

SIGNIFICANT FACTORS CAUSING TIME AND COST OVERRUNS IN CONSTRUCTION PROJECTS IN THE GAZA STRIP: CONTRACTORS' PERSPECTIVE

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Abstract

The construction industry is considered one of the most important industries in Palestine. However, most construction projects in the Gaza Strip have been exposed to time and cost overruns. The aim of this paper is to identify factors influencing time and cost overruns in construction projects in the Gaza Strip. A detailed questionnaire containing 110 factors that caused time delay and 42 factors that caused cost overruns was developed as a basis to invite inputs from contractors. 80 questionnaires were distributed to contractors and 66 were completed and returned representing an 83% response rate. The view of contractors has been analyzed to rank the causes of delay and cost overruns on an importance index. The most significant causes of time delay identified in this research are; strikes, border closures, lack of materials in markets, shortage of construction materials at site, delay of material delivery to site, cash-flow problems during construction, and poor site management. The most significant causes of cost overruns are; increase in material prices due to continuous border closures, delay in construction, supply of raw materials and equipment by contractors, fluctuations in the cost of building materials, project materials monopoly by suppliers, instability of the local currency in relation to dollar value, low commitment of donors to compensate any negative outcomes attributable to the poor economic and political situation, and donor policy in awarding tenders to the lowest bidder. Better project management procedures and the inclusion of an appropriate contingency allowance in the pre-contract estimate are recommended as a means of minimizing the adverse effect of construction delays.

Keywords

Construction, Time, Cost, Overruns, Contractors Survey, Gaza Strip.

INTRODUCTION

The construction industry is the vehicle through which physical development is achieved, and this is truly the locomotive of the national economy. The more resources, engineering know-how, labor, materials, equipment, capital, and market exchange 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 the planned budget and with high quality (Enshassi et al. 2003).

The successful execution of construction projects, and keeping them within estimated cost and prescribed schedules, depends on a methodology that requires sound engineering

judgment. To the dislike of owners, contractors and consultants, however, many projects experience extensive delays and thereby exceed initial time and cost estimates (Faridi and El-Sayegh 2006). This problem is more evident in the traditional or adversarial type of contracts in which the contract is awarded to the lowest bidder, i.e. the awarding strategy of the majority of public projects in developing countries/regions including the Gaza Strip.

Therefore, improving construction efficiency by means of cost-effectiveness and timeliness would certainly contribute to cost savings for the country as a whole. Efforts directed to cost and time effectiveness were associated with managing time and cost. These were investigated in this study via assessing time and cost overruns of construction projects in the Gaza Strip. Unlike developed countries, Palestine does not have a mature construction industry consisting of 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).

One of the main objectives and policies of any public or private sector dealing with execution of projects is to upgrade project performance, through reduction of costs, completion of projects within their assigned budget and time constraints, and improved quality. The construction industry in the Gaza Strip (average annual value of about US \$ 3 million) suffers from many problems which negatively affect time, cost and quality. Most of these factors are related to the political environment including:

- Border closures and consequential material shortages in markets
- Dependency on Israel and a few other countries for construction materials
- Continuing increase in material prices
- Dependency on donor countries for funding projects in the Gaza Strip
- Unstable economic situation and its correlation with the Israeli economy
- Unstable political situation.

This research sought to identify and assess factors causing time and cost overruns in the construction industry in the Gaza Strip. It is hoped that the results of the questionnaire survey would lead to recommendations to alleviate some of the prevailing problems associated with construction project management.

PREVIOUS STUDIES

Time overrun is defined as the extension of time beyond planned completion dates traceable to the contractors (Kaming et al. 1997). Cost overrun is defined as excess of actual cost over budget. Cost overrun is also sometimes called "cost escalation," "cost increase," or "budget overrun" (Zhu et al. 2004). The main types of delay have been stated by a number of researchers (Kumaraswamy and Chan 1995, Vidalis et al. 2002, Ahmed et al. 2003, Alaghabri et al. 2007, Al-Gahtani and Mohan 2007, Abdul-Rahman et al. 2008). These types are compensable delay, critical delay, non-critical delay, excusable delay and concurrent delay. A compensable delay is one where a contractor is entitled to financial recovery in the form of direct and indirect time related costs arising from an employer risk event. Critical delay is a delay to the progress of any activity on a critical path of a project, which causes delay to the project completion. Non-critical delay is a delay to a group of

isolated activities which are not on a critical path and which do not impact upon the planned completion date. Excusable delay is a delay for which a contractor will have relief from damages and potential financial entitlement depending on contractual circumstances. Non-excusable delay is a delay caused by contractor.

Concurrent delays occur when there are two or more independent delays during the same time period. Concurrent delays are significant when one is an employer risk event and the other a contractor risk event, the effects of which are felt at the same time. When two or more delay events arise at different times, but the effects of them are felt (in whole or in part) at the same time, this is more correctly termed 'concurrent effect' of sequential delay events. These types of delays have internal or external impacts on project processes. Internal causes of delay include those that emanate from the owner, designers, contractors, and consultants. External causes of delays originate from outside construction projects such as from utility companies, government, some subcontractors and suppliers, labor unions, nature, etc.

Several researchers (Chan and Kumaraswamy 1996, Ogunlana et al. 1996, Kaming et al. 1997, Alwi and Hampson 2003, Ahmed et al. 2003, Faridi and El-Sayegh 2006, Alaghbari et al. 2007, and Abdul-Rahman et al. 2008) identified factors causing delays in construction projects. Some of them have categorized these factors into four categories (groups): contractor's responsibility, consultant responsibility, owner's responsibility and external factors.

Factors attributed as contractor's responsibility are: delay in delivery of materials to site; shortage of materials on site; construction mistakes and defective work; poor skills and experience of labour; shortage of site labour; low productivity of labour; financial problems; coordination problems with others; lack of subcontractor's skills; lack of site contractor's staff; poor site management; and equipment and tool shortages on site.

