Figure 1.

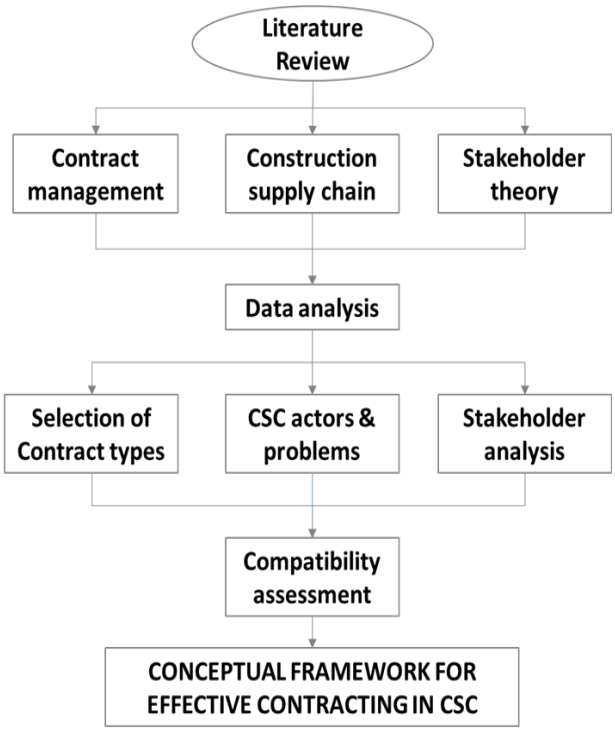

Figure 1: Overall Methodological Approach

CONSTRUCTION SUPPLY CHAIN

The concept of the SC was adopted by the construction industry somewhat later than other industrial sectors. Latham (1994) suggested that the implementation of SC management could improve construction performance, while collaboration could constitute the key element of success in construction projects. Until that time, construction was regarded as a completely unique industrial sector and it was believed that there was not much room for adopting SC

management principles (Egan, 1998). CSC can be described as a network of client(s), contractors, sub-contractors, suppliers, transporters, designers, engineers, consultants etc. Figure 2 provides an illustration of the structure of the CSC, based on a configuration proposed by O' Brien *et al.* (2002). The construction site lies on the core of the network. Everything is delivered on site and each supplier has its own groups of suppliers. The construction site has two main inflows: a flow dealing with materials (from suppliers) and another flow dealing with funds / financial flows (from the owner). Information typically flows from and towards every part of the CSC structure.

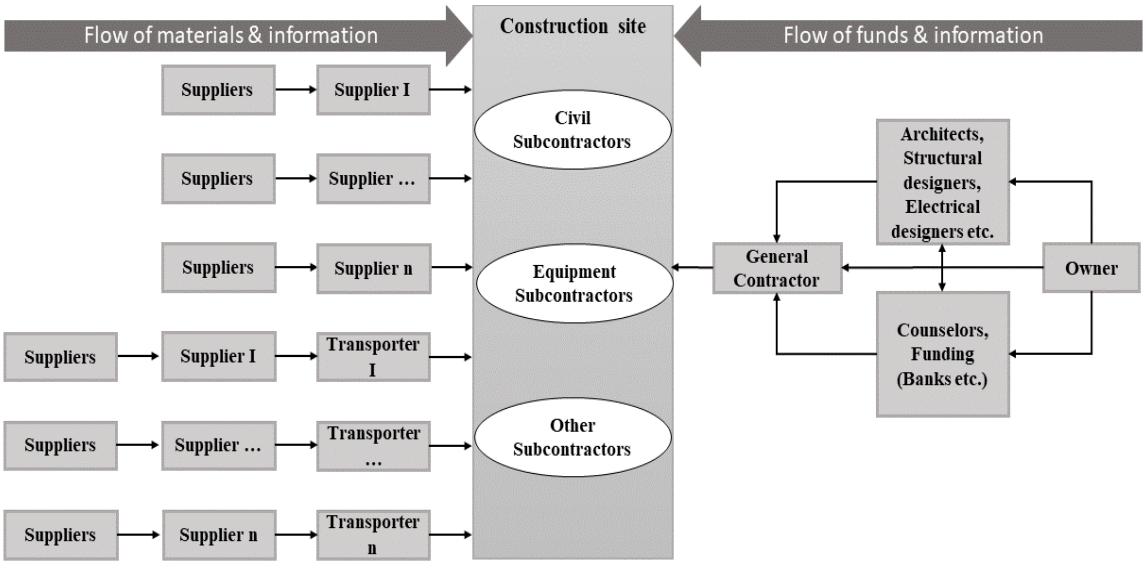

Figure 2: Configuration of the structure of the CSC (adapted from O' Brien *et al.*, 2002)

The structure of the CSC is further distinguished by its tailor-made nature and impermanence. These characteristics cause instability and fragmentation and as a result the CSC cannot be standardized (Vrijhoef & Koskela, 2000). The actors of the CSC do not actually pursue the development of relationships on the basis of trust due to the short-term nature of construction projects. SC collaboration is affected drastically, while communication and information sharing is hindered (Bidabadi *et al.*, 2015).

Another important characteristic of the CSC pertains to its hub-and-spoke organization around the General Contractor coordinating and monitoring the work undertaken by several subcontractors. The relationships between the GC and the large variety of subcontractors tend to be antagonistic (Dainty *et al.*, 2001). The productivity of subcontractors is drastically determined by the quality of their relationships with the GC (Loosemore, 2014), which are negatively affected by the frequent changes in contracts, bid shopping and the lowest price-based tendering process (Briscoe *et al.*, 2004; Chalker & Loosemore, 2016; Hartmann & Caerteling, 2010). Usually, the GC applies continuous pressure to the actors who lie at a lower level in the project hierarchy, such as subcontractors and suppliers (Dainty et al., 2001). From the subcontractors' point of view, financial issues (e.g., delayed payments), time-related issues (e.g., unrealistic project scheduling), information quality issues (e.g. late or inaccurate information) or even attitude issues (e.g., aggressive or arrogant GC's employees) represent key barriers against smooth collaboration with the GC (Dainty *et al.*, 2001). As a result,

conflicts along the CSC are quite common and create problems to the efficient and smooth construction process (Vrijhoef *et al*., 2001). Apparently, claims all along the whole SC are inevitable and have a negative impact on the relationships of the CSC actors and their collaboration (Stamatiou *et al.*, 2018).

