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Delays and cost overruns in the construction projects in the Gaza Strip

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Abstract

Purpose – Delays and cost overruns are evidently frequent problems in the construction industries of many developed and developing countries. The purpose of this paper is to assess factors leading to time overruns (delays) and cost overruns in construction projects in the Gaza Strip. Since there appear to be additional special contributors to delays here, the relative perceptions of contractors, consultants and owners are compared, based on a listing of causal factors derived from previous studies elsewhere, together with other factors arising from special conditions in the Gaza Strip.

Design/methodology/approach – A survey of a randomly selected samples yielded responses from 66 contractors, 27 consultants, and 31 owners. The survey included 110 delay factors/causes which were grouped into 12 major groups. The same survey also included 42 cost overrun factors. The level of importance of the delays and cost overrun factors were measured and ranked by their importance indexes, according to the perspectives of contractors, consultants, and owners.

Findings – There seems to be a general agreement between contractors, consultants and owners regarding causes of delays and cost overruns. The main four causes of time delays included strikes and border closures, material-related factors, lack of materials in markets, and delays in materials delivery to the site. Additionally, the main three causes for cost overruns included price fluctuations of construction materials, contractor delays in material and equipment delivery, and inflation.

Originality/value – The outcome of this paper will assist owners, contractors, and consultants in understanding the reasons for delays and cost overruns, thus eliminating or minimizing these causes. This could be achieved by better management of the projects and by finding new methods for storing the critical materials from the beginning of the project. Furthermore, the local government is advised to initiate legislation to overcome problems arising from monopolies in the supply of construction materials.

Keywords Construction operations, Contract costs, Delivery lead time, Palestine

Paper type Research paper

1. Introduction

Keeping construction projects within estimated costs and schedules requires sound strategies, good practices, and careful judgment. To the dislike of owners, contractors and consultants, however, many projects experience extensive delays and thereby exceed initial time and cost estimates. This problem is more evident in the traditional or adversarial type of contracts in which the contract is awarded to the lowest bidder,

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which is the strategy in the majority of public projects in developing countries including the Gaza Strip. The construction industry is the locomotive of physical development for the national economy (Kumaraswamy, 2006). The more resources, engineering know-how, labour, materials, equipment, capital, and market exchange are provided from within the national economy, the higher the extent of self-reliance. The increasing complexity of infrastructure projects and the environment within which they are constructed place greater demands on construction managers to deliver projects on time, within budget and to high quality (Enshassi *et al.*, 2003, 2008).

Since the 1993 Oslo Peace Accords, Palestinian occupied territories have undergone rapid reconstruction. Despite lack of resources and technologies, hundreds of infrastructure, residential, and governmental projects were implemented (Raufaste and Callahan, 2002). Therefore, improving construction efficiency by means of cost-effectiveness and timeliness would certainly contribute to cost savings for the whole country. Unlike developed countries, Palestine does not have a mature construction industry with well-established contracting and consulting companies. Much of the building and construction is done by the informal sector. This consists of individuals building family shelters, water wells and the like. The formal sector consists of public and private domestic contractors (Enshassi *et al.*, 2003).

The first objective of this study is to identify key variables causing construction time and cost overruns in the Gaza Strip. The importance levels of the chosen/shortlisted delays and cost overruns factors were measured and ranked by their importance indices. The second study objective is to evaluate their relative importance from the perspectives of owners, consultants, and contractors.

2. Review of literature

Time and cost overruns occur in most construction projects, although of course, the magnitude of these delays and cost overruns varies considerably from project to project. Therefore, it is important to unearth the actual causes of time and cost overruns in order to address these in any construction project. Delays and cost overruns have contributed to the high cost of construction in many countries for many years (Okpala and Aniekwu, 1988; Charles and Andrew, 1990; Zaki and James, 1987; Abdul-Rahman *et al.*, 2008). The construction industry plays a major role in the development of many countries. At the macro level, delay will lead to a negative rate of national economic growth and monetary loss (Arditi *et al.*, 1985; Lo *et al.*, 2006; Mezher and Tawil, 1998; Enshassi *et al.* 2007). At the micro level, a delayed project can lead to time and cost overruns, disputes, arbitration, and even total abandonment (Abdul-Rahman *et al.*, 2008; Enshassi *et al.*, 2008).

Time overrun is the delay beyond planned completion dates traceable to the contractors (Kaming *et al.*, 1997). Delays can be taken to be "incidents" that impact a project's progress and postpone project activities. Project delays may be caused by very bad weather, unavailability of resources, design delays, etc. In general, project delays result from activities that have both external and internal cause and effect relationships (Vidalis and Najafi, 2002). Cost overrun is the excess of actual cost over budget. Cost overrun is also sometimes called "cost escalation," "cost increase," or "budget overrun" (Zhu and Lin, 2004). The degree of cost overruns can be compared by measuring the change in contract amount divided by the original contract award amount. This calculation can be converted to a percentage for ease of comparison (Jackson, 1999).

Ahmed *et al.* (2003) claimed that responsibility for delay is reflected in whether the contractor is awarded or is liable for costs and additional time to complete the project. Several scholars have studied the factors that influence delays and cost overruns (Chan and Kumaraswamy, 1996, 2002; Ogunlana *et al.*, 1996; Kaming *et al.*, 1997; Alwi and Hampson, 2003; Ahmed *et al.* (2003); Odeh and Battaineh, 2002; Enshassi *et al.*, 2003; Abdul-Rahman *et al.*, 2006, 2008; Alghbari *et al.*, 2007; Chimwaso, 2001; Faridi and El-Sayegh, 2006).

Aibinu and Jagboro (2002), in their study of the growing problem of construction delay in Nigeria, examined the effects of delays on the delivery of construction projects in the country. Utilizing a questionnaire survey of 61 construction projects, the authors identified, and assessed the impact of delays on the delivery of construction projects. Chan and Kumaraswamy (2002) also explored strategies used to compress construction durations of various types of building projects. The authors present the primary findings of three parallel investigations that sought out the critical contributors of faster construction procedures in Hong Kong. The paper finally recommends specific technological and managerial strategies for reducing construction durations.

Odeh and Battaineh (2002) studied the causes of construction delay in traditional contracts in Jordan, using a questionnaire survey. The study illustrated that contractors felt labour productivity to be the most important delay factor. However, inadequate contractor experience was the most important delay factor to consultants. All parties generally agreed on the ranking of the individual delay factors. They agreed that inadequate contractor experience, owner interference, and financing of work were among the top five most important factors.

Ahmed *et al.* (2003) found that the most common type of delay is excusable compensatable (48 percent), followed by non-excusable delays (44 percent) and excusable non-compensatable delays (8 percent). By definition, when the contractor is responsible, the type of delay is non-excusable; while if the responsibility is with the owner or the consultant it is an excusable compensatable delay. Depending on the contractual risk allocation, even if the government (or a third party) is responsible, the delay may considered an excusable. However, certain delay due to uncontrollable causes may be excusable and non-copensatable. Enshassi *et al.* (2003) studied the contributors to construction delay in Palestine. They found that the "financing" group of delay factors was ranked the highest by all three parties and the "environment" group was ranked the lowest.

Koushki *et al.* (2005) studied delays and cost increases in the construction of private residential projects in Kuwait. The amount of time-delays and cost-increases was greater when the total cost of a residential project was higher. A major factor contributing to the time-delay and cost-increase was the inadequacy of money and time allocated to the design phase. The three main causes of time-delays were, in order, the number of change orders, financial constraints and owners' lack of experience in construction. The three main causes of cost overruns on the other hand were, in order, contractor-Elide and material-related problems and, again, owners' financial constraints.