Consultant's responsibilities included; absence of consultant's site staff; lack of experience on the part of the consultant; lack of experience on the part of the consultant's site staff; (managerial and supervisory personnel); delayed and slow supervision in making decisions; incomplete documents; and delayed instructions.

The factors that related to owner's responsibility are; lack of working knowledge; delayed decisions; lack of coordination with contractors; contract modifications (replacement and addition of new work to the project and change in specifications); and financial problems (delayed payments, financial difficulties, and economic problems).

The factors considered external factors are; lack of materials on the market; lack of equipment and tools on the market; adverse weather conditions; poor site conditions (location, ground, etc.); poor economic conditions (currency, inflation rate, etc.); changes in laws and regulations; transportation delays; and external work due to public agencies (roads, utilities and public services) (Alghbari et al. 2007).

Chan and Kumaraswamy (2002), Alwi and Hampson (2003), Assaf (2006), Odeh and Battaineh (2002) and Alghbari et al. (2007) classified factors that cause time overruns into eight groups (owner, contractor, consultant, material, labour and equipment, contract, contractual relationships and external factors. Ogunlana et al. (1996) examined

construction delays in a fast-growing economy: comparing Thailand with other economies. 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. Utilizing a questionnaire survey of 61 construction projects, the authors identified and assessed the impact of delays on the delivery of construction projects.

Ahmed et al. (2003) found that the most common type of delay in their US study was excusable compensable at 48%, followed by non-excusable delays. In most of the cases, it was found that when the contractor has the responsibility, the type of delay was most commonly non-excusable; when the responsibility was the owner's or the consultant's it was an excusable compensable delay; and when the government was responsible, the delay was considered excusable compensable.

Alaghbari et al. (2007) examined the factors that cause delay in construction projects in Malaysia. The results of the analysis show that from a total of 31 variables examined, separated into four categories by responsibility, the major factors causing delay in construction projects are factors due to the contractor, followed by factors due to the consultant, factors due to the owner, and finally external factors. The main finding of the study is that financial factors cause the most delays in construction projects in Malaysia. Coordination problems are considered to be the second-most important factor causing delay in construction projects, followed by materials problems.

Previous research has attempted to unveil reasons for the disparity between the tender sum and the final account. Four cost overruns factors were identified from the existing research findings Morris et al. (1990), Kaming et al. (1997) and Chimwaso (2001). These are: design changes, inadequate planning, unpredictable weather conditions; and fluctuations in the cost of building materials. Chimwaso (2001) evaluated ten projects to assess their cost performance. The results have shown that seven out of ten projects had reported cost overruns. The factors that influence cost overruns have been identified and ranked in order of significance. These factors have further been classified under categories according to the format of final account reports. Classifying them into categories helps to deal with them effectively. The four categories arrived at were: variations, measurement of provisional works, contractual claims and fluctuations in the cost of labour and materials; with variations being the most significant.

Frimpongs et al. (2003) studied 26 factors that cause cost overruns in construction of ground water projects in Ghana. They sent 55 questionnaires to owners, 40 to contractors and 30 to consultants. According to the contractors and consultants, monthly payments difficulties from agencies was the most important cost overruns factor, while owners ranked poor contractor management as the most important factor. Despite some difference in viewpoints held by 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 cause excessive groundwater project overruns in developing countries are poor contractor management, monthly payment difficulties from agencies, material procurement, poor technical performance, escalation of material prices according to their degree of influence.

*Significant Factors Causing Time and Cost Overruns in Construction Projects in the Gaza Strip:
Contractors' Perspective*

Table 1 illustrates the factors that influence time overruns which were collected from a review of previous literature. The factors are categorized into twelve groups. Table 2 illustrates the factors of cost overruns from previous literature (Chan and Kumaraswamy (1996, 2002), Ogunlana et al. 1996, Kaming et al 1997, Alwi and Hampson 2003, Elinwa and Joshua 2001, Ahmed et al. 2003, Odeh et al. 2002, Enshassi et al. 2003, Abudul-Rahman et al. 2006, Alaghbari et al. 2007, Abudul-Rahman et al. 2008, Morris et al. 1990, Chimwaso 2001).

Table 1: Factors causing time overruns

Country where survey was conducted	Hong-Kong	Thailand	Indonesia	Indonesia	Nigeria	U.S.A (Florida)	Hong Kong	Jordan	Palestine (Gaza Strip)	New Zealand	Malaysia	Malaysia
Factors causing project delays	Chan and Kumara-swamy 1996	Ogunlana et al 1996	Kaming et al 1997	Alwi et al 1999	Elinwa et al 2001	Ahmed et al 2002	Chan and Kumara-swamy 2002	Odeh et al 2002	Enshassi et al 2003	Ying et al 2005	Abudul-Rahman et al 2006	Alghbari et al 2007
Contractor's responsibilities												
Insufficient number of staffs						*						
Spend some time to find sub-contractors company who is						*						
Often changing Sub-contractors Company						*						
Harvest time						*						
low productivity of labour	*		*				*	*				*
Lack of subcontractor's skills	*			*	*		*	*				*
Lack of subcontractor's staff												*
Poor site management	*			*			*	*			*	*
Equipments and tool shortage on site			*	*							*	*
Lack of trades skill				*								
Poor distribution of labour				*								
Mistakes during construction								*				*
Inadequate contractor experience	*							*				
Deficiencies in organization		*										
Deficiencies in coordination between parties- (Contractor, Consultant and Owner)		*		*	*	*						*
Uncompromising attitude between parties		*				*						
Equipment allocation problems		*										
Lack of protection of complete work											*	
Failure in testing											*	
Human error									*		*	
Poor communications and misunderstanding	*							*		*	*	

Table 1 : Factors causing time overruns (cont.)