Existing relevant research has examined the cooperation and trust which is highly affected by procurement and contractual arrangements between the owner and the GC (Eriksson & Laan, 2007; Sarhan *et al.*, 2017). The client and the GC constitute two major, but not the only important actors of the CSC. The GC has to manage multiple relationships with several CSC actors (such as suppliers, subcontractors, architects/engineers, consultants, project management experts, surveyors, facility management experts etc.), whose behaviour is affected drastically by the adopted procurement procedures (Rahmani *et al*., 2017). Despite the obvious importance of stakeholder relationship management in dealing with SC conflicts, there has been limited research towards the implementation of a systematic framework (Saad *et al.*, 2002). Partnering in the form of inter-organizational collaboration has been proposed as a potential solution (Bresnen & Marshall, 2000), but the geographical dispersion of construction projects does not provide favourable conditions for partnership to flourish in practice (Briscoe *et al.*, 2004). Another approach suggests the application of contractual governance, which entails CSC coordination by means of formal contracts specifying agreed sets of responsibilities and obligations for each party (Ke *at al*., 2015). Xue *et al.* (2005) claim that such problems can be solved by means of effective coordination of the CSC actors through integration. In a different front, Meng (2010) suggests the implementation of a Capability Maturity Model for the evaluation and improvement of CSC relationships. Moreover, Das *et al*. (2015) claim that the solution relies in procurement and they propose an online platform for the material procurement process. Hijazi *et al*. (2019) and Nanayakkara *et al*. (2019) propose the use of Blockchain in order to increase transparency in CSC, while Nanayakkara *et al.* (2019) combines this solution with the use of smart contracting. Meng (2019) proposes the use of proactive management instead or reactive management in CSC in order to improve collaboration and Yazdani *et al*. (2019) tried to develop methods for suppliers' performance measurement that could facilitate suppliers' selection. Wang and Shi (2019) focused on knowledge management and knowledge sharing in order to obtain more benefits. From another point of view, Gao *et al*. (2019) point out the heterogeneity and its inevitable implications in construction and suggest the application of Design for Manufacture and Assembly (DfMA), combining prefabrication and onsite assembly, which could be applied through CSC management. In what follows, we present an overview table (Table 1) summarizing key CSC problems along with the associated proposed solutions discussed by authors in relevant literature.

In the existing literature, authors have presented thoroughly the problems that CSC faces. Relationship management and contracting have been already suggested as possible ways to tackle these issues. Till now, the CSC has not been regarded as a network of stakeholders and the idea that different contract types could be used for different profiles of stakeholders has not been discussed. Moreover, stakeholder analysis is a useful tool applied by managers in order to manage relationships with people and organizations involved in their projects. Therefore, this study regards the situation from GC point of view, borrows principles and tools from Stakeholder Analysis, proposes to understand the profiles of CSC stakeholders and match the different stakeholders with different contract types, in order to prevent problems stemming from conflicting interests between the GC and suppliers/ subcontractors.

Table 1: Overview of existing literature

Problems in CSC	**Relevant research**
Conflicts	Vrijhoef and Koskela, 2000; Dainty *et al*., 2001; Vrijhoef *et al.*, 2001; Briscoe *et al*., 2004; Wong *et al*., 2008; Hartmann and Caerteling, 2010; Bemelmans *et al*., 2012; Chow *et al*., 2012; Loosemore, 2014; Bidabadi *et al*., 2015; Chalker and Loosemore, 2016; Naismith *et al*., 2016; Stamatiou *et al*., 2018
Lack of trust	Latham, 1994; Egan, 1998; Vrijhoef and Koskela, 2000; Eriksson and Laan, 2007; Chow *et al*., 2012; Bidabadi *et al*., 2015; Ke *at al*., 2015; Chalker and Loosemore, 2016; Sarhan *et al*., 2017
Poor cooperation	Latham, 1994; Egan, 1998; Vrijhoef and Koskela, 2000; Wong *et al*., 2008; Chow *et al*., 2012; Bidabadi *et al*., 2015; Das *et al*., 2015; Chalker and Loosemore, 2016
Poor performance	Vrijhoef and Koskela, 2000; Dainty *et al.*, 2001; Loosemore, 2014; Chalker and Loosemore, 2016
Poor information sharing/ transparency	Vrijhoef and Koskela, 2000; Wong *et al.*, 2008; Chow *et al*., 2012; Bidabadi *et al*., 2015; Hijazi *et al*., 2019; Wang and Shi, 2019
Financial Risks	Wong *et al*., 2008; Chow *et al*., 2012; Dziadosza *et al.*, 2015
Conflicts	Vrijhoef and Koskela, 2000; Dainty *et al.*, 2001; Vrijhoef *et al*., 2001; Briscoe *et al*., 2004; Wong *et al*., 2008; Hartmann and Caerteling, 2010; Bemelmans *et al.*, 2012; Chow *et al.*, 2012; Loosemore, 2014; Bidabadi *et al*., 2015; Chalker and Loosemore, 2016; Naismith *et al.*, 2016; Stamatiou *et al*., 2018
Lack of trust	Latham, 1994; Egan, 1998; Vrijhoef and Koskela, 2000; Eriksson and Laan, 2007; Chow *et al*., 2012; Bidabadi *et al*., 2015; Ke *at al*., 2015; Chalker and Loosemore, 2016; Sarhan *et al.*, 2017
Poor cooperation	Latham, 1994; Egan, 1998; Vrijhoef and Koskela, 2000; Wong et al., 2008; Chow *et al*., 2012; Bidabadi *et al.*, 2015; Das *et al.*, 2015; Chalker and Loosemore, 2016
Poor performance	Vrijhoef and Koskela, 2000; Dainty *et al.*, 2001; Loosemore, 2014; Chalker and Loosemore, 2016
Proposed solutions	**Relevant research**
Contracting	Gordon, 1994; Ke *at al*., 2015; Nanayakkara *et al*., 2019
Collaboration	Bidabadi *et al.*, 2015
Relationship management	Saad *et al*., 2002; Meng 2010; Bemelmans *et al.*, 2012
Partnering	Bresnen and Marshall, 2000
Integration	Briscoe et al., 2004; Xue et al., 2005
Procurement methods	Hartman, 1993; Hartmann and Caerteling, 2010; Das *et al.*, 2015
Proactive management	Meng, 2019
Suppliers' selection	Yazdani *et al*., 2019
Design for manufacture and assembly	Gao *et al*., 2019
Blockchain	Hijazi *et al*., 2019; Nanayakkara *et al.*, 2019
Knowledge management	Wang and Shi, 2019