Lo *et al.* (2006) in Hong Kong found that all respondent groups tended to admit their own contributions to delays. The respondents thought that construction delays caused by unforeseen ground conditions, poor site management and supervision by consultants, environmental restrictions, exceptionally low bids, and client variations

were highly significant and ranked them in the top ten. Four factors that cause cost overruns were identified from the existing research findings of Kaming *et al.* (1997) and Chimwaso (2001). These are; design changes, inadequate planning, unpredictable weather conditions; and fluctuations in the cost of building materials.

Frimpongs *et al.* (2003) studied 26 factors that cause cost overruns in construction of ground water projects in Ghana. According to the contractors and consultants, monthly payments difficulties was the most important cost overruns factor, while owners ranked poor contractor management as the most important factor. Despite some difference in viewpoints among the three groups surveyed, there is a high degree of agreement among them with respect to their ranking of the factors. The overall ranking results indicate that the three groups felt that the major factors that can cause excessive groundwater project cost overruns in developing countries are poor contractor management, monthly payment difficulties, material procurement, poor technical performances, and escalation of material prices.

3. Methodology

A comprehensive list of causes of delays and cost overruns was compiled through literature review and by conducting a pilot study that sought advice from experienced construction practitioners. This process led to the identification of 110 factors that caused time overrun and 42 factors that caused cost overruns.

From previous studies, it was found that around 136 factors caused the time and cost overruns in engineering projects in various countries around the world and at different points of time (Arditi *et al.*, 1985; Assaf *et al.*, 1995; Chan and Kumaraswamy, 1996, 2002; Ogunlana *et al.*, 1996; Kaming *et al.*, 1997; Alwi and Hampson, 2003; Aibinu and Jagboro, 2002; Ahmed *et al.* (2003); Odeh and Battaineh, 2002; Enshassi *et al.*, 2003; Abudul-Rahman *et al.*, 2006, 2008; Alghbari *et al.*, 2007; Chimwaso, 2001; Faridi and El-Sayegh, 2006; Assaf and Al-Hejji, 2006). However, not all of these factors are consistent with the conditions in the Gaza Strip, e.g. the economic level, the type of projects, geographical region and political factors. Therefore, factors commensurate with the nature of construction projects and problems in the Gaza Strip were from the above 136, shortlisted for this paper. Modifications and new questions were added as a result of interview with experienced contractors to suit the local construction industry in the Gaza Strip. Based on previous studies as indicated in Table I, and personal interviews, the causes are grouped into 12 categories:

(1) project-related;

(2) contractors' responsibilities;

(3) consultants' responsibilities;

(4) owners' responsibilities;

Item	Spearman correlation coefficient	*P*-value (sig.)
Time overruns factors	0.980	0.000 (*)
Cost overruns factors	0.845	0.000 (*)

Note: Correlation is significant at the *0.01 level (one-tailed)

Table I.
Correlation coefficient of questionnaire and the total of this field at $N = 124$

(5) professional management;
(6) design and documentation;
(7) materials;
(8) execution;
(9) labour and equipment;
(10) contractual relationship;
(11) government relations; and
(12) external factors.

A questionnaire survey was then conducted to assess the relative importance of these potential causes from the perspective of contractors, consultants, and owners in Gaza Strip projects. The population base for this research included three groups, comprising a contractor group, a consultant group and owner group. The contractor companies had valid registration according to the Palestinian Contractors Union – PCU (2004) records. A total of 151 copies of the questionnaire were distributed to randomly selected contractors, consultants and owners. The samples were selected from publicly available sources, including PCU, association of consultants, and governmental and non-governmental organizations. The total numbers distributed to contractors, consultants and owners were 80, 33, and 38 questionnaires, respectively, of which 66, 27, and 31 were returned, respectively, (response rates of 82.5, 81.8, and 81.6 percent, respectively).

3.1 Structure validity of the questionnaire

Structure validity is the statistical test used to test the validity of the questionnaire structure by testing the validity of each field and the validity of the whole questionnaire. It measures the correlation coefficient between one field and all other fields of the questionnaire that have the same level of Likert scale. Table I shows the correlation coefficient for each category of the time overruns, cost overruns and the whole questionnaire. The *P*-values (sig.) are less than 0.05 or 0.01, so the correlation coefficients of all the fields are significant at $\alpha = 0.01$ or 0.05, and it can be said that the fields are valid to measure what is intended to fulfill the main aim of the study.

3.2 Reliability of the research

The reliability of an instrument is the degree of consistency with which it measures the attribute it is supposed to be measuring (Poilt and Hungler, 1985). The less variation an instrument produces in repeated measurements of an attribute, the higher its reliability. Table II shows high values of Cronbach's α for each category of the questionnaire and the entire questionnaire; and indicates high reliability of each field of the questionnaire, as well as high reliability for the entire questionnaire.

Table II.
Cronbach's α for each part of time and cost overruns of the questionnaire and all the questionnaire

Field	Cronbach's α
Time overruns	0.956
Cost overruns	0.907
Total	0.96

The results were in the ranges from 0.907 and 0.956. This range is considered high; and this assures the reliability of the questionnaire. Cronbach's α equals 0.96 for the entire questionnaire indicating a very good overall reliability. It can be concluded that the questionnaire was valid, reliable, and ready for distribution to the population sample.

3.3 Analysis of data

The collected data were analyzed using an importance index. The importance index was computed by the following formula:

$$I = \sum_{i=1}^{5} a_i x_i \ldots$$

where $I =$ importance index; $a_i = 0,1,2,3,4$ for $i = 0,1,2,3,4$, respectively; $x_i =$ frequency of the ith response given as a percentage of the total response for each cause; $i =$ response category index where; $a_i = 0,1,2,3,4$; for $x_1 =$ frequency of strongly not important response, $x_2 =$ frequency of not important response, $x_3 =$ frequency of neutral response, $x_4 =$ frequency of the important response and $x_5 =$ frequency of very important response.(Enshassi *et al.*, 2003).

The importance index for all the delay and cost overruns factors were calculated using the above formula. Next, the Spearman rank correlation coefficient was determined to study the strength of relationships between contractors, consultants, and owners rankings (Odeh and Battainaeh, 2002).

4. Results and analysis

Table III shows the summary of importance indices and ranks of delay factors/causes, that were investigated in this research from contractor, consultant and owner viewpoints. A total of 110 factors causing delays in the Gaza Strip have been categorized into 12 groups. The ranks are based on importance index values.

4.1 Contractors' views

Table III shows that respondent contractors ranked "the strikes, external or internal military attacks and border closures" in the first position with importance index (II = 92.80 percent). This indicates the high complexity of the construction industry in the Gaza Strip with an unstable security situation. In the case of border closures or strikes, the construction materials run out, prices increase dramatically, and suppliers may monopolize the remaining construction materials. The respondents of contractors ranked "lack of materials in markets" in the second position with importance index (II = 90.53 percent), which indicates the high importance of materials availability. Lack of materials in markets is one of the clearest factors that cause delay of the project. In the Gaza Strip, given the extraordinary political and economical situation, there are particular difficulties to import materials, especially because all the borders are controlled by Israel.