Country where survey was conducted	Hong-Kong	Thailand	Indonesia	Indonesia	Nigeria	U.S.A (Florida)	Hong Kong	Jordan	Palestine (Gaza Strip)	New Zealand	Malaysia	Malaysia
Factors causing project delays	Chan and Kumara-swamy 1996	Ogunlana et al 1996	Kaming et al 1997	Alwi et al 1999	Elinwa et al 2001	Ahmed et al 2002	Chan and Kumara-swamy 2002	Odeh et al 2002	Enshassi et al 2003	Ying et al 2005	Abdul-Rahman et al 2006	Alghbari et al 2007
Professional Management												
Low speed of decision making within each project team	*	*		*		*		*		*		*
Inadequate construction planning	*	*	*	*			*	*	*	*		
Preparation and approval of shop drawings									*			
Lack of tracking of schedules									*			
Lack of personnel training and management support									*			
Poor judgment in estimating time and resources									*			
Lack of contractor's home office follows up									*			
Inspection and testing procedure used in project									*			
Rework of bad quality performance									*			
Design and Documentation												
Poor quality site documentation				*								
Unclear specifications				*								
Poor design				*					*		*	
Incomplete drawings		*										*
Poor documentation and no detailed written procedures											*	*
Using systematic procedures											*	
Delays in design work / lack of design information							*					
Lack of designer's experience							*					
Materials												
Delay of material delivery to site		*	*	*	*	*			*			*
Poor material handling on site		*		*								
Inappropriate / misuse material		*		*								
Poor procurement programming of materials	*											
Shortage of materials in markets	*								*			*
Shortage of construction materials		*		*								*
Low quality of materials		*							*			
Too much overtime for labour				*								
Inappropriate construction methods				*				*				

Significant Factors Causing Time and Cost Overruns in Construction Projects in the Gaza Strip: Contractors' Perspective

Table 1: Factors influencing time overruns (cont.)

Country where survey was conducted	Hong-Kong	Thailand	Indonesia	Indonesia	Nigeria	U.S.A (Florida)	Hong Kong	Jordan	Palestine (Gaza strip)	New Zealand	Malaysia	Malaysia
Factors causing project delays	Chan and Kumara-swamy 1996	Ogunlana et al 1996	Kaming et al 1997	Alwi et al 1999	Elinwa et al 2001	Ahmed et al 2002	Chan and Kumara-swamy 2002	Odeh et al 2002	Enshassi et al 2003	Ying et al 2005	Abudul-Rahman et al 2006	Alghbari et al 2007
Materials												
Poor equipment choice/ infective equipment				*								
Highly bureaucratic organization						*						
Project construction complexity	*											
Execution												
Price escalation		*										
Lack of a strong organizational culture										*		
Labor supply								*				
Equipment availability and failure		*				*		*				
Shortage of site workers		*							*			*
Inaccurate prediction of equipment production rate		*	*									
Skilled labor shortage	*	*	*						*			*
Lack of equipment				*							*	*
lack of maintenance for the equipment				*	*						*	
Weak motivation									*			
Low productivity									*			
Unskilled operators									*			
Contractual relationship												
Major disputes and negotiations								*				
Inappropriate overall organizational structure linking-all parties to the project								*				
Mistakes and discrepancies in contract documents								*				
Inappropriate type of contract							*					
Government relations												
Building Regulations									*			
Bureaucracy in Government agencies									*			
Slow permits by Govt. agencies		*										
External factors												
Poor site conditions (location, ground, etc.)	*	*	*	*			*	*	*			*

Table 1: Factors causing time overruns (cont.)

Country where survey was conducted	Hong-Kong	Thailand	Indonesia	Indonesia	Nigeria	U.S.A (Florida)	Hong Kong	Jordan	Palestine (Gaza Strip)	New Zealand	Malaysia	Malaysia
Factors causing project delays	Chan and Kumaraswamy 1996	Ogunlana et al 1996	Kaming et al 1997	Alwi et al 1999	Elinwa et al 2001	Ahmed et al 2002	Chan and Kumaraswamy 2002	Odeh et al 2002	Enshassi et al 2003	Ying et al 2005	Abdul-Rahman et al 2006	Alghbari et al 2007
External factors												
Poor economic conditions (currency, inflation rate, etc.)								*				*
Changes in laws and regulations												*
Transportation delays												*
External work due to public agencies												*
Problems with neighbors												*
Strikes, Israeli attacks and border closures									*			
Hot and cold weather			*		*	*			*			

Significant Factors Causing Time and Cost Overruns in Construction Projects in the Gaza Strip: Contractors' Perspective

Table 2: Factors causing cost overruns

Country where survey was conducted	India	Indonesia	Botswana
Factors causing cost overruns	Morris et al 1990	Kaming et al 1997	Chimwaso 2001
Design changes			*
Inadequate planning			*
Unpredictable weather conditions		*	*
Fluctuations in the cost of building materials			*
Lack of coordination at design phase			*
Inadequate review			*
Incomplete design at the time of tender			*
Additional work at owner's request			*
Changes in owner's brief			*
Lack of cost planning/monitoring during pre-and post contract stages			*
Site/poor soil conditions			*
Adjustment of prime cost and provisional sums			*
Remeasurement of provisional works			*
Logistics due to site location			*
Lack of cost reports during construction stage			*
Delays in issuing information to the contractor during construction stage			*
Technical omissions at design stage			*
Contractual claims, such as, extension of time with cost claims			*
Improvements to standard drawings during construction stage			*
Indecision by the supervising team in dealing with the contractor's queries resulting in delays			*
Omissions and errors in the bills of quantities			*
Delays in costing variations and additional works			*
Ignoring items with abnormal rates during tender evaluation, especially items with provisional quantities			*
Some tendering maneuvers by contractors, such as front-loading of rates			*
Materials cost increased		*	
Labour cost increased due to environment restriction		*	
Lack of experience of project location		*	
Lack of experience of project type		*	
Lack of experience of local regulation		*	
Inadequate project preparation, planning and implementation	*		

Table 2: Factors causing cost overruns (cont.)

