

## **SUBCONTRACTOR PREQUALIFICATION PRACTICES IN PALESTINE**

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### **Abstract**

The construction industry is a major part of the Palestinian economy. Contracting companies carry out important construction projects in cooperation with subcontractors. The majority of elements of a construction project (such as shuttering, building, plastering, painting, carpentry, and ironmongery works) are implemented by subcontractors through the main contractors. The aim of this paper is to identify and rank the factors used by main contractors in the selection of suitable subcontractors in the Gaza Strip, and to propose recommendations for improving the selection of subcontractors. A survey was conducted of 57 main contractors and 57 subcontractors randomly selected from the Gaza Strip. The study revealed the important factors used by main contractors for selection of suitable subcontractors. These include adherence of the subcontractor to contract terms, adherence to time schedule, commitment to prices, good reputation, expertise in certain type of work, commitment to quality and the existence of required equipment and machinery. Factors related to the resources group were identified as the most important group of factors among the 16 groups used for the selection of subcontractors. It is recommended that contractors select the subcontractor according to previous experience, reputation and capabilities in terms of labour, equipment and machinery, since these items ensure the subcontractor's commitment to contract conditions and completing the works according to the time schedule and while achieving best quality. This paper would be valuable for all academics and professionals involved in construction contracting business in general.

### **Keywords**

Main contractors, subcontractors, selection process, prequalification.

## **INTRODUCTION**

Palestine is a developing country in the Asia region that suffers from economic and financial problems due to the current unstable political situation. The construction industry has played an important role in Palestinian economic growth (PASSIA, 2008). The industry has contributed approximately 5-8% of the national Gross Domestic Product (GDP). There are two main sectors for construction projects in Palestine: public and private sector. Some of the public sector projects are handled by Public Works and Housing Ministry and a majority of public projects are offered to contractors. The construction project can be regarded as successful when the project is completed on time, within budget, with appropriate quality, and without accidents.

Subcontractors play a vital role in the construction industry (Ng and Luu, 2008). Subcontractors are specialty contractors who are hired to perform specific tasks on a project (Fah, 2006). The main contractor who wins the contract normally subcontracts at least 70% of the work to subcontractors who report directly to the contractor (Al-Hammad, 1993). On many projects, particularly building projects, it is common for 80-90% of the work to be performed by subcontractors (Hinze and Tracy, 1994; Wong and So, 2001). If the subcontracting practice is restricted or regulated, it may cause a great impact to society due to unemployment of the subcontractors and their construction workers (Wong and So, 2001). Arditi and Chotibhongs (2005) showed that subcontractors were very important to the successful completion of most construction projects.

A subcontractor is a construction firm that contracts with a main contractor to perform some aspects of the main contractor's project. Usually, the main contractor performs the basic operations and subcontracts the remainder to various specialty contractors. Joseph and Proctor (1996) showed that relations between subcontractors and general contractors (GCs) are often strained and prone to disputes due to a poor sense of fairness and misunderstanding of each others' needs. After the award of a contract and subcontracts, and during the execution of the work, the working relationship between the GC and the subs must be one of teamwork, with each party recognizing the importance and contribution of the other to the success of the project. Also, Fah (2006) stated that, the relationship between the main contractor and subcontractors at times are problematic as the subcontractors are at the mercy of the main contractor. The purpose of this paper is to identify and rank the most common factors used by main contractors in the selection of suitable subcontractors in the Gaza Strip

## **LITERATURE REVIEW**

One of the most important phases of construction is the bidding process (Drew, and Skitmore 1993). During the bidding process, selecting the most appropriate subcontractors for relevant sub-works is highly critical for overall project performance. In order to select the most appropriate subcontractors for the project and prepare the most realistic and accurate bid proposal, main contractors have to know financial, technical and general information about their subcontractors (Al-Hammad and Assaf, 1992). Within this context, main contractors should consider several factors in the selection process. These factors may include the quality of production, efficiency, employment of qualified staff members, reputation of the company, accessibility of the company, completion of previous work on time etc (Arslan et al., 2008). Sub-contracting has extensively been used in the construction industry. It allows main contractors to employ a minimum workforce in construction projects and promotes specialization (Chung et al. 2003). Many main contractors only act as construction management agents in construction projects and sub-contract a large volume of their work to subcontractors (Shash, 1998).

The success of construction projects may depend on the philosophy of selecting "the right person for the right job". Clearly, the correct choice of subcontractors ensures the overall success of a construction project. However, the importance of subcontractor selection is mostly underestimated and neglected in construction (Kumaraswamy and Matthews, 2000).

Bidding usually occurs between main contractors and subcontractors. Main contractors rely mostly on the bid prices submitted by the subcontractors to estimate the final bid sum for the projects. Subcontractors play an important role in the bidding process (Chiang 2009). During the bidding process, selecting the most appropriate subcontractors for the sub-works is highly critical. Therefore, main contractors must be extremely careful while selecting the most appropriate subcontractor for a certain part of the work or the entire project (Arslan et al., 2008).

Shash (1998) indicated that contractors showed interest in several characteristics of the subcontractors' firms during negotiations. The most important characteristics were (1) the firm's experience in the field of work, (2) the current work load of the subcontractor, (3) number of labourers, (4) financial capacity, (5) types and modernity of equipment. He advised the main contractors to concentrate on attracting qualified and professional subcontractors who will produce quality work, which will ultimately have a significant impact on improving the contractors' business reputation. He advised subcontractors to seek as much information as needed to produce quotations with reasonable and acceptable accuracy. Finally he advised subcontractors to concentrate on improving characteristics that are of interest to main contractors and thus increase the chances of being awarded the sublet work.

On the other hand, Haksever et al., (2001) reported that commercial factors were seen as overriding features in the selection process of subcontractors, such as: experience in similar projects, previous project performance, previous disputes, current workload, and lowest bid. PCICB (2003) recommended that all tenders submitted by subcontractors should be assessed on an equal basis using the criteria stipulated in tender documents. Also, tender assessment criteria should aim at promoting healthy competition by placing suitable weights on price, past performance and quality. PCICB (2003) recommended the following criteria to be used in tender evaluation:

- previous experience on jobs of similar nature;
- adequacy and professional competence of key management and supervisory staff;
- availability of capital and labour resources to undertake the subcontract on top of other on-going commitments;
- quality of technical proposal with particular reference to compliance with tender requirements;
- track record of past performance; and
- price and payment terms

Chung et al (2003) identified ten basic factors for selection of subcontractors, which included: (1) financial strength to sustain the required cash flows, (2) adequacy of experienced site supervisory staff (3) standard of workmanship, (4) timely payment to labourers, (5) adherence to program, (6) number of relevant projects completed (7) sufficiency of craftsmen and labourers, (8) provision of safety information, instruction and training, (9) updating program as works progress; and (10) sufficiency of plant. Arslan et al., (2008) stressed that main contractors should consider several factors in the process of selection of subcontractors. These factors may include the quality of production, efficiency, employment of qualified staff members, reputation of the company, accessibility of the company, completion of the work on time etc. They have proposed a Web-Based Subcontractor Evaluation System (WEBSSES) in which

they categorized the selection factors into four main headings as cost, quality, time and adequacy.

Ng et al., (2008) listed 55 factors for evaluating and selection of subcontractors classified into the following 14 groups:

1. company background;
2. past experience;
3. financial strength;
4. organization structure;
5. resources;
6. contractual relation;
7. general obligation;
8. progress;
9. quality;
10. safety;
11. environmental protection;
12. communication;
13. design support;
14. participation in tendering stage

Ko et al., (2007) proposed a process for evaluation of subcontractors' performance that consists of two stages: primary score (given by field superintendents) and final score (given by the managers of the main contractor). They suggested 12 items to be used by main contractors to evaluate performance of labour type subcontractors, as follows:

- construction technique
- duration controllability
- cooperative manner
- material wastage
- services after work completion
- collaboration with other subcontractors
- safety and protection
- tool usage habit (tools borrowed from contractor)
- working space clearance
- management ability
- subcontractor's personality
- economic condition

Arslan et al (2008) stated that subcontractor evaluation was a vital part of the project management cycle. As construction projects become more complex, the need for evaluating subcontractor performance becomes more crucial. Although there are no generalized sets of rules in evaluating subcontractors, several factors should be considered by the main contractor in the selection process. These factors may include the quality of production, efficiency, employment of qualified members, reputation of the company, accessibility to the company, completion of the work on time, etc.

