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Delay Management in Construction Projects in the Gaza Strip -Clients perspectives

إدارة التأخير في المشاريع الإنشائية في قطاع غزة من وجهة نظر المالك

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بسم الله الرحمن الرجيم

{يرفع الله الذين امنوا منكم
والذين أوتوا العلم درجات والله
بما تعملون خبير}

صدق الله العظيم

المجادلة أيه (11)

الإهداء

إلى الطيف الذي لا يغيب عن حياتي

إلى من شاءت الأقدار أن تغيب عني بجسدها

إلى روح والدتي الكريمة رحمها الله

واسكنها الله الفردوس الأعلى من الجنة

م. شرين رمضان حلس

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ABSTRACT

Most of construction projects in Gaza Strip are suffering from delay due to borders closure and shortage of materials in markets. This delay has had an effect on all parties which work in construction sector. The effects of delay could be traced to cost overrun, loss of efforts, and suspension of work, contract termination and huge problem between parties of contract.

The aim of this study is to identify the major causes of delays in construction projects in the Gaza Strip, the effects of delays, methods of minimizing delays in construction

project. It also aims to develop a mathematical model for management of construction project delays in order to mitigate the negative impact of delay. The objectives of the study were achieved through two approaches; the first one was a valid questionnaire that was obtained from client organization that works in Gaza Strip. The second by case study approach showing analytical data was used to collect actual data from sixty nine projects that were constructed during the period from (2005-2007).

The results showed that the most important factors that contributed to the causes of delays include political situation, shortage of construction materials, unethical behaviors used by contractors to achieve the highest possible level of profit, contractor un commitment to consultant instructions, and low motivation and morale.

The study illustrated that time and cost overrun were the common effects of delays in construction projects. The results showed that adequate and available source of finance, competent project manager, and site management and supervision were the most effective methods of minimizing delays.

From the result of this study the appropriate model was established by using Factor analysis from a stepwise multiple regression analysis on the delay factors. The model is able to predicts the delay in project before it happens; it gives the client a chance to make suitable procedures which lead to the reduction of the negative effects that include cost overrun, disputes', claims and so on.

The study recommended clients to use the developed predictive model to measure delay of project. Project managers can use this model to assess the delay level of a construction project. Assessments of likely project outcomes can be ascertained during construction and any necessary correction actions can be initiated.

ملخص البحث

اغلب المشاريع الإنشائية في قطاع غزة تعانى من التأخير بسبب عدم استقرار قطاع الإنشاءات نتيجة للظروف الخاصة التي يمر بها قطاع غزة. إذ يؤثر التأخير على كل الأطراف المعنية العاملة في قطاع الإنشاءات ومن هذه الآثار زيادة التكلفة, زيادة وقت المشروع, إنهاء العقد, وضياع الجهد, بالإضافة إلى حدوث العديد من المشاكل بين أطراف العقد المعنية.

تهدف هذه الدراسة إلى تحديد:

- **الأسباب الرئيسية لحدوث التأخير.**

- **الآثار المترتبة على حدوث التأخير.**
- **أفضل الطرق المستخدمة لتقليل الآثار السلبية لحدوث التأخير.**
- **إيجاد نموذج رياضي لتنبؤ بنسبة حدوث التأخير في المشاريع الإنشائية.**

أهداف الدراسة تحققت من خلال طريقتين:

1. **استبانه تم تعبئتها من قبل الجهات المالكة العاملة في قطاع الإنشاءات في قطاع غزة**
2. **دراسة حاله من خلال تحليل 69 مشروع تم تنفيذه من قبل وكاله غوث وتشغيل اللاجئين (الاونروا) في الفترة من 2005-2007 وتحديد أهم الأسباب وراء حدوث التأخير.**

أظهرت النتائج أن أكثر العوامل المسببة لحدوث التأخير تشمل الوضع السياسي لقطاع غزة, ندرة الموارد الإنشائية في الأسواق المحلية, سلوكيات المقاول غير الأخلاقية لتحقيق اكبر قدر من الربح, عدم التزام المقاول لتعليمات الاستشاري, و عدم فاعليه برنامج التحفيز المادي والمعنوي للعمال

أوضحت الدراسة أن من أكثر النتائج المترتبة على حدوث التأخير هي زيادة تكلفة المشروع, وزيادة مدة المشروع. كما أظهرت الدراسة أيضا أن من أفضل الطرق المستخدمة في تقليل التأخير هو التأكد من وجود التمويل الكافي للمشروع , وجود مدير مشروع خبير , وضرورة تفتيش ومتابعة الموقع بشكل مستمر.

من نتائج الدراسة الحصول على نموذج رياضي وذلك من خلال دراسة مدى الترابط (التشبع) بين أكثر العوامل المسببة لحدوث التأخير. هذا النموذج يعمل على التنبؤ بنسبة التأخير المحتمل حدوثها والذي من شانه يمكن المالك من اتخاذ الإجراءات المناسبة

وقد أوصت الدراسة المؤسسات المالكة بضرورة استخدام هذا النموذج الرياضي لقياس نسبة التأخير المتوقعة الحدوث. والذي بدوره يساعد مدير المشروع في تحديد العوامل المسببة للتأخير وبالتالي اتخاذ الإجراءات العلاجية المناسبة لتقليل الآثار السلبية للتأخير.

List of Abbreviation

AGCAS	Association of Graduate Careers Advisory Services
ANOVA	Analysis Of Variance
CCR	Construction Completion Report
CM	Construction Manager
CSFs	Critical Success Factors
EU	European Union
ECSD	Engineering and Construction Services
GDP	Gross Domestic Product
GNI	Gross National Income
GNP	Gross National Product
GVA	Gross Value Added
MOE	Ministry Of Education
NGO's	Non Governmental Organizations
ILO	International Labour Organization
PCHR	Palestinian Canter for Human Rights
PCBS	Palestinian Central Bureau of Statistics
PASSIA	Palestinian Academic Society for the Study of International Affairs
PA	Palestinian Authority
PCU	Palestinian Contractors Union
SPSS	Statistical Package for Social Science
SEM	Structural Equation Model

SHC	Special Hardship Cases in the camps
RII	Relative Importance Index
SEHP	Special Environmental Health Programme
SHC's	Special Hard Ship case
UK	United Kingdom
USA	United States of America
UNDP	United Nations Development Program
UNRWA	United Nations Relief and Work Agency
WBGS	West Bank and Gaza Strip
WB	West Bank

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1 INTRODUCTION

1.1 Introduction

The construction industry is a key activity in any economy; it influences and is influenced by the Gross Domestic Product (GDP) of any country. The construction sector is one of the key economic sectors and is the main force motivating the Palestinian national economy (Tumi, et al. 2009).

Enshassi and Abu Mosa (2007) showed that the construction is a risky industry with uncertainties due to many external and internal factors that influence the construction process. The construction sector is one of the key economic sectors and is the main force motivating the Palestinian national economy, has resulted in the recovery of the construction contracting profession and subsidiary industries, encouraged the investment of the Palestinian expatriates capital in the local construction sector, and contributed to the creation of jobs for thousands of Palestinians. On other hand, the external risk led to large losses in construction sector and termination of most projects during the Intifada.

A construction project is commonly acknowledged as successful, when it is completed on time, within budget, and in accordance with the specifications (Hancher , 1981) One of the most important problems in the construction project is delays. Delays may occur in every construction project and the magnitude of these delays varies considerably from project to project. Delay is usually a situation when the contractor, consultant, and client jointly or separately contribute to the non-completion of the project within the original or agreed contract period (Skitmore, et al. 2009).

This research aims to study causes of delay in the construction projects in the Gaza Strip, a mathematical model will be extracted to show the best representation of delay causes. Which mainly directed to the client benefits through predicting the delay of project before it happens. It gives the client a chance to make suitable procedures which lead to reducing the negative effects that include cost overrun, disputes', claims and so on. In addition this model was applied to the implementation stage because most critical causes of delay occur at this stage. The model will help the decision maker to take the right decision at the right time thus reducing the delay effects.

1.2 Features of construction industry (Selected countries)

Construction is one of the important sector overall countries in the world. This sector is considered the economical backbone of many countries; in addition, it contributes to absorbing high percent of the labour forces. In United Kingdom (UK), the construction industry is considered the second largest industry in the European Union (EU). This sector is contributing around 8.2% of Gross Value Added (GVA), employing 7 % of the UK's workforce and providing some 2.2 million jobs and that figure is expected to increase to over 2.8 million by 2011(AGCAS, 2008).

In the United States of America (USA), the construction industry is considered the largest in the world. This sector added approximately 1 billion square feet of commercial construction annually; the US market accounts for 25% of the total global construction industry. In India, the construction industry is worth around USD 25 billion (£15 billion) annually and accounts for more than 6% of GDP. This sector employs 18 million people who are considered the second largest employers after agriculture in the country. In Bulgaria, over 36,000 registered construction companies were recorded. The volume of building and construction activities amount to 2,500 million Euros per annum and the industry has a 5 % share in Bulgaria's GDP, which is expected to double over the next two years and the estimated annual growth is 15%. The sector employs some 120,000 people (UK Trade & Investment Website, 2007).

The construction sector in Malaysia contributes over 3% to the national GDP. It has a workforce of around 800,000 with over 71,000 registered contractors. In year 2005, some 4,678 contracts valued at £6.6 billion were awarded, 28% being public initiatives. Romania's construction business continues to go from strength to strength. Housing, airports, retail, commercial (& logistic), road and leisure are all active and demand is high. The construction market finished in the last year (2007) some of €10 billion. In South African, the construction industry accounts for approximately 10% of South African's GDP. For the area of Middle East, Saudi Arabia is the largest construction market in the Middle East. In spite of the rapid growth of the local manufacture of building's products and accessories', the country is still largely reliant on imports from the global market (UK Trade & Investment Website, 2007).

1.3 Features of construction industry in Palestine and Gaza strip

The Gaza Strip was part of the British mandate of Palestine before 1948 and was captured by Israel from Egypt in the 1967 war. The Gaza Strip is approximately 360 square kilometers in area. It has an 11km land border with Egypt and a 51km land border with Israel. Its land borders and 40km coastline are under Israeli control. Unlike the West Bank, the Gaza Strip is entirely surrounded on land by an Israeli-controlled security fence. Three-quarters of Gazans are refugees expelled from what is now Israel in the 1948 war, or their descendants. The Palestinian population in the Gaza Strip is growing rapidly, at over 4% per year; half of the population is under age 15. Before the outbreak of the al-Aqsa Intifada in September 2000, the Gazan economy was valued at approximately $US 1 billion. The service sector is the largest part in the economy, followed by agriculture. Approximately 24,000 Gazans who used to work in Israel are now unable to reach their jobs due to Israeli border closures (PCHR, 2003).

The construction sector in Palestine is considered one of the crucial economical sectors. According to Palestinian Central Bureau of Statistics (PCBS) report in 2006, it was shown that, 11.6% of the employed persons in the WBGS were working in construction. The closure of border crossings imposed on the Gaza Strip since uprising of Al Aqsa intifada has left grave impacts on the Palestinian economic, social, cultural, civil and political rights and obviously on the construction industry (PCHR, 2007). Construction has been completely stopped due to preventing the entry of raw construction materials, especially cement, aggregate and iron, into the Gaza Strip. Consequently, many infrastructure projects, including roads and sewage systems, have been suspended. In addition, 5 projects funded by the United Arab Emirates, Saudi Arabia, Japan, Netherlands and the European Union, which include the construction of 2,354 housing units in Rafah and Khan Younis for Palestinians whose houses had been destroyed by Israeli forces, have been halted (PCHR, 2007).

The closure of border crossings, especially al-Mentar- (Karni) crossing, has seriously impacted the economy of the Gaza Strip, and the private sector is at the edge of collapse due to the ban of import and export. At least 85% of factories have been forced to stop their production, and the remaining 15% were forced to decrease their productive capacity to less than the half die to the lack for raw materials. As a

consequence, the production capacity of the Gaza Strip has decreased by at least 80%. Many employers have been forced to dismiss worker, which has increased the levels of unemployment. Additionally, at least 35,000 out of approximately 42,000 construction workers have lost their jobs due to the lack of raw construction materials, which has led to the suspension of many construction projects (PCHR, 2007).

According to a July 2007 report by the UNDP, a majority of Palestinians (58%) live below the poverty line, and about half of them live in extreme poverty. A majority of Palestinians (about 60%) reported a decline in their household incomes in 2006–07. The Palestinian Authority (PA) has been facing a severe liquidity crisis since early 2006. It is estimated that budgetary resources fell by over a third in 2006 compared to 2005 (from $2.20 billion to $1.45 billion), despite a doubling of external budgetary assistance, leading to a 30% contraction in cash spending (PASSIA, 2008). To investigate the Palestinian economy, some indicators are useful to be notified. From Table 1.1, it is observed that, the indicator of the Gross Domestic product (GDP) reflects decreasing trends during the period of (1999-2006). For instant, in 2006, the percent of real GDP growth was (-7.0%), while the GDP per capita in year 2006 is USD 1,134.0 being (17.8%) lower than the GDP per capita in year 1995.

Table 1.1: Key Indicators of the Palestinian Economy (Excl. Jerusalem, selected years)

Economy Indicator	1995	1999	2001	2002	2003	2004	2005	2006
GDP (US$ million)	4,511	4,261	3,816	3,556	3,995	4,248	4,443	4,150
GNI (US$ million)	3,699	4,932	4,143	3,835	4,251	4,884	5,119	4,522
GDP per capita (US$)	1,380	1,478	1,229	1,146	1,221	1,264	1,258	1,134
GNI per capita (US$)	1,583	1,736	1,335	1,215	1,298	1,441	1,452	1,236
Real GDP growth (%)	6.1	9	-7	-4	9	6	5	-7
Real GNI per capita growth (%)	7.9	4	-16	-9	6	2	-1	-15
Domestic expenditure (% of GDP)	151.8	163	143	146	150	151	155	173
Inflation (annual %)	10.8	6	1	6	4	3	4	4
Poverty rate (% of population)		20	37	51	47	48		
West Bank		13	27	41	37	38		
Gaza Strip		32	54	68	64	65		

Source: (PASSIA, 2008)

In general, the figures shown in Table 1.1 reflect the suffering of the Palestinian economy during the last years. The poverty rate that is shown in Table 1.1 emphasized the deep trouble which the Palestinian economy (including the construction industry sector) suffers from. These indicators will be essential to be

highlighted for the world community. The GDP trend that is shown in Figure 1.1 reflects the instability and disturbance of the Palestinian economy.

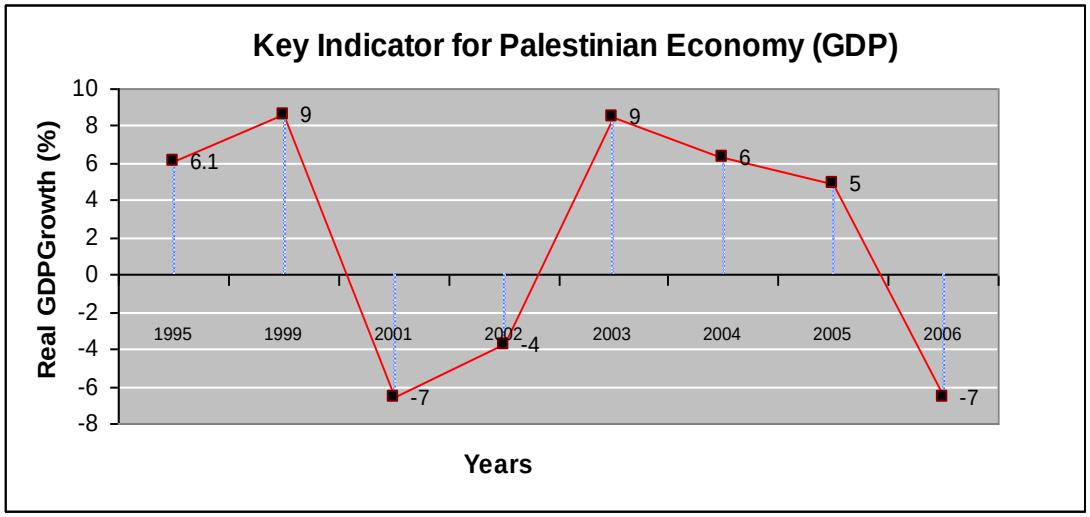

Figure 1.1: Real GDP growth (%) from years 1999-2006. (Source: PASSIA, 2008)

1.4 Contribution of the construction industry in Palestine economy

The construction industry is one of the main sectors that contribute strongly to the Palestinian economy. From Table 1.2, it is observed that, in year 2007 this sector contributed to absorbing 11.6 % from the Palestinian labor forces in the west bank and Gaza strip. The absorbed labor forces in the Gaza strip was relatively small (3.7%) due to the imposed closures at Gaza strip. The figures in Table 1.2 illustrate also that, the largest labour forces during the last period were absorbed by the commerce, hotels, restaurants and construction sector.

Table 1.2: Palestinian Labor Force – Various Features (by ILO Standards)

By economic activity (%)	2007 (July-Sept.)		Total	1997-1999	2000	2005
	WB	G.S		Average		Average
Agriculture, forestry, fishing	16.1	12.7	15.1	12.8	13.7	14.6
Mining, quarrying, manufacturing	15.4	5.8	12.8	15.8	14.3	13
Construction	**14.8**	**3.7**	**11.6**	**21.2**	**19.7**	**12.9**
Commerce, hotels, restaurants	19.7	18.7	19.4	17.8	17.5	19.4
Transportation, storage,	5.4	6.9	5.8	4.7	4.9	5.7
Services and other branches	28.6	52.2	35.3	27.7	29.9	34.4

Source: (PASSIA, 2008)

The comprehensive Figures obtained from Table 1.3 showed that, the construction industry contributed to the first quarter of year 2006 by 2.36% of the Palestinians GDP. This percent is roughly close to the previous years. The historical trend of the construction industry contributions for the GDP is shown in Figure 1.2.

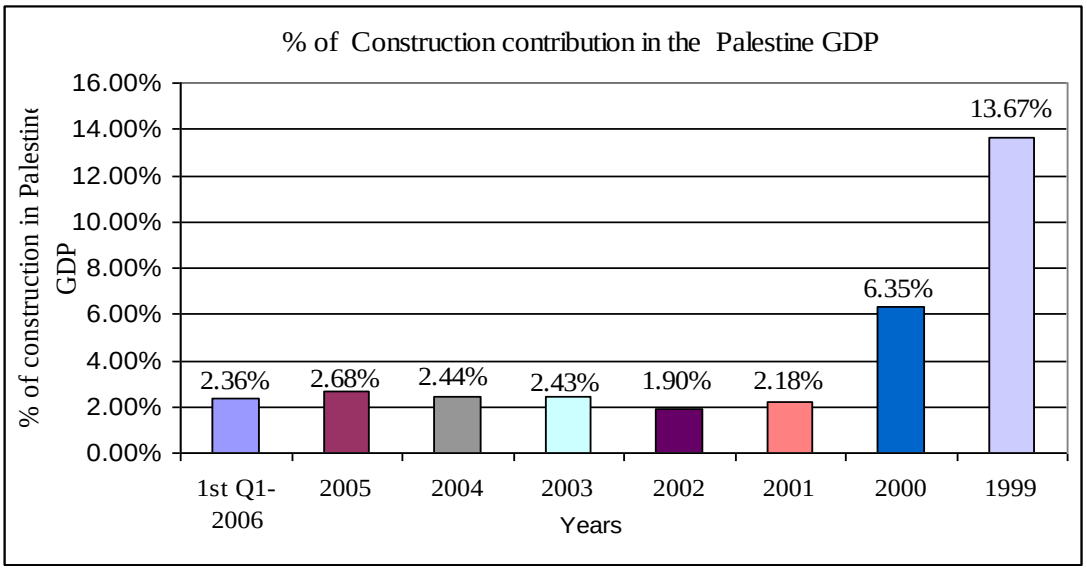

Figure 1.2: Percent (%) of the construction's contribution in the GDP from years 1999-2006 (Source: Palestinian Central Bureau of Statistics, 2006).

From Figure 1.2, it is observed that, the highest construction contribution in the Palestinian GDP was in year 1999 which showed 13.67%. The percentage of the contribution approximately decreased constantly from year 2000 to year 2006. The figure shows that, in average the contribution of the construction industry in the Palestinian GDP was ranged from (2.18 to 2.68) during the period from 2000 till 2006.

Table 1.3: GDP in Remaining West Bank and Gaza Strip by Economic Activity for the years 1999- 2005 at Constant Prices: (1997 is the base year)

Economic Activity	1999	2000	2001	2002	2003	2004	2005	1st Q1-2006
Agriculture and fishing	**470.7**	**388**	**350.1**	**269.6**	**311.2**	**319**	**312.6**	**67.3**
Mining, manufacturing, electrical and water	**655.5**	**668.6**	**614.6**	**580**	**532.9**	**564.3**	**564.8**	**121.4**
Mining and quarrying	35.7	32.6	28.9	33	17	17.5	18.3	4
Manufacturing	566.4	570.2	504.6	476.3	450.7	477.7	476.5	102.3
Electricity and water supply	53.4	65.8	81.1	70.7	65.2	69.1	70	15.1
Construction	**616.9**	**270.4**	**85.5**	**67.5**	**96.9**	**103.7**	**119.4**	**26**
Wholesale and retail trade	**537.8**	**519.2**	**414.8**	**350**	**340.4**	**359**	**373.9**	**92.3**
Transport, Storage and Communications	**231**	**292.5**	**317.3**	**349.6**	**392**	**444.4**	**461.5**	**123.9**
Financial intermediation	**169.1**	**191.5**	**138.1**	**149.9**	**158.9**	**170**	**187.4**	**50.3**
Other services	**990.8**	**1055.7**	**994.6**	**899.1**	**1,002.50**	**1,047.20**	**1,100.20**	**292.5**
Real estate, renting and business services	444.3	566.7	444.6	392.7	404.1	428.9	446.8	116.8
Community, social and personal services	28.3	32.2	29.3	33.2	42.5	43.3	43.2	11.1
Hotels and restaurants	128	93.7	104.4	60.7	58	61.8	68.1	16.9
Education	262.4	244.4	290.8	287.7	315.1	324.9	342.5	99.2
Health and social work	127.8	118.7	125.5	124.8	182.8	188.3	199.6	48.5
Public administration and defense	**497.7**	**559.3**	**628.9**	**578.1**	**694.7**	**736.4**	**796.1**	**239.6**
Households with employed persons	8.7	9.1	7.7	8.2	8.4	8.6	8.5	2.2
Less: FISIM	129.5 -	-154.4	-117.4	-109.6	-118.9	-124.9	-139.7	-35.5
Plus: Customs duties	208.6	196.3	174.6	75.8	262.2	277.9	291.9	55.1
Plus: VAT on imports, net	254.4	264.9	309	338.2	313.8	342.1	379.8	67.6
Gross Domestic Product	4,511.70	4,261.10	3,917.80	3,556.40	3,995.00	4,247.70	4,456.40	1,102.70
% of Construction contribution in the GDP	**13.67%**	**6.35%**	**2.18%**	**1.90%**	**2.43%**	**2.44%**	**2.68%**	**2.36%**

(Source: Palestinian Central Bureau of Statistics, 2006).

1.5 Significance of Research

Most of the construction projects in the Gaza Strip suffer of delay due to unstable construction industry in the Gaza Strips. This delay has an effect on all parties which works in construction sector. The effects of delay could be traced to cost overrun, loss of efforts, suspension of work, contract termination and huge problem between parties of contract.

From this point, it was important to do this research in order to identify the critical factors causing delay in construction project. In addition, to study the effects of delay and to know the most method applied in the Gaza Strip in order to manage delay.

This research is aimed to develop the level of people who work in construction project through a mathematical models which focus on identify the critical factors that causes delay. This research is especially for clients' benefits through knowing the factors which causes delay before start the work and to take the corrective action to minimize these effects, then the level of construction sector will be improved in the Gaza Strip.

1.6 Research Aim

The aim of this study is to develop the level of people who work in construction projects in the Gaza Strip through a mathematical model that being able to predict the construction delay.

1.7 Research objectives:

This research focuses on the implementation stages of projects. The objectives of this research are:

1. To identify the major causes of delay in construction project
2. To identify the effects of delays in construction project
3. To identify the methods of minimizing construction delays.
4. To develop a mathematical model that being able to predict the construction delay.
5. To identify any underlying interrelationship existing among the causes in terms of degree of occurrence
6. To conduct case study verifying the delay causes.

1.8 Contents of the thesis:

The thesis consists of seven chapters as follows:

Chapter One ***:****Introduction*

This chapter has a general introduction to the subject of the thesis (Features of construction industry in Palestine and Gaza Strip, significance of research, research aim, research objectives, contents of the thesis).

Chapter Two*:* *Literature Review*

This chapter includes (Definition, type of delays, causes of delays categorization of factors causing delay, methods of minimizing construction delays, effects of delays, factor analysis, and modeling delay in the construction projects).

Chapter Three*:* *Research methodology*

This chapter defines the process of the methodology that will be applied through the questionnaires (Flowchart of Research Methodology).

Chapter Four: *Case Study*

This chapter includes historical data analysis for UNRWA construction projects during the period of 2005-2007

Chapter Five*:* *Results and Discussion*

This chapter includes questionnaire, data collection, analysis of Results.

Chapter Six*:* *Model developing*

This chapter includes factor Extraction, factor Rotation, interpretation of clusters, stepwise Multiple Regression Analysis, the suggested model, and model Application

Chapter seven*:* *Conclusion and re*commendation

This chapter states the conclusions and recommendations.

References

Annex

Questionnaire

Raw material of UNRWA case study

Statistical output

2 LITERATURE REVIEW

One of the most important problems in the construction project is delays. Delay is generally acknowledged as the most common, costly, complex and risky problem encountered in construction projects. Because of the overriding importance of time for both the client (in terms of performance) and the Contractor (in terms of money); it is the source of frequent disputes and claims leading to lawsuits (Abd El-Razek, et al. 2008).

The duration of a construction project is an important factor to set forth when entering into a construction agreement. If a contractor works with a planned parameter, he or she should be able to finish the construction project in a timely manner. However, compared to other industries, it is difficult to complete a construction project in which many construction trades participate and numerous unknown variables exist. When such difficulties arise, construction schedules are delayed, and consequently delay claim occur (Assaf and Al-Hejji .2006).

Delays in construction may be caused by the client, the contractor, the consultants, acts of God, or a third party. They may occur early or late in the job, alone, or with other delays. In whatever cases, negotiating a fair and timely damage settlement is beneficial to all parties (Bubshait and Cunningham, 1998). Thus, the ascertainment of the period of project delay serves as a basic information from the appointment of responsibility, which may be a highly complex operation in cases with concurrent causes (Shi, et al. 2001). Assigning responsibility for project delays is critical to the allocation of responsibility for time-related costs (Al-Saggaf, 1998). when a delay claim occurs, it is very important to assign responsibility and magnitude to delays exist, and it is often difficult to analyze the ultimate liability in delay claims (Kraiem and Dieknam, 1987). Lost productivity or loss of productivity is one the most important causes of delay among the various causes of construction delays.

Delays can be minimized when their causes are identified. Identification of the factors that contributed to the causes of delays has been studied by numerous researchers in several countries. Delay is a situation when the contractor, consultant, and client

jointly or severally contributed to the non-completion of the project within the original or the stipulated or agreed contract period.

This chapter will introduce the theoretical background of the delay occurrence in the construction projects.

2.1 Background of the Study

A common characteristic of construction projects is that they are dynamic and have a high level of uncertainty. This results in a cyclical argument, where delays are accepted as inevitable and is considered by some to be a global phenomenon affecting all the various construction project participants (Sambasivan and Soon, 2007).

Numerous researchers have also examined and identified the causes of delays in construction project. Assaf, et al. (1995), for example, studied the causes of delays large building construction projects in Saudi Arabia. They identified that the most causes of delay included are the approval of shop drawings, delays in payment to contractors and the resulting cash problems during construction, design changes, conflicts in work schedules of subcontractors, slow decision making and executive bureaucracy in client's organizations, design errors, labor shortage and inadequate labor skills. Ogunlana, et al. (1996) studied the delays in building project in Thailand, as an example of problem faced by the developing economies. They concluded that the problems of the construction industry in developing economies can be nested in three layers: problem of shortages or inadequacies in industry infrastructure, mainly supply of resources; problems caused by clients and consultants; and problems caused by incompetence of contractors.

Chan and Kumaraswamy (1996) surveyed and classified the causes of construction delays in Hongkong as seen by clients, contractor and consultants, and examined the factors affecting productivity. The results of their research indicate that the five principal and common causes of delays are: poor site management and supervision; unforeseen ground condition; low speed of decision making involving all projects team; client initiated variations; and necessary variation of works. Mezher and Tawil (1998) conducted the survey of the causes of delays in the construction industry in Lebanon from the viewpoint of clients, contractors and architectural/engineering firms. It was found that clients had more concerns with regard to financial issues, contractors regarded contractual relationship the most important, while consultants considered project management issues to be the most important causes of delays.

A comprehensive classification of causes of construction delays has also been recommended by Al-Momani (2000) who conducted a quantitative analysis of construction delays by examining the records of 130 public building projects constructed in Jordan during the period of 1990-1997. The researcher presented regression models of the relationship between actual and planned project duration for different causes of delays. The researcher concluded that the main causes of delays in construction projects relate to designers, user changes, weather, site conditions, late deliveries, economic conditions, and increase in quantities.

Odeh and Battaineh (2002) studied causes of construction delay in Jordan. In their study presents the results of the survey which indicate that contractors and consultants have agreed that the owner interference, inadequate contractor experience, financing and payments, labor productivity, slow decision making, improper planning, and subcontractors are among the top ten most important factors.

Frimpong, et al. (2003) studied the factors contributing to delay and cost overruns in Ghana groundwater construction projects. The results of the study revealed the main causes of delay and cost overrun in construction of groundwater projects includes: monthly payment difficulties from agencies; poor contractor management; material procurement; poor technical performances; and escalation of material prices. Long, et al (2004), studied the problems on large construction projects in developing countries, a case study from Vietnam. They revealed that the problems could be grouped under five major factors; incompetent designers/contractors; poor estimation and change management; social and technological issues; site related issues; and improper techniques and tools.

Koushki, et al. (2005) conducted a survey of the time-delay and cost-increase associated with the construction of private residential projects in the state of Kuwait. They identified three main causes of time-delays includes: changing orders; clients' financial constraints; and owners' lack of experience in the construction business. Regarding cost overruns, the three main causes were identified as contractor related problems, material-related problems, and owners' financial constraints. Wiguna and Scott (2005) studied on the risks affecting construction delays and cost overruns in building projects in Surabaya, Indonesia. They identified the most critical factors are: high inflation/increased material price; design change by client; defective design; weather conditions; delayed payment on contracts and defective construction work.

2.2 Delays definition

In the study of Assaf and Al-Hejji (2006) construction delay was defined as "the time overrun either beyond completion date specified in a contract, or beyond the date that the parties agreed upon for delivery of a project. Zack (2003) was also defined delay as an act or event which extends required time to perform or complete work of the contract manifests itself as additional days of work.

Stump (2000) defined delay as an act or event that extends time required to perform the tasks under a contract. It usually shows up as additional days of work or as a delayed start of an activity. He showed that delay does matter and that different methods for analyzing schedule delay lead to different results for the owner and contractor.

Ahmed et al, (2003) said that schedule delay refers to a situation where a construction project does not come to completion within the planned period. Time is an integral part of every plan a company develops for performing contract work. There is a relationship between the schedule, the scope of work, and project conditions. Changes to any one or more of the above three can affect the compensation level and time of completion.

Chan (2001) defined the time overruns as the difference between the actual completion time and the estimated completion time. Time overruns is defined as the extension of time beyond planned completion dates traceable to the contractors (Kaming et al 1997). The period between the initial conception of the project and signing of the contract; and the construction phase which is the period after award of the contract when the actual construction is going on (cited in Frimpong, 2003).

2.3 Types of delays

Determining the delay type is a difficult task due to problems in assigning the responsibility of delays to a party. Delays are mostly interdependent and auto correlated (Abd Majid and McCaffer, 1998).

Several studies by numerous researchers like Ahmed et al.(2003), Abd Majid and McCaffer, (1998) (Reams.1990), and Abdul-Rahman,(2006) grouped the delay in the following four broad categories depending on how they operate contractually:

- non-excusable delays;
- non-compensable excusable delays;
- compensable excusable delays; and

- concurrent delays.

2.3.1 Non-excusable Delays

Non-excusable delays are delays, which the Contractor either causes or assumes the risk for. These delays might be the results of underestimates of productivity, inadequate scheduling or mismanagement, construction mistakes, weather, equipment breakdowns, staffing problems, or mere bad luck. Such delays are inherently the Contractor's responsibility and no relief is allowed. These delays are within the control of the Contractor or are foreseeable; however, it is not necessary that they be both. (Ahmed et al, 2003).

Abd Majid and McCaffer (1998) studied the factors of non-excusable delays that influence contractors' performance. They classified the main causes of non excusable delays according to the source of occurrence, and then identified the factor contributing to those causes. It is assumed that the client has more control over the compensable delays and can take action to prevent them. The contractor is expected to have control over the non-excusable delays and, presumably, do more to prevent them. They classified the factor of causes of non-excusable delays into twelve groups: material-related delays; labor-related delays; equipment-related delays; financial-related delays; improper planning; lack of control; subcontractor-related delays; poor coordination; inadequate supervision; improper construction methods; technical personnel shortages; and poor communication.

2.3.2 Non-compensable Excusable Delays

When a delay is caused by factors that are not foreseeable, beyond the Contractor's reasonable control and not attributable to the Contractor's fault or negligence, it may be "excusable". This term has the implied meaning that neither party is at fault under the terms of the contract and has agreed to share the risk and consequences when excusable events occur. The Contractor will not receive compensation for the cost of delay, but he will be entitled for an additional time to complete his work and is relieved from any contractually imposed liquidated damages for the period of delay. (Ahmed et al 2003). Excusable non compensable not the client's or the contractor's fault, so the contractor gets an extension of time but no delay damages (Reams.1990).

2.3.3 Compensable Excusable Delays

Compensable delays occur when the owner or the consultant has delayed the contractor in the completion of the work. It entitles the contractor to additional compensation and the contractor may be granted extension of time and money if there

is any change in scope of work, late supply of client materials or information, impeded site access, differing site conditions, and failure to provide timely and review shop drawings (Abdul Rahman, 2006).

If the delay is compensable, then the Contractor is entitled not only to an extension of time but also to an adjustment for any increase in costs caused by the delay.

client-issued contracts specifically address some potential compensable delays and provide equitable adjustments. The usual equitable adjustment clauses in client issued contracts that apply to delay are:

- Changes
- Differing Site Conditions
- Suspension

The changes clause in Owner-issued contracts provides that equitable adjustments may be considered as follows: (Ahmed et al 2003).

2.3.3.1 Changes

With the help of a written Change Notice, the client may, without any notice to the sureties (if any), unilaterally make any change, at any time in the Work within the general scope of the Contract, including but not limited to changes:

- In the drawings, designs or specifications
- In the method, manner or sequence of Contractor's work
- In Customer or Owner furnished facilities, equipments, materials, services or site(s)
- Directing acceleration or deceleration in the performance of the work
- Modifying the Contract Schedule or the Contract milestones

If at any time a contractor believes that acts or omissions of Customer or Client constitute a change to the Work not covered by a Change Notice, Contractor shall within ten (10) calendar days of discovery of such act or omission, submit a written Change Notice Request, explaining in detail the basis for the request. Client may either issue a Change Notice or deny the request in writing. If any change under this clause causes directly or indirectly an increase or decrease in the cost, or the time required for the performance of any part of the Work, whether or not changed by any order, an equitable adjustment shall be made and the contract will be modified accordingly. (Ahmed et al, 2003).

The clause recognizes that changes in the work or changes in the method or manner of performance may require changes in the schedule and schedule milestones and this could further necessitate revisions in activity durations, sequence of work items, or interrelationships of various tasks. These changes may have a direct impact on the schedule, as where a change in method requires a greater or lesser period of performance or its effects may be subtler, as where the change merely rearranges priorities. In addition to a time extension, the contract's clause provides compensation for any delay resulting from a contract change by allowing an equitable adjustment for the increased cost of the performance of the work caused by the change. (Ahmed et al, 2003).

2.3.3.2 Differing Site Conditions

The portion of the clause addressing cost or time adjustments for 'differing site conditions' provides: If such conditions do differ in material and thus cause an increase/decrease in the Contractor's cost or time required for performance of the Work, an equitable adjustment will be made pursuant to the General Condition titled "Changes". No claim of the Contractor under this clause will be allowed unless the Contractor has given the required notice. The main intention is to leave the Contractor neither damaged nor enriched because of the resultant delay. (Ahmed et al, 2003).

The differing site conditions clause must not be confused with the Site Conditions clause in Owner issued contracts - the so-called "Exculpatory" clause. Its intent is to disallow any claims for delays relating to conditions at the site, which the Contractor should have anticipated. The exceptions are limited to those conditions defined in the Differing Site Conditions clause (Ahmed et al, 2003).

2.3.4 Concurrent Delays

Concurrent delays refer to delay situations when two or more delays occur at the same time or overlap to some degree either of which, had the delays occurred alone, would have affected the ultimate completion date. Normally concurrent delays which involve any two or more excusable delays result in a time extension. When excusable with compensation and non-excusable delays are concurrent, a time extension can be issued or the delay can be apportioned between the owner and the contractor.(Abd Majid and McCaffer, 1998).

In analyzing concurrent delays, each delay is assessed separately and its impact on other activities and the project duration is calculated. The following guidelines for classifying these kinds of concurrent delays:

- If excusable and non-excusable delays occur concurrently, only a time extension is granted to the contractor;
- If excusable with compensation and excusable without compensation delays occur concurrently, the contractor is entitled to time extension, but not to damages;
- If two excusable with compensation delays occur concurrently, the contractor is entitled to both time extension and damages.

An example of a concurrent delay would be if the client failed to supply detailed designs for specified machine installations (excusable delay with compensation) while at the same time, the contractor who would have installed those machines was on strike (excusable delay without compensation). In this scenario, since both excusable with compensation and excusable without compensation delays are present, the contractor would be entitled to a time extension, but not to damages.

Although such guidelines are useful for the purpose of carrying out delay analysis, it is in the best interest of all parties involved in a construction project to agree, at the beginning, the definitions of such delays and accommodate them throughout the contract language. Until the development of CPM schedule analysis, there was no reliable method to differentiate the impact of the impact of contractor caused delays from client caused delays. With the sophisticated computerized techniques now available, however, it has become possible to segregate the impacts of apparently concurrent client and contractor delays (Abd Majid and McCaffer, 1998).

2.4 Mitigation of Delay in the construction projects.

An analysis is needed to identify the impact of delay on time and cost followed by taking the appropriate action to mitigate delay and minimize the cost required. It is important to improve the estimated activity duration according to the actual skill levels, unexpected events, efficiency of work time, and mistakes and misunderstandings .Mitigation efforts are necessary to minimize losses and this can be achieved by many procedures such as protection of uncompleted work, timely and reasonable re-procurement, and timely changing or cancellation of purchase orders. It is important to predict and identify the problems in the early stages of construction and diagnose the cause to find and implement the most appropriate and economical solutions (Abdul-Rahman et al 2006).

In many cases, delays can be mitigated to some extent by prompt remedial action initiated by the contractor – the contractor's degree of contractually liability for the delays being an important motivating factor (Yogeswaran et al, 1998).

Construction projects involve more variables and uncertainties than in the product line. This factor increases the probability of delay occurrences in construction projects and makes effective management important to reduce the diversions from the original program. Planning is easily done in a homogeneous task environment under stable conditions such as found in production firms than in a construction project and this presents a challenge for managers involved in construction projects.

2.5 Types of claims due to delay

Different types of claims arising out of 'Time delay and extension' clause are as follows (Iyer, et.al. 2008)

- Levy of compensation by owner due to delay attributed to contractor.
- Claim for price escalation of resources by the contractor when the work is not completed in time and extensions are to be allowed because of client's default.
- Claim for idling of resources/overheads by the contractor due to delay by owner.
- Whenever, a contractor does not do the work with due diligence or his pace is slow, the running bill amount may be withheld leading to claim for interest on withheld payment.
- Sometimes the clause for 'reimbursement of price escalation' may not exist in the contract and the contractor claims for compensation, when the project gets delayed, as extra-contractual obligation.