CONSTRUCTION CONTRACTING

This section aims to review alternative types of construction contracts as a means of better dealing with CSC relationships between the GC and subcontractors or suppliers. A fundamental line of arguments adopted in this paper suggests that the proper contract type should aim to reflect the specific interests and preferences of different stakeholder groups. Having established a transparent and mutually agreed set of relationships, stakeholders will be more inclined to engage in formal business relationships on the basis of trust, cooperation and information sharing. Trust is considered a core element of informal management in CSC, while contracting represents the core element of formal management. Contractual governance has a positive impact on performance, since it encourages each SC member to adopt cooperative attitude (which entails information sharing, commitment and compliance to power execution) and works as a safety valve against opportunism (Ke *et al.*, 2015). Contracts reduce uncertainty on the grounds that they set a framework of rights and obligations among the contracting parties. Moreover, they provide for a fair allocation of risks and responsibilities that creates a fertile ground for trust building (Wong *et al*., 2008) and information sharing (Chow *et al*., 2012).

Based on the hub-and-spoke organizational structure of the CSC, General Contractors reward two basic types of contracts: (a) with subcontractors (e.g., equipment subcontractors and civil subcontractors such as foundation subcontractors, builders, electricians, plumbers, carpenters, painters, flooring specialists) and (b) suppliers. Both types of construction contracts along with their variations are further discussed in what follows.

Contracts with Suppliers

Cachon (2003) listed six different contract types that can be applied in commercial SC relationships: i) the wholesale price contract, ii) the buy-back contract, iii) the revenue-sharing contract, iv) the quantity flexibility contract, v) the sales rebate contract and vi) the quantity discount contract. In the case of revenue-sharing contract, the purchaser pays to the supplier the agreed price for each unit ordered plus a percentage of their total revenue. In CSC, the GC is the final consumer and does not resell the material to obtain additional revenue. Therefore, the revenue-sharing contract is not applicable. The same applies also with the quantity flexibility contract types. This contract type requires periodical orders. The supplier charges an agreed price per unit purchased but has to compensate the buyer for their losses in case of unsold goods. In the CSC, the GC does not order material periodically because the amount of required material is specific and the orders are based on quantity surveying. Any unused materials (probably due to miscalculations) can be used in other construction projects or returned to the supplier under a buy-back contract. Consequently, the quantity flexibility contract is not applicable either. The rest of the aforementioned contract types can be adapted to the CSC peculiarities as follows:

The Wholesale Price Contract

In terms of large trade, the wholesale price is the price charged for a product when sold in bulk. In CSC, under a Wholesale Price Contract, the supplier charges the GC a wholesale price per unit purchased, regardless of the total number of units ordered. This contract is rather simple, with GC trying to lower the cost of purchased material (Lariviere & Porteus, 2001).

The Buy-Back Contract

Under a buy-back contract, the supplier provides the GC with the ordered quantity of materials at an agreed price per unit and commits to buy back any unused materials again at a pre-specified price (Pasternack, 1985). This type is usually applied in retail SC where products have low variable costs.

The Sales-Rebate Contract

This contract type contains the following parameters: i) the initial purchased quantity, ii) a wholesale price, iii) an agreed rebate and iv) an agreed threshold for purchased quantity. The GC is charged a wholesale price per unit for the initial purchased quantity. If the GC orders more than the agreed quantity threshold (e.g., in case of wrong quantity estimation or for use in other projects), the supplier offers a rebate to the GC (Taylor, 2002).

The Quantity Discount Contract

In this case, the supplier charges the purchased material at a decreasing (variable) cost per unit as an incentive for the GC to purchase larger quantities (that can be probably used in other/similar construction projects) (Cachon, 2003).

Contracts with Subcontractors

The most common construction contract types that are signed between GCs and subcontractors are the following: i) lump sum, ii) unit price, iii) cost-plus and iv) guaranteed maximum price (Borg & Lind, 2014; Gordon, 1994; Hartman, 1993; Turner & Simister, 2001).

Lump Sum

The subcontractor agrees to deliver a specific work for a specific sum of money. This contract type is also known as “fixed sum” or “single fixed price”. It usually includes labour, materials, overheads and profit (Gordon, 1994). The subcontractor has to estimate all costs mentioned above, while simultaneously accounting for any unexpected situations that may increase the cost. Thus, the subcontractor assumes a high risk. On the other hand, the GC undertakes lower risk, but, in the case of unexpected cost increases, the subcontractor may look for cost cutting by usually downgrading the quality of the delivered work. Usually these contracts contain penalties against the subcontractor in order to guarantee the quality and time of the delivered work (Dziadosza *et al.*, 2015).

Unit price

The subcontractor agrees to deliver the stipulated work and be paid on a specific price charged per unit for each element of the work. The final cost of the work is estimated on the basis of the actual measured elements after the completion of the construction project. The subcontractor offers a final price per unit based on the estimation of quantities, plus overheads and profit. Upon completion of the project, quantity surveyors undertake the responsibility of delivering a bill of quantities by measuring the constructed elements and agreeing upon the measured quantities with the subcontractors. Under such a contract type, the total cost of the work is estimated and agreed on completion (Borg & Lind, 2014; Gordon, 1994). This

contract type entails low risk for the GC but higher risk for the subcontractor on the grounds that the subcontractor undertakes the risk that the final bill may not cover actual costs (Hartman, 1993).

Cost-plus

The GC and the subcontractor agree on a sum of money for labour, materials and project overheads. In addition to the direct cost, they agree on an extra fee, which includes company overheads and profit. The extra fee may be calculated as a percentage of the direct cost. Alternatively, it may be calculated as a fixed fee or a combination of percentage and fixed fee (Borg & Lind, 2014; Gordon, 1994). In this case, the risk is higher for the GC rather than the subcontractor, because this contract type entails uncertainty for the GC who has a specific budget to manage. Since the final cost of the service is not known in advance, there is possibility of budget failure (Hartman, 1993).

Guaranteed Maximum Price

Similar, to the previous contract type, the GC and the subcontractor agree on some reimbursement for labour, materials and project overheads. On top of it, there is an extra fee for company overheads and profit, which cannot surpass a maximum price. In case of unexpected costs, the subcontractor cannot claim for additional reimbursement that may violate the upper cap (maximum agreed price) limit (Gordon, 1994). This contract type entails the lowest risk for both parties because the deal encourages them to collaborate in order to keep the cost under the maximum price (Dziadosza *et al*., 2015).

