



Improving the Main Contractor-Subcontractor Relationship in Egypt

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Abstract

The building construction is vital to Egypt's economy. The main contractor is dependent on subcontractors to finish the job. However, a lack of planning, poor management, and poor contracting result in various issues, including delays that result in claims and disagreements among project participants. A paradigm based on Visual Studio, the C++ programming language, and the problems and solutions program (PASP) was designed to overcome project problems. In Egyptian construction projects, a case study of the interaction between the main contractors and the subcontractors was conducted. The factors of problems and resolution of disputes that face the main contractor and subcontractor relationship during execution of the project have been stated and gathered by interviews in case study in Egypt . this problems related to the main contractor, the sub contractor, and the other source .The factors to resolution of disputes was related to communication , financial, work performance, contract and other sources .This study aids in the selection of a subcontractor for a project as well as the enhancement of the Egyptian subcontracting environment. The result showed good acceptable limits of homogeneity and reliability that allowed to this model to use for identify answers to a variety of project difficulties. The project's recommendations focused on selecting a subcontractor and improving the Egyptian subcontracting environment, such as contract compliance, selecting contractors who have experience in the required works, timely contract progress payment, inefficiency, and favoritism without regard. This research opens the way for continued improvement of model parameters that will help in effectively treating this field.

Keywords : Main contractor; Subcontractor; Conflicts; Contracting; Construction projects.

1. Introduction

Subcontracting has been a growingly useful and vital part of building projects in recent years [1]. A subcontractor is a partner who works with the main

contractor to complete a sector of a building project based on knowledge and ability. Among some of the reasons why the general contractor undertakes the projects with the assistance of third parties are the different specialties, the avoidance of financial strain, and the reduction of dispensable costs[2]. Subcontracting has grown in importance as projects

have become more complex as a result of technological improvements and the need for useful resource control to compete successfully [3]. Partnering with subcontractors reduces the contractor's risk exposure [4]. Subcontracting also improves quality and ensures that work is completed on time [5]. Subcontracting is also viewed as a problem to the construction industry due to increasing problems and conflicts as a result of poor choice [6]. Contracted work difficulties lead to poor outcomes[1]. There must be ways for selecting the best subcontractors, but when they are used incorrectly, problems arise later in the project. As both the main contractors and the subcontractors share the profit and loss, it is vital to propose a model resolving both parties' problems and viewing the project as whole individually. Project delays are typical in the construction firm. The problems produced by the primary contractor's connection with the subcontractors are to blame for turning successful projects into loser in terms of project completion time and expense. Verification is required to discover issues and devise solutions with each party. This research helps to select a subcontractor in a project and improve the Egyptian subcontracting environment and help the parties to avoid or decrease the problems that interface them in the project.

1.2 Literature Review:

The literature review was utilized to identify the problems that existed between the main contractor and the subcontractor, as well as the methods to solve and the contracting selection criteria.

1.2.1 The partnership's problems:

Before taking any action, the problem's factors and causes must be recognized. Among the challenges identified in the interaction between the primary contractors and the subcontractors were a lack of communication and an aggressive culture[7]. Tesha and Luvara [8] stated that the cash flow management and inadequate management techniques are the problems that main contractors face while managing subcontracted work. The problem of delayed payments to subcontractors was the most critical factor that contributed to the problem[1]. The main reasons of problems between main contractors and subcontractors on construction procurement are the problems of delayed payments to subcontractors[9]. Enshassi et al. [10] said that the main contractor's financial troubles, non-compliance to the agreement's, terms of contract, delays in contract advance payment, and delays in work behind schedule are the most significant challenges affecting the relationship between the identified contractor and subcontractors. Mirawati et al. [11]

stated that poor communications, a lack of knowledge on the construction site, poor monitoring, and a leadership failure systems are the leading causes of project late delivery and poor interaction between the primary contractors and subcontractors.

