

**The Islamic University of Gaza**

**Deanship of Research and Graduate Studies**

**Faculty of Engineering**

**Engineering Projects Management**



الجامعة الإسلامية بغزة

عمادة البحث العلمي والدراسات العليا

كلية الهندسة

# **Factors Affecting Cost Escalation in Construction Project in Gaza Strip**

العوامل التي تؤثر على تصاعد الاسعار في المشاريع الانشائية في  
قطاع غزة

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**A thesis submitted in partial fulfilment  
of the requirements for the degree of  
Master of Engineering Projects Management**

**April /2018**

## إقرار

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### Factors Affecting Cost Escalation in Construction Project in Gaza Strip

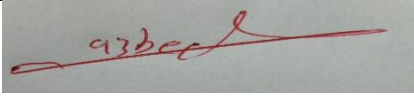
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الجامعة الإسلامية - غزة  
The Islamic University of Gaza

عمادة البحث العلمي والدراسات العليا

هاتف داخلي: 1150

ج س غ/135

الرقم: Ref: 2018/04/23م

التاريخ: Date:

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وبعد المداولة أوصت اللجنة بمنح الباحث درجة الماجستير في كلية الهندسة/ قسم الهندسة المدنية/ إدارة المشروعات الهندسية.

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22

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# *Dedication*

*To my loving parents who supported me all the way; to my wife whose constant dedication and love enlightened me; to my sisters and brothers; to all of my friends and colleagues who stood beside me with great commitment; I dedicate my research, hoping that I made all of them proud.*

## **ACKNOWLEDGMENTS**

*I wish to express my profound gratitude to Dr. Nabil EL Sawalhi for his continued guidance, supervision, and comments throughout the course of this research. He has been ever present force in helping me to mature as a student and as a researcher.*

*Special thanks to all friends and colleagues. Special thanks to engineer Raed Al Ghamri for his efforts in this research*

*My grateful thanks to all contractors, and engineers who participated in filling questionnaires and provided important information for this study.*

*Special thanks to the Engineers Syndicate especially to the employees of the middle office and the employees of Khan Younis office. Special thanks to the employees of the Palestinian Contractors Union.*

*Finally, I would like to thank my wife for her love, support and for tolerating the time I spent working with my research.*

## Abstract

It is known that the construction industry is one of the industries necessary for the economic growth of countries and the development of their sectors in all forms, whether through the development of infrastructure or the development of buildings in order to achieve the objectives of the strategic plan for the development of the country. However, the construction sector suffers from many problems in the Gaza Strip, including: the ever-increasing cost of raw materials, construction inputs and inflation in the domestic and international market and other factors that affecting costs escalation in projects.

The aim of this research is to assess factors that affect of cost escalation in construction project in Gaza strip. The main objective of the research is to review the current situation of cost escalation in construction project, to identify the factors that affect cost escalation of construction projects and to investigate the reasons that increases the cost escalation of construction projects. The questionnaire was used as a research tool that was distributed to all areas in the Gaza Strip.

In order to address the problem, a questionnaire survey was prepared and distributed on the owners, consultants and contractors in the construction sector. 120 questionnaires were distributed, (82) questionnaires were returned completed, 23 losses and 15 incomplete. Showing (69 %) response rate divided as (30) contractors, (31) owners and (21) consultants. The questionnaire was divided into several sections. The first part is the general information and thus the factors affecting the cost escalation, the factors were divided into several sections at the project level, level of the owner, level of the workers and level of the equipment. The third section the practices related to the cost escalation factors for construction projects in Gaza Strip. An integrated desk study on cost escalation in construction projects was conducted.

Based on the results of the questionnaires and the use of simple statistical methods such as correlation coefficients of the rank of the scale, Spearman's correlation scale and the ANOVA scale for the analysis of variance. The cost of building materials, permits and approvals, the availability of an effective supervisory system, the improper cost estimate, the changes in the project, the quality of work, the machinery and equipment required to carry out the tasks and activities required for the project completion are the main reasons leading to the escalating costs of construction projects in Gaza.

The study recommended contractors to conduct site visit with detailed exploratory, provide sufficient technical and administrative staff, and reconcile the estimated schedule. The main recommendation to owner were on time payment, make prequalification, and reconcile the estimated cost. The main recommendation to consultant were review and approve the design documents, proper market price assessment, qualify his team of engineers and give the powers to the engineers within the site. The recommendation in this research to avoid problems that arise cost escalation in the construction projects in the Gaza Strip.

## المخلص

أصبح من المعروف ان صناعة الانشاءات من الصناعات الضرورية لنمو الاقصادي للبلدان وتطوير قطاعاتها بجميع اشكالها سواء من خلال تطوير البنية التحتية او تطوير المباني من اجل تحقيق اهداف الخطة الاستراتيجية لتطوير البلاد. الا ان قطاع الانشاءات يعاني من مشكلات كثيرة في قطاع غزة منها: التكلفة المتصاعدة باستمرار للمواد الأولية ومدخلات البناء والتضخم في السوق المحلي والدولي وغيرها من العوامل التي تؤدي الى تصاعد التكاليف في المشاريع.

الهدف الرئيسي من هذه الدراسة تحديد العوامل المؤثرة على تصاعد التكاليف في المشاريع الانشائية في قطاع غزة. الأهداف الفرعية من الدراسة هي مراجعة الوضع الحالي لتساعد التكلفة في مشروع الانشائية، لتحديد العوامل التي تؤثر على تصاعد تكاليف مشاريع والتحقيق في الأسباب التي تزيد من تصاعد تكاليف المشاريع الانشائية. أيضا أداة البحث هي الاستبيان بحيث تم توزيعها على مناطق قطاع غزة ومن ثم جمعها وتحليلها.

ومن اجل معالجة المشكلة تم تصميم استبيان وتوزيعه على المالك والاستشاريين والمقاولين في صاعة التشييد. حيث تم توزيع 120 استبانة، تم استرداد (82) استبانة كاملة، و 23 استبانة مفقودة و 15 استبيان غير كامل. حيث ان معدل الاستجابة (69%) مقسماً على (30) مقاول ، (31) مالك و (21) استشاري. حيث قسم الاستبيان الى عدة أقسام بحيث قسمت الاستبانة الى عدة اقسام: القسم الأول المعلومات العامة ومن ثم العوامل المؤثرة على تصاعد التكاليف وتم تقسيم العوامل الى اقسام عدة على مستوى المشروع ،على مستوى الاشراف ،مستوى النشاطات ،مستوى المالك ،مستوى العمال وعلى مستوى المعدات ، ثم القسم الثالث الممارسات المتعلقة بعوامل تصاعد التكاليف للمشاريع الهندسة في قطاع غزة. من ثم اجريت مراجعة تكاملية للدراسات السابقة بشأن تصاعد التكاليف في المشاريع الانشائية.