## METHODOLOGY

To achieve the research objective, a questionnaire survey was used to collect factual profiles, perceptions and attitudes of the respondents (Fellows and Liu, 1997; Israel, 2003). The research focused on professionals from two groups, first the professionals from the Palestinian Contractors Union (PCU) categories that are classified under the building categories in Gaza Strip. These categories are "1st, 2nd, 3rd, Building categories" that have valid registration. The small categories (4th and 5th) were not considered due to the low practical and administrative experience of these companies in construction works and the low experience of their subcontractors. Based on the list of registered contractors at the PCU in December 2008, the size of population for the 1st, 2nd, 3rd, building categories was 144 companies.

Second, professionals from subcontractors in the various types of work fields like shuttering, building, plastering, tiling, painting, mechanical, electrical, aluminium, carpentry and ironmongery were selected. Unfortunately, there are no official reports showing the exact number of subcontractors in Gaza, since they are not represented by any union or association. However, after discussion with some main contractors from different classification categories about the number of their subcontractors, the number of subcontractors is roughly estimated to be 250. To determine the sample size for each population of contractors and subcontractors, the Kish (1965) equation was used.

$$n = \frac{n'}{1 + \frac{n'}{N}}$$

$n'$  is the sample size from infinite population, which can be calculated from this formula [ $n' = S^2/V^2$ ]. The definitions of all variable can be defined as the following:

$n$ : sample size from finite population.

$N$ : Total population (144 contractors and 250 subcontractors)

$V$ : Standard error of sample population equal 0.05 for the confidence level 95%,  $t = 1.96$ .

$S^2$ : Standard error variance of population elements,  $S^2 = P(1-P)$ ; maximum at  $P = 0.5$

The sample size for the contractors' and subcontractors' population can be calculated from the previous equations as follows:

$$n' = S^2/V^2 = (0.5)^2/(0.05)^2 = 100$$

$$n_{\text{contractors}} = \frac{100}{1 + 100/144} = 59 \text{ contractors}$$

$$n_{\text{subcontractors}} = \frac{100}{1 + 100/250} = 71 \text{ subcontractors}$$

Although the calculated sample size for contractors is 59, the questionnaires were sent to 70 randomly selected contractors to overcome the risk of low participation from the respondents and to ensure higher reliability and benefits of the study. For the same reason, 80 questionnaires were sent to randomly selected subcontractors. The response rate was 81% for contractors and 71% for subcontractors as shown in Table 1.

**Table 1: Sample Size and Response Rate of The Study Populations**

Response Rate	Number of respondents	Distributed questionnaire	Calculated Sample Size	Total Population	Population Category
81%	57	70	59	144	Contractors
71%	57	80	71	250	Subcontractors

Moser and Kalton (1971) showed that a response rate of less than 30% is likely to produce results subject to non-response bias. Based on this, the obtained response rates of 81% and 71% are reasonable and will reflect reasonable results and outputs.

The study was carried out in Gaza Strip and targeted the main contractors and subcontractors distributed all over Gaza Strip as shown in Table 2.

**Table 2: Geographical Distribution of The Sample**

Group	North	Gaza	Middle Area	South	Total
Contractors	11	32	5	9	57
Subcontractors	12	35	6	4	57

The respondents were experienced construction managers (with average experience 20 years in the construction industry). Based on literature review, 48 factors for the selection of subcontractors were considered in this study. The factors were categorized under 12 groups (Arslan et al., 2008; Ng et al., 2008; Ng and Luu, 2008; Ko et al., 2007; Fah, 2006; PCICB, 2003; Chung et al., 2003; Haksever et al., 2001; Shash, 1998; Hinze and Tracy, 1994; Al-Hammad, 1993 ) The selected factors are shown in Table 3.

A pilot study considering five contractors, two subcontractors and three consultants was conducted. . The professionals for the pilot study were selected based on their technical and managerial capabilities to ensure quality review of the questionnaire.

**Table 3: List of Factors Used by Main Contractors for Selection of Suitable Subcontractors**

Factors identified from literature	Selected factors after pilot study	
<b>1. Factors related to subcontractor background</b>		
Plant intensive nature (Nature of business)	Deleted	
Specialised trade category	Modified	Specialty in certain type of work
Long- term relationship with main contractor	Selected	Long- term relationship with the Main Contractor
Use of advanced construction technology	Selected	Use of advanced construction technology by the Subcontractor
Number of years in business	Selected	Number of years in business
	Added	Reputation of the subcontractor
	Added	Type of work implemented by the subcontractor
<b>2. Factors related to Progress</b>		
Extent of delay caused by subcontractor	Modified	Adherence of the subcontractor to the time schedule
Preparing necessary programme at project start Procedure	Selected	Preparing a detailed plan and method of work at project start
Updating programme as works progress	Selected	Updating programme as works progress

**Table 3: List of Factors Used by Main Contractors for Selection of Suitable Subcontractors (cont'd)**

<b>3. C- Factors related to General Obligation</b>		
Compliance with regulations	Selected	Compliance with regulations
Sufficient notice for inspection of works	Selected	Sufficient notice for inspection of works
Care to public utilities	Modified	Compliance to the environmental regulations
Care to works by others sub-contractors	Merged	Care to works done by others sub-contractors
Collaboration with other subcontractors	Merged	
<b>4. Factors related to Communication</b>		
Regular and effective communication with main contractor	Selected	Regular and effective communication with main contractor
Willingness to discuss with main contractor before construction	Selected	Willingness to discuss with main contractor before construction
Coordination of utilities and other subcontractors	Merged	Coordination with project beneficiaries and other subcontractors
Regular communication to other parties	Merged	
<b>5. Factors related to Safety</b>		
Inspection and maintenance of work environment	Selected	Inspection and maintenance of work place
Provision of safety information, instruction and training	Selected	Provision of safety information, instruction and training for the sub contractor's labor
Previous safety record	Selected	Previous safety record
Inspection and maintenance of plant	Deleted	
<b>6. Factors related to Quality</b>		
Availability of document control system	Deleted	
Management ability	Deleted	
Accredited quality management system	Deleted	
Mechanism for monitoring preparation works	Selected	Mechanism for monitoring preparation works
Mechanism for monitoring material equipment supplied	Selected	Material and equipment monitoring mechanism
Mechanism for monitoring remedial work	Selected	Mechanism for remedial works
Mechanism for monitoring workmanship	Selected	Labour monitoring mechanism
	Added	Commitment to quality standards
	Added	Commitment to do remedial works
	Added	Quality of shop drawings and as-built drawings
<b>7. Factors related to Resources</b>		
Number of craftsmen and labourers	Selected	Number of qualified craftsmen and labourers
Sufficiency of plant	Modified	Ability to provide the necessary equipment
Type of essential plant	Modified	Existence of sufficient equipment and machinery
Capacity of existing resources	Selected	Capacity of existing resources
Supply of necessary materials	Selected	Ability to supply sufficient materials
Construction technique	Deleted	
Sufficiency of craftsmen and labourers	Merged	
Types and modernization of equipment.	Merged	
<b>8. Factors related to Organisation Structure</b>		
Number of experienced site supervisory staff	Selected	Number of experienced site supervisory staff
Existence of a proper management hierarchy	Modified	Existence of proper organization structure
Extent of training provided to the work force	Selected	Extent of training provided to the work force
<b>9. Factors related to Participation in Tendering Stage</b>		
Provision of information to support main contractor	Selected	Providing adequate information to main contractor
Experience in early involvement in tendering	Selected	Involvement / participation in previous tendering
Evidence of bringing out innovative idea	Selected	Bringing out innovative ideas
Level of discount offered	Selected	Price reduction / discounts offered