1.2.2 Problem-solving in the partnership:

Mirawati et al. [11] remarked that a greater awareness of the main contractor's and subcontractors' responsibilities and obligations, as well as rules that promote a general expectation of fairness, could help to avoid disagreements. They also claimed that many problems may be avoided if the positions of the parties were reversed during contract negotiation and implementation. To assure the quality of completed and ongoing work, contracting parties should collaborate and anticipate problems, hold regular progress meetings, and perform collaborative inspection. The most successful methods for avoiding contract-related issues were discovered to be well written documents with no ambiguity, right contract procedures, signing after confirming facts, and using sustainable competitive[12]. The main contractor's proactive coordination and good site management is vital for resolving project challenges and completing the project on time [3]. When it comes to getting better know the subcontractors first before subcontract is given, face-to-face communication is viewed as a vital aspect for a good outcome. According the subcontractors, the primary contractor's site group's proper management and collaboration was important role in the project's accomplishment [13]. Enshassi et al. [10] remarked that to prevent complications, contractors should make timely cash payments to subcontractors. It would assist the contractor establish a strong reputation while also allowing the subcontractors to pay their expenses, obtain necessary materials, and be paid on time. Prior starting a job, the contractor should discuss project scope with the subcontractor in order to make plans and allocate jobs. Written contracts should be used by contractors to set responsibilities and protect all parties' rights. To fulfill the subcontract's standards and timetable, it is recommended that subcontractors acquire a suitable number of competent technical experts with suitable expertise, as well as arrange for the essential equipment and materials.

1.2.3 Criteria for selecting subcontractors:

Previous research has been conducted on a variety of strategies for selecting subcontractors. They improved techniques for addressing and avoiding project-related issues between the general contractor and subcontractors. Yin et al. [14] mentioned that the success of the main contractor in projects is improved by good subcontractor selection. One of

the conditions for selecting subcontractors is that they also have a positive mindset, are devoted, and respond swiftly to the needs of the primary contractor [15]. Enshassi et al. [10] noted that choosing a subcontractor based on previous expertise, reputation, and labor, equipment, and machinery abilities ensures the subcontractor's dedication to the contract conditions, as well as their capacity to do the task on time and to the best quality. Payments to contractors are made on time, which assists the contractor retain a good reputation while also allowing subcontractors to meet their expenses, obtain the necessary goods, and be paid on time[16]. Past experience was shown to be the most important factor in subcontractors selection in building projects, and the negotiating phase included the most key factors, with project competence and trust being most important two criterion[17]. El-khalek et al. [18] stated to the time, reputation, quality, cost, and technical capability are all factors in choosing a subcontractor. Biketi et al. [19] suggested that the subcontractor's skills and previous expertise be considered while making a decision. The primary contractor should also evaluate the subcontractor's abilities and repute to guarantee that the selected subcontractor is able to complete the assignment and obtaining the best potential quality.

2. Model for improving the main contractor's and subcontractor's problem-solving abilities:

2.1. Ground condition and description of building

Previous studies provided the challenges and remedies. The most essential elements that impact

the interaction between primary contractors and subcontractors were determined using literature in Egypt. To address the relationship concerns revealed in the study, a problems and solutions program (PASP) model was developed using the Visual Studio-language C++. The PASP methodology was developed to promote project success by resolving issues between the general contractor and subcontractors. The PASP model is helpful for assisting with challenging decision-making. It is based on the idea that when interface with a tough decision, humans have a tendency to group the decision parts together depending on their related characteristics. Decision analysis systems are defined as "computer systems meant to help decision-makers make better, quicker, and low expensive judgments with less effort and time." This method addresses issues in any project that involved project parties and aims to develop the interface between the primary contractor and the subcontractors. Table 1 shows how the difficulties are divided into three major groups (main contractors, subcontractors, and others). The major contractors and subcontractors on projects have a lot of experience working together on prior (and presumably future) projects. Several issues arose between stakeholders during the project, resulting in conflicts. As shown in Table 1, the main contractors, the subcontractors, and others are among some of the issues that are likely to escalate into disputes. Table 2 lists the project's solutions, which are grouped into five categories (communication, financial, performance, contract, and other sources). Each component category was thoroughly examined in order to understand what causes contribute to disputes and what efficient preventative measures are available.

Table1. Main contractor and subcontractor problems

Main Group	Problems
Main contractor	<ul style="list-style-type: none"> • Contract progress payment is being delayed. • The subcontractor's work is suspended and terminated. • Critical materials are not being delivered on schedule to subcontractors. • Failure to offer essential clarifications to subcontractors. • Providing subcontractor with low-quality materials. • The assignment is assigned to new subcontractors without informing the first subcontractor. • Providing the subcontractor with essential services such as water and power. • Noncompliance with the construction schedule. • A lack of faith • Failure to offer on-site security. • Revealing a subcontractor's offer price to third parties in order to obtain a lower bid price • The primary contractor is not present on the jobsite. • Failure to offer on-site health and safety precautions. • Delay in completing the work. • Failure to make the final payment over a prolonged length of time.

