

Subcontracting Strategy in Industrial Projects: Evidence from Saudi Arabia

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Abstract

Subcontracting is widely employed in the construction industry owing to the variation of methods, materials, magnitude, and function of the infrastructures. However, the rapport between parties in construction are mostly adversarial and plagued with hitches, which negatively impact construction productivity. This research investigates the problems associated with subcontracting strategies of contractors in industrial projects in the Eastern Province of Saudi Arabia via questionnaire survey. The questionnaire contains a list of thirty-three likely problems affecting subcontracting strategy of contractors organised under the three categories of planning, awarding, and contracting issues. The respondents matched the likely problems with the project value drivers (quality, cost, and time) with which they impact, and rated the magnitude of the problems on project performance. The survey identified incompatibility of the subcontractor/supplier's time schedule with the project's time schedule as the topmost problem related to planning issues. Unethical practices is ranked highest among problems related to awarding issues, while incompatibility of subcontracts' terms and conditions with the main contract's terms and conditions is rated top among the topmost problems related to contracting issues. The findings revealed that the three problem categories have negative impacts on all the project value drivers in different combinations and are almost equally significant in the view of contractors while making subcontracting decisions. Contractors are therefore advised to critically evaluate the schedule, cost, and quality performance of industrial projects during the planning, awarding, and contracting phase of subcontracting in industrial projects.

Keywords: Contractors, Industrial projects, Project value drivers, Saudi Arabia, Subcontracting strategy

Introduction

Subcontracting refers to an arrangement whereby a contractor authorizes another firm (a subcontractor) to undertake part of the work he has secured with the owner (Lehtinen, 2001). Subcontract arrangements are widely used in construction because of the structure of the industry; the industry's workload is highly diversified by type, size, function, form and method of production, and materials used (Ramalingam, 2020). Everyday economic facts justify the use of subcontracting because it utilizes resources efficiently and economically. Generally, the activities of contractors are not extensive enough to sustain full-time employment of skilled workers in all the available trade classifications necessary in the construction field. Also, it is impracticable for these companies to possess, operate and maintain specialized equipment that may have little use during a project (Arditi and Chotibhongs, 2005).

Subcontractors provide specialist construction services thereby absorbing the fluctuating workloads of contractors (Hinze, 2010). Ng et al (2009) broadly classified subcontractors into two namely: equipment-intensive subcontractors and labour-intensive subcontractors, the former are mainly hired because of their specialized plants and equipment, while the latter are chiefly hired based on their specialized labour resources. They have a significant proportion of their expenditure dedicated to employing skilled manual labour to execute a trade specific construction operation, and many contractors would subcontract work to those specialist traders who possess the required manpower and expertise to accomplish the task to reduce

the risk of hiring direct labour (Lee, 2018; Ng and Tang, 2009). Subcontracting helps to utilize already available resources in the market, diversify against risks, lower operation costs, obtain competitive advantage and inquire for the most satisfactory profit base (Mahamid, 2017; Tserng and Lin, 2002).

In recent years, most engineering functions and values of a project are executed by specialized engineering firms or subcontractors who de facto employ the actual builders and direct labour to carry out the work while the contractor functions as the project coordinator or manager (Tan *et al.*, 2017; Tserng and Lin, 2002). Construction sites are often geographically dispersed and itinerant workforce is uncommon, making it imperative for contractors to sublet works to local subcontractors who have resident workforce (Murdoch and Hughes, 2008). Sometimes, contract terms require the contractor to sublet certain percentage of work to minority-owned and/or women-owned businesses (Hinze, 2010).

Contractors generally sublet portions of the project for which no in-house capability exists, however other reasons for which a subcontract may be awarded includes avoidance of overextended workload and transfer of risks. Buying out' of subcontracts and supplies require the contractor to ascertain the exact scope of work for each of the work item designated for self-perform and those to be sublet to ensure complete coverage of and avoid overlapping of all work items (Ganiyu and Shash, 2010). The dynamic quality of construction mandates provisional relationship of a group, comprising the contractor, subcontractors, and owners. The relationship terminates with the completion and acceptance of the works and the consequent payments of fees (Liu *et al.*, 2017; Assaad *et al.*, 2020).