These results are similar to those of Ogunlana *et al.* (1996), Abudul-Rahman *et al.* (2006), Sambasivan and Soon (2007) and Alaghbari *et al.* (2007) that the lack of materials is one of the important causes of delay. But the result of Mezher and Tawil (1998), Odeh and Battaineh (2002), Assaf and Al-Hejji (2006), and Fong *et al.* (2006)

Table III.
Summary of importance index and rank of delay factors/causes

Group	Delay factors/causes of time overruns	Contractor II	Contractor Rank	Consultant II	Consultant Rank	Owner II	Owner Rank
External factors	Strikes, external or internal military action and border closures	92.80	1	93.52	1	96.77	1
Material	Lack of materials in markets	90.53	2	81.48	11	91.13	2
Material	Shortage of construction materials at site	90.15	3	65.74	41	87.10	3
Material	Delay of material delivery to site	89.77	4	87.96	4	82.26	5
Contractor's responsibilities	Cash problem during construction	83.08	5	92.59	2	83.06	4
Contractor's responsibilities	Poor site management	81.06	6	87.96	4	80.65	6
External factors	Poor economic conditions (currency, inflation rate, etc.)	79.92	7	81.48	11	73.39	19
Labor and equipment	Shortage of equipment at site	76.52	8	69.44	33	78.23	8
Contractor's responsibilities	Equipments and tool shortage on site	76.52	8	75.93	17	70.97	24
Owner's responsibilities	Owner delay in freeing the contractor financial payment's	76.52	8	38.89	102	33.06	104
Consultant's responsibilities	Low quality of materials	76.52	8	70.37	31	75.00	14
Consultant's responsibilities	Delay of materials approval by consultant	76.15	12	51.85	81	66.13	40
Material	No adherence with materials standards that is storage in the site	76.14	13	85.19	7	78.23	8
Labor and equipment	Shortage of site workers	76.14	13	63.89	46	75.00	14
Consultant's responsibilities	Waiting time for approval of tests and Poor inspection	75.77	15	53.70	74	70.97	24
Owner's responsibilities	Contract modifications (replacement and addition of – new work to the project and change in specifications)	75.76	16	71.30	29	67.74	36
Professional management	Poor judgment in estimating time and resources	75.00	17	53.70	74	66.13	40
Execution	Price escalation of materials and for manpower	75.00	17	72.22	24	69.35	30
Material	Poor material handling on site	73.86	19	65.74	41	70.16	28
Professional management	Poor provision of information to project participants	73.48	20	66.67	38	66.13	40
Labour and equipment	Skilled labour shortage	73.48	20	58.33	62	76.61	11
Owner's responsibilities	Owner – initiated variation	73.46	22	64.81	45	48.39	92
Contractor's responsibilities	Unethical behaviors used by contractors to achieve the highest possible level of profit	73.08	23	77.78	14	75.81	12

(*continued*)

Group	Delay factors/causes of time overruns	Contractor II	Contractor Rank	Consultant II	Consultant Rank	Owner II	Owner Rank
Government relations	Slow permits by government agencies	72.73	24	58.33	62	31.45	107
Material	Inappropriate/misuse material	72.73	24	69.44	33	62.90	56
Contractor's responsibilities	Low productivity of labour	72.35	26	52.78	78	58.87	68
Execution	Inappropriate construction methods	72.35	26	72.22	24	74.19	17
Contractual relationship	Major disputes and negotiations	71.97	28	88.89	3	72.58	21
Professional management	Inadequate construction planning	71.97	28	75.00	19	65.32	44
Professional management	Inadequate managerial skills for all parties	71.97	28	65.74	41	70.16	28
Project	Suspension of work by owner or contractor	71.97	28	83.33	10	77.42	10
Professional management	Low speed of decision making within each project team	71.97	28	62.04	49	71.77	23
Contractor's responsibilities	Dependence on a newly-graduated engineer to bear the whole responsibilities in the site	71.97	28	65.74	41	63.71	50
Professional management	Back of follow up for the project schedule and absence of continuous tracking.	71.97	28	72.22	24	59.68	66
Owner's responsibilities	Unrealistic contract durations imposed by owner	71.59	35	59.26	59	33.06	104
Design and documentation	Incomplete drawings	71.59	35	52.78	78	62.10	58
Contractor's responsibilities	Mistakes during construction	71.21	37	75.93	17	64.52	47
Professional management	Slow of inspection and testing procedure used in project	71.21	37	29.63	108	60.48	62
Contractor's responsibilities	Lack of experience on the part of the consultant's site-staff; (managerial and supervisory personnel)	70.83	39	58.33	62	74.19	17
Consultant's responsibilities	Slowness in giving instructions	70.83	39	40.74	101	68.55	33
Owner's responsibilities	Owner interference	70.83	39	52.78	78	29.03	108
Professional management	Bad preparing and approval of shop drawings	70.83	39	55.56	68	65.32	44
Professional management	Lack of personnel training and management support	70.83	39	53.70	74	57.26	71
Professional management	Lack of contractor's home office follows up	70.83	39	45.37	92	62.10	58
Government relations	Bureaucracy in government agencies	70.45	45	55.56	68	41.94	101
External factors	Problems with neighbors	70.45	45	54.63	73	68.55	33
Consultant's responsibilities	Centralization of decision-making process from consultant party	70.45	45	66.67	38	70.97	24
Material	Poor procurement programming of materials	70.45	45	66.67	38	63.71	50

(*continued*)

Table III.

Table III.

Group	Delay factors/causes of time overruns	Contractor II	Contractor Rank	Consultant II	Consultant Rank	Owner II	Owner Rank
Labor and equipment	Equipment availability and failure	70.45	45	63.89	46	64.52	47
Consultants responsibilities	Delays of payments	70.45	45	38.89	102	55.65	74
Consultant's responsibilities	Lack of technical and managerial skills of staff	70.08	51	37.96	105	65.32	44
External factors	Poor site conditions (location, ground, etc.)	70.08	51	74.07	20	52.42	84
Contractor's responsibilities	Poor distribution of labour	69.70	53	60.19	55	75.00	14
Contractor's responsibilities	Lack of subcontractor's skills	69.32	54	73.15	22	67.74	36
Consultant's responsibilities	Bad past history and reputation of the consultant (corruption)	69.32	54	29.63	108	50.00	90
Contractual relationship	Mistakes and discrepancies in contract documents	68.94	56	73.15	22	70.97	24
Contractor's responsibilities	Inadequate contractor experience	68.94	56	84.26	8	61.29	61
Design and documentation	Poor documentation and no detailed written procedures	68.56	58	59.26	59	63.71	50
Contractual relationship	Inappropriate overall organizational structure linking all parties to the project	68.56	58	72.22	24	68.55	33
Contractor's responsibilities	Insufficient number of staff (contractor)	68.46	60	87.04	6	79.84	7
Execution	Poor equipment choice/ineffective equipment	68.18	61	60.19	55	54.84	78
Consultant's responsibilities	Lack of job security for the consultancy team	68.18	61	62.04	49	60.48	62
Labour and equipment	Inaccurate prediction of equipment production rate	68.18	61	71.30	29	69.35	30
Professional management	Rework of bad quality performance	67.80	64	74.07	20	69.35	30
Execution	Highly bureaucratic organization	67.80	64	49.07	86	58.87	68
Consultants responsibilities	Bad contract management by consultant	67.42	66	37.04	107	63.71	50
Owner's responsibilities	Unrealistic owners initial requirements	67.05	67	59.26	59	20.16	110
Labour and equipment	Lack of maintenance for the equipment	66.92	68	61.11	52	66.13	40
Contractor's responsibilities	Contractor uncommitment to consultant instructions	66.67	69	77.78	14	67.74	36
Labour and equipment	Unskilled operators	65.91	70	47.22	90	60.48	62
Project	Discrepancies between contract documents	65.53	71	76.85	16	63.71	50
Design and documentation	Lack of designer's experience	65.53	71	48.15	88	54.84	78
Design and documentation	Unclear specifications	65.53	71	67.59	36	56.45	72
Project	Inflexibility of donor in giving appropriate periods for project implementation	65.15	74	60.19	55	46.77	97

(*continued*)