واستنادا الى النتائج من الاستبيانات واستخدام طرق إحصائية بسيطة مثل معامل ارتباط كاندل للرتب ومقياس سبيرمان للارتباط ومقياس نونفا للتحليل تباين الأحادي. نستنتج ان تضخم تكلفة مواد البناء، التصريحات والموافقات، توافر جهاز اشراف فعال، تقدير غير سليم للتكلفة، التغييرات في المشروع، جودة العمل والآلات والمعدات المطلوبة للقيام بالمهام والنشاطات المطلوبة للإنتاج المشروع هي الأسباب الرئيسية التي تؤدي الى تصاعد التكاليف المشاريع الانشائية في قطاع غزة.

اوصت الدراسة المقاولين القيام بزيارة استكشافية مفصلة للموقع، توظيف العدد اللازم من الموظفين الفنيين والإداريين وربط الجدول الزمني بالتكلفة. اهم التوصيات للمالك هي الدفع في الوقت المحدد، التأهيل المسبق لكل من المقاولين والاستشاريين، والتقدير الجيد للتكلفة. اهم التوصيات للاستشاري هي مراجعة واعتماد مستندات التصميم، وتقييم سعر السوق المناسب، وتأهيل فريق المهندسين وإعطاء الصلاحيات للمهندسين داخل الموقع. كانت هذه اهم التوصيات في هذا البحث لتجنب المشاكل التي تنشأ عن تصاعد التكلفة في المشاريع الانشائية في قطاع غزة.



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## List of Abbreviations

- AFDB – African Development Bank  
BOQ – Bill of Quantity  
CA – Competitive Advantage  
CPI – Consumers Price Index  
EU - European Union  
GDP – Gross Domestic Price  
GDP – Gross Domestic Product  
GE – Government Fund  
GRM – Gaza Reconstruction Mechanism  
IDA – International Development Association  
IT – Information Technology  
MWUD – Ministry of Works and Urban Development  
NGOS – Non Governmental Organizations  
PCBS – Palestinian Central Bureau of Statistics  
PCU – Palestinian Contractors Union  
PM – Project Management  
QS – Quantity Surveyor  
RII – Relative Importance Index  
SPSS – Statistical Package for the Social Sciences  
US – United States

# Chapter 1 Introduction

## 1.1 Background and Context

Construction projects are known for their bad reputation in increasing the budget, the time schedule, the required quality, and the changes in the goals due to the poor communication between the frameworks. All these problems occur in the projects whether small or large projects. Therefore, the administration needs to continue monitoring the project in all stages (Guérin, 2012).

The main objective of the contractor is to deliver the project on time and the budget required and to make a profit. A culture of mutual trust between the parties in project is a key to the success of the project. Which contributes to the work of all workers in the project to work in a homogeneous manner, without unduly delaying or damaging others, is a highly complex task requiring the utmost coordination, cooperation and communication (The Associated General Contractors, 2003).

Service industry for the rest of the economic and industrial sectors, usually offering their products according to specific demand and specific objectives. These products vary from very simple projects to complex projects using the highest standards of technology and knowledge. Regulator of economic growth. There is a positive relationship between economic growth and the growth of the construction sector. Industry adopts the principle of the project, which has a long life and heavy weight where it is not possible to transfer and reuse because it is usually built for a specific purpose. The construction project passes through several stages from the idea to the feasibility study. The first design is the detailed contract, the construction, then the operation and maintenance, and eventually the replacement or removal (Zahlan, 2008), Where participants differ in each stage according to their role and goals. It is complex industry with a large number of shareholders and from various practical and practical backgrounds (managers, engineers from various fields, trade unions, consulting firms, geologists, city planners, legalists, accountants, financiers, technicians, government sectors, Etc.) and the experience of workers or participants in the construction industry varies from the highest levels of skills and experience to workers without any experience or skills. A complex industry because the final product in the construction industry is a composite of a large number of materials of different properties and shapes

as well as various mechanical and electrical equipment. This product is used to produce a large number of temporary and permanent resources and may be stored or used within a certain time. The final product was obtained in the construction industry through many contracting and supply strategies that differ from each other and suitability for each type of project (Askar & Gab-Allah, 2002).

The construction industry is differs from other industries in the physical sciences of their products, where the product is of great size and need to be manufactured in the place of investment, which requires the transfer of workshops and implementation to the site of the construction , As a result, the regulatory environment and administrative methods of the construction industry vary deferent .Where a large number of contractors, construction companies, design offices and engineering consultancy work in construction (Andrew, 2004).

The construction industry is one of the largest industries in size, with Arab countries allocating about \$ 130 billion a year for construction, and it is estimated that more than 70 percent of this spending goes outside the Arab economy. The construction industry has a large number of workers and professionals, which earns the construction industry a great importance in the national economy of most Arab countries. The objective of increasing efficiency in the management and organization of this industry is a strategic goal for all Arab countries, especially in light of the great challenges posed by economic changes (Jalaly & Khairallah, 2005).

The construction industry is of great importance in the national economy of all countries of the world. Its products constitute the best basis for the development process. They constitute between 3 and 8 percent of the national product in developing countries. This percentage rises to 10 percent in developed countries. The industry annually invests 50 percent of the total. Investment spending in various countries of the world and increase this percentage to 60 percent in Arab countries (The World Bank, 2010).

Project's construction cost has significant role to affect the overall construction industry of a country. The construction industry has a great impact on the economy of a country. In the present situation, the sector suffers from many problems, such as the reduction of domestic investments in construction due to poor economic conditions,

absence of laws and regulations, weak research and studies related to construction, the absence of a national database for the construction sector, the low use of modern technologies in the management of the construction sector, The absorption of equipment, maintenance and operation of the few projects, contractors in the Gaza Strip is unable to continue, and the erosion of capital due to the accumulation of losses without compensation in the work and the existence of fierce competition, it comes to the end R or bankruptcy, or its merger with other companies (Fiad, 2013). The construction sector is a fundamental pillar of the composition of the economy in the Gaza Strip, where it contributes about 35 percent of the GDP of the sector, and the number of workers is estimated at 80 thousand workers, and if the projects stop, this means the accession of tens of thousands to the ranks of the unemployed " , The Gaza Strip suffers from severe liquidity weakness, especially in the dollar category, prompting the banks to put financial restrictions to protect themselves from the possibility of failure of the contractor to pay the bank's debts to the projects under his supervision (Samhuri, 2017).

## **1.2 Scope and Objectives**

### **Aim**

The aim of this research is to assess factors that affect of cost escalation in construction project in Gaza strip.