2.6 Causes of Delays

2.6.1 Palestinian Studies in delay

Delay of project in the Gaza Strip is one of most important problems at construction management field, also research and studies in this field in Palestine are few compared to worthy expected results. Enshassi et al (2003) found that the financing group of delay factors was ranked the highest by all three parties and the environment group was ranked the lowest. In order to improve the situation , there is a need to pay more attention to the financial issues in the local construction industry, and there is a need for better communication and coordination with international funding agencies. There is also an urgent need to develop human resources in the construction industry in Palestine.

Enshassi and Al-Najjar, (2010) 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.

2.6.2 International Studies in delay

Construction delays became an integral part of the project's construction life. Even with today's advanced technology, and management understanding of project management techniques, construction projects continue to suffer delays and project completion dates still get pushed back (Stump, 2000).

There are many reasons why delays occur. They may be due to strikes, rework, poor organization, material shortage, equipment failure, change orders, act of God and so on. In addition, delays are often interconnected, making the situation even more complex (Alkass Harris, 1996).

Assaf and Al-khalil(1995) outline the main causes of delay in large building projects and their relative importance. They found that 56 causes of delay exist in Saudi construction projects. According to the contractors surveyed the most important delay factors were preparation and approval of shop drawings, delays in contractor's progress, payment by owners and design changes. The architects and engineers view were cash problems during construction, the relationship between subcontractors and the slow decision making process of the owner.

Mezher and Tawil (1998) conducted a survey of the causes of delays in the construction industry in Lebanon from the viewpoint of owners, contractors and architectural/engineering firms. It was found that owners had more concerns with regard to financial issues, contractors regarded contractual relationship the most important, while consultants considered project management issues to be the most important causes of delays. Chan and Kumaraswamy (1996) surveyed the causes of construction delays in Hong kong as seen by clients, contractor and consultants, and examined the factors affecting productivity. The results of their research indicate that the five principal and common causes of delays are: poor site management and supervision; unforeseen ground condition; low speed of decision making involving all projects team; client initiated variations; and necessary variation of works.

A comprehensive classification of causes of construction delays has also been recommended by Abd Majid and McCaffer (1998). They studied factors of non-excusable delays that influence contractors' performance. They classified the main causes of non-excusable delays according to the sources of occurrence, and then identified the factors contributing to those causes. It is assumed that the client has more control over the compensable delays and can take action to prevent them. The contractor is expected to have control over the non-excusable delays and, presumably, do more to prevent them.

Kaming et al. (1997) exploited questionnaire survey in Indonesian high-rise construction projects. They identified 11 variables of delays and 7 variables of cost overruns. Out of which, materials cost increased by inflation, inaccurate quantity take-off and labor cost increased are the first three causes of cost overruns, while design changes, poor labor productivity, inadequate planning, materials shortage and inaccuracy of materials estimate are first five causes of delays.

Al-Momani (2000) conducted a quantitative analysis of construction delays by examining the records of 130 public building projects constructed in Jordan during period of 1990-1997. The researcher presented regression models of the relationship between actual and planned project duration for different causes of delays. The researcher concluded that the main causes of delays in construction projects relate to designers, user changes, weather, site conditions, late deliveries, economic conditions, and increase in quantities. Odeh and Battaineh (2002) studied causes of construction delay in Jordan. Their study presents results of the survey indicate that contractors and consultants agreed that owner interference, inadequate contractor experience, financing and payments, labor productivity, slow decision making, improper planning, and subcontractors are among the top ten most important factors.

Frimpong, et al. (2003) conducted a survey to identify and evaluate the relative importance of significant factors contributing to delay and cost overruns in Ghana groundwater construction projects. A questionnaire with 26 factors was carefully designed from preliminary investigations conducted in groundwater drilling projects between 1970 and 1999 in Ghana. The questionnaire was directed towards three groups in both public and private organizations: owners of the groundwater projects, consulting offices, and contractors working in the groundwater works. The questionnaire was distributed to a random sample of 55 owners, 40 contractors and 30

consultants. The result of the study revealed the main causes of delay and cost overruns in construction of groundwater projects: monthly payment difficulties from agencies; poor contractor management; material procurement; poor technical performance; and escalation of material prices.

Koushki, et al. (2005) identified the main causes of delays in the construction of private residential projects in Kuwait included: changing orders; owner's financial constraints; owner's lack of experience in the construction business; contractor-related problem; and material related problem.

Wiguna and Scott (2005) studied the risks affecting construction delay and cost overruns in building projects in Surabaya and Denpasar, Indonesia. The most critical risk affecting cost overrun and delay perceived by the building contractors were: high inflation/increased material price; design change by owner; defective design; weather conditions; delayed payments on contract; and defective construction work.

Long, et al. (2004b), studied the problems in large construction projects in developing countries, a case study from Vietnam. They revealed that the problems could be grouped under five major factors; incompetent designers/contractors; poor estimation and change management; social and technological issues; site related issues; and improper techniques and tools.

Assaf and Al-Hejji (2006) conducted a survey on time performance of large construction projects in Saudi Arabia. The survey had 73 different causes of delay. He studied the importance of various causes from the viewpoint of contractors, consultants, and owners. The most common cause of delay identified by all the parties was change order. He also found that about 70% of the projects experienced time overruns.

Sambasivan, (2007)studied causes of delay from clients, consultants, and contractors The results of the study revealed that the main causes of delay were contractor's improper planning, contractor's poor site management, inadequate contractor experience, inadequate client's finance and payments for completed work, problems with subcontractors, shortage in material, labor supply, equipment availability and failure, lack of communication among parties, and mistakes during the construction stage are the most significant factors that contribute to causes of delays.

Abd El-Razek and Mobarak (2008) identify the main causes of delay in construction projects in Egypt from the point of view of contractors, consultants, and owners. The overall results indicated that the most important causes are: financing by contractor

during construction, delays in contractor's payment by owner, design changes by owner or his agent during construction, partial payments during construction, and nonutilization of professional construction/contractual management.

Le-Hoai et al. (2008) studied causes of delay in Vietnam, the researcher showed that there are no differences in the viewpoints among three principal parties in the project. The factor analysis technique was applied to categorize the causes, which yielded 7 factors: Slowness and Lack of constraint, Incompetence, Design, Market and Estimate, Financial Capability, Government, and Worker.

Skitmore and Al-Kharashi. (2009) conducted the survey of the causes of delays in Saudi Arabian public sector construction projects The analysis reveals some considerable heterogeneity between the cause groupings and respondent groupings in terms of means and correlations, apparently partly due to lack of knowledge of respondents and a tendency for the consultants to blame the contractors for the delays and viceversa. The main results are disaggregated to reflect the views of each respondent group concerning each group of causes they found that the most influencing current cause of delay is the lack of qualified and experienced personnel, attributed to the considerable amount of large, innovative, construction projects and associated current undersupply of manpower in the industry.

Kaliba et al, (2009) studied the schedule delays in road construction projects in Zambia they found delayed payments, financial processes and difficulties on the part of contractors and clients, contract modification, economic problems, materials procurement, changes in drawings, staffing problems, equipment unavailability, poor supervision, construction mistakes, poor coordination on site, changes in specifications and labour disputes are the major causes of schedule delays in road construction projects.

Tumi et al.(2009) studied the causes of delay in construction industry in Libya .They found that improper planning, lack of effective communication, design errors, shortage of supply , slow decision making, financial issues, shortage of material, cash-flow, problems during construction, increase in quantities, mismanagement by the contractor (financial, supplier support, sub-contractor), and changes in site conditions are the most factors that contribute to causes of delay.

Yang et al.(2010) outline the main causes of delay in Large public construction works in Taiwan. They found that change orders, unexpected increased quantity, late site liberation by client, shortage of construction budget, bad weather and disaster, law

and regulation change, fluctuation on resource price, shortage of materials, failed examination and inspection, failed final examination during the implementation stage are the most significant factors that contribute to causes of delays.

Ahsan and Gunawan.(2010) conducted the survey of the causes of delays in New Zealand international development projects they found lengthy procedure for contract evaluation and award, procurement delay, civil works and land acquisition delay, consultant recruitment delay, natural calamities, government procedural delay, local politics and economic problem, loan approval and disbursement delay, project staff hiring delay, new scope addition, and frequent change of project staff are the most causes of delay of international development projects.

2.7 Categorization of factors causing delay

Chan and Kumaraswamy.(1996) categorized the factors affecting delay into eight groups:

- Project-related factors include project characteristics, necessary variations, communication among the various parties, speed of decision making involving all project teams, and ground conditions;
- Client-related factors include those concerned with client characteristics, project financing, their variations and requirements, and interim payments to contractors;
- Design team-related factors include design team experience, project design complexity, and mistakes and delays in (producing) design documents;
- Contractor-related factors include contractor experience in planning and controlling the projects, site management and supervisions, degree of subcontracting, and their cash-flow;
- Materials related factors include shortages, materials changes, procurement programming, and proportion of off-site prefabrication;
- Labor factors related include labor shortages, low skill levels, weak motivation, and low productivity;
- Plant/Equipment related factors include shortages, low efficiency, breakdowns, and wrong selection; and
- External factors include waiting time for approval of drawings and test samples of materials and environmental concerns and restrictions.

Abd Majid and McCaffer (1998) listed the delay causes in the following categorizes

- Material-related delays factors include late delivery, unreliable supplier, damaged materials, poor quality, poor materials planning, poor monitoring and control, and inefficient communication;
- Labor-related delays factors includes low mobilization, unreliable subcontractor, poor labor planning, strikes, poor workmanship, low morale/motivation, absenteeism, poor monitoring and control, and inefficient communication;
- Equipment-related delays factors include poor equipment planning, late delivery, equipment breakdown, improper equipment, unreliable supplier, poor monitoring and control, and inefficient communication;
- Improper planning factors include attitude, inappropriate practices/procedures, lack of facilities, and lack of experience;
- Financial-related delays factors include delay payment to supplier and/or subcontractor, inadequate fund allocation, poor monitoring and control, and poor financial planning;
- Lack of control factors include lack of experience, attitude, shortages of personnel, inappropriate practices/procedures, low morale/motivation, and deficient contract;
- Subcontractor-related delays factors include unreliable subcontractor, subcontractor bankruptcy, interferences with other trade, poor monitoring and control, absenteeism, poor quality, and slow mobilization;
- Poor coordination factors include inappropriate practices/procedures, shortages of personnel, and lack of experience;
- Inadequate supervision factors include too many responsibilities, shortages of personnel, shortages of personnel, absenteeism, inappropriate practices/procedures, poor quality, and poor labor planning;
- Improper construction methods factors include wrong methods statement, lack of experience, inadequate fund allocation, inappropriate practices/procedures, and unavailability of proper resources;
- Technical personnel shortages factors include strike, absenteeism, lack of experience, poor planning, and slow mobilization; and
- Poor communication factors include lack of facilities, lack of experience, and inappropriate practice/procedures.

Odeh and Battaineh (2002) studied causes of construction delay in Jordan. They classified the causes of delays into the following eight major groups:

- Client related factors include finance and payments of completed work, owner interference, slow decision-making by owners, and unrealistic imposed contract duration;
- Contractor related factor include subcontractors, site management, construction methods, improper planning, mistakes during construction, and inadequate contractor experience;
- Consultant related factor include contract management, preparation and approval of drawings, quality assurance/control, and waiting time for approval of test and inspections;
- Material related factor include quality of material and shortage in material;
- Labor and equipment related factor include labor supply, labor productivity, and equipment availability and failure;
- Contract related factor include change orders, mistakes and discrepancies in contract documents, contractual relationship related factor include, major disputes and negotiations, inappropriate overall organizational structure linking all parties to the project, and lack of communication between the parties; and
- External factors include weather condition, regulatory changes and building code, problems with neighbors, and unforeseen ground conditions.

Le-Hoai et al (2008) studied causes of delay in Vietnam, the researcher showed that there are no differences in the viewpoints among three principal parties in the project. The factor analysis technique was applied to categorize the causes, These causes were categorized into the following six major respective groups:

1. Owner-related group consists of financial difficulties of owner and slow payment of completed works.
2. Contractor-related group involves poor site management and supervision, financial difficulties of contractor, obsolete or unsuitable construction methods, inaccurate estimates, incompetent subcontractor and mistakes during construction.

3. Consultants-related group consists of poor project management assistance, poor contract management, slow inspection of completed works and mistakes in design.
4. Project-related group comprises design changes, additional works and slow information flow between parties.
5. Material and labor group involves shortages of materials and shortages of skilled workers.
6. External factors-related group consists of unforeseen site conditions, price fluctuations, bad weather and obstacles from government.

Ogunlana, et al.(1996) studied the delays in building project in Thailand, as an example of developing economies. They concluded that the problems of the construction industry in developing economies can be nested in three layers: problem of shortages or inadequacies in industry infrastructure, mainly supply of resources; problems caused by clients and consultants; and problems caused by incompetence of contractors. They were classified source and causes of delays into six groups:

- Owners related factors include change orders and slow decision making,
- Designers related factors include incomplete drawings and low response,
- CM or inspector related factors include deficiencies in organization, deficiencies in coordination; and uncompromising attitude,
- Contractors related factors include materials management problem, deficiencies in organization, coordination deficiencies, planning and scheduling problems, equipment allocation problems, financial difficulties, and inadequacy of site inspection,
- Resources suppliers related factors include shortage of construction materials, late delivery, price escalation, low quality of materials, shortage of site workers, shortage of technical personnel, insufficient numbers of equipment, and frequent equipment breakdown, and
- Others factors include confined site, problems with neighbors, and slow permits by Government agencies.

Sambasivan and Soon, (2007)studied the Causes of delays in Malaysian These causes were categorized into the following eight major groups:

1. Client related factors: finance and payments of completed work, owner interference, slow decision making and unrealistic contract duration imposed by owners.
2. Contractor related factors: delays caused by subcontractor, site management, improper construction methods, improper planning and errors during construction, and inadequate contractor experience.
3. Consultant related factors: contract management, preparation and approval of drawings, quality assurance and waiting time for approval of test and inspection.
4. Material related factors: quality of material and shortage in material.
5. Labor and equipment related factors: labor supply, labor productivity and equipment availability and failure.
6. Contract related factors: change orders and mistakes or discrepancies in contract document.
7. Contract relationship related factors: major disputes and negotiations, inappropriate overall organizational structure linking to the project and lack of communication between the parties.
8. External factors: weather condition, regulatory changes, problem with neighbors and unforeseen site condition.

2.8 Identify group of factors

Several studies by numerous researchers identified the group of delay like Al-Kharashi and Skitmore (2009), Ahsan and Gunawan (2010), Enshassi and Al-Najjar, (2010), Kim and Ogunlana (2009), Abd El-Razek and Mobarak (2008), Kaliba et al (2009), Sweis et al.(2008), Le-Hoai et al.(2008), Moura and Teixeira(2007), Sambasivan and Soon, (2007), Assaf and Al-Hejji (2006), Koushki et al.(2005), Wiguna and Scoot (2005), Frimpong et al.(2003), Alwi and Hampson (2003), Odeh and Bataineh (2002), Abd Majid and McCaffer (1998), Chan and Kumaraswamy (1996), Assaf et al.(1995) and Ogunlana et al. (1996) they had grouped the delay causes into eleven major groups which are:

1. Material Related factors,
2. Labor Related factors,
3. Equipment Related factors,
4. Finance Related factors,
5. Contractor Related factors,
6. Sub-Contractor Related factors,
7. Client Related factors,
8. Consultant Related factors,
9. Project Related factors,
10. Design and Documentation Related factors,
11. Contract/relationships-Related factors, and
12. External Related factors.

2.9 Factor Causes Delay

2.9.1 Material Related Factors

Based on the applied literature review, it was found that the cause of delay in construction projects can be categorized into 12 groups. The summary of these groups is discussed as follow:

Category of material related delays was identified as one of the groups of causes of delays in construction projects. Any factor that is related to materials was categorized under this group of causes. One of the sources used to identify the factors under materials group of causes was the literature review.

Table (2.1) shows that the factors of poor procurement of construction materials, shortage of construction materials, poor quality of construction materials, and late delivery of materials are the most significant factors that contribute to causes of delays because these factors included by many researchers in several studies, but the factors of selection of finishing materials due to availability, delay in manufacturing special building materials, and waiting for approval of material samples are included in few researchers. In spite of this, I will present it in my research to measure the effect of these factors in Gaza construction sector.

Based on this previous literature review, 11 factors related to the material Group were identified as shown in Table(2.1).

Table 2.1: Summary of the material related factors

Factors	References
1) Shortage of construction materials	*Skitmore and Al-Kharashi (2009), Tumi et al. (2009), Kim et al. (2009), Abd El-Razek et al. (2008), Sweis et al.(2008), Le-Hoai (2008), Assaf and Al-Hejji (2006), Koushki et al. (2005), Abd Majid and McCaffer (1998), Chan (1996), Ogunlana, et al. (1996), Enshassi and Al-Najjar (2010),Sambasivan and Soon (2007), Frimpong et al.(2003) and Odeh and Battaineh (2002).*
2) Poor quality of construction materials	*Moura (2007), Koushki et al. (2005), Odeh and Battaineh (2002), Abd Majid and McCaffer (1998), Ogunlana et al. (1996), Enshassi and Al-Najjar (2010), Sambasivan and Soon (2007), and Alwi and Hampson (2003).*
3) Poor procurement of construction materials	*Skitmore and Al-Kharashi (2009), Kaliba et al (2009), Assaf and Al-Hejji (2006), Koushki et al. (2005), Frimpong et al.(2003), Abd Majid (1998), Chan (1996), Enshassi and Al-Najjar (2010), Ahsan et al. (2010), and Kaliba et al (2009).*
4) Damage of sorted material while they are needed urgently	*Skitmore and Al-Kharashi (2009), Assaf and Al-Hejji (2006), Enshassi and Al-Najjar (2010), and Alwi and Hampson (2003).*
5) Changes of materials types & specifications	*Skitmore and Al-Kharashi (2009), Abd El-Razek et al.(2008), Kaliba et al (2009), Sweis et al.(2008), Assaf and Al-Hejji (2006), and Moura et al. (2007).*
6) Late selection of finishing materials due to availability	*Skitmore and Al-Kharashi (2009), and Assaf and Al-Hejji (2006).*
7) Delay in manufacturing special building materials	*Skitmore and Al-Kharashi (2009), and Assaf and Al-Hejji (2006).*
8) Waiting for approval of material samples	*Abd El-Razek et al. (2008)and Enshassi and Al-Najjar (2010)*
9) Late delivery of materials	*Skitmore and Al-Kharashi (2009), Abd El-Razek (2008), Sweis et al.(2008), Moura et al. (2007), Assaf and Al-Hejji (2006), Abd Majid and McCaffer (1998), Ogunlana et al. (1996), Enshassi and Al-Najjar (2010),and Alwi and Hampson (2003)*

Factors	References
10) Escalation of material prices	*Skitmore and Al-Kharashi (2009), Kim (2009), Sweis et al.(2008), Wiguna (2005), and Ogunlana et al. (1996).*
11) No adherence with materials standards that is storage in the site	*Enshassi and Al-Najjar (2010).*

2.5.1 Labor Related Factors:

This group of factors related to labor characteristic that cause delay were summarized here under the Table (2.2).

Table (2.2) shows that the factors of low productivity level of labor, shortage of manpower (skilled, semi-skilled, unskilled labor), and shortage in labor are the most significant factors that contribute to causes of delays because these factors included by many researchers in several studies, but the factors of absenteeism, low motivation and morale, personal conflicts among labor, Poor distribution of labour and ageing of site workers are included in few researchers. In spite of this, I will present it in my research to measure the effect of these factors in Gaza construction sector. Based on this previous literature review, 8 factors related to the labor group were identified as shown in Table (2.2).

Table 2.2: Summary of the labor related factors

Factors	References
1. Low productivity level of labor	*Skitmore and Al-Kharashi (2009), Abd El-Razek et al. (2008), Odeh and Battaineh (2002), Ogunlana, et al. (1996), Sambasivan and Soon (2007), and Assaf and Al-Hejji (2006).*
2. Shortage of manpower (skilled, semi-skilled, unskilled labor),	*Skitmore and Al-Kharashi (2009), Enshassi and Al-Najjar(2010), Abd El-Razek et al. (2008), Sweis et al.(2008), Chan and Kumaraswamy (1996), Ogunlana, et al. (1996), Faridi et al.(2006), Assaf et al. (2006), and Frimpong (2003).*
3. Low motivation and morale	*Abd Majid et al.(1998).*
4. Personal conflicts among labor	*Skitmore and Al-Kharashi (2009), and Assaf and Al-Hejji (2006).*
5. Poor distribution of labour	*Enshassi and Al-Najjar (2010).*
6. Shortage in labor	*Skitmore and Al-Kharashi (2009), Enshassi and Al-Najjar(2010), Abd El-Razek et al. (2008), Sweis et*

Factors	References
	al.(2008), Abd Majid and McCaffer (1998), Odeh and Battaineh (2002), Sambasivan and Soon (2007), Assaf and Al-Hejji (2006), Frimpong et al. (2003), and Ahsan and Gunawan (2009).
7. Ageing of site workers	*Enshassi and Al-Najjar (2010).*
8. Different political and factional affiliation of workers	*Skitmore and Al-Kharashi (2009), Enshassi and Al-Najjar (2010), Kaliba et al (2009), Assaf and Al-Hejji (2006).*

2.9.3 Equipment Related Factors:

This group of factors related to equipment characteristic that cause delay were summarized here under the Table (2.3).

Table (2.3) shows that the factors of frequent equipment breakdown, Shortage of construction materials, and equipment allocation problem, are the most significant factors that contribute to causes of delays because these factors included by many researchers in several studies, but the factors of improper equipment used for the work, Slow mobilization of equipment, and lack of maintenance for the equipment are included in few researchers. In spite of this, I will present it in my research to measure the effect of these factors in Gaza construction sector.

Based on this previous literature review, 11 factors related to the equipment group were identified as shown in Table (2.3).

Table 2.3: Summary of the equipment related factors

Factors	Reference
1. Shortage of equipment parts required	*Enshassi and Al-Najjar (2010), Skitmore and Al-Kharashi (2009), Chan and Kumaraswamy (1996), Assaf and Al-Hejji (2006), Sweis et al.(2008), Frimpong et al. (2003), and Kaliba et al. (2009).*
2. Improper equipment used for the work	*Abd Majed and McCaffer (1998), and Chan and Kumaraswamy (1996).*
3. low level of equipment-operator's skill	*Skitmore and Al-Kharashi (2009), Enshassi and Al-Najjar (2010),and Assaf and Al-Hejji (2006).*
4. Insufficient numbers of equipment	*Skitmore and Al-Kharashi (2009), Enshassi and Al-Najjar (2010),Sambasivan and Soon (2007), Sweis et al.(2008), and Ogunlana et al. (1998).*

Factors	Reference
5. lack of high-technology mechanical equipment	*Skitmore and Al-Kharashi (2009), Long et al. (2004), and Assaf and Al-Hejji (2006).*
6. Frequent equipment breakdown	*Enshassi and Al-Najjar (2010), Skitmore and Al-Kharashi (2009),Sweis et al.(2008), Ogunlana et al. (1998), Abd Majed and McCaffer (1998), Sambasivan and Soon (2007), and Assaf and Al-Hejji (2006).*
7. Equipment allocation problem	*Ogunlana et al. (1998), Abd Majed and McCaffer (1998),and Odeh and Battaineh (2002).*
8. Slow mobilization of equipment	*Abd Majed and McCaffer (1998).*
9. low productivity and efficiency of equipment	*Skitmore and Al-Kharashi (2009), Abd El-Razek et al. (2008), and Assaf and Al-Hejji (2006).*
10. lack of maintenance for the equipment	*Enshassi and Al-Najjar (2010)*
11. inaccurate prediction of equipment production rate	*Enshassi and Al-Najjar (2010), and Skitmore and Al-Kharashi (2009).*

2.9.4 Finance Related factors:

The methodology of establishing the factors of this group of causes was similar to that of the material related delays, labor related delays, and equipment related delays. One of the sources used to identify the factors under finance group of causes was the literature review. Table (2.4) shows that the factors of delay in progress payment by owner, and difficulties in financing project by contractor are the most significant factors that contribute to causes of delays because these factors included by many researchers in several studies, but the factors of delays in payment by consultant, Delay payment to suppliers/subcontractors, Inadequate fund allocation, and Unreasonable constraints to client, and Cash problem during construction are included in few researchers. In spite of this, I will present it in my research to measure the effect of these factors in Gaza construction sector.

Based on this previous literature review, 7 factors related to the finance Group were identified as shown in Table 2.4.

Table 2.4: Summary of the finance related factors

Factors	References
1. delay in progress payment by owner	*Skitmore and Al-Kharashi (2009), Enshassi and Al-Najjar (2010), Abd El Razek et al. (2008), Sweis et al.(2008), Chan and Kumaraswamy (1996), Sambasivan and Soon (2007), Koushk et al. (2005), Assaf and Al-Hejji (2006), Fong et al.(2006), Abudul-Rahman et al. (2006), Kaliba et al.(2009). Odeh and Battaineh (2002), and Alaghbari et al. (2007).*
2. difficulties in financing project by contractor	*Skitmore and Al-Kharashi (2009), Tumi et al. (2009) Abd El Razek et al.(2008), Le-Hoai et al. (2008), Ogunlana et al. (1996), and Assaf and Al-Hejji (2006).*
3. Delay payment suppliers/subcontractors	*Sweis et al.(2008), and Abd Majid and McCaffer, (1998).*
4. Inadequate fund allocation	*Skitmore and Al-Kharashi (2009), Abd Majid and McCaffer (1998), and Long et al.(2004).*
5. monthly payment difficulties	*Chan and Kumaraswamy (1996), Frimpong et al. (2003).*
6. Unreasonable constraints to client	*Koushki et al. (2005).*
7. Cash problem during construction	*Enshassi and Al-Najjar (2010),and Frimpong et al.(2003). Arditi et al.(1985), Assaf et al.(1995), Ogunlana et al.(1996), Mezher and Tawil (1998), Al-Khalil and Al-Ghafly (1999), Chan and Albert (2002), Enshassi et al (2003), and Alaghbari et al (2007).*

2.9.5 Contractor Related Factors:

This group of factors related to contractor characteristic that cause delay were summarized here under the Table (2.2).

Table (2.5) shows that the factors of inappropriate construction methods, poor site management and supervision, inadequate contractor experience, ineffective project planning and scheduling, lack of database in estimating activity duration and resources, and poor coordination & communication by contractor with other parties are the most significant factors that contribute to causes of delays because these factors included by many researchers in several studies, but the factors of rework poor company organization, increased number of projects, replacement of key personal,

failure in testing, dependence on a newly graduated engineer to bear the whole responsibilities in the site, unethical behaviors used by contractors to achieve the highest possible level of profit, contractor un commitment to consultant instructions, and safety rules are not followed within the contractor's organization are included in few researchers, In spite of this I will present it in my research to measure the effect of these factors in Gaza construction sector.

Based on this previous literature review, 22 factors related to the contractor group were identified as shown in Table(2.5).

Table 2.5: Summary of the contractor related factors

Factors	References
1. Inappropriate construction methods	*Skitmore and Al-Kharashi (2009), Abd Majid and McCaffer (1998), Long et al. (2004), Odeh and Battaineh (2002), Sambasivan and Soon (2007),and Assaf and Al-Hejji (2006).*
2. Poor site management and supervision	*Skitmore and Al-Kharashi (2009), Enshassi and Al-Najjar (2010), Abd El-Razek (2008), Sweis et al.(2008), Odeh and Battaineh (2002), Chan and Kumaraswamy (1996), Sambasivan and Soon (2007), Assaf and Al-Hejji (2006), and Kaliba et al.(2009).*
3. Inadequate contractor experience	*Skitmore and Al-Kharashi (2009), Enshassi and Al-Najjar (2010), Abd Majid and McCaffer (1998), Long et al. (2004), Odeh and Battaineh (2002), Sambasivan and Soon (2007), and Alwi and Hampson (2003).*
4. Ineffective project planning and scheduling	*Skitmore and Al-Kharashi (2009),Sweis et al (2008), Abd Majid and McCaffer (1998), Long et al. (2004), Frimpong et al.(2003), Chan and Kumaraswamy (1996), Assaf and Al-Hejji (2006), Sambasivan and Soon (2007), Faridi and El-Sayegh, (2006),and Ogunlana et al. (1996).*
5. Incompetent project team	*Enshassi and Al-Najjar (2010),and Long et al. (2004).*
6. Delay in site mobilization	*Skitmore and Al-Kharashi (2009), Sweis et al.(2008), Abd El-Razek (2008), and Assaf and Al-Hejji (2006).*
7. Poor company organization	*Skitmore and Al-Kharashi (2009) ,and Abd El-Razek (2008) Sweis et al.(2008), and Assaf and Al-Hejji (2006).*

Factors	References
8. Inefficient quality control by contractor	*Skitmore and Al-Kharashi (2009), Enshassi and Al-Najjar (2010), Sweis et al.(2008), and Frimpong et al. (2003).*
9. Increased number of projects	*Skitmore and Al-Kharashi (2009).*
10. Improper technical study by contractor during the bidding stage	*Skitmore and Al-Kharashi (2009), and Sweis et al.(2008).*
11. Replacement of key personal	*Skitmore and Al-Kharashi (2009).*
12. Conflicts between contractor and other parties	*Skitmore and Al-Kharashi (2009), Enshassi and Al-Najjar (2010), and Assaf and Al-Hejji (2006).*
13. Poor coordination & communication by contractor with other parties	*Skitmore and Al-Kharashi (2009), Enshassi and Al-Najjar (2010), Odeh and Battaineh (2002). Sambasivan and Soon (2007), Sweis et al.(2008), and Assaf and Al-Hejji (2006).*
14. Uncompromising attitude between parties	*Enshassi and Al-Najjar (2010)*
15. Mistakes during construction	*Enshassi and Al-Najjar (2010),Skitmore et al .(2009), and Assaf and Al-Hejji (2006). Sambasivan and Soon (2007), and Frimpong et al. (2003).*
16. Insufficient contractor competition	*Enshassi and Al-Najjar (2010).*
17. Dependence on a newly –graduated engineer to bear the whole responsibilities in the site	*Enshassi and Al-Najjar (2010).*
18. Unethical behaviors used by contractors to achieve the highest possible level of profit	*Enshassi and Al-Najjar (2010).*
19. Contractors are not committed to consultant instructions.	*Enshassi and Al-Najjar (2010).*
20. Lack of database in estimating activity duration and resources	*Abd El-Razek and Mobarak (2008), Le-Hoai et al.(2008), Long et al. (2004), and Frimpong et al. (2003).*
21. Safety rules and regulations are not followed within the contractor's organization	*Sweis et al.(2008).*
22. Improper handling of the project progress	*Enshassi and Al-Najjar (2010), and Sweis et al.(2008).*

2.9.6 Sub-Contractors Related Factors:

The methodology of establishing the factors of this group of causes was similar to that of the material related delays, labor related delays, equipment related delays, finance related delays and contractor related delays. One of the sources used to identify the factors under sub-contractors group of causes was the literature review. Table (2.6) shows that the factors of unreliable subcontractor, Often changing sub-contractors company, and Lack of subcontractor's skills are the most significant factors that contribute to causes of delays because these factors included by many researchers in several studies, but the factors of delays in sub-contractors' work, and spend some time to find sub-contractors company who is appropriate for each task are included in few researchers, In spite of this I will present it in my research to measure the effect of these factors in Gaza construction sector.

Based on this previous literature review, five factors related to the sub-contractor group were identified as shown in Table (2.6).

Table 2.6: Summary of the sub-contractor related factors

Factors	References
1. Unreliable subcontractor	*Abd Majid and McCaffer (1998), Long et al. (2004), Odeh and Battaineh (2002), and Alwi and Hampson (2003).*
2. delays in sub-contractors' work	*Skitmore et al.(2009), and Assaf and Al-Hejji (2006).*
3. Spend some time to find sub-contractors company who is appropriate for each task	*Enshassi and Al-Najjar (2010).*
4. Often changing sub-contractors company	*Enshassi and Al-Najjar (2010), Assaf and Al-Hejji (2006), Ahsan and Gunawan (2009).*
5. Lack of subcontractor's skills	*Enshassi and Al-Najjar (2010), Sambasivan (2007), and Assaf and Al-Hejji (2006).*

2.9.7 Client Related factors

The methodology of establishing the factors of this group of causes was similar to that of the material related delays, labor related delays, equipment related delays, finance related delays and contractor related delays. One of the sources used to identify the factors under client group of causes was the literature review.

Table (2.7) shows that the factors of slow decision making by client, change orders client interference, and lack of communication and coordination are the most significant factors that contribute to causes of delays because these factors included by many researchers in several studies, but the factors of lack of capable representative, lack of experience of client in construction, negotiation by knowledgeable people, Improper project feasibility study, owner has no priority (urgency) to complete the project, and high quality of work required are included in few researchers. In spite of this, I will present it in my research to measure the effect of these factors in Gaza construction sector.

Based on this previous literature review, 11 factors related to the client group were identified as shown in Table(2.7).

Table 2.7: Summary of the client related factors

Factors	References
1. Slow decision making by client	*Skitmore and Al-Kharashi (2009), Tumi et al. (2009), Abd El-Razek et al. (2008), Sweis et al.(2008), Odeh and Battaineh (2002), Ogunlana et al. (1996), Sambasivan and Soon (2007), Alwi and Hampson (2003), Assaf and Al-Hejji (2006), and Frimpong et al. (2003).*
2. change orders	*Skitmore and Al-Kharashi (2009), Enshassi et al.(2010), Sweis et al.(2008), Odeh and Battaineh (2002), Al-Mouman (2000),Ogunlana et al. (1996), Koushki et al. (2005), and Assaf and Al-Hejji (2006).*
3. Lack of capable representative	*Long et al. (2004).*
4. Lack of experience of client in construction	*Koushki et al. (2005).*
5. Negotiation by knowledgeable people	*Skitmore and Al-Kharashi (2009).*
6. Client interference	*Skitmore and Al-Kharashi (2009), Sweis et al.(2008), Long et al. (2004), and Sambasivan and Soon (2007).*
7. Improper project feasibility study	*Long et al. (2004).*
8. variations in quantities,	*Skitmore and Al-Kharashi (2009), Abd El-Razek et al. (2008), and Sweis et al.(2008).*

Factors	References
9. owner has no priority/ urgency to complete the project.	*Enshassi and Al-Najjar (2010).*
10. delays in site preparation	*Sweis et al.(2008), and Assaf and Al-Hejji (2006).*
11. high quality of work required	*Enshassi and Al-Najjar (2010).*

2.9.8 Consultant Related factors:

The methodology of establishing the factors of this group of causes was similar to that of the material related delays, labor related delays, equipment related delays, finance related delays, contractor related delays and client related delays. To identify the factors to causes of delays related to consultant responsible based on literature review. Table (2.8) shows that the factors of delay in performing inspection and testing by consultant, delay in approving major changes in the scope of work by consultant, inadequate consultant experience, inadequate project management assistance, and previous dispute between consultant and contractor are the most significant factors that contribute to causes of delays because these factors are included by many researchers in several studies, but the factors of inflexibility (rigidity) of consultant, internal company problems, absence of consultant's site staff, lack of technical and managerial skills of staff, waiting time for approval of tests and giving instructions, delay of materials approval by consultant, centralization of decision making process from consultant bad past history and reputation of the consultant(corruption), and lack of job security for the consultancy team are included in few researchers, In spite of this I will present it in my research to measure the effect of these factors in Gaza construction sector. Based on this previous literature review, 12 factors related to the consultant group were identified as shown in Table (2.8).

Table 2.8 : Summary of the consultant related factors

Factors	References
1. delay in performing inspection and testing by consultant	*Skitmore and Al-Kharashi (2009), Enshassi and Al-Najjar (2010), Sweis et al.(2008), Odeh and Battaineh (2002), Frimpong et al.(2003), Assaf and Al-Hejji (2006), Ogunlana et al.(1996), Sambasivan and Soon (2007), and Alwi et al. (2003).*

Factors	References
2. delay in approving major changes in the scope of work by consultant	*Skitmore and Al-Kharashi (2009), Sweis et al.(2008), Assaf and Al-Hejji (2006), and Frimpong, et.al (2003).*
3. Inadequate consultant experience	*Skitmore and Al-Kharashi (2009), Long et al. (2004), Assaf and Al-Hejji (2006), Alwi and Hampson (2003), Enshassi and Al-Najjar (2010),and Kaliba et al (2009).*
4. inflexibility (rigidity) of consultant	*Skitmore and Al-Kharashi (2009), and Assaf and Al-Hejji (2006).*
5. internal company problems	*Skitmore and Al-Kharashi (2009).*
6. absence of consultant's site staff	*Enshassi and Al-Najjar (2010).*
7. lack of technical and managerial skills of staff	*Enshassi and Al-Najjar (2010).*
8. lack of quality assurance / control	*Enshassi and Al-Najjar (2010),and Sambasivan and Soon (2007).*
9. Previous dispute between consultant and contractor	*Skitmore et al. (2009), Enshassi and Al-Najjar (2010), Assaf and Al-Hejji (2006).*
10. Centralization of decision making process from consultant	*Enshassi and Al-Najjar (2010).*
11. Bad past history and reputation of the consultant(corruption)	*Enshassi and Al-Najjar (2010).*
12. lack of job security for the consultancy team	*Enshassi and Al-Najjar (2010).*

2.9.9 Project Related factors:

The methodology of establishing the factors of this group of causes was similar to that of the material related delays, labor related delays, equipment related, finance related delays, clines related delays contractor related delays, and consultant related delays. One of the sources used to identify the factors under project related group of causes was the literature review.

Table (2.9) shows that the factors of project size, project complexity, project regional location, poor site safety, suspension of work by owner or contractor, slow information flow between project team members, donor own policy in implementation methods and characteristics of the project, inflexibility of donor in

giving appropriate periods for project implementation are the less important factors that contribute to causes of delays because these factors included in few researchers, In spite of this I will present it in my research to measure the effect of these factors in Gaza construction sector. Based on this previous literature review, 9 factors related to the project group were identified as shown in Table 2.9.

Table 2.9: Summary of the project related factors

Factors	References
1. project size	*Ahmad et al.(2006).*
2. project complexity	*Kumaraswamy* and Dissanayaka *(1999), and Ahmad et al. (2006).*
3. project regional location	*Ahmad et al. (2006).*
4. Poor site safety	*Enshassi and Al-Najjar (2010).*
5. Slow information flow between project team members	*Enshassi and Al-Najjar (2010).*
6. Suspension of work by owner or contractor	*Enshassi and Al-Najjar (2010), and Assaf and Al-Hejji (2006).*
7. Inconsistency between the project and its environmental due to donor agenda	*Enshassi and Al-Najjar (2010).*
8. Donor own policy in implementation methods and characteristics of the project	*Enshassi and Al-Najjar (2010), and Chan and Kumaraswamy (1997).*
9. Inflexibility periods for project implementation	*Enshassi and Al-Najjar (2010).*

2.9.10 Design and Documentation Related factors:

The methodology of establishing the factors of this group of causes was similar to that of the material related delays, labor related delays, equipment related, finance related delays, client related delays, contractor related delays, consultant related delays and project related delays. One of the sources used to identify the factors under design and documentation group of causes was the literature review.

Table (2.10) shows that the factors of late in reviewing and approving design documents by consultant, poor design, ambiguities and mistakes in specifications and drawings, and incomplete drawing and detail design are the most significant factors that contribute to causes of delays because these factors included by many researchers in several studies, but the factors of complexity of project design, lack of designer's experience, delays in design work, insufficient data collection and survey before

design, un-use of advanced engineering design software, and misunderstanding of owners requirements by design engineer are included in few researchers, In spite of this I will present it in my research to measure the effect of these factors in the Gaza construction sector. Based on this previous literature review, 11 factors related to the design and documentation group were identified as shown in Table (2.10).