Subcontractor	<ul style="list-style-type: none"> • Work interruptions. • Not following the directions of the major contractors. • Absence of a subcontractor from the job site. • collaborating with another subcontractor without the authorization of the principal contractor • Inadequate equipment, insolvency of a subcontractor • Poor health and safety compliance by subcontractors. • The subcontractor is not in regular contact with the principal contractor. • When there is a difficulty, the subcontractor does not notify the principal contractor. • Failure of the subcontractor to adhere to the contract's terms and conditions. • Construction work of poor quality. • The subcontractor is working on many projects at any same time. • Skilled labor is in short supply. • Poor cash flow management. • Failure to safeguard and maintain the material.
Other Source	<ul style="list-style-type: none"> • Government policy and legislation are always evolving. • Extreme weather conditions • Increases in material and labor prices. • The geological condition of the place is not as expected. • Political intervention. • Floating of Egyptian pound

Table 2. Resolution of disputes between the main contractors and the subcontractors.

Main Group	Solutions
Communication	<ul style="list-style-type: none"> • Regular communication • When there is a problem, communicating is essential. • Timely communication of information
Financial	<ul style="list-style-type: none"> • Documents of contract must be complete and transparent. • Payment of progress to the subcontractor on time. • The accuracy of the project's cost estimate. • Stability of finances of the subcontractor/main contractor.
Work performance	<ul style="list-style-type: none"> • Subcontractors with enough skilled labor. • The subcontractor has adequate machinery. • Performance in health and safety. • Excellent construction work. • Observance of the construction schedule. • Getting rid of stereotyped thinking.
Contract	<ul style="list-style-type: none"> • Contracting fairly. • Adherence to the contract's terms and conditions.
Other	<ul style="list-style-type: none"> • Subcontractor engagement in a project at an early stage. • Participation of subcontractors in decision-making. • Objectives that are shared. • Between the parties, there is trust.

2.2. Structure of the program:

The system of computing was built using Visual Basic for application, a Windows-standard computing suite, to efficiently program and run PASP program. It's also a big plus that the PASP application doesn't take up any space on the hard drive. The system's release package was created so that it could be readily installed on a Windows system and run without the need for any further

configurations. The main contractor must compile a list of problems that have facing the relationship with the subcontractor. The most important stage, coding all problems and solutions, is shown in Appendix 1. The solutions will be linked to the problems using the program's code based on their characteristics. There will be a variety of solutions, as well as more than one. The PASP program can be

used to search for a specific problem by name. Figure 1 shows the program phases that were followed to meet the study's objectives. The steps began with the

an example: the problem of work being assigned to new subcontractors without informing the original subcontractor. This problem is with the main contractor, and its classification is 3-2. (Appendix1). According the characteristics, the solution to this problem is regular communication, communication when there is a problem, timely and accurate information, clear contract documents, subcontractor involvement in decision-making, and confidence between the parties. These solutions are relate to with the program's problem codes. Simply search for the problem's name and solutions will appear instantly. Another example is the occurrence of work delays. The subcontractor is the source of this problem; its classification is 4-1. The answer to this problem, according to its characteristics, is for the subcontractor to have enough skilled workers, suitable machinery, and early involvement of the subcontractor in a project

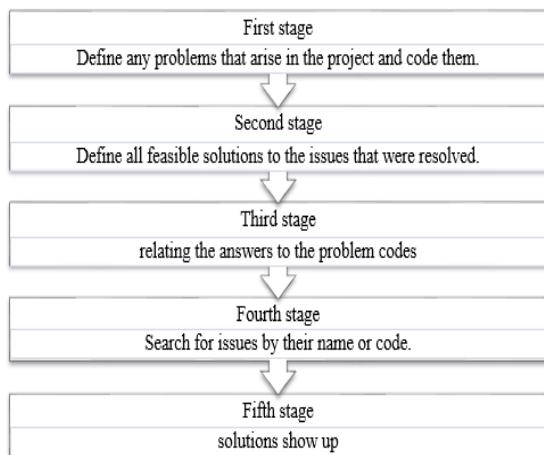


Fig 1: Steps of the PASP program

3. Verification:

The case study's data was gathered through interviews with the company's managers and engineers. A project in Egypt is the subject of the case study. October Plaza is the name of the project. Six of October Development and Investment Company (SODIC), Solid Constructions, and EHAF are the project's owner, major contractor, and consultant, respectively. The project's location is Giza, Egypt's Sixth of October City. November 2017 and January 2019 are the start and end dates, respectively. The project consists of ten structures (six blocks). Seventy-eight million, two hundred and three thousand, two hundred fifty-six Egyptian

definition of all problems (as shown in Table 1), followed by the definition of all solutions (as shown in Table 2).