### **Objectives**

1. To review the current situation of cost escalation in construction project.
2. To identify the factors that affect cost escalation of construction projects.
3. To investigate the reasons that increases the cost escalation of construction projects.

## **1.3 Problem Statement**

Managing capital construction projects requires the coordination of human, organizational, technical, and natural resources. The construction of complex project and civil engineering work overshadowed by economic, social, and political challenges. These challenges influence cost and factors which engineers are often least equipped to appreciate. In view of the previous studies during the research, there is great importance



to the problem of price escalation in the construction projects, resulting in significant damage to the level of the owner and the contractor, as well as the level of construction and finally on the construction sector.

Construction cost escalation of projects over the past years is believed to have caused considerable budget constraints on construction sector development of the country. The uncontrolled rise of these cost have negatively influenced budgetary planning of construction programs by owner and donors in that adhering to the strict policies of the funding agencies like International banks and donors has been so challenging. Therefore it has been a great challenge in construction sector as result of the unsteady and inconsistent periodical project price escalation. Therefore, this situation is highly influencing the road construction industry thereby the chasing economic development of the country. The construction sector has faced many obstacles that prevented the actual management of the crisis. The most important of these obstacles are the absence of basic materials necessary for construction, in addition to the difficulties faced by construction companies in the Gaza Strip. Lack of human capacity and lack of cadres, skills and technical experts and managers to carry out the activities required of them may hinder their development and the absence of strategic planning and development, which must be developed by the companies going through the work of the most important problems faced by those companies ( Farwana & Al Deeb, 2016).

## **1.4 Justification**

Construction industry is one of the most important industries in the Gaza Strip, one of the most complex industries and most vulnerable to changes that occur because of the political and economic conditions. The Gaza Strip suffers from the cost escalation problems in construction projects because of many reasons and factors. The important of thesis to identify and to evaluate the main factors affecting the cost escalation in construction projects in the Gaza strip. The practices concerning in mitigating problems which may arise in the project financing, planning and procurement stage. Checklists will be analyzed in order to know the main practical problems of cost escalation in construction projects in Gaza Strip and then to formulate recommendations for construction projects in Gaza Strip.

## 1.5 Writing of the Research

The research has four major stages. These are the research proposal, the literature review part, the research methodology and analysis, and the final research writing. The research proposal writing has already been undertaken. The literature review part has taken the longest period of the research in which various documents were gathered and tested against the research objectives to take relevant information pertinent to the basic objectives of the research.

Finally, the information was extracted and analyzed and linked to literary references and research papers and then the recommendations of this thesis as a result of the analysis obtained through the search for workers in the construction projects in the Gaza Strip. Where the research was divided into five sections as follows and in Table 1.1.

Chapter 1: Introduction

Chapter 2: Literature Review

Chapter 3: The Research Design and Methodology

Chapter 4: Data Analysis and Discussion

Chapter 5: Conclusions and Recommendations

**Table 1.1 : Time schedule**

No.	Activity	11	12	1	2	3	4
1.	Literature review	■	■				
2.	Questionnaire distribution, analysis			■	■		
3.	Recommendation					■	
4.	Presentation						■

## Chapter 2 Literature Review

One of the most important problems facing the construction industry is the escalation of costs in construction projects of various types' roads, buildings, sewage and water. In this chapter contains previous studies of the problem of escalation costs in the world where we will first mention an introduction to the construction industry in the Gaza Strip and its importance and then know the escalation of costs from several points of view of researchers and the difference between them and the contingency of the project and other, the current situation of construction and escalation costs, ways to reduce cost escalation, factors that lead to escalation costs, cost overrun factors led to escalation, a table shows cost escalation factors for scientific papers reported by research, the implications of escalating costs in projects and damage size, methods of analysis cost escalation and finally a summary of the chapter.

### 2.1 Introduction

In construction project one of the largest and the most important problems that most projects suffer or nearly all of them constantly, whether in fixed or changing economic conditions is a problem of increase the cost and time of the project as result of changes in projects. Regardless of the initial planning, preliminary engineering, final design, or even at the start of construction changes and the problem of higher cost projects may appear.

Public organization face the changes of the project by trying to control the budget and time. The play in the cases of the increase in costs by shrinking the size of the projects and modify them to suit the new budget in an attempt to solve problems that might arise from the changes, or cancel projects and stop at certain limit and the completion of projects in the other time when the availability of new fund (Shane J., Molenaar, Anderson, & Schexnayder, 2009).

One of definitions of cost escalation is the increase of the cost of the construction element of the original contract cost for the construction project. There is a lot of analytical techniques used to calculate the cost escalation depending on values of typical cost index or long term forecasting cost escalation technique (Touran & Lopez, 2005).

The Middle East and the Gaza Strip area has the largest share of suffering and problems of rising prices and the extension of the time period for projects implemented, so what is going through the blockade of the Gaza Strip, these problems are:

- The large number of workers in the Gaza Strip due to widespread unemployment;
- Frequent closure of crossings and lack of rapid materials in markets;
- Reliance on foreign markets in materials used in construction projects;
- Continued increase in material prices;
- Most of the projects implemented are from donor countries;
- Unstable economic situation and its correlation with Israeli one;
- Unstable political situation.

Therefore, improving construction work in Gaza depend in improving the time schedule and feasibility study and history of the area to avoid the major problem that may happened during the construction work. The needs from engineers, owner, contractor and others to make sure that they take all precautions to avoid escalation in projects ( Enshassi, Al-Najjar, & Kumaraswamy, 2009).

## **2.2 Definition of Escalation**

Rate escalation is defined as changes in the cost or price of specific goods or services in a given economy over a period of time (Vamsidhar, Swaroop, Krishna, & Gopinath, 2014).

Cost escalation reflects changes in the price drivers of projects such as technology, productivity and changes in local market forces such as lack of skilled labor, high demand for materials and so on. The cost escalation is different from inflation, which is a general variable in the prices of materials in the market due to the devaluation of the currency. The escalation of costs is also different from the contingency, which represents the addition of a fixed amount or a certain percentage of the funds to the project budget or the estimates of the project, in anticipation of an accident or unexpected events and that experience shows will likely result, in aggregate, in additional costs. Through the definition of escalating costs come out of the circle of contingency, although they are essentially derived from the risk cycle. Probabilistic approaches are the best estimating practices for both escalation and contingency.

However, unlike contingency estimating, cost engineers are poorly equipped to estimate escalation. That is because escalation is driven by macro conditions; the study or which is a core skill and knowledge area of economists, not cost engineers (Hollmann, 2007).