Table 2.10: Summary of the design and documentation factors

Factors	References
1. late in reviewing and approving design documents by consultant	*Skitmore and Al-Kharashi (2009), Enshassi and Al-Najjar (2010), Sambasivan and Soon (2007), Assaf (2006). and Alwi and Hampson (2003).*
2. poor design	*Enshassi and Al-Najjar (2010), Abd El-Razek et al. (2008), Ogunlana et al. (1996), Assaf and Al-Hejji (2006), and Alwi and Hampson (2003).*
3. Complexity of project design	*Assaf and Al-Hejji (2006).*
4. lack of designer's experience	*Enshassi and Al-Najjar (2010), Long et al. (2004), and Assaf and Al-Hejji (2006).*
5. ambiguities and mistakes in specifications and drawings	*Enshassi and Al-Najjar (2010), Sweis et al.(2008), Alwi and Hampson (2003), and Kaliba et al. (2009).*
6. incomplete drawing and detail design	*Enshassi and Al-Najjar (2010), Abd El-Razek et al. (2008), Long et al. (2004) Ogunlana et al. (1996), Assaf and Al-Hejji (2006), Alwi and Hampson (2003), and Kaliba et al.(2009).*
7. poor documentation and no detailed written procedures not using systematic procedures	*Enshassi and Al-Najjar (2010), Assaf and Al-Hejji (2006), and Alwi and Hampson (2003).*
8. delays in design work (lack of design information)	*Enshassi and Al-Najjar (2010), and Ogunlana et al. (1996).*
9. Insufficient data collection and survey before design	*Assaf and Al-Hejji (2006).*
10. Un-use of advanced engineering design software	*Assaf and Al-Hejji (2006).*
11. Misunderstanding of owners requirements by design engineer	*Assaf and Al-Hejji (2006).*

2.9.11 Contract &Contractual relationships-Related factors:

The methodology of establishing the factors of this group of causes was similar to that of the material related delays, labor related delays, equipment related, finance related delays, client related delays, contractor related delays, consultant related delays, project related delays, and Design and Documentation Related Delays . One of the sources used to identify the factors under Contract/relationships group of causes was the literature review.

Table (2.11) shows that the factors of inappropriate type of construction contract, type of project bidding and award (negotiation, lowest bidder), inappropriate overall organization structure linking all parties to the project, and major disputes and negotiations are the most significant factors that contribute to causes of delays because these factors included by many researchers in several studies, but the factors of ineffective delay penalties, the scope of work is not well defined, and unavailability of incentives for contractor for finishing ahead of schedule in the contract are included in few researchers, In spite of this I will present it in my research to measure the effect of these factors in Gaza construction sector.

Based on this previous literature review, 9 factors related to the Contract relationships group were identified as shown in Table 2.11.

Table 2.11 : Summary of the Contract relationships related factors

Factors	References
1. Ineffective delay penalties	*Skitmore and Al-Kharashi (2009), and Assaf and Al-Hejji (2006).*
2. Unavailability of incentives for contractor for finishing ahead of schedule in the contract.	*Skitmore and Al-Kharashi (2009), and Assaf and Al-Hejji (2006).*
3. Inappropriate type of construction contract	*Skitmore and Al-Kharashi (2009), Enshassi and Al-Najjar (2010), Ahsan and Gunawan (2009), Assaf and Al-Hejji (2006). Ahmad et al. (2006), Chan and Kumaraswamy (1999).*
4. Type of project bidding and award (negotiation, lowest bidder)	*Skitmore and Al-Kharashi (2009), Enshassi and Al-Najjar (2010), Assaf and Al-Hejji, (2006), and Ahmad et al. (2006).*
5. contract modification	*Enshassi and Al-Najjar (2010), and Kaliba et al (2009).*

Factors	References
6. Original contract duration is too short	*Skitmore and Al-Kharashi (2009), Enshassi and Al-Najjar (2010), Assaf and Al-Hejji (2006), Sambasivan and Soon (2007).*
7. Inappropriate overall organization, structure linking all parties to the project	*Skitmore and Al-Kharashi (2009), Enshassi and Al-Najjar (2010),Sambasivan, et al (2007), and Odeh and Battaineh (2002).*
8. Major disputes and negotiations	*Skitmore and Al-Kharashi (2009), Enshassi and Al-Najjar (2010), Sambasivan and Soon (2007), Odeh and Battaineh's (2002).*
9. Mistakes and discrepancies in contract Documents	*Enshassi and Al-Najjar (2010).and Skitmore and Al-Kharashi (2009).*

2.9.12 External Related factors:

The methodology of establishing the factors of this group of causes was similar to that of the material related delays, labor related delays, equipment related, finance related delays, client related delays, contractor related delays, consultant related delays, project related delays, design and documentation related delays, and of contract/relationships-related delays. One of the sources used to identify the factors under external group of causes was the literature review.

Table (2.12) shows that the factors of weather conditions, unforeseen ground condition, problem with neighbors, and poor economic conditions are the most significant factors that contribute to causes of delays because these factors are included by many researchers in several studies, but the factors of changes in laws and regulations, unavailability of utilities in site (such as, water, electricity, telephone, etc.), Political situation, accident during construction, changes in Government regulations, and damage by other participants are included in few researchers, In spite of this I will present it in my research to measure the effect of these factors in Gaza construction sector.

Based on this previous literature review, 11factors related to the external group were identified as shown in Table 2.12.

Table 2.12: Summary of the external related factors

Factors	References
1. Weather condition	*Enshassi and Al-Najjar (2010),Abd El-Razek et al. (2008), Odeh and Battaineh (2002), Long et al. (2004), AL-Momani (2000), Sambasivan and Soon (2007), Assaf and Al-Hejji (2006),Frimpong (2003), and Alwi and Hampson (2003).*
2. Unforeseen ground condition	*Abd El-Razek et al. (2008), Odeh and Battaineh (2002), Long et al. (2004), Sambasivan and Soon (2007), Assaf and Al-Hejji (2006), Alwi and Hampson (2003). and Frimpong et al. (2003).*
3. Problem with neighbors	*Enshassi and Al-Najjar (2010), Odeh and Battaineh (2002), Ogunlana, et al. (1996), and Sambasivan and Soon (2007).*
4. Changes in laws and regulations	*Enshassi and Al-Najjar (2010), and Sambasivan and Soon (2007).*
5. Poor economic condition	*Long et al. (2004), Enshassi and Al-Najjar (2010), Wiguna and Scott (2005), Frimpong et al. (2003), Ahsan and Gunawan (2010), and Kaliba et al.(2009).*
6. Unavailability of utilities in site (such as, water, electricity, telephone, etc.)	*Assaf and Al-Hejji (2006).*
7. Political situation (strikes Israeli attacks and borders closures, war)	*Enshassi and Al-Najjar (2010).*
8. Delay in obtaining permits from municipality.	*Abd El-Razek and Mobarak (2008), Assaf and Al-Hejji (2006), and Ahsan and Gunawan (2010).*
9. Accident during construction	*Assaf and Al-Hejji (2006).*
10. changes in Government regulations	*Sweis et al.(2008), and Assaf and Al-Hejji (2006).*
11. Damage by other participants	*Alwi and Hampson (2003).*

2.10 Relationship between causes and effect of delay

Some studies have alluded to the probable link between the causes and effects of delays without a systematic analysis. Manavizha and Adhikarib. (2002)linked the material-related causes to the probable cost overruns in construction projects in Nepal.

Assaf and Al-Hejji. (2006) linked the contractor-related and labor-related causes to the probable time overruns in construction projects in Saudi Arabia.

Odeh and Battaineh. (2002) linked the contract-linked causes to the probable disputes occurring in construction projects in Jordan. Chan and Kumaraswamy. (1997) linked the consultant- related and client-related causes to the probable time overruns in construction projects in Hong Kong. Mansfield (1994) and Frimpong et al. (2003)linked the client-related, consultant-related, and material-related factors to the probable cost and time overruns.

2.11 Effects of delays

The effects of delays in construction projects have been undertaken by numerous researchers. Sambasivan and Soon, (2007) found about Six main effects of delay were: (1) time overrun, (2) cost overrun, (3) disputes, (4) arbitration, (5) litigation, and (6) total abandonment.

Aibinu and Jagboro (2002) studied and evaluated the effects of construction delays on project delivery in Nigerian construction industry. They found that the six effects of construction delay were: time overrun, cost overrun, dispute, arbitration and litigation and total abandonment. The questionnaires were sent to three groups of construction practitioners: quantity surveyors, architects and engineers, and contractors.

Koushki and Kartam (2004) studied on the impact of construction materials in construction project in Kuwait. They obtained that time and cost overrun were the impact of the material time, their availability in the local market, and the presence of the supervising engineer.

Manavazhia and Adhikari. (2002) conducted a survey to investigate material and equipment procurement delays in highway projects in Nepal. Delay in the delivery of materials and equipment to construction sites is often a contributory cause to cost overruns in construction projects in developing countries. An assessment of the causes of the delays and the magnitude of their impact on project costs was also made. The survey method was used in conducting this research involving 22 highway projects. The main causes of material and equipment procurement delays were found to be (in rank order) organizational weaknesses, suppliers' defaults, governmental regulations and transportation delays. However, the actual impact of these delays on project costs was found to be on average, only about 0.5% of the total budgeted cost of the

projects. Among materials, delays in the supply of aggregates and equipment were found to occur most frequently.

Chan and Kumaraswamy (2002) explored strategies of compressing construction durations of various types of building projects on the basis of the lessons learned from Hong Kong based surveys and other research findings. The literature from different countries on the factors affecting construction durations, reasons for project delays and existing statistical models for duration forecasts were reviewed. A regression-based model developed from Hong Kong public housing construction project data was used for predicting the durations of the primary work packages in the building process and the overall completion period. And finally, a survey was conducted by the researchers to explore the construction time performance of projects in three building sub-sectors (i.e. public housing, public non-residential and private sector). Based on the factors identified as significant from the above research, specific technological and managerial strategies for reducing construction periods in particular building sub-sectors were formulated in order to improve the construction time performance of Hong Kong building projects.

Terry Williams (2003) studied the standard methods currently available for assessing extension of time delays on major projects, and issues around such assessment. He used network causal mapping and system dynamics approach to study the impact of delays on a project.

Based on the literature review identified the six factors were common effects of delays in construction project. Furthermore, these factor used in questionnaire survey in order to identify the common effects of delays in construction project. The following are six factors that were common contributed to construction delay which includes:

1. Time Overrun;
2. Cost Overrun;
3. Dispute;
4. Arbitration;
5. Total abandonment(Contract Termination)
6. Litigation.

2.12 Methods used to mitigate delay effect

The success of construction projects is very important for all project participants as well as the community and the nation to sustain national development. However, various factors affect whether or not a project is completed successfully.

Several studies have been studied and recommended the methods of minimizing delays in construction projects. Nguyen, et al (2004), identified five critical success factors could be applied to reduce the effects of delays includes: competent project manager; adequate funding until project completion; multidisciplinary/competent project team; commitment to projects; and availability of resources. Aibinu and Jagboro (2002) in their study also identified two methods to reduce or if possible eliminate time overrun were acceleration of site activities, and contingency allowance. A comprehensive study to improve the situation of construction project also has been recommended by Odeh and Battaineh (2002). They recommended four includes: developing human resources in the construction industry through proper training and classification of craftsman; adopting a new approach to contract award procedure by giving less weight to prices and more weight to the capabilities and past performance of contractors; and adopting new approaches to contracting, such as design-build and construction management type of contracts.

Koushki, et al. (2005) revealed that the minimization of time delays and cost overruns would require: ensure adequate and available source of finance until project completion; allocation of sufficient time and money at the design phase select of a competent consultant and a reliable contractor to carry out the work; perform a preconstruction planning of project tasks and resource needs; hire an independent supervising engineer to monitor the progress of the work; and ensure timely delivery of materials.

Sambasivan and Soon, (2007) divide the prescriptions to adopted into three groups: (1) prescriptions for the clients, (2) prescriptions for the consultants, and (3) prescriptions for the contractors

1. Prescriptions for the clients

(1) While selecting the contractors, clients have to make sure that the contractors are not selected based only on the lowest bid. The selected contractor must have sufficient experience, technical capability, financial capability, and sufficient manpower to execute the project, (2) clients should not interfere frequently during the

execution and keep making major changes to the requirements. This can cause inordinate delays in the project, (3) clients should have the finances in time to pay the contractors after completion of a work. Therefore, clients should work closely with the financing bodies and institutions to release the payment on schedule, and (4) clients must make quick decisions to solve any problem that arise during the execution.

2. Prescriptions for the consultants

(1) While drawing the contract between the client and contractor, the consultant must include items such as duration of contract, mechanism to solve disputes, mechanism to assess the causes of delay, if there are any and risk management plans, (2) consultants should prepare and approve drawings on time, and (3) consultants should monitor the work closely by making inspections at appropriate times.

3. Prescriptions for the contractors

(1) Contractors should not take up the job in which they do not have sufficient expertise, (2) contractors should have able site-managers for the smooth execution of work, (3) contractors must plan their work properly and provide the entire schedule to the clients, and (4) contractors must make sure they have a sound financial backing.

Based on several studies like Nguyen, et al (2004), Aibinu and Jagboro (2002), Odeh and Battaineh (2002), Koushki et al. (2005), and Sambasivan and Soon, (2007) a total of 34 methods have been identified in order to minimize construction delays as shown in Table (2.13).

Table 2.13 Summary of methods used to minimize mitigate delay effect

No	Methods used to mitigate delay effect
1.	Competent project manager
2.	Ensure adequate and available source of finance
3.	Multidisciplinary/competent project team
4.	Availability of all resources in the site
5.	Commitment to projects
6.	Adopting a new approach to contract award procedure by giving less weight to prices and more weight to the capabilities and past performance of contractors;
7.	Adopting new approaches to contracting such as Design-Build (D/B) and Construction Manager (CM) type of contract
8.	Complete and accurate project feasibility study and site investigation
9.	Comprehensive contract documentation

No	Methods used to mitigate delay effect
10.	Frequent progress meeting
11.	Project management assistance
12.	Use up to date technology utilization
13.	Use of experienced subcontractors and suppliers
14.	Complete and proper design at the right time
15.	Competent personnel of consultant/designer
16.	Competent and capable of client's representative
17.	Site management and supervision
18.	Use of proper and modern construction equipment
19.	Proper project planning and scheduling
20.	Accurate initial cost estimates
21.	Proper emphasis on past experience
22.	Frequent coordination between the parties involved
23.	Absence of bureaucracy
24.	Clear information and communication channels
25.	Accurate initial time estimates
26.	Developing human resources in the construction industry through proper.
27.	Allocation of sufficient time and money at the design phase
28.	Awarding bids to the right/experience consultant and contractor
29.	Perform a preconstruction planning of project tasks and resources needs.
30.	Systematic control mechanism
31.	Effective strategic planning
32.	Use of advanced engineering design software
33.	Government should construct new store houses in settlements of Gaza Strip to store the required construction materials such as; the cement, base course, aggregates, steel, etc
34.	Government is advised to put a condition on the donor in the memorandum of understanding that obligate donor to compensate the contractor for any loss that result from hard political situation.

2.13 Factor Analysis

Factor analysis was used to explore and detect the underlying relationships among the identified Critical Success Factors (CSFs). This statistical technique identifies a relatively small number of factors that can be used to represent relationships among sets of many interrelated variables The appropriateness of the factor analysis for the factor extraction needs to be tested in various ways (Amer, 2002). Factor analysis can be used either in hypothesis testing or in searching for constructs within a group of variables. Chen et al.(2007). It is a series of methods for finding clusters of related variables and hence an ideal technique for reducing a large number of items into a more easily understood framework (Shen et al. 2003).

2.14 Modeling delay in construction projects

Construction time has always been seen as one of the benchmarks for assessing the performance of a project and the efficiency of the project organization. Timely completion of a construction project is one goal of the client and contractor because each party tends to incur additional costs and lose potential revenues when completion is delayed (Thomas et al.1995).

In a survey of 370 building projects in Australia. Bromilow (1974) produced a model, which predicted construction duration as follows:

$$T=KC^{B}$$

where T is the duration of the construction period from date of site possession to practical completion, in working days, C is the final cost of building in millions of dollars, adjusted to constant labour and material prices, K is a constant describing the general level of time performance for a one-million-dollar project and B is a constant describing how the time performance is affected by project size, as measured by cost. His model was summarized as

$$T=313\ C^{0.3}$$

Since recent studies of time-cost relationships were concentrated on building works, Kaka and Price (1991) conducted a similar research on roadwork projects within the period 1984–1989 in the United Kingdom and a similar empirical relationship was arrived at a study of the time-cost relationship of 67 Australian public projects, 20 Australian private projects and 51 Malaysian public projects confirmed Bromilow's

initial model at the 0.00 level of significance and came up with the following models (Yeong, 1994).

Australian private projects: $T=161C^{0.367}$

Australian public projects: $T=287C^{0.237}$

Australian all projects: $T=269C^{0.215}$

Malaysian public projects: $T=518C^{0.352}$

Furthermore, since most of the studies so far reported dealt with either building or civil engineering projects, Kumaraswamy and Chan (1995) surveyed a combination of building and civil engineering projects and confirmed that the time-cost relationship for both types of project can be modelled in the form of Equation $T=KC^{B}$. They suggested the inclusion of other project-characteristic macro variables such as construction cost, gross floor area, number of stories and microfactors affecting productivity, as well as other significant factors that may influence project duration. The latest of the series of studies of time-cost relationship was carried by Chan (1999). His study of 110 building projects in Hong Kong resulted with the following models:

Public projects: $T=166C^{0.28}$

Private projects: $T=120C^{0.34}$

All projects: $T=152C^{0.29}$

A time-cost relationship for construction projects in Nigeria has been developed based on Bromilow's time-cost model. Cost data on 87 completed building projects executed within the period 1991–2000 were obtained. The data were subjected to regression analyses using double log and later the piecewise model with breakpoint. For the Nigerian situation, predict a model The Bromilow time-cost relationships (BTC) for Nigeria for private, public and all projects under consideration are shown as follows (Ogunsemi and Jagboro, 2007).

All projects: $T=63C^{0.262}$

Private projects: $T=55C^{0.312}$

Public projects: $T=69C^{0.255}$

Kim et al.(2009)develops a Structural Equation Model (SEM) to predict the project success of uncertain international construction projects by using factor analysis Through a comparative analysis of SEM with a multiple regression analysis and artificial neural network, SEM shows a more accurate prediction of performance

because of its intrinsic ability to consider various risk variables in a systematic and realistic way. The model shown as follow.

Time (predict) = 4.670 + 0.619 *(quality of estimation)
+ 0.527 *(project information in the early stage of a project)
+ 0.506 *(owner & Architecture engineers ability and attitude)
+ 0.499 *(contract condition & management)
+ 0.477 *(project condition including resource delivery, labor skill, etc)
+ 0.470* (commitment of organization including PM competency)
+ 0.402* (contractors 'ability & experience)
+ 0.379 *(quality of design).

2.15 Chapter summary

A total of one hundred and twenty seven(127) factors in twelve groups of causes of delays used on questionnaire survey in order to collect data from the targeted respondent. The groups and factors were identified based on literature review which contributed to the causes of delays in construction project.

The delay causes are grouped into twelve major groups which are: material related factors, labor related factors, equipment related factors, finance related factors, contractor related factors, sub-contractor related factors, client related factors, consultant related factors, project related factors, design and documentation related factors , contract relationships-related factors, and external related factors.

1. **Material Related factors**: eleven causes of this group were selected. These causes are shortage of construction materials, poor quality of construction materials, poor procurement of construction materials, damage of sorted material while they are needed urgently, changes of materials types & specifications, late in selection of finishing materials due to availability, delay in manufacturing special building materials, waiting for approval of material samples, late delivery of materials, escalation of material prices, and no adherence with materials standards that is storage in the site.
2. **Labor Related Factors:** eight causes of this group were selected. These causes are low productivity level of labor, shortage of manpower (skilled, semi-skilled, unskilled labor), low motivation and morale, Personal conflicts among labor, Poor

distribution of labour, shortage in labor, ageing of site workers, ageing of site workers, different political and factional affiliation of workers.

3. **Equipment Related Factors:** eleven causes of this group were selected. These causes are shortage of equipment parts required, improper equipment used for the work, low level of equipment-operator's skill, insufficient numbers of equipment ,lack of high-technology mechanical equipment, frequent equipment breakdown, equipment allocation problem, slow mobilization of equipment, low productivity and efficiency of equipment, lack of maintenance for the equipment, and inaccurate prediction of equipment production rate.
4. **Finance Related factors:** seven causes of this group were selected. These causes are delay in progress payment by owner, difficulties in financing project by contractor, delay payment suppliers/subcontractors, delay payment suppliers/subcontractors, Inadequate fund allocation, monthly payment difficulties, unreasonable constraints to client, and cash problem during construction.
5. **Contractor Related Factors:** seven causes of this group were selected. These causes are inappropriate construction methods, poor site management and supervision, Inadequate contractor experience, ineffective project planning and scheduling, incompetent project team, delay in site mobilization, Poor company organization, inefficient quality control by contractor, increased number of projects, improper technical study by contractor during the bidding stage, replacement of key personal, Conflicts between contractor and other parties, Poor coordination & communication by contractor with other parties, Mistakes during construction, insufficient contractor competition, dependence on a newly – graduated engineer to bear the whole responsibilities in the site, unethical behaviors used by contractors to achieve the highest possible level of profit, contractor un commitment to consultant instructions, Lack of database in estimating activity duration and resources, Safety rules and regulations are not followed within the contractor’s organization, and Improper handling of the project progress.
6. **Sub-Contractors Related Factors:** five causes of this group were selected. These causes are unreliable subcontractor, delays in sub-contractors' work, spend some time to find sub-contractors company who is appropriate for each task, often changing sub-contractors company , and lack of subcontractor's skills.

7. **Client Related factors:** eleven causes of this group were selected. These causes are slow decision making by client, change orders, lack of capable representative, lack of experience of client in construction, negotiation by knowledgeable people, client interference, Improper project feasibility study, variations in quantities, suspension of work by owner, owner has no priority/ urgency to complete the project, delays in site preparation, and high quality of work required.
8. **Consultant Related factors:** thirteen causes of this group were selected. These causes are delay in performing inspection and testing by consultant, delay in approving major changes in the scope of work by consultant, Inadequate consultant experience, inflexibility (rigidity) of consultant, internal company problems, absence of consultant's site staff, lack of technical and managerial skills of staff, lack of quality assurance / control, Previous dispute between consultant and contractor, centralization of decision making process from consultant, Bad past history and reputation of the consultant(corruption),and lack of job security for the consultancy team.
9. **Project Related factors:** nine causes of this group were selected. These causes are project size**,** project complexity**,** project regional location**,** Poor site safety**,** Slow information flow between project team members, suspension of work by owner or contractor, inconsistency between the project and its environmental due to donor agenda, donor own policy in implementation methods and characteristics of the project, and Inflexibility periods for project implementation.
10. **Design and Documentation Related factors: :** eleven causes of this group were selected. These causes are late in reviewing and approving design documents by consultant, poor design, Complexity of project design, lack of designer's experience, ambiguities and mistakes in specifications and drawings, incomplete drawing and detail design, poor documentation and no detailed written procedures not using systematic procedures, delays in design work, Insufficient data collection and survey before design, Un-use of advanced engineering design software, and Misunderstanding of owners requirements by design engineer.
11. **Contract &Contractual relationships-Related factors:** nine causes of this group were selected. These causes are Ineffective delay penalties**,** unavailability of incentives for contractor for finishing ahead of schedule in the contract, Inappropriate type of construction contract, type of project bidding and award, contract modification, original contract duration is too short, Inappropriate overall

organization, structure linking all parties to the project, major disputes and negotiations, and Mistakes and discrepancies in contract Documents.

12. **External Related factors:** eleven causes of this group were selected. These causes are Weather condition, Unforeseen ground condition, Problem with neighbors, Changes in laws and regulations, Poor economic condition, Unavailability of utilities in site, Political situation(strikes Israeli attacks and borders closures, war), Delay in obtaining permits from municipality, Accident during construction, changes in Government regulations, and Damage by other

Seven factors that common contributed to delays and thirty four methods of minimizing delays were identified based on literature review. These factors, effects, and methods are used to develop the questionnaire survey.

3 METHODOLOGY

This chapter discusses the methodology which is used in this research. The methodology includes information about the research design, population, sample size, data collection, questionnaire design, questionnaire content, instrument validity, pilot study, and the method of processing and analyzing the data. The questionnaire will be the main approach to collect the data and perspectives of the respondents. Besides, a case study showing UNRWA projects within the period 2005-2007 was used to investigate the main causes of delay in UNRWA's construction project.

The purpose of any research is to discover answers to questions through the application of scientific procedures. In line with this and as stated in chapter 1, the main purpose of this research is to investigate the major causes of delay in construction project. In addition, the research will develop a mathematical models showing the best representation of delay causes.

Kallet (2004) explained that, the methods section should describe what was done to answer the research question, describe how it was done, justify the experimental design, and explain how the results were analyzed. In addition, the structure of methods section should describe the materials used in the study, explain how the materials were prepared for the study, describe the research protocol, explain how measurements were made and what calculations were performed, and finally state which statistical tests were done to analyze the data.

3.1 Research design

In this research, the questionnaire approach was used to collect the factual perspectives and attitudes of the respondents. In addition, the case study approach showing analytical data was used to collect actual data from sixty nine (69) projects that were constructed during the period from (2005-2007).

In this research, the questionnaire approach was used as a quantitative approach to gain insights and to understand people's perception regarding the factors that cause delay in the construction projects. The justification to adopt the questionnaire approach is ascribed to the following reasons:

- The questionnaire approach can be considered as an deductive approach and necessarily encompasses a wide range of research strategies and methods, embracing the perspectives both of researchers and participants, and has a primary aim of understanding the meaning of human action.
- From the questionnaire approach, the researcher can obtain both, qualitative data which is related to the perspectives and attitudes of the respondents in addition to the quantities data which present the facts and actual cases in the works. Both quantities and qualitative approaches are essential to the developments and continuous improvement of the construction industry wherever it is.
- Most of the Construction Management research is currently dominated by the following three principal approaches; quantitative methods, qualitative methods and Mixed Approach (A combination of quantitative and qualitative methods) and many researchers like Fellows and Liu, (2008) explained the critical importance of the questionnaire approach in the development and collection of all necessary data for the practical and researching benefits.
- Using the questionnaire approach is considered an easy, rapid and efficient approach to collect the data, facts and attitudes of the contractors, clients, or consultants.
- The questionnaire approach is the widely used approach for descriptive and analytical surveys in order to find out the facts, opinions and views; this discussion is supported by many researchers like Fellows and Liu, (2008) and Naoum (1998).

In addition to the questionnaire approach, the case study approach was used as a supportive and efficient approach to obtain actual and quantities data regarding the factors that cause delay in the UNRWA construction projects. This quantitative approach seeks to gather factual data which will be compared with the questionnaire results and the previous qualitative and quantities studies, and to show the relationships between facts from the case study and the facts, perceptions and attitudes that were obtained from the questionnaire results.

Haseman (2006) explained that, quantitative research embraces a set of scientific, deductive approaches and establishes "research questions and hypotheses from theoretical models, and then tests them against empirical evidence", while the qualitative research operates quite differently. It prefers inductive approaches and

necessarily encompasses a wide range of research strategies and methods, embracing the perspectives if both of researchers and participants, and has a primary aim of "understanding the meaning of human action"

In this research, both questionnaire and case study approaches were considered as method to collect the needed data. The case study was targeting one association in Gaza Strip that work in construction projects. The questionnaire was targeting most of the Palestinian clients.

Figure 3.1 illustrates the methodology flow chart which includes the objectives of the study, questionnaire design, case study, data analysis, discussion, conclusions, and recommendations.

3.2 Research period

The study started in October 2009 when the initial proposal was approved. The literature review was completed on December 5th 2009. The validity testing, piloting and questionnaire distribution and collection took one month and half and completed on the beginning of January 2010. The study was carried out on Gaza Strip clients. The analysis, discussion, conclusion and recommendation were completed on the beginning of May 2010.

3.3 Case study

A case study was conducted for the projects that were constructed in the engineering and construction services department in the United Nations Relief and Work Agency (UNRWA).

These projects as shown in Annex "B" were implemented during the period (2005 - 2007). These projects were analyzed with respect to investigate the most factors that cause delay. Not all factors were investigated, only part of the factors that are related to the contract and project characteristics, part of the factors that are related to the client and material group and some factors related to the external environment. The main reason of not investigating all factors was attributed to the non availability of these data in the UNRWA's data base. The benefit from this case study is to investigate the main causes of delay in UNRWA's construction project and to reflect the comparison study between this association and other ministries and associations in the Gaza Strip. Besides the study could provide some benefit guidance for the clients in Gaza Strip.

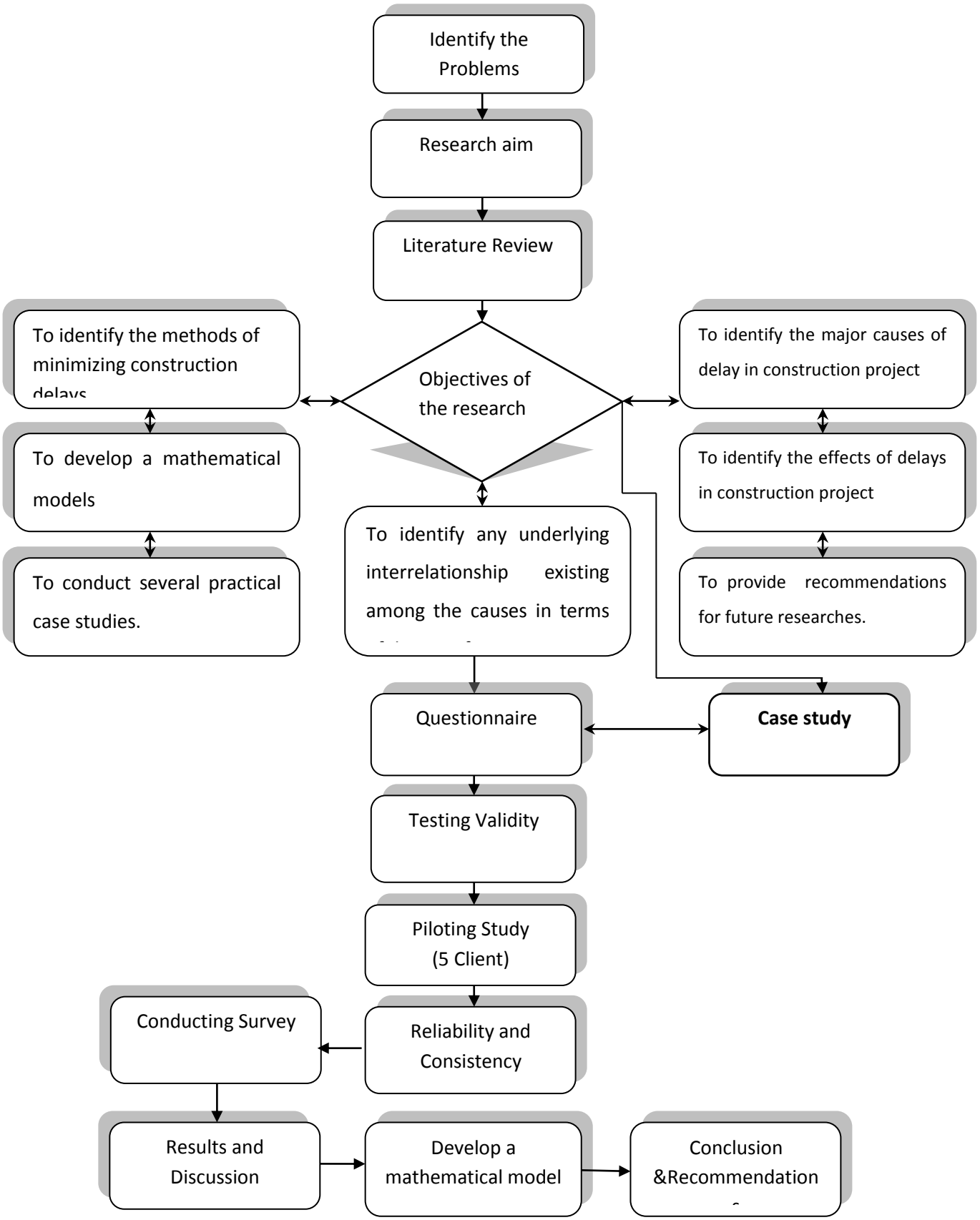

Figure 3.1: Flow chart of Methodology

3.4 Research Population

The target group in this research are the clients. There is no official report that mention the number of clients in Gaza. Such rareness of the data reflects margin of barrier. To overcome this problem, sessions with the expertise and local staff who is working in several associations and ministries were held to list the names of clients who have experience and works in construction projects These steps were taken to verify the consistent and reliable results and output as much as possible. The total populations that were aggregated were sixty (60) clients.

3.5 Sample size

Fellows and Liu, (2008) defined the sample as a part of total population that represents this population. Israel (2003) explained that, there are several approaches to determining the sample size. These include using a census for small populations, imitating a sample size of similar studies, using published tables, and applying formulas to calculate a sample size. Fellows and Liu, (2008) showed that three types of sampling can be conducted during the research study; a systematic sampling, stratified sampling, and the cluster sampling. The stratified sampling will be used in this study after the sample size determination. Fellows and Liu, (2008) showed that the strata sampling determination occurs most commonly by considering the relative importance of each stratum in population and using such weighting to divide this population, the sample size between strata, the elements to be sampled. These elements will be selected randomly from each stratum. To determine the sample size for the population of clients, Kish (1965) equation was used. Several studies such as (Assaf et al (1999, 2001) and Al-Khalil (1999) used this equation. The population of clients is sixty.

$$n = \left[\frac{n'}{1 + \left(\frac{n'}{N} \right)} \right] \quad \text{.....} \text{ Kish (1965)}$$

Where:

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

n': sample size from finite population.

N: Total population (60 clients)

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

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

The sample size for the clients population can be calculated from the previous equations as follows: $n' = S^2/V^2 = (0.5)^2/(0.05)^2 = 100$.

$$n_{clients} = \left[\frac{100}{1 + \left(\frac{100}{60} \right)} \right] = 38 \text{ clients.}$$

Table (3.1) shows that the population, calculated sample size and the response rate for clients. Although the calculated sample size for clients is 38, as the size of the clients is relatively small, the questionnaire was distributed among 60 clients instead of 38 clients. This will reflect higher reliability and benefits for the study. To overcome the risk of not responding from the clients, the questionnaires that were distributed were higher than the calculated sample size figure. Fortunately.

Table 3.1: clients' population, sample size and response rate.

Clients	**Population**	**Sample Size**	**Number of distributed**	**Number of respondents**	**Response Rate**
Like: NGO's, Ministries and municipalities	60	38	60	54	90 %

Moser and Kalton (1971) showed that, for the most postal questionnaires, the response rate is normally attracting return rates of between 20-30%. According to Moser and Kalton (1971), a response rate of less than 30% is likely to produce results subject to response bias. Based on this, this response rate is excellent and will reflect good results and outputs.

For the population which is related to the clients, the clients represented by the ministries, Non Governmental Organizations (NGO's), international organizations, municipalities that are working in the construction project was targeted. Tables 3.1 shows the population, sample size and the weighted number for clients.

3.6 Data collection

A questionnaire was chosen to be the method of collecting data in this research. Scanning by a questionnaire can be the fastest and the easiest method of collecting data and is more accurate when starting processing and analyzing these data. Besides, a case study of UNRWA's construction projects was used as a supportive and for comparative purposes. Data collected from different questions will be gathered to answer different objectives. Analysis is done based on various categories by using the statistical methods.

3.7 Questionnaire design

The questionnaire was designed based on literature review as shown in Annex "A". Factors that contributed to the causes of delays, the effects of delays, and the methods to minimize delays were identified. A questionnaire survey was developed to assess the perceptions of clients of the relative importance of causes and the effects of construction delays. The questionnaire was designed in four sections: section "A" , section "B", section "C", and section "D".

The questionnaire was developed and distributed among the clients in Arabic language. The researcher believes that the Arabic language will be much effective and easier to be understood to get more realistic results. They were asked to take their opinions in consideration.

3.8 Questionnaire content

The questionnaire as shown in Annex "A" was provided with a cover letter explaining the purpose of the study, the way of responding, the aim of the research and the security of the information in order to encourage a high response. The questionnaire included three types of questions. (1) a multiple choice questions: which are used widely in the questionnaire, (2) text open-end questions, and (3) agreement scale questions. The variety of the questions aims first to meet the research objectives, and to collect all the necessary data that can support the discussion, results and recommendations in the research.

The questionnaire aimed to study the perception of construction clients in the construction projects and to collect a supportive data for the research development in the construction industry. The sections in questionnaire will verify the objectives in this research as the following:

3.8.1 Section "A": Company and Respondent Profile

This section is to obtain the information about the respondents. The questionnaire includes the following:

- The number of years organization has experience in construction
- Location of organization
- No of project during implementations in the last 5 years
- Average of projects executed in the last 5 years ($)
- No of projects management in the organization
- Respondent's years of experience
- Respondent's qualification

3.8.2 Section B: Causes of Delays

This section is to obtain the information on factors that contribute to the causes of delays in construction projects from the perspective of clients . There are twelve categories with 127 factors of causes of delays identified, and then constructed into structured questions. The questionnaire is mainly based on Likert scale of five ordinal measures from one (1) to five (5) according to level of contributing. Each scale represents the following rating:

(5) = Very high contributing,

(4) = High contributing,

(3) = Medium contributing,

(2) = Low contributing, and

(1) = Very low contributing.

3.8.3 Section C: Effects of Delays

This section's focus is to identify the frequent effects of delays in construction project. The respondents were asked to rank the individual effect of delays in construction project based on frequency of occurrence according to their own judgment and working experience with clients. There are seven effects of delays in construction project that are identified then constructed into structured question. The questionnaire is mainly based on Likert scale of five ordinal measures from one (1) to five (5) according to level of frequent. Each scale represents the following rating:

(5) = Always,

(4) = Mostly,

(3) = Sometimes,

(2) = Seldom, and

(1) = Never.

3.8.4 Section D: Methods of Minimizing Construction Delays

This section is to identify the effective methods of minimizing construction delays. Thirty five methods were identified from several literature review, and then are used in the structured question. The questionnaire is mainly based on Likert scale of five ordinal measures from one (1) to five (5) according to level of effectively. Each scale represents the following rating:

(5) = Very high effective;

(4) = High effective;

(3) = Medium effective;

(2) = Low effective; and

(1) = Very low effective.

3.9 Validity test

Heffner (2004) explained that, validity refers to the degree in which our test or other measuring device is truly measuring what we intended to measure. Burns and Grove (1993) defined the validity of an instrument as a determination of the extent to which the instrument actually reflects the abstract construct being examined. Polit and Hungler (1985) give another definition, "Validity refers to the degree to which an instrument measures what is supposed to be measured". High validity is the absence of systematic errors in the measuring instrument. When an instrument is valid; it truly reflects the concept it is supposed to measure. Achieving good validity required the care in the research design and sample selection (Fellows and Liu, 2008). The amended questionnaire was done by five expertise in the construction projects (two work in UNDP, and then two work in UNRWA, and finally one works at Ministry Of Education(MOE). The expertise agreed that the questionnaire was valid and suitable enough to measure the purpose that the questionnaire was designed for.

3.9.1 Criterion-related validity test

To test criterion-related validity test, it measures the correlation coefficient between one filed and all the fields of the questionnaire that have the same level of similar scale. The P- Values were less than the significance level of 0.05 and 0.01, So the correlation coefficients of the fields are significant at $\alpha = 0.01$ or $\alpha = 0.05$ and statistically, it can be concluded that the fields are consistent and valid to measure what was set for as shown in Table(3.2).

3.9.2 Structure validity test

It assessed the fields structure validity by calculating the correlation coefficients of each field of the questionnaire and the whole of questionnaire.

Table (3.2) Correlation coefficient of each field and the whole of questionnaire

Factors	Spearman Correlation Coefficient	Sig. value	Sig. level
1. Material - Related Factors	0.682	0.001	sig. at 0.01
2. Labor - Related Factors	0.447	0.048	sig. at 0.05
3. Equipment- Related Factors	0.531	0.011	sig. at 0.05
4. Finance -Related factors	0.510	0.021	sig. at 0.05
5. Contractor- Related Factors	0.797	0.000	sig. at 0.01
6. Sub-Contractors - Related Factors	0.488	0.038	sig. at 0.05
7. Client -Related factors	0.714	0.000	sig. at 0.01
8. Consultant - Related factors	0.770	0.000	sig. at 0.01
9. Project - Related factors	0.577	0.008	sig. at 0.01
10. Design and Documentation Related factors	0.807	0.000	sig. at 0.01
11. Contract &Contractual relationships - Related factors	0.677	0.001	sig. at 0.01
12. External - Related factors	0.701	0.001	sig. at 0.01

** According to table (3.2), the coefficient correlation of each item within its scope is significant at levels (0.01) and (0.05).