Country where survey was conducted	India	Indonesia	Botswana
Factors causing cost overruns	Morris et al 1990	Kaming et al 1997	Chimwaso 2001
Delay in construction, supply of raw Materials and equipment by contractors	*		
Resources constraint: funds foreign, exchange power, and associated auxiliaries not ready	*		
Delays in decisions making by Government, failure of specific coordinating	*		
Wrong / inappropriate choice of site	*		
Technical incompetence, poor organizational structure, and failures of the enterprise other than (1) above	*		
Labour unrest	*		
Natural calamities, Wars	*		
Lack of experience of technical consultants, inadequacy of foreign collaboration agreements, monopoly of technology	*		

METHODOLOGY

This research studied 110 factors known to commonly cause time overruns and 42 factors that influence cost overruns. These factors were identified through a literature review, personal interviews with a number of contractors and the experiences of the researchers. From previous studies, it was found that a 136 factors had been identified that cause time and cost overruns in engineering projects in various countries around the world (Tables 1 and 2). 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, only factors commensurate with the nature of construction projects and problems in the Gaza Strip were selected. Modifications and new questions were added as a result of interviews with experienced contractors to modify the questionnaire to suit the local construction industry in the Gaza Strip. Based on previous studies as indicated in Table 1, and personal interviews, the causes are grouped into twelve categories: (1) project-related, (2) contractors' responsibilities, (3) consultants' responsibilities, (4) owners' responsibilities, (5) professional management, (6) design and documentation, (7) materials, (8) execution, (9) labor and equipment, (10) contractual relationship, (11) government relations, and (12) external factors.

A questionnaire was developed in order to evaluate the importance index of the identified factors. The target population comprised the contracting companies with valid registration in the Palestinian Contractors Union (PCU) in the following fields: building, roads, water and sewage, electro-mechanical and public works. Statistical methods were used to calculate an appropriate sample size for the contractors.

Equation 1 was used to determine the sample size of the unlimited population (Creative Research System, 2008):

$$SS = \frac{Z^2 * P * (1 - P)}{C^2} \quad \text{Equation 1}$$

Where SS = Sample size

Z = Z value (e.g. 1.96 for 95% confidence level)

P = percentage picking a choice, expressed as a decimal (0.50 used for sample size needed).

C = margin of error (9%)

$$SS = \frac{1.96^2 \times 0.5 \times (1 - 0.5)}{0.09^2} = 118.57 \approx 119 \text{ contractors}$$

Correction for Finite Population

$$SS_{new} = \frac{SS}{1 + \frac{SS - 1}{POP}} \quad \text{Equation 2}$$

Where POP is the population = 139 match the proposed classes of contracting companies

$$SS_{new} = \frac{119}{1 + \frac{119 - 1}{139}} = 64.36 \approx 64$$

80 questionnaires were distributed to contractors. 66 responded to the survey, yielding a response rate of 82.5 %. The high response rate reflects the importance and the effects of delays on a contractor. The contractor is the first affected/ aggrieved party from time and cost overruns of the project.

Structure validity is the usual statistical test used to test the validity of the questionnaire structure by testing the validity of each field and also the validity of the whole questionnaire. As shown in Table 3, the p-values (Sig.) are less than 0.01, so the correlation coefficients of all the fields are significant at $\alpha = 0.01$, so it can be said that the fields are valid for measuring what was intended in the main aim of the study.

Table 3: Correlation coefficient of Questionnaire and the total of this field at N= 124

Item	Spearman Correlation Coefficient	P-Value (Sig.)
Time overruns factors	0.980	0.000(**)
Cost overruns factors	0.845	0.000(**)

** . Correlation is significant at the 0.01 level (1-tailed).

The reliability of an instrument is the degree of consistency which measures the attribute it is supposed to be measuring (Poilt and Hungler, 1985). Table 4 shows high values of Cronbach's Alpha for each category of the questionnaire and the entire questionnaire. This confirms the high reliability of each field of the questionnaire and high reliability for the entire questionnaire.

Table 4: Cronbach's Alpha for each Part of time and cost overruns in the questionnaire, and also for the whole the questionnaire

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

The results were in the range from 0.907 and 0.956. This range is considered high; and ensures the reliability of the questionnaire. In our study, the overall Cronbach's Alpha (for the entire questionnaire) was 0.96, indicating very good overall reliability.

The five-point scale was adopted to assess the effect of each factor on project delay and cost overruns, where '1' represented the lowest level of effect, and '5' the highest level of effect. This scale was transformed to relative importance indices for each factor, to determine the ranks of the different causes. The importance index is used to rank the factors for time overruns and cost overruns separately. Another importance index is also used to rank the groups of time overruns in the questionnaire.

$$II = \sum_{i=1}^5 a_i x_i \dots\dots\dots \text{(Enshassi et al. 2003, Wanous et al 2003)}$$

Where II = importance index

$a_i = 1,2,3,4,5$ for $i = 1,2,3,4,5$ respectively

x_i = frequency of the i^{th} response given as a percentage of the total response for each cause.

i = response category index where

$a_i = 1,2,3,4,5$; 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 'important' response and x_5 = frequency of 'very important' response.

RESULTS AND ANALYSIS

Ranking of all factors causing time overruns (delay)

Table 5 shows the ranks of all factors causing time overruns that have been investigated in this research from the contractors' perspective. A total of 110 factors causing time overruns in the Gaza Strip have been categorized into 12 groups. The ranking was based on importance index values. The most six important causes will be briefly discussed.