The term "cost escalation" reflects the expected rise in the prices of basic inputs in construction projects - materials, labor, equipment, etc., as well as inflation in the market over time. It is used in project construction cost estimation to convert current dollars to outturn dollars for budgeting purposes (Raniga, 2015).

Cost escalation refers to the amount of the anticipated increase over a specified time period in the cost of a particular project. Usually, these increases reflect the materials, workers, equipment and activities. Therefore, the administration must bear in mind that the budget covers the escalation of costs to reduce the problems of succession (Department of Housing and Public Works, 2008).

With increasing attention to rising and fluctuating costs, the construction industry needs to be highly aware of factoring in cost escalation when planning upcoming construction projects. Cost escalation is a factor applied to a cost estimate to account for the rise in material and labor prices over a given period of time.

Cost escalation provides a more realistic and accurate picture of a project's cost and is generally included when a project's bidding timeline is more than six months from the time the cost estimate is prepared. For large private and public entities, long-term planning is essential for construction projects and the cost escalation factor must be included. Also, the very presence of an escalation factor within a cost estimate provides a constant reminder to an owner that longer planning timelines increase the possibility of increased costs (Poskin, 2016).

### **2.3 Current situation of cost escalation**

The construction companies in Indian consumes 40 to 50% of the national five year plan and in large and medium projects take over a year for completion and the cost of materials and labor often increase, which leads to major problems in administration of the contract. There is suffer from rapid increase in the price of construction materials, labor, interest charges and equipment cost. Many of factor founded as impact of inflation on construction, factors influencing market price like:

- Increase in transportation charges;
- Increase in electricity charges ;
- Increase in labor cost charges ;
- Increase in equipment charges ;
- Increase in material charges ;
- Increase in Lending rate for various sector;
- Power cuts ;
- Increase in Service taxes;
- Increase in demand for residential building.

Materials and products, construction equipment, increases in fuel cost and increases in electricity cost (Vamsidhar K. , Eshwarwaroop, Ayyappapreamkrishna, & Gopinath, 2014).

The cost escalation is important because impact of its risks as:

- Profitability of contractors;
- Ability of owners to fund project completion;
- Affordability for consumers and end users.

Having identified cost escalation as being a risk on a project, the project owner needs to determine how to treat the risk. Eliminating the risk can only really be achieved by deciding not to proceed. In a highly inflationary market, a developer may decide the risk is too great when compared to the potential returns. If a particular component of the works is subject to supply constraints or a higher inflationary risk, the risk may be at least partially eliminated through redesign or material substitution. The risk may be managed by early engagement with the market or supply chain, the principal can also manage the risk through the setting of the project budget and ensuring an appropriate amount of contingency. Allocation of the risk is usually done via the construction contract as a consequence of the delivery method and compensation mechanism or a combination of both (Maling & Neave, 2015).

Many construction projects failed to achieve their goals, whether time, cost or quality. Making the construction industry a bad reputation compared to other industries due to poor risk management, mitigation, reduction or transfer (Renuka, Umarani, & Kamal, 2014).

In recent years, drastic price changes for certain commodities, such as steel and cement have upset not only financial markets, but integrated economic entities along the value chain as well. Escalation is a pronounced and continued increase in the cost basis of certain, specific economic production factors over time. It is frequently tied to one commodity or industrial sector and initially impacts producers of goods whereas inflation represents a general price increase across the broad spectrum of an economy. In the long run however cost escalation is passed on to the end consumer in form of higher prices. In order to adequately capture project cost information over time and ensure comparability among projects (Jackson, 2008).

Most of the construction industry in the United Kingdom is suffering from the problem of escalation costs due to unexpected things outside the plan, strategies and budget deficit, where the Kingdom pays about 200 million pounds. Many projects in the civil sector suffer similar problems (Davey, 2000) .

## **2.4 Prevent Escalation**

This approach is used to mitigate historical estimation problems by: the actual cost estimate is determined by adding the changes in the schedule and the risks that are expected to occur during the implementation, so that all risks are combined with the actual cost, prioritize risks and arrange them both schedule, cost and activities, determine the cost and return of risk mitigation and treatment strategies at work if they occur, and improving communication and decision-making, including clarifying funding and cash flow requirements (Lindquist, 2007).

Client focus required a number of consideration when reporting the cost escalation as:

- The use of design bid build contracts leads the owner to be exposed to design errors risk;
- Risk reduction by pre-qualification of contractors;
- Contract payment types that focused on schedule of rates and bill of quantities;
- Use items in the contract to reduce the owner's exposure to the risk of escalating costs;
- Tender evaluation techniques;

- Contract provisions that protect the owner from physical changes, material changes and climatic changes (Creedy, 2006).

Improper expectations in defining responsibilities, risks, laws and disputes over sources and conflicts between parties all lead to costs escalation. There are several types of escalation to consider:

- Answer yes or no in activities that are outside of your responsibilities;
- Conflict requires people with a clearer vision and greater authority in the project to resolve it;
- Informing management of project information has the potential to plan to reduce the problem of future cost escalation (Karekar, 2012).

The shortage of capital projects, and the high demand for capital reflect the need for improved methodology aimed at helping decision-makers to successfully manage situations subject to uncertainty, thereby reduce cost overruns, while maximizing the benefits provided and satisfying financial constraints of the budget (EI-Choum M. K., 1995).

The first steps in preventing and limiting the escalating costs is the development of the budget and the contract price. Since the budget is not properly subsidized, there is a chance of rising costs in the project regardless of the project's success. Effectively using contingency with the budget developed and agreed the process is not yet complete. It is new to have a portion of the project budget put in place to solve the risks incurred during implementation. This contingency or risk allowance, often incorrectly labelled as possible additional short-term profit, is now the key to reducing further downstream costs (Davey, 2000).

The developed overruns tool represents opportunities to the cost estimate a project, at the most opportune the concept of a control system functionality evolving for many years. The construction has often been described as a hierarchy or layering of functions. This organizational structure responds perfectly to scientific parsimony (EI-Choum, Bachman, Ezeldin, & Brahim, 1997).

Forecasts that may occur for projects are determined by looking at previous projects and examining the factors that have been experienced and also looking at the state of the market, obtaining the views of the contractors and the practices of the quantity



server. This indicator reflects the size of the competition for tenders. This depends on the volume of construction work and the availability of materials. When the project budget is processed, the administration must consider the cost escalation at the time of processing the tender and during the contract period. Escalation calculations should allow for price increases that are likely to be incurred by the head contractor, sub-contractors and suppliers. These anticipated increases in cost should be built into the project budget and used when preparing budget submissions for funding approval (Department of Housing and Public Works, 2008).