Group	Delay factors/causes of time overruns	Contractor II	Contractor Rank	Consultant II	Consultant Rank	Owner II	Owner Rank
Consultant's responsibilities	Little periodical sessions to address work problems	64.77	75	45.37	92	46.77	97
Owner's responsibilities	Lack of unified system for contracts, general conditions, and specifications of projects	64.77	75	42.59	97	45.83	99
Design and documentation	Poor design	64.39	77	42.59	97	52.42	84
Design and documentation	Delays in design work/lack of design information	64.39	77	55.56	68	55.65	74
Contractual relationship	Inappropriate type of contract used (traditional, design and-build, etc.)	64.39	77	51.85	81	48.33	95
Design and documentation	Not using systematic procedures	64.39	77	44.44	94	62.10	58
Execution	Project construction complexity	64.02	81	67.59	36	64.52	47
Contractor's responsibilities	Uncompromising attitude between parties	64.02	81	44.44	94	63.71	50
External factors	Changes in laws and regulations	63.64	83	59.26	59	54.84	78
Contractor's responsibilities	Spend some time to find sub-contractors company who is appropriate for each task	63.26	84	78.70	13	66.94	39
Project	Donor own policy in implementation methods and characteristics of the project	63.26	84	61.11	52	50.81	89
Contractor's responsibilities	Poor communications and misunderstanding	62.69	86	70.37	31	59.68	66
Contractor's responsibilities	Low harmony between technician team of contractor and consultant which may lead to controversy between both of them	62.50	87	72.22	24	62.90	56
Contractor's responsibilities	Use of unemployment programs in projects	62.50	87	50.93	84	75.81	12
Consultant's responsibilities	Absence of consultant's site staff	62.50	87	41.67	99	56.45	72
Owner's responsibilities	Owner has no priority/urgency to complete the project	62.12	90	50.00	85	26.61	109
Design and documentation	Slow drawing revision and distribution	61.36	91	53.70	74	49.19	91
Consultants responsibilities	Previous dispute between contractor and consultant	61.15	92	18.52	110	54.03	81
Government relations	Building regulations	60.98	93	68.52	35	48.39	92
Execution	Lack of a strong organizational culture	60.61	94	55.56	68	51.61	88
Contractor's responsibilities	Equipment allocation problems	60.61	94	63.89	46	60.48	62
Contractor's responsibilities	Failure in testing	60.61	94	84.26	8	73.39	19
Consultant's responsibilities	Lack of quality assurance/control	60.61	94	38.89	102	55.65	74
External factors	Hot and cold weather (weather conditions)	59.09	98	44.44	94	52.42	84

(*continued*)

Table III.

Table III.

Group	Delay factors/causes of time overruns	Contractor II	Contractor Rank	Consultant II	Consultant Rank	Owner II	Owner Rank
Contractor's responsibilities	Lack of protection of complete work	59.09	98	56.48	67	53.23	83
Contractor's responsibilities	Often changing sub-contractor company	58.33	100	60.19	55	72.58	21
Contractual relationship	Inappropriate type of contract used (traditional, design-and-build, etc.)	57.69	101	46.30	91	52.42	84
Execution	Too much overtime for labour	57.58	102	37.96	105	47.50	96
Contractor's responsibilities	Insufficient contractor competition	57.20	103	61.11	52	58.87	68
Project	Slow information flow between project team members	56.92	104	62.04	49	48.39	92
Contractual relationship	Inappropriate type of contract used (traditional, design-and-build, etc.)	57.69	101	46.30	91	52.42	84
Execution	Too much overtime for labour	57.58	102	37.96	105	47.50	96
Contractor's responsibilities	Insufficient contractor competition	57.20	103	61.11	52	58.87	68
Project	Slow information flow between project team members	56.92	104	62.04	49	48.39	92
Project	High quality of work required	56.06	105	41.67	99	55.65	74
Project	Inconsistency between the project and its environmental due to donor agenda	55.68	106	58.33	62	41.13	102
Owner's responsibilities	High quality of work	54.55	107	48.15	88	35.48	103
Project	Poor site safety	53.41	108	55.56	68	45.16	100
Labour and equipment	Ageing of site workers	53.41	108	51.85	81	54.03	81
Labour and equipment	Different political and factional affiliation of workers	35.98	110	57.41	66	32.26	106
Execution	Too much overtime for labour	57.58	102	37.96	105	47.50	96
Contractor's responsibilities	Insufficient contractor competition	57.20	103	61.11	52	58.87	68
Project	Slow information flow between project team members	56.92	104	62.04	49	48.39	92
Project	High quality of work required	56.06	105	41.67	99	55.65	74
Project	Inconsistency between the project and its environmental due to donor agenda	55.68	106	58.33	62	41.13	102
Owner's responsibilities	High quality of work	54.55	107	48.15	88	35.48	103
Project	Poor site safety	53.41	108	55.56	68	45.16	100
Labour and equipment	Ageing of site workers	53.41	108	51.85	81	54.03	81
Labour and equipment	Different political and factional affiliation of workers	35.98	110	57.41	66	32.26	106

seem contrary to this result. This is because in Saudi Arabia, Jordan, China, Indonesia, and Lebanon, there is no problem with materials. These countries have an open international market, and can import construction materials easily.

The third important factor ranked by respondents contractors was "the shortage of construction materials at site" (II = 90.15 percent). Contractor should have their own stores in order to be able to store required construction materials for the project. This behavior protects the contractor from any shortage of materials. The closures will lead to shortage of construction materials. If the contractor was not well prepared for such situations, the project will be delayed. The research results of Ogunlana *et al.* (1996), Abudul-Rahman *et al.* (2006), Sambasivan and Soon (2007) and Alaghbari *et al.* (2007) coincide with this result, in that the shortage of construction materials on site is a very important factor of delay. The result of Mezher and Tawil (1998), Odeh and Battaineh (2002), Assaf and Al-Hejji (2006), and Fong *et al.* (2006) seem contrary, but that is because the surveyed locations of these researchers have international and open markets, which means that construction materials are freely available.

"Delay of materials delivery to site" (II = 89.77 percent) was ranked as the fourth factor causing delay in this group. Any delay in the supply of materials to the site implies their mismanagement by contractors. The failure of supplying materials on time mean that human resources will be idle, and delay will result. The research results of Alaghbari *et al.* (2007) were similar in that "the delay of materials delivery to the site" is important factor of delay, but the results of Mezher and Tawil (1998), Al-Khalil and Al-Ghafly (1999a, b), Chan and Kumaraswamy (2002), and Assaf and Al-Hejji (2006) seem contrary.

Table III shows that respondent contractors ranked "cash problems during construction" in the fifth position with importance index (II = 83.08 percent). Any shortage of cash for the contractors will cause many problems such as slow progress and decline in productivity. Also, the contractors will not be able to purchase the needed equipment for work. Moreover, cash-flow problems also expanded to traders and suppliers, which in turn slows work further. This result coincides with the results of Arditi *et al.* (1985), Assaf *et al.* (1995), Ogunlana *et al.* (1996), Mezher and Tawil (1998), Al-Khalil and Al-Ghafly (1999a, b), Chan and Kumaraswamy (2002), Enshassi *et al.* (2003) and Alaghbari *et al.* (2007). The suitable description for this consensus is that cash is very necessary for contractors regardless of the location of research, economic level, or the culture of organization. But the contractors in the study of Ogunlana *et al.* (1996) in Thailand, did not consider cash as an important factor causing delays. The ability and experience of contractor in Thailand may perhaps explain this result.