3.10 Reliability statistics

Heffner (2004) showed that the reliability is synonymous with the consistency of a test, survey, observation, or other measuring device. "The reliability test refers to the test's consistency among different administrations. To determine the coefficient for this type of reliability, the same test is given to a group of subjects on at least two separate occasions. If the test is reliable, the scores that each respondent receives on the first administration should be similar to the results on the second round" (Heffner, 2004).

Reliability of an instrument is the degree of consistency with which it measures the attribute it is supposed to be measuring (Polit and Hunger, 1985). The test is repeated to the same sample of people on two occasions and then compares the scores obtained by computing a reliability coefficient (Polit and Hunger, 1985). For the most purposes

reliability coefficient above 0.7 are considered satisfactory. Period of two weeks to a month is recommended between two tests (Burns and Groves, 1993). Due to complicated conditions that the clients is facing at the time being, it was too difficult to ask them to responds to our questionnaire twice within short period. Barakat (2007) explained that overcoming the distribution of the questionnaire to measure the reliability can be achieved by using Kronpakh Alph coefficient

Chronbach's coefficient alpha (George and Mallery, 2003) is designed as a measure of internal consistency, that is, do all items within the instrument measure the same thing? Chronbach.s alpha is used here to measure the reliability of the questionnaire between each field. The normal range of Chronbach.s coefficient alpha value between 0.0 and + 1.0. The closer the Alpha is to 1, the greater the internal consistency of items in the instrument being assumed. The formula that determines alpha is fairly simple and makes use of the items (variables), k, in the scale and the average of the inter-item correlations, r:

$$\alpha = \frac{Kr}{1 + (k-1)r}$$

As the number of items (variables) in the scale (k) increases the value α becomes large. Also, if the intercorrelation between items is large, the corresponding α will also be large. Since the alpha value is inflated by a large number of variables then there is no set interpretation as to what is an acceptable alpha value. A rule of thumb that applies to must situations is:

$0.9 \leq \alpha \leq 1.0$	Excellent
$0.8 \leq \alpha < 0.9$	Good
$0.7 \leq \alpha < 0.8$	Acceptable
$0.6 \leq \alpha < 0.7$	Questionable
$0.5 \leq \alpha < 0.6$	Poor
$0.0 \leq \alpha < 0.5$	Unacceptable

The Chronbach.s coefficient alpha was calculated for each field of the questionnaire. The most identical values of alpha indicate that the mean and variances in the original scales do not differ much, and thus standardization does not make a great difference in alpha.

The values of Chronbach's Alpha for each filed of the questionnaire and the entire questionnaire. Chronbach's Alpha equals 0.958 for the entire questionnaire which indicates an excellent reliability of the entire questionnaire and the researcher used split half test to measure reliability by Guttman equation were in the range from 0.797 and 0.826. This range is considered high; the result ensures the reliability of each field of the questionnaire.. Thereby, it can be said that it is proved that the questionnaire is valid, reliable, and ready for distribution for the population sample.

3.11 Pilot study

A pilot study for the questionnaire was conducted before collecting the results of the sample. It provides a trial run for the questionnaire, which involves testing the wordings of the questions, identifying ambiguous questions, testing the techniques used to collect data, and measuring the effectiveness of standard invitation to respondents (Naoum, 1998).

The piloting process was conducted by five clients who were selected precisely because of their practice in the construction projects. The five were invited to participate in the piloting process and were asked to review the questionnaire and give their advice. In general, they agreed that the questionnaire is suitable to achieve the goals of the study. Important comments and some modifications have been done. The main comments could be summarized as follow:

Q1: The name of the organization & Address changed to be optional to keep the information of the organization secret.

3.12 Data processing and analysis

The collected raw data was first sorted, edited, coded and then entered into a computer software. Two programs used where the Excel sheet and Statistical Package for Social Science (SPSS). Appropriate graphical representations and tables were obtained to understand and analyze the questions. The ordinal scale was used in the analysis process. The ordinal scale is a ranking or rating data which normally uses integers in an ascending or a descending order. The Relative Importance Index (RII) was used in the analysis in addition to other approaches such as the one way ANOVA and frequencies and percentiles.

3.13 Relative Important Index (RII)

The relative important index and the mean values were used in this research. Egemen and Mohamed (2005) explained that the relative index techniques has been widely used in construction research for measuring attitudes with respect to surveyed variables Several researches such as { Skitmore, et.al (2009), Enshassi, et.al (2009). Abd El Razek (2008), Sweis et al.(2008), Chan and Kumaraswamy (1996), Sambasivan, Assaf,et.al (2006), and Kaliba et al(2009)} used the relative important index in their analysis. Likert scaling was used for ranking questions that have an agreement levels. The respondents were asked to give their perceptions in group of questions on five-point scale (1, for the strongly disagree to 5 for the strongly agree), which reflects their assessment regarding the factors causing delay in construction projects. The importance index was computed using the following equation:

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

Where W is the weighting given to each factor by the respondent, ranging from 1 to 5 ,(n1 = number of respondents for Strongly disagree, n2 = number of respondents for disagree, n3 = number of respondents for neutral, n4 = number of respondents for agree , n5 = number of respondents for strongly agree). A is the highest weight (i.e 5 in the study) and N is the total number of samples. The relative importance index ranges from 0 to 1.

SPSS program was used to analyze all sections, while the excel was supportive in the presentation and layout. The main factors which are used in analysis were the mean and the percentage weight. The analyzed data was finally presented using descriptive methods for easy interpretation of data.

3.14 Limitation of the study

The instability of the political, economical and other situations resulting from the imposed closure by Israel after the eruption of Al Aqsa intifada till now may affect the precision of the obtained results.

The study is considered limited as it covers the structure and maintenance building categories only. Other type of works such as infrastructure and steel structures could be covered in further researches. In addition, this study is surveyed on the Gaza strip only; if we expand our study to the building categories in the West Banks the results could be compared with larger scale and scope.

3.15 Summary

In order to achieve the objectives of the study, the research methodology has been established. This study was carried out based on literature review, case study, and questionnaire survey.

4 ANALYTICAL CASE STUDY

4.1 Introduction

UNRWA (United Nations Relief and Works Agency for Palestine Refugees in the Near East) is a relief and human development agency, providing education, health Care, social services and emergency aid to over 4.5 million refugees living in the Gaza Strip, the West Bank, Jordan, Lebanon and the Syrian Arab Republic. UNRWA is by far the largest UN operation in the Middle East, with over 28,000 staff, almost all of them refugees themselves, working directly to benefit their communities as teachers, doctors, nurses or social workers (UNRWA, 2009[a]). The Figures that were cited from (UNRWA in figure, 2007) report in Table 4.1 showed the registration profiles of the refugees in the Gaza strip's camps, besides; geographical locations of each camp can be shown in Figure 4.1.

Table 4.1: Registration profiles of the refugees in Gaza strip camps

CAMP	NUMBER OF REGISTERED REFUGEES
Jabalia	107,590
Rafah	98,872
Beach	82,009
Nuseirat	62,117
Khan Younis	68,324
Bureij	31,360
Maghazi	23,981
Deir el-Balah	20,753
Total	**494,296**

Figure 4.1: Geographical locations of Gaza strip camp

(Source: UNRWA, 2009b, http://www.un.org/unrwa/refugees/gaza.html)

4.2 Background

In UNRWA, there are mainly two departments that are processing the construction and infrastructure tenders, The Special Environmental Health Programme (SEHP) and the Engineering and Construction Services Department. The Special Environmental Health Programme (SEHP) was established to plan, design and construct water supply, sewerage and drainage works in refugee camps and surrounding. the programme also maintains the basic environmental health services in the camps such as refuse removal. The Engineering and Construction Services (ECSD) is in charge of the construction of UNRWA installations (schools, clinics, etc.). It organizes the tendering process and then supervises the contractors work and building progress. The department is also responsible for the maintenance of UNRWA installations (Fact Sheet, 2007)ECSD is now, jointly with the SEHP, working on large-scale projects. with an estimated total budget of US$ 70 million. The ECSD main responsibilities are:

- Preparing detailed profiles of the needy families and conducting an initial survey in the area where the houses will be constructed.

- Working closely with beneficiaries at the design stage to take into consideration, whenever possible, their needs.
- Preparing and implementing all site plans, architectural drawings, tender documentation and bills of quantities.
- Supervising the work in progress and inspect the completed projects for final approval (Fact Sheet, 2007).

4.3 Organizational chart of UNRWA's Field office

The departments and programs that are compromising UNRWA field office can be shown in Figure 4.2. The figure shows that there are six departments and six programs. One of these departments is the engineering and construction services department which will be considered in our focusing. This study will analyze the bidding process and the bidders' participation trends in the construction, maintenance and repair tenders.

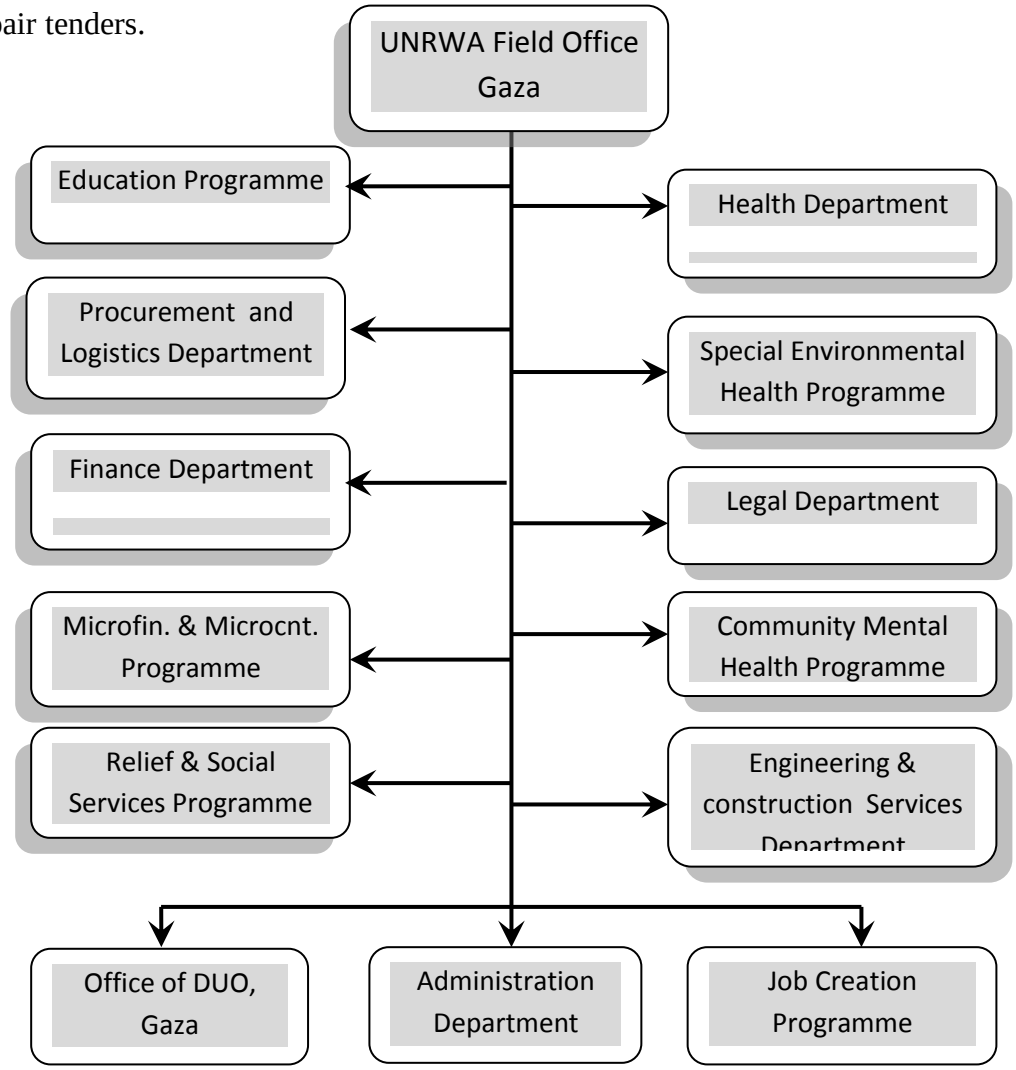

Figure (4.2): Departments and programmes in the UNRWA Field office, Gaza
(Source: UNRWA, 2009[c])

4.4 The objectives of the Case Study

1. To investigate the main causes of delay in UNRWA's construction project.
2. To provide benchmarking tool for comparative purpose with other clients.

4.5 Methodology

4.5.1 Historical Data analysis

The historical data used to study the delay in UNRWA Construction projects, was collected from the Engineering and Construction Services (ECSD) as shown in Annex "B". Sixty nine projects were analyzed by Excel 5.1(software).These projects were sorted based on delay occurrence in each projects, the severity of the delay, and the location of projects.

Data collected from UNRWA Construction Completion Report (CCR) includes the main information for each project such as project name, tender number, tender amount, location of project, project year, construction estimate cost, final expenditure & cost, period of contract, contract date for completion, actual date of completion, and Reasons for delay as shows in Figure (4.3).

The sixty nine public projects were constructed in North of Gaza, Gaza, Middle area, and South area, during the period of 2005-2007. Data collected was of two types of project .The first type of tenders is the construction" building" projects that include schools facilities like (canteens, toilets), health centers, relief building, re-housing projects, shelters buildings for SHC(Special Hardship Cases in the camps). The second type is the repair projects. These projects are advertised and implemented for the Palestinian refugees' families whose houses and properties were partially damaged due to the Israeli invasions and attacks. Moreover, the repair works can be carried out for the SHC's shelters that suffer from bad living conditions.

CONSTRUCTION COMPLETION REPORT

To ……..

From ……..

Subject ……..

B. Contract No. ..... Dated : ……..

Job No. …….. Code No. :

In compliance with Technical Services Instruction No. 1, please find hereunder details relating to the above construction.

1. BREAKDOWN OF ESTIMATE AND FINAL COSTS:

Description	Construction Estimate $	Amended Estimate $	Final Expenditure
A) Contractual Services			
B) Agency Supplied			
C) Overhead			
D) Contingencies			
Total $			

2. TOTAL ALLOTMENT ……

3. PERIOD OF CONTRACT: ……

A) Commencement and completion:

I) Date of commencement. ……

II) Contract date for completion. ……

III) Actual date of completion. ……

IV) Delay (in days). ……

Reasons for delay :

…….

4. ESTIMATION DATE:

5. COMMENTS

…….

Figure(4.3) : Construction COMPLETION REPORT(CCR)

4.6 Result & Discussion:

4.6.1 Classifications of projects having delay or not

The information in the Construction Completion Report (CCR) was organized. Sixty nine projects(69) were categorized into two parts: projects having delay, and projects not having delay.

From Figure (4.4), it was observed that 12 projects out of 69 project , representing 17.39% do not have any delay, while (57) projects represent 82.61% have a delay. Such results reflect strongly the importance of this study in our country as the majority of projects have a delay. These results could be matched with Al-Momani, (2000) with delay percentage (81.5%) and Al- Khalil and AL-Ghafly, (1999) with delay percentage (84%).

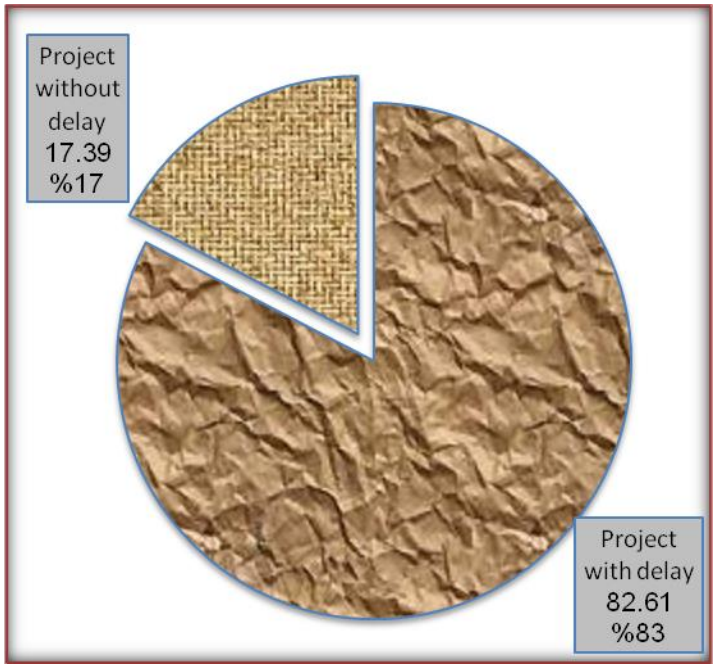

Figure (4.4):Classifications of projects having delay

4.6.2 Factor Causes Delay:

From the analyzed projects, it was found that twelve (12) factor was observed as a major factor causes delay in UNRWA Construction projects. The influence and the severity of each factors is shown in table (4.2).

Table(4.2) Critical Factors causes delay" %of Occurrence"

Factors	Description	Freq.	% occurrence	Cumulative of Occur.	Rank
F1	Closing building by clients (suspension work)	1	1.15%	1.15%	10
F2	Non availability of raw materials-closure impact	30	34.48%	35.63%	1
F3	waiting results of tests- such as (concrete, soil,	2	2.30%	37.93%	9
F4	Israeli Invasions	6	6.90%	44.83%	6
F5	Bad weather conditions	10	11.49%	56.32%	3
F6	Additional works required by clients	8	9.20%	65.52%	4
F7	changes in design requirements	12	13.79%	79.31%	2
F8	Managerial problems from client	8	9.20%	88.51%	4
F9	Amendment in the BOQ	4	4.60%	93.11%	7
F10	Stopping the works by beneficiaries	1	1.15%	94.26%	10
F11	Force majeure, bad security conditions in Gaza	4	4.60%	98.86%	7
F12	Contractors managerial and financial problems	1	1.15%	100.00%	10
Total		**87**	**100.00%**		

Table (4.2) shows that the non availability of raw materials was ranked in 1st – position as most frequency factor occurred in 30 projects with a percentage (34.48%). This could be attributed to non-stability of local markets due to closure impact on the Gaza Strip. Changes in design were ranked in 2nd position as an important factor causes delay in construction projects. This factor was shown in (12) projects with a percentage of (13.79%). This results reflects strongly the importance of this factor in causing delay. These results could be matched with Al-Momani, (2000).

While closing building by clients, stopping the works by beneficiaries, and Contractors managerial and financial status were ranked as the least factor causing delay in the construction projects because the Gaza Strip faces terrible situation, the clients try to avoid disputes with contractors and also the clients focus on having their projects completed in adequate time.

4.6.3 Sensitivity influence

Sensitivity reflects the direct impact of the factors in construction project. The delay occurred in the 69 projects that are under this analysis was (3269)day. These delay days were not distributed equally overall factors. The result is shown in Table (4.3).

Table: 4.3 Critical Factors causes delay " Sensitivity influence"

Factors	Delay-Days	Description	% Sensitivity	Rank
F1	8	Closing building by clients	0.24%	12
F2	1675	Non availability of raw materials-closure impact	51.24%	1
F3	73	waiting results of tests- such as (concrete, soil,	2.23%	7
F4	93	Israeli Invasions	2.84%	6
F5	114	Bad weather conditions	3.49%	5
F6	368	Additional works required by clients	11.26%	3
F7	331	changes in design requirements	10.13%	4
F8	418	Managerial problems from client-	12.79%	2
F9	30	Amendment in the BOQ	0.92%	10
F10	70	Stopping the works by beneficiaries	2.14%	8
F11	59	Force majeure, bad security conditions in Gaza	1.80%	9
F12	30	Contractors managerial and financial problems	0.92%	10
Total	**3269**		**100.00%**	

Table (4.3) shows that the non availability of raw materials was ranked in 1st – position as most frequency factor occurred with Sensitivity percentage (51.24%), which reflects 1675 delay days out of 3269delay days, while managerial problems from client was ranked in the second position with 418 delay days (Sensitivity 12.79%), where as additional works required by clients was ranked in the third position with 368 delay days (Sensitivity 11.26%).

It could not be generalized that the most frequently occurred factor means most influenced factor as shown in Table (4.2) & Table (4.3).

4.6.4 Pareto chart analysis

4.6.4.1 Definition

Pareto Analysis is a statistical technique in decision making which is used for the selection of a limited number of tasks that produce significant overall effect. It uses the Pareto Principle (also known as the 80/20 rule) the idea is that by doing 20% of the work, you can generate 80% of the benefit of doing the whole job. In terms of quality improvement, a large majority of problems (80%) are produced by a few key causes (20%) (MindTools. 2010).

Table: 4.4 Critical Factors causes delay "Pareto Analysis"

Factors	Description	% Occurrence	Cumulative of Occurrence	Rank
F2	Non availability of raw materials-closure	34.48%	34.48%	1
F7	changes in design requirements	13.79%	48.27%	2
F5	Bad weather conditions	11.49%	59.76%	3
F8	Managerial problems from client-	9.20%	68.96%	4
F6	Additional works required by clients	9.20%	78.16%	4
F4	Israeli Invasions	6.90%	85.06%	6
F9	Amendment in the BOQ	4.60%	89.66%	7
F11	Force majeure, bad security conditions in Gaza	4.60%	94.26%	7
F3	waiting results of tests- such as (concrete, soil,.	2.30%	96.55%	9
F12	Contractors managerial and financial problems	1.15%	97.70%	10
F1	Closing building by clients	1.15%	98.85%	10
F10	Stopping the works by beneficiaries	1.15%	100%	10
Total		**100.00%**		

4.6.4.2 Steps to identifying the important factors cause delay using Pareto Analysis:

Step 1: Form a table listing the causes and their frequency as a percentage.

Step 2: Arrange the rows in the decreasing order of importance of the causes, i.e. the most important cause first.

Step 3: Add a cumulative percentage column to the table.

Step 4: Plot with causes on x-axis and cumulative percentage on y-axis.

Step 5: Join the above points to form a curve.

Step 6: Plot (on the same graph) a bar graph with causes on x-axis and percent frequency on y axis.

Step 7: Draw a line at 80% on y-axis parallel to x-axis. Then drop the line at the point of intersection with the curve on x-axis. This point on the x-axis separates the important causes on the left and less important causes on the right (Duncan, 2010).

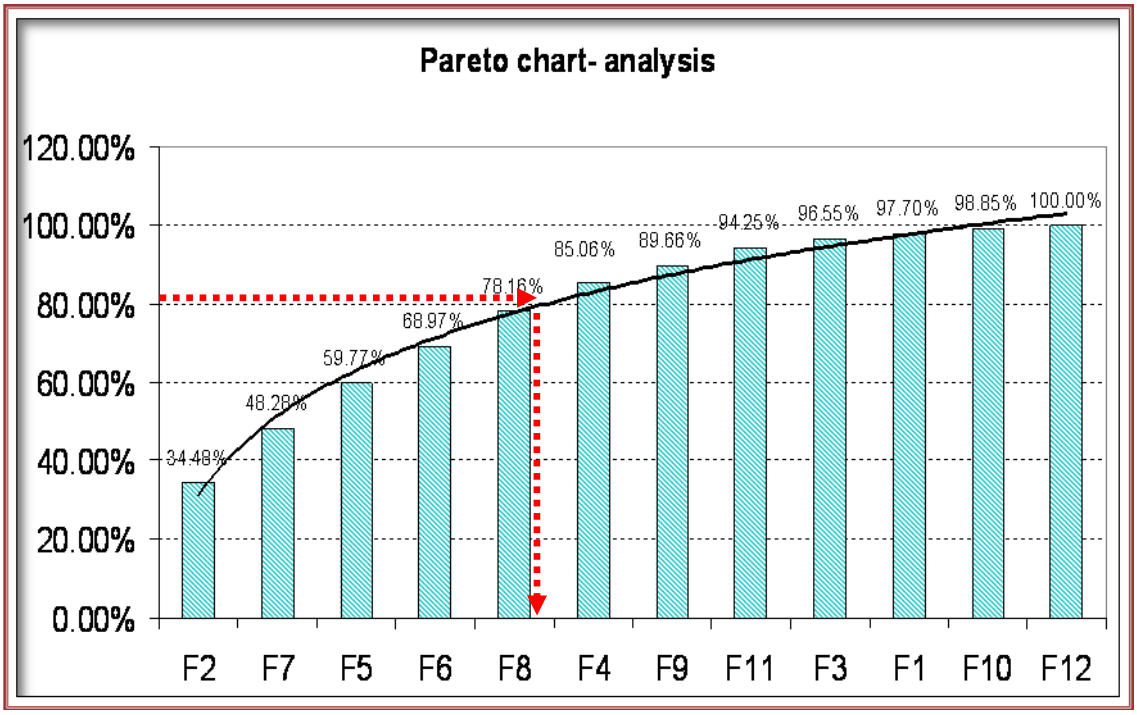

Figure (4.5) Pareto chart analysis

Figure (4.5)shows that the relation between the factor causes delay and the cumulative of their occurrence from Table (4.4).Based on Pareto chart analysis at 80% the critical success factors (CSFs)cause delay in UNRWA construction project are non availability of raw materials (F2), changes in design requirements(F7), bad weather conditions(F5), additional works required by clients(F6), and managerial problems from client(F8).

4.6.5 Linear regression Model (forecasting delay from project period):

Simple linear regression develops an equation that describes the relationship between two variables. In this case the equation takes the form of:

$$Y= b0 +b1X + Ɛ$$

In this model Y is the dependent variable which is delay percent in this case. The parameters b0 and b1 are the coefficients which are unknown and are to be estimated. X is the independent variable which is contract period in this case, and Ɛ is a random error which is the amount of variation in Y not accounted for by the linear relationship.

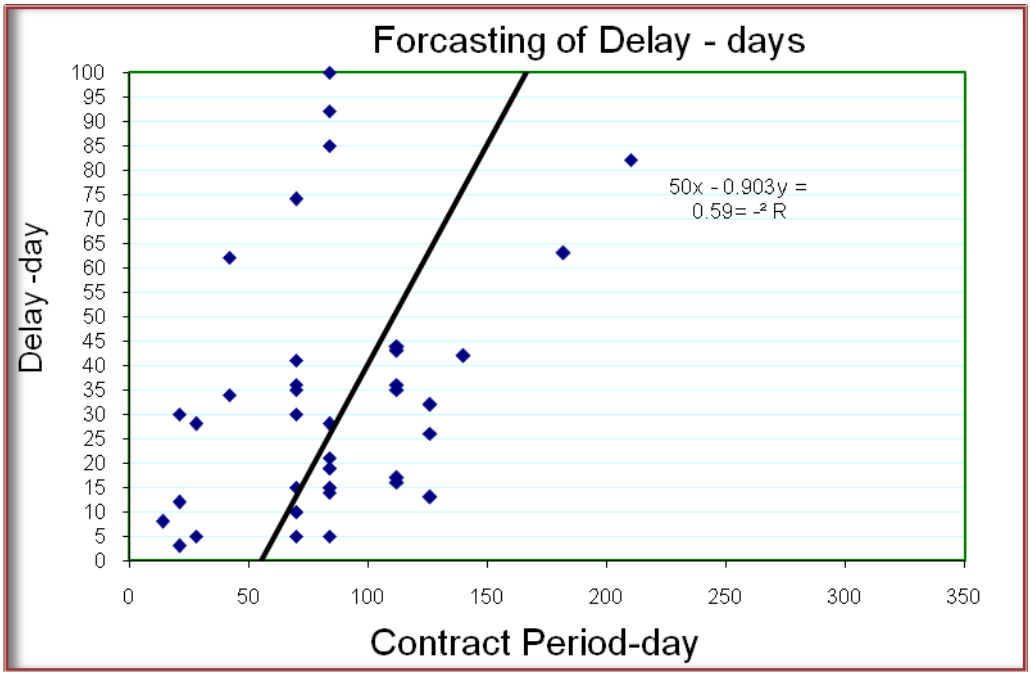

Figure (4.6). Scatter plot of delay (days)Y versus contract period(day) X

The theoretical models are derived and explained in the following. For a comparison of the delay time and contract period distribution, the equation developed for overall public projects is

$$Y = 0.903X-50 \text{ , } R2=-0.59 \ldots\ldots\ldots\ldots\ldots\ldots \text{Eq.(1)}$$

R^2=-0.59, R =0.77

The correlation coefficient for this relationship is 0.77 indicate that the distribution of delay times mirror's the contract time with a high degree of accuracy, specific models such as Eq.(1) were developed, which exhibited a reasonable fit to the data. Figures (4.6) gives a graphical view of how well the charts relate the delay time of the project to the contract time.

4.6.6 location of projects

Table (4.5) distribution of project due to their location

Location	# of projects	% of occurrence	delay/ day	% of delay
Gaza	17	24.6	545	17
Middle area	13	18.8	625	19
South area	28	40.6	1139	35
North area	11	15.9	960	29
Total	69	100	3269	100

From Table 4.5 it is observed that 24.6% of UNRWA projects located in Gaza area, and 18.8% of projects located in Middle Area, 40.6% of projects constructed in South area, and 15.9% of projects located in North area.

As shown in Table (4.5) it is observed that the most project suffering from delay are located at the South area (35% of delay)and the North area (29% of delay) because UNRWA repair and construction projects are emergency project and these location suffering from several Israeli Invasions(hot area), because they are border locations.

4.7 Limitations of the study

- This study is applied to the projects within a period of 2005-2007, and accordingly, the obtained results may be affected by the political situations such as the closure impact.
- The delay model is used for projects with contract period between 7 to25 weeks.

4.8 Conclusion

Construction delay is a critical function in construction of public projects. A survey of the sixty nine (69) public projects constructed in North of Gaza, Gaza, Middle area, South area during the period of 2005-2007 indicated that most building suffering from delay due many reason such as closing building by clients, non availability of raw materials, waiting results of tests, Israeli Invasions, bad weather conditions, additional works required by clients, changes in design requirements, managerial problems from client, Amendment in the BOQ, stopping the works by beneficiaries, force majeure, bad security conditions in Gaza, and contractors managerial and financial problems.

By using Pareto chart analysis the critical success factors (CSFs) causing delay in UNRWA construction projects are:

non-availability of raw materials,

changes in design requirements,

Bad weather conditions,

Additional works required by clients, and

Managerial problems from client.

Reliable prediction of construction delay, and then controlling cost within budget is widely used in decision making and is an essential part of successful management. A simple linear model was used to estimate the relationship between the delay and

contract time. The major implication of the foregoing have important ramifications for understanding the actual time of public projects.

This has been repeatedly stated as the outstanding need of construction in Gaza Strip. The relations obtained have the advantage of relying upon the statistical treatment of real data and could without doubt be improved by considering a larger sample of projects. The researcher believes that the arguments and findings presented in this study provide a good guidance for managerial intervention, and also provide some guidelines and actionable information that managers can utilize to manage their projects.

5RESULTS AND DISCUSSION

This chapter introduces the survey results and the discussion of the questionnaire's sections for the clients. Section one will present the clients profile and all necessary information about the respondents. Section Two was designed to attain the first and fifth objectives in this research. These objectives intend to identify the major causes of delays in construction project in the Gaza Strip and to developing the model. Section two in the client questionnaire was designed to attain the third objective in this research. This objective tries to identify the effects of delays in construction project. Section three was designed to attain fourth objective. This objective was to identify the methods of minimizing construction delays.

Section "A" in questionnaire

5.1 COMPANY RESPONDENT PROFILE AND PROJECT DESCRIPTION

5.1.1 Years of experience for the organization

Figure 5.1 shows that 3.7% from the clients have less than 5 years experience , 14.8 % have an experience between 5-10 years, 11.1% have an experience between11-15 years, and 70.4% from the client have an experience more than 15 years.

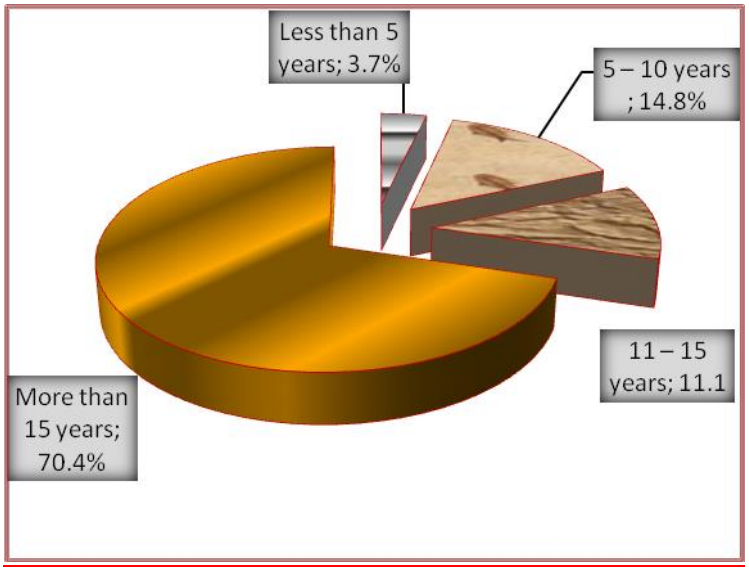

Figure 5.1 Years of experience

Figure 5.1 observed that 70.4% of the surveyed samples have experience more than 15 years, while 3.7% of the surveyed samples have experience less than 5 years for their organizations. This will reflect good indicators as the obtained results will be concentrated and comprehensive to add a value for this research throughout the long a commutative years of experiences, knowledge and management that these organizations obtained.

Moreover, the variety of experiences between each group (less than 5 years, from 5-10 years from 11-15 years and more than 15 years) will be expected to enrich the research with different knowledge and information.

5.1.2 - Location of organization

In this study, the Gaza Strip is divided into four geographical regions; these parts are (North of Gaza , Gaza city, Middle area and South of Gaza). From Figure 5.2 it is observed that 61.1% from client work in Gaza, and 18.5% work in North area , 3.7% work in Middle Area, and 16.7 % work in south area.

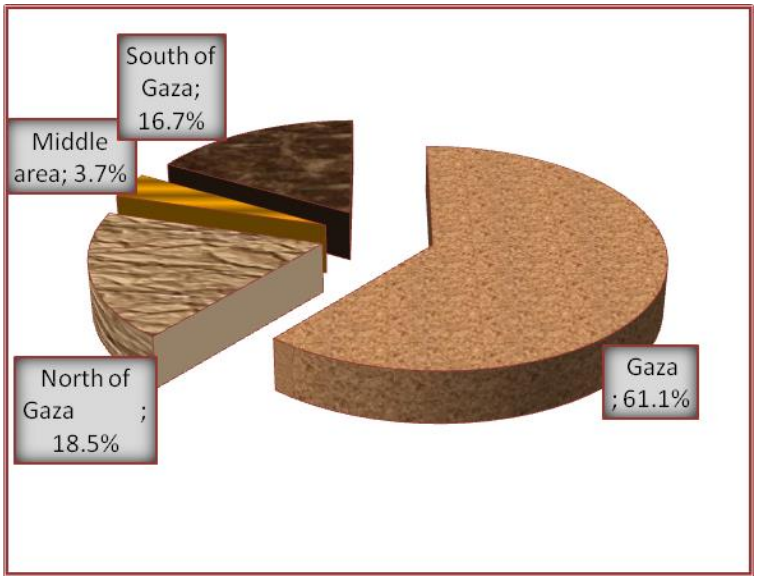

Figure 5.2 Location of organization

5.1.3 - Number of projects executed in the last five years

As shown in Figure 5.3 (59 %) of the companies' volume of work of more than 30 projects in the last five years, which means an average of six projects per year. Also (24%) of the companies have a volume of work from 1-10 projects in the last five years. This indicates that these companies have a very good experience that enables them to identify the most important factors affecting delay.

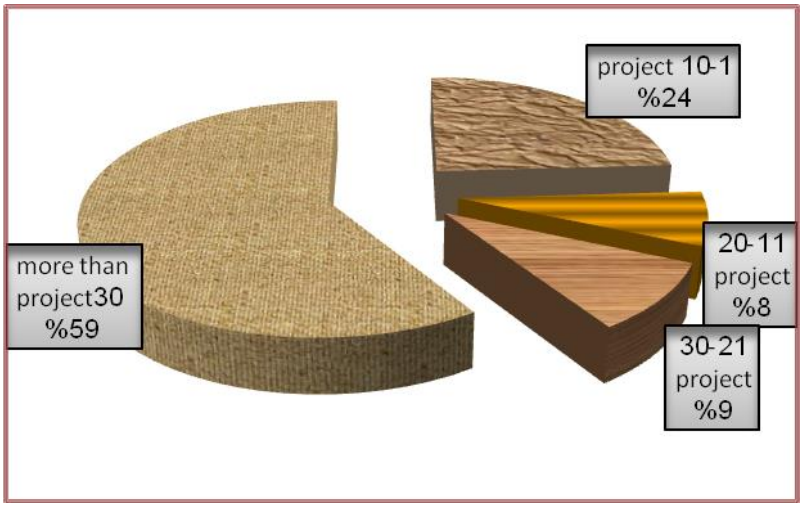

Figure 5.3 Number of projects executed in the last five years

5.1.4- The value of projects executed in the last five years

Figure 5.4 shows that only 18.5 % of respondents executed projects with cost less than two million dollars per year, 24.1 % executed projects with cost ranged from two to five million dollars 3.7 % executed projects with cost ranged from six to nine million dollars. From Figure 5.4, it is noticed that (53.6%) of the companies have executed a volume of work with a value of more than ten million dollars which means that the local construction projects are mainly small to medium projects compared or wide world construction projects.

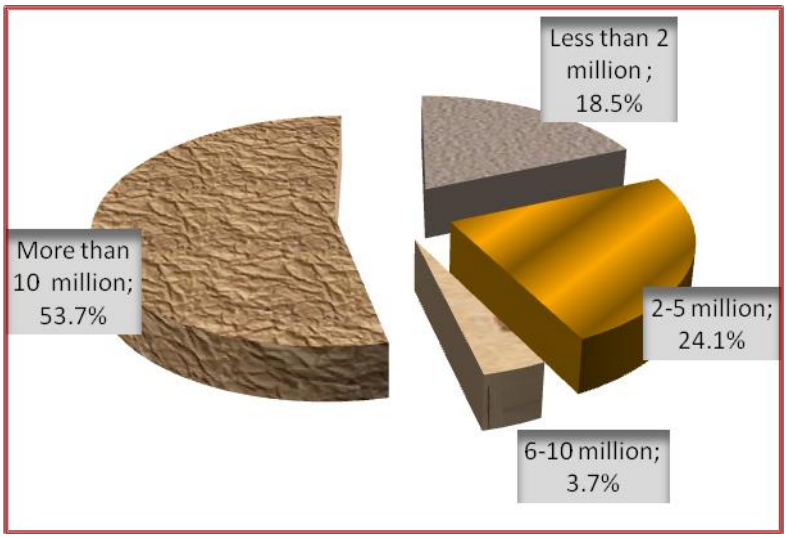

Figure 5.4 The value of projects executed in the last five years

5.1.5 project duration

Figure 5.5 shows that 59.3% of respondents have projects duration with less than 12 months , 25.9 % have projects duration ranged from 12 months to 18 months , 1.9 %

have projects duration ranged from 18 months to 24 months, and 13% have projects duration more than 24 months. This indicates that most clients have minimum project duration because most of these projects are maintained projects.

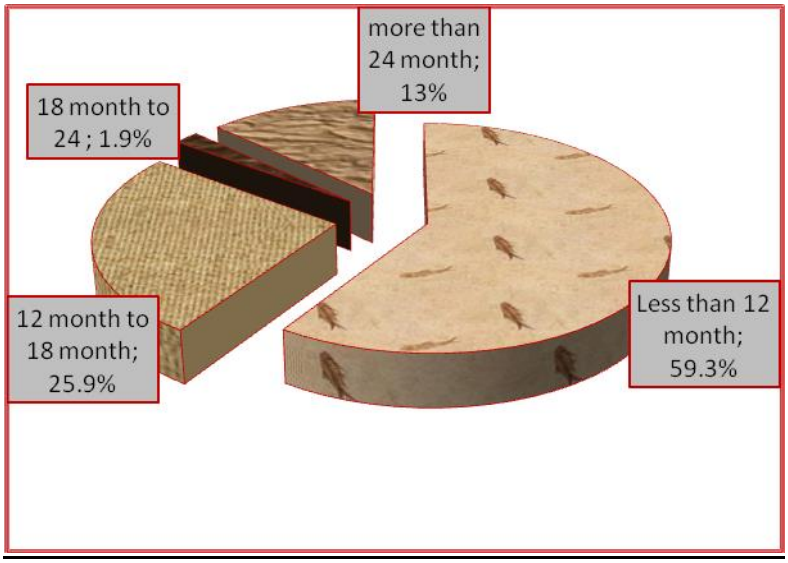

Figure 5.5 project duration

5.1.6 -No. of project management in the organization:

Due to the need for several employees at the organization to perform the required works, it can be understood from Figure 5.6 that the majority of organization clients (57.4 %) have more than 20 project management, (20.4%) have from 10 to 15 project management, while (16.7%) have from 16 to 20 project management. This indicates that these organizations have a very large company because most of them are government organization.