**Table 3: List of Factors Used by Main Contractors for Selection of Suitable Subcontractors (cont'd)**

	Added	Commitment to the provided prices after awarding
<b>10. Factors related to Contractual Relation</b>		
History of failing to adhere to subcontract requirements	Modified	Adherence of the subcontractor to subcontract requirements
Defect rate	Modified	Performance during defect liability period
Experience in partnering	Modified	Not partnering the works to another subcontractor
Services after work completion	Deleted	
Percentage of secondary subcontracting of work	Deleted	
<b>11. Factors related to Financial Strength</b>		
Ability to undertake the size of work-liquidity ratio	Selected	Ability to undertake the size of work
Timely payment to labourers	Selected	Prompt payment to labourers
Financial background- annual turnover	Selected	Financial background
History of delay in paying labourers	Merged	
Financial strength to sustain the required cash flows	Deleted	
<b>12. Factors related to Past Experience</b>		
Performance of relevant previous projects	Selected	Implementing similar previous projects
Number of relevant project completed	Selected	Number of projects implemented by the Subcontractor
Size of relevant previous projects completed	Selected	Size of previous projects implemented by the Subcontractor
<b>13. Factors related to Environmental Awareness</b>		
Compliance to environmental regulations under relevant statutory body	Deleted	
Inspection and maintenance of work environment	Merged	
Provision of environmental equipment in construction	Deleted	
Provision of environmental information to main contractor	Deleted	
<b>14. Factors related to Design Support</b>		
Expertise in preparing design presentation	Deleted	
Expertise in preparing shop drawings & as-built drawings	Selected	
Experience in joint design with main contractors	Deleted	
Number of design professionals and experts	Deleted	

The ten respondents (contractors and subcontractors and consultants) were asked to review the questionnaire and to verify the validity of the questionnaire topics and their relevance to the research objective and to give their advice. Important comments and suggestions were collected and evaluated carefully. At the end of the pilot study, a few minor changes, modifications and additions were accommodated to finalize the questionnaire. The questionnaire was validated by the criterion-related reliability test, which measures the correlation coefficients between the factors selected for in one group and the whole group, and structure validity test (Spearman test).

The relative index technique has been widely used in construction research for measuring attitudes with respect to surveyed variables. Several researchers (Enshassi et al., 2007, Alinaitwe et al., 2007; and Chung et al., 2003) used the relative importance index in their analysis. The respondents were asked to gauge the factors on a five-point Likert scale (1 for the strongly disagree to 5 for the strongly agree) based on their experience. Based on the response of the survey, a relative importance index was calculated using the following equation:

$$\text{Relative Importance Index} = \frac{\sum w}{AN} = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1}{5N}$$

Where  $w$  is the weighting given to each factor by the respondent, ranging from 1 to 5, ( $n_1$  = number of respondents for strongly disagree,  $n_2$  = number of respondents for disagree,  $n_3$  = number of respondents for neutral,  $n_4$  = number of respondents for agree,  $n_5$  = number of respondents for strongly agree). "A" is the highest weight (i.e 5 in the study) and  $N$  is the total number of samples. The relative importance index ranges from 0 to 1.

## RESULTS

### Factors related to subcontractor's background (Group 1)

Table 4 shows the opinion of respondents about the factors related to the subcontractors' background according to relative importance index ranked from high to low.

**Table 4: RII and Ranks of Factors Related to Subcontractor's Background**

Factors	Both contractors and subcontractors		Contractors		Subcontractors	
	RII	Rank	RII	Rank	RII	Rank
Reputation of the subcontractor	0.912	1	0.874	2	0.951	1
Specialty in certain type of work	0.895	2	0.881	1	0.909	2
Number of years in business	0.814	3	0.814	3	0.814	5
Type of work implemented by the subcontractor	0.811	4	0.768	4	0.853	3
Long- term relationship with the Main Contractor	0.793	5	0.758	5	0.828	4
Use of advanced construction technology by the Sub Contractor	0.705	6	0.663	6	0.747	6
All factors	0.822		0.793		0.850	

As illustrated in Table 4 "Reputation of the subcontractor" was ranked in the first position by both the contractors and subcontractors with RII of (0.912). The responding contractors ranked this factor in the second position with RII of (0.874) while the subcontractors ranked it in the first position with RII of (0.951). The results indicate that reputation of the subcontractor was the most important factor used by main contractors for selection of suitable subcontractors. Reputation of the subcontractor ensures to the main contractor that the work will be done smoothly and with good quality. The results agree with Haksever et al. (2001) and Arslan et al. (2008) who suggested that the reputation of the subcontractor is an important factor that must be used by main contractors for selection of suitable subcontractors.

"Specialty in certain type of work" factor was ranked in the second position by both the contractors and subcontractors with RII of (0.895). The responding contractors ranked this factor in the first position with RII of (0.881) while it was ranked in the second position by the responding subcontractors with RII of (0.909). The results suggest that speciality in certain type of work is an important factor for selection of suitable subcontractors in this group, since the speciality in certain type of work as it ensures high quality works from the subcontractor side. The results agree with Shash (1998)., Haksever et al. (2001), Chung et al. (2003) and Ng et al. (2008) who found that speciality in certain type of work is an important factor that must be used by main contractors for selection of suitable subcontractors.

"Use of advanced construction technology by the subcontractor" was ranked in the last position by both the contractors and subcontractors with RII of (0.705). Also, each of them separately ranked it in the last position with RII of (0.663) and (0.747) respectively. However, the results do not agree with Shash (1998) and Ko et al. (2007) who emphasized that, "The use of advanced construction technology by the subcontractor" is an important factor that must be used by main contractors for selection of suitable subcontractors. This contradiction in results can be attributed to the fact that the size of construction projects in Gaza Strip is relatively small and thus does not require advanced technology.

#### Spearman rank correlation coefficient

Spearman rank correlation coefficient ( $\rho$ ) is a non-parametric test for measuring the difference in ranking between target groups (main contractors and subcontractors).

For calculation of ( $\rho$ ), the following simple formula is applied:

$$\rho = 1 - \frac{6 \sum d_i^2}{N(N^2 - 1)} \quad (\text{Naoum, 1998})$$

where,  $d_i$  = the difference in ranking between each pair of factors.

$N$  = number of factors.

For the group of factors related to *subcontractor's background*, the correlation coefficient equals to 0.771 with P-value (Sig.) = 0.000. The P-value is less than the level of significance,  $\alpha = 0.05$ , so there is a good correlation between the contractors and subcontractors in this group.

#### **Factors related to work achievement and progress (Group 2)**

Table 5 shows the opinion of the respondents about the factors related to work achievement and progress according to relative importance index from high to low.

**Table 5: RII and Rank of Factors Related to Work Achievement and Progress**

Factors	Both contractors and subcontractors		Contractors		Subcontractors	
	RII	Rank	RII	Rank	RII	Rank
Adherence of the subcontractor to the time schedule	0.930	1	0.909	1	0.951	1
Updating programme as works progress	0.775	2	0.751	2	0.800	2
Preparing a detailed plan and method of work at project start	0.754	3	0.737	3	0.772	3
All factors	0.820		0.799		0.841	

As shown in Table 5, "Adherence of subcontractor to the time schedule" was ranked in the first position by both the contractors and subcontractors with RII of (0.930). Also, each of them separately ranked it in the first position with RII of (0.909) and (0.951), respectively. The results agree with Ng et al. (2008) who found that this factor was in the first position in the group related to work achievement and progress. Also, Chung et al. (2003), Ko et al. (2007) and Arslan et al. (2008) emphasized that this factor is an important factor that must be used by main contractors for selection of suitable subcontractors.