Subcontracts are similar in form and content to main contract. In most cases, the provisions of general contract such as changes, changed conditions, warranty period, compliance with applicable law, approval of shop drawings and responsibility for safety extend to the subcontractors. Clauses relevant to temporary site facilities to be furnished, insurance and surety bonds to be provided by subcontractors, arbitration of disputes, and extension of time and indemnification of main contractors by subcontractors are always provided as general conditions of the subcontract. Terms of payment and retainage, job site storage, security clearance for workers, works to be completed after hours and other peculiar requirements of a particular project will be in the special condition of the subcontract (Clough *et al.*, 2015; Ganiyu, 2011).

Furthermore, for a subcontract to be valid there must be an offer to execute the work from the subcontractor and an acceptance by the contractor for valid consideration (fees), both of them must be acceptable in law as having the capacity to contract and genuinely accept the terms of the contract with an intention to establish the legality of the contract and the contract must be achievable and legal (Harris and McCaffer, 2001; Shash and Habash 2020). The contents of the contract documents should include the work to be performed, the quality of work required, the contractual conditions, the cost of the finished work and the schedule of the construction program as minimum information (Ashworth, 2001; Sha'ar *et al.*, 2016).

A reasonable amount of competition on time, price and quality is desirable for subcontractor selection; the contractor is likely to strike a better deal in the presence of competition among the subcontractors. However, negotiated approach has proven more valuable in situations such as early start on site, continuation contract, business relationship, contractor specialization, financial arrangements, geographical situation etc. Each project is being specifically examined based on its features and the prevailing conditions (Ashworth, 2001; Shash and Habash, 2021; Oke *et al.*, 2018). Prequalification is the process of screening (sub)contractors to verify their competence to execute the project within the specified objective of time, budget, and quality standard, and it is also used to identify (sub)contractor groupings based on factors including size, resource capacity and suitability for specific project types. This facilitates the identification of injudicious (sub)contractor at an early stage (Elazouni and Abido, 2013; Martin and Benson, 2021).

Hinze and Tracey (1994) conducted an exploratory study on contractor-subcontractor relationship, and the result revealed that a more adversarial situation with a large amount of mistrust and insufficient communication. Relationship between subcontractors and the contractor are often strained and liable to cause conflicts due to poor sense of fairness and misunderstanding of each other. To coordinate the subcontractor's work with that of other subcontractors, the contractor must know each subcontractor's work in detail (El-Kholy, 2019; Tang *et al.*, 2018). Ceric *et al.* (2021) established that the gap between contractors and subcontractors has a negative impact on site productivity.

Every company involved in a project has expectations regarding the other companies, and unfulfilled expectations are responsible for most conflict that arises on a project. The ideal subcontractor (as viewed by the contractors): is honest about mistakes, innovative and creative, adheres to schedules, fairly resolves impacts and change orders, produces work of high quality, has fully supported invoices, works in the best interest of the project, flexible to reasonable changes, helps the project beyond his own scope of work, comes in under budget, has a well trained workforce, is thoroughly familiar with the terms and conditions of the contract, identifies needs in timely fashion and has a perfect safety program. Similarly, an ideal contractor (as viewed by subcontractors): accepts responsibility, is flexible and open to suggestions, gives accurate information for scheduling and coordinating, is fair and honest with compensation for changes, demands quality, pays promptly, has no hidden agendas, treat subcontractors equally, presents a reasonable and logical schedule, makes decisions and resolves conflicts in timely fashion, has a defined chain of command and shows faith and trust in subcontractor's experience (Eom *et al.*, 2015; Javanmardi *et al.*, 2018).

Clough *et al.* (2015) submits that industrial construction includes the erection of projects associated with the manufacture and production of commercial products or services. They include some of the largest project built and require a high technical approach. They are mostly built by large, specialized contracting firms that do both design and field construction. They are designed by engineers; and examples include petroleum refineries, steel mills, paper mills, chemical plants, electric power-generating stations etc. Ochieng and Price (2006) stated that industrial projects are of critical importance to the organizations that build and finance them, and on successful completion, are of great benefit to the society thereby generating substantial revenues to the owner. Conversely the society suffers if they go wrong, and the organizations associated with them experience severe financial difficulties and considerable damages to their reputations.