Significant Factors Causing Time and Cost Overruns in Construction Projects in the Gaza Strip: Contractors' Perspective

Table 5: Summary of Importance Index and rank for the causes of time overruns

Group	Factors of time overruns	II	Rank
External factors	Strikes, Israeli attacks and border closures	92.80	1
Materials	Lack of materials in markets	90.53	2
Materials	Shortage of construction materials at site	90.15	3
Materials	Delay of material delivery to site	89.77	4
Contractor's responsibilities	Cash problem during construction	83.08	5
Contractor's responsibilities	Poor site management	81.06	6
External factors	Poor economic conditions (currency, inflation rate, etc.)	79.92	7
Labor and equipment	Shortage of equipment at site	76.52	8
Contractor's responsibilities	Equipments and tool shortage on site	76.52	8
Owner's responsibility	Owner delay in freeing the contractor financial payment's	76.52	8
Consultant's responsibilities	Low quality of materials	76.52	8
Consultant's responsibilities	Delay of materials approval by consultant	76.15	12
Materials	No adherence with materials standards that is storage in the site	76.14	13
Labor and equipment	Shortage of site workers	76.14	13
Consultant's responsibilities	Waiting time for approval of tests and Poor inspection	75.77	15
Owner's responsibility	Contract modifications (replacement and addition of – new work to the project and change in specifications)	75.76	16
Professional Management	Poor judgment in estimating time and resources	75.00	17
Execution	Price escalation of materials and for manpower	75.00	17
Materials	Poor material handling on site	73.86	19
Professional Management	Poor provision of information to project participants	73.48	20
Labor and equipment	Skilled labor shortage	73.48	20
Owner's responsibilities	Owner – initiated variation	73.46	22
Contractor's responsibilities	Unethical behaviors used by contractors to achieve the highest possible level of profit	73.08	23
Government relations	Slow permits by Govt. agencies	72.73	24
Materials	Inappropriate / misuse material	72.73	24
Contractor's responsibilities	Low productivity of labour	72.35	26
Execution	Inappropriate construction methods	72.35	26
Contractual relationship	Major disputes and negotiations	71.97	28
Professional Management	Inadequate construction planning	71.97	28
Professional Management	Inadequate managerial skills for all parties	71.97	28
Project-related	Suspension of work by owner or contractor	71.97	28
Professional Management	Low speed of decision making within each project team	71.97	28
Contractor's responsibilities	Dependence on a newly – graduated engineer to bear the whole responsibilities in the site	71.97	28
Professional Management	Back of follow up for the project schedule and absence of continuous tracking.	71.97	28
Owner's responsibilities	Unrealistic contract durations imposed by owner	71.59	35
Design and Documentation	Incomplete drawings	71.59	35
Contractor's responsibilities	Mistakes during construction	71.21	37
Professional Management	Slow of inspection and testing procedure used in project	71.21	37
Contractor's responsibilities	Lack of experience on the part of the consultant's site- staff; (managerial and supervisory)	70.83	39
Consultant's responsibilities	Slowness in giving instructions	70.83	39
Owner's responsibilities	Owner interference	70.83	39
Professional Management	Bad preparing and approval of shop drawings	70.83	39
Professional Management	Lack of personnel training and management support	70.83	39
Professional Management	Lack of contractor's home office follows up	70.83	39
Government relations	Bureaucracy in Government agencies	70.45	45
External factors	Problems with neighbors	70.45	45
Consultant's responsibilities	Centralization of decision making process from consultant party	70.45	45
Materials	Poor procurement programming of materials	70.45	45

Table 5 : Summary of Importance Index and rank for the causes of time overruns(cont.)

Group	Factors of time overruns	II	Rank
Labor and equipment	Equipment availability and failure	70.45	45
Consultants responsibility	Delays of payments	70.45	45
Consultant's	Lack of technical and managerial skills of staff	70.08	51
External factors	Poor site conditions (location, ground, etc.)	70.08	51
Contractor's	Poor distribution of labor	69.70	53
Contractor's	Lack of subcontractor's skills	69.32	54
Consultant's	Bad past history and reputation of the consultant (corruption)	69.32	54
Contractual relationship	Mistakes and discrepancies in contract documents	68.94	56
Contractor's	Inadequate contractor experience	68.94	56
Design and	Poor documentation and no detailed written procedures	68.56	58
Contractual relationship	Inappropriate overall organizational structure linking- all parties to the project	68.56	58
Contractor's	Insufficient number of staffs (contractor)	68.46	60
Execution	Poor equipment choice/ infective equipment	68.18	61
Consultant's	Lack of job security for the consultancy team	68.18	61
Labor and equipment	Inaccurate prediction of equipment production rate	68.18	61
Professional Management	Rework of bad quality performance	67.80	64
Execution	Highly bureaucratic organization	67.80	64
Consultants responsibility	Bad contract management by Consultant	67.42	66
Owner's responsibilities	Unrealistic owners initial requirements	67.05	67
Labor and equipment	lack of maintenance for the equipment	66.92	68
Contractor's	Contractor un commitment to consultant instructions	66.67	69
Labor and equipment	Unskilled operators	65.91	70
Project-related	Discrepancies between contract documents	65.53	71
Design and	Lack of designer's experience	65.53	71
Design and	Unclear specifications	65.53	71
Project-related	Inflexibility of donor in giving appropriate periods for project implementation	65.15	74
Consultant's	Little periodical sessions to address work problems	64.77	75
Owner's responsibilities	Lack of unified system for contracts, general conditions, and specifications of projects	64.77	75
Design and	Poor design	64.39	77
Design and	Delays in design work / lack of design information	64.39	77
Contractual relationship	Inappropriate type of contract used (e.g. traditional, design- and-build, etc.)	64.39	77
Design and	Not using systematic procedures	64.39	77
Execution	Project construction complexity	64.02	81
Contractor's	Uncompromising attitude between parties	64.02	81
External factors	Changes in laws and regulations	63.64	83
Contractor's responsibilities	Spend some time to find sub-contractors company who is appropriate for each task	63.26	84
Project-related	Donor own policy in implementation methods and characteristics of the project	63.26	84
Contractor's	Poor communications and misunderstanding	62.69	86
Contractor's responsibilities	Low harmony between technician team of contractor and consultant which may lead to controversy between both of them	62.50	87
Contractor's	Use of unemployment programs in projects	62.50	87
Consultant's	Absence of consultant's site staff	62.50	87
Owner's responsibility	Owner has no priority/ urgency to complete the project	62.12	90
Design and	Slow drawing revision and distribution	61.36	91
Consultants responsibility	Previous dispute between contractor and consultant	61.15	92
Government relations	Building regulations	60.98	93

Table 5: Summary of Importance Index and rank for the causes of time overruns(cont.)