The sixth important factor ranked by respondent contractors was poor site management (II = 81.06 percent). Poor management causes many constraints at the projects, such as poor follow-up of progress, incorrect distribution of works, non-commitment of site employees, poor monitoring of project, etc. which in turn contribute to delay the project. The results of Arditi *et al.* (1985), Assaf *et al.* (1995), Chan and Kumaraswamy (1996), Ogunlana *et al.* (1996), Kaming *et al.* (1997), Kumaraswamy and Chan (1998), Al-Khalil and Al-Ghafly (1999a, b), Odeh and Battaineh (2002), Enshassi *et al.* (2003), Abudul-Rahman *et al.* (2006) and Alaghbari *et al.* (2007) are similar to our findings. Poor site management and delayed activities interrupt the work sequence eventually leading to delays. The result of Mezher and

Tawil (1998) in Lebanon did not tally with this though, since managerial skills of staff seem better in Lebanon.

The seventh important factor ranked by respondent contractors was "poor economic conditions (currency inflation rate, etc.)" (II = 79.92 percent). The difficult economic situation in the Gaza Strip, and high reliance on donors to fund projects, contribute to increase the economic dependence of the local community. Fluctuation of the local currency rates and the high rates of inflation are also considered major factors that affect construction process.

4.2 Consultants' views

Table III shows that respondents consultants ranked "the strikes, external or internal military attacks and border closures" (II = 93.52 percent) as the first factor causing delay in this category. This result is consistent with that of the respondent contractors, but in case of consultants and owners, the proportion of the importance index is higher, implying that owners and consultants are more aware of these problems and give them greater priority. The respondent consultants ranked the cash-flow problem during construction (II = 92.59 percent) as the second factor to cause delays in this category. This result is in conformity with the respondent contractors and indeed owners, but in the case of consultants, the value of the importance index is higher.

The respondent consultants ranked "major disputes and negotiations" (II = 88.89 percent) as the third factor to cause delay in this category. Disputes are one of the important reasons for delay, generating mistrust among parties, reducing contractor compliance with instructions, and more rigorous checks by consultant. These developments put all project parties under stress, and increase the likelihood of delays. This result coincides with Sambasivan and Soon (2007), that major disputes and negotiations are major contributors to delay. At any time or place, disputes destroy relationships between parties and hence, prolong many processes.

The respondents consultants ranked the delay of materials delivery to site (II = 87.96 percent) as the fourth factor to cause delay in this category and the fifth factor to cause delay was poor site management (II = 87.96 percent). This result conforms to that of respondent contractors, but in the case of consultants, the value of the importance index is higher, which means that consultants are more technically aware of these elements and give them greater priority. The sixth important factor ranked by consultants was insufficient number of staff for contractor (II = 87.04 percent). This is a strong indication of the importance of technical staff for the contractor. The small number of staff causes a great burden on the technical staff at work, which in turn leads to poor quality of work, also increasing responsibilities, and disrupting concentration, also leading to delay. The problem is one of the major problems in Gaza Strip, where contractor often depends on one engineer to manage all technical and managerial activities of a project.

"Insufficient number of staff for contractor" has a high importance index as mentioned before, but in the research of Arditi *et al.* (1985), Ogunlana *et al.* (1996), Dayton and Erickson (2006), Alaghbari *et al.* (2007), Chan and Kumaraswamy (1996), Al-Khalil and Al-Ghafly (1999a, b), and Wang *et al.* (2003) this factor has a low rank. This contradiction was because that research was conducted in places with different conditions including more human resources, such as Turkey, Saudi Arabia, Hong Kong, Indonesia, Thailand, and Malaysia.

The seventh factor to cause delay was "no adherence with materials standards that is storage in the site" (II = 85.19 percent). The lack of commitment to specifications of materials is one of the most obvious factors to cause delay. Since the contractor loses time during the replacement of rejected materials with another accepted materials. In the case of using these materials, the consultant will reject these activities and the contractor is forced to rework the related activities. All of the previous reasons can cause delays of the project. "Inadequate contractor experience" (II = 84.26 percent) and "failure in testing" (84.26 percent) were together ranked as the eighth factors for delays by consultants in this group. This result explains that the experience of contractors in similar projects will allow them to execute the work more professionally and in shorter times, rather than contractors executing such projects for the first time. In the same context, it is obvious that the failure of any test of various materials or activities cause delays to the project. When failure occurs, the contractor would be obligated to re-do the works or replace the failed materials.

The results of Chan and Kumaraswamy (1996), Odeh and Battaineh (2002), Enshassi *et al.* (2003) and Dayton and Erickson (2006) agree with the findings of this research in that inadequate contractor experience is one of the major factors that cause delay. The geographical location or the culture of people did not affect this factor, so the results in the Gaza Strip and other countries are similar. "Failure of tests" has a high importance index and is considered as one of the important factors causing delay but Odeh and Battaineh (2002) and Abudul-Rahman *et al.* (2006) did not agree with this result. Failure of tests leads to rework, which needs new materials, staff and border closer tracking of the schedule. This is difficult in the Gaza Strip due to shortage of materials closures and inadequate experience of the contractors.

4.3 Owners' views

Table III shows that the respondents owners ranked "strikes, external attacks and border closures" (II = 96.77 percent) as the first factor to cause delays in this category. This result is in full conformity with the results of the respondent contractors and consultants, this similarity in opinions showing the importance of this factor. The respondent owners ranked the "lack of materials in markets" (II = 91.13 percent) as the second factor to cause delay in this category, while the third factor was shortage of construction materials at site (II = 87.1 percent). Owners ranked "cash problem during construction" (II = 83.06 percent) as the fourth factor to cause delay, and the fifth factor to cause delay was the delay of materials delivery to site, (II = 82.26 percent). These results are identical in terms of ranking with contractor and consultant views, again emphasizing the importance of these factors.

The sixth important factor was poor site management (II = 80.65 percent). This result is similar in sequence with those of the contractors and consultants, reflecting the importance of these factors. "Insufficient number of staff for contractor" (II = 79.84 percent) is the third ranked factor of time overruns, and is the same ranking as that of the consultants, so this indicates the high responsibilities lying with contractors' staff in terms of productivity.

4.3.1 Spearman rank correlation coefficient of the "time overruns" group. Table IV presents the Spearman correlation coefficient for all groups of time overruns for contractors, owners and consultants. For this group, the correlation coefficient between contractor and owner is 0.595 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 contractor and owner. The correlation coefficient between contractors and consultants is 0.421 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 contractor and consultant. In addition, the correlation coefficient between owners and consultants is 0.55 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 owner and consultant views.

4.4 Groups influencing time overruns at construction projects

Table V shows the ranks of 12 groups that influence delays at construction projects in the Gaza Strip, according to the viewpoints of contractors, consultants and owners.

4.4.1 Materials. The materials group of delays was ranked very high by all parties (contractors, consultants, and owners). This is due to the scarcity of resources in the Gaza Strip. Most construction materials are imported from other countries, especially from Israel and Egypt. It is worth mentioning that the three parties (contractors, consultants, and owner) ranked "the lack of materials in markets", and "shortage of construction materials at site" high among causes of delay. Closures of borders is considered as the most important factor causing the shortage of construction materials reflecting the extraordinary political situation in the Gaza Strip.