STAKEHOLDER ANALYSIS IN SUPPLY CHAINS

This section provides an overview of the theoretical fundamentals of the Stakeholder Analysis and establishes the link between stakeholder analysis and SC decision making.

Stakeholder Analysis

Stakeholder theory contemplates that managers of organizations (or projects) should not solely focus on the interests of the owners and the shareholders. Unlike the traditional way of business thinking, the function of an organization (or project) affects its environment, which consists of people, social groups, companies or other organizations such as employees, customers, suppliers, competitors, media, government etc. At the same time, the impacted stakeholding groups further affect the functions of an organization (or project) depending on their power and influence (Freeman, 1984). The relationships between organizations and stakeholders vary, according to the compatibility of their interests (Friedman & Miles, 2002). As far as projects are concerned, the ability to perceive the conflicting interests is crucial. If the needs and expectations of the stakeholders are disregarded or misinterpreted, the project cannot be considered successful, even if it is delivered in time and without budget overrun (Bourne & Walker, 2005). Consequently, each affected stakeholder should be treated in a special way and their interests should be taken into account by managers (Freeman, 1984).

The majority of stakeholder analysis methods use the stakeholders' power and degree of influence in order to define how much friendly or hostile the stakeholder stands towards the organization (Pan *et al.*, 2013). Some indicative examples of stakeholder analysis tools

applied in existing literature are the following: (a) the Power-Interest Matrix (Mendelow, 1991), (b) the Impact-Probability Matrix (Johnson & Scholes, 1999), (c) the Power-Impact Matrix (Office of Government Commerce UK, 2003), (d) the Stakeholder Circle (Bourne, 2006) and (e) the Power-Interest-Attitude Matrix (Murray-Webster & Simon, 2006). For the purposes of this paper, we opted for a simple tool that would assist stakeholders' classification into distinct groups. Hence, we excluded more complex tools, such as the Stakeholder Circle and the Power-Interest-Attitude Matrix. Furthermore, a critical characteristic for stakeholders' classification is their power, which refers to what extend the stakeholders can impose their will and to what extent they affect project-related decisions (Mendelow, 1991). Overall, the Power-Interest Matrix and the Power-Impact Matrix were found to be the most suitable candidate tools for our analysis. Stakeholders with power have also impact on the project. But do they also have interest on it in order to attempt to affect the project delivery? Based on this concern, we concluded that the Power-Interest Matrix represents the most suitable stakeholder classification tool for our analysis. The selected Power-Interest Matrix applied for the classification of CSC stakeholders is presented in Figure 3 below. The horizontal axis depicts the level of interest over the construction project, while the vertical axis represents the level of stakeholders' bargaining power. Four groups of stakeholders are defined with the following characteristics:

- A (Minimal effort): Low level of interest and low level of bargaining power
- B (Keep informed): High level of interest and low level of bargaining power
- C (Keep satisfied): Low level of interest and high level of bargaining power
- D (Key players): High level of interest and high level of bargaining power

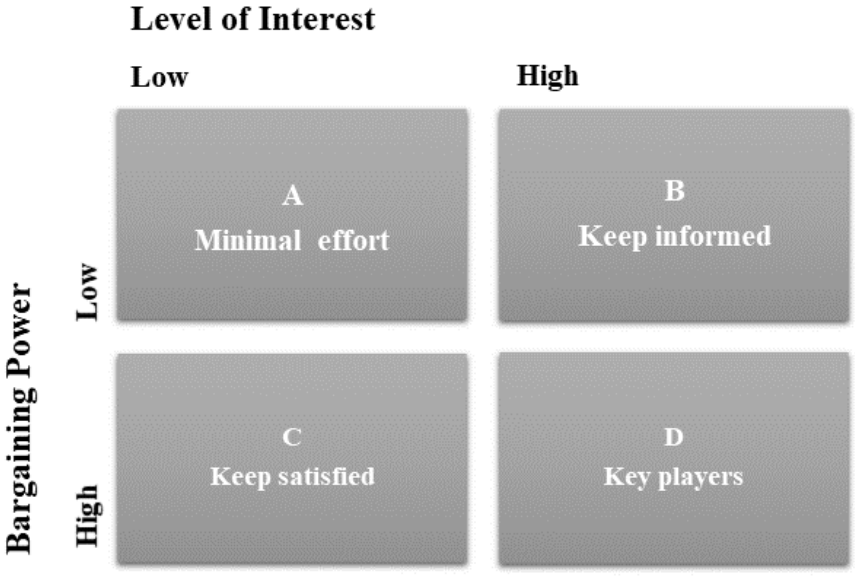

Figure 3: The Power-Interest Matrix (adapted from Mendelow, 1991)

Supply Chain Stakeholders

The SC is defined as a network of collaborating people, organizations, companies and services that are involved in the production of the final goods/services (from the stage of raw material to the product/service delivery to the final customers) exchanging (semi)finished products, materials, information, knowledge, technologies etc. during the entire process (Pan *et al*., 2013). Inevitably, SC participants can be also viewed as stakeholders of a project (or the SC behind a project), since they affect (or get affected by) its implementation.

A critical question investigated in this paper is how stakeholder theory can provide support to strategic SC management decisions, such as the selection of the most suitable contract type for different types of stakeholders. Stakeholder theory is closely related to decision support (Freeman *et al*., 2010). Stakeholders have impact on SC management decisions and consequently they are actively participating in the decision making process (Wittke, 2014). The stakeholder salience, defined by power, legitimacy and urgency (Mitchell *et al*., 1997), can act as a guideline for SC management decision making (Wittke, 2014). The term salience refers to the importance that managers assign to their stakeholders. Managers give priority to the stakeholders' demands according to their salience, during the decision making process of every project. Stakeholder analysis can be employed to determine which stakeholders are more salient. The degree of salience will be used to prioritize the stakeholders and their interests in order to further decide how to treat each of them and support relevant CSC decision making.

PROPOSED FRAMEWORK

Low levels of collaboration and poor information sharing inevitably lead to friction and frequent conflicts among CSC actors. Formal contracts allocate risks and responsibilities among contracting parties and have a potential to promote trust, collaboration and information sharing. The selection of the proper contract type for different types of stakeholders may assist GCs in mitigating conflicts among CSC stakeholders. Stakeholder analysis can be effectively used for stakeholder profiling purposes. This section presents a conceptual framework for managing relationships and risks in the CSC through the deployment of stakeholder analysis as a "best fit" mechanism between various types of contracts and different types/profiles of stakeholders. The proposed framework consists of the following five steps:

Step 1: CSC Identification - Where should we focus?