Execution	Lack of a strong organizational culture	60.61	94
Contractor's	Equipment allocation problems	60.61	94
Contractor's	Failure in testing	60.61	94
Consultant's	Lack of quality assurance / control	60.61	94
External factors	Hot and cold weather (weather conditions)	59.09	98
Contractor's	Lack of protection of complete work	59.09	98
Contractor's	Often changing sub-contractors company	58.33	100
Contractual relationship	Inappropriate type of contract	57.69	101
Execution	Too much overtime for labour	57.58	102
Contractor's	Insufficient contractor competition	57.20	103
Project-related	Slow information flow between project team members	56.92	104
Project-related	High quality of work required	56.06	105
Project-related	Inconsistency between the project and its environmental due to donor agenda	55.68	106
Owner's responsibility	High quality of work	54.55	107
Project-related	Poor site safety	53.41	108
Labor and equipment	Ageing of site workers	53.41	108
Labor and equipment	Different political and factional affiliation of workers	35.98	110

Table 5 shows that respondents contractors ranked the “strikes, and border closures” in the first position by importance index (I.I = 92.80%). This reflects the complexity of the construction industry in the Gaza Strip with its unstable security situation. In the case of border closures or strikes, the construction materials run out in the markets, prices increase dramatically, and suppliers may ‘engineer’ a monopoly or cartel (with artificially high prices) of the affected construction materials.

The respondents ranked "lack of materials in markets" in the second position by importance index (I.I = 90.53 %). Materials are of utmost importance in any project. Lack of materials in markets is one of the clearest factors that cause project delays. In the Gaza Strip, the extraordinary political and economic situation leads to great difficulties in obtaining materials, particularly as the Palestinians have no control over their borders.

This result coincides with the findings of Ogunlana et al. (1996), Abudul-Rahman et al. (2006), Sambasivan and Soon (2007), and Alaghbari et al. (2007), in that the lack of materials is one of the important causes of delay. The results of Mezher et al. (1998), Alwi and Hampson (2003), Odeh and Battaineh (2002), Assaf et al. (2006), and Fong et al. (2006) are contrary to this particular result. In Saudi Arabia, Jordan, China, Indonesia and Lebanon, there aren't any problems with materials supply. These countries have open international markets, and so can procure construction materials easily. , However, in the Gaza Strip the market is limited and border closures escalate the problems with materials.

The third important factor ranked by respondent contractors was "the shortage of construction materials at site" (I.I = 90.15 %). Contractors should have their own stores in anticipation of border closures which will lead to shortage of construction materials. If the contractor is not well prepared for such situations, with buffer stocks, 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) concur with this result, that

the shortage of construction materials at site is a very important cause of delay. This result reflects the importance of materials in the construction process. The results of Mezher et al. (1998), Alwi and Hampson (2003), Odeh et al. (2002), Assaf et al. (2006), and Fong et al. (2006) contradict this result. The countries/ locations surveyed by these researchers involve international open markets, such as Thailand, which implies that construction materials should be readily available.

"Delay of materials delivery to site" (I.I = 89.77 %) was ranked as the fourth factor to cause delay in this research. Any delay in the supply of materials to the site implies mismanagement by contractors. The failure to supply materials on time mean that contractors will lose due to idling human resources and also lose allotted time for execution, hence delays. The research results of Alwi and Hampson (2003), Alaghbari et al. (2007) gave a similar result that " the delay of materials delivery to the site" is an important factor of delay, but the results of Mezher et al. (1998), Al- Khalil et al. (1999), Chan et al. (2002), and Assaf et al. (2006) seem contrary to this result. Of course this can also contribute to cause 2 on "shortage of materials" at site.

Table 5 shows that respondents ranked "cash problem during construction" in the fifth position by importance index (I.I = 83.08 %), which indicates the high importance of cash-flow for the progress of any project. Shortage of cash for the contractor will cause many problems such as slow progress and decline in productivity. Also the contractors will not be able to purchase the equipment needed for ongoing work. Moreover, cash-flow problems can also extend to traders and suppliers, which in turn leads to slowing down the work, then to project delay.

This result conforms with the findings of Arditi et al. (1985), Assaf et al. (1995), Ogunlana et al. (1996), Mezher and Tawil (1998), Al- Khalil et al. (1999), Chan and Kumaraswamy (2002), Enshassi et al. (2003), and Alaghbari et al. (2007). A potential explanation for this consensus is that cash-flow is very necessary for contractors regardless of the location of the research, economic level, or the culture of the organization or environment. However, the contractors in the study of Ogunlana et al. (1996) in Thailand didn't consider cash as one of the important factors causing delay. One would need to examine the Thai scenario in depth, in order to explain this phenomenon.

The sixth important factor ranked by respondent contractors was poor site management (I.I = 81.06 %). Poor management causes many constraints on projects, such as poor following up of progress, incorrect distribution of works, lack of commitment by employees at site, and poor monitoring of project. These factors also contribute to project delays.

Groups of factors influencing time overruns at construction projects

Table 6 shows the rank of 12 groups of causative factors influencing time overruns (delays) at construction projects in the Gaza Strip, according to the perspective of contractors.