Table IV.
Correlation test of "time overruns" group among contractor, consultant, and owner

Group	Contractor and owner		Contractor and consultant		Owner and consultant	
	Correlation coefficient	*P*-value	Correlation coefficient	*P*-value	Correlation coefficient	*P*-value
Time overrun	0.595	0.000*	0.421	0.000*	0.550	0.000*

Note: *Correlation is significant at 0.05 level

Table V.
Index and rank concerning main groups of delay factors/causes

Group	Importance index (contractor)		Importance index (consultant)		Importance index (owner)	
	II	Rank	II	Rank	II	Rank
Material	80.02	1	74.07	1	76.31	1
External factors	72.66	2	67.90	4	66.40	3
Professional management	71.63	3	59.43	8	64.88	5
Owner's responsibilities	68.55	4	52.98	11	37.79	12
Contractual relationship	68.47	5	70.14	2	66.13	4
Consultant's responsibilities	68.28	6	43.30	12	60.36	7
Government relations	68.06	7	60.80	6	40.59	11
Contractor's responsibilities	67.57	8	70.09	3	68.3	2
Execution	66.50	9	59.26	9	60.23	8
Design and documentation	65.72	10	53.01	10	57.06	9
Labour and equipment	65.24	11	60.49	7	64.07	6
Project	60.59	12	61.21	5	53.07	10

4.4.2 External factors. The "external factors" group of delays was ranked high by all parties (contractors, consultants, and owners). This category consists of six factors causing delay, two of them are "strikes, external attacks and borders closures" and "poor economic conditions (currency, inflation rate, etc)." The three parties agreed that border closures is the major factor causing delay. Gaza Strip is an occupied territory that suffers from a poor political situation, successive strikes, and closure of borders which are under Israeli control. Frequent closures of borders lead to shortage of materials and equipment which are necessary for construction. Also, closures escalate the prices of these materials and contribute to economic inflation. Closure of borders largely contributes to the paralysis of construction related activities and consequently leads to project delays. On the other hand, closure of borders tempts traders to monopolize construction materials and equipment. As a result of the poor political situation, donors may suspended or terminate ongoing projects, or even stop their donations to Gaza Strip projects.

4.4.3 Professional management. The "professional management" group of delay factors was ranked high by contractors, relatively high by owners and low by consultants. In this group, contractors ranked "poor judgment in estimating time and resource" as the major factor, consultants in this group considered "inadequate construction planning" as the highest, but owners ranked "low speed of decision making" within each project team as the first factor. It seems that contractors and owners acknowledged that professional management plays an important role in the construction process. This reveals serious weaknesses in construction management and a lack of professionalism in the Gaza Strip. Many reputable engineering companies and construction firms do not have a human resources department to handle professionals and staff training. Therefore, many engineers and skilled personnel have a desperate need to develop their skills. However, the consultant group held different views and did not rank this group very high. This could be traced to a high proportion of experts and their organisations.

4.4.4 Owners' responsibilities. The contractor party has ranked this group in the fourth place. However, the consultants and the owners have ranked this group in the 11th and 12th place, respectively. This reflects the adversarial relationship between the contractors on the one hand and both consultants and owners on the other hand. It also indicates that owners and consultants did not see themselves as responsible for projects delay.

4.4.5 Contractual relationship. Both consultants and owners ranked this "delay causing" group high, while contractors ranked this group as relatively high. The three parties ranked "major disputes and negotiations" and "mistakes and discrepancies in contract" as the most important two factors in this group. The consultants' opinions show that the importance index of these factors is higher than owners and contractors. Relatively, factors relating to organizational disputes, mistakes and discrepancies in contract were more important to consultants and owners, especially for public projects in the Gaza Strip. The ranking of this group indicates the weakness of construction companies in understanding the contract conditions, and also reflects the professionalism of consultants and contractors in dealing with contractual relationship variables.

4.4.6 Consultants' responsibilities. Table V shows that the consultants ranked this group in the last place. This seems to be logical as the consultants are not willing to

admit or take the responsibility for projects delay. On the other hand, contractors and owners have similar view regarding consultants responsibilities for the delay. This can be traced to the fact that most projects in the Gaza Strip are managed by consultants.

4.4.7 Governmental responsibilities. It is not surprising that the public owners did rank this group in a high position. They believe that contractors and consultants are responsible for projects delay. This adversarial view will not help to reduce or eliminate delay factors. Blaming one another for delays is not very helpful for the success of any project; however, teamwork is required in order to reduce delays.

4.4.8 Contractors' responsibilities. The "contractor's responsibilities" group of delay factors was ranked high by both owners and consultants and relatively low by contractors. The three parties (contractors, consultants, and owners) agreed that cash-flow problems during construction and poor site management were the first and second ranking in this group. This indicates that the cash-flow problem is more critical than other variables in the group of contractor responsibilities. As expected, the contractors did not concentrate on the contractual factors of their work such as "failure in testing", "lack of protection of complete work," and "insufficient contractor competition," so the contractor's responsibilities group was ranked low by contractors. Hence, it can be concluded that all parties agree that "cash-flow" or, in general, "financial problems" is the major cause of delay in this group.

4.5 Factors causing cost overruns in construction projects

Table VI shows the ranking of all "cost overruns" causative factors that have been investigated in this research from contractor, consultant and owner viewpoints. A total of 42 factors causing cost overruns in Gaza Strip have been studied and discussed. The ranking was based on importance index values.

4.5.1 Contractors' view. Table VI shows that respondent contractors ranked "the increment of materials prices due to continue borders closures" in the first position with importance index (II = 89.39 percent). Materials are considered as the backbone of construction projects, which accounted for nearly 70 percent of the total value of project (Enshassi *et al.*, 2003). Therefore, any problem of materials availability would significantly affect the progress of the project. In case of borders closures, construction materials are drawn down, leading to inflated prices and monopolization by suppliers. The construction process gets suspended, and projects are exposed to cost overruns.

"Delay in construction, supply of raw materials and equipment by contractors" (II = 83.71 percent) was ranked as the second major factor to cause cost overruns in this group. Therefore, each day of delay costs the contractor additional losses such as overheads, cost of sub contractors and penalty. The delay in supplying necessary materials and equipment, lead to time losses and cost increases. In case of delay, the cost of materials or equipment may increase, or these goods may run out from the local markets. These results do not coincide with those of Morris (1990), in that "the delay in the construction supply of raw materials and equipment by contractors" is one of major factors of cost overruns, unlike in many other countries.

The third major factor ranked by respondent contractors was fluctuations in the cost of building materials (II = 81.06 percent). Fluctuation in prices has a significant impact on cost increase. Often the contractor estimates prices of the tender according to the present prices at local markets. It is known that the tendering phase is quite long. So, there is a higher chance of price fluctuation. In case of high prices, the contractor