pounds is the contract price. Finally, the major contractor's components include earthworks, concrete, masonry, metal, paint, thermal and moisture protection, marble, mechanical, electrical, and low voltage works, as well as common areas, entrances, and exterior finishes.

Table 3 lists items covered by the agreement as well as the number of subcontractors who will carry them out. The project was broken down into 11 sections. The number of subcontractors needed to complete the project is determined by the principal contractor.

Table 3. Numbers of subcontractors implement the activities of project

Activity	Total number of subcontractors
Earth work	2
Concrete	4
Masonry	5
Metal	6
Paints	5
Thermal and moisture protection insulation	1
Marble	5
Mechanical	2
Electrical and low voltage	2
Common area, entrances	2
External finishes	2

3.1. Main contractor problems:

From the interviews performed, the most vital problems related to the main contractor were uncovered and grouped into seven problems. This project was delayed due to various problems that arose during execution, much above those that can be expected in any project. Table 4 lists the project's issues as well as a summary of the issue that is causing the project's delay. Effective solutions to execute the project in the shortest time period from the date of completion are determined by applying the model to the factors connected to the main contractor. In addition, the main contractor must identify cash flow solutions for the subcontractor. Additionally, to increase trust between the parties, this leads to effective project performance.

Table 4. Problems with the main contractor on the project

Activity	Problem	Problem explanation
1	Contract progress payment is being delayed	<ul style="list-style-type: none"> The signed agreement must be paid within 30 days of the invoice submission date. It does not occur. The subcontractor has lowered his labor rate or ceased working on the job site until he receives his payment, which has been prolonged to 60-90 days. <p>- Example (1): The subcontractor used ten resources, however owing to a payment delay, the subcontractor lowered the quantity of resources to two.</p> <p>-Example (2): Although the finishing tasks item had a 60 percent advance financial agreement, only 15% was actually paid. As a consequence, the subcontractors refused to run working, delaying the project's completion date.</p>
2	Late delivery of the necessary material to the subcontractor	<ul style="list-style-type: none"> Suppliers were late in supplying material and subcontractor work for items (Concrete activities, Masonry activities, Marble activities, and Entrances works), and subcontractors returned to send claims as a result of delayed fee. <p>- Example (1): The concrete and steel arrived late under the Concrete Works item, and the subcontractor submits a claim for labor payment.</p>
3	Failure to provide necessary clarifications to subcontractors	<ul style="list-style-type: none"> Changes in concrete work drawings lead to higher costs for what will be implemented.
4	The assignment is assigned to new subcontractors without informing the original subcontractor	<ul style="list-style-type: none"> Two blocks were removed without telling the original subcontractor of a different concrete works implementation.
5	Noncompliance with the construction schedule	<ul style="list-style-type: none"> As a result of the payment delay, the project timetable was pushed back.
6	A lack of faith	<ul style="list-style-type: none"> The final component was a negative reputation in the market as a result of late payment, so subcontractors are hesitant to work with the primary contractor and raise the price to compensate for late payment.

3.2. Subcontractors problems:

The subcontractor's critical problems were divided into five categories based on the interviews performed. Table 5 shows the problems and their

consequences for project components. The majority of the project's items are being implemented by a subcontractor. The program provides subcontractors practical solutions for completing the project while avoiding conflicts with the main contractor, avoiding disagreements, and improving performance.

Table 5. Problems with the subcontractor on the project

Activity	Problem	Problem explanation
1	Late in work for the subcontractor	<ul style="list-style-type: none"> The project schedule was delayed due to delays in payments or raw material delivery deadlines.
2	Inadequate equipment, insolvency of a subcontractor	<ul style="list-style-type: none"> The subcontractor's equipment was insufficient for the concrete works item, limiting the scope. <p>- The subcontractor for the Concrete Works item must construct buildings in concurrently. The subcontractor's equipment was insufficient for the execution. To fix the problem, the principal contractor purchased materials and equipment and then deducted them from the subcontractor.</p>
3	Construction work of poor quality	<ul style="list-style-type: none"> The consultant rejected delivery of masonry work due to a lack of quality on the part of the subcontractor due to limited options.