There are many procedures used to minimize the problem of escalating costs. Seven of them are mentioned here:

1. Contract: Although the contractor's contract contains the escalation clauses, it is necessary that the owner's contract contains the escalation clauses. Is it possible to build in some contingency for exceptional escalations;
2. Prequalification: Financial Prequalification is very important to know the contractor's ability cost escalation emotion and also sub-contractor's ability;
3. Schedule: The schedule may provide the possibility of reducing and mitigating the cost escalation to reduce the duration of the project. As a result of the potential exposure to many of the escalation factors, the contractor may wish to speed up some of the work or increase the number of activities simultaneously and thus reduce its overall duration and therefore exposure to potential escalation;
4. Purchasing: To remove some escalation in costs, the main items and activities are often identified and their material and equipment requirements are determined so that the purchase of these materials is expedited in order to fix the price as soon as possible.;
5. Materials pre-purchase: As builders, contractors have options related to the procurement of materials when they know that a cost escalation is likely. They may wish to have a strategic delivery storage plan to enable them to have materials purchased and staged in advance of need;
6. Value engineering and alternates: Contractor contracts with suppliers and subcontractors in order to ensure the availability of equipment and materials for the project. Risk is transferred to suppliers and subcontractors;

7. Awareness of safety, code, or project certification requirements during estimating: It is necessary to take into account internal and external factors in order to reduce the impact of escalation costs (Hanes & Tolman , 2017).

Cost to fix errors increases as a project matures that it will cost more to fix a requirements error after the product is built than it is important to discover an error during the primary phases in project cycle.

There are three methods to calculate the escalation in costs:

1. The bottom-up cost method determining the cost to fix errors found in different phases of the life cycle is derived from the most detailed form of cost estimation;
2. The total cost breakdown method with firsthand knowledge of the phase in which an error occurred and averaging multiple changes for each phase, a cost factor escalation can be calculated between phases;
3. The top-down hypothetical project method models the escalation of error costs (Dabney, Stecklein, Dick, & Brandon, 2004).

Taking steps to reduce the cost impact and failure of the project timeline indicates that factors such as post-employment, lack of adequate labor, poor work practices and modification of work systems can lead to increased costs. Poor management can cause costs to escalate. But stress that poor project execution caused by management deficiencies is usually not the primary driver of project cost escalation ( Kaliba, Muya, & Mumba, 2009) .

Strategic and structural projects depend on their ability to control the escalating costs of projects. The problem of cost escalation is one of the most difficult types of cost problems. Procedures, design and management are required to reduce them. In many agencies there are organizational structures that lead to failures and lack of transfer of project information and consequently affect the goal, cost and design of the project. The cost management process must track appraisal amounts and cost of acquisitions, and analyze expenditure trends against the right-of-way budget. To minimize escalation should

- Systematic and structured processes for cost management and estimating;
- Communication and coordination between sections and development teams;
- Use all tools available to agencies to help estimate project costs;

- Involve the staff responsible for the planning process in the process of estimating project prices;
- Make connection between the planning estimate and later estimates;
- Cost estimation management is minimal throughout the cost estimation process and especially during the preliminary design project development phase;
- Lack of use of risk assessment methodologies and non-reliance on percentages used in estimation;
- Effective scope definition and communication (Anderson, Molenaar, & Schexnayder, 2008).

## 2.5 Cost Escalation Factors

The most severe cause of project cost escalation is price fluctuations that attributed to the limitation in exchange rate which in turn affects construction materials prices and the general price level and the unstable inflationary trend a result of demand exceeding supply and creating a scarcity of goods. The financing and payment of completed works was the second causes of cost escalation that causes by irregular financing of public projects. Poor contract management was the third factor of the project cost escalation. In construction word the contractor succeed the bid that is the lowest price and some of these low bidders may lack management skills and have less regard for contract plans, cost control, overall site management and resource allocation. Many causes of escalation like delay, changes in site conditions, inaccurate estimates, shortage of materials, imported materials and plant items (Omoregie & Radford, 2006).

Common cost escalation factors identified across a number of projects list project acceleration requirement, constructability difficulty costs, project scope change, scope change design - environmental issues, scope change design - design error, design preload requirement, design change to subgrade, scope change design - safety scanner audit requirement, extras unspecified, initiative government, condition latent, increase cost material, contract failure and remote location costs (Creedy, 2006).

Causes associated with cost that were compiled as type of project:

- Construction projects affected by factors price fluctuations, additional works, delays, inaccurate estimates, fraudulent practices and kickbacks, shortening of contract period and insurance;
- Building construction projects : Mismanagement, unforeseen nature of the land, changes in design, availability of information, lack of plans, methods of assessment, performance of staff, schedule, requirements, external factors, nature of suppliers and neighbors;
- Groundwater planning and scheduling deficiencies, the failure to estimate the costs of the project, the inadequate control procedures, delays in obtaining approvals, waiting for information, errors during implementation, delays in inspections and payments during work, frequent breakdowns of construction plant and equipment, shortages of technical personnel, labour shortage, monthly payment difficulties;
- Highway project : Changes in project objectives, bid prices greater than the estimated original price of the project, sewerage, measurement of increase in quantities, paving materials, replacement of non-crisis materials, environmental issues, traffic during construction, transport costs, construction difficulty costs, specification changes, unspecified additions, project acceleration requirements and safety requirements, cultural heritage issues;
- Private residential projects: Government, government initiative - contribution by rail, material cost increase – asphalt, bitumen price, new contract establishment costs and contract ( Ameh, Soyingbe , & Odusami , 2010).

The recurring factors that affect the costs of the project continuously are as follows project size and location, Lack of plans, unexpected utilities, regulatory approvals, ground conditions ,weather conditions, quality of supervision ,sequence of activities , inaccurate estimate, schedule, knowledge of owner, change work orders ,time required to make a decision, how well crew works together , morale/motivation of crew ,availability of skilled labour , over manning and crowding , amount of overtime worked , worker absenteeism , quality of work material, quality and timeliness of subcontractors and suppliers (Knight & Fayek, 2000).

In civil project escalation causes fall into five categories:

- Changes in project requirements. Often due to the lack of clarity of ideas or changes in the quality of materials used in the project, these changes occur by the owner;
- Technology costs: This is the result of the use and reliance on modern technology, whether from equipment or programs without realizing the nature of the technology, which presents the project with technical difficulties and work;
- Changing quotations;
- Organizational stability: This problem appears in projects where alliances between contractors or companies occur so that the team is reorganized and managed so that the work is threatened to collapse at the first line may occur;
- Impact of risk: allowing for the unexpected is never easy, but is key to the prevention of excessive cost and schedule escalations (Davey, 2000).