In the first step, the GC has to identify the structure of the CSC of the project and all the possible sub-supply chains interacting with the core CSC. The particular focus of the analysis pertains to the left part of the diagram in Figure 2, that is, flows/interactions among suppliers and various types of subcontractors. Since every construction project and its associated CSC are unique, it is essential to identify every process and interaction that will be subsequently analyzed. Conflicts are mainly detected at the interfaces between various functions of the SC. Therefore, the GC should identify and analyze the interfaces where SC conflicts may occur.

Step 2: CSC Stakeholder Identification -Who are the CSC stakeholders?

Step 2 aims to shed light onto the stakeholders that may be involved in the conflicts identified in Step 1. The GC has to detect and list the CSC stakeholders, based on the SC structure and configuration identified in the previous step. These stakeholders will be divided into two groups: (a) suppliers and (b) construction subcontractors. The process requires data collection about each stakeholder with emphasis placed on their level of interest on the specific project, the bargaining power that they possess, in case they want to impose their will as well as other useful information, such as their attitude about the project, their reputation etc. (Figure 4). The interest refers to making profit from the specific project, will for long-term collaboration in future projects with the GC, gaining reputation in the construction market etc. The bargaining power refers mainly to monopolies, expertise or specialised services. The attitude of the stakeholders may be positive, negative or indifferent towards the project, according to their interests. The reputation of stakeholders is also useful information, because it can affect their bargaining power. Other information or drivers affecting stakeholders' interests or power should be also explored.

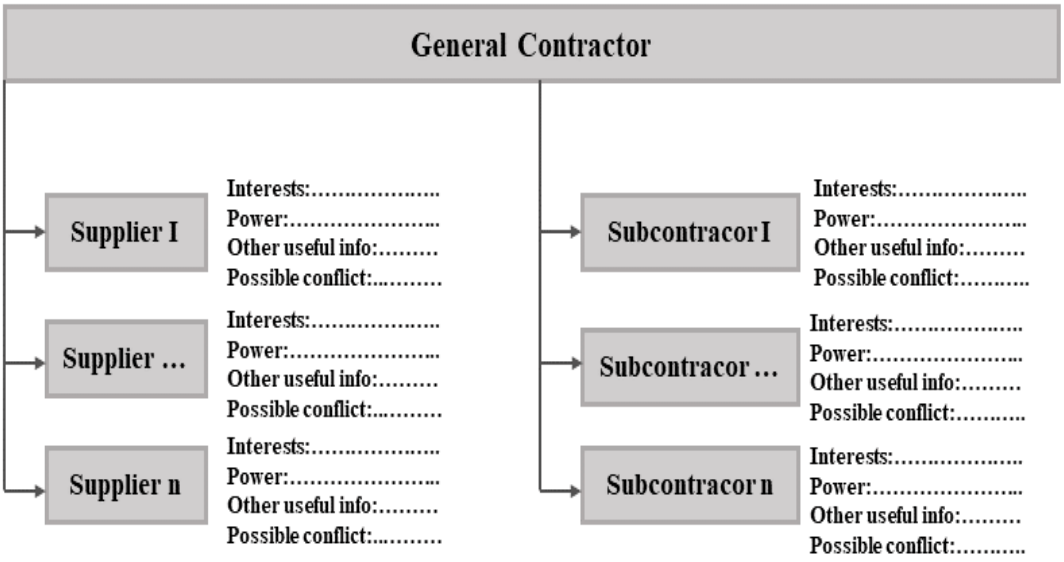

Figure 4: List of CSC Stakeholders' Profiles

Step 3: CSC Stakeholder Analysis - Which are the various stakeholder profiles?

The GC should proceed to Stakeholder Analysis for each stakeholding group identified in Step 2. Using the Power-Interest Matrix, each group will be divided into four smaller groups (Figure 5) that are summarized below:

Group A ("Minimal Effort")

The first group of stakeholders has low level of interest and power and cannot affect the decision making. In this group, one would usually list small/medium subcontractors or suppliers, who do not offer unique services, expertise or equipment/material. Consequently, a lot of firms could potentially offer equivalent or similar services/equipment/material at the same market. Practically, they could be easily substituted, since they do not monopolize or

offer a unique offering to the relevant construction market. Moreover, the competition in this certain market is high. Stakeholders of Group A are primarily interested to get the work assignment in order to increase their financial turnover, but they do not also target towards a long-term collaboration with the GC. This may be attributed to the lack of strategic planning, opportunistic business culture or even the fact that the GC will not undertake another project at the same geographical area. Due to their low level of interest, they may show little commitment to the project or will to collaborate and share information with the rest of the CSC actors. Therefore, the GC should monitor them but pay minimal effort to satisfy their needs.

Group B ("Keep Informed")

The second group is characterised by high level of interest and insignificant power. The stakeholders of this group may be small/medium sized firms without significant bargaining power, because they do not monopolize the local market. On the other hand, their interests may have two aspects: (a) the opportunistic aspect which refers to making the highest possible profit and (b) the strategic aspect which refers to establishing a long-term collaboration with the GC and building professional reputation for their firm. Their high level of interest may push them towards seeking ways to gain power in order to satisfy their needs. In case of opportunistic interest, the stakeholders of group B are not willing to collaborate and share information. However, in case of strategic interest, their attitude is exactly the opposite. The GC should keep an eye on this group and be always informed about their moves and motives.