4	Poor cash flow management.	<ul style="list-style-type: none"> Poor cash flow management will have an influence on the scope and timeline of a project..
5	Failure to safeguard and maintain the material.	<ul style="list-style-type: none"> The principal contractor was in charge of supplying cement for the masonry work. The subcontractor is not responsible for extracting precise quantities, and there is no provision in the contract for a penalty if more cement is not preserved or removed.

3.3. Other problems:

Other factors have an impact on the project. The most critical problems with the other sources were divided into three categories based on the interviews conducted. Table 6 lists the project's problems as well as a description of each one. Government rules, global effects, and weather conditions are all factors outside the control of the main contractor and subcontractor. The model's solutions in this section encourage cooperation between the two parties in order to avoid problems from occurring in the first place or to quickly resolve them when they do.

Table 6. Problems with the other on the project

Activity	Problem	Problem explanation
1	Government policy and legislation are always evolving.	<ul style="list-style-type: none"> Licensing has been delayed due to the owner
2	Extreme weather condition	<ul style="list-style-type: none"> Rains and improper storage harmed the materials cement and steel for the concrete and masonry activities items.
3	Increases in material and labor prices	<ul style="list-style-type: none"> It had occurred in each and everything (Financial claims have been filed, item prices have been altered based on what happened by a subcontractor, and clearance has been granted at lower rates than required)

3.4. Implementing the program's model:

The PASP approach was created to improve project performance by resolving disputes between the main contractor and subcontractors. In some of the examples provided, the result of the used model was visible. The program's goal is to connect project-related problems with their solutions based on their shared qualities.

- Example (1): Figure 2 shows the problem of subcontractor's absence from the site. The program is solved by six factors regular communication, When there is a problem, communicating is essential, timely communication of information, mutual objectives, early involvement of subcontractor in a project, and trust between the parties. The effective communication increases the project performance. A balanced flow of information between main contractor and sub-contractor is necessary for the execution of the project. It results to better cooperation, fewer claims, and fewer disputes. The project manager should be treated subcontractors more humanely, and the communication will be two-way.

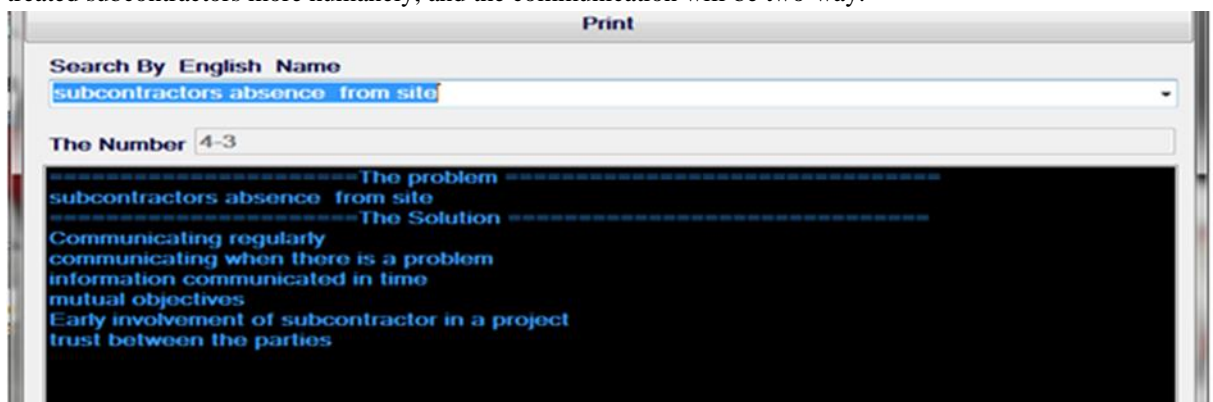


Fig 2: Subcontractor's absence from the site problem.

- Example (2): Figure 3 illustrated the problem price increment of material and labor. The program solved it by three factors: fair contract, adherence to the contract's terms and conditions, and main contractor

financial stability. Assume that, due to no fault of the subcontractor, the price of the material rises dramatically throughout the fulfillment of the contract. In that situation, the price must be equitably adjusted by an amount reasonably necessary to meet any such major price rises, which was the fair contract's purpose.