"Updating programme as works progress" was ranked in the second position by both the contractors and subcontractors with RII of (0.775). Also, each of them separately ranked it in the first position with RII of (0.751) and (0.800), respectively. The results show that updating programme as works progress was an important factor used by main contractors for selection of suitable subcontractors related to the work achievement and progress group. Updating programme helps in reducing delays because the project team can identify appropriate resources required for successful completion of the activities. The results agree with Chung et al. (2003) who found that this factor was ranked in the first position in the group related to work achievement and progress.

#### Spearman rank correlation coefficient

For the group of factors related to *work achievement and progress*, the correlation coefficient equals to 1.0 with P-value (Sig.) = 0.000. The P-value is less than the level of significance,  $\alpha = 0.05$ , so there is total agreement between the contractors and subcontractors in this group.

#### **Factors related to general obligation (Group 3)**

Table 6 shows the opinion of the respondents about the factors related to the General Obligation according to the relative importance index from high to low. From Table 6, it is shown that, "Compliance with regulations" was ranked in the first position by both the contractors and subcontractors with RII of (0.807). Also, each of them separately ranked it in the first position with RII of (0.779) and (0.835), respectively. As results indicate, compliance with regulations is the most important factor in this group used by main contractors for selection of suitable subcontractors, since knowledge and compliance with regulations reduces problems. The results agreed with Ng et al. (2008) who found that this factor was in the first position in the group related to general obligations.

**Table 6: RII and Rank of Factors Related to General Obligation**

Factors	Both contractors and subcontractors		Contractors		Subcontractors	
	RII	Rank	RII	Rank	RII	Rank
Compliance with regulations	0.807	1	0.779	1	0.835	1
Sufficient notice for inspection of works	0.779	2	0.733	2	0.825	2
Care to works done by others subcontractors	0.754	3	0.719	3	0.789	3
Compliance to the environmental regulations	0.656	4	0.607	4	0.705	4
All factors	0.749		0.710		0.789	

The "sufficient notice for inspection of works" factor was ranked in the second position by both the contractors and subcontractors with RII of (0.779). Also, each of them separately ranked it in the first position with RII of (0.733) and (0.825), respectively. The results endorse that sufficient notice for inspection of works is an important factor used by main contractors for selection of suitable subcontractors in this group. It is important that the subcontractor completes the works early and gives the supervisors sufficient time to inspect the works according to the required specifications and allows enough time to rectify the defects. The results comply with

the findings by Ng et al. (2008) who revealed that this factor was an important factor in the group related to general obligations.

#### Spearman rank correlation coefficient

For the group of factors related to general obligation, the correlation coefficient equals to 1.0 with P-value (Sig.) = 0.000. The P-value is less than the level of significance,  $\alpha = 0.05$ , so there is total agreement between contractors and subcontractors in this group.

#### **Factors related to the communication (Group 4)**

Table 7 shows the opinion of the respondents about the factors related to communication according to relative importance index.

**Table 7: Ranks and RII of Factors Related to Communication**

Factors	Both contractors and subcontractors		Contractors		Subcontractors	
	RII	Rank	RII	Rank	RII	Rank
Regular and effective communication with main contractor	0.854	1	0.860	2	0.849	1
Willingness to discuss with main contractor before construction	0.842	2	0.867	1	0.818	2
Coordination with project beneficiaries and other subcontractors	0.728	3	0.726	3	0.730	3
All factors	0.808		0.818		0.799	

From Table 7, it is shown that, "Regular and effective communication with main contractor" was ranked in the first position by both the contractors and subcontractors with RII of (0.854). The responding contractors ranked this factor in the second position with RII of (0.860) while the subcontractors ranked it in the first position with RII of (0.849). The results indicate that regular and effective communication with the main contractor is an important factor in this group used by main contractors for selection of suitable subcontractors. Regular communication indicates the attention of the subcontractors to the project and this will provide him more chance to get work from the main contractors. The results agreed with Ng et al. (2008) who found that this factor was in the first position in the group related to communication.

The "Willingness to discuss with main contractor before construction" factor was ranked in the second position by both the contractors and subcontractors with RII of (0.842). The responding contractors ranked this factor in the first position with RII of (0.867) while it was ranked in the second position by the responding subcontractors with RII of (0.818). The importance of this factor stems from the fact that discussions before construction make the main contractors aware of the methods that will be used by the subcontractors and allows exchange of ideas to accelerate the work, save time and money and improve the quality of works. The results comply with the findings by Ng et al. (2008) who suggested that this factor was in the first position in the group related to communication.

#### Spearman rank correlation coefficient

For the group of factors related to communication, the correlation coefficient equals to 0.5 with P-value (Sig.) =0.000, which is less than the level of significance,  $\alpha=0.05$ ,

so there is a significant relationship between contractors and subcontractors in this group.

#### **Factors related to the safety (Group 5)**

Table 8 shows the opinion of the respondents about the factors related to safety according to relative importance index from high to low.

**Table 8: Ranks and RII of Factors Related to Safety**

Factors	Both contractors and subcontractors		Contractors		Subcontractors	
	RII	Rank	RII	Rank	RII	Rank
Inspection and maintenance of work place	0.758	1	0.747	1	0.768	1
Provision of safety information, instruction and training for the sub contractor's labor	0.718	2	0.677	2	0.758	2
Previous safety record	0.684	3	0.635	3	0.733	3
All factors	0.720		0.687		0.753	

From Table 8, it is shown that, "Inspection and maintenance of work place" was ranked in the first position by both the contractors and subcontractors with RII of (0.758). Also, each of them separately ranked it in the first position with RII of (0.747) and (0.768), respectively. The results reveal that inspection and maintenance of the workplace is an important factor in the safety group used by main contractors for selection of suitable subcontractors. Regular inspection prevents injuries and helps to secure enhanced site safety. The results agree with Ko et al. (2007) and Arslan et al. (2008) who emphasized that this is an important factor that must be used by main contractors for selection of suitable subcontractors.

The results also revealed that provision of safety information, instruction and training for subcontractor's labour was ranked in the second position by both the contractors and subcontractors with RII of (0.718). Also, each of them separately ranked it in the second position with RII of (0.667) and (0.758), respectively. Provision of safety information will help in minimizing potential site accidents. The results agree with Chung et al. (2003) who emphasized that "Provision of safety information, instruction and training for the subcontractor's labor" was ranked in first position in the group related to the safety.

#### Spearman rank correlation coefficient

For the group of factors related safety, the correlation coefficient equals to 1.0 with P-value (Sig.) = 0.000. The P-value is less than the level of significance,  $\alpha = 0.05$ , so there is a total agreement between the contractors and subcontractors in this group.

#### **Factors related to the quality (Group 6)**

Table 9 shows the opinion of the respondents about the factors related to quality according to relative importance index.

**Table 9: Ranks and RII of Factors Related to Quality**

Factors	Both contractors and subcontractors		Contractors		Subcontractors	
	RII	Rank	RII	Rank	RII	Rank
Commitment to do remedial works	0.895	1	0.888	1	0.902	3
Commitment to quality standards	0.893	2	0.846	3	0.940	1
Labor monitoring mechanism	0.886	3	0.849	2	0.923	2
Mechanism for monitoring preparation works	0.851	4	0.842	4	0.860	6
Material and equipment monitoring mechanism	0.840	5	0.804	5	0.877	4
Mechanism for remedial works	0.811	6	0.758	6	0.863	5
Quality of shop drawings and as-built drawings	0.707	7	0.719	7	0.695	7
All factors	0.840		0.815		0.866	

From Table 9, it is shown that, "Commitment to do remedial works" was ranked in the first position by both the contractors and subcontractors with RII of (0.895). The responding contractors ranked this factor in the first position with RII of (0.888) while the subcontractors ranked it in the third position with RII of (0.902). Commitment ensures a smooth relationship and produces high quality work. The results agree with Ng et al. (2008) who found that this factor is an important factor that must be used by main contractors for selection of suitable subcontractors

The "Commitment to quality standards" factor was ranked in the second position by both the contractors and subcontractors with RII of (0.893). The responding contractors ranked this factor in the third position with RII of (0.846) while the subcontractors ranked it in the first position with RII of (0.940). Quality of works is the ultimate goal of the contractor that can be achieved through commitment to quality standards and technical specifications. The results comply with the findings by Haksever et al. (2001) and Arslan et al. (2008) who emphasized that this factor is an important factor that must be used by main contractors for selection of suitable subcontractors.