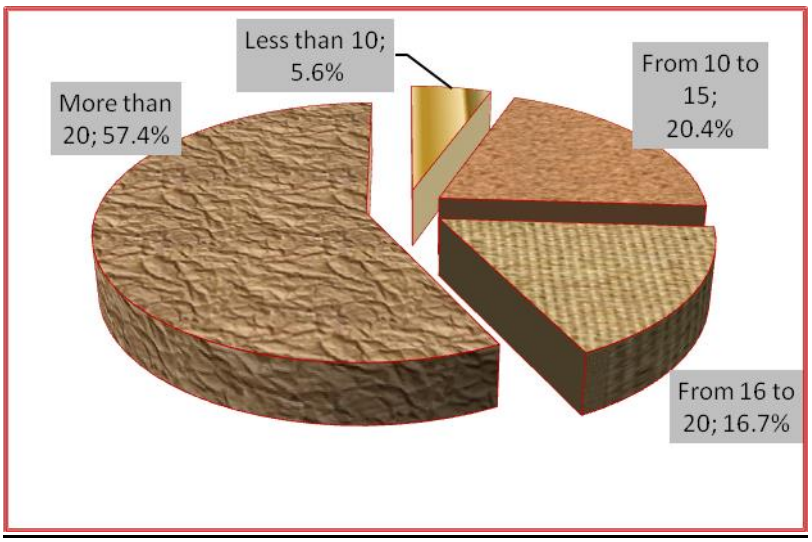

Figure 5.6 No. of project management in the organization

5.1.7- Respondent's years of experience

Figure 5.7 shows that13% from the clients have years of experience between 1-3 years, 4.5 % have years of experience between 4-5 years. 33.3% have years of experience between 6-9 years, and 44.4% have years of experience more than 10 years. These results will also provide a level of satisfaction that the obtained data will reflect what it was designed for.

Furthermore, it is important to observe that the good relationship between the researchers and the respondents will motivate those respondents to provide satisfactory inputs, facts and information.

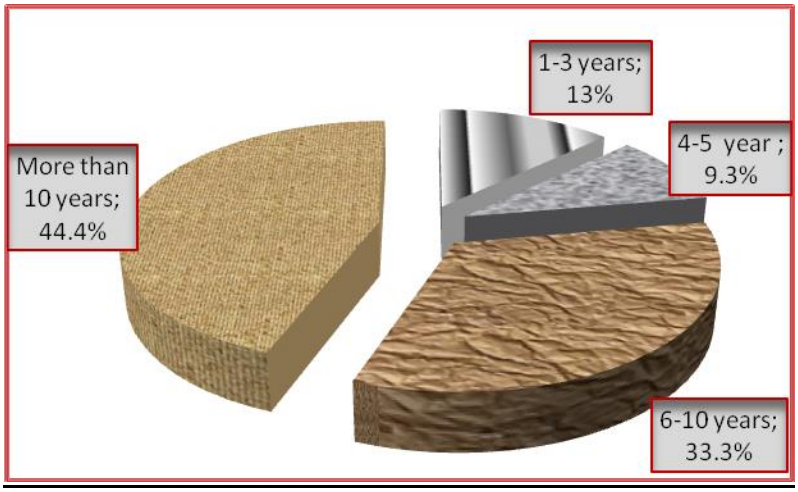

Figure 5.7 Respondent's years of experience

5.1.8- Position of Respondent

Figure 4.8 shows that 40.7 % from the clients were project managers, 40.7 % were an office engineers, 5.6 % were site engineers, and 13% were others such as: administrative officers, quality engineers, quantity surveyors, etc.

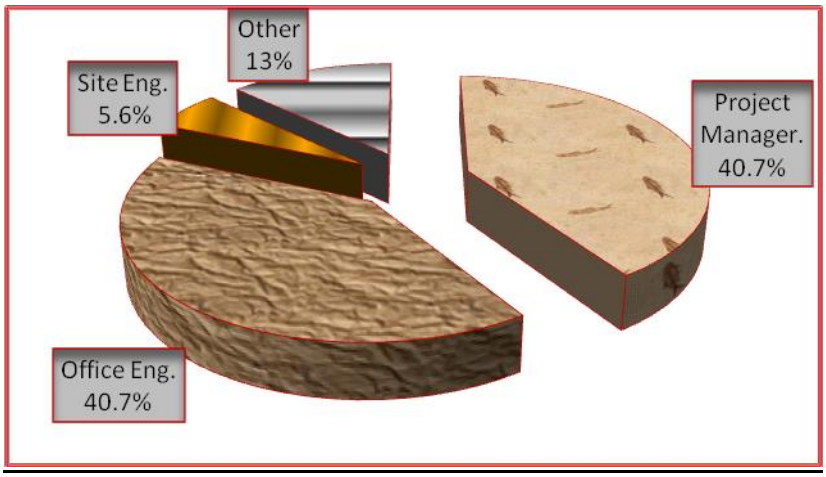

Figure 5.8 Position of Respondent

5.1.9- Respondent's qualification

Figure 5.9 shows that 27.8 % from the client respondents have master degree in civil engineering, 66.7% have an bachelors' in civil engineering. These results will also provide a level of satisfaction that the obtained data will reflect what it was designed for.

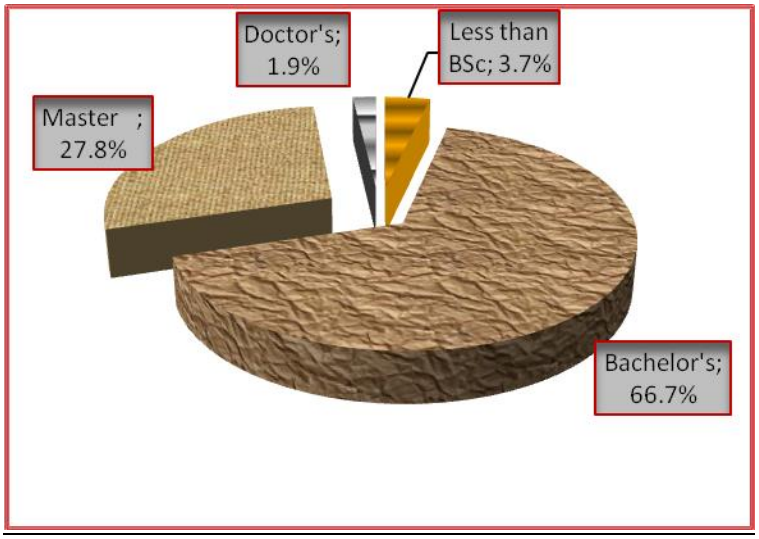

Figure 5.9 Respondent's qualification

Section "B" in questionnaire

5.2 - FACTORS THAT CONTRIBUTE TO CAUSES OF DELAYS

A total of 127 major factors that contributed to causes of delays were identified. The one hundred and twenty seven factors were grouped into twelve major groups: material related factors, labor related factors, equipment related factors, finance related factors, contractor related factors, sub-contractor related factors, client related factors, consultant related factors, project related factors, design and documentation related factors, contract/relationships related factors, and external related factors. These factors were ranked in each group based on Importance Index (I.I) from the viewpoint of client. The following is a brief description of these factors in each group:

5.2.1- Factors of Material Related Delays

Table 5.1 shows that the respondents client ranked the " Shortage of construction materials" (I.I = 84.4 %) as the first factor to cause delay in this category. Shortage of construction materials is considered as one of the key factors that causes delay, due to the frequent closure of the Gaza Strip's borders and the consequent depletion of basic

materials, tools and petrol stocks. It is then the situation aggravated, hence, work suspension, and delays occurred.

The obtained results are in line with results obtained from Enshassi and Al-Najjar (2010) who ranked this factor in the second position with important index of (87.10%) , Kim et al (2009) ranked this factor in the first position with (I.I=87%), these result explained that the shortage of Construction materials is one of the important causes of delay.

The obtained results from this study at this factor is higher than Sambasivan and Soon (2007) results that ranked this factor in the six position with (77.1%).The discriminations between the obtained results in this study and Sambasivan, et al (2007) could be ascribed to the different environmental conditions between the Gaza strip and Malaysian, Abd El-Razek, et al (2008) also ranks this factor in the 12^{th} position (I.I=51%), Sweis et al.(2008) ranks it on the 11^{th} position with (I.I=66.4%) , Le-Hoai (2008) rank this factor in the 16^{th} position (I.I=55.6%). The different could be attributed to the different targeted and the stability of political situation of these country.

The second factor was late in selection of finishing materials due to availability in market (I.I = 78.1 %). Specifications may mention a certain quality of material which is supposed to be used for construction work owing to the frequent closure of the Gaza Strip's borders. In some cases, such materials are no longer available. Hence, contractors indifferently tend not to match the criteria or use it less efficiently to keep up with local availability. Thus the process of decision-making and approval of these samples by the client may cause a delay to the project.

Assaf and Al-Hejji (2006) gave similar results that late selection of finishing materials due to availability is a major cause of delay, but the obtained results from this study at this factor are higher than Abd Majid, et.al (1998) results that ranked this factor in the seventh position with important index of (59%). The discriminations between the obtained results in this thesis and Abd Majid, et.al (1998) could be related to the different target group.

The third factor to cause delay was the" late delivery of materials" (I.I = 76.3%). Many contractors tend to provide no more than necessary materials according to their needs regardless of the circumstances they face. Both of Manufacturing and access process take a part of time and hence, it causes a delay; it is preferable for contractors to request what it takes and store it till it comes into use. These results could be

matched with Enshassi and Al-Najjar (2010) who ranked this factor in the third position with (I.I=82.26%), but Sweis et al.(2008) who ranked this factor in position 16 with (I.I=59.2%) are in contradiction with this result.

Respondents client as shown in Table 5.1 ranked the " Damage of sorted material which are needed urgently " (I.I = 55.9 %) as the least factor of delay in this category. The Damage of sorted material while they are needed urgently is also considered as ineffective factor of delay. Materials deteriorate relatively during their useful life are attributed to many reasons. Poor quality of the used materials, misuse of the material, inaccessible materials and lack of workforce competences in transporting materials. These results could be matched with Alwi et al.(2003), but the results of Enshassi, et.al (2009), Assaf and Al-Hejji (2006) are in contradiction with this result. The difference between this result and Enshassi and Al-Najjar (2010), could refer to the different targeted and instability of construction situation of the Gaza Strip.

In the Gaza Strip the labour is aware of construction materials stored and the labour has well understanding of the importance of these materials for work execution.

Table 5.1 : Materials related factors

No.	Sub -Factor	Sum	Mean	Std. Deviation	I.I	rank
A1	Shortage of construction materials	228	4.222	0.718	84.4	1
A2	Poor quality of construction materials	182	3.370	0.958	67.4	7
A3	Poor procurement of construction materials.	196	3.630	0.977	72.6	5
A4	Damage of sorted material while they are needed urgently.	151	2.796	0.898	55.9	11
A5	Changes of materials types & specifications	188	3.481	1.041	69.6	6
A6	Late selection of finishing materials due to availability.	211	3.907	1.069	78.1	2
A7	Delay in manufacturing special building materials	159	2.944	0.979	58.9	10
A8	Waiting for approval of material samples	182	3.370	1.104	67.4	8
A9	Late delivery of materials	206	3.815	0.992	76.3	3

No.	Sub -Factor	Sum	Mean	Std. Deviation	I.I	rank
A10	Escalation of material prices	199	3.685	0.948	73.7	4
A11	No adherence with materials standards that is storage in the site.	174	3.222	0.904	64.4	9

5.2.2- Factors of Labor Related Delay

Table 5.2 shows that client respondents ranked " Low motivation and morale " in the first position with importance index (I.I = 81.1%) as the first factor to cause delay in this category, Abd Majid, et al. (1998) did not coincide with this finding who ranked this factor in the 25 position. This factor is very important that causes delay which refers to bad situation of labor due the decreasing level of labor salary in the Gaza Strip. Abd Majid et al (1998) coincide with this finding who ranked this factor in the first position with (I.I=66%).

The second factor was Shortage of manpower(skilled, semi-skilled, unskilled labor) with (I.I = 73.3%). The skilled labour affects the level of quality, facilitates the handing of the completed works and performs the work successfully. Therefore, shortage of skilled labour causes delay of project. These results could be matched with Chan, et al (1996) who ranks this factor as the major causes of delay with (I.I= 74%). Enshassi and Al-Najjar (2010) ranks this factor in the same position with (I.I=76.2%).

These result indicated that this factor is the major cause of delay, but the results of Abd El-Razek, et al (2008) are in contradiction with this result who ranked this factor in the 24 position with(I.I=44%), and Sweis et al. (2008) ranked this factor in 12 position with (I.I=67.8%).

The third factor to cause delay was the "Poor distribution of labour" with important index (I.I = 73.3%) but the results of Assaf and Al-Hejji (2006), Frimpong, et al (2003), and Ahsan, et al (2009) are in contradiction with this result. These different between results could be ascribed to the different environmental conditions between Gaza strip and these countries.

Respondents client as shown in Table 4.2 ranked the " Different political and factional affiliation of workers " (I.I = 49.3 %) as the least factor causes delay in this category. The Different political and factional affiliation of workers is also considered as

ineffective factor of delay. The most appropriate interpretation of this rank is that the Gaza Strip characterized with high political fluctuation, but due to miserable economic situation, high levels of unemployment, and poverty, the workers tend to avoid any possibility of losing their work. The workers are then avoid any political conflicts at site. These results could be matched with Enshassi and Al-Najjar (2010).

Table 5.2 : Labor related factors

No.	Sub -Factor	Sum	Mean	Std. Deviation	I.I	rank
B1	Low productivity level of labor	184	3.407	1.125	68.1	5
B2	Shortage of manpower (skilled, semi-skilled, unskilled labor),	198	3.667	1.197	73.3	2
B3	Low motivation and morale	219	4.056	0.940	81.1	1
B4	Personal conflicts among labor	163	3.019	1.019	60.4	6
B5	Poor distribution of labour	198	3.667	0.932	73.3	2
B6	Shortage in labor	192	3.556	1.269	71.1	4
B7	Ageing of site workers	151	2.796	1.035	55.9	7
B8	Different political and factional affiliation of workers	133	2.463	1.161	49.3	8

5.2.3 -Factors of Equipment Related Delay

Table 5.3 shows that client respondents ranked " lack of high-technology mechanical equipment " (I.I = 78.9%) as the first factor to cause delay in this category, These results could be matched with Al-Kharashi and Skitmore et al.(2009), but the results of Assaf et al.(2006) did not coincide with this finding. This factor is very important in causing delay which refers to closure impact.

The second factor was " lack of maintenance for the equipment " (I.I = 75.2%). Many of the contractors do not own equipment that is required for the construction work. They rent the equipment when required. During the season when there are many construction projects, the equipments are in short supply and are poorly maintained. This leads to failure of the equipments causing the progress to be hampered. The obtained results are higher than the results obtained by Enshassi and Al-Najjar (2010) who ranked this factor in the fifth position with important index of (66.1%).

The discriminations between the obtained results in this study and Enshassi and Al-Najjar (2010) could be attributed to the instability of construction sector in the Gaza strip from one year to another.

The third factor to cause delay was the " required equipment and tools are not available " (I.I = 74.1%).This indicates the high importance of equipment to complete the project on time. Shortage of equipment causes many problems such as dependence on labour instead of equipment, decline of productivity and the difficulty of execution, so the delay may occur These results could be matched with Sambasivan (2007) who rank this factor in the nine position with (I.I= 75.5%), but the results of Abd El-Razek et al. (2008) are in contradiction with this result who rank this factor in the 24 position with (I.I=43.67%).

Respondents client as shown in table 5.3 ranked the " Equipment allocation problem " (I.I = 64.4%) as the least factor causing delay in this category. These results could be matched with Odeh and Battaineh (2002).

Table 5.3 : Equipment related factors

No.	Sub -Factor	Sum	Mean	Std. Deviation	I.I	rank
C1	Improper equipment used for the work	188	3.481	0.986	69.6	7
C2	Insufficient numbers of equipment	199	3.685	0.886	73.7	4
C3	low level of equipment-operator's skill	183	3.389	0.878	67.8	9
C4	required equipment and tools are not available	200	3.704	0.882	74.1	3
C5	lack of high-technology mechanical equipment	213	3.944	0.856	78.9	1
C6	Frequent equipment breakdown	195	3.611	0.787	72.2	5
C7	Equipment allocation problem	174	3.222	0.861	64.4	11
C8	Slow mobilization of equipment	182	3.370	0.831	67.4	10
C9	low productivity and efficiency of equipment	189	3.500	0.927	70.0	6
C10	lack of maintenance for the equipment	203	3.759	0.910	75.2	2
C11	inaccurate prediction of equipment production rate	184	3.407	1.037	68.1	8

5.2.4-Factors of Finance Related Delay

Table 5.4 shows that client respondents ranked " Cash problem during construction " in the first position with importance index (I.I = 80.7%) as the first factor to cause delay in this category. this indicates the high importance of money for the progress of project. Any shortage of money for the contractor will cause many problems such as slow progress and work decline in productivity. Also the contractors will not be able to purchase the needed equipment for work. More-over the problem of cash also expanded to traders and suppliers which in turn leads to slow the work then to occurrence of project's delay.

These results could be matched with the results of Sweis et al.(2008) who rank this factor in the first position with (I.I = 86%), Abd El Razek, et al (2008) who ranked this factor in the first position with (I.I = 68.33%).The obtained results from this study at this factor is higher than results Frimpong, et.al (2003) that ranked this factor in the six position with important index of (88.2%). The difference between the obtained results in this study and Frimpong, et.al (2003) could be ascribed to the different environmental conditions between the Gaza strip and Ghana.

The second factor was " difficulties in financing project by contractor " (I.I = 79.6%).These results could be matched with Sweis et al.(2008) who ranked this factor in second position with (I.I= 84.8%%) , and Le-Hoai, et al (2008) who ranked this factor in the second position with (II=81%), and Sambasivan (2007) who ranked this factor in forth position with (I.I= 78%). These results indicate that difficulties in financing project by contractors are the major causes of delay in many countries.

The third factor to cause delay was the " delay in progress payment by owner " (I.I = 77%). Payment is considered as the first factor to complete the project on time construction works involve huge amounts of money and most of the contractors find it very difficult to bear the heavy daily construction expenses when the payments are delayed. Work progress can be delayed due to the late payments from the clients because there is inadequate cash flow to support construction expenses especially for those contractors who are not financially sound. These results could be matched with the results of Abd El Razek et al.(2008) that rank this factor in the second position with (I.I=64%). Sambasivan et al. (2007) they ranked this factor in the fourth position with (I.I=78%), Odeh et al (2002) they ranked this factor in the second position with (I.I=66.4%), but the results of Sweis et al.(2008) ranked this factor in position17 with (I.I=56.8%).These results are in contradiction with this result.

the obtained results from this study at this factor is higher than Enshassi and Al-Najjar (2010) results that ranked this factor in the fifth position with a relative important index of (33.06%).The differences between the obtained results in this thesis and Enshassi and Al-Najjar (2010) could refer to the instability of construction sector in the Gaza strip from one year to another.

Respondents client as shown in table 5.4 ranked the " Inadequate fund allocation " (I.I = 68.1%) as the least factor causing delay in this category. Inadequate fund allocation is also considered as an ineffective factor of delay. These results could be matched with Chan and Kumaraswamy (1996), but the results of Skitmore et al. (2009), Abd Majid and McCaffer (1998),and Kaliba et al(2009). These results are in contradiction with this result.

Table 5.4 : Finance related factors

No.	Sub -Factor	Sum	Mean	Std. Deviation	I.I	rank
D1	delay in progress payment by owner	208	3.852	0.960	77.0	3
D2	difficulties in financing project by contractor	215	3.981	0.739	79.6	2
D3	Delay payment suppliers/subcontractors	205	3.796	0.939	75.9	4
D4	Inadequate fund allocation	184	3.407	1.237	68.1	7
D5	monthly payment difficulties	195	3.611	0.834	72.2	5
D6	Unreasonable constraints to client	187	3.463	0.926	69.3	6
D7	Cash problem during construction	218	4.037	0.846	80.7	1

5.2.5-Factors of Contractor Related Delay

Table 4.5 shows that client respondents ranked " Unethical behaviors used by contractors to achieve the highest possible level of profit " in the first position with importance index (I.I = 81.9%). It is first factor to cause delay in this category; any unethical behavior by contractor by manipulating a degree of quality, and changing in specification could be enough to generate disputes between parties thus, causing delays.

The obtained results from this study at this factor is higher than Enshassi and Al-Najjar (2010) results, they ranked this factor in the forth position with important index

of (75.81%). The difference between the obtained results in this thesis and Enshassi and Al-Najjar (2010) could be related to the instability of the Gaza Strip situation from one year to another.

The second factor was " Contractor un-commitment to consultant instructions."(I.I = 81.5%).An client finds the contractor's non-compliance to follow the consultant's instructions as one of the key factors causing disputes between the contractor and the consultant, as a result of greed to get as much as possible of benefit that might lead the consultant to suspend the work. These results are higher than Enshassi and Al-Najjar (2010) results that ranked this factor in the eleven position with (I.I= 67.74%).

The third factor to cause delay was " Ineffective project planning and scheduling " (I.I = 80.4%) . Local contractors often fail to come out with a practical and effective schedule at the initial planning stage. This failure is interrelated with lack of systematic site management and inadequate contractor's experience towards the projects. The consultant only checks and reviews the schedule submitted by the contractors based on experience and intuitive judgment. Improper planning at the initial stages of a project manifests throughout the project and causes delays at various stages. Only a project that is well planned can be well executed.

The obtained results are in line with the results obtained from Frimpong et al.(2003) who ranked this factor in the same position with (I.I=90.4%), but the obtained results from this study at this factor are lower than Sweis et al (2008) results that ranked this factor in the first position with (II=86.4%), and Sambasivan, et.al (2007) results that ranked this factor also in the first position with (I.I=81.5%); these result explained that the ineffective project planning and scheduling is one of the major causes of delay.

Respondents client as shown in Table 5.5 ranked the " Conflicts between contractor and other parties " (I.I = 72.2 %) and " Insufficient contractor competition " (I.I = 71.5 %). Conflicts between contractor and other parties and Insufficient contractor competition is also considered as ineffective factor of delay Owner finds that there is a tough and effective competition between contractors in construction projects. Hence, it's concluded that lack of workforce competition is one of the factors influencing the delay of the projects. These results could be matched with Enshassi and Al-Najjar (2010), and Assaf (2006).

Table 5.5 : Contractor related factors

No.	Sub -Factor	Sum	Mean	Std. Deviation	I.I	rank
E1	Inappropriate construction methods	199	3.685	0.948	73.7	16
E2	Poor site management and supervision	205	3.796	0.939	75.9	11
E3	Inadequate contractor experience	209	3.870	0.870	77.4	6
E4	Ineffective project planning and scheduling	217	4.019	0.858	80.4	3
E5	Incompetent project team	207	3.833	1.023	76.7	8
E6	Delay in site mobilization	196	3.630	0.853	72.6	19
E7	Poor company organization	202	3.741	0.955	74.8	15
E8	Inefficient quality control by contractor	206	3.815	0.803	76.3	10
E9	Increased number of projects	209	3.870	0.933	77.4	5
E10	Improper technical study by contractor during the bidding stage	207	3.833	0.863	76.7	9
E11	Replacement of key personal	197	3.648	0.994	73.0	18
E12	Conflicts between contractor and other parties	195	3.611	0.878	72.2	21
E13	Poor coordination & communication by contractor with other parties	204	3.778	0.816	75.6	12
E14	Uncompromising attitude between parties	196	3.630	0.784	72.6	20
E15	Mistakes during construction	202	3.741	0.828	74.8	14
E16	Insufficient contractor competition	193	3.574	0.815	71.5	22
E17	Dependence on a newly –graduated engineer to bear the whole responsibilities in the site	212	3.926	0.929	78.5	4
E18	Unethical behaviors used by contractors to achieve the highest possible level of profit	221	4.093	0.759	81.9	1
E19	Contractors are not committed to consultant instructions.	220	4.074	0.749	81.5	2

No.	Sub -Factor	Sum	Mean	Std. Deviation	I.I	rank
E20	Lack of database in estimating activity duration and resources	208	3.852	0.787	77.0	7
E21	Safety rules and regulations are not followed within the contractor's organization	197	3.648	0.894	73.0	17
E22	Improper handling of the project progress	203	3.759	0.799	75.2	13

5.2.6- Factors of Sub-Contractors Related Delay

Table 5.6 shows that client respondents ranked " Unreliable subcontractor " in the first position with importance index (I.I = 80.0%) as the first factor to cause delay in this category. Dealing with unreliable sub contractor is considered as one of the key factors causing delay; contractors generally pursue what is cheap ,pay no attention about reputation and expertise hence, this leads to a delay and suspend the work.

These results could be matched with Odeh et al (2002); however, the results of Alwi et al (2003) are in contradiction with this result.

The second factor was "delays in sub-contractors' work "(I.I = 78.1%). delays in sub-contractors' work occurred due to lack of qualified workers , insufficient number of workers, and partiality about employing their relatives at the expense of experience and skills.These results could be matched with Skitmore et al.(2009).

The obtained results from this study at this factor is higher than Chan and Kumaraswamy (1996) results that ranked this factor in the 18 position with a important index of (70.8%), and Abd El-Razek et al. (2008) results that ranked this factor in the 14 position with a important index of (50.7%).The difference between the obtained results in this study and Chan and Kumaraswamy (1996) could refer to the different environmental conditions between the Gaza strip, Hong Kong and Egypt.

The third factor tocause delay was the" Often changing sub-contractors company" (I.I = 77%). Contractor frequently changes subcontractor in every project, depending on the lowest price. These results could be matched with Sambasivan, et.al (2007) results that ranked this factor in the fifth position with (I.I=77.1%).

Respondents client, as shown in Table 6, ranked the " Lack of subcontractor's skills " (I.I = 73.3%) as the least factor causing delay in this category. As mentioned before lack of subcontractor's skills is also considered as an ineffective factor of delay.

The obtained results from this study shows this factor is higher than Enshassi and Al-Najjar (2010) results who ranked this factor in the eleven position with a important index of (67.74%).The discriminations between the obtained results in this study and Enshassi and Al-Najjar (2010) could be attributed to the instability of construction sector from one year to another.

Table 5.6 : Sub-Contractors related factors

No.	Sub -Factor	Sum	Mean	Std. Deviation	I.I	rank
F1	Unreliable subcontractor	216	4.000	0.890	80.0	1
F2	delays in sub-contractors' work	211	3.907	0.807	78.1	2
F3	Spend some time to find sub-contractors company who is appropriate for each task	207	3.833	0.863	76.7	4
F4	Often changing sub-contractors company	208	3.852	0.920	77.0	3
F5	Lack of subcontractor's skills	198	3.667	0.890	73.3	5

5.2.7- Factors of Client Related Delay

Table 5.7 shows that client respondents ranked " change orders " in the first position with importance index (I.I = 77.4%) as the first factor to cause delay in this category; change of order is one of obvious reasons to extend the original duration of project; thus it contributes to delay in handing over the project. Often the required additional duration of variations are specified in the agreement.

The obtained results are in line with results obtained from Enshassi and Al-Najjar (2010) results that ranked this factor in the second position with (I.I = 73.46 %), and Sweis et al (2008) results that ranked this factor in the second position with (I.I=80.6%), but the obtained results from this study at this factor are higher than Tumi et al.(2009) results; they ranked this factor in the 35 position with (I.I=40%), Odeh et al. (2002); results they ranked this factor in the 26 position with (I.I=35.8%), and Sambasivan (2007)results ranked this factor in the 21 position with (I.I=68%) The

different between these results could refer to the different environmental conditions between the Gaza strip and these countries.

The second factor was " Slow decision making by a client "(I.I = 75.6%). Slow decision making by a client could be a reason for the delay, it refer to long period of time which is consumed to make a proper decision that guarantee to implement the project by best means and quality. Decentralized decision making may also cause delay. These results could be matched with Odeh et al (2002) results they ranked this factor in the same position with (70.2%), and %), Frimpong (2003) results who ranked this factor in the fourth position with (I.I=89.6%). These result explained that the slow decision making by client is one of the most important factor causing of delay.

The obtained results from this study at this factor are higher than Abd El-Razek, et al (2008) results, they ranked this factor in the ninth position with (I.I=56%), Alwi et al (2003) results ranked this factor in the eleven position with (I.I=68%), Tum i et al (2009) results ranked this factor in the sixth position with (I.I=74%), Sambasivan (2007) results, they ranked this factor in the 13 position with (I.I=73.2%), and Sweis et al (2008) results, they ranked this factor These different between results could be attributed to the different target for these studies.

The third factor to cause delay was " variations in quantities" , (I.I = 73.7%). The results could be matched with Skitmore, et al (2009), and Assaf and Al-Hejji (2006).

The obtained results from this study at this factor are higher than Sweis et al.(2008) results that ranked this factor in the 17 position with important index of (49.6%).The discriminations between the obtained results in this study and Sweis et al.(2008) could be ascribed to the different environmental conditions between the Gaza Strip and Jordan.

Respondents client as shown in Table 5.7 ranked the " owner has no priority/ urgency to complete the project " (I.I = 62.6 %). Owner has no priority/ urgency to complete the project is also considered as ineffective factor of delay. These results could be matched with Enshassi and Al-Najjar (2010), but the results of Abd El-Razek (2008), did not coincide with this finding.

Table 5.7 : Client related factors

No.	Sub -Factor	Sum	Mean	Std. Deviation	I.I	rank
G1	Slow decision making by client	204	3.778	0.839	75.6	2
G2	change orders	209	3.870	0.802	77.4	1
G3	Lack of capable representative	192	3.556	1.110	71.1	4
G4	Lack of experience of client in construction	179	3.315	1.163	66.3	9
G5	negotiation by knowledgeable people	174	3.222	0.984	64.4	10
G6	Client interference	182	3.370	0.958	67.4	6
G7	Improper project feasibility study	180	3.333	0.952	66.7	8
G8	variations in quantities,	199	3.685	0.886	73.7	3
G9	owner has no priority/ urgency to complete the project	169	3.130	1.029	62.6	11
G10	delays in site preparation	181	3.352	1.246	67.0	7
G11	high quality of work required	184	3.407	0.901	68.1	5

4.2.8- Factors of Consultant Related Delay

Table 5.8 shows that client respondents ranked " delay in approving major changes in the in the scope of work by consultant " in the first position with importance index (I.I = 73.7%) as the first factor to cause delay in this category, delay in approving major changes in the scope of work by consultant is one of obvious reasons to extend the original duration of project. Consultant's delay in accepting the fundamental changes at work due to what is a major cause of delay. These results could be matched with Sweis et al.(2008), but the results of Frimpong, et al. (2003) are in contradiction with this result.

The second factor was " lack of job security for the consultancy team "(I.I = 71.5%). Lack of job security for the consultancy team causes far-reaching negative outcomes that may lead to delay. The fear of job loss damages the health of employees and reduces the productivity of company. Moreover, consultant's feelings of being not belong to the company where he works with, may also cause delay.

The obtained results from this study at this factor are higher than Enshassi and Al-Najjar (2010) results that ranked this factor in the seven position with important index of (60.48%).The discriminations between the obtained results in this thesis and Enshassi and Al-Najjar (2010) could be referred to the insatiability of construction sector due to political situation of Gaza Strip.

The third factor to cause delay was " delay in performing inspection and testing by consultant " (I.I = 70.4%). These results could be matched with Enshassi and Al-Najjar (2010) results ranked this factor in the first position with (I.I= 70.97%), but they contradicted with Abd El-Razek and Mobarak. (2008) results ranked this factor in position 21 with (I.I= 45), Frimpong, et al (2003)) results, they ranked this factor in position 24 with (I.I=59.4%), Sambasivan et al. (2007) results, they ranked this factor in position 23 with (I.I=66.9%), Tumi et al.(2009)) results, they ranked this factor in position 23 with (I.I=60%), Sweis et al.(2008)) results, they ranked this factor in position 21 with (I.I=55.2%), and Le-Hoai et al (2008) results, they ranked this factor in the position 17 with (I.I=55.6%) the difference between results could be related to the different environmental conditions between Gaza Strip and these countries.

Respondents client as shown in Table 5.8 ranked the "internal company problems " (I.I = 57.4 %) as the least factor causes delay in this category.

Table 5.8 : Consultant related factors

No.	Sub -Factor	Sum	Mean	Std. Deviation	I.I	rank
H1	delay in performing inspection and testing by consultant	190	3.519	0.841	70.4	3
H2	delay in approving major changes in the sub factor of work by consultant	199	3.685	0.907	73.7	1
H3	Inadequate consultant experience	184	3.407	1.000	68.1	8
H4	inflexibility (rigidity) of consultant	186	3.444	0.965	68.9	6
H5	internal company problems	155	2.870	0.991	57.4	12
H6	absence of consultant's site staff	182	3.370	1.087	67.4	9
H7	lack of technical and managerial skills of staff	187	3.463	0.884	69.3	4

No.	Sub -Factor	Sum	Mean	Std. Deviation	I.I	rank
H8	lack of quality assurance / control	184	3.407	1.000	68.1	7
H9	Previous dispute between consultant and contractor	167	3.093	0.996	61.9	11
H10	Centralization of decision making process from consultant	186	3.444	1.058	68.9	5
H11	Bad past history and reputation of the consultant(corruption)	181	3.352	1.348	67.0	10
H12	lack of job security for the consultancy team	193	3.574	1.057	71.5	2

5.2.9- Factors of Project Related Delay

Table 5.9 shows that the respondents client ranked "the Suspension of work by client or contractor " in the first position with importance index (I.I = 77.8 %), which indicates the high importance of work continuity in order to complete the project on time. The suspension of work creates disputes among the parties of project. The sequence of project activities will be affected thus leading to delay.

These results could be matched with Enshassi and Al-Najjar (2010) results that ranked this factor in the first position with (I.I=77.4%),but this result is not consistent with Sweis et al.(2008) results that ranked this factor in position 31 with (I.I=49.6%). This may be traced to the severe political situation in Gaza which it differs from Jordan.

The second important factor ranked by respondents client was " project complexity " (I.I = 75.9 %). This is a strong indication that any additional detail for special building will cause delay.

"Project size" (I.I = 73.7 %) was ranked as the third important factor to cause delay at this group. This reason of time overruns is one of the clearest factors that cause the delay in the Gaza Strip. These results could be matched with Ahmad et al (2003), but the results of Skitmore et al (2009), Long et al. (2004), Assaf and Al-Hejji (2006), and Kaliba et al (2009) are in contradiction with this result.

Table 5.9 shows that the respondents client ranked the " project regional location " (I.I = 63.7 %) which is considered as ineffective factor of delay.

Table 5.9 : Project related factors

No.	Sub -Factor	Sum	Mean	Std. Deviation	I.I	rank
I1	project size	199	3.685	1.079	73.7	3
I2	project complexity	205	3.796	1.053	75.9	2
I3	project regional location	172	3.185	1.047	63.7	9
I4	Poor site safety	181	3.352	0.828	67.0	6
I5	Slow information flow between project team members	186	3.444	0.744	68.9	5
I6	Suspension of work by client or contractor	210	3.889	0.839	77.8	1
I7	Inconsistency between the project and its environmental due to donor agenda	179	3.315	1.061	66.3	8
I8	Donor own policy in implementation methods and characteristics of the project	179	3.315	0.987	66.3	7
I9	Inflexibility periods for project implementation	195	3.611	0.940	72.2	4

5.2.10- Factors of Design and Documentation Related Delay

Table 5. 10 shows that respondents client ranked " late in reviewing and approving design documents by consultant" in the first position with importance index (I.I = 73.3 %). Consultant mostly delays in revising and relying the drawings that could badly affect on the progress of the project; everything depends upon relying the drawings that takes a long time to be implemented, and hence it causes delay.

The obtained results from this study at this factor is higher than of Enshassi and Al-Najjar (2010) results ranked this factor in the fifth position with(I.I=55.65%), Sweis et al.(2008) results ranked this factor in the 16th position with (I.I=61.6%), Abd El-Razek, and Mobarak (2008) results that ranked this factor in the 17th position with (I.I=47%), Sambasivan et al (2007) results ranked this factor in the 16th position with (I.I=70.5), and Odeh and Battaineh (2002) results ranked this factor in the19th position with (I.I=44.2%).The difference between the obtained results in this study and the previous studies could be related to the different target group of these studies.

Table 5.10 shows that the second important factor ranked by respondents client was " incomplete drawing and detail design " in the second position with importance index (I.I = 71.1 %). Sometimes the site is handed over to contractor while the drawings of the project are incomplete, so the consultant should complete these drawing before they start the work. on some occasions, the consultant may complete the drawings gradually according to the priorities of activities. For the two cases, the project is delayed; therefore, the design team should complete the drawings before the tendering phase.

This result is agreed with Tumi, et al (2009) results that ranked this factor in the third position with (I.I=76%), and Enshassi and Al-Najjar (2010) results that ranked this factor in the third position also with (I.I=62.10); incomplete drawing is one of important causes of delay. Incomplete drawing is not affected with the location of country, but with the professionalism of designer. While these are in contradiction with this result, but Abd El-Razek and Mobarak (2008) results, they ranked this factor in the 10^{th} position with (I.I=54%) are in contradiction with this result.

The third factor to cause delay was " ambiguities and mistakes in specifications and drawings" (I.I = 70.7%). Sometimes there is a contrast between drawings and specifications; this would be a reason why conflict probably occurs between parties that may cause delay. These results could be matched with Enshassi and Al-Najjar (2010) results that ranked this factor in the second position with (I.I=63.7%).

The obtained results from this study at this factor are higher than Sambasivan (2007) results that ranked this factor in the 17^{th} position with (I.I=70.4%), Le-Hoai, et.al (2008) results that ranked this factor in the 10^{th} position with (I.I=72.4%), Sweis et al.(2008) results that ranked this factor in the 19^{th} position with (I.I=55.2%, and Odeh and Battaineh (2002) results that ranked this factor in the 23 position with (I.I= 41%).The difference between the obtained results in this thesis and these studies could be related to the different environmental conditions between the Gaza strip and these countries.

Respondents client as shown in table 4.10 ranked the " Un-use of advanced engineering design software " (I.I = 61.9 %) as the least factor causing delay in this category. Un-use of advanced engineering design software is also considered as ineffective factor of delay because From client' viewpoint most of designer using software for design work.

Table 4.10 : Design and Documentation related factors

No.	Sub -Factor	Sum	Mean	Std. Deviation	I.I	rank
J1	Late in reviewing and approving design documents by consultant,	198	3.667	0.952	73.3	1
J2	Poor design	188	3.481	1.209	69.6	5
J3	Complexity of project design	184	3.407	1.091	68.1	7
J4	Lack of designer's experience	186	3.444	1.058	68.9	6
J5	Ambiguities and mistakes in specifications and drawings	191	3.537	0.985	70.7	3
J6	Incomplete drawing and detail design	192	3.556	0.965	71.1	2
J7	Poor documentation and no detailed written procedures not using systematic procedures	183	3.389	0.998	67.8	9
J8	Delays in design work (lack of design information)	190	3.519	0.906	70.4	4
J9	Insufficient data collection and survey before design	179	3.315	1.146	66.3	10
J10	Un-use of advanced engineering design software	167	3.093	1.217	61.9	11
J11	Misunderstanding of owners requirements by design engineer	183	3.389	1.017	67.8	8

5.2.11- Factors of Contract & Contractual relationships Related Delay

Table 5.11 shows that client respondents ranked " Ineffective delay penalties " with importance index (I.I = 75.2%) as the first factor to cause delay in this category, This is a very important factor that causes delay which refer to non-seriousness of parties in putting penalties, and executing it in case of delays; It's due to bad political and economical situation in the Gaza Strip, rising of materials prices and change in Dollar's value, all these could make the client to tolerate contractors.

The second factor was " Mistakes and discrepancies in contract Documents " (I.I = 73.7%).There are some mistakes among contract documents (general specification - Bill of Quantities – drawings and maps). Non-clearness of contract clauses, terms and conditions that lead to dispute between the owner and contractor, and therefore it

leads to delay in construction projects. These results could be matched with Enshassi and Al-Najjar (2010) results that ranked this factor in the same position with (I.I=70.96).