In Saudi Arabia, several industrial projects are sited in remote locations with rough terrains such as mountains and deserts in undeveloped and environmentally sensitive regions. They are far from major urban concentrations. During construction, all project parties experience countless difficulties and cumbersome management problems. These potential problems negatively affect project quality and cause substantial delays and increase in costs. This impact of remoteness also manifests in the impact of delay and in making decisions on project performance and process (AlSaedi *et al.*, 2019; Shash and Alawad, 2020; Sidawi 2012). This paper utilizes questionnaire survey to unravel the problems encountered by contractors in subcontracting strategy of industrial projects in Saudi Arabia and assesses the effects of the problems on project value drivers (cost, quality, and time) and the magnitude of each of the identified problems on project performance from contractors' point of view.

Method

The list of 40 contractors working on industrial project was obtained from the Eastern Province Chamber of Commerce & Industry, where all contractors working within the jurisdiction are statutorily required to register. Shash and Almufadhi (2020) recently affirmed that there are forty contractors involved in developing industrial complex projects in the Eastern Province of Saudi Arabia. Due to this small number, the entire population was used as the sample size. This study was limited to industrial construction contractors practicing in the Eastern Province of Saudi Arabia. The Eastern province is chosen because it

is the largest industrial and commercial area in Saudi Arabia with 86% (Asharqia Chamber, 2008) of the Saudi basic industries and because of its proximity and the constraints of time and finance available for this study. The Eastern Province is the largest province by area and the third most populous province (accounting for 15.05% of entire population) of Saudi Arabia. The province is of a great economic significance because most of the Saudi Arabia's oil reserves are located there, likewise Saudi Arabia's largest agricultural product; dates, also forms a sizeable part of the province's economy.

A questionnaire was prepared and sent to the list of 40 industrial contractors. The questionnaire contains a list of thirty-three (33) potential problems affecting subcontracting strategy of contractors in industrial projects. The list was collated from an extensive review of literatures and was arranged under the three categories of planning, awarding, and contracting issues. The respondents were required to relate the potential problems by matrix with the project's value drivers (cost, time, and quality) with which they may have negative impacts. In addition, the respondents were to rate the magnitude of each of the problems on project performance on a Likert scale of 1 to 5 (1= no impact; 2= low impact; 3= moderate impact; 4= high impact and 5= extremely high impact).

Fifteen (15) contractors, which represents 37.5% of the population returned the questionnaires. The number of respondents also minimally satisfied the statistical analysis of the suitable sample to represent the population using Kish's (2004) formula as shown in Eq. (1) and (2). We set 10% as the maximum allowed percentage of error E , the estimated proportion of the population attribute, p was set as 0.5, q is $1-p$, n is the sample size and N is the population size.

$$n_o = \frac{p * q}{E^2} \quad (1)$$

$$n = \frac{n_o}{1 + \frac{n_o - 1}{N}} \quad (2)$$

The responses were analyzed using basic statistical methods, the average or the mean scores were calculated, the importance values, corresponding to a scale of 0-100 of each factor and problem in each category was calculated using the interpolation concept by applying Eq. (3).

$$IV_i = \frac{(100 * M_i - 100)}{(5 - 1) * 100} \quad (3)$$

Where i = the respective factor or problem in each category, IV_i = the importance value for factor or problem i and M_i = the mean score for factor or problem i . The relative importance weight for each factor or problem in each category was obtained by applying Eq. (4).

$$RIW_i = \frac{IV_i}{\sum IV_i} \quad (4)$$

The overall mean score, overall importance value and the overall relative importance weight of each category of problems/ factors was also calculated using the Eq. (5-7).

$$OM_i = \sum \frac{M_i}{Z_j} \quad (5)$$

$$OIV_j = \frac{(100 * OM_j - 100)}{(5 - 1) * 100} \tag{6}$$

$$ORIW_j = \frac{OIV_j}{\sum OI_j} \tag{7}$$

Where OM_j = the overall mean score for the j category of problems/factors,
 M_i = the mean score for the problem/factor i in each category,
 Z_j = the number of problems/factors in category j ,
 OIV_j = the overall importance value of category j , and
 $ORIW_j$ = the overall relative importance weight for category j .