The "Labour monitoring mechanism" factor was ranked in the third position by both the contractors and subcontractors with RII of (0.886). The responding contractors ranked this factor in the second position with RII of (0.849) while the subcontractors ranked it in the second position with RII of (0.923). Continuous monitoring of labour ensures efficient utilization of time and helps in completing works within the specified duration and quality. The results agree with Ng et al. (2008) who found that this factor is an important factor that must be used by main contractors for selection of suitable subcontractors.

The "Quality of shop drawings and as-built drawings" factor was ranked in the last position by both of the contractors and subcontractors with RII of (0.707). Also, each of them separately ranked it in the third position with RII of (0.719) and (0.695), respectively. The results are in line with the findings by Ng et al (2008) who suggested that this factor was in the last position in the group related to the quality.

The low importance of this factor is justified since the subcontractors are generally not requested to submit any drawings.

#### Spearman rank correlation coefficient

For the group of quality related factors, the correlation coefficient equals to 0.75 with P-value (Sig.) = 0.000. The P-value is less than the level of significance,  $\alpha = 0.05$ , so there is a good agreement between the contractors and subcontractors in this group.

#### **Factors related to resources (Group 7)**

As illustrated in Table 10, "Ability to provide the necessary equipment" was ranked in the first position by both the contractors and subcontractors with RII of (0.889). Also, each of them separately ranked it in the first position with RII of (0.902) and (0.877), respectively. The results agreed with Shash (1998), Chung et al. (2003) and Arslan et al. (2008) who emphasized that adequacy of equipment and machinery was an important factor that must be used by main contractors for selection of suitable subcontractors.

"Existence of sufficient equipment and machinery" factor was ranked in the second position by both the contractors and subcontractors with RII of (0.884). The responding contractors ranked this factor in the first position with RII of (0.902) while the subcontractors ranked it in the second position with RII of (0.867). The results conform to the research findings of Shash (1998), Chung et al. (2003) and Arslan et al. (2008) who emphasized that "Existence of sufficient equipment and machinery" was an important factor that must be used by contractors for selection of subcontractors.

"Number of qualified craftsmen and labourers" was ranked in the third position by both the contractors and subcontractors with RII of (0.860). The responding contractors ranked this factor in the second position with RII of (0.856) while the subcontractors ranked it in the fourth position with RII of (0.863). The results are inline with the findings by Shash (1998), PCICB (2003), Chung et al. (2003) and Arslan et al. (2008) who emphasized that "Existence of sufficient equipment and machinery" was an important factor that must be used by main contractors for selection of suitable subcontractors.

#### Spearman rank correlation coefficient

For the group of factors related resources, the correlation coefficient equals to 0.70 with P-value (Sig.) = 0.000. The P-value is less than the level of significance,  $\alpha = 0.05$ , so there is a good agreement between the contractors and subcontractors in this group.

**Table 10: Ranks and RII of Factors Related to Resources**

Factors	Both contractors and subcontractors		Contractors		Subcontractors	
	RII	Rank	RII	Rank	RII	Rank
Existence of sufficient equipment and machinery	0.889	1	0.902	1	0.877	1
Ability to provide the necessary equipment	0.884	2	0.902	1	0.867	2
Number of qualified craftsmen and laborers	0.860	3	0.856	2	0.863	4
Ability to supply sufficient materials	0.854	4	0.842	3	0.867	3
Capacity of existing resources	0.832	5	0.818	4	0.846	5
All factors	0.864		0.864		0.864	

**Factors related to organization structure (Group 8)**

From Table 11, it is shown that, "Number of experienced site supervisory staff" was ranked in the first position by both the contractors and subcontractors with RII of (0.802). Also, each of them separately ranked it in the first position with RII of (0.800) and (0.804), respectively. The existence of experienced staff is important to achieve the required quality and completion of the project on time. The results are in accordance with PCICB (2003), Chung et al (2003) and Arslan et al. (2008) who emphasized that "Number of experienced site supervisory staff" was an important factor that must be used by main contractors for selection of suitable subcontractors.

**Table 11: Ranks and RII of Factors Related to Organization Structure**

Factors	Both contractors and subcontractors		Contractors		Subcontractors	
	RII	Rank	RII	Rank	RII	Rank
Number of experienced site supervisory staff	0.802	1	0.800	1	0.804	1
Existence of proper organization structure	0.668	2	0.642	3	0.695	2
Extent of training provided to the work force	0.642	3	0.674	2	0.611	3
All factors	0.704		0.705		0.703	

The "Existence of proper organization structure" factor was ranked in the second position by both the contractors and subcontractors with RII of (0.668). The responding contractors ranked this factor in the third position with RII of (0.642) while the subcontractors ranked it in the second position with RII of (0.695). "Extent of training provided to the work force" factor was ranked in the third position by both the contractors and subcontractors with RII of (0.642). The responding contractors ranked this factor in the second position with RII of (0.674) while the subcontractors ranked it in the third position with RII of (0.611). The factors of this group had relatively low RII since the subcontractors' companies are usually small companies that do not have proper organization structure.

Spearman rank correlation coefficient

For the group of factors related organization structure, the correlation coefficient equals to 0.50 with P-value (Sig.) = 0.000. The P-value is less than the level of significance,  $\alpha = 0.05$ , so there is a significant relationship between the contractors and subcontractors in this group.

**Factors related to participation in tendering stage (Group 9)**

From Table 12, it is shown that, "Commitment to the provided prices after awarding" was ranked in the first position by both the contractors and subcontractors with RII of (0.921). Also, each of them separately ranked it in the first position with RII of (0.933) and (0.912), respectively. The results indicate that commitment to the provided prices after awarding is an important factor used by main contractors for selection of suitable subcontractors related to the participation in tendering stage group, The main contractor submits his tender based on the prices of the subcontractors so they have to show commitment to their prices after awarding in order to select them to implement the works.

The "Providing adequate information to main contractor" factor was ranked in the second position by both the contractors and subcontractors with RII of (0.823). The responding contractors ranked this factor in the fourth position with RII of (0.789), while the subcontractors ranked it in the second position with RII of (0.856). The results highlight that providing adequate information to the main contractor is an important factor used by main contractors for selection of suitable subcontractors because adequate information is very useful for the contractor during pricing of tenders. The results comply with the findings by Ng et al. (2008) who found that this factor was an important factor that is used by main contractors for selection of suitable subcontractors.

**Table 12: Rank and RII of Factors Related to Participation in Tendering Stage**

Factors	Both contractors and subcontractors		Contractors		Subcontractors	
	RII	Rank	RII	Rank	RII	Rank
	Commitment to the provided prices after awarding	0.921	1	0.933	1	0.912
Providing adequate information to main contractor	0.823	2	0.789	4	0.856	2
Price reduction / discounts offered	0.811	3	0.804	2	0.818	3
Involvement / participation in previous tendering	0.802	4	0.800	3	0.804	4
Bringing out innovative ideas	0.716	5	0.712	5	0.719	5
All factors	0.827		0.808		0.846	

The "Price reduction/discounts offered" factor was ranked in the third position by both the contractors and subcontractors with RII of (0.811). The responding contractors ranked this factor in the second position with RII of (0.804) while the subcontractors ranked it in the third position with RII of (0.818). This is important for

the contractor since discounts lead to increased profit. The results agree with Haksever et al. (2001) and Ng et al. (2008) who found that this factor was an important factor that used by main contractors for selection of suitable subcontractors.