The third factor to cause delay was the " Unavailability of incentives for contractor for finishing ahead of schedule in the contract." (I.I = 73.0%). Unavailability of incentives for contractor for finishing ahead of schedule in the contract could be a reason for delay; it's worth mentioning that motivation, incentives, and gratitude certificate would be much better to keep them active and motivated to implementation the project and may be faster than necessary. These results could be matched with Assaf and Al-Hejji (2006).

Respondents client as shown in table 5.11 ranked the " Inappropriate overall organization structure linking all parties to the project " (I.I = 66.3%) as the least factor causing delay in this category. These results could be matched with Tumi, et al (2009) , Sambasivan (2007), and Abd El-Razek, et al (2008), but the results of Odeh, et al and Battaineh's (2002) are in contradiction with this result.

Table 5.11 : Contract &Contractual relationships related factors

No.	Sub -Factor	Sum	Mean	Std. Deviation	I.I	rank
K1	Ineffective delay penalties	203	3.759	1.196	75.2	1
K2	Unavailability of incentives for contractor for finishing ahead of schedule in the contract.	197	3.648	0.955	73.0	3
K3	Inappropriate type of construction contract	184	3.407	0.901	68.1	8
K4	Type of project bidding and award (negotiation, lowest bidder),	191	3.537	1.004	70.7	5
K5	contract modification	185	3.426	0.838	68.5	7
K6	Original contract duration is too short	190	3.519	0.841	70.4	6
K7	Inappropriate overall organization, structure linking all parties to the project	179	3.315	0.773	66.3	9
K8	Major disputes and negotiations	195	3.611	0.940	72.2	4
K9	Mistakes and discrepancies in contract Documents	199	3.685	0.948	73.7	2

5.2.12- Factors of External Related Delay

Table 5.12 shows that client respondents ranked " Political situation (strikes Israeli attacks and borders closures, war)" in the first position with importance index (I.I = 86.7%) as the first factor to cause delay in this category. The political situation is considered as one of the key factors causing delay based on the frequent closure of the borders, which are considered as the main access to bringing the constructional materials, like cement, steel, and so on . In addition to recurring invasion from Israeli soldiers to the border areas. These results could be matched with Enshassi and Al-Najjar (2010) results that ranked this factor in the first position with (I.I= 96.77%). but Tumi et al (2009) results are in contradiction with this result; they ranked this factor in the 23rd position with (I.I=58%).

The second factor was " Poor economic condition " (I.I = 71.1%), which indicates the high importance of this factors to cause delay which refer to increasing of unemployment rate, high prices of basic materials, risk averse, and claim resulting from the differences of currency's price. All of these lead to disputes among parties and suspension of work. These results could be matched with Enshassi and Al-Najjar (2010) results that ranked this factor in the second position with (I.I= 73.39).

And the third factor to cause delay was the " Delay in obtaining permits from municipality" (I.I = 70.7%). Delay in obtaining permits from municipality is considered as the most factors causing delay because these permits take a long time to be granted, as it passes through the same routine processes which are imposed by governmental authorities especially when the project is located in far places where services could be hardly available. These results could be matched with Enshassi and Al-Najjar (2010) results that ranked this factor in the third position with (I.I=31.45%). However, Abd El-Razek and Mobarak (2008) results ranked this factor in position 19 with (I.I=48.67%) and Sweis et al.(2008) results ranked this factor in position 32 with (I.I= 48.8%). All these results are in contradiction with this result.

Respondents client as shown in Table 4.12 ranked the " Accident during construction " (I.I = 61.1%) as the least factor causing delay in this category. From client viewpoint, accident occurrence is not a reason behind delays in construction projects; it may occur due to the client strategy in following a certain route in case of emergencies, inside the site to keep on working. These results could be matched with Tumi et al (2009), Abd El-Razek and Mobarak (2008).

Table 5.12 : External related factors

No.	Sub -Factor	Sum	Mean	Std. Deviation	I.I	rank
L1	Weather condition	180	3.333	1.149	66.7	6
L2	Unforeseen ground condition	184	3.407	0.836	68.1	4
L3	Problem with neighbors	183	3.389	1.017	67.8	5
L4	Changes in laws and regulations	171	3.167	0.947	63.3	9
L5	Poor economic condition	192	3.556	1.040	71.1	2
L6	Unavailability of utilities in site (such as, water, electricity, telephone, etc.)	178	3.296	1.127	65.9	7
L7	Political situation (strikes Israeli attacks and borders closures, war)	234	4.333	0.847	86.7	1
L8	Delay in obtaining permits from municipality	191	3.537	0.884	70.7	3
L9	Accident during construction	165	3.056	0.940	61.1	11
L10	changes in Government regulations	166	3.074	1.079	61.5	10
L11	Damage by other participants	173	3.204	0.979	64.1	8

5.2.2 Rank of the top twenty most important factors that causes of delays.

The results as shown in Annex "C" illustrate that the client agreed that Political situation shortage of construction materials, unethical behaviors of contractors to achieve the highest possible level of profit, contractor un commitment to consultant instructions, low motivation and morale, cash problem during construction, Ineffective project planning and scheduling, unreliable subcontractor, difficulties in financing project by contractor, and lack of high-technology mechanical equipment were the most important factors that cause projects delay. The most important factors of delay was discussed and analyzed in the previous paragraphs in this chapter.

Table 4.13: Rank of the top twenty most important factors that causes of delays

Factors	N	Mean	I.I	rank
Political situation (strikes Israeli attacks and borders closures, war)	54	4.333	86.7	1
Shortage of construction materials	54	4.222	84.4	2
Unethical behaviors used by contractors to achieve the highest possible level of profit	54	4.093	81.9	3
Contractor un commitment to consultant instructions.	54	4.074	81.5	4
Low motivation and morale	54	4.056	81.1	5
Cash problem during construction	54	4.037	80.7	6
Ineffective project planning and scheduling	54	4.019	80.4	7
Unreliable subcontractor	54	4.000	80.0	8
difficulties in financing project by contractor	54	3.981	79.6	9
lack of high-technology mechanical equipment	54	3.944	78.9	10
Dependence on a newly –graduated engineer to bear the whole responsibilities in the site	54	3.926	78.5	11
Late in selection of finishing materials due to availability	54	3.907	78.1	12
delays in sub-contractors' work	54	3.907	78.1	13
Suspension of work by owner or contractor	54	3.889	77.8	14
Inadequate contractor experience	54	3.870	77.4	15
Increased number of projects	54	3.870	77.4	16
change orders	54	3.870	77.4	17
delay in progress payment by client	54	3.852	77.0	18
Lack of database in estimating activity duration and resources	54	3.852	77.0	19
Often changing sub-contractors company	54	3.852	77.0	20

5.2.3- Groups affecting delay at construction projects:

The survey is based on 127 factors that were grouped into twelve groups of causes of delays. Calculating the important index(I.I) of the factors to causes of delays in each

group provides the relative importance index of the main groups as shown in Table (5.14).

Table 5.14: Groups affecting delay at construction projects

Main group	factor	Sum	Mean	Std. Deviation	I.I	rank
1. Material - Related Factors	11	2076	38.444	5.562	69.9	7
2. Labor - Related Factors	8	1438	26.630	5.896	66.6	12
3. Equipment- Related Factors	11	2110	39.074	6.231	71.0	4
4. Finance -Related factors	7	1412	26.148	4.371	74.7	3
5. Contractor- Related Factors	22	4505	83.426	10.306	75.8	2
6. Sub-Contractors - Related Factors	5	1040	19.259	3.175	77.0	1
7. Client -Related factors	11	2053	38.019	7.110	69.1	8
8. Consultant - Related factors	12	2194	40.630	7.875	67.7	11
9. Project - Related factors	9	1706	31.593	5.254	70.2	6
10. Design and Documentation Related factors	11	2041	37.796	8.491	68.7	9
11. Contract &Contractual relationships -Related factors	9	1723	31.907	5.260	70.9	5
12. External - Related factors	11	2017	37.352	6.446	67.9	10

As shown in Figure 5.14 Sub-Contractors related delays have high influence on causes of delays followed by Contractor- Related Factors, Finance -Related factors, Equipment- Related Factors, Contract &Contractual relationships -Related factors, Project - Related factors, Material - Related Factors, Client -Related factors, Design and Documentation Related factors, External - Related factors, Consultant - Related factors, and Labor - Related Factors.

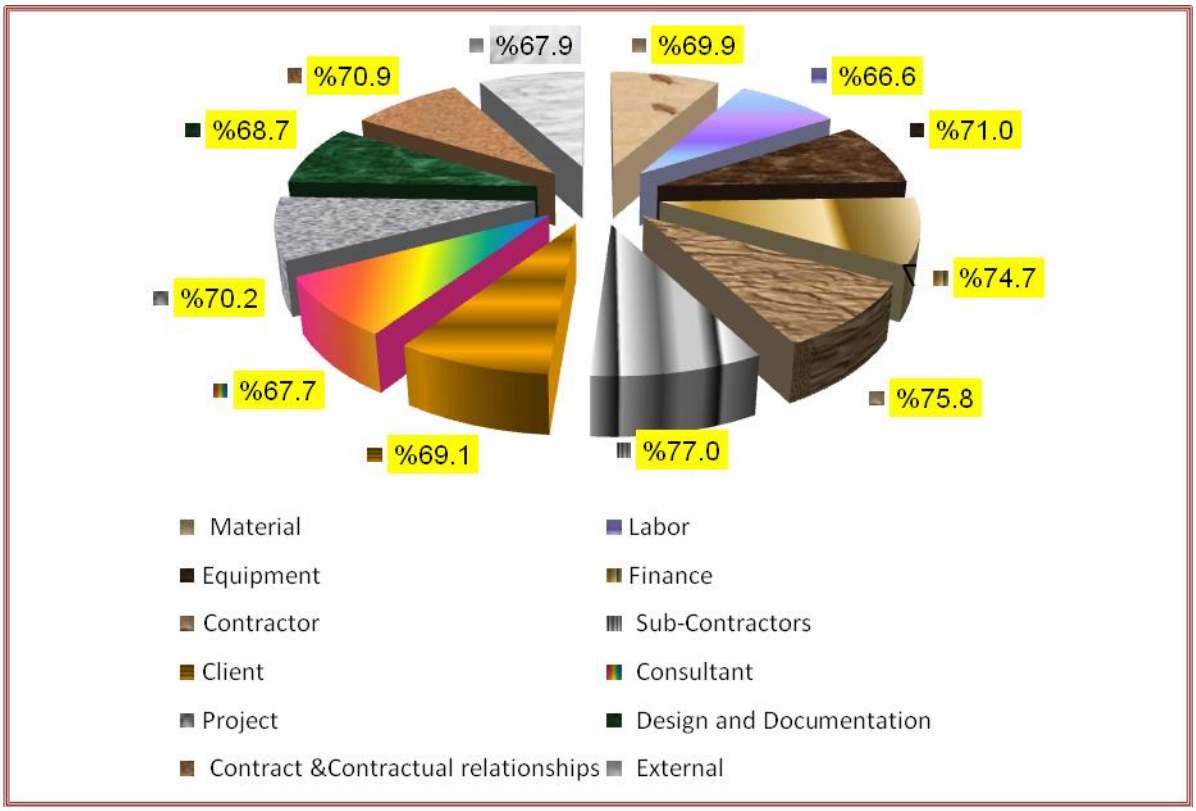

Figure 5.10 The major delays groups that causes delays

5.2.3.1 Sub- Contractors Related Delays

The groups of Client Related Delays were ranked in the first position with importance index(I.I = 77 %) by client as shown in Table 5.14. Referring to Table 5.6, from a total of 5 factors of identified client-related delays there are three factors included in the top twenty most important factors that cause delays which are Unreliable subcontractor, delays in sub-contractors' work, and often changing sub-contractors company. Contractor's choice depends on how to maximize a profit; it matters not what circumstances are possibly to be found at the site, or whether subcontractor could be qualified or not at the expense of work efficiency .Most likely, money is everything they care for.

5. 2.3.2- Contractor Related Delays

As shown in Table 5.14 client ranked this group of causes very high in second position . From a total of 22 identified factors of contractor-related delays, there are seven factors that include the top twenty most important factors that causing of delays which refer to unethical behaviors used by contractors to achieve the highest possible level of profit, contractor un commitment to consultant instructions, ineffective

project planning and scheduling, dependence on a newly graduated engineer to bear the whole responsibilities in the site, inadequate contractor experience, increased number of projects, and lack of database in estimating activity duration and resources. Client mostly hold the responsibility of being late on the contractor. Hence, the contractors group mostly occupies first rank ,while client group occupies the eighth rank; that implies that owner is likely to hold the contractor liable in getting delay that wouldn't solve the dispute but instead it affects badly on construction projects.

5.2 3.3 Equipment Related Delays

The groups of equipment related were ranked in the forth position with importance index(I.I = 71.0%) by client as shown in Table 5.14 Referring to Table 5.3 there is one factor of equipment related delays that include the top twenty most important factors of causes of delays. This factors of lack of high-technology mechanical equipment is particularly true for the old model equipment used by contractor which is related to low production and frequent equipment breakdown.

5.2 3.4 Client Related Delays

The groups of client related delays were ranked in the ninth position with importance index (I.I=69.1%) by client as shown in Table 5.14 referring to Table 5.7. From a total of 11 identified factors of client-related delays, there is one factor include the top twenty most important factors that causes of delays. Change orders in construction projects can occur, and this is caused by the construction and administration needs. In the construction needs, there are four types of causes, namely planning and design, underground conditions, safety considerations, and natural incidents. In the administration needs, another four types can be distinguished; these include changes rules/regulations, changes of decision-making authority, special needs for project commissioning and ownership transfer, and neighborhood pleading. the weight of this group is too low because the client did not believe that he contributes to the delay and he transfers this responsibility to the contractor.

5.2. 3.5 -Material Related Delays

Referring to Table 5.14, the group of material related was ranked in the seventh position by client . As shown in Table 5.1. Out of a total of 11 identified factors of material related delays; there are two factors that are included in the top twenty most important factors that cause delays; these include shortage of construction materials

and late in selection of finishing materials due to availability. Factor of shortage of construction material was ranked second and factor of late selection of finishing materials due to availability ranked twelfth.

Problem of shortage of construction material in construction site related to factors of poor site management and supervision, poor procurement programming of materials, and contractor's financial difficulties, material transportation problems, increase of material prices and inflation/prices fluctuation were causes of delay. Shortage of construction material at local market due to closures of borders is considered the most important factor causing the shortage and lack of construction materials this result is related direct to the extraordinary political situation in the Gaza Strip.

5.2 3.6 Finance Related Delays

The groups of finance related delays were ranked in the third position with importance index(I.I = 74.7%) by client as shown in Table 5.14 referred to in Table 5.4 out of a total of 7 identified factors of client-related delays, there are three factors that include the top twenty most important factors causing of delays. These include cash problem during construction, difficulties in financing project by contractor. Delay in progress payment by owner factor of cash problem during construction was ranked sixth among the top twenty factors. This problem may be due to the existing culture in the construction industry. Like most developing countries, most public work projects, including any construction projects under government authority. However, there is delay in payment for the completed work due to bureaucracy in governments departments. Regular monthly payment to contractors for work done may remove constraints which otherwise may have impeded project progress that cause delay. The other factors of finance related is factor of contractor's financial difficulties was ranked ninth by the client. This factor is related to funding shortage, high interest rate, and cash flow of contractor during construction.

5.2. 3.7 Consultant Related Delays

The groups of consultant related delays were in the eleventh position with importance index(I.I = 67.7%) by client as shown in Table 5.14 referred to in Table 5.8. out of a total of 12 identified factors of consultant related delays, there are no factors that include the top twenty most important factors causing delays. This means this group of causes is considered as ineffective.

5.2. 3.8 External Factor Related Delays

The groups of external factor related delays were ranked in the tenth position with importance index (I.I = 67.9%) by client as shown in Table 5.14 Referred to in Table 5.12. From a total of 11 identified factors of external factor related delays, there is one factor which includes the top twenty most important factors that cause delays. These include the political situation which was ranked in the first position among the top twenty most important factors that contributed to the causes of delays in construction project. This is particularly true due to the political situation in the Gaza Strip and the 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 processes. Also closures lead to increase the prices of these materials and eventually result in economic inflation. Closure of borders largely contributes to the paralysis of construction related activities and consequently leads to projects delay.

5.2.3.9 Labor related delays

Referring to Table 5.14 this group of causes received very low ranking by client. There is one factors of labor related delays among the top twenty most important factors that contributed to the causes of delays which are low motivation and morale. This referred to the bad economic situation of labor and low wages in the Gaza Strip.

5.2.3.10 Project Related Delays

The groups of "Project Related Delays" were ranked in the sixth position with importance index(I.I = 70.2%) by client as shown in Table 5.14 Referring to Table 5.9 From a total of 9 identified factors of client-related delays, there is one factor, which includes the top twenty most important factors that cause delays. This includes suspension of work by client or contractor.

SECTION "C" IN QUESTIONAIRE

5.3 -EFFECT OF DELAYS

Based on literature review and some interviews with construction practices as the preliminary investigation at the outset of this research, it was possible to identify certain major effects of delays on project delivery. The seven identified effects of delays: time overrun, cost overrun, dispute, arbitration, total abandonment, litigation, and Suspension of the work as shown in Table 5.14.The questionnaire survey was

designed and distributed among targeted respondents in order to obtain information on the perception of client about the effects of delays in construction project.

Table 5.15 Effects of delays in construction project

No.	items	Sum	Mean	Std. Deviation	I.I	rank
M1	Time Overrun	236	4.370	0.734	87.4	1
M2	Cost Overrun	229	4.241	0.775	84.8	2
M3	Dispute	202	3.741	0.757	74.8	3
M4	Arbitration	177	3.278	0.712	65.6	5
M5	Total abandonment (Contract Termination)	170	3.148	0.737	63.0	7
M6	Litigation.	176	3.259	0.975	65.2	6
M7	Suspension of the work	194	3.593	0.790	71.9	4

5.3.1 Time overrun

Table 5.15 shows that respondents client ranked "Time Overrun " in the first position with importance index (I.I = 87.4%). Factors such as political situation (strikes Israeli attacks and borders closures, war), shortage of construction materials, contractor un commitment to consultant instructions, ineffective project planning and scheduling, lack of high-technology mechanical equipment, inadequate contractor experience, lack of database in estimating activity duration and resources, and delay in the payments for the work completed directly affect the completion of the project and cause time overrun.

5.3.2 Cost overrun

Table 5.15 shows that respondents client ranked " Cost Overrun " in the second position with importance index (I.I = 84.8%).Factors such as change orders (changes in the deliverables and requirements) and mistakes and discrepancies in the contract document result in cost overrun. Mistakes and discrepancies in the contract document can be in scope, deliverables, resources available and allocated, payment terms, achievement of various milestones, and the project duration. In most of the instances, time overrun leads to cost overrun.

5.3.3 Disputes

Table 5.15 shows that respondents client ranked " Disputes " in the third position with importance index (I.I = 74.8%).Factors such as delay in the payments for completed work, frequent client interference, changing requirements, lack of communication between the various parties, problems with neighbors, and unforeseen site conditions give rise to disputes between the various parties. The disputes, if not resolved amicably can lead to arbitration or litigation.

5.3.4 Arbitration

Escalate disputes are settled by arbitration process. A competent third-party can settle the disputes amicably without going to the court.

5.3.5 Total abandonment (Contract Termination)

Promoters of various projects backed out because of poor cash flow and economic conditions. Many of these projects have now become so prohibitive that they have been abandoned permanently.

5.3.6 Litigation

Escalate disputes to be settled by the litigation process. The parties involved in the projects use litigation as a last resort to settle disputes.

5.3.7 Suspension of the work

Factors such as unethical behaviors used by contractors to achieve the highest possible level of profit, contractor un commitment to consultant instructions will arise disputes among the parties so one of these parties will suspend the work.

Section "D" in questionnaire

5.4- METHODS TO MINIMIZ DELAY IN CONSTRUCTION PROJECTS

A total of thirty four methods of minimizing construction delays were identified based on the literature review. The questionnaire survey was developed and distributed among the targeted respondent. Data from a questionnaire survey was analyzed and ranked based on relative importance index as shown in Table (5.16).

Table 5.16 Summary of methods to minimizing of construction delay

No.	items	Sum	Mean	I.I	rank
N1	Competent project manager	244	4.519	90.4	2
N2	Ensure adequate and available source of finance	245	4.537	90.7	1
N3	Multidisciplinary/competent project team	236	4.370	87.4	6
N4	Availability of all resources in the site	231	4.278	85.6	15
N5	Commitment to projects	226	4.185	83.7	24
N6	Adopting a new approach to contract award procedure by giving less weight to prices and more weight to the capabilities and past performance of contractors;	209	3.870	77.4	32
N7	Adopting new approaches to contracting such as Design-Build (D/B) and Construction Manager (CM) type of contract	197	3.648	73.0	35
N8	Complete and accurate project feasibility study and site investigation	221	4.093	81.9	28
N9	Comprehensive contract documentation	234	4.333	86.7	11
N10	Frequent progress meeting	236	4.370	87.4	7
N11	Project management assistance	235	4.352	87.0	9
N12	Use up to date technology utilization	214	3.963	79.3	29
N13	Use of experienced subcontractors and suppliers	231	4.278	85.6	15
N14	Complete and proper design at the right time	238	4.407	88.1	4
N15	Competent personnel of consultant/designer	231	4.278	85.6	15
N16	Competent and capable of client's representative	235	4.352	87.0	10
N17	Site management and supervision	243	4.500	90.0	3
N18	Use of proper and modern construction equipment	226	4.185	83.7	23
N19	Proper project planning and scheduling	236	4.370	87.4	5
N20	Accurate initial cost estimates	226	4.185	83.7	25
N21	Proper emphasis on past experience	232	4.296	85.9	13

No.	items	Sum	Mean	I.I	rank
N22	Absence of bureaucracy	223	4.130	82.6	27
N23	Clear information and communication channels	206	3.815	76.3	34
N24	Accurate initial time estimates	228	4.222	84.4	20
N25	Developing human resources in the construction industry through proper	227	4.204	84.1	22
N26	Awarding bids to the right/experience consultant and contractor	236	4.370	87.4	8
N27	Allocation of sufficient time and money at the design phase	232	4.296	85.9	14
N28	Perform a preconstruction planning of project tasks and resources needs	225	4.167	83.3	26
N29	Systematic control mechanism	231	4.278	85.6	18
N30	Effective strategic planning	233	4.315	86.3	12
N31	Use of advanced engineering design software	230	4.259	85.2	19
N32	Government should construct new store houses in settlements of Gaza	214	3.963	79.3	30
N33	Strip to store the required construction materials such as; the cement, base course, aggregates, steel, etc	210	3.889	77.8	31
N34	Government is advised to put a condition on the donor in the memorandum of understanding that obligate donor to compensate the contractor for any loss that result from hard political situation	207	3.833	76.7	33

Table 5.16 shows that respondents client ranked " Ensure adequate and available source of finance " in the first position as the most effective solution to minimize the delay in construction project with importance index (I.I = 90.70%). For any project, it is important to have adequate source of finance for project implementation on time without delay. If the source of finance is available, the contractor could procurement of the construction material, rent the equipment, and pay the wages for labors from the result most of projects delay because there are difficulties in financing projects.

The second factor was " Competent project manager " (I.I = 90.4%). which indicates the high importance of this method to minimize delay. Project manager who has experience in construction work is the most effective method to reduce delay because expertise project manager can predict any problem facing the project before it occur; otherwise, solving these problem because complicated. So the project manager can prevent deputies and claim before occurrence and this lead to reduce negative impact of delay.

The third factor to cause delay was the " Site management and supervision " (I.I = 90%) which indicates the high importance of this method to minimize delay. The continuity of inspection the work in the construction site has two benefits. The first is monitoring the work and disallowing mistake which lead to delay the work, the second if the inspection occur in the continues way this encourage the labor to do the work in the best way with best quality without delay.

Respondents client as shown in table 5.16 ranked the " Government is advised to put a condition on the donor in the memorandum of understanding that oblige donor to compensate the contractor for any loss that results from hard political situation " (I.I = 76.6%) as the least method could be used to minimize the delays in construction projects. From the client perspective, it is more difficult for the government to put a condition on the donor to compensate the contractor who is are suffering losses from dollar exchange and unavailability of material due to the hard situation the Gaza Strip. This is because the government organization has difficulty in getting the finance .

5.4.1 Top ten methods used to minimize construction delays

From Table 5.16 the top ten methods to minimizing construction delays according to client views are:

1. Ensure adequate and available source of finance
2. Competent project manager
3. Site management and supervision
4. Complete and proper design at the right time
5. Proper project planning and scheduling
6. Multidisciplinary/competent project team
7. Frequent progress meeting
8. Awarding bids to the right/experience consultant and contractor

9. Project management assistance

10. Competent and capable of client's representative.

5.5 Chapter summary

The major delays groups were identified and ranked. The group of contractor related delays is the top main group that contributes to the causes of delays. From a total of one hundred and twenty seven factors to causes of delays, twenty top most important factors have been identified. The most important factors that contributed to the causes of delays are factors of insufficient numbers of equipment, inaccurate time estimate, monthly payment difficulties, change orders, and inaccurate cost estimate. The effects of delays have been identified which time overrun and cost overrun were the most common effects of delays in construction projects. To minimize delays in construction project have been identified, the top ten effective methods of minimizing construction delays from a total of thirty four methods.

6 MODEL DEVELOPMENT

In this chapter, will introduce the model development stages that was concluded factor analysis factor extraction, rotation, interpretation of clusters, stepwise multiple regression analysis, the suggested model, model application, model verification. The mathematical models will develop the level of people who work in construction project through being able to predict the construction delay.

6.1 Factor Analysis

Factor Analysis is considered a technique for finding a small number of underlying dimensions from among a large number of variables (Amer, 2002). This technique was applied in this study to identify a relatively small number of factors that can be used to represent relationships among those 127 sets of independent variables (sub-factors affecting delay presented in section 2 of the questionnaire).

Generally there are two steps to factor analysis:

1. The extraction of the factors; and
2. The rotation of the factors.

In this study, we extracted 20 critical sub-factors which have an important indices more than 77% and ranked them as shown in Table 6.1. The most important twenty Critical Success Factors (CSFs) were subjected to factor analysis using principal components analysis and varimax rotation. Principle components analysis is a common method in factor analysis. It involves the generation of linear combinations of variables in the way of factor analysis so that they account for as much of the variance present in the collected data as possible. Such an analysis summarizes the variability in the observed data by means of a series of linear combination of ‘‘factors’’. Each factor can, therefore, be viewed as a ‘‘super-variable’’ comprising a specific combination of the actual variables examined in the survey. The advantage of this method over other factor analytical approaches is that the mathematical representation of the derived linear combinations avoids the need for the use of questionable causal models.

Table 6.1: Critical success factors causes delay.

No.	Critical Sub-Factors(CSFs)	Mean	I.I	rank
1	Political situation (strikes Israeli attacks and borders closures, war)…. (CSF1)	4.333	86.7	1
2	Shortage of construction materials(CSF2)	4.222	84.4	2
3	Unethical behaviors used by contractors to achieve the highest possible level of profit(CSF3)	4.093	81.9	3
4	Contractors are not committed to consultant instructions.. (CSF4)	4.074	81.5	4
5	Low motivation and morale(CSF5)	4.056	81.1	5
6	Cash problem during construction(CSF6)	4.037	80.7	6
7	Ineffective project planning and scheduling(CSF7)	4.019	80.4	7
8	Unreliable subcontractor(CSF8)	4.000	80.0	8
9	difficulties in financing project by contractor(CSF9)	3.981	79.6	9
10	lack of high-technology mechanical equipment(CSF10)	3.944	78.9	10
11	Dependence on a newly –graduated engineer to bear the whole responsibilities in the site(CSF11)	3.926	78.5	11
12	Late in selection of finishing materials due to availability (CSF12)	3.907	78.1	12
13	delays in sub-contractors' work(CSF13)	3.907	78.1	13
14	Suspension of work by owner or contractor(CSF14)	3.889	77.8	14
15	Inadequate contractor experience(CSF15)	3.870	77.4	15
16	Increased number of projects(CSF16)	3.870	77.4	16
17	change orders(CSF17)	3.870	77.4	17
18	delay in progress payment by owner(CSF18)	3.852	77.0	18
19	Lack of database in estimating activity duration and resources(CSF19)	3.852	77.0	19
20	Often changing sub-contractors company(CSF20)	3.852	77.0	20

6.2 Factor Extraction

The twenty Sub-Factors is the major causes of delays in construction projects in the Gaza Strip were assumed to be independent variables. Principal component analysis was used to identify the underlying factors. To determine how many factors will be needed to represent the data, the percentage of total variance explained by each is examined. The total variance is the sum of the variance of each variable. Since there are 7 variables and each is standardized to have a variance of 1, the total variance is twenty.

Table 6.2 contains the initial statistics for each factor. The total variance explained by each factor is listed in the column labeled "Eigen value". The next column contains the percentage of the total variance attributable to each factor. For example, factor 2 has a variance of 2.25, which is 11.25 percent of the total variance of 20 . The last column, the cumulative percentage, indicates the percentage of variance attributable to that factor and those that precedes it in the table. The first two columns provide information about the variables, while the last four columns describe the factors. Several procedures have been proposed for determining the number of factors to use in a model. One criterion suggests that only the factors that account for variance greater than 1 (Eigen value greater than 1) should be included (Chan and Tam, 2000). Another criterion is called the Scree plot test illustrated in Figure(6.1). Both of the two criteria will be used in this study.

Table 6.2 shows that almost 65.52 percent of the total variance is attributed to the first 7 factors where each factor have an Eigen value greater than 1. The remaining 13 factors together account for only 34.48 percent of the variance. Thus a model with 7 factors should be considered adequate to represent the data.

Figure 6.1 is called a Scree plot of the total variance associated with each factor. It plots the new factors as the X-axis and the corresponding Eigen values as the Y-axis. As one moves to the right, towards later factor, the Eigen values drop. The plot shows a distinct break between the steep slope of the large factors and the gradual trailing off of the rest of the factors. This gradual trailing off is called the Scree because it resembles the rubble that forms at the foot of a mountain. Experimental evidence indicates that the Scree begins at the kth factor, where k is the true number of factors

(Chan and Tam, 2000). From the Scree Plot. Figure 6.2 it again shows that 20 factor model should be sufficient for the research model.

Table 6.2: Initial statistics for the 20 variables (sub-factors causing)

No.	Critical Sub-Factors(CSF)	Eigen values	% of Variance	Cumulative %
1	Political situation (strikes Israeli attacks and borders closures, war)…. (CSF1)	3.90	19.51	19.51
2	Shortage of construction materials(CSF2)	2.25	11.25	30.75
3	Unethical behaviors used by contractors to achieve the highest possible level of profit(CSF3)	1.89	9.42	40.18
4	Contractors are not committed to consultant instructions. (CSF4)	1.37	6.82	47.00
5	Low motivation and morale(CSF5)	1.35	6.72	53.72
6	Cash problem during construction(CSF6)	1.30	6.47	60.20
7	Ineffective project planning and scheduling(CSF7)	1.07	5.33	65.52
8	Unreliable subcontractor(CSF8)	0.99	4.94	70.45
9	difficulties in financing project by contractor(CSF9)	0.91	4.56	75.01
10	lack of high-technology mechanical equipment(CSF10)	0.811	4.05	79.06
11	Dependence on a newly –graduated engineer to bear the whole responsibilities in the site(CSF11)	0.79	3.96	83.02
12	Late in selection of finishing materials due to availability (CSF12)	0.67	3.36	86.38
13	delays in sub-contractors' work(CSF13)	0.549	2.719	89.09

No.	Critical Sub-Factors(CSF)	Eigen values	% of Variance	Cumulative %
14	Suspension of work by owner or contractor(CSF14)	0.48	2.39	91.48
15	Inadequate contractor experience(CSF15)	0.44	2.19	93.67
16	Increased number of projects(CSF16)	0.41	2.06	95.73
17	change orders(CSF17)	0.30	1.50	97.23
18	delay in progress payment by owner(CSF18)	0.23	1.13	98.36
19	Lack of database in estimating activity duration and resources(CSF19)	0.193	0.97	99.33
20	Often changing sub-contractors company(CSF20)	0.133	0.67	100.00

Figure 6.1: Factor Scree Plot

6.3 Factor Rotation

Once a set of common factors has been identified, there remains the question of how the individual variables (sub-factors) relate to those common factors. A Varimax rotation method was used in this study to explore the relationship of the individual variables (sub-factors) to these common factors. It is an orthogonal rotation of the factor axis to maximize the variance of the squared loadings of a factor (column) on all the variables (rows) in a factor matrix, which has the effect of differentiating the original variables by extracted factor. That is, it minimizes the number of variables, which have high loadings on any given factor. Each factor will tend to have either large or small loadings of particular variables on it. A varimax solution yields results which make it easy as possible to identify each variable with a single factor. This is the most common rotation option(Amer, 2002).

Table 6.3 shows the factor rotation results indicating the new factors and their elements related to each factor. It also shows the strength of correlation between new factor and their variables.

Table 6.3: Factor Rotation Results

Critical Sub-Factors (CSF)	F1	F 2	F 3	F 4	F 5	F 6	F 7
Unreliable subcontractor(CSF8)	0.780						
Dependence on a newly –graduated engineer to bear the whole responsibilities in the site(CSF11)	0.620						
delays in sub-contractors' work(CSF13)	0.870						
Cash problem during construction(CSF6)	0.315	0.688					
difficulties in financing project by contractor(CSF9)		0.820					
delay in progress payment by owner(CSF18)		0.731					
Unethical behaviors used by contractors to achieve the highest possible level of profit(CSF3)			0.698				
Contractors are not committed to consultant instructions. (CSF4)			0.677				
Suspension of work by owner or contractor(CSF14)			0.580				
Increased number of projects(CSF16)				0.619			

Critical Sub-Factors (CSF)	F1	F 2	F 3	F 4	F 5	F 6	F 7
Political situation (strikes Israeli attacks and borders closures, war) (CSF1)				-0.661			
Shortage of construction materials(CSF2)				0.666	-0.468		
change orders(CSF17)		0.327		0.321	0.538		
Ineffective project planning and scheduling(CSF7)					0.796		
Often changing sub-contractors company(CSF20)			0.575		0.456		
Late in selection of finishing materials due to availability(CSF12)			0.355			0.487	
Low motivation and morale(CSF5)						0.770	
lack of high-technology mechanical equipment(CSF10)						0.717	
Inadequate contractor experience(CSF15)				0.473			0.448
Lack of database in estimating activity duration and resources (CSF19)							0.911

In order to prevent confusion between the extracted factors which represent the relationships among the 20 CSFs and the same word used in previous sections which indicates the attributes for causing delay in construction project, it is necessary to rename the extracted factor as a ‘‘cluster’’ in the interpretation of the results of the analysis.

seven clusters with Eigen values greater than 1 are extracted. The cluster matrix after varimax rotation is presented in Table 6.4. Each of the CSFs weighs heavily to only one of the clusters,. Table 6.4 shows the final statistics of the principal component analysis, and the clusters extracted account for 65.52% of the variance.

Table 6.4: Cluster Matrix after Varimax Rotation

Factor	Cluster	Cluster 2	Cluster	Cluster 4	Cluster	Cluster 6	Cluster 7
CSF8	0.780						
CSF11	0.620						
CSF13	0.870						
CSF6		0.688					
CSF9		0.820					
CSF18		0.731					
CSF3			0.698				
CSF4			0.677				
CSF14			0.580				
CSF16				0.619			
CSF1				-0.661			
CSF2				0.666			
CSF17					0.538		
CSF7					0.796		
CSF20					0.456		
CSF12						0.487	
CSF5						0.770	
CSF10						0.717	
CSF15							-0.448
CSF19							0.911

6.3.1 Interpretation of Clusters

It is necessary to assign a new name to each of the groupings. Based on an examination of the inherent relationships among the CSFs under each of the clusters, the seven extracted clusters can be reasonably interpreted as shown in Table (6.4). The associated explanations regarding these clusters are provided in the Table (6.4).

Table 6.5: New group causes of delays in construction projects in the Gaza

No.	New Group	CSFs
1	**Cluster 1**	8, 11, 13
2	**Cluster 2**	6, 9, 18
3	**Cluster 3**	3, 4, 14
4	**Cluster 4**	16, 1, 2
5	**Cluster 5**	7, 20, 17
6	**Cluster 6**	12, 5, 10
7	**Cluster 7**	15, 19

6.3.1.1 Cluster 1:

The three extracted CSFs significant for cluster 1 are all related to Subcontractor influence. It contains of unreliable subcontractor, dependence on a newly graduated engineer to bear the whole responsibilities in the site, and delays in sub-contractors' work.

6.3.1.2 Cluster 2:

The three extracted CSFs significant for cluster 2 are all related to the cash problem during construction, difficulties in financing project by contractor, and delay in progress payment by client.

6.3.1.3 Cluster 3:

This cluster contains unethical behaviors used by contractors to achieve the highest possible level of profit, Contractors are not commitment to consultant instructions., and Suspension of work by owner or contractor.

6.3.1.4 Cluster4:

This cluster contains the Increased number of projects, Political situation (strikes Israeli attacks and borders closures, war), and Shortage of construction materials The

closure of Gaza Strip have a big bad effect on the construction projects and cause of delay the most of construction project in the last five years.

6.3.1.5 Cluster5:

This cluster contains the change orders, ineffective project planning and scheduling, and often changing sub-contractors company.

6.3.1.6 Cluster6:

This cluster contains the late in selection of finishing materials due to availability, low motivation and morale ,and lack of high-technology mechanical equipment.

6.3.1.7 Cluster7:

This cluster contains the inadequate contractor experience, and lack of database in estimating activity duration and resources.

6.4 Stepwise Multiple Regression Analysis

In this approach, the stepwise multiple regression was applied on the twenty new group resulted from the factor analysis. The aim of this method is to define the most important factor that causes delay in the construction project.

A Stepwise model-building technique for regression designs with a single variable has the basic procedures which involve (1) identifying an initial model, (2) iteratively "Stepping", that is, repeatedly altering the model at the previous step by adding or removing a predictor variable in accordance with the "Stepping criteria", and (3) terminating the search when stepping is no longer possible given the stepping criteria, or when a specified maximum number of steps has been reached.

The following topics provide details on the use of stepwise model-building procedures. A primary purpose of this study was to develop a model to predict delay of the construction projects. As shown in Table 6.1, the 20 factors that causes delay described in Section 6.1 were utilized as independent variables to determine their usefulness for predicting changes in the dependent variable, which is delay. Stepwise multiple regression analysis was applied to determine the relationships of these underlying factors with delay A summary of the regression results can be seen in Table (6.6).

Table 6.6: Stepwise Multiple Regression Analysis Results

Model	R	R Square	Adjusted R Square	F	significant
1-a	.693	.480	.470	47.922	0.000*
2-b	.834	.695	.683	58.184	0.000*
3-c	.897	.804	.792	68.369	0.000*
4-d	.947	.896	.888	105.569	0.000*
5-e	.971	.943	.937	157.607	0.000*
6-f	.992	.984	.982	483.160	0.000*
7-g	1.000	1.000	1.000	-	-

* P less than 0.05

1- a Predictors: (Constant), F1

2- b Predictors: (Constant), F1, F2

3- c Predictors: (Constant), F1, F2, F5

4- d Predictors: (Constant), F1, F2, F5, F6

5- e Predictors: (Constant), F1, F2, F5, F6, F3

6- f Predictors: (Constant), F1, F2, F5, F6, F3, F4

7- g Predictors: (Constant), F1, F2, F5, F6, F3, F4, F7

6.5The suggested model

Table 6.6 shows 7 models, which include different factors. To choose the appropriate model, the value of R^2 is used as a guide. As R^2 is the percent of variance in the independent variables to variance of the dependent variable, the value of R^2 equal 0.984 will be taken as indication of the appropriate model. This means that any change in the independent variables represent 98.4% of change in the dependent variable which is delay. Other values of R^2 could be used for choosing other models, but the value of R^2 equal 0.984 is sufficient to represent the most important factors

causing delay. Also it will narrow the factors used in the proposed model to 6 factors and this will make the model easy to use. Therefore, model number 6 with R^2 equal 0.98 was chosen. Coefficients of the different factors and results of the multiple regression are found in Annex (D).