Results and Discussions

The characteristics of the respondents and their firms are shown in Figures 1(a & b). The firms cut across all the different grade categories of the Ministry of Municipal and Rural Affairs (MOMRA) while about a third of them were not classified. This demonstrates the variations in size, organization, and nature of work specialty among the firms. The respondents are top management officials in their respective firms and are directly involved in subcontracting decisions on numerous projects. The respondents have an average of 20 years hands-on experience in the management of subcontracting practices (Figure 2).

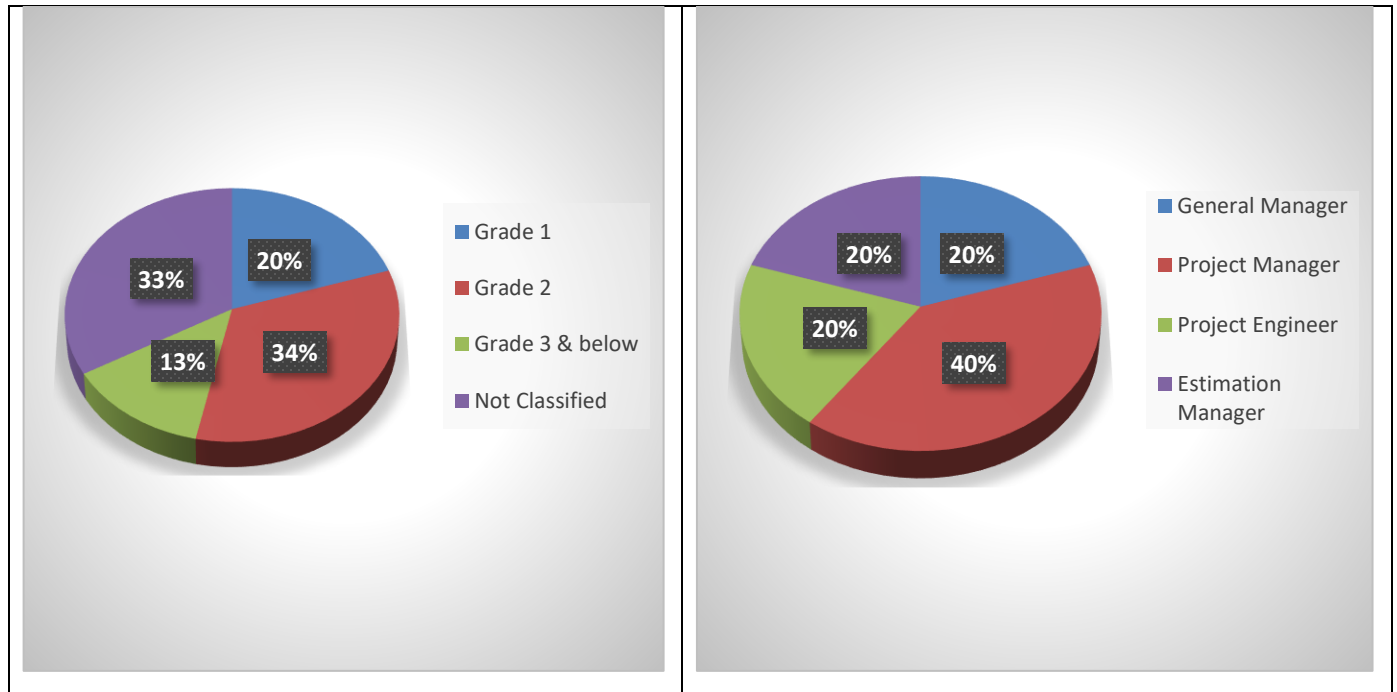


Figure 1: Characteristics of respondents and their firms

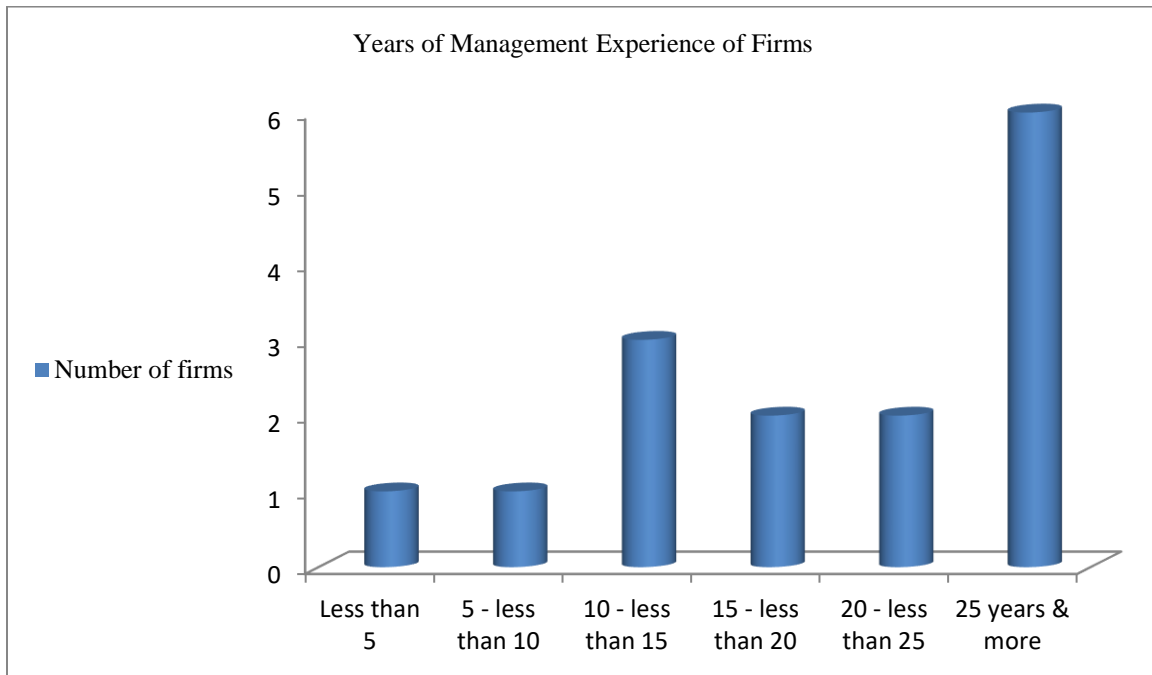


Figure 2: Years of management experience of respondents in industrial projects

Table 1 shows a summary of the relationships between each of the potential problems and the project value drivers with which they have negative impact(s) as rated by the respondents. From the analysis, it could be observed that all the three problem categories are related to having negative impacts on all the project value drivers (cost, time, and quality) in different combinations. About four of the problems have impacts on all the three project value drivers, twelve problems have impact on a pair of the three value drivers – mostly cost and time, while the remaining problems have impacts on a single value driver only.

Table 2 shows potential problems affecting the subcontracting practices of contractors as ranked by the respondents, the mean score of the ratings, the importance value (IV), and the relative importance weight (RIW) of each of the factors as collated from the respondents. From Table 2, the three highly rated problems with negative impacts on project performance under the categories of problems related to planning issues are incompatibility of the subcontractor/suppliers’ time schedule with the project schedule, inadequate planning of subcontracting practices and inaccurate cost estimates of subcontract packages, respectively.

Since the relationship between the subcontractor/supplier and the contractor is not exclusive (i.e., subcontractor/supplier works with more than one contractor concurrently), many cases of conflict of priority with respect to project schedule are bound to occur. When the subcontractor is expected to commence working on a project and his workforce are engaged on a different project at the same time, the work activity will be delayed, and any other successive tasks will be delayed thus creating a schedule performance problem. To avert this problem, subcontractors often rationalize their workforce amidst competing projects at hand, this could result in slow pace of work on site and/or the use of lesser skilled workforce to execute job tasks which may lead to poor quality of work done and resulting into rework which will eventually impact the project quality, cost, and schedule performance negatively.

Table 1: Potential Problems and their Project Value Drivers.