#### Spearman rank correlation coefficient

For the group of factors related participation in tendering stage, the correlation coefficient equals to 0.70 with P-value (Sig.) = 0.000. The P-value is less than the level of significance,  $\alpha = 0.05$ , so there is a good agreement between the contractors and subcontractors in this group.

#### **Factors related to Contractual relations (Group 10)**

From Table 13, it is shown that, "Adherence of the subcontractor to subcontract requirements" was ranked in the first position by both the contractors and subcontractors with RII of (0.951). Also, each of them separately ranked it in the first position with RII of (0.944) and (0.958) respectively. The adherence to the subcontract requirements will ensure achieving works with the required quality and within the specified time. The results conform to the findings of Ko, et al. (2007) and Arslan et al. (2008) who emphasized that this factor was an important factor that must be used by main contractors for selection of suitable subcontractors.

"Not partnering the works with another subcontractor" factor was ranked in the second position by both the contractors and subcontractors with RII of (0.828). The responding contractors ranked this factor in the third position with RII of (0.821) while the subcontractors ranked it in the second position with RII of (0.835). This emphasizes that, this is an important factor used by main contractors for selection of suitable subcontractors, because the subcontractor is selected based on his own experience and reputation, not the experience and reputation of other subcontractors.

**Table 13: Ranks and RII of Factors Related to Contractual Relations**

Factors	Both contractors and subcontractors		Contractors		Subcontractors	
	RII	Rank	RII	Rank	RII	Rank
Adherence of the subcontractor to subcontract requirements	0.951	1	0.944	1	0.958	1
Not partnering the works with another subcontractor	0.828	2	0.821	3	0.835	2
Performance during defect liability period	0.802	3	0.828	2	0.775	3
All factors	0.860		0.864		0.856	

The "Performance during defect liability period" factor was ranked in the third position by both the contractors and subcontractors with RII of (0.802). The responding contractors ranked this factor in the second position with RII of (0.828) while the subcontractors ranked it in the third position with RII of (0.775). The contractor is committed to performing the maintenance works during the defect liability period that shall be implemented by the subcontractor. Hence the performance of the subcontractor in this period is a critical factor. The obtained

results agreed with Ko et al. (2007) who emphasized that this is an important factor that must be used by main contractors for selection of suitable subcontractors,

#### Spearman rank correlation coefficient

For the group of factors related contractual relation, the correlation coefficient equals to 0.50 with P-value (Sig.) = 0.000. The P-value is less than the level of significance,  $\alpha = 0.05$ , so there is a significant relationship between the contractors and subcontractors in this group.

#### **Factors related to financial strength (Group 11)**

As indicated in Table 14, "Ability to undertake the size of work" was ranked in the first position by both the contractors and subcontractors with RII of (0.828). Also, each of them separately ranked it in the first position with RII of (0.818) and (0.839), respectively. Financial strength enables the subcontractor to implement large works without obstacle. The obtained results agreed with Ng et al. (2008) who found that this factor was in the first position in the group related to financial strength. Also, Shash (1998), Haksever et al. (2001), PCICB (2003) and Chung et al. (2003) emphasized that "Financial strength of subcontractor" is an important factor that must be used by main contractors for selection of suitable subcontractors.

The "Prompt payment to labourers" factor was ranked in the second position by both the contractors and subcontractors with RII of (0.811). The responding contractors ranked this factor in the third position with RII of (0.807) while the subcontractors ranked it in the second position with RII of (0.814). Prompt payment to labourers prevents problems between the subcontractor and his labourers and prevents stoppage or delayed works. The results somewhat comply with research findings by Chung et al. (2003) and Arslan et al. (2008) who emphasized that this was an important factor that must be used by main contractors for selection of suitable subcontractors.

**Table 14: Ranks and RII of Factors Related to Financial Strength**

Factors	Both contractors and subcontractors		Contractors		Subcontractors	
	RII	Rank	RII	Rank	RII	Rank
Ability to undertake the size of work	0.828	1	0.818	1	0.839	1
Prompt payment to laborers	0.811	2	0.807	3	0.814	2
Financial background	0.807	3	0.814	2	0.800	3
All factors	0.815		0.813		0.818	

The "Financial background" factor was ranked in the third position by both the contractors and subcontractors with RII of (0.807). The responding contractors ranked this factor in the second position with RII of (0.814) while the subcontractors ranked it in the third position with RII of (0.800). Financial strength will enable the subcontractor to deliver the required materials and to pay the labourers on time that ensures continuity of works. The results agreed with Ng et al. (2008) who found that this factor was in the first position in the group related to financial strength. Also, Shash (1998), Haksever et al. (2001) and Arslan et al. (2008) emphasized that, "Financial background" was an important factor that must be used by main contractors for selection of suitable subcontractors.

Spearman rank correlation coefficient

For the group of factors related financial strength, the correlation coefficient equals to 0.50 with P-value (Sig.) = 0.000. The P-value is less than the level of significance,  $\alpha = 0.05$ , so there is a significant relationship between the contractors and subcontractors in this group.

**Factors related to past experience (Group 12)**

From Table 15, it is shown that, "Implementing similar previous projects" was ranked in the first position by both the contractors and subcontractors with RII of (0.853). Also, each of them separately ranked it in the first position with RII of (0.881) and (0.825), respectively. Implementing similar previous projects enables the subcontractor to work smoothly and complete the works on time to achieve the best quality. The results agreed with Shash (1998), Chung et al. (2003) and Ng et al. (2008) who found that, this factor was in the first position in the group related topast experience. Haksever et al. (2001), PCICB (2003) and Arslan et al. (2008) emphasized that this factor was an important factor that must be used by contractors for selection of subcontractors.

"Size of previous projects implemented by the subcontractor" factor was ranked in the second position by both the contractors and subcontractors with RII of (0.777). Also, each of them separately ranked it in the second position with RII of (0.789) and (0.765), respectively. The size of previous projects provides a good indication of the subcontractor's ability to implement smaller projects. The "Number of projects implemented by the subcontractor" factor was ranked in the third position by both the contractors and subcontractors with RII of (0.751). Also, each of them separately ranked it in the third position with RII of (0.754) and (0.747), respectively. The number of previous projects gives a good indication that subcontractor has gained good experience and gained the trust of contractors.

**Table 15: Ranks and RII of Factors Related to Past Experience**

Factors	Both contractors and subcontractors		Contractors		Subcontractors	
	RII	Rank	RII	Rank	RII	Rank
Implementing similar previous projects	0.853	1	0.881	1	0.825	1
Size of previous projects implemented by the subcontractor	0.777	2	0.789	2	0.765	2
Number of projects implemented by the subcontractor	0.751	3	0.754	3	0.747	3
All factors	0.794		0.808		0.779	

Spearman rank correlation coefficient

For the group of factors related past experience, the correlation coefficient equals to 1.0 with P-value (Sig.) = 0.000. The P-value is less than the level of significance,  $\alpha = 0.05$ , so there is a total agreement between the contractors and subcontractors in this group.

**Comparison between all groups of factors used for selection of subcontractors**

From Table 16, it is shown that, factors related to the resources group was ranked in the first position by both the contractors and subcontractors with RII of (0.864). The responding contractors ranked these factors in the first position with RII of (0.864) while the subcontractors ranked them in the second position with RII of (0.864). The availability of resources such as labourers, materials, machines and equipment indicates the ability of the subcontractor to carry out the works and perform the works on time and with the required quality. Factors related to the contractual relation group was ranked in the second position by both the contractors and subcontractors with RII of (0.860). The responding contractors ranked this factor in the fourth position with RII of (0.864) while the subcontractors ranked it in the second position with RII of (0.856). The commitment of the subcontractor to implement contractual obligations is a top priority for the contractor to ensure completing the works successfully.