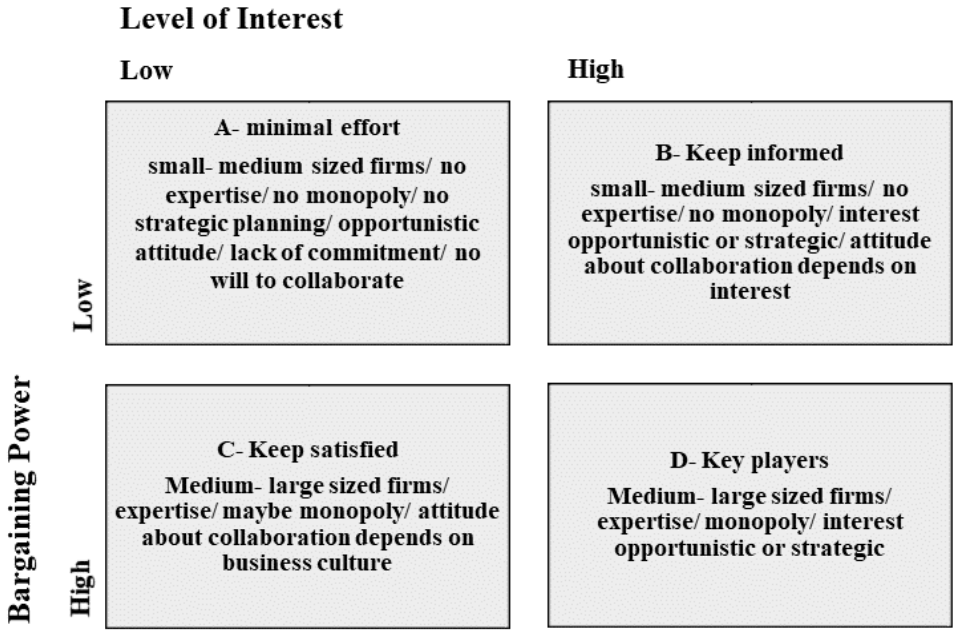

Figure 5: Visualization of Stakeholder Analysis

Group C ("Keep Satisfied")

The third group consists of stakeholders having bargaining power but low interest on the project. The stakeholders of this group may be medium/large sized firms. They may have expertise in certain construction works or may provide specialised equipment/material. They

may even have the monopoly at the region of the construction site. The low interest may lie on the fact that they do not consider the specific project of strategic importance to their firm. Collaboration and commitment depend on their business culture. The GC should keep them satisfied in order to prevent them from getting more interested and deter them from moving to group D.

Group D ("Key Players")

The last group contains the stakeholders exhibiting high level of interest and bargaining power. They can exert substantial influence on the CSC that may affect or even jeopardize the output of the construction project. Stakeholders of this group may be medium/large sized firms with expertise in certain construction works. They may provide specialised equipment/material or even have the monopoly at the specific geographical region. Their interest can be either opportunistic or strategic. The GC should collaborate closely with this group and effectively pursue the proper satisfaction of their needs.

Step 4: Selection of Contract Type - What is the most suitable contract type?

Based on the previous steps, the following elements have been defined: (a) four contract types for suppliers, (b) four contract types for construction subcontractors and (c) four CSC stakeholders groups. In this step, we aim to match the respective groups with the most appropriate contract types (Table 1).

Suppliers Group A ("Minimal Effort")

The stakeholders of the first group cannot affect the decision making. There are a lot of other suppliers at the same market, who can provide the same material, so they can be easily substituted. They do not threaten the smooth operation of the CSC. The GC does not need to pay the most attention to their expectations and is able to negotiate about the price to get a reasonable discount. On the other hand, the suppliers cannot deny a discount, because their bargaining power is insignificant. Moreover, if the suppliers charge the purchased material at a decreasing cost per unit, the GC will be encouraged to purchase again from them in the future, in case of another project at the same area. A quantity discount contract seems rather suitable in this case.

Suppliers Group B ("Keep Informed")

The stakeholders of the second group provide comparable or equivalent material to their local competitors. They do not differentiate, so they can be easily substituted, and they do not threaten directly the CSC operation. The GC can negotiate about purchase prices but should not apply pressure to them because their high level of interest may encourage them to look for ways to gain power and impose their will. This is the reason why the GC should always keep them informed in order to ensure that no major issues are arising. As in the previous group, the suppliers cannot deny a discount. The discount is the incentive for the GC to choose them. At the same time, their high interest may render them a risk factor for the project. So the GC should not cause them dissatisfaction by insisting on great discount. A sales-rebate contract could be a satisfactory option for both sides, since the G C gets a discount and the supplier does not have to offer a discount for the whole amount of purchased material.

Suppliers Group C ("Keep Satisfied")

The stakeholders of the third group either differentiate from their competitors in the local market or they enjoy a monopolistic situation. They can affect the smooth operation of the CSC, if they want to impose their will. However, the low level of interest may deter them from adopting such an attitude. The GC cannot negotiate aggressively about the purchase price because the suppliers of group C should be kept satisfied in order to avoid shifting them to the "Key players" group. A buy-back contract could be a favorable deal for both contracting parties. The supplier will not need to offer a discount, while the GC will have the option to return unused materials that may incur financial costs. Under this contract type, the GC by accepting the offered price, keeps the suppliers satisfied. The suppliers do not have to get involved in a price negotiation process, which could cause them frustration. In return, they just have to accept the buy-back of unused material (if any).

Suppliers Group D ("Key Players")

The stakeholders of the last group provide specialised materials that are not offered by competitors. They may also operate under a monopolistic environment. They can affect the smooth operation of the CSC, in case that their interests are ignored. The GC should actively pursue collaboration with this group them and try to keep them satisfied. Aggressive negotiation practices and discount offering do not usually constitute acceptable options. The supplier offers a price regardless of the quantity of the purchased material and the GC accepts it because the bargaining power of the supplier is high and cannot be easily substituted. A wholesale contract represents the most suitable contractual option.

Subcontractors Group A ("Minimal Effort")

The subcontractors of the first group cannot affect the decision making. There are a lot of competitors at the same market, who can offer the same service or construction equipment. Thus, they can be easily substituted. They do not threaten the smooth operation of the CSC. The GC does not need to pay the utmost attention to their expectations, while there will be ample room for negotiation about the risk allocation. The subcontractors of Group A have to undertake the whole risk and deliver a specific work for a specific sum of money. The GC, having a specific budget to manage, has the privilege to avoid any financial risk since the work will cost a certain amount of money, even if unexpected events raise the actual cost of the work. In that respect, the GC may opt for a lump sum contract passing risks to the subcontractor.

Subcontractors Group B ("Keep Informed")

The stakeholders of the second group do not differentiate from their competitors in the local market. They offer the same services or equipment, so they do not threaten directly the CSC operation, since they can be easily substituted. Their high level of interest may encourage them to look for ways to increase their power, possibly through strategic alliances. The GC has higher bargaining power than the subcontractors and is therefore able to pursue a low-risk contract type. The unit-price contract seems a suitable option for this group, on the grounds that it involves lower risk for the GC as compared to the subcontractor, who takes the risk that the final bill will not cover the actual cost. The GC is offered a final price per unit. Based on the estimation of quantities, the GC is able to calculate the final cost of the work in order to

avoid the financial risk of exceeding the budget. In any case, a proper and flawless measurement of total costs by the quantity surveyors should be ensured.