Table 6: Groups influencing time overruns at construction projects

Group	Importance Index	
	I.I	Rank
Materials	80.02	1
External factors	72.66	2
Professional Management	71.63	3
Owner's responsibilities	68.55	4
Contractual relationship	68.47	5
Consultant's responsibilities	68.28	6
Government relations	68.06	7
Contractor's responsibilities	67.57	8
Execution	66.50	9
Design and Documentation	65.72	10
Labor and equipment	65.24	11
Project-related	60.59	12

Materials

The 'materials' group was ranked very high by the respondents. This is also due to the lack of required resources in the Gaza Strip. Most construction materials are imported from other countries, especially Israel and Egypt. It is worth recounting that the contractors ranked "the lack of materials in markets", and "shortage of construction materials at site" among all causes of delay in this survey. Closures of borders are considered the most important factor causing the shortage of construction materials. Of course, these results reflect the extraordinary political situation in the Gaza Strip

External Factors

The 'external factors' group causing delays was ranked high by the respondents. This group/ category consist of six factors causing delays. Two of them are "strikes, and borders closures" and "poor economic conditions (currency, inflation rate, etc)". The contractors considered the border closures as the major factor causing delays. The Gaza Strip being a territory that suffers from a volatile political situation, successive strikes, and closure of borders which are under external (Israeli) control. Frequent closures of borders lead to shortage of materials and equipment which are necessary for construction processes. Also closures lead to material price escalations and eventually result in 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 some traders to monopolize (or form cartels to control) materials and equipment needed for construction operations. The poor political situation, also discourages donors, who may suspend or terminate working projects, or even discontinue their donations for Gaza Strip projects.

Professional management

The 'professional management' group of delay factors was also ranked high by contractors. In this group, contractors ranked "poor judgment in estimating time and resource" as the major factor. It seems that the contractors acknowledged that professional management plays an important role in the construction process. It is perceived that there are serious weaknesses in construction management in the Gaza Strip and the industry suffers from a lack of professionalism. Many reputable

engineering companies and construction firms don't have a human resources department to handle professional and staff training.

Factors influencing cost overruns at construction projects

Table 7 shows the rank of all factors of cost overruns that have been investigated in this research from contractor's perspective. A total of 42 factors influencing cost overruns in the Gaza Strip have been studied and discussed. The ranking was based on importance index values derived from the survey, as before.

Table 7: Summary of Importance Index and rank for the causes of cost overruns

causes of cost overruns	II	Rank
Increment of materials prices due to continuous border closures	89.39	1
Delay in construction, supply of raw Materials and equipment by contractors	83.71	2
Fluctuations in the cost of building materials	81.06	3
Project materials monopoly by some suppliers	80.68	4
Unsettlement of the local currency in relation to dollar value	78.79	5
Low commitment of donor to compensate any bad result that may come from	78.79	5
Donor policy in Biding tender to the lowest price one	77.65	7
Design changes	76.92	8
Additional work at owner's request	76.52	9
Resources constraint: funds and associated auxiliaries not ready	76.52	9
Lack of cost planning/monitoring during pre-and post contract stages	75.38	11
Improvements to standard drawings during construction stage	75.00	12
Inadequate review for drawings and contract documents.	74.24	13
Contractual claims, such as, extension of time with cost claims	73.48	14
Inaccurate quantity take-off	72.73	15
Technical incompetence, poor organizational structure, and failures of the	71.59	16
Lack of cost reports during construction stage	71.21	17
Inadequate project preparation, planning and implementation	70.08	18
Delays in issuing information to the contractor during construction stage	69.70	19
Lack of coordination at design phase	68.94	20
Change in the scope of the project, in Government policies	68.94	20
Some tendering maneuvers by contractors, such as front- loading of rates	68.56	22
Incomplete design at the time of tender	67.42	23
Bad allocation of labour inside the site	67.42	23
Delays in decisions making by Government, failure of specific coordinating	67.42	23
Delays in costing variations and additional works	67.31	26
Lack of experience of project type	67.05	27
Re measurement of provisional works	66.29	28
Wrong / inappropriate choice of site	65.15	29
Omissions and errors in the bills of quantities	64.77	30
Delay in project's handing over	64.62	31
Absence of managerial programs that help in saving materials inside the site	64.02	32
Indecision by the supervising team in dealing with the contractor's queries	63.64	33
Lack of experience of local regulation	63.64	33
Changes in owner's brief	62.88	35
Inability of the contractor to be adopted property with the projects environment	59.23	36
Labour unrest	57.20	37
Attracting skillful technicians for work	56.82	38
Lack of experience of technical consultants, inadequacy of foreign	56.82	38
Unpredictable weather conditions	54.92	40
Long period of the project maintenance period "one year "	54.92	40
Over time work hours of supervising engineer are paid by the contractor	52.27	42

Table 7 shows that respondent contractors ranked the "increment of materials prices due to continuous border closures" in the highest position by importance index (I.I = 89.39 %). Materials are considered the backbone of construction projects, which account for nearly 70% of the total value of project (Enshassi et al. 2003). Any problem of materials availability significantly affects the progress of a project. In the case of border closures, construction materials become scarce, leading to elevated prices. This is aggravated by supplier cartels and monopolies. In addition, the quantities of new materials entering the Gaza Strip are limited. During any closure the construction process is suspended, so the project is exposed to cost overruns.

"Delay in construction, supply of raw materials and equipment by contractors" (I.I = 83.71 %) was ranked as the second major factor to cause cost overruns in this group. Each day of delay costs the contractor additional losses due to unavoidable overheads, costs of sub contractors and penalties. The delay of necessary materials and equipment supply for the work, leads to time lost, hence cost increases. In case of delay, the cost of required materials or equipment may increase, or these goods may run out from local markets, after which cost overruns may arise. This result seems different from that of Morris (1990), that "the delay in the construction supply of raw materials and equipment by contractors" is one of the major factors of cost overruns. Shortage of materials and equipment is not always a serious problem elsewhere worldwide, but the Gaza Strip construction industry suffers from serious shortages of construction materials and equipment.

The third major factor ranked by respondent contractors was "fluctuations in the cost of building materials" (I.I = 81.06 %). Fluctuation in prices has a significant impact on cost increases. Often the contractor estimates prices of the tender according to the present prices at local markets. It is known that the tendering phase including the award of the tender, is an early phase of the project. As even the awarding process takes a long time, this delay leads to a greater chance of price fluctuations. In case of higher prices, the contractor would face the problem of cost overruns at the execution phase. The fluctuation of prices in the Gaza Strip is also associated with the Israeli economy and that of other neighbouring countries. In particular, the Gaza Strip economy is very engaged with the Israeli economy.