S/N	PROBLEMS	CATEGORY
A	<i>Problems which have negative impact on cost, time, and quality.</i>	
1	Insufficient period/squeezed schedule for subcontract's arrangement activities	Planning
2	Insufficient number of subcontractors to allow for competitive biddings	Awarding
3	Insufficient number of suppliers to allow for competitive biddings	Awarding
4	Inconsistency in the different parts of subcontract's documents	Contracting
B	<i>Problems which have negative impact on cost and time only</i>	
1	Inadequate planning of subcontracting practices	Planning
2	Incompatibility of the subcontractor/supplier's time schedule with the project's time schedule	Planning
3	Lack of information/imprecise data from previous practices	Planning
4	Gap or double coverage in the scope of work of subcontractors/suppliers compared to the project scope of work	Planning
5	Financing and other regulatory constraints	Planning
6	Requiring too much management and coordination effort	Planning
7	Incomplete request for proposals	Awarding
8	Inappropriate request for proposals	Awarding
9	Incompatibility of subcontracts' terms and conditions with the main contract's terms and conditions	Contracting
10	Improper contractual terms and conditions (terms of payment, liquidated damages etc.)	Contracting
C	<i>Problem which has negative impact on cost and quality only</i>	
1	Unethical practices	Awarding
D	<i>Problem which has negative impact on time and quality only</i>	
1	Management and coordination problems	Contracting
E	<i>Problems which have negative impact on cost only</i>	
1	Inaccurate cost estimates of subcontract packages	Planning
2	Imposed vendor list by the client	Awarding
3	Inappropriate contract pricing (lump sum, unit price, cost-plus)	Contracting
F	<i>Problems which have negative impact on time only</i>	
1	Too many interfaces between subcontractors/suppliers' works	Planning
2	Inconsistency in subcontractors/suppliers' schedules	Planning
3	Lack of an appropriate vendor list	Awarding
4	Lack of an updated vendor list	Awarding
5	External issues/ regulatory restrictions	Awarding
6	Inappropriate company procedures	Awarding
7	Communication problems	Awarding
8	Time consuming contract negotiations	Contracting
9	Reneged of subcontractors on the previous agreements during contract negotiation	Contracting
10	Reneged of suppliers on the previous agreements during contract negotiation	Contracting
G	<i>Problems which have negative impact on quality only</i>	
1	Inappropriate subcontractor evaluation criteria	Awarding
2	Inappropriate suppliers' evaluation criteria	Awarding
3	Lack of subcontractors' performance history	Awarding
4	Lack of suppliers' performance history	Awarding

Table 2: Mean, importance value, relative importance weight and ranking of potential problems.

	Mean Score	IV (%)	RIW (%)	Rank
Problems related to planning issues				
Inadequate planning of subcontracting practices	4.07	77	11.2	2
Incompatibility of the subcontractor/supplier's time schedule with the project's time schedule	4.27	82	11.9	1
Lack of information/imprecise data from previous practices	3.40	60	8.8	7
Too much interfaces between subcontractors/suppliers works	3.33	58	8.5	10
Insufficient period/squeezed schedule for subcontract's arrangement activities	4.00	75	10.9	4
Inaccurate cost estimates of subcontract packages	4.07	77	11.2	2
Inconsistency in subcontractor/suppliers schedules	3.93	73	10.7	5
Gap or double coverage in the scope of work of subcontractors /suppliers compared to the project scope of work	3.53	63	9.2	6
Financing and other regulatory constraints	3.40	60	8.8	7
Requiring too much management and coordination effort	3.40	60	8.8	7
Problems related to awarding issues				
Incomplete request for proposals	3.67	67	7.1	4
Inappropriate request for proposals	3.53	63	6.7	8
Lack of an appropriate vendor list	3.00	50	5.3	14
Lack of an updated vendor list	3.00	50	5.3	14
External issues/regulatory restrictions	3.60	65	6.9	7
Imposed vendor list by the client	3.27	57	6.0	13
Inappropriate subcontractor evaluation criteria	3.80	70	7.4	2
Inappropriate suppliers evaluation criteria	3.73	68	7.3	3
Insufficient number of subcontractors to allow for competitive biddings	3.67	67	7.1	4
Insufficient number of suppliers to allow for competitive biddings	3.47	62	6.6	9
Lack of subcontractors performance history	3.40	60	6.4	12
Lack of suppliers performance history	3.47	62	6.6	9
Inappropriate company procedures	3.47	62	6.6	9
Communication problems	3.67	67	7.1	4
Unethical practices	3.87	72	7.6	1
Problems related to contracting issues				
Inappropriate contract pricing (lump sum, unit price, cost-plus)	3.73	68	13.9	2
Time consuming contract negotiations	3.20	55	11.2	6
Incompatibility of subcontracts' terms and conditions with the main contract's terms and conditions	3.80	70	14.3	1
Reneged of subcontractors on the previous agreements during contract negotiation	2.93	48	9.9	8
Reneged of suppliers on the previous agreements during contract negotiation	3.13	53	0.9	7
Improper contractual terms and conditions (terms of payment, liquidated damages etc.)	3.60	65	13.3	4
Inconsistency in the different parts of subcontract's documents	3.47	62	12.6	5
Management and coordination problems	3.73	68	13.9	2