**Table 16: Ranks and RII of All Groups**

Group of factors	Both contractors and subcontractors		Contractors		Subcontractors	
	RII	Rank	RII	Rank	RII	Rank
Factors related to resources	0.864	1	0.864	1	0.864	2
Factors related to contractual relations	0.860	2	0.864	1	0.856	3
Factors related to quality	0.840	3	0.818	2	0.866	1
Factors related to participation in tendering stage	0.827	4	0.808	4	0.846	5
Factors related to subcontractor's background	0.822	5	0.793	6	0.850	4
Factors related to work achievement and progress	0.820	6	0.799	5	0.841	6
Factors related to financial strength	0.815	7	0.813	3	0.818	7
Factors related to communication	0.808	8	0.818	2	0.799	8
Factors related to past experience	0.794	9	0.808	4	0.779	10
Factors related to general obligation	0.749	10	0.710	7	0.789	9
Factors related to safety	0.720	11	0.687	9	0.753	11
Factors related to organization structure	0.704	12	0.705	8	0.703	12
Total factors	0.809		0.795		0.823	

The factors related to quality group were ranked in the third position by both the contractors and subcontractors with RII of (0.840). The responding contractors ranked this factor in the second position with RII of (0.818) while the subcontractors ranked it in the first position with RII of (0.856). The contractors should ensure monitoring of the labourers and materials to implement the works according to best quality. Factors related to the participation in tendering stage group, was ranked in the fourth position

by both the contractors and subcontractors with RII of (0.827). The responding contractors ranked this factor in the fourth position with RII of (0.808) while the subcontractors ranked it in the fifth position with RII of (0.846). Providing adequate information, commitment to prices and offering discounts encourage the contractor to select the subcontractor.

#### Spearman rank correlation coefficient

For the group of factors related to groups of factors for selection of suitable subcontractors, the correlation coefficient equals to 0.82 with P-value (Sig.) = 0.000. The P-value is less than the level of significance,  $\alpha = 0.05$ , so there is a good agreement between the contractors and subcontractors.

#### **Ranking of all factors used for selection of subcontractors**

Table 17 shows the rank of all factors used by main contractors for selection of suitable subcontractors from point view of contractors and subcontractors.

**Table 17: Ranks and RII of All Factors for Selection of Subcontractors**

Factors	Both contractors and subcontractors		Contractors		Subcontractors		Group
	RII	Rank	RII	Rank	RII	Rank	
Adherence of the subcontractor to subcontract requirements	0.951	1	0.944	1	0.958	1	Contractual relation
Adherence of the subcontractor to the time schedule	0.93	2	0.909	3	0.951	3	Work achievement and progress
Commitment to the provided prices after awarding	0.921	3	0.933	2	0.912	5	Participation in tendering stage
Reputation of the subcontractor	0.912	4	0.874	8	0.951	2	Subcontractor's background
Specialty in certain type of work	0.895	5	0.881	7	0.909	6	Subcontractor's background
Commitment to do remedial works	0.895	5	0.888	6	0.902	7	Quality
Commitment to quality standards	0.893	6	0.846	13	0.94	3	Quality
Existence of sufficient equipment and machinery	0.889	7	0.902	4	0.877	8	Resources
Labor monitoring mechanism	0.886	8	0.849	12	0.923	4	Quality

*Subcontractor Prequalification Practices in Palestine*

<b>Cont'd Table 17</b>							
Factors	Both contractors and subcontractors		Contractors		Subcontractors		Group
	Ability to provide the necessary equipment	0.884	9	0.902	5	0.867	
Number of qualified craftsmen and labourers	0.86	10	0.856	11	0.863	11	Resources
Regular and effective communication with main contractor	0.854	11	0.86	10	0.849	15	Communication
Ability to supply sufficient materials	0.854	11	0.842	14	0.867	10	Resources
Implementing similar previous projects	0.853	12	0.881	7	0.825	20	Past experience
Mechanism for monitoring preparation works	0.851	13	0.842	14	0.86	12	Quality
Willingness to discuss with main contractor before construction	0.842	14	0.867	9	0.818	21	Communication
Material and equipment monitoring mechanism	0.84	15	0.804	20	0.877	9	Quality
Capacity of existing resources	0.832	16	0.818	17	0.846	16	Resources
Ability to undertake the size of work	0.828	17	0.818	17	0.839	17	Financial strength
Not partnering the works to another subcontractor	0.828	18	0.821	16	0.835	18	Contractual relation
Providing adequate information to main contractor	0.823	19	0.789	23	0.856	13	Participation in tendering stage
Number of years in business	0.814	20	0.814	18	0.814	22	Subcontractor's background

<b>Cont'd Table 17</b>							
Factors	Both contractors and subcontractors		Contractors		Subcontractors		Group
	Type of work implemented by the subcontractor	0.811	21	0.768	25	0.853	
Mechanism for remedial works	0.811	21	0.758	26	0.863	11	Quality
Price reduction / discounts offered	0.811	21	0.804	20	0.818	21	Participation in tendering stage
Prompt payment to laborers	0.811	21	0.807	19	0.814	22	Financial strength
Compliance with regulations	0.807	22	0.779	24	0.835	18	General obligation
Financial background	0.807	22	0.814	18	0.8	24	Financial strength
Number of experienced site supervisory staff	0.802	23	0.8	21	0.804	23	Organization structure
Involvement / participation in previous tendering	0.802	23	0.8	21	0.804	23	Participation in tendering stage
Performance during defect liability period	0.802	23	0.828	15	0.775	26	Contractual relation
Long- term relationship with the Main Contractor	0.793	24	0.758	26	0.828	19	Subcontractor's background
Sufficient notice for inspection of works	0.779	25	0.733	31	0.825	20	General obligation
Size of previous projects implemented by the Subcontractor	0.777	26	0.789	23	0.765	29	Past experience
Updating programme as works progress	0.775	27	0.751	28	0.8	24	Work achievement and progress
Inspection and maintenance of work place	0.758	28	0.747	29	0.768	28	Safety
Preparing a detailed plan and method of work at project start	0.754	29	0.737	30	0.772	27	Work achievement and progress

*Subcontractor Prequalification Practices in Palestine*

<b>Cont'd Table 17</b>							
Factors	Both contractors and subcontractors		Contractors		Subcontractors		Group
	Care to works done by others subcontractors	0.754	29	0.719	33	0.789	
Number of projects implemented by the Subcontractor	0.751	30	0.754	27	0.747	31	Past experience
Coordination with project beneficiaries and other subcontractors	0.728	31	0.726	32	0.73	33	Communication
Provision of safety information, instruction and training for the sub contractor's labor	0.718	32	0.677	35	0.758	30	Safety
Bringing out innovative ideas	0.716	33	0.712	34	0.719	34	Participation in tendering stage
Quality of shop drawings and as-built drawings	0.707	34	0.719	33	0.695	36	Quality
Use of advanced construction technology by the Sub Contractor	0.705	35	0.663	37	0.747	31	Subcontractor's background
Previous safety record	0.684	36	0.635	39	0.733	32	Safety
Existence of proper organization structure	0.668	37	0.642	38	0.695	37	Organization structure
Compliance to the environmental regulations	0.656	38	0.607	40	0.705	35	General obligation
Extent of training provided to the work force	0.642	39	0.674	36	0.611	38	Organization structure
Total factors	0.809		0.795		0.823		

Spearman rank correlation coefficient

For the group of factors related to groups of factors used by main contractors for selection of suitable subcontractors, the correlation coefficient equals to 0.89 with P-

value (Sig.) = 0.036. The P-value is less than the level of significance,  $\alpha = 0.05$ , so there is a good agreement between the contractors and subcontractors.

### **Top-ten factors used for selection of subcontractors**

Table 18 shows the top ten factors for selection of subcontractors from point view of both contractors and subcontractors.