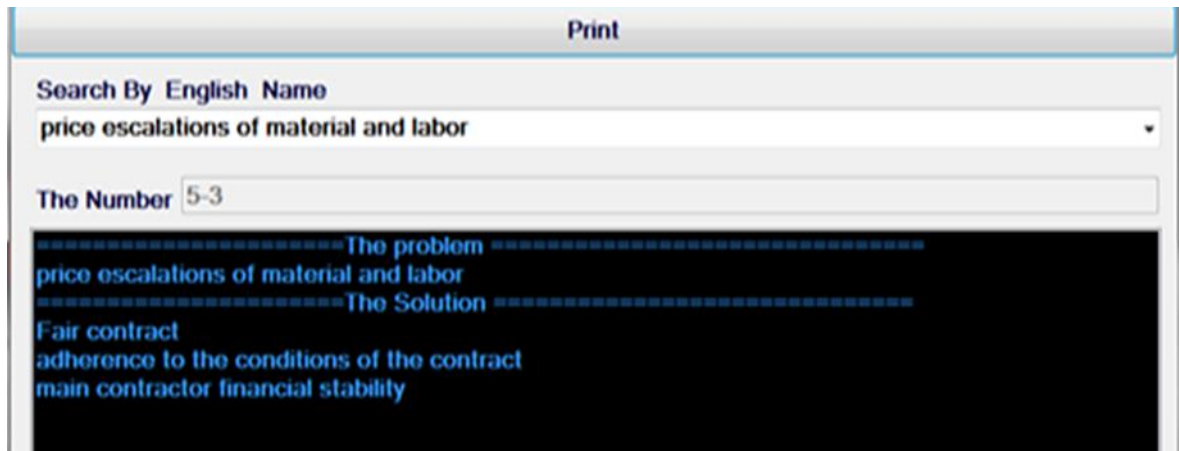


Fig 3: Price increment of material and labor problem.

4. Egyptian subcontracting environmental improvement:

The opinions and interviews clarify the ideas for developing Egyptian subcontracting to reduce project difficulties. For instance, consider these suggestions:

- The contract's provisions are being followed.
- Choose contractors who specialize in the tasks at hand..
- Contract progress payments are made on time.
- Lack of favoritism and efficiency.
- Tender is fair.
- The relationship between the principal contractor and the subcontractor has improved.
- Dealing with trustworthiness.
- It is necessary to have prior experience.
- Business quality-financial stability.
- Comparisons of contractors' technical and financial capabilities.
- Use the FIDIC contracting system.
- Collaboration with the consultant during the selection process to ensure the subcontractor's capacity to complete the work.

- Provisions in the contract between the owner and the principal contractor.
- Observance of the penal provisions.
- Raising the contractor's number and the level of competition they face.

5. Conclusions:

Due to the limited amount of resources, contracting firms have found it difficult to take on a project alone considering of the advanced owner's expectations. As a result, subcontracting has become a common practice in the construction industry. To avoid any disputes, it is critical to have a thorough awareness of methods and prevention measures. This paper introduces the PASP model, which may be used to identify answers to a variety of project difficulties (Problems and Solutions Program). If there is a disagreement between project parties, it will be detrimental to the project's implementation and failure to meet its objectives. As a result, the study was carried out in order to aid in the improvement of this relationship. A case study of the interaction between the primary contractor and the subcontractors was undertaken in the Egyptian construction firm. A model based on Visual Studio, the C programming language, problems, and solutions was utilized to solve the project's problems. This model improves performance by establishing trust between stakeholders, completing projects on time, and eliminating issues before they arise. The

project's recommendations focused on selecting a subcontractor and improving the Egyptian subcontracting environment, such as contract compliance, selecting contractors specialized in the required works, timely contract progress payment, efficiency and lack of favoritism, and fair tender, in order to avoid problems that can arise during project execution, causing delays and conflicts.

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7. Appendix:

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new ClsSection() { Index = "3-3" ,Name="main contractor financial stability"},
new ClsSection() { Index = "3-3" ,Name="Fair contract"},
new ClsSection() { Index = "3-3" ,Name="adherence to the conditions of the contract"},

new ClsSection() { Index = "3-4" ,Name="communicating regularly"},
new ClsSection() { Index = "3-4" ,Name="communicating when there is a problem"},
new ClsSection() { Index = "3-4" ,Name="information communicated in time"},

```

Appendix 1 : coding the problems and solutions