'To fail to plan is to plan to fail', like all business affairs, subcontracting must be precisely planned ahead of time to forestall negative impacts on schedule performance. Subcontracting plan must be formulated early in the project and should be judiciously followed. Many contractor firms have not inculcated the production of subcontracting plan as part of their company procedures /methods, in some cases lack of necessary personnel to produce an efficient subcontracting plan may be the case. The impact of project-specific issues such as unclear scope of work, project tight schedule etc. often premeditates the absence of subcontracting plan on projects (Yin *et al.*, 2014; Marechal and Morand, 2003). The initial subcontracting plan produced should be subjected to a rigorous risk analysis and the plan be modified to reflect any identified risk before being adopted for use. Inadequate planning of subcontracting practices may impact the cost and schedule performance of a project negatively.

The presence and effective use of subcontracting plan on a project depends on the accuracy of cost estimates of subcontract packages. In its absence, multiple hitches will crop up ranging from incomplete and/or double coverage of work items, unreliable schedule, variations in expenditures, change order, claims, etc. which could negatively impact schedule and cost performance of a project. Inaccurate cost estimates of subcontract packages results from unclear scope definition, inadequate use of work breakdown structure, errors inherent in the actual estimate used for bidding etc.

In the category of problems related to awarding issues, unethical practices, inappropriate subcontractor evaluation criteria, and inappropriate suppliers' evaluation criteria (Table 2) were respectively the three highly rated problems with negative impacts on project performance. Practices such as pre or post bid, bid peddling and bid shopping still abounds in the construction industry. Although not illegal but unethical, they could frustrate the good intentions of a contractor and completely reverse his decisions on the choice of a subcontractor, and this could lead to shoddy performance of work at site, poor safety at site, use of a substandard material/equipment resulting in execution of work which does not meet up with the client's requirement. This will lead to rework thereby negatively impacting quality, cost, and schedule performance of the project, respectively. Luhr et al (2020) identified withdrawal, cover pricing, collusion, and compensation of tendering costs and declaration of conflict of interest as other issues with ethical implications during the tendering process in the construction industry. Unethical practices in Nigerian and Ghanaian construction industry are explicitly discussed by Alutu (2007), Inuwa et. al (2015), and Ameyah et. al (2017).

All subcontractors are not appropriate for all jobs, some are befitting for specific project size within a certain price range. Subcontractor selection criteria often used include price, past performance, health and safety record, financial capability, current workload, reputation, past relationships, resources (physical and human), technical and managerial capability, numbers of years of experience, references, location of firm, firm's experience of similar projects and appropriate insurance cover (Lavelle *et al.*, 2007). The list could be inexhaustive depending on type / size/ nature of the project, the awarding method, the pricing approach etc. All the above makes the subcontractor selection more of an art than science; in fact, none of the numerous objective selection models developed by researchers has been identified to be all-embracing for different situations. Despite this the contractor must ensure the use of appropriate criteria, giving necessary priority to the prevailing factors to select subcontractors/suppliers as a wrong choice of subcontractor could result in higher capital cost of construction operations, unnecessary request for extension of time, reduced quality of workmanship etc. thereby impacting the cost, schedule and quality performance of the project negatively.

Incompatibility of subcontracts' terms and conditions with the main contract's terms and conditions, inappropriate contract pricing approach (lump sum, unit price, and cost-plus) and management and coordination problems were the three highly rated problems with negative impacts on project performance under the category of problems related to awarding issue (see Table 2).