Delay model = (1.573 + 1.143 F1 + 1.026 F2 + 1.027 F3 + 1.114 F4 + 1.190 F5 + 1.013 F6) * (100/34.138)

Where:

F1, F2, F5, F3, F4 F6 are average weighted scores resulted from collecting the ranking scores of the factors explained as the following:

F1: Factors included in cluster 1

F2: Factors included in cluster 2

F3: Factors included in cluster 3

F4: Factors included in cluster 4

F5: Factors included in cluster 5

F6: Factors included in cluster 6

- 34.138= the summation of the formula if each factor has the maximum score, which is 5.
- 100 = The expected result of major causes of delays in construction projects in the Gaza Strip score.

Multiple regression analysis has identified that 7 out of the 20 factors resulting from factor analysis were significantly causing delay in construction project.

Therefore, the percentage of delay can be increased by improvement of Subcontractor efficiency, financial management, increase the contractor experience, Political situation influence, improving Consultant experience and experienced management staff.

6.6 Model Application

In order to make Model more practical and easy to use as a measuring tool of delay of a construction project, two forms are developed. In the first form as shown in Figure 6.2. a Construction Manager or a Project Engineer will be asked to rank the

degree of their agreement on different elements resulted from factor rotation as shown in Table 5.4 and related to the factors affecting delay in their specific project.

The second form was developed in Excel sheet as shown in Figure 6.3. It incorporates the data collected from the first form. The first column is used for factor elements, the second for presenting the score of each element, the third column assigns the main factor as resulted from the multiple regression analysis, and the fourth column represents the computation of the average weight of each factor depending on the scores of its elements. The last row in the worksheet assigns the value of delay as computed by Model for a specific project out of 100.

Figure (6.2): Form "1" worksheet for measuring delay in construction projects

Project name……..……

Client ……..……

Please identify (carefully) the degree of Agreement of each of the following factors in your construction project.
5 = Strongly agree 4 = Agree 3 = Neither agree nor disagree contributing
2 = Disagree 1 = Strongly disagree

New Group (clasters)	Critical Sub-Factors (CSF)	Degree ofAgreement				
		5	4	3	2	1
Cluster 1 (F1)	Unreliable subcontractor					
	Dependence on a newly –graduated engineer to bear the whole responsibilities in the site					
	delays in sub-contractors' work					
Cluster 2 (F2)	Cash problem during construction					
	difficulties in financing project by contractor					
	delay in progress payment by client					
Cluster 3 (F3)	Unethical behaviors used by contractors to achieve the highest possible level of profit					
	Contractors are not committed to consultant instructions.					
	Suspension of work by owner or contractor					
Cluster 4 (F4)	Increased number of projects					
	Political situation (strikes Israeli attacks and borders closures, war)					
	Shortage of construction materials					
Cluster 5 (F5)	change orders					
	Ineffective project planning and scheduling					
	Often changing sub-contractors company					
Cluster 6 (F6)	Late in selection of finishing materials due to availability					
	Low motivation and morale					
	lack of high-technology mechanical equipment					

Figure (6.3) Form 2 Excel Work sheet for measuring delay in construction projects (Average score weight)

Critical Sub-Factors (CSF)	Score	Main factors	Average score weight
Unreliable subcontractor	5	F1	5
Dependence on a newly –graduated engineer to bear the whole responsibilities in the site	5		
delays in sub-contractors' work	5		
Cash problem during construction	5	F2	5
difficulties in financing project by contractor	5		
delay in progress payment by client	5		
Unethical behaviors used by contractors to achieve the highest possible level of profit	5	F3	5
Contractors are not committed to consultant instructions.	5		
Suspension of work by owner or contractor	5		
Increased number of projects	5	F4	5
Political situation (strikes Israeli attacks and borders closures, war)	5		
Shortage of construction materials	5		
change orders	5	F5	5
Ineffective project planning and scheduling	5		
Often changing sub-contractors company	5		
Late in selection of finishing materials due to availability	5	F6	5
Low motivation and morale	5		
lack of high-technology mechanical equipment	5		
Total	**100%**		

6.7 Model Verification

Model verification is undertaken to ensure the soundness and usefulness of the model. two construction projects was taken to test the Model. The first one project is UNRWA maintenance works at several installation in Middle Area, the second project is School construction & rehabilitation project at Rafah Area. The project managers is given the worksheet (Form 1), explained in Figure 6.2 to define their degree of agreement of the different factors assigned in the model.

6.8 Verification Case

6.8.1 CASE1: maintenance works at severe installations in Middle Area

6.8.1 .1 General Background

In the context of UNRWA's policy to sustain its installations in healthy conditions, a periodical maintenance is conducted to rehabilitate schools, health centers, and other installations. In this project, Maintenance works at several installations in middle area was planned to be achieved. This works include concrete, metal, painting, plastering, plumbing, electrical, finishing works and other activities in five installations.

- This project was advertised for tendering on 14th March 2010 with a tender closing date on 24th March 2010.
- The invitation for tendering this project was addressed to all Palestinian contractors registered at the PCU under building & maintenance categories.
- Tender No: T/M/01/2010
- This project is planned to be implemented within 10 weeks.
- The lowest bidder in this tender is classified under 1st PCU category with a tender amount $75,903.5.
- Type of contract: Unit Price
- Site handed over on: 11 April 2010

6.8.1.2 The Verification Case applied in two steps

First step : Form 1 is filled from the client overview in May 3th 2010. Then data collected from Form 1 is filled in the Excel worksheet as shown in Figure 6.4 (Form 2) The computed project delay score equals 52.18%.The results indicated that there is about 52.18% delay probability occurs.

Figure(6.4) Form 2 Excel work sheet for measuring delay in UNRWA construction projects

Critical Sub-Factors (CSF)	Score	Main factors	Average score weight
Unreliable subcontractor	3	F1	2.66
Dependence on a newly –graduated engineer to bear the whole responsibilities in the site	2		
delays in sub-contractors' work	3		
Cash problem during construction	2	F2	2.33
difficulties in financing project by contractor	3		
delay in progress payment by client	2		
Unethical behaviors used by contractors to achieve the highest possible level of profit	2	F3	2.66
Contractors are not committed to consultant instructions.	3		
Suspension of work by owner or contractor	2		
Increased number of projects	1	F4	3.66
Political situation (strikes Israeli attacks and borders closures, war)	5		
Shortage of construction materials	5		
change orders	1	F5	1.66
Ineffective project planning and scheduling	2		
Often changing sub-contractors company	2		
Late in selection of finishing materials due to availability	1	F6	2
Low motivation and morale	3		
lack of high-technology mechanical equipment	2		
Total	52.18%		

Second step: the researcher conducted a direct contact with the manager in UNRWA and gives guidance for the manager about the factors with the highest score. After project completed the manager again filled form 1 then the computed project delay

score equals 52.18% as shown in figure 6.5so the probability of delay decrease from 52.18% to 35.5%These result produce the benefit of the model.

Figure(6.5) Form2 Excel work sheet for measuring delay in UNRWA construction projects after project completion.

Critical Sub-Factors (CSF)	Score	Main factors	Average score weight
Unreliable subcontractor	2	**F1**	1.67
Dependence on a newly –graduated engineer to bear the whole responsibilities in the site	2		
delays in sub-contractors' work	1		
Cash problem during construction	1	**F2**	1.33
difficulties in financing project by contractor	2		
delay in progress payment by client	1		
Unethical behaviors used by contractors to achieve the highest possible level of profit	1	**F3**	1.33
Contractors are not committed to consultant instructions.	1		
Suspension of work by owner or contractor	2		
Increased number of projects	1	**F4**	2.00
Political situation (strikes Israeli attacks and borders closures, war)	2		
Shortage of construction materials	3		
change orders	1	**F5**	1.67
Ineffective project planning and scheduling	2		
Often changing sub-contractors company	2		
Late in selection of finishing materials due to availability	1	**F6**	1.67
Low motivation and morale	2		
lack of high-technology mechanical equipment	2		
Total	35.50%		

6.8.2 Case (2): Program for improving the learning environment in schools at Rafah Area.

Project name: School construction & rehabilitation project at Rafah Area

Client: Ministry of education (MOE)

Location : Rafah Area

Consultant: Technical Engineering Consulting company

Project duration: Six month

Site handed over on: 6/6/2010

Project cost: 3,068,187 NIS

Tender No:2010-17

Funded by: Islamic Relief

Form 1 is filled from the client overview in June 12/6/ 2010. data collected from Form 2 is filled in the Excel worksheet as shown in Figure 6.6 (Form 2).The computed project delay score equals 41.46%. The results indicated that there is about 41.47% delay probability occurs so the manger will manage the project by reduce the effect of factors with high score.

Figure(6.6) Form 2 Excel work sheet for measuring delay in Ministry Of Education projects at Rafah Area.

Critical Sub-Factors (CSF)	Score	Main factors	Average score weight
Unreliable subcontractor	2	**F1**	1.33
Dependence on a newly –graduated engineer to bear the whole responsibilities in the site	1		
delays in sub-contractors' work	1		
Cash problem during construction	4	**F2**	2.67
difficulties in financing project by contractor	3		
delay in progress payment by client	1		
Unethical behaviors used by contractors to achieve the highest possible level of profit	2	**F3**	1.67.
Contractors are not committed to consultant instructions.	2		

Critical Sub-Factors (CSF)	Score	Main factors	Average score weight
Suspension of work by owner or contractor	1		
Increased number of projects	1	**F4**	2.33
Political situation (strikes Israeli attacks and borders closures, war)	3		
Shortage of construction materials	3		
change orders	1	**F5**	1.67
Ineffective project planning and scheduling	2		
Often changing sub-contractors company	2		
Late in selection of finishing materials due to availability	4	**F6**	2.00
Low motivation and morale	1		
lack of high-technology mechanical equipment	1		
Total	41.47 %		

6.9 Summary:

The model is developed to measure & forecast the delay occurrence in different construction projects. This model can be used at implementation stages of construction. It also helps in identifying the weak points that affect in lowering project delay score. Therefore, it helps project managers to take actions toward improving these low score areas and hence improving the overall project condition/progress.

7 CONCLUSIONS AND RECOMMENDATIONS

7.1 Introduction

This chapter includes the conclusions and recommendations that would help in mitigate and solving impact of delay in construction projects in the Gaza Strip. The objectives of this research are to identify the major causes of delay in construction project, to identify the effects of delays in construction project, and to identify the methods of minimizing construction delays. to develop a mathematical models showing the best representation of delay causes, and to conduct case study verifying the delay causes.

A structured questionnaire survey approach was considered to study the factors causing delay in the construction projects in the Gaza Strip. The questionnaire assists to study the attitude of clients towards key delay indicators in the construction industry. Pilot study of the questionnaire was achieved by a scouting sample, which consisted of 10 questionnaires. These questionnaires were distributed among expert engineers such as projects managers, site engineers/office engineers and organizations managers. They have a strong practical experience in construction industries field. Their sufficient experiences are a suitable indication for pilot study.

One hundred and twenty seven (127) factors were identified in this study and were listed under twelve groups based on literature review. These groups give a comprehensive summary of the main factors that cause delay. The factors were summarized and collected according to literature review and others are added as recommended by local experts. The main groups considered in this thesis are sub-Contractors , contractor, finance, equipment, contract & contractual relationships, project, material, client, design and documentation, external, consultant ,and labor group.

The target groups in this research are client 60 questionnaires were distributed 54 questionnaires (90%) were received. The respondents are classified as projects managers, site engineers/office engineers and organizations managers, as they have a practical experience in construction industries field. Their sufficient experiences were

a suitable indication to find out the perceptive of the relative importance of project delay factors of the client.

The results were analyzed, discussed to obtain the most important factor that causing delay. The relative importance index method (RII) was used here to determine client perceptions of the relative importance of the most important factors causing delay in Gaza Strip construction projects.

7.2 Conclusion

This part of the thesis concludes the main findings as following :

7.2.1 Major causes of delay in construction project

A total of 127 factors that causes delays were identified. These factors were grouped into 12 groups.

7.2. 1.1 -Material Related Delays

Client ranked this group of causes in the seventh position with importance index (I.I=69.9%). Shortage of construction materials is considered as one of the key factors that cause delay; this is due to the frequent closure of the Gaza Strip's borders and the consequent depletion of basic materials, tools and petrol stocks. It is then, the situation aggravated, hence, work suspension, and delays occurred. Problems of shortage of construction material in construction site related to factors of poor site management and supervision, poor procurement programming of materials, and contractor’s financial difficulties, material transportation, and increase of material prices and inflation/prices fluctuation were causes of delay.

7.2.1.2 Labor related delays

Labor related delays were ranked in the twelve position with importance index (I.I = 66.6%) by client. Low motivation and morale is considered as one of the key factors that causes delay, which refers to bad situation of labor due the decreasing level of labor salary in the Gaza Strip.

7.2 1.3 Equipment Related Delays

The groups of equipment were ranked in the forth position with importance index(I.I = 71.0%) by client; the most important factors that cause delays which refer to lack of high-technology mechanical equipment are particularly true for the old model equipment used by contractor which is related to low production and frequent equipment breakdown.

7.2 1.4 Finance Related Delays

The groups of finance related delays were ranked in the third position with importance index (I.I = 74.7%) by client, Cash problem during construction is considered as one of the key factors that cause delay; this indicates the high importance of money for the progress of project. Any shortage of money for the contractor will cause many problems such as slow progress and work decline in productivity. Also the contractors will not be able to purchase the needed equipment for work.

7. 2.1.5- Contractor Related Delays

Client ranked this group of causes in the second position with importance index(I.I = 75.8 %) the most important factors that cause delays which refer to unethical behaviors used by contractors to achieve the highest possible level of profit. Any unethical behavior by contractor via a manipulating degree of quality, and change in specification could be enough to generate disputes among parties thus, causing delays. Client, mostly hold the responsibility of being late for the contractor; that implies that client is likely to hold the contractor liable in getting delay that wouldn't solve the dispute but instead it affects badly on construction projects.

7.2.1.6 Sub- Contractors Related Delays

Client Related Delays were ranked in the first position with importance index (I.I = 77 %), Unreliable subcontractor factor has been ranked as the major factor by client in this group. Contractor's choice depends on how to maximize a profit; it matters not what circumstances are possibly to be found at the site or whether subcontractor could be qualified or not at the expense of work efficiency. Money is everything they care for.

7.2 1.7 Client Related Delays

The groups of client related delays were ranked in the ninth position with importance index (I.I=69.1%) by client, the most important factors that causing of delays which refer to Change orders in construction projects, and this is caused by the construction and administration needs. In the construction needs, there are four types of causes, namely planning and design, underground conditions, safety considerations, and natural incidents. In the administration needs, another four types can be distinguished; these include changes rules/regulations, changes of decision-making authority, special needs for project commissioning and ownership transfer, and neighborhood pleading.

the weight of this group is too low because the client did not believe that he contributes to the delay and he transfers this responsibility to the contractor.

7.2. 1.8 Consultant Related Delays

The groups of consultant related delays were ranked in the eleventh position with importance index (I.I = 67.7%) by client, delay in approving major changes in the in the scope of work by consultant.

7.2.1.9 Project Related Delays

The groups of project related delays" were ranked in the sixth position with importance index(I.I = 70.2%) by client, the Suspension of work by client or contractor is considered as one of the key factors that causes delay in this group which indicates the high importance of work continuity in order to complete the project on time. The suspension of work creates disputes among the parties of project. The sequence of project activities will be affected thus leading to delay.

7.2.1.10 Design and Documentation Related Delay

The groups of design related delays were ranked in the ninth position with importance index(I.I = 68.7%) by client, late in reviewing and approving design documents by consultant is considered as one of the key factors that causes delay in this group. Consultant mostly delays in revising and relying the drawings that could badly affect on the progress of the project; everything depends upon relying the drawings that takes a long time to be implemented.

7.2.1.11 Contract & Contractual relationships Related Delay

The groups of contract &contractual relationships related delay were ranked in the fifth position with importance index(I.I = 70.9%) by client. Ineffective delay penalties is considered as one of the key factors that causes delay in this group This is a very important factor that causes delay which refer to non-seriousness of parties in putting penalties, and executing it in case of delays; It is due to bad political and economical situation in the Gaza Strip, rising of materials prices and change in Dollar’s value, all these could make the client to tolerate contractors.

7.2.1.12 External Factor Related Delays

The groups of external factor related delays were ranked in the tenth position with importance index (I.I = 67.9%) by client. The political situation is considered as one of the key factors causing delay based on the frequent closure of the borders, which are considered as the main access to bringing the constructional materials, like

cement, steel, and so on. In addition to recurring invasion from Israeli soldiers to the border areas. Frequent closures of borders lead to shortage of materials and equipment which are necessary for construction processes. Also closures lead to increase the prices of these materials and eventually result in economic inflation. Closure of borders largely contributes to the paralysis of construction related activities and consequently leads to projects delay.

7.2.2 Top ten most important factors that cause delays from client views.

Results indicated that the top ten factors that cause delays are" political situation" in the 1st position, "shortage of construction materials" in the 2st position, "unethical behaviors used by contractors to achieve the highest possible level of profit" in the 3st position, "contractor un commitment to consultant instructions" in the 4st position, "low motivation and morale" in the 5st position , "cash problem during construction", in the 6st position "ineffective project planning and scheduling" in the 7st position, "unreliable subcontractor" in the 8st position, "difficulties in financing project by contractor" in the 9st position, and "lack of high-technology mechanical equipment" in position ten.

7.2.3 The Common Effects of Delays

Results show that the " time overrun " has been ranked in the 1st position, "cost overrun" in the 2st position, "dispute" in the 3st position, "arbitration" in the 4st position, "total abandonment" in the 5st position, "litigation" in the 6st position, "suspension of the work" in the 7st position. The results of analysis shown time overrun and cost overrun were the two most common effects of delays in construction project.

7.2.4 The Methods of Minimizing Construction Delays

Results show that the most effective methods of minimizing delays include: ensure adequate and available source of finance, competent project manager, site management and supervision, complete and proper design at the right time, proper project planning and scheduling, multidisciplinary/competent project team, frequent progress meeting, awarding bids to the right/experience consultant and contractor, project management assistance, competent and capable of client's representative.

7.2.5 Develop a mathematical models showing the best representation of delay causes

The Stepwise Multiple Regression Analysis carried out to define factors that causing delay of a construction project during construction phase. Factor analysis was used to

developed models, 12 groups and 127 factors causing delay were determined. Based on ranking the factors causing delay , the weights of the main factors were determined.

The model was developed: Through Stepwise Multiple Regression, the factors were utilized as independent variables to determine their usefulness for predicting changes in the dependent variable which is delay. The results of the Stepwise Multiple Regression were used in forming Model.

Delay model = (1.573 + 1.143 F1 + 1.026 F2 + 1.027 F3 + 1.114 F4 + 1.190 F5 + 1.013 F6) * (100/34.138)

This model was considered as the most useful for predicting the delay of a construction project. In order to make Model more practical and easy to use, the elements of the model were incorporated in an Excel Sheet. This sheet makes it possible for a project manager to input the weights of the elements and the degree of delay will then be computed directly.

The model was verified through testing on two construction projects. The results show that it is easy to use and useful as a tool to measure the delay of a construction building project.

7.2.6 Factors that causing delay from the case study in UNRWA construction projects are:

The results of case study indicated that most building suffering from delay are due to many reason such as closing building by clients, non availability of raw materials, waiting results of tests, Israeli Invasions, bad weather conditions, additional works required by clients, changes in design requirements, managerial problems from client, Amendment in the BOQ, stopping the works by beneficiaries, force majeure, bad security conditions in Gaza, and contractors managerial and financial problems.

7.2.7 Comparison between the results of questionnaire and the results of case studies

From the results obtained from questionnaire at this thesis, and compare it with the results and analysis of previous cases studies, it has been found that there are similarity of the important factors that causing delay. Case studies and the respondents of questionnaire concentrate on some factors causing delay; these factors are:

- Non availability of raw materials-closure

- Additional works required by clients
- Political situation
- Force majeure, bad security conditions in Gaza
- Contractors managerial and financial problems
- Closing building by clients

The above agreement between the respondents of questionnaire and the results of cases studies proves the importance of these factors in delay. While the difference between the case study and questionnaire about other factors could be related to the different time period between case study about projects implement at 2005-2007 and questionnaire implemented at 2009-2010.The construction industry is different from year to year.

7.3 Recommendation

Clint's recommended to use the developed predictive model to measure delay of project. Project managers can use this model to assess the delay level of a construction project. Assessments of likely project outcomes can be ascertained during construction and any necessary correction actions can be initiated.

While selecting the contractors, clients have to make sure that the contractors are not selected based only on the lowest bid. The selected contractor must have sufficient experience, technical capability, financial capability, and sufficient manpower to execute the project.

It is recommended that clients should have big stories to store the basic material for their projects such as cement, base course, steel, bitumen, etc. And it is also recommended that client should have advance contract such as implementation contract. It means that client should found out material and equipment for their work and contractor just has to implement the work . This proposal is a partially solution of borders closures matters and could protect any problem faced contractor such as unavailability of material, increase material price, and dollar exchange.

It is also recommended that contractor should chose subcontractor based on experience, efficiency, and good reputation which lead to improvement of work and punctual achievement of the work.

It is recommended client and contractors to have their responsibility towards their contract and not to blame responsibility on each other .

Proper costing is essential in every capital project. The initial cost required funds for executing the project are sourced in good time and made available when required. Cost and value engineering principles must be applied at all stages of the project. During the execution stage of the project, project managers should ensure that contractual obligations are dealt with diligently within the required period. Delayed payments due to complex financial processes in client organizations would cause financial difficulties to contractors, and consequently cause schedule delays. Interest could also be charged on delayed payments, hence inducing cost escalation.

Clients should ensure that they have funds available for projects before they are commissioned. On the other hand, contractors should avoid misapplying project finances as this could put them in financial distress that could result in them failing to execute the works. Advance payments should be applied on intended purposes in order that project objectives of cost, time and quality are achieved.

Effective project implementation requires competent personnel. This would minimize errors, poor supervision and enhance coordination on sites. Clients, Consultants and Contractors should ensure that they have the right personnel with the right qualifications to manage their projects. Where possible, construction managers need to have experience and qualifications in project or construction management so that they can effectively utilize the project management tools that are available.

Delays in construction projects can be reduced through the joint efforts of participants in the construction industry. Clients, designers/consultants, contractors, suppliers, finance sources, educational institutions, manufacturers, and the government should cooperate to provide the infrastructure necessary for efficient management. A means

of achieving this is to formulate and execute a participatory program for the development of the construction industry.

Clint's recommended to adopting a new approach to contracting, such as design build this contracts reduce delay by limiting client interference, improving the design and improving the contractual relationships among all parties to the project.

Contractors should not take up the job in which they do not have sufficient expertise; contractors should have able site-managers for the smooth execution of work, contractors must plan their work properly and provide the entire schedule to the clients, and contractors must make sure they have a sound financial backing.

It recommended while prepare the contract between the client and contractor, the consultant must include items such as duration of contract, mechanism to solve disputes, mechanism to assess the causes of delay, if there are any and risk management plans, consultants should prepare and approve drawings on time, and consultants should monitor the work closely by making inspections at appropriate times.

Consultant recommended to reviewing and approving design documents: any delay caused by the consultant engineer in checking, reviewing and approving the design submittals prior to construction phase, could delay the progress of the work.**.** Consultant should make a complete and accurate project feasibility study and continues site investigation**.**

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LIST OF ANNEXES

Annex A : Questionnaire (English)

Annex AA : Questionnaire (Arabic)

Annex B : Form of Construction Completion Report (CCR)

- Raw material of UNRWA case study

Annex C : Ranking of all factors causes delay from point view of client

Annex D : Tables of modeling

Annex A

QUESTIONNAIRE FOR RESEARCH THESIS

SECTION A

COMPANY RESPONDENT PROFILE AND PROJECT DESCRIPTION

Please, thick one box and fill in the blanks if you select others.

1. Organization/Company Name (Optional) ……
2. Address (Optional) ……..……
3. State the number of years the organization has experience in construction.

☐ 0– 5 years ☐ 5 – 10 years ☐ 10 – 15 years ☐ More than 15 years

4. Location of orgnization:

☐ Gaza ☐ North of Gaza ☐ iddle area ☐ th of Gaza

5. No of project during implementations in the last 5 years

☐ 1-10 project ☐ 11-20 project ☐ 21-30 project ☐ More than 30 project

6. Average of projects executed in the last 5 years ($):

☐ Less than 2 million ☐ 2-5 million ☐ 6-10 million ☐ More than 11 million

7. State estimate project duration.

☐ Less than 12 month ☐ 12 month to 18 month ☐ 18 month to 24 ☐ more than 24 month

8. No. of projects management in the organization:

☐ Less than 10 ☐ 10-15 ☐ 15-20 ☐ More than 20

9. Respondent's years of experience

☐ 1-3 years ☐ 4-5 year ☐ 6-10 years ☐ More than 10 years

10. Position of Respondent

☐ Project Manager ☐ Office Eng. ☐ Site Eng ☐ Other (Mention pls)……

11. Respondent's qualification

☐ Less than BSc ☐ Bachelor's ☐ Master ☐ Doctor's

SECTION B

FACTORS THAT CONTRIBUTE TO CAUSES OF DELAYS

Objective of the Study: To identify the major causes of delays in construction project.

Please, thick and fill in the blanks if you select others.

Each scale represents the following rating:

(5) = Very high contributing (4) = High contributing (3) = Medium contributing

(2) = Low contributing (1) = Very low contributing.

Question: What did the following related factors below that contribute to causes of delays of

construction project?

Factors	(5)	(4)	(3)	(2)	(1)
1. Material - Related Factors					
Shortage of construction materials					
Poor quality of construction materials					
Poor procurement of construction materials					
Damage of sorted material while they are needed urgently					
Changes of materials types & specifications					
Late selection of finishing materials due to availability					
Delay in manufacturing special building materials					
Waiting for approval of material samples					
Late delivery of materials					
Escalation of material prices					
No adherence with materials standards that is storage in the site					
2. Labor - Related Factors					
Low productivity level of labor					
Shortage of manpower (skilled, semi-skilled, unskilled labor),					
Low motivation and morale					

Factors	(5)	(4)	(3)	(2)	(1)
Personal conflicts among labor					
Poor distribution of labour					
Shortage in labor					
Ageing of site workers					
Different political and factional affiliation of workers					
3. Equipment -Related Factors					
Improper equipment used for the work					
Insufficient numbers of equipment					
low level of equipment-operator's skill					
required equipment and tools are not available					
lack of high-technology mechanical equipment					
Frequent equipment breakdown					
Equipment allocation problem					
Slow mobilization of equipment					
low productivity and efficiency of equipment					
lack of maintenance for the equipment					
inaccurate prediction of equipment production rate					
4. Finance -Related factors					
delay in progress payment by owner					
difficulties in financing project by contractor					
Delay payment suppliers/subcontractors					
Inadequate fund allocation					
monthly payment difficulties					
Unreasonable constraints to client					
Cash problem during construction					
5. Contractor -Related Factors					
Inappropriate construction methods					
Poor site management and supervision					
Inadequate contractor experience					
Ineffective project planning and scheduling					

Factors	(5)	(4)	(3)	(2)	(1)
Incompetent project team					
Delay in site mobilization					
Poor company organization					
Inefficient quality control by contractor					
Increased number of projects					
Improper technical study by contractor during the bidding stage					
Replacement of key personal					
Conflicts between contractor and other parties					
Poor coordination & communication by contractor with other parties					
Uncompromising attitude between parties					
Mistakes during construction					
Insufficient contractor competition					
Dependence on a newly –graduated engineer to bear the whole responsibilities in the site					
Unethical behaviors used by contractors to achieve the highest possible level of profit					
Contractors are not committed to consultant instructions.					
Lack of database in estimating activity duration and resources					
Safety rules and regulations are not followed within the contractor's organization					
Improper handling of the project progress					
6. Sub-Contractors - Related Factors					
Unreliable subcontractor					
delays in sub-contractors' work					
Spend some time to find sub-contractors company who is appropriate for each task					
Often changing sub-contractors company					
Lack of subcontractor's skills					

Factors	(5)	(4)	(3)	(2)	(1)
7. Client -Related factors					
Slow decision making by client					
change orders					
Lack of capable representative					
Lack of experience of client in construction					
negotiation by knowledgeable people					
Client interference					
Improper project feasibility study					
variations in quantities, suspension of work by owner					
owner has no priority/ urgency to complete the project					
delays in site preparation					
high quality of work required					
8. Consultant - Related factors					
delay in performing inspection and testing by consultant					
delay in approving major changes in the scope of work by consultant					
Inadequate consultant experience					
inflexibility (rigidity) of consultant					
internal company problems					
absence of consultant's site staff					
lack of technical and managerial skills of staff					
lack of quality assurance / control					
Previous dispute between consultant and contractor					
Centralization of decision making process from consultant					
Bad past history and reputation of the consultant(corruption)					

Factors	(5)	(4)	(3)	(2)	(1)
lack of job security for the consultancy team					
9. Project - Related factors					
project size					
project complexity					
project regional location					
Poor site safety					
Slow information flow between project team members					
Suspension of work by owner or contractor					
Inconsistency between the project and its environmental due to donor agenda					
Donor own policy in implementation methods and characteristics of the project					
Inflexibility periods for project implementation					
10. Design and Documentation Related factors					
late in reviewing and approving design documents by consultant,					
poor design					
Complexity of project design					
lack of designer's experience					
ambiguities and mistakes in specifications and drawings,					
incomplete drawing and detail design					
poor documentation and no detailed written procedures not using systematic procedures					
delays in design work (lack of design information)					
Insufficient data collection and survey before design					
Un-use of advanced engineering design software					
Misunderstanding of owners requirements by design engineer					

Factors	(5)	(4)	(3)	(2)	(1)
11. Contract &Contractual relationships - Related factors					
Ineffective delay penalties					
Unavailability of incentives for contractor for finishing ahead of schedule in the contract.					
Inappropriate type of construction contract					
Type of project bidding and award (negotiation, lowest bidder),					
contract modification					
Original contract duration is too short					
Inappropriate overall organization, structure linking all parties to the project					
Major disputes and negotiations					
Mistakes and discrepancies in contract Documents					
12. External - Related factors					
Weather condition					
Unforeseen ground condition					
Problem with neighbors					
Changes in laws and regulations					
Poor economic condition					
Unavailability of utilities in site (such as, water, electricity, telephone, etc.)					
Political situation (strikes Israeli attacks and borders closures, war)					
Delay in obtaining permits from municipality					
Accident during construction					
changes in Government regulations					
Damage by other participants					

SECTION C

EFFECT OF DELAYS

Objective of the Study: To identify the effects of delays in construction project

Please, thick and fill in the blanks if you select others.

Each scale represents the following rating:

(5) = Always (4) = Mostly (3) = Sometimes

(2) = Seldom (1) = Never.

Questions : What Effect due to delays?

Effect	(5)	(4)	(3)	(2)	(1)
Time Overrun					
Cost Overrun					
Dispute					
Arbitration					
Total abandonment(Contract Termination)					
Litigation.					
Suspension of the work					

SECTION D

METHODS TO MINIMIZING OF CONSTRUCTION DELAYS

Objective of the Study: To identify the methods of minimizing construction delays

Please, thick and fill in the blanks if you select others.

Each scale represents the following rating:

(5) = Very high effective (4) = High effective (3) = Medium effective

(2) = Low effective (1) = Very low effective.

Questions : What did the following methods will minimizing of construction delays?

Methods	(5)	(4)	(3)	(2)	(1)
Competent project manager					
Ensure adequate and available source of finance					
Multidisciplinary/competent project team					
Availability of all resources in the site					
Commitment to projects					
Adopting a new approach to contract award procedure by giving less weight to prices and more weight to the capabilities and past performance of contractors;					
Adopting new approaches to contracting such as Design-Build (D/B) and Construction Manager (CM) type of contract					
Complete and accurate project feasibility study and site investigation					
Comprehensive contract documentation					
Frequent progress meeting					
Project management assistance					
Use up to date technology utilization					
Use of experienced subcontractors and suppliers					
Complete and proper design at the right time					
Competent personnel of consultant/designer					
Competent and capable of client's representative					
Site management and supervision					
Use of proper and modern construction equipment					
Proper project planning and scheduling					
Accurate initial cost estimates					
Proper emphasis on past experience					
Absence of bureaucracy					

Methods	(5)	(4)	(3)	(2)	(1)
Clear information and communication channels					
Accurate initial time estimates					
Developing human resources in the construction industry through proper					
Awarding bids to the right/experience consultant and contractor					
Allocation of sufficient time and money at the design phase					
Perform a preconstruction planning of project tasks and resources needs					
Systematic control mechanism					
Effective strategic planning					
Use of advanced engineering design software					
Government should construct new store houses in settlements of Gaza Strip to store the required construction materials such as; the cement, base course, aggregates, steel, etc					
Government is advised to put a condition on the donor in the memorandum of understanding that obligate donor to compensate the contractor for any loss that result from hard political situation					

THANK YOU FOR YOUR TIME AND SUPPORT

Annex AA

The Islamic University of Gaza
Civil Engineering Department
Master's Degree Program
Construction management

استبانه لاستنتاج

نموذج رياضي لإدارة التأخير في المشاريع الإنشائية في قطاع غزة من وجهة نظر المالك

A mathematical model for delay management in Construction Projects in the Gaza Strip-clients perspectives

إعداد الباحثة:

م. شرين رمضان حلس

تحت إشراف:

د. علاء الدين الجماصى

بسم الله الرحمن الرحيم

استبانة للجهات المالكة في قطاع غزة

السادة الكرام/

السلام عليكم ورحمة الله وبركاته وبعد,

بداية أتقدم لكم بجزيل من الشكر والامتنان لمساهمتكم بجزء من وقتكم الثمين للاجابه على هذه الاستبانة, والفت عناية حضارتكم إلى الملاحظات التالية:

1. يعتبر هذا الاستبيان هو جزء من دراسة العوامل المسببة للتأخير في المشاريع الانشائيه في قطاع غزة وأثرها على سير المشاريع التي تقومون بتنفيذها والإشراف عليها إلى جانب أكثر الطرق المستخدمة من قبل سيادتكم للتقليل من هذه الآثار
2. الدراسة هي البحث التكميلي لنيل شهادة الماجستير في إدارة المشاريع الهندسية في الجامعة الإسلامية بغزة
3. أرجو أن تسهم هذه الدراسة في تحسين الأداء من خلال تقليل الآثار الناجمة عن حدوث التأخير فى المشاريع الإنشائية في قطاع غزة
4. تقديرا لجهودكم لمشاركتكم في تعبئة هذه الاستبانه فان سنطلعكم على نتائج الدراسة للاستفادة منها قدر الإمكان من اجل خدمة قطاع التشييد في فلسطين
5. المعلومات التي ستساهمون بها هي لغرض البحث العلمي, وسيتم الالتزام التام بالمحافظة على سرية المعلومات الخاصة بكم
6. أرجو أن تكون المعلومات صحيحة ودقيقة للوصول إلى النتائج المرجوة من هذا البحث.

يتكون هذا الاستبيان من 4 أجزاء

الجزء الأول: معلومات عامة عن المؤسسة المالكة

الجزء الثانى : العوامل المؤثرة على تأخير المشاريع الإنشائية في قطاع غزة

الجزء الثالث:دراسة تأثير التأخير على المشاريع الانشائيه

الجزء الرابع:الطرق الأكثر استخداما لتقليل أثار التأخير على المشاريع الانشائيه

مع خالص الشكر والتمنيات بالتوفيق....,,,

الجزء الأول: معلومات عامة

1. اسم الجهة المالكة (اختيارى):.....

2. عنوان الجهة المالكة الحالي (اختيارى):.....

3. عدد سنوات خبرة الجهة المالكة

O اقل من 5 سنوات O من 5 – 10 سنوات O من 11- 15سنة O أكثر من 15 سنة

4. مكان عمل المؤسسة

O غزة O شمال غزة O المنطقة الوسطى O منطقة الجنوب

5. عدد المشاريع التي نفذت خلال الخمس أعوام الماضية

O1-10 مشروع O 11-20 مشروع O21-30 مشروع O أكثر من 30 مشروع

6. قيمة المشاريع التي نفذت خلال الخمس أعوام الماضية

O اقل من 2 مليون دولار O من2 - 5 مليون دولار

O من 6 - 10 مليون دولار O أكثر من10 مليون دولار

7. متوسط المدة الزمنية اللازمة لانجاز المشروع

O اقل من 12 شهر O من 12-18 شهر Oمن 18-24 شهر O أكثر من 24 شهر

8. عدد الموظفين الادارين الدائمين في الجهة المالكة

O اقل من 5 O من5 إلى 10 Oمن 11الى 15 O أكثر من15

9 . سنوات الخبرة لمن يقوم بتعبئة الاستبيان

O 1-3 سنوات O 3-5 سنوات O 5-10 سنوات O أكثر من 10سنوات

10. المركز الوظيفي لمن يقوم بتعبئة الاستبيان

O مدير المشروع O مهندس موقع/مكتب O مدير المؤسسة O غير ذلك وضح.....