Subcontractors Group C ("Keep Satisfied")

The stakeholders of the third group either differentiate from their competitors in the local market or they have the monopoly in their area of expertise. They can affect the smooth operation of the CSC, if they want to impose their will. However, they exhibit low levels of interest and are not normally expected to play a decisive role in the CSC. Subcontractors of group C should be kept satisfied in order not to get more interested and become "Key players". In this case, the GC has to assume higher risk than subcontractors. A cost-plus contract seems proper for this group, because the subcontractor will be paid the direct cost, plus an extra fee, which includes company overheads and profit. As a result, under this contract type, the subcontractor is kept satisfied and does not undertake high risk since all the costs of the provided work and profit will be covered regardless of any complications or unexpected events. On the contrary, the risk is higher for the GC, because of the uncertainty about the final cost of the work, which may cause budget overrun.

Subcontractors Group D ("Key Players")

The stakeholders of the last group offer specialised work or equipment. They may also operate under a monopolistic environment in the local market. They can affect the smooth operation of the CSC, if their interests are ignored. The GC should actively collaborate and try to keep them satisfied. The maximum guaranteed price contract is the most suitable for the subcontractors of this group. Under this contract type, the two parties agree on a given amount of money for labor, materials and project overheads, plus an extra fee for subcontractor's overheads and profit, which cannot surpass a maximum price. Hence, the GC is protected against overpricing, which is frequently arising in monopolistic environments. At the same time, the subcontractor's reimbursement for the work as well as their profit are secured. Since the two parties have agreed on a maximum price, they have a common goal: to keep the cost under the threshold. As a result, they are encouraged to collaborate.

The proposed matching between the identified stakeholder groups (i.e., suppliers, subcontractors) and the respective contract types is summarized in Table 2.

Table 2: Matching CSC Stakeholders with Contract Types

GROUP OF STAKEHOLDERS	CONTRACT TYPE	
	SUPPLIERS	**SUBCONTRACTORS**
A - Minimal effort	Quantity discount	Lump sum
B - Keep informed	Sales-rebate	Unit price
C - Keep satisfied	Buy-back	Cost-plus
D - Key players	Wholesale	Guaranteed maximum price

Having identified the stakeholders, their power and the potential conflicts of interest, the GC has to select the proper contract type for each actor. The attribute of power has been emphasized in the whole procedure. The GC wishes to be the most powerful actor or tries to avoid increase of stakeholders' interest/power, indicating an authoritative use of power. However, according to other streams of research, power could be used alternatively in an influential way, which favors the development of collaboration (Gadde, 2004). Naismith *et al.* (2016) claim that the CSC conflicts can be smoothed by balancing the power of the conflicting parties. In that sense, the GC may use the process described above in order to decide the level of involvement in the construction project of each stakeholder (Gadde, 2004) rather than selecting the proper contract type.

Step 5: Process evaluation

The process concludes with a final step aiming to evaluate and provide feedback towards future process improvements. The GC should assess the effectiveness of the framework in terms of conflict reduction and their associated impact on trust, collaboration and information sharing among CSC stakeholders. A broad set of multi-criteria assessment methods/techniques (e.g. Analytic Hierarchy Process, Analytic Network Process) can be deployed in order to evaluate the effectiveness of the proposed framework and its associated impacts of implementation.

Overall, the GC starts from mapping the unique construction supply chain of the project, which may contain several sub-supply chains. In the following step, information about each stakeholder group (e.g., special characteristics, interest, power, possible conflicts etc.) are collected. Based on the gathered information, the GC defines the stakeholder's profiles, which will be used in the subsequent steps of the analysis. Then (third step), two main categories of stakeholders are distinguished: Suppliers and Subcontractors. By means of stakeholder analysis, the identified stakeholder profiles help them classify the stakeholders of each category in four distinctive groups, making use of the Power-Interest Matrix of Mendelow. The four groups are the following: Group A (minimal effort), Group B (keep informed), Group C (keep satisfied) and Group D (key players). In the subsequent step, every group is assigned with a certain contract type. The applied compatibility analysis resulted in four contract types for each stakeholders' category. As far as suppliers are concerned, the proposed contract types are the following: quantity discount (for Group A), sales- rebate (for Group B), buy-back (for Group C) and wholesale (for Group D). For subcontractors, the proposed contract types are the following: lump sum (for Group A), unit price (for Group B), cost-price (for Group C), guaranteed maximum price (for Group D). After completion of the supply of materials/work, the fifth and concluding step pertains to the evaluation of the result of the collaboration with every stakeholder. If the used contract types were effective, they can be retained and further used, otherwise the procedure needs to be iterated with additional information and experience from the previous collaboration in order to come up with new contract types or even look for new suppliers/ subcontractors. A schematic illustration of the proposed conceptual framework along with its associated individual methodological steps is presented in Figure 6.