Causative factors of cost overruns	Contractor II	Rank	Consultant II	Rank	Owner II	Rank
Increment of materials prices due to continuous border closures	89.39	1	94.44	2	91.13	1
Delay in construction, supply of raw materials and equipment by contractors	83.71	2	95.37	1	83.87	2
Fluctuations in the cost of building materials	81.06	3	87.96	6	80.65	4
Project materials monopoly by some suppliers	80.68	4	75.93	10	81.45	3
Unsettlement of the local currency in relation to dollar value	78.79	5	88.89	4	77.42	5
Low commitment of donor to compensate any bad result that may come from the bad economic and political situation	78.79	5	46.30	34	62.10	23
Donor policy in biding tender to the lowest price one	77.65	7	44.44	36	40.32	40
Design changes	76.92	8	69.44	16	75.81	6
Additional work at owner's request	76.52	9	66.67	20	72.58	12
Resources constraint: funds and associated auxiliaries not ready	76.52	9	89.81	3	73.39	10
Lack of cost planning/monitoring during pre and post-contract stages	75.38	11	82.41	7	74.19	9
Improvements to standard drawings during construction stage	75.00	12	81.48	8	72.58	12
Inadequate review for drawings and contract documents	74.24	13	64.81	22	73.39	10
Contractual claims, such as, extension of time with cost claims	73.48	14	74.07	14	75.00	7
Inaccurate quantity take-off	72.73	15	75.93	10	75.00	7
Technical incompetence, poor organizational structure, and failures of the enterprise	71.59	16	75.00	12	62.90	22
Lack of cost reports during construction stage	71.21	17	74.07	14	65.32	17
Inadequate project preparation, planning, and implementation	70.08	18	60.19	24	70.97	14
Delays in issuing information to the contractor during construction stage	69.70	19	60.19	24	62.10	23
Lack of coordination at design phase	68.94	20	68.52	18	60.48	28
Change in the scope of the project, in government policies	68.94	20	60.19	24	59.68	29
Some tendering maneuvers by contractors, such as front-loading of rates	68.56	22	88.89	4	64.52	21
Incomplete design at the time of tender	67.42	23	57.41	29	57.26	32
Bad allocation of labour inside the site	67.42	23	68.52	18	66.94	16
Delays in decisions making by Government, failure of specific coordinating	67.42	23	53.70	30	50.81	36
Delays in costing variations and additional works	67.31	26	65.74	21	65.32	17
Lack of experience of project type	67.05	27	75.00	12	64.52	19
Re measurement of provisional works	66.29	28	52.78	31	67.74	15
Wrong/inappropriate choice of site	65.15	29	41.67	38	47.58	38
Omissions and errors in the bills of quantities	64.77	30	77.78	9	61.29	26
Delay in project's handing over	64.62	31	58.33	28	64.52	19
Absence of managerial programs that help in saving materials inside the site	64.02	32	69.44	16	59.68	29

(*continued*)

Table VI.
Summary of importance index and rank of causes of cost overruns

Causative factors of cost overruns	Contractor II	Contractor Rank	Consultant II	Consultant Rank	Owner II	Owner Rank
Indecision by the supervising team in dealing with the contractor's queries resulting in delays	63.64	33	39.81	39	62.10	23
Lack of experience of local regulation	63.64	33	62.96	23	54.84	34
Changes in owner's brief	62.88	35	44.44	36	52.42	35
Inability of the contractor to be adopted properly with the projects environment	59.23	36	59.26	27	58.06	31
Labour unrest	57.20	37	45.37	35	60.83	27
Attracting skillful technicians for work	56.82	38	48.15	32	48.39	37
Lack of experience of technical consultants, inadequacy of foreign collaboration agreements, monopoly of technology	56.82	38	26.85	41	55.65	33
Unpredictable weather conditions	54.92	40	48.15	32	44.35	39
Long period of the project maintenance period "one year "	54.92	40	27.78	40	37.90	41
Over time work hours of supervising engineer are paid by the contractor	52.27	42	16.67	42	32.26	42

Table VI.

would face the problem of cost overruns at the execution phase. The fluctuation of prices in the Gaza Strip is associated with the Israeli economy and the surrounding countries. The research finding of Chimwaso (2001) seems different to this result, in that fluctuations in the cost of construction materials is one of the major factors causing cost over runs. Fluctuations in the cost of construction materials is associated with the location (country), the economic level, and the volume of required materials.

"Project materials monopoly by some suppliers" (II = 80.68 percent) was ranked as the fourth major factor of cost overruns by contractors in this group. Materials monopoly by suppliers is a result of borders closures or as a result of assigning "proxy" of materials to limited suppliers. So the contractor is forced to buy the required materials or equipments at high prices. In these cases the project will be exposed to cost overruns. The fifth cause of cost overruns was "unsettlement (instability) of the local currency in relation to dollar value" (II = 78.79 percent). Gaza Strip currency is new Israeli shekel (NIS). However, most construction projects are financed by the (US$). Any fluctuation in the exchange rate between dollars and shekels will affect the cost of the project. Also it is noted that most project expenses such as the purchase of material, renting of equipment, the salaries of employees and other indirect costs are in NIS. Therefore, cost overruns will certainly result from movements in these currencies.

"Low commitment of donor to compensate any bad result that may come from the bad economic and political situation" (II = 78.79 percent) was classified as the fifth factor to cause cost overruns. The Gaza Strip is exposed to military attacks of different types, hence construction project works may be destroyed partially or totally by these events. This difficult political and security situation affects the cost of projects, especially given that most donors do not recognize contractors' damage due to any external or internal military actions so the contractor is forced to remedy any such damages at his own expense.

Table VI shows that respondent contractors ranked unpredictable weather condition (II = 54.92 percent) as one of the "lowest" of three factors that cause cost overruns.

The Gaza Strip has good climatic conditions, so it is not exposed to any hurricanes or great leaps in temperature or snow fall, hence the weather does not affect the execution of construction projects and does not contribute to any damages of these projects. The long period assigned for the project maintenance – usually – one year (II = 54.92 percent) was also ranked as one of the "lowest" three factors causing cost overruns. When the period of maintenance is not long, the project was not exposed to substantial damage in this short period. So the cost of maintenance is low, and this result reflects the low impact of the maintenance period on cost overruns of the project. Respondent contractors as shown in Table VI classified the "over time work hours of supervisor engineers are paid by the contractor" (II = 52.27 percent) as the lowest factor causing cost overruns. This result shows that contractors benefit from the presence of supervising engineers during overtime periods, so this factor does not contribute to cost overruns.

4.5.2 Consultants' view. Table VI shows that the respondents consultants ranked "the delay in construction, supply of raw materials and equipments by contractor" (II = 95.37 percent) as the first factor causing cost overruns at this category, while the second-most important factor was "increment of materials prices due to continuous border closures" (II = 94.44 percent). This ranking is identical with that of the contractor, supporting the importance of these factors.

"Resources constraint: funds and associated auxiliaries not ready" (II = 89.81 percent) was the third factor of cost overruns ranked by consultant. The required resources of project (materials, equipment, people and others) are considered as the backbone of the construction project. In case of any unavailability of these resources, such as shortage of cash, the project would be exposed to cost overruns. The contractor who has sufficient cash does not have any resources constraints, and vice versa. Contractors should also store the needed project resources, and keep reserves to provide for closures, lack of resources, prices fluctuation, etc. This result did not agree with the findings of Morris (1990). This may be because the resource constraints in India are limited, where local materials are available and the economy is stable.

Respondent consultants consider "some tendering maneuvers by contractors, such as front–loading of rates" (II = 88.89 percent) as the fourth factor to cause cost overruns in this group. If noticed, the owner – according to contract – may cancel some items in the bill of quantities. In this case, the contractor may lose the profits expected from these items. Sometimes, the front loading rates are huge, and the cost overruns could also be huge. Unsettlement (instability) of the local currency in relation to dollar value (II = 88.89 percent) was also ranked as the fourth factor to cause cost overruns in this group, while the sixth one was fluctuation in the cost of building materials (II = 87.96 percent). These results are in full conformity with the respondent contractors but in the case of consultants, the proportion of the importance index is higher, which means that consultants focus more on these elements.

Table VI shows that respondents consultants ranked "the long period of project maintenance –usually – one year" (II = 27.78 percent) as one of the last three factors that cause cost overruns. This result is in full conformity with the results of the respondent' contractors. "The lack of experience of consultants, inadequacy of foreign collaboration agreements, monopoly of technology" (II = 26.85 percent) was ranked as one of the last three factors that cause cost overruns. The most appropriate interpretation of this rank is that the experience of the consultants in the Gaza Strip is

considered appropriate for projects to be executed. Also, since the mega projects implemented in the Gaza Strip are limited, donors may require that the local consultant should enter into a join venture with an international consultant. Usually, these projects are executed well and without cost overruns.