Factors responsible for the escalation of civil and building engineering projects were identified. They are: Fluctuation of price of materials, Variation, Government policies, Change of Government and political instability, Wrong method of estimation, Poor financial control on site, Long period between design and tendering time, Design errors, Lack of coordination between contractors and consultant, Poor supervision and liquidation Damages, Previous experience of contract, Inadequate production of raw materials, Effect of weather and Absence of construction cost data Inaccurate projects cost estimation (Muhammad, et al., 2015).

The key factors influencing transport construction costs:

- a. General inflation;
- b. Market conditions included construction cost were added to the market causing a shortage of skilled workers or certain materials.;
- c. Separate consideration between contingency and cost estimation;
- d. Change scope. The objective of the project or the nature of the project may change in long-term projects due to changes in the decisions of the government or the owner. The change in the project objective will therefore reflect the change in project costs. However, scope change is project specific thus difficult to be included in the general cost escalation methodology;

- e. Changes in environmental and safety requirements. Cost can change due to conditions of environmental approval and safety regulations. These changes are project specific thus difficult to be included in the general cost escalation methodology (Raniga, 2015).

The major factors escalation projects include: contractor financial problems, payments delay from the owners. Also, reference to the political situation of the area of feasibility study and its impact on construction projects. There are also other important factors affecting the completion of projects such as poor communication among parties, lack of efficient machineries and tools and competition among bidders, showed significant effect on projects' schedules.

The construction industry is a risky business due to its complexity and strategic nature. The critical risk factors identified in different type projects like scope and design changes, technology implementation, site conditions and unknown geological condition, inflation, economic condition and rules and regulation, unavailability of funds, financial failure, inadequate managerial skills, lack of availability of resources, improper coordination between teams, poor safety procedures and construction delays (Renuka, Umarani, & Kamal, 2014).

During the construction period, there are many factors that affect the final cost of the project. The factors affecting the cost are divided into two main groups: construction specific factors include unknown geological conditions, wither condition and contractor risk. Economic and political environment specific factors are affected by events that occur outside the construction industry (Akinci & Fischer, 1998).

The most important reason that leads to cost escalation was terrain conditions. These conditions include difficulties in reaching the work site, difficulties of the work type, land acquisition issues, delay in relocating utilities, and the lack of civil services near the work site, which were not included in the work plan and cost studies. The second main reason was weather conditions that occurred in the projects ( Al-Hazim, Abu Salem, & Ahmad, 2017).

Factors that lead to escalating costs include other factors such as: project size, project scope, inflation cost, completion project time, incompleteness of preliminary quantity surveys, engineering uncertainties, delays, complexities of administrative structures, and inexperience of administrative personnel. Further factors compounded

cost escalation is such as project conditions, project location, suspension of works, environmental costs, strikes, poor coordination on site, bid expiry, local government pressures, political condition and transportation problems ( Kaliba, Muya, & Mumba, 2009).

### **2.5.1 Estimate Project Cost Escalation**

Traditionally estimated project costs and schedules based on historical data by owners and engineers. The preliminary cost estimate heavily influences the fate project, poor prediction of costs, the consistent underestimation of construction projects worldwide and a statistical analysis using the historical data of cost contingency this all led to cost escalation in construction project (Lindquist, 2007).

The factor affected estimated project are by nature internal and external. The internal factors that attribute to cost escalation and are controllable by the owner, while the external factors are existing outside the direct control of the owner. There are many internal escalation factors that the owner can control to minimize project costs during the initial stages of the project in planning and document design such as bias, procurement approach, engineering and construction complexities, schedule changes, scope creep, scope changes, and poor estimating. External escalation factors are those factors that the owner can not fully control and monitor, but owner has little control over their impact. However, the owner should consider these factors and take them into account when estimating costs. During the design and planning phase of project development external factors such local government requirements, fluctuations in the rate of inflation, scope creep, scope change, and market conditions can lead to underestimation of project costs (Shane J. , Molenaar, Anderson, & Schexnayder, 2009).

Most of the estimator specific factors are controllable and can be managed by checking and calculations. Design and project specific factors that affect the cost estimate, which include vagueness in scope, design complexity, and project size.

During the development process by Planning or Project Development Section, cost estimates for the acquisition of rights of way are required for project planning purposes and to encumber adequate funds. At minimum, there are five Real Estate estimates developed during various levels of a major project process. The five main phases are

- Level 1: Program estimate;
- Level 2: Base estimate;
- Level 3: Build-out estimate;
- Level 4: Not to exceed estimate;
- Level 5: Project cost allocation – encumbrance.

Estimates are the basis of the success of the project. The success of the project and the status of the project at any point in the project are measured by the estimates (CTC & Associates LLC and WisDOT RD&T Program, 2006).

### **2.5.2 Project Management Tools Used in Project Cost Estimation:**

The actual management of the project is based on the tools and techniques of project management. There are many factors that lead to delays and cost overruns in the construction projects. All the parties involved in the project, namely the contractor, the owner and the consultant, agreed on several main factors of cost escalation. Were monthly payment difficulties from agencies, poor contractor management, material procurement, poor technical performances, and escalation of material prices (Frimponga, Oluwoyeb, & Crawfordca, 2003).

The four most important factors agreed upon by the contractor, owner and consultant were shortages of materials, the financing of payment for completed works, changes in site conditions and poor contract management. The financing of and payment for completed works was ranked first factor by contractors, and ranked as the second factor by the owners and consultants. The reason is due to this that the prevailing culture within the construction industry that the government is responsible for project financing, and private sector involvement is also minimal for public projects. Poor contract management leads to a deficit in the contractor plan, a weak management of cost and a weak control over the overall management of the project. This is the result of either of the following factors:

- Lack of expertise in senior management and lack of skilled labor;
- level of productivity;
- Inadequate finances for short- and long-term purr-poses;
- An absence of specialization.



The third factor changes in the conditions of the site are the result of the inaccuracy and adequacy of the technical feasibility study of the site before the authorization of the project ( Mansfield , ugwu , & Doran, 1994).

It is worth emphasizing that the effectiveness of construction management on finishing a project on time and within budget can fall below expectation as a result of many uncontrollable factors, such as unknown field condition, activity sequencing, regulations, construction methods, lack of supervision, inexperienced management, morale/motivation, improper supervision and many other factors (EI-Choum M. K., 1995).

For many reasons, the actual costs of the projects are greater than the estimated cost of the project in the initial stages of project development. The use of an agency for the costing process, taking into account potential factors that lead to increased project costs, results in a significant improvement in the accuracy of the assessment. The following problems inherent cost estimation in the state highway agencies;

- Lack of coherence and integration in the assessments of all concerned;
- Lack of communication and integration between those responsible for project planning and those responsible for project cost estimation;
- Lack of communication between those responsible and those responsible for project implementation (Anderson, Molenaar, & Schexnayder, 2008).