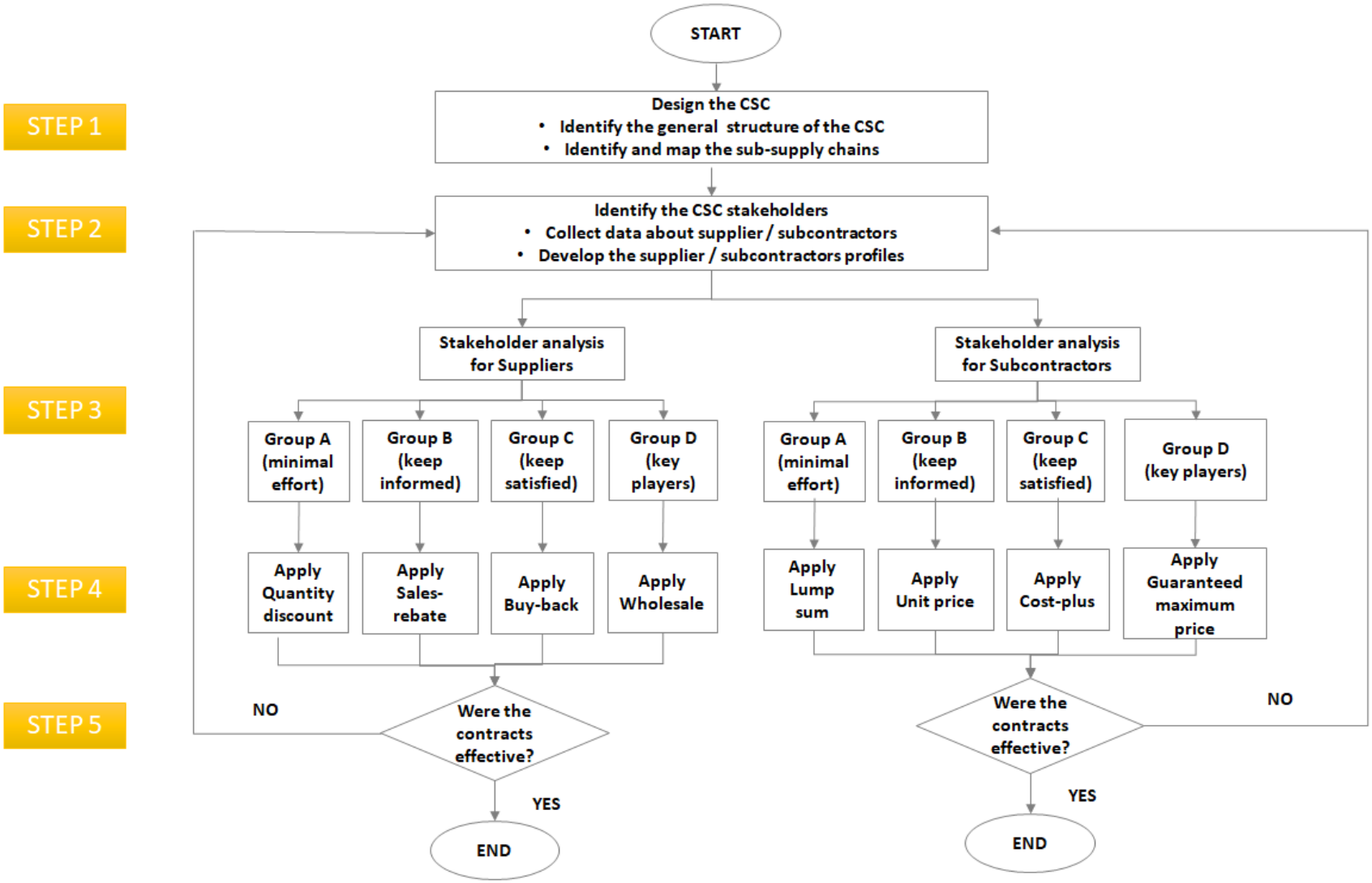

Figure 6: Proposed Conceptual Framework

CONCLUSION

The project-based organisational structure and temporary nature of CSCs result in short-term professional relationships of opportunistic character that do not favour the development of mutual trust, collaboration and information sharing among CSC stakeholders. The lack of collaboration and trust causes friction and conflicts among CSC stakeholders with direct implications on the efficiency, quality and output of the SC. Existing literature has shown that collaboration problems and barriers can be overcome through better integration, partnering and contractual governance. Contracts have been extensively discussed in existing literature as safeguards against opportunism and primary drivers of trust-building, collaboration and information sharing. However, different types of contracts may fit more or less with different profiles of stakeholders. The latter requires some form of compatibility analysis and matching between the stakeholder profile and the appropriate contract type. Existing literature has not sufficiently addressed the selection of different contracts types with view to different profiles of stakeholders. In that respect, stakeholder analysis constitutes a powerful strategic management tool that can be deployed in order to develop the necessary stakeholder profiles and manage the associated contractual relationships among the identified stakeholder profiles, hence thereafter better dealing with conflicting interests between the GC and suppliers/ subcontractors. In this paper, we used Stakeholder Analysis in order to identify the various stakeholder profiles in CSC and thereafter propose the appropriate contract types for the resulted stakeholder profiles. Furthermore, we developed a conceptual framework that will be able to assist the GC in dealing with the complicated relationships and risks in CSCs through effective contracting. The proposed framework provides an implementation roadmap with specific guidance on the appropriate types of contracts for different CSC actors.

The key contribution of our study is the integration of stakeholder theory and contractual administration in construction supply chains in order to tackle opportunism and its negative impacts on construction projects. Our paper points out that contracts could be used as safeguards against implications caused by conflicting interests among the CSC stakeholders and proposes a tool that GC could use in order to assist decision making in contract type selection and matching with various types/profiles of suppliers and subcontractors.

As far as the actual operationalization of the framework is concerned, we should take into account that the GC is usually in contract with multiple suppliers and subcontractors. In every stakeholder profile, one or more stakeholders could be assigned. The framework does not propose that only two suppliers and two subcontractors could be examined. Instead, it suggests that stakeholders can be divided into four distinct groups and every group (with multiple memberships) could be handled in a different strategic way depending on the power and the interest of each group. As a result, big construction companies and EPCs could benefit from the use of the proposed framework, which handle large scale construction projects, with complicated supply chains involving a huge number of suppliers and subcontractors.

FUTURE RESEARCH

The main contribution of this paper is that it proposes a conceptual framework demonstrating the deployment of stakeholder theory in better dealing with complicated contract management in construction supply chains. The proposed conceptual framework capitalizes on the properties of stakeholder theory in terms of power and interest in order to match stakeholder

profiles with the most compatible types of contracts. A subsequent, on-going step of our research involves the triangulation of our qualitative research findings with empirical survey data and perspectives from actual CSC stakeholders. Our future research focuses on the empirical assessment and validation of the proposed conceptual framework through a detailed survey design with a threefold objective: i) development of stakeholder profiles in CSCs, ii) validation of the proposed framework with real-world data and stakeholders and iii) assessment of the impact of the proposed construction contract types on trust, collaboration and information sharing among CSC participants. In that respect, Structural Equation Modeling (SEM) will be examined in order to validate the relationship between contract types and various constructs expressing trust, collaboration and information sharing in line with relevant social and behavioral studies. Other compatibility analysis techniques can be certainly used as complements or substitutes of the integral components of the proposed conceptual framework in order to assess the level of compatibility between stakeholder profiles and contract types. Another interesting extension of our research would be the deployment of qualitative (e.g. typology development) or quantitative (e.g., cluster analysis) methods to develop the profiles/groups of CSC stakeholders with view to multiple classification criteria.

Additional research areas / directions can also emerge from this research, especially in social sciences. For example, the identification of stakeholders' profiles can be further extended to the spectrum of psychology and behavioral studies. The selection, development and particularly the performance monitoring of contracts introduces a challenging strategic management topic that merits further research investigation. Finally, risk management constitutes another key interrelated field so that risks and their mitigation plans / measures associated with certain types of contracts can be also explored in future research.

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