The research result of Chimwaso (2001) seems different to this result, in that the fluctuation in the cost of construction materials is one of major factors to cause cost over runs. The fluctuation in the cost of construction materials is associated with the location of the project country, the economic level, and the volume of required materials. The result of this factor differs from country to country. "Project materials monopoly by some suppliers" (I.I = 80.68 %) 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 a materials supply proxy to limited suppliers. Thus, the contractor is forced to buy the required materials or equipments at high prices. In these cases the project will be exposed to cost overrun.

It may be noted that the artificial fixing of prices is not confined to the Gaza strip. For example: (1) in the UK, the Office of Fair Trading (OFT) investigated 112 construction companies from about April 2008, of which 40 companies soon admitted allegations of 'cover pricing' and/or other bid fixing arrangements, and 37 soon

applied for leniency, while others were given time to answer charges (Mason 2008); and (2) in Hong Kong there are allegations of cartel activities in general, as well as in construction, while existing legislation is apparently not strong enough to preclude some such arrangements, e.g. as in the failed prosecution of a bid-rigging cartel that supplied iron gates for public housing units (Williams 2007). Hong Kong is presently considering new legislation to overcome such anti-competition arrangements.

The fifth cause of cost overruns was "unsettlement (instability) of the local currency in relation to dollar value" (I.I = 78.79 %). The Gaza Strip currency is new Israeli shekel (N.I.S). However most construction projects are financed by United States dollar (US \$). Any fluctuation in the exchange rate of dollars and shekels will affect the cost of the project. It is also noted that most of the project expenses such as the purchase of material, equipment hire, employee salaries and other indirect costs are in N.I.S. These results show that cost overruns will certainly arise when currencies are not stable.

"Low commitment of donor to compensate any bad result that may come from the poor economic and political situation" (I.I = 78.79 %) was ranked as the fifth factor to cause cost overrun. The Gaza Strip is exposed to military attacks of different types, and construction projects may be disrupted, destroyed partially or totally by these events. This difficult political situation affects the cost of projects, especially because most donors don't recognize contractor's damage, so contractors are compelled to remedy works damaged by military attacks at their own expense.

Table 7 shows that respondent contractors ranked unpredictable weather conditions (I.I = 54.92 %) as one of the three least important factors causing cost overruns. The Gaza Strip has good climatic conditions, as it isn't exposed to hurricanes or great leaps in temperature or snow fall, therefore the weather conditions do not affect the execution of construction project and doesn't contribute to damages on these projects. The long period of the project maintenance period "one year" (I.I = 54.92 %) was also ranked as one of these least important factors causing cost overruns. The period of maintenance was not unusually long, and the project is not exposed to substantial damage through this short period. So the cost of maintenance is low. This result reflects the low impact of maintenance period on the cost overruns of these projects.

Respondent contractors as shown in table 7, classified the "over time work hours of supervisor engineer are paid by the contractor" (I.I = 52.27 %) as the factor least influencing cost overruns. This result shows that the contractor benefits from the presence of supervisor engineer during overtime. The contractor can complete some works, which help to complete the project on time, for example: the presence of supervisor engineer during overtime enables the contractor to cast ready-mix concrete elements. This approach helps the contractor to deliver the project on time, hence this factor does not contribute to cost overruns.

CONCLUSIONS

The results indicated that the top ten factors causing time overruns as perceived by contractors are; strikes and border closures, lack of materials in markets, shortage of construction materials at site, delay of material delivery to site, cash-flow problem

Significant Factors Causing Time and Cost Overruns in Construction Projects in the Gaza Strip: Contractors' Perspective

during construction, poor site management, poor economic conditions (currency, inflation rate, etc.), shortage of equipment at site, equipments and tool shortage on site and owner delay in freeing the contractor financial payments. Better project management procedures and the inclusion of an appropriate contingency allowance in the pre-contract estimate were recommended as a means of minimizing the adverse effect of construction delays

The results indicated that, the five most important factors causing cost overruns are; increase of material prices due to continuous border closures, delay in construction, supply of raw materials and equipment by contractors, fluctuations in the cost of building materials, project materials control/ monopoly by some suppliers, and instability of the local currency in relation to dollar value. Results show that the materials related factors group has been ranked in the first position by the respondents, external factors group has been ranked in the second position and professional management group was in the third position. Contractors are recommended to continuously monitor the quality of their activities and to set up and maintain the required quality system for the different project activities; 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 or in limited quantity in the markets, to avoid time and cost overruns.

Contractors are recommended to build up capacities for controlling most project activities, using approved materials, and work mechanisms to avoid failure. Contractors are advised to avoid front loading of items upon each other during tender pricing. Deletion of any loaded items, or increased quantities of negatively loaded (unloaded) items will lead to contractor loss. Contractors are advised to prepare a method statement and schedule for the project that take into consideration both reality and project type. Also it is advised to monitor financial spending of the project and payments because any financial problems can lead to time and cost overruns.

It is recommended that the Government should construct new warehouses in settlements of the Gaza Strip to store the required construction materials such as: cement, base course material, aggregates, steel and bitumen. This proposal is a partial solution to border closure problems. For the long-term, the Palestinian government is urged to find a new and sustainable way to handle and mitigate materials entry issues and problems. The Government is also advised to consider promulgating a law through the Palestinian legislative council to prevent materials monopoly and/or cartel activities and other prices manipulations. This would also minimise time and cost overruns of projects.

The findings presented in this study should assist construction managers in understanding the most important factors that cause delay and cost overruns in order to be able to pre-empt or minimize these causes. This will reduce resources wasted on heavy claims processing and litigation in the construction industry; and improve construction productivity. It will also increase the 'time certainty' that is important for all stake-holders.

The international construction community is often called upon, or indeed some opt to, work in regions suffering catastrophe, whether from natural disasters (e.g. earthquakes or tsunamis) or human-induced crises, (e.g. in Africa, Asia or Iraq), apart from the Gaza strip. It is thus useful to identify and analyze examples of the different constraints that they may face, so they may be better equipped in these scenarios.

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