### **2.5.3 Cost Overrun Factors Led to Escalation**

Cost overruns can occur as a result of several factors, including fluctuations in prices, lack of experience of construction contractors, increased material costs, economic situation and high interest rates imposed by banks and mode of financing, bonds and payments as well as fraudulent practices, thus escalating costs of construction projects (Rahman, Memon, Azis, & Abdullah, 2013).

The increase in costs in the construction projects in the Gaza Strip as a result of ten factors were increment of materials prices due to continuous closures, delay in construction, fluctuations in cost materials, supply of raw materials and equipment by contractors, unsettlement of the local currency in relation to dollar value, project materials monopoly by some suppliers, resources constraint: funds and associated auxiliaries not ready, improvements to standard drawings during construction stage,

lack of cost planning / monitoring during pre-and post-contract stages, design changes and inaccurate quantity take-off ( Enshassi, Al-Najjar, & Kumaraswamy, 2009).

Cost overrun is generally distributed between an owner and a general contractor, factor that directly affect cost estimate of project can be gathered into two groups: estimate specific, design and project specific factors.

Increased costs and time in construction projects are the result of material selection time and time of purchase, their availability in the local market and the presence of the supervising engineer. It is also important to estimate the duration of activities well according to the available worker and the equipment used, taking into consideration unexpected events and errors that may occur at the time of implementation of these activities. Delays in construction projects have negative effects on the contractor, leading to conflicts, problems, low productivity, increasing construction costs and thus impact on project objectives (Abedi & Fathi, 2011).

The key parameters which significantly impact cost overruns are: morale/motivation, social influence, feedback procedure, Improper supervision, lack of supervision, inexperienced management, unknown field condition, scope changes, design changes, activity sequencing, legal problems, financial availability, processing modification , documentation, estimate preparation, and contingency allocation (EI-Choum, Bachman, Ezeldin, & Brahim, 1997).

The main measure of project productivity is the cost scale or the cost performance. The difference between the planned cost of the project and the actual cost incurred when the completion is cost overrun. Here are six categories of reasons for increasing project costs:

1. Client causes delay in progress payments, frequent change orders during, late in approving design documents construction;
2. Contractor causes financial difficulties;
3. Consultant causes mistakes and discrepancies in design documents;
4. Labour causes high cost of labour, overtime issues;
5. Material & equipment causes poor material handling on site, inappropriate / misuse of material, poor procurement programming of material;
6. External cases security, market inflation, inappropriate type of project bidding and award, lengthy bureaucracy in government entities.

The unstable political situation represents a major threat to most projects that the owners wish to deliver in time and budget. The political situation is a major challenge for the construction stakeholders. Encounter with, as a result, most of projects are delayed which leads to cost increases. The delay in payments to the contractor is also a major factor in cost overruns because the contractor can not continue to spend on the project, this problem in most countries ( Niazi & Painting, 2017).

Based on previous literature review and historical cost escalation factors of construction studies on projects. Table 2.1 shows a summary of the main groups of factors that affecting in cost escalation of construction projects.

**Table 2.1 : Factors of cost escalation**

<b>Authors</b>	<b>Deviation</b>	<b>Factors</b>
Omoregie & Radford, 2006	Contractors consultants public clients	Price fluctuations
		Financing and payment
		Poor contract management
		Delay
		Changes in site conditions
		Inaccurate estimates
		Shortage of materials
		Imported materials
Creedy, 2006		Acceleration requirement
		Constructability
		Scope change
		Environmental issues
		Design error
		Safety
		Initiative government
		Cost material
Ameh, et al., 2010	Construction projects	Price fluctuations
		Additional works
		Delays
		Inaccurate estimates
		Fraudulent practices
Ameh, et al., 2010	Building construction	Project management
		Ground condition
		Information availability
		Estimating method
		Design
		Claims
	Groundwater	Scheduling deficiencies
		Cost estimates
		Inadequate control
		Inspection and testing delay
		Equipment
		Technical personnel
Knight & Fayek, 2000	Contractor's perspective	Payment difficulties
		Project size
		Location
		Drawings
		Regulatory approvals
		Ground conditions

**Table 2.1 : Factors of cost escalation (cont.)**

Knight & Fayek, 2000	Contractor's perspective	Weather conditions
		Supervision
		Estimation
		Knowledge of owner
		Crew
		Quality
Davey, 2000		Changes to requirements
		Technology costs
		Changing quotations
		Organizational stability
		Impact of risk
EI-Choum, 1995		Management
		Field condition
		Activity sequencing
		Construction methods
		Supervision
Muhammad, et al., 2015		Fluctuation
		Variation
		Government
		Estimation
		Financial control
		Lack of coordination
		Supervision
		Weather
Raniga, 2015		Inflation
		Market conditions
		Contingency
		Scope change
		Environmental and safety
Al-Hazim, et al., 2017	Contractors consultants owners	Financial problems
		Payments
		Political situation
		Poor communication
		Terrain conditions
		Weather conditions
Kaliba, et al., 2009		The size of the project
		Project scope
		Inflation
		Uncertainties
		Complexities administrative
		Project location

**Table 2.1 : Factors of cost escalation (cont.)**

Kaliba, et al., 2009	Project conditions
	Environmental
Mansfield , et al., 1994	Financing
	Poor contract management
	Site conditions
	Shortages of materials
	Culture
Rahman, et al., 2013	Lack of experience
	Material
	Fluctuation
	Design changes
	Economic stability
Enshassi, et al., 2009	Materials prices
	Delay
	Currency unsettlement
	Resources constraint
	Drawings
	Design changes
Renuka, et al., 2014	Scope and design changes,
	Technology
	Site conditions
	Inflation
	Inflation
	Economic condition
	Skills
	Safety
Abedi & Fathi, 2011	Material
	Local market
	The supervising engineer
	Activity duration
	Mistakes
	Delays
	Contractors performance
Frimponga, et al., 2003	Payment difficulties
	Poor contractor management
	Material procurement
	Technical performances
	Material prices
EI-Choum, et al., 1997	Motivation
	Social influence
	Feedback procedure
	Improper supervision

**Table 2.1 : Factors of cost escalation (cont.)**

EI-Choum, et al., 1997	Management
	Field condition
	Design and scope changes
	Financial

## 2.6 Implications of Cost Escalation

In any segment of the factors, the cost estimates are minimized. The results of the initial projects are often determined based on the estimated cost, time schedule, quality required and finally the satisfaction of the owner. Any factor of cost escalation causes taint to the owner, the contractor and the designer (Shane J. , Molenaar, Anderson, & Schexnayder, 2009).