**Table 18: Top-ten Factors Used for Selection of Subcontractors**

Factors	Both Contractors and Subcontractors		Group
	RII	Rank	
Adherence of the subcontractor to subcontract requirements	0.951	1	Contractual relation
Adherence of the subcontractor to the time schedule	0.93	2	Work achievement and progress
Commitment to the provided prices after awarding	0.921	3	Participation in tendering stage
Reputation of the subcontractor	0.912	4	Subcontractor's background
Specialty in certain type of work	0.895	5	Subcontractor's background
Commitment to do remedial works	0.895	5	Quality
Commitment to quality standards	0.893	6	Quality
Existence of sufficient equipment and machinery	0.889	7	Resources
Labor monitoring mechanism	0.886	8	Quality
Ability to provide the necessary equipment	0.884	9	Resources
Number of qualified craftsmen and laborers	0.86	10	Resources

From Table 18, it is shown that, "Adherence of the subcontractor to subcontract requirements" in the contractual relation group was ranked in the first position by both contractors and subcontractors with RII of (0.951). The results agreed with Ng et al. (2008), Ko et al. (2007) and Arslan et al. (2008) who emphasized that this factor was important for selection of suitable subcontractors. The results revealed that the adherence of the subcontractor to subcontract requirements was considered the most important factor for subcontractor selection. Adherence to the subcontract requirements will ensure completing the works with the required quality and within the specified time.

"Adherence of the subcontractor to the time schedule" in the work achievement and progress group was ranked in the second position by both contractors and subcontractors with RII of (0.930). Adherence to the schedule will assist in completing the project on time without delay, useful to both the contractors and subcontractors. The results agree with Ng et al. (2008), Ko et al. (2007) and Arslan et al. (2008) who emphasized that this factor was an important factor that must be used by main contractors for selection of suitable subcontractors.

"Commitment to the provided prices after awarding" related to the participation in tendering stage and was ranked in the third position by both contractors and subcontractors with RII of (0.921), because the main contractor submits his tender

based on the prices of the subcontractors so they have to show commitment to their prices after awarding in order to select them to implement the works. "Reputation of the subcontractor" related to the subcontractor's background group and was ranked in the fourth position by both contractors and subcontractors with RII of (0.912). The results agree with Haksever et al. (2001) and Arslan et al. (2008) who emphasized that, this factor was an important factor that must be used by main contractors for selection of suitable subcontractors.

"Commitment to do remedial works" related to the quality group and "Specialty in certain type of work" related to subcontractor's background group were ranked in the fifth position by both contractors and subcontractors with RII of (0.895). The quality of works is the ultimate goal of the contractor which can be achieved through speciality subcontractors in and commitment to do remedial works. "Commitment to quality standards" related to the quality group was ranked in the sixth position by both contractors and subcontractors with RII of (0.893). The results indicate that the commitment to do remedial works is an important factor used by main contractors for selection of suitable subcontractors. Best quality of works is the ultimate goal of the contractor and can be achieved through commitment to quality standards and technical specifications. The results agreed with Haksever et al. (2001) and Arslan et al. (2008) who emphasized that this factor was an important factor that must be used by main contractors for selection of suitable subcontractors,

From Table 18, it is shown that "Existence of sufficient equipment and machinery" related to the resources group were ranked in the seventh position by both the contractors and subcontractors with RII of (0.889). Availability of sufficient equipment and machinery ensures the ability to complete the works on time. The results are in line with the findings by Shash (1998), PCICB (2003), Chung et al. (2003) and Arslan et al. (2008) who emphasized that this factor was an important factor that must be used by main contractors for selection of suitable subcontractors since it guarantees the ability to complete the works on time. "Labour monitoring mechanism" related to the quality group was ranked in the eighth position by both contractors and subcontractors with RII of (0.886). Continuous monitoring of labour ensures efficient utilization of time and completion of works within the specified duration and quality. The results agree with Ng et al. (2008) who found that this factor was an important factor that must be used by main contractors for selection of suitable subcontractors.

"Ability to provide the necessary equipment" related to the resources group was ranked in the ninth position by both contractors and subcontractors with RII of (0.884). The results show that the ability to provide the necessary equipment is an important factor used by main contractors for selection of suitable subcontractors. Ability to provide the necessary equipment guarantees the availability of required resources to complete the works on time. The results agreed with Shash (1998), Chung et al. (2003) and Arslan et al. (2008) who emphasized that adequacy of equipment and machinery was an important factor that must be used by main contractors for selection of suitable subcontractors. "Number of qualified craftsmen and labourers" related to the resources group was ranked in the tenth position by both contractors and subcontractors with RII of (0.860). The results reveal that the number of qualified craftsmen and labourers is an important factor used by main contractors for selection of suitable subcontractors, since it guarantees the ability to complete the

works on time and with the required quality. The results agreed with Shash (1998), PCICB (2003), Chung et al. (2003) and Arslan et al. (2008) who emphasized that "Existence of sufficient equipment and machinery" was an important factor that must be used by main contractors for selection of suitable subcontractors.

## CONCLUSION

Table 19 shows the ranking of the most important ten factors used by main contractors in the selection of suitable subcontractors in Gaza Strip according to the points of view of contractors and subcontractors, individually and combined.

**Table 19: Most Important Ten Factors Used for Selection of Subcontractors**

Rank	Both contractors and subcontractors	Contractors	Subcontractors
1	Adherence of the subcontractor to subcontract requirements	Adherence of the subcontractor to subcontract requirements	Adherence of the subcontractor to subcontract requirements
2	Adherence of the subcontractor to the time schedule	Commitment to the provided prices after awarding	Reputation of the subcontractor
3	Commitment to the provided prices after awarding	Adherence of the subcontractor to the time schedule	*Adherence of the subcontractor to the time schedule. *Commitment to quality standards.
4	Reputation of the subcontractor	Existence of sufficient equipment and machinery	Labour monitoring mechanism
5	Specialty in certain type of work. Commitment to do remedial works.	Ability to provide the necessary equipment	Commitment to the provided prices after awarding
6	Commitment to quality standards	Commitment to do remedial works	Specialty in certain type of work
7	Existence of sufficient equipment and machinery	*Implementing similar previous projects. *Specialty in certain type of work.	Commitment to do remedial works
8	Labour monitoring mechanism	Reputation of the subcontractor	Existence of sufficient equipment and machinery
9	Ability to provide the necessary equipment	Willingness to discuss with main contractor before construction	Material and equipment monitoring mechanism
10	Number of qualified craftsmen and labourers	Regular and effective communication with main contractor	Ability to supply sufficient materials

Contractors are recommended to select the subcontractor according to his previous experience, reputation and capabilities in terms of labourers, equipment and machinery, since these items ensure the commitment of the subcontractor to the contract conditions and ensure completion of the work according to the time schedule and achievement of best quality. Contractors are recommended to supervise the subcontractors' works on a daily basis and communicate with him continuously in order to solve any problems, immediately. Contractors are recommended to issue financial payments to the subcontractor on time, since this ensures the good reputation

of the contractor and enables the subcontractor to cover his expenses, purchase the required materials and pay labourers on time, which results in completion of the work on time without delay.

Subcontractors are recommended to employ sufficient numbers of qualified technical staff with appropriate experience of the project and to prepare all required materials and equipment in order to be able to adhere to subcontract requirements and time schedule. Subcontractors are recommended to propose suitable and reasonable prices that ensure acceptable margins of profit for them, and then to adhere to their prices after contract award and implement the works without requesting any change in price. The owners are recommended to consider the current financial situation of the contractor and not award the contract to financially weak contractors who can't pay subcontractors on time and hence can't complete the project on time. The owners are recommended to issue financial payments for the contractor on time so that he can cover the payments for the subcontractors who in turn can purchase the required materials and pay the labourers and complete the works without delay.

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