Respondents consultants as shown in Table VI classified "over time work hours of supervising engineer paid by contractor" (II = 16.67 percent) as the factor least likely to cause cost overruns. This result is in full conformity with that of respondent contractors but in case of consultants, the proportion of the importance index is higher, which means that consultant gives greater priority to these elements.

4.5.3 Owners' view. Table VI shows that respondents owners ranked "the increment of materials prices due to continuous borders closures" (II = 91.13 percent) as the first factor to cause cost overruns in this category. "The delay in construction, supply of raw materials and equipment by contractors" (II = 83.87 percent) was the second factor to cause cost overruns, the third being "project materials monopoly by some suppliers" (II = 81.45 percent), while "fluctuations in the cost of building materials" (II = 80.65 percent) was ranked as the fourth factor of cost overruns and the fifth factor ranked by owners was "unsettlement of the local currency in relation to dollar value" (II = 77.42 percent). This ranking is identical in sequence to those of contractors and consultants, hence supporting the importance of these factors.

"Design changes" (II = 75.81 percent) was ranked as the sixth factor in this category. Design changes are considered as one of major factor for increasing the cost of projects. Any modification in the design will affect the budget allocated for the project, the volume of required materials, type of required materials and needed labour. Sometimes, design changes cause the rework of already completed items, which means increased project durations and loss of materials. The research results of Kaming *et al.* (1997) and Chimwaso (2001) coincide with this result, in that design changes is one of the major factors to cause cost overruns. This agreement reflects the importance of these factors regardless of geographical location.

Table VI shows that respondent owners ranked "donor policy in building tender to the lowest price one" (II = 40.32 percent) as one of the last three factors. It is not necessary that the lowest price contractor could bear a cost overrun. The contractor tries to estimate a suitable cost for the project's items with suitable profit, so it is not logical that contractors estimate the prices only roughly. Thus, the policy of donors in awarding tenders to the "lowest price" tender is not a major factor for cost overruns. Also it is known that most projects in the Gaza Strip are awarded to the lowest price bidder, and not all are exposed to cost overruns. The lowest two factors, as ranked by owners in this category were "long period of the project maintenance period one year" (II = 37.90 percent) and "over time work hours of supervising engineer are paid by contractor" (II = 32.26 percent). These results conform with those of respondent contractors and consultants, this similarity in opinions supporting the results of the study.

4.5.3.1 Spearman rank correlation coefficient of the "cost overruns" group. Table VII presents the spearman correlation coefficients for groups of cost overruns as perceived by contractors, owners and consultants. For this group, the correlation coefficient between contractors and owners is 0.792 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 contractors and owners. The correlation coefficient between contractor and

consultant is 0.737 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 contractors and consultants. In addition, the correlation coefficient between owner and consultant is 0.819 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 owners and consultants.

5. Conclusion

A survey of contractors, consultants, and owners was conducted to elicit their opinions regarding causes of delays and cost overruns in construction projects in the Gaza Strip. The survey itself was based on delay and cost overrun factors drawn from findings research in other countries, together with special factors identified as potentially affecting the Gaza Strip. The survey showed that all three parties generally agree on the ranking of individual delay factors. Results indicated that the most important factors that cause time overruns as perceived by the three parties are: strikes, external or internal military action and border closures, lack of materials in markets, delay of material delivery to site, cash flow problem during construction, shortage of construction materials at site, poor site management, no adherence to materials standards relating to site storage, poor economic conditions (currency, inflation rate, etc.), major disputes and negotiations and suspension of work by owner or contractor.

The delay factors were categorized into 12 groups and also ranked. Results show that the materials related factors group was ranked in the first position by contractors, consultants and owners. Results also show that the external factors group has been ranked in the second position by contractors. Respondent consultants ranked the group of contractual relationships in the second position in the group of time overruns. Contractors' responsibility group was ranked in the second position by owners. The top ten factors that cause cost overruns as perceived by the three parties are: "increment of materials prices due to continuous border closures," "delay in construction, supply of raw materials and equipment by contractors," "fluctuations in the cost of building materials," "unsettlement of the local currency in relation to dollar value," "project materials monopoly by some suppliers," "resources constraint: funds and associated auxiliaries not ready," "lack of cost planning/monitoring during pre-and post contract stages," "improvements to standard drawings during construction stage," "design changes," and "inaccurate quantity take-off."

Contractors are recommended to be more aware about construction materials and their logistics. They are advised to purchase the construction materials at the beginning of work. It is also better for them to plan a time schedule for material delivery processes in order to avoid shortages of materials. Contractors are also recommended to monitor the quality of activities continuously and to set the required

Group	Contractor and owner		Contractor and consultant		Owner and consultant	
	Correlation coefficient	P-value	Correlation coefficient	P-value	Correlation coefficient	P-value
Cost overruns	0.792	0.000*	0.737	0.000*	0.819	0.000*

Note: *Correlation is significant at 0.05 level

Table VII. Correlation test of cost overruns group among contractors, consultants, and owners

quality system in the different activities of the project so as to avoid any mistakes that may lead to rework of activities, and finally time and cost overruns. Contractors are advised to set up stores for required construction materials, and especially for those that are scarce.

Contractors are recommended to have qualified technical staff with appropriate experience in order to be able to follow the different technical and managerial aspects of the project. The staff will be more effective if they includes enough and appropriate engineers, technicians, and foremen, so that the responsibilities would be shared. Contractors are advised to prepare a method statement and the schedule for the project that take into consideration both reality and project type. Also, it would be advisable to follow such a plan and update it from time to time, and to compare it with available resources. Contractors are recommended to have enough cash before beginning any project to minimize financial problems. Also, it is advisable to monitor financial spending because any financial problem can lead to time and cost overruns.

Owners are recommended to review and improve bid documents such as technical specifications, drawings, bill of quantities and ensure quality design of the project. This is because any discrepancy in bid documents will lead to disputes between projects parties and incur delays. Making progress payments to contractors on time is critical. Owners are recommended to assess materials available with the contractors and to assess their financial ability to implement the project. Also, owners are advised not to depend on lowest price contractors. Owners are advised to directly intervene in case of disputes between contractors and consultants to reduce the effects of such problems on project completion and the quality. Owners are recommended to facilitate the issue of licenses needed to begin project work; and also to minimize change orders in order to reduce any time and cost overruns. Improvements in the communication and coordination between local construction agencies and international funding can help to reduce financial problems.

Expediting the reviewing and approving of design documents, shop drawings, and payments to contractor can reduce any delay or cost overruns at the project. Consultants are advised to hire qualified technical staff to manage the project professionally, to overcome any technical or management problems. It is also advised for consultants to give suitable instructions in a timely manner, and to be able to answer any questions asked by contractors. Consultants are recommended to avoid centralization of decisions especially those related to design changes because this may lead to project delay. This may lead to marginalization of site engineers and further problems. Consultants should be flexible in evaluating contractor works, e.g. compromising where needed and possible, e.g. between the cost and higher (than required) quality.

It is recommended that the government constructs new warehouses in settlements of the Gaza Strip to store critical construction materials such as the cement, base course materials, aggregates, steel, and bitumen. This proposal is a partial solution to borders closures. The Palestinian Government may also be advised to find a new way to reduce entry problems, for example it may negotiate as soon as possible, for an appropriate entry point at a suitable border crossing to be opened up to permit smoother materials flow to the Gaza Strip. The government is advised to introduce a condition in each donor memorandum of understanding that obligates donors to compensate contractors for any losses that result from unforeseen and particularly difficult political problems.

This can be very important for the continuity of the construction industry in the Gaza Strip, apart from alleviating time and cost overruns. While some of the above recommendations are specific to the Gaza Strip, given the unfortunate proliferation of trouble-spots worldwide, some of the findings may also be tested and adapted where useful, in other regions.

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