11.المؤهل العلمي لمن يقوم بتعبئة الاستبيان

O اقل من بكالوريوس O بكالوريوس O ماجستير O دكتوراه

الجزء الثاني : العوامل التى تسبب حدوث التأخير فى المشاريع الإنشائية بقطاع غزة

ضع إشارة (×) توضح درجة موافقتك على مدى مساهمة كل من العوامل التالية فى حدوث التأخير في المشاريع الإنشائية بقطاع غزة

العامل الذي يسبب التأخير في المشاريع الانشائيه	أوافق بشدة(5)	أوافق (4)	أوافق أحيانا(3)	لا أوافق (2)	لا أوافق أبدا(1)
مجموعة (1) العوامل المتعلقة بالمواد					
1. عدم تخزين كميات كافية من المواد في الموقع					
2. انخفاض جودة المواد الانشائيه المتوفرة					
3. الافتقار إلى جداول سليمة لبرنامج استخدام المواد					
4. تلف المواد المخزنة أثناء نقلها لاستخدامها					
5. حدوث تغيير في نوع ومواصفات المواد					
6. التأخر في اختيار العينات النهائية للمواد حسب توافرها بالأسواق					
7. تأخر المصانع في تصنيع مواد البناء					
8. التأخر في اعتماد عينات المواد					
9. التأخر في توريد المواد إلى الموقع					
10. تصارع أسعار المواد في السوق المحلى					
11. عدم تخزين المواد بشكل سليم					
مجموعة (2) العوامل المتعلقة بالعمال					
1. تدنى مستوى الإنتاجية عند العمال					
2. نقص العمال المهرة والفنيين					
3. انخفاض مستوى تحفيز العمال (مادي + معنوي)					
4. النزاعات بين العمال					
5. سوء توزيع العمال في الموقع					
6. عدم وجود العدد الكاف من العمال					
7. كبر سن العاملين في الموقع (شيخوخة العمال)					
8. اختلاف الانتماءات السياسية والحزبية للعاملين					

مجموعة (3) العوامل المتعلقة بالمعدات					
1. نقص فى قطع غيار المعدات					
العامل الذي يسبب التأخير في المشاريع الانشائيه	**أوافق بشدة**	**أوافق**	**أوافق أحيانا**	**لا أوافق**	**لا أوافق أبدا**
تابع - مجموعة (3) العوامل المتعلقة بالمعدات					
2. المعدات المستخدمة في الموقع قديمة (غير صالحة)					
3. انخفاض مستوى مهارة المشغلين للمعدات					
4. عدم توفر المعدات والأدوات في السوق					
5. عدم توفر معدات عاليه التقنية في موقع العمل					
6. عطل المعدات وتوقفها عن العمل في الموقع					
7. وضع المعدات في مكان غير مناسب					
8. بطء تجهيز المعدات					
9. قله إنتاج وكفاءة المعدات					
10. ضعف صيانة المعدات					
11. تنبؤ غير الدقيق بمعدل إنتاجية العمال					
مجموعة (4) العوامل المتعلقة بالتمويل					
1. تأخر المالك في صرف المستحقات المالية للمقاول					
2. صعوبات في تمويل المشروع من قبل المقاول (مشاكل ماليه)					
3. عدم حصول الموردين على دفعاتهم					
4. عدم كفاية التمويل من الدول المانحة لإكمال المشروع					
5. صعوبات في صرف الدفعات الشهرية					
6. قيود غير مبررة من قبل المالك					
7. عدم توفر سيولة لدى المقاول					
مجموعة (5) العوامل المتعلقة بالمقاول					
1. أساليب العمل غير ملائمة					
2. افتقار موقع العمل للإدارة والإشراف					
3. افتقار المقاول للخبرة					
4. عدم فعاليه الجدول الزمني					
5. الطاقم الفني للمقاول غير كفؤ وغير مؤهل لانجاز المشروع					

6. تأخر المقاول في تجهيز الموقع					
7. ضعف الهيكل التنظيمي شركة المقاول					
العامل الذي يسبب التأخير في المشاريع الانشائيه	**أوافق بشدة**	**أوافق**	**أوافق أحيانا**	**لا أوافق**	**لا أوافق أبدا**
تابع - مجموعة (5) العوامل المتعلقة بالمقاول					
8. عدم مراقبة جودة العمل من قبل المقاول					
9. زيادة عدد المشاريع الراسية على المقاول					
10. الدراسة الفنية من قبل المقاول خلال مرحله تقديم العطاء غير فعاله					
11. تغيير العاملين في المؤسسة بشكل مستمر					
12. النزاعات بين المقاول والأطراف الأخرى					
13. حدوث سوء فهم نتيجة لضعف التنسيق و الاتصالات بين الأطراف المعنية					
14. تمسك كل طرف من الأطراف المعنية في المشروع بوجهة نظره					
15. إعادة العمل بسبب أخطاء أثناء التنفيذ					
16. روح التنافس لدى المقاول غير كافيه لانجاز الأعمال					
17. اعتماد المقاول على مهندس حديث التخرج لكامل المسئوليات في الموقع " الإدارة الفنية – إدارة العاملين– الخ					
18. اعتماد المقاول على أساليب غير مقبولة لتحقيق اكبر قدر من الربح					
19. عدم التزام المقاول بتعليمات الاستشاري					
20. عدم اعتماد المقاول على قاعدة بيانات في تقدير مدة النشاط والموارد					
21. عدم إتباع أنظمة وقواعد السلامة داخل الموقع					
22. التتبع الغير سليم لمراحل تطور المشروع					
مجموعة (6) العوامل المتعلقة بمقاولي الباطن					
1. الاعتماد على مقاولي الباطن الغير ثقة					
2. تأخر مقاول الباطن في انجاز العمل					
3. قضاء وقت طويل في إيجاد مقاولي الباطن بأقل سعر للقيام بالنشاطات المطلوبة					
4. عدم اعتماد الشركة على مقاول باطن ثابت(سياسة الاعتماد على اقل الأسعار)					
5. قلة خبرة مقاول الباطن					
مجموعة (7) العوامل المتعلقة بالمالك					

1. بطء اتخاذ القرار بواسطة المالك					
2. الأوامر التغيرية أثناء العمل					
العامل الذي يسبب التأخير في المشاريع الانشائيه	**أوافق بشدة**	**أوافق**	**أوافق أحيانا**	**لا أوافق**	**لا أوافق أبدا**
تابع- مجموعة (7) العوامل المتعلقة بالمالك					
3. عدم توفر ممثل واحد للمالك					
4. قله خبرة المالك في عمل الإنشاءات					
5. التفاوض من قبل الآخرين					
6. تداخل أراء المجموعة الممثلة للمالك					
7. دراسة الجدوى المعدة من قبل المالك غير سليمة					
8. حدوث تغيير في الكميات					
9. المالك ليس لديه الصلاحية في استعجال العمل					
10. التأخر في تسليم الموقع للمقاول					
11. الجودة العالية المطلوبة للعمل					
مجموعة (8) العوامل المتعلقة بالاستشاري					
1. الاستشاري يتأخر في إعطاء التعليمات والفحوصات للأعمال					
2. التأخر في الموافقة على إجراء تغييرات رئيسية في نطاق العمل من قبل استشاري					
3. خبرة الاستشاري في مجال عمل الإنشاءات غير كافيه					
4. عدم مرونة الاستشاري					
5. المشاكل الداخلية في المؤسسة الاستشارية					
6. غياب فريق عمل الاستشاري عن الموقع					
7. ضعف المهارات الإدارية والفنية للطاقم الفني للاستشاري					
8. عدم وجود ضمان الجودة(المراقبة) من قبل الاستشاري					
9. وجود خلافات سابقة بين الاستشاري والمقاول					
10. مركزية القرار لدى الاستشاري					
11. سوء السيرة الذاتية للاستشاري" الكسل – الرشوة – التهرب من الدوام					
12. عدم وجود الأمان الوظيفي لطاقم الاستشاري					
مجموعة (9) العوامل المتعلقة بالمشروع					

1. حجم المشروع					
2. درجة التعقيد في المشروع					
العامل الذي يسبب التأخير في المشاريع الانشائيه	**أوافق بشدة**	**أوافق**	**أوافق أحيانا**	**لا أوافق**	**لا أوافق أبدا**
تابع - مجموعة (9) العوامل المتعلقة بالمشروع					
3. مكان المشروع					
4. الافتقار إلى وسائل الأمن والسلامة في الموقع					
5. بطئ تدفق المعلومات بين أفراد فريق المشروع					
6. حدوث تعليق للأعمال بواسطة المالك أو المقاول					
7. عدم ملائمة المشروع للبيئة المحيطة بسبب تحديد المانح لتنفيذ أنواع معينة من المشاريع					
8. فرض المانح لسياسة معينة في مواصفات المشروع وفى أليه وتنفيذ الأعمال					
9. عدم مرونة المدة الزمنية اللازمة لتنفيذ المشروع					
مجموعة (10) العوامل المتعلقة بالتصميم والتوثيق					
1. التأخير في مراجعة واعتماد المخططات بواسطة الاستشاري					
2. سوء التصميم					
3. درجة تعقيد التصميم					
4. قله خبرة المصمم					
5. أخطاء في المخططات و المواصفات					
6. الرسومات الغير كاملة					
7. عدم استخدام الطرق المنظمة والمرتبة في التوثيق					
8. التأخير في تجهيز أعمال التصميم					
9. عدم توفر المعلومات الكافية عن مواصفات الموقع قبل إجراء التصميم					
10. عدم استخدام برامج حاسوبية لإجراء التصميم					
11. عدم فهم المهندس المصمم لمتطلبات المالك في التصميم					
مجموعة (11) العوامل المتعلقة بالعقد والعلاقات التعاقدية					
1. غرامات التأخير غير فعاله					
2. عدم توفر بند تحفيزي في العقد للمقاول من أجل الانتهاء قبل الموعد المحدد					
3. استخدام أنواع من العقود الغير ملائمة					

4. الطريقة المتبعة في إرساء العطاء(التفاوض أو اقل الأسعار)					
5. حدوث تعديلات في العقد					
العامل الذي يسبب التأخير في المشاريع الانشائيه	**أوافق بشدة**	**أوافق**	**أوافق أحيانا**	**لا أوافق**	**لا أوافق أبدا**
تابع- مجموعة (11) العوامل المتعلقة بالعقد والعلاقات التعاقدية					
6. المدة اللازمة لانجاز العمل في العقد صغيرة					
7. عدم ملائمة الهيكل التنظيمي للربط بين أفراد المشروع					
8. حدوث الخلافات والنزاعات					
9. حدوث أخطاء وتعارض بين وثائق العطاء					
مجموعة (12) العوامل الخارجية					
1. الظروف الجوية الصعبة					
2. الظروف المحيطة بالموقع غير واضحة					
3. المشاكل مع الجيران					
4. حدوث تغيير في الأنظمة والقوانين					
5. الظروف الاقتصادية الصعبة(نسبة التضخم ، العملات, ...)					
6. عدم توافر المرافق في الموقع (مثل المياه والكهرباء والهاتف ، ...)					
7. حدوث اجتياحات وإغلاق المعابر أو حدوث حرب					
8. صعوبة الحصول على أذونات العمل من المؤسسات الحكومية					
9. وقوع الحوادث في الموقع					
10. تغيير القوانين والنظم التي تخص مشاريع الإنشاء (الفيدك –الشروط الخاصة والعامة)					
11. حدوث ضرر من قبل طرف أخر					

الجزء الثالث : الآثار الناتجة عن حدوث التأخير في المشاريع الانشائيه

ضع إشارة (×) توضح درجة موافقتك في أن كل ما ياتى هي من الآثار الناجمة عن حدوث التأخير في المشاريع الإنشائية بقطاع غزة مع ملاحظة أن

الآثار الناتجة عن حدوث التأخير	أوافق بشدة	أوافق	أوافق أحيانا	لا أوافق	لا أوافق أبدا
1. زيادة مدة المشروع					
2. زيادة التكاليف					
3. حدوث نزاعات					
4. التحكيم					
5. اللجوء للقضاء					
6. إنهاء العقد (التخلي عنه)					
7. تعليق العمل من قبل طرف من الأطراف					

الجزء الرابع: الطرق المستخدمة في تقليل الآثار الناجمة عن حدوث التأخير في المشاريع الإنشائية في قطاع غزة

ضع إشارة (×) توضح درجة موافقتك في مدى فاعلية كل من الطرق التالية في تقليل الآثار الناجمة عن حدوث التأخير في المشاريع الإنشائية في قطاع غزة

الطريقة المستخدمة	أوافق بشدة	أوافق	أوافق أحيانا	لا أوافق	لا أوافق أبدا
1. وجود مدير مختص في الموقع					
2. ضمان توفير ما يكفي من مصادر التمويل					
3. توفير فريق عمل متخصص					
4. توفير جميع المواد البنائية اللازمة في الموقع					
5. الالتزام بمسئوليه المشروع					
6. اعتماد نهج جديد في منح العطاء من خلال إعطاء وزن اقل للأسعار وإعطاء الوزن الأكبر لقدرات وسمعة المقاول					
7. اعتماد نهج جديد في التعاقد مثل عقد التصميم/ البناء وعقد مدير المشروع (CM)					
8. التحقق من الموقع وإجراء دراسة جدوى دقيقة وكاملة					
9. أن تكون وثائق العقد شامله					
10. عمل لقاءات متكررة في مراحل تطور المشروع					
11. إدارة تقييم المشروع(التقارير-التغذية الراجعة)					
12. استخدام تكنولوجيا حديثة في العمل					
13. استخدام مقاولي باطن وموردين ذوى كفاءة عاليه وسمعة حسنة					
14. تجهيز التصميم الكامل في الوقت المحدد					
15. أن يكون طاقم الاستشاري مكون من مصممين مختصين					

16. ممثل المالك أن يكون مختص وذو قدرة عاليه					
17. الإدارة والإشراف الجيد على الموقع					
الطريقة المستخدمة	**أوافق بشدة**	**أوافق**	**أوافق أحيانا**	**لا أوافق**	**لا أوافق أبدا**
18. استخدام معدات سليمة وحديثة في عمليه الإنشاء					
19. التخطيط السليم وعمل جدول زمني مناسب للعمل					
20. الدقة في حسابات التكاليف الاوليه					
21. المشاركة الفعالة بين الأطراف المعنية					
22. التركيز على الخبرة السابقة					
23. غياب البيروقراطية					
24. توفر قنوات اتصال وتبادل المعلومات بين الأطراف المعنية					
25. حسابات دقيقة للوقت اللازم لإنهاء المشروع					
26. تطوير الموارد البشرية في قطاع الإنشاءات					
27. منح العطاء إلى الشخص(المقاول والاستشاري) السليم صاحب الخبرة					
28. تخصيص ما يكفي من الوقت والمال في مرحلة التصميم					
29. تنفيذ عمليه التخطيط لمرحله ما قبل البناء من مهام المشروع الموارد اللازمة					
30. المراقبة الدورية للأعمال					
31. التخطيط الاستراتيجي الفعال					
32. استخدام برامج حديثة في التصميم					
33. أن تقوم الحكومة بتخزين المواد الأساسية للبناء(اسمنت-حديد-...)					
34. يجب تضع الحكومة شروط على الجهة المانحة أن تعوض المقاول في حال حدوث تأخير نتيجة الوضع السياسي					

نـشكـر لـكـم حسن تـعـاونـكـم

Annex B

FORM OF CONSTRUCTION COMPLETION REPORT(CCR)

ECSD/CD/Acc/Com. (…….)

To :

From :

Subject :

B. Contract No……. Dated : ……

Job No. …….. **Code No. : ……..…..**

In compliance with Technical Services Instruction No. 1, please find hereunder details relating to the above construction.

1. **BREAKDOWN OF ESTIMATE AND FINAL COSTS:**

Description	Construction Estimate $	Amended Estimate $	Final Expenditure & Cost $
A) Contractual Services			
B) Agency Supplied Material			
C) Overhead			
D) Contingencies			
Total $			

2. **TOTAL ALLOTMENT:** **……**

3. **PERIOD OF CONTRACT:** **……**

A) Commencement and completion:

I) Date of commencement. **: ……..**

II) Contract date for completion. **: ……..**

III) Actual date of completion. **: ……..**

IV) Delay (in days). **: ……**

B) Reasons for delay :

…….

4. **ESTIMATION DATE**:

5. COMMENTS

Annex B

RAW MATERIAL OF UNRWA CASE STUDY

No	Project Name	year	Location	Construction estimate$	Final expenditure &cost$	Period of contract (weak)	Date of commencement	Contract date for completion	Actual date of completion	Delay days	Reason for delay
1.	Construction of temporary teacher room&tolit unit for femal	2007	Gaza Strip	12556	11724	3	1/12/2007	21/12/2007	18/12/2007	0	0
2.	Construction of temporary teacher room&tolit unit for femal	2007	Gaza Strip	119441	115307	3	18/11/2007	8/12/2007	11/12/2007	3	Due to purchasing containers prces
3.	Construction of temporary teacher room&tolit unit for femal	2007	Gaza Strip	6262	5814	3	25/11/2007	15/12/2007	15/12/2007	0	/
4.	Construction of temporary three councel room	2008	Gaza	31695	27905	2	9/1/2008	22/1/2008	6/2/2008	15	1 d due to invasion by IDF AT Shighaeya&zaitoun area-2 day due to shortage of fuel and cut off electricity all over gaza strip-6 day due to bad weather and heavy rain at Gaza Strip
5	Landscaping works	2008	Kh-YOUNIS	14593	15542	3	5/1/2008	12/2/2008	12/2/2008	0	
6.	Re Construction of eight SHc shelters	2007	Jabalia	221027	208441	16	12/5/2007	31/8/2007	20/8/2007	0	
7.	Re Construction of eleven SHc shelters	2007	Beach Camp	281810	272635	16	12/5/2007	31/8/2007	13/9/2007	13	Due to the site level difference which was not complied with drawing &bad local securitu situation
8.	Construction of five per-fabricated tolite unit	2007	Om – ELNaser camp (North)	49347	35401	3	14/5/2007	3/6/2007	3/9/2007	92	85 days are approved(56 ady to AoOO's instruction in north area/7 due to mobilization and approval materials/11 due to objection of local resident/2 due to change in drawings/9due to change the place of latrines and choice a

											suitable place for it) / 7 days delay from the contractor
9.	Construction of Elem Co-ed school at Saudi project	2007	Rafah	832002	805187	43	15/8/2006	11/6/2007	15/7/2007	34	Due to non- availability of concrete &material at local market as result of closure
10.	Construction of prep. Boys school at Saudi project	2007	Rafah	870410	834465	43	15/8/2006	11/6/2007	7/8/2007	57	Due to non- availability of concrete &material at local market as result of closure
11.	Construction of three small teachers room, converting three stores to two classrooms converting shed to one classroom at Gaza Strip schools	2007	Gaza Strip	27218	28331	12	27/1/2007	20/4/2007	2/6/2007	43	Due result of concrete test of foundation & additional works
12.	Construction of prep. girls school at Saudi project	2007	Rafah	863466	843598	43	3/9/2006	30/6/2007	30/7/2007	30	13 days Due to non-availability of concrete &material at local market as result of closure/3 days the work was stopped due retrogressive and bad security situation ib\n Gaza Strip/15 days due dely of supplying security screen &cupboard unit
13.	Re – construction of single Sided boys school	2007	Deir Al-Balah	883932	862513	43	7/10/2006	3/8/2007	23/7/2008	0	0
14.	Construction of Khan Younis training center	2007	Khan Younis	1548412	1652070	30	15/10/2006	12/5/2007	17/5/2007 فيها خطأ	5 (20)	15 days Due to non-availability of concrete &material at local market as result of closure / 5 days due to heavy rains at Gaza STRIP
15.	Repair of 110 shelters at middle area & Khan Younia area	2007	Khan Younis	144863	140575	10	25/2/2007	5/5/2007	4/6/2007	30	20 days due to additional works 10 days due to new design

16.	Repair of 125 shelters at B\Hanoun, B/Lahia, Jabalia	2007	B\Hanoun, B/Lahia, Jabalia	238311	225450	10	11/2/2007	21/4/2007	22/6/2007	62	7 d due to bad security situation at Gaza Strip/28 d due to issuing variation order and adding new works/16 d due to interference from beneficiaries with the repairing/3 d due to IDF invasion at B/Hanoun
17.	Repair of thirty shelters at Gaza area	2007	Gaza	24254	23933	4	24/6/2007	21/7/2007	21/7/2007	0	/
18.	Repair of thirteen shelters at Gaza area	2007	Gaza	29613	20263	4	24/6/2007	21/7/2007	21/7/2007	0	/
19.	Repair of 32 shelters at Khan Younis	2007	Khan Younis	136806	121440	10	10/3/2007	18/5/2007	16/5/2007	0	/
20.	Repair of 30 shelters at Khan Younis	2007	Khan Younis	144928	147128	10	10/3/2007	18/5/2007	17/5/2007	0	/
21	Re – construction of thirteen dwelling units on scattered lands at north area	2007	north area	261793	244321	16	10/10/2006	29/1/2007	15/5/2007	106	21 days due IDf invasion at B/Hanoun & Jabalia/22 day due to heavy rain / 15 days due to shortage of concreteat local market/8 days to delay of reciving modified design and additional work /7 days due to bad local security situation 3 fiter feast holiday
22.	Repair of 82 shelters at Nuseirat area	2007	Nuseirat	118223	104391	10	21/3/2007	1/5/2007	21/4/2007	0	/

23	Re – construction of 30 dwelling units on scattered lands at Rafah & middle area	2007	Rafah & middle area	523890	485415	16	23/9/2006	12/1/2007	1/5/2007	109	21 Due to non- availability of construction &material at local market/ 2 day due heavy rain/2 day chech the location safety /9 days due to additional works/5 days due to waiting sample approval of ceramic tiles/3 holiday/ 67 days due to new design &additional work `
24.	construction of gymnasium hall at Gaza field office	2007	Gaza	39136	38549	12	1/2/2007	25/4/2007	7/5/2007	12	2 days due to heavy rains/2day due to bad local security situation/ 10 day due to additional work
25.	Construction of 14 dwelling units at Rafah area	2006	Rafah	222733	216852	16	20/3/2006	9/7/2006	8/2/2007	214	97 days Due to non-availability of concrete &material at local market as result of closure/ 10 days Due to non- availability of ceramic tiles at local market as result of closure/70 days due to stopping the works by beneficiary/ 10 days change the design of RW /10 due to waiting the approval forcompleting the Finish works
26.	Repair of 23 shelters at Rafah area	2006	Rafah	82113	77954	10	21/9/2006	29/11/2006	25/12/2006	26	Due to delay of receiving drawing
27.	Repair of 58 shelters at Kh/ Younis area	2006	Kh/ Younis	205248	220911	10	24/9/2006	2/12/2006	12/12/2006	10	Due to amendment in B.O.Q

28.	Repairing of the damages at the Palestinian industrial estate	2007	Gaza	12374	12054	2	24/12/2006	6/1/2007	14/1/2007	8	Due to closing the building of client
29.	Repair of 57 shelters at Kh/ Younis area	2006	Kh/ Younis	206945	193106	10	1/10/2006	9/12/2006	14/12/2006	5	Due to amendment in B.O.Q
30.	Repair of 41 shelters at Rafah area	2006	Rafah	159590	164870	10	21/9/2006	29/11/2006	18/12/2006	19	Due to additional works needed for variation order
31.	Re construction of toilet block for boys ,one canteen	2006	Beit Hanoun	60910	56772	12	28/8/2006	19/11/2006	17/12/2006	28	12 due to IDF invasion at Biet Hanoun /12 due ttowaiting decision for damage part of B/wall/5 due to non-availability of construction &material at local market
32	Repair offifteen shelters at Gaza	2006	Gaza	34928	34851	4	3/9/2006	30/9/2006	13/11/2006	44	Due to non- availability of aluminum at local market as result of closure and additional work
33.	Constrction of 14 dwelling units at Rafah area	2006	Rafah	216633	207144	16	25/3/2006	14/7/2006	1/11/2006	110	65 day due to non-availability of concrete &material at local market as result of closure/33 due to amendment of the design/3 days due to IDF invasion to south area/15 days due to amendment of the drawings
34.	Constrction of 17 dwelling units at Gaza area	2005	Gaza	248445	244496	20	26/9/2004	23/5/2005	7/6/2005	15	8 days because of dwarh of President Yasser Arafat/14 days due the heavey rain in Gaza area
35	Repair of 116 shelters at Nuseirat, Dier ElBalah & Bureij Camp	2006	Nuseirat, Dier ElBalah & Bureij	150586	150473	6	5/1/2006	15/2/2006	8/6/2006	113	31 days due to execute additional work/ 51 days due to negotiation with donor fo additional work/23 days Due to non- availability of

											concrete &material at local market as result of closure/4 days due to heavy rain /4 days due to Al Adha Feast
36.	Construction of toilet block for boys at Maghazi Elem	2005	Maghazi	18709	18001	8	16/10/2005	10/12/2005	2/1/2006	145	Due to non- availability of concrete &material at local market as result of closure & additional work
37.	Repair of 15 shelters at Maghazi camp	2006	Maghazi	31911	31874	6	26/12/2005	5/2/2006	19/2/2006	14	Additional work
38.	Re construction of five SHC shelters at Nuseirat camp	2005	Nuseirat	105954	102699	16	31/7/2005	19/11/2005	24/12/2005	35	Due to non- availability of construction material at local market and amendment drawing
39.	Re construction of twelves SHC shelters at Bureij Maghazi & Jabalia Camp	2005	Bureij Maghazi & Jabalia	189695	182381	16	31/7/2005	19/11/2005	25/12/2005	36	24 days Due to non-availability of construction material at local market and 8 days due amendment the layout design
40.	Construction of five C/r and two learning supporting centers at Remal	2006	Gaza	158125	144835	16	1/2/2006	23/5/2006	6/7/2006	44	Due to non- availability of construction material at local market
41.	Repair of 101shelters at Jabalia & B/Hanoun	2006	Jabalia & B/Hanoun	109169	101289	6	15/1/2006	25/2/2006	20/6/2006	115	38 days due additional works / 24 due to replacement of beneficiaries who reject /7 days partially suspension of the works by som beneficiaries /64 Due to non-availability of construction material at local market
42.	Construction of offices at Jabalia Relief social service	2006	Jabalia	58331	55658	12	19/1/2006	12/4/2006	25/6/2006	74	Due to non- availability of construction material at local market

43	Construction of one learning supporting center Khan-Younis	2006	Khan-Younis	35870	31903	12	23/1/2006	16/4/2006	18/5/2006	32	due to non- availability of concrete &material at local market as result of closure
44.	Repair of 35 average four levrl Building at Tel Al Sultan –Rafah area	2006	Rafah	54917	31803	4	1/3/2006	28/3/2006	8/5/2006	41	20 daysdue to non-availability of concrete &material at local market as result of closure & 21 days due to un acceptable of some beneficiaries for reparing works
45.	Re construction of eight SHC shelters at Beach camp	2005	Beach	135293	128931	16	31/7/2005	19/11/2005	31/12/2005	42	Due to amending shelter design
46.	Re construction of twelveSHC shelters at Maghazi	2005	Maghazi	189695	182381	16	31/7/2005	19/11/2005	25/12/2005	36	24 days due shirtage of construction material in local market & 8 days due amendment the layout design
47.	Re construction of five SHC shelters at Nuseirat camp	2005	Nuseirat	105954	102699	16	31/7/2005	19/11/2005	24/12/2005	35	34 days due shirtage of construction material in local market & 2 days due amendment the drawing
48	Re construction of four SHC shelters at Khan Younis & Di\eir ElBalah camp	2005	Khan Younis & Di\eir ElBalah	77525	74986	16	31/7/2005	19/11/2005	6/12/2005	17	Due to the closure of boarders by IDF caused non availability of cement in local market
49	Re construction of six SHC shelters at Khan Younis camp	2005	Khan Younis	89025	84852	16	26/7/2005	14/11/2005	29/11/2005	15	Due to non availability of cement in local market
50.	Re construction of six SHC shelters at Rafah camp	2005	Rafah	99837	93291	16	26/7/2005	14/11/2005	30/11/2005	16	Due to non availability of cement &materials in local market
51.	Construction of six computer laboratories one special	2006	Rafah	428808	424875	18	28/12/2005	2/5/2006	4/7/2006	63	Due to non availability of concrete &materials in local

	education two teachers rooms two stories six class room one toilet block at Rafah area schools										market
52.	Construction of four computer lab two rooms two room for special education at north area schools	2006	north area	216157	205314	12	1/11/2005	23/1/2006	25/5/2006	122	48 days due delay for reciving air condition &computer tables/7 days due heavy rains 6/due preparing of drawing /84 days Due to non availability of concrete &materials in local market
53.	Construction of four computer lab at Gaza	2005	Gaza	221828	196921	12	20/6/2005	11/9/2005	5/1/2006	116	days due delay for supplying &computer tables by UNRWA
54.	Construction of five computer lab two rooms two room for special education at Jabalia area schools	2006	Jabalia	311229	267030	12	1/11/2005	23/1/2006	25/5/2006	122	46 due non availability of materials in local market &12 due to design change of computer lab/8 due heavy rains &61 days delay for receiving air condition &computer tables
55.	Construction of nine computer lab two rooms two room for special education need ,two canteen &ramp at Rafah area schools	2006	Rafah	410115	406473	12	2/1/2006	26/3/2006	15/7/2006	111	81 due non availability of materials in local market/ 20 due to delay of manufacturing security screens by unrwa/10 due non existence of electricity supply
56.	Construction of 15 computer lab three room for special education need ,stage &teacher toilet at middle area schools	2005	middle area	670003	628669	12	8/9/2005	30/11/2005	2/4/2006	123	28 days due heavy rain /5 day dely of supplying material by UNRWA/77 days due non availability of materials in local market/8

											due to shortage of aluminum
57	Construction of six computer lab two room for special education need , at middle area schools	2005	middle area	375145	308479	12	10/9/2005	2/12/2005	16/5/2006	165	121 due to non- availability of concrete &material at local market as result of closure/14 day due non-availability ofsecurity fence in agency stores/* 11 due to heavy rains/12due to non-availability of security screen in UNRWA
58	Construction of fifteen computer lab six room for special education need , bridge, ramps, 2toliet unit \at Gaza area schools	2006	Gaza	1129558	1042894	18	1/11/2005	6/3/2006	27/5/2006	82	36 due to non- availability of concrete &material at local market/ 41due delay of receiving air condition &computer tables
59	Construction of six computer lab two room for special education need at south area schools	2005	south area	265025	263506	12	13/8/2005	4/11/2005	28/1/2006	85	49 due to non- availability of concrete &material at local market/ 12due delay of supplying computer tables/ 4 due to heavy rains / 15 due to change the location of computer lab/4 due waiting change the design of beam
60	Constrction of 117 dwelling units at Khan Younis area	2005	Khan Younis	1729149	1551397	26	9/6/2005	7/12/2005	7/12/2005	0	/
61	Construction of three computer lab at Gaza area schools	2005	Gaza	228191	190540	12	27/6/2005	18/9/2005	4/1/2006	108	12due delay of supplying computer tables by UNRWA
62.	Construction of four computer lab eight class rooms toilet unit &ramp at Jabalia area schools	2006	Jabalia	354353	278713	18	1/11/2005	6/3/2006	15/6/2006	101	48due to non- availability of material at local market/ 37due delay of handing computer tables/ 6 due to heavy rains / 8 due to relocation of the project site

63	Construction of thirteen computer lab ,3 rooms for special education needs &ramp at Khan Younis area schools	2006	Khan Younis	741519	681248	12	27/12/2005	20/3/2006	31/7/2006	133	11 due delay of evacuating classrooms/74 due to non-availability of material at local market /2 for additional work/2 for heavy rains /40 due to delay supply of security screens / 30due delay of handing computer tables
64	Construction of four computer lab ,at Beit Hanoun area schools	2005	Beit Hanoun	182339	166753	12	20/6/2005	11/9/2005	9/3/2006	179	56 due to non- availability of material at local market /24 for re considering the foundation design /10 for heavy rains /35 due to civil unrest/54 due preparation of drawing for new location of computer lab
65	Repair of 58shelters at Khan Younis area	2006	Khan Younis	205248	220911	10	24/9/2006	2/12/2006	12/12/2006	10	Due to amendments in B.O.Q
66	Re Construction of toilet block for boys , one canteen at Beit Hanoun schools	2006	Beit Hanoun	60910	56772	12	28/8/2006	19/11/2006	17/12/2006	28	12 due to IDF invasion /12 due waiting the decision of the damage part/ 5 due to non- availability of material at local market
67	Repair of 41shelters at Rafah area	2006	Rafah	159590	164870	10	21/9/2006	29/11/2006	18/12/2006	19	Additional work for variation order
68	Construction of temporary teacher room&tolit unit for femal	2007	Gaza Strip	12556	11724	3	1/12/2007	21/12/2007	18/12/2007	0	0
69	Repair of 57shelters at Khan Younis area	2006	Khan Younis	206945	193106	10	1/10/2006	9/12/2006	14/12/2006	5	Due to amendments in B.O.Q

Annex C

Ranking of all factors causes delay from point view of client

Factors	N	Mean	I.I	rank
Political situation (strikes Israeli attacks and borders closures, war)	54	4.333	86.7	1
Shortage of construction materials	54	4.222	84.4	2
Unethical behaviors used by contractors to achieve the highest possible level of profit	54	4.093	81.9	3
Contractor un commitment to consultant instructions.	54	4.074	81.5	4
Low motivation and morale	54	4.056	81.1	5
Cash problem during construction	54	4.037	80.7	6
Ineffective project planning and scheduling	54	4.019	80.4	7
Unreliable subcontractor	54	4.000	80.0	8
difficulties in financing project by contractor	54	3.981	79.6	9
lack of high-technology mechanical equipment	54	3.944	78.9	10
Dependence on a newly –graduated engineer to bear the whole responsibilities in the site	54	3.926	78.5	11
Late in selection of finishing materials due to availability	54	3.907	78.1	12
delays in sub-contractors' work	54	3.907	78.1	13
Suspension of work by owner or contractor	54	3.889	77.8	14
Inadequate contractor experience	54	3.870	77.4	15
Increased number of projects	54	3.870	77.4	16
change orders	54	3.870	77.4	17
delay in progress payment by owner	54	3.852	77.0	18
Lack of database in estimating activity duration and resources	54	3.852	77.0	19
Often changing sub-contractors company	54	3.852	77.0	20

Factors	N	Mean	I.I	rank
Incompetent project team	54	3.833	76.7	21
Spend some time to find sub-contractors company who is appropriate for each task	54	3.833	76.7	22
Improper technical study by contractor during the bidding stage	54	3.833	76.7	23
Late delivery of materials	54	3.815	76.3	24
Inefficient quality control by contractor	54	3.815	76.3	25
Delay payment suppliers/subcontractors	54	3.796	75.9	26
Poor site management and supervision	54	3.796	75.9	27
project complexity	54	3.796	75.9	28
Poor coordination & communication by contractor with other parties	54	3.778	75.6	29
Slow decision making by client	54	3.778	75.6	30
lack of maintenance for the equipment	54	3.759	75.2	31
Improper handling of the project progress	54	3.759	75.2	32
Ineffective delay penalties	54	3.759	75.2	33
Mistakes during construction	54	3.741	74.8	34
Poor company organization	54	3.741	74.8	35
required equipment and tools are not available	54	3.704	74.1	36
Insufficient numbers of equipment	54	3.685	73.7	37
variations in quantities, suspension of work by owner	54	3.685	73.7	38
delay in approving major changes in the scope of work by consultant	54	3.685	73.7	39
Inappropriate construction methods	54	3.685	73.7	40
project size	54	3.685	73.7	41
Escalation of material prices	54	3.685	73.7	42
Mistakes and discrepancies in contract Documents	54	3.685	73.7	43

Factors	N	Mean	I.I	rank
Shortage of manpower (skilled, semi-skilled, unskilled labor),	54	3.667	73.3	44
Poor distribution of labour	54	3.667	73.3	45
Lack of subcontractor's skills	54	3.667	73.3	46
late in reviewing and approving design documents by consultant,	54	3.667	73.3	47
Safety rules and regulations are not followed within the contractor’s organization	54	3.648	73.0	48
Unavailability of incentives for contractor for finishing ahead of schedule in the contract.	54	3.648	73.0	49
Replacement of key personal	54	3.648	73.0	50
Delay in site mobilization	54	3.630	72.6	51
Poor procurement of construction materials	54	3.630	72.6	52
Uncompromising attitude between parties	54	3.630	72.6	53
Inflexibility periods for project implementation	54	3.611	72.2	54
monthly payment difficulties	54	3.611	72.2	55
Conflicts between contractor and other parties	54	3.611	72.2	56
Frequent equipment breakdown	54	3.611	72.2	57
Major disputes and negotiations	54	3.611	72.2	58
Insufficient contractor competition	54	3.574	71.5	59
lack of job security for the consultancy team	54	3.574	71.5	60
Shortage in labor	54	3.556	71.1	61
Lack of capable representative	54	3.556	71.1	62
incomplete drawing and detail design	54	3.556	71.1	63
Poor economic condition	54	3.556	71.1	64
ambiguities and mistakes in specifications and drawings,	54	3.537	70.7	65
Type of project bidding and award (negotiation, lowest	54	3.537	70.7	66

Factors	N	Mean	I.I	rank
bidder),				
Delay in obtaining permits from municipality	54	3.537	70.7	67
delay in performing inspection and testing by consultant	54	3.519	70.4	68
delays in design work (lack of design information)	54	3.519	70.4	69
Original contract duration is too short	54	3.519	70.4	70
low productivity and efficiency of equipment	54	3.500	70.0	71
poor design	54	3.481	69.6	72
Changes of materials types & specifications	54	3.481	69.6	73
Improper equipment used for the work	54	3.481	69.6	74
lack of technical and managerial skills of staff	54	3.463	69.3	75
Unreasonable constraints to client	54	3.463	69.3	76
inflexibility (rigidity) of consultant	54	3.444	68.9	77
Centralization of decision making process from consultant	54	3.444	68.9	78
Slow information flow between project team members	54	3.444	68.9	79
lack of designer's experience	54	3.444	68.9	80
contract modification	54	3.426	68.5	81
lack of quality assurance / control	54	3.407	68.1	82
inaccurate prediction of equipment production rate	54	3.407	68.1	83
Complexity of project design	54	3.407	68.1	84
Unforeseen ground condition	54	3.407	68.1	85
Low productivity level of labor	54	3.407	68.1	86
Inadequate fund allocation	54	3.407	68.1	87
high quality of work required	54	3.407	68.1	88
Inadequate consultant experience	54	3.407	68.1	89
Inappropriate type of construction contract	54	3.407	68.1	90

Factors	N	Mean	I.I	rank
low level of equipment-operator's skill	54	3.389	67.8	91
poor documentation and no detailed written procedures not using systematic procedures	54	3.389	67.8	92
Misunderstanding of owners requirements by design engineer	54	3.389	67.8	93
Problem with neighbors	54	3.389	67.8	94
Poor quality of construction materials	54	3.370	67.4	95
absence of consultant's site staff	54	3.370	67.4	96
Client interference	54	3.370	67.4	97
Waiting for approval of material samples	54	3.370	67.4	98
Slow mobilization of equipment	54	3.370	67.4	99
delays in site preparation	54	3.352	67.0	100
Bad past history and reputation of the consultant(corruption)	54	3.352	67.0	101
Poor site safety	54	3.352	67.0	102
Weather condition	54	3.333	66.7	103
Improper project feasibility study	54	3.333	66.7	104
Lack of experience of client in construction	54	3.315	66.3	105
Donor own policy in implementation methods and characteristics of the project	54	3.315	66.3	106
Insufficient data collection and survey before design	54	3.315	66.3	107
Inappropriate overall organization, structure linking all parties to the project	54	3.315	66.3	108
Inconsistency between the project and its environmental due to donor agenda	54	3.315	66.3	109
Unavailability of utilities in site (such as, water, electricity, telephone, etc.)	54	3.296	65.9	110
Equipment allocation problem	54	3.222	64.4	111

Factors	N	Mean	I.I	rank
No adherence with materials standards that is storage in the site	54	3.222	64.4	112
negotiation by knowledgeable people	54	3.222	64.4	113
Damage by other participants	54	3.204	64.1	114
project regional location	54	3.185	63.7	115
Changes in laws and regulations	54	3.167	63.3	116
owner has no priority/ urgency to complete the project	54	3.130	62.6	117
Previous dispute between consultant and contractor	54	3.093	61.9	118
Un-use of advanced engineering design software	54	3.093	61.9	119
changes in Government regulations	54	3.074	61.5	120
Accident during construction	54	3.056	61.1	121
Personal conflicts among labor	54	3.019	60.4	122
Delay in manufacturing special building materials	54	2.944	58.9	123
internal company problems	54	2.870	57.4	124
Damage of sorted material while they are needed urgently	54	2.796	55.9	125
Ageing of site workers	54	2.796	55.9	126
Different political and factional affiliation of workers	54	2.463	49.3	127

Annex D

(Tables of modeling)

Table B1: Models summary

Model	R	R Square	Adjusted R Square	F	significant
1-a	.693	.480	.470	47.922	0.000*
2-b	.834	.695	.683	58.184	0.000*
3-c	.897	.804	.792	68.369	0.000*
4-d	.947	.896	.888	105.569	0.000*
5-e	.971	.943	.937	157.607	0.000*
6-f	.992	.984	.982	483.160	0.000*
7-g	1.000	1.000	1.000	-	-

* P less than 0.05

a Predictors: (Constant), F1

b Predictors: (Constant), F1, F2

c Predictors: (Constant), F1, F2, F5

d Predictors: (Constant), F1, F2, F5, F6

e Predictors: (Constant), F1, F2, F5, F6, F3

f Predictors: (Constant), F1, F2, F5, F6, F3, F4

g Predictors: (Constant), F1, F2, F5, F6, F3, F4, F7

Table :B2: Coefficients of the different factors and results of the multiple regression

Model	Dependents	Coefficients(a)			t	Sig.
		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta		
1	(Constant)	52.595	3.954		13.301	.000
	FACTOR1	2.278	.329	.693	6.923	.000
2	(Constant)	37.380	3.968		9.420	.000
	FACTOR1	1.940	.260	.590	7.447	.000
	FACTOR2	1.619	.270	.476	6.008	.000
3	(Constant)	26.779	3.793		7.061	.000
	FACTOR1	1.729	.215	.526	8.054	.000
	FACTOR2	1.432	.221	.421	6.475	.000
	FACTOR5	1.304	.248	.343	5.266	.000
4	(Constant)	18.456	3.063		6.025	.000
	FACTOR1	1.433	.164	.436	8.727	.000
	FACTOR2	1.384	.163	.406	8.493	.000
	FACTOR5	1.283	.182	.337	7.041	.000
	FACTOR6	1.062	.161	.318	6.585	.000
5	(Constant)	13.366	2.440		5.477	.000
	FACTOR1	1.303	.125	.396	10.413	.000
	FACTOR2	1.133	.129	.333	8.801	.000
	FACTOR5	1.140	.139	.300	8.222	.000
	FACTOR6	1.002	.121	.300	8.250	.000
	FACTOR3	.996	.160	.243	6.239	.000
6	(Constant)	1.573	1.682		.935	.354
	FACTOR1	1.143	.068	.348	16.771	.000

Model	Dependents	Coefficients(a)			t	Sig.
		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta		
	FACTOR2	1.026	.069	.301	14.813	.000
	FACTOR5	1.190	.074	.313	16.079	.000
	FACTOR6	1.013	.065	.303	15.656	.000
	FACTOR3	1.027	.085	.251	12.079	.000
	FACTOR4	1.114	.101	.212	11.052	.000
7	(Constant)	-5.421E-15	.000		.	.
	FACTOR1	1.000	.000	.304	.	.
	FACTOR2	1.000	.000	.294	.	.
	FACTOR5	1.000	.000	.263	.	.
	FACTOR6	1.000	.000	.299	.	.
	FACTOR3	1.000	.000	.244	.	.
	FACTOR4	1.000	.000	.190	.	.
	FACTOR7	1.000	.000	.153	.	.

a Dependent Variable: SUM SUBF