A subcontract is a contract between a contractor and a subcontractor, it is a separate legal entity from the main contract with its' own terms and conditions. However, its 'hitch-free and successful execution largely depends on the outcome of the main contract between the client and the contractor. Hence all efforts must be geared towards the alignment of the subcontract terms and conditions with the main contract terms and condition. The rights and obligations of the contracting parties are usually specified in the contract conditions, incompatibility in subcontract and main contract arises when different standard contract forms were used, a different contract method or pricing approach (cost based, price based etc.) is used, difference in selection approach (competition and negotiation), substantial difference in size of work / total contract price etc. The resultant effect is a project plagued with claims and disputes which often lead to suspension of work at site and or delays which impact both the schedule and cost performance of the project negatively.

The determination of an appropriate contract pricing approach is a factor of the clarity of scope of work, time urgency, technical complexity, risk allocation, flexibility for changes in project etc. The contractor should employ an approach that will be attractive to the subcontractor, enable him to submit competitive prices and, complete the work efficiently. However, the pricing approach should equally minimize the total cost for the contractor; produce an acceptable quality work completed within a reasonable amount of time. The wide variety of options available often makes the selection cumbersome – lump sum, unit price (work unit rate and time unit rate) and reimbursable contracts (cost plus percentage of cost, cost plus fixed fee, cost plus percentage of cost with maximum price, cost plus fixed fee with a guaranteed maximum price etc.). Hence the contractor should have a hands-on experience on the most proper situation to use each variation and act accordingly. Inappropriate contract pricing approach may result in substandard work, claims and dispute which could impact quality, schedule, and cost performance of a project negatively.

Management and coordination problems which occur on construction site directly impact schedule performance of a project negatively, on the long run they may adversely impact the cost and quality performance of a project as well. They are deeply rooted in lack of project management skills, knowledge, and experience of construction project managers. They manifest within all phases of the project life cycle and their effects may be specifically pronounced during the contracting phase of the subcontract. Good record keeping and the use of project management tools and software can drastically reduce their occurrence.

Table 3 shows the overall mean score, overall importance value (OIV) and overall relative importance weight (ORIW) of the problem categories using equations 5-7. With an ORIW of 35.8%, 32.6% and 31.6% respectively, it could be observed that the problems related to planning, awarding, and contracting are almost equally significant in the view of contractors while making subcontracting decisions.

Table 3: Mean, OIV and ORIW of problem categories.

Problems	Mean score	OIV (%)	ORIW (%)
Problems related to planning issues	3.74	69	35.8
Problems related to awarding issues	3.51	63	32.6
Problems related to contracting issues	3.45	61	31.6

Conclusion

The adoption of appropriate subcontracting strategy is very crucial to the successful execution of industrial project. It will eliminate or mitigate against the pitfall of construction process such as litigation, delays, and cost overruns. A questionnaire survey was utilized to garner hands-on information from industrial contractors practicing in the Eastern Province of Saudi Arabia on problems affecting subcontracting strategies employed on projects. The survey result revealed that project value drivers of cost, time and quality are impacted negatively by problems encountered during planning, awarding, and contracting of

subcontracts in industrial projects, and are almost equally significant in the view of contractors while making subcontracting decisions.

The three highly rated problems with negative impacts on project performance under the categories of problems related to planning issues are incompatibility of the subcontractor/supplier's time schedule with the project schedule, inadequate planning of subcontracting practices and inaccurate cost estimates of subcontract packages. In the category of problems related to awarding issues, unethical practices, inappropriate subcontractor evaluation criteria, and inappropriate suppliers' evaluation criteria were the three highly rated problems. Incompatibility of subcontracts' terms and conditions with the main contract's terms and conditions, inappropriate contract pricing approach (lump sum, unit price, and cost-plus) and management and coordination problems were the three highly rated problems with negative impacts on project performance under the category of problems related to contracting issue.

Also, contractors handling industrial projects are advised to critically evaluate the schedule performance, cost performance and quality performance of their projects decisions during the planning, awarding, and contracting phases. It is also recommended for them to equally prioritize the problems related to planning, awarding, and contracting for avoidance while making subcontracting decisions. The knowledge of the problems facing industrial contractors and their significance in the categories of planning, awarding, and contracting issues as discussed in the study will equip the construction stakeholders ahead of possible hitches in an industrial construction. The list of potential problems and their ranking will be of benefits to the entire construction industry including prospective clients and construction educators. Contractors are therefore advised to critically evaluate the schedule, cost, and quality performance of industrial projects during the planning, awarding, and contracting phase of subcontracting industrial projects.

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