Escalation principle used in purchase contracts contributes to rising prices because it allows rising costs to be passed on too easily. The same unfavorable trend can result from escalation in wage contracts. It may be necessary to include some price protection in the contract, since the length of the contract increases the potential risk. Only wide price swings should be covered, not minor fluctuations. Price escalation should be used to protect against drastic price increases rather than to guarantee a desired profit (C&EN center , 2001).

To the client, it means less return on the investment. Since the project is now completed at a cost in excess of the earlier agreed sum. And to the end user, the added costs are passed on as higher rental/lease costs or prices. To the consultants, it means inability to deliver value-for-money and could tarnish their reputation. It may result in loss of confidence reposed in them by clients. To the contractor, it implies loss of profit through penalties for non- completion, and negative word of mouth that could jeopardize his/her chances of winning further jobs, if at fault. Therefore, projects successes affects all the construction stakeholders including government (Muhammad, et al., 2015).

Schedule overruns is important factor of cost escalation, its effects in construction project as Time overrun pushed to the late completion or late delivery, from the time specified or agreed by all parties of the construction project. Cost overrun, when a

project is completed at a cost higher than what was budgeted, it is said to experience a budget overrun. Dispute and Claims arise because of the losses incurred through schedule overruns. Arbitration, that projects would have extra costs and time consequences related to the engagement of professional arbitrators in cases of disputes that go through arbitration. Litigation can lead to court cases for resolution especially when large penalties are at stake. Total project abandonment, schedule overruns in project execution could lead to total abandonment if issues leading to the overruns are not resolved timeously as show in Figure 2.1 (Mukuka, Aigbavboa, & Thwala , 2015).

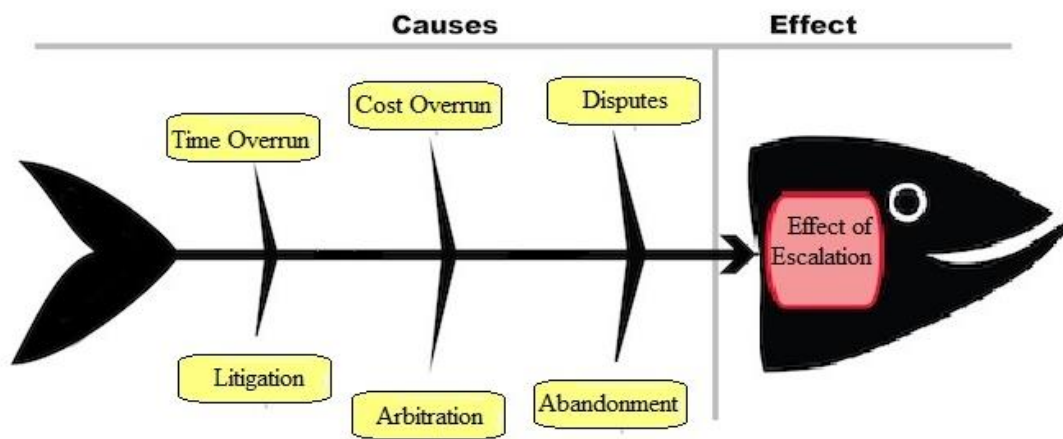


Figure 2.1 Fish-Bone Diagram of six effects of escalation

## 2.7 Cost Escalation Analysis

Inflation in the prices of materials and equipment, especially long-term construction projects, leads to disputes between the owner and the contractor. In these cases, the judgment is used according to the items of materials and equipment that were agreed upon at the beginning of the work in order to ensure fair settlement of disputes arising due to the problem of changes in prices. Where the analysis of the prices of the materials used to determine the amounts of the costs of these materials to be a fair method for the owner and the contractor. Where these methods are often used to estimate costs:

- Contract administration;
- Construction cost estimating;
- Mediation and arbitration support;
- Litigation support.

Material escalation analysis is a neutral and fair way to mitigate claims and disputes for both the owner and the contractor ( Spire Consulting Group, 2017).



To deal with the problem of escalating prices in construction projects. Contract documents and conditions of tender play a key role in the governance of these problems. The implementation of the work is done in a timely manner. The clear contract document leads to the prevention and resolution of disputes arising as a result of rising costs. The existence of conditions for the escalation of costs in tender documents is necessary. These conditions oblige the property owner to establish a special financial provision for compensation and reimbursement in the event of the problem of escalating costs due to economic changes and fluctuations in the cost of the contract clauses. This includes methods for calculating the escalation of the prices of building materials to compensate the contractor fairly, taking into account the responsibility of the contractor. The contractor depends on the current market indicators and does not know what may happen in the future of economic fluctuations, especially projects that have a different nature from other projects.. Due to frequent rise in the prices of materials and wages of labour, the contract rates of the various items of work are affected adversely for the contractor who could not visualize such a steep rise and therefore could not include the same in his tender rates (Chaphalkar & Sandbhor, 2012).

The unexpected increase in the prices of building materials leads to damage to all workers in the construction industry and financial difficulties for the suppliers, the general contractor, the subcontractor and the owner. Consequently, differences arose between all parties due to the increase in the prices of building materials. The project is affected by quality or time or stopped construction. There are many reasons that lead to the increase in costs on projects in recent times, especially construction projects as a result of the high prices of materials used in construction, such escalation is the result of strong market local and international alike, as well as aspects of the construction industry that make it particularly susceptible to above-average cost increases.

The impact on the construction industry of the recent, unprecedented price escalation has been multifold:

- Delayed or cancelled projects;
- Lack of firm price quotes;
- Reduced numbers of bidder;
- Higher project costs;
- Stolen construction materials ( Gallagher & Riggs , 2006).

A critical area to be included cost escalation is material cost fluctuations, volatile and frequent fluctuations in specific areas, such as petroleum-based products, including roofing and asphalt. Natural resources, such as cement for concrete, lumber, and copper also experience fluctuations as well as iron ore and recycled steel in the domestic and world markets. Material cost fluctuations can have a drastic impact if escalation is not factored. Cost escalation adjustment is most impactful during long-term capital planning projects. Contractors and clients who do not consider an adjustment in their estimates for labor and material escalation will not have an accurate picture of project cost. Clients will have more confidence in their projects when they work with contractors who factor in cost escalation in their projects (Poskin, 2016).

There are several classifications for the problem of cost escalation in projects. There are three basic classifications of cost escalation, which are as follows: day one-dollar one escalation clauses, significant dollar increase escalation clauses, and delay escalation clauses.

Day one-dollar one escalation clauses reimburse The contractor shall cover the costs of any increase in prices related to the materials and equipment for the project from the date of signing the contract or acceptance of the application. On the other hand, the owner shall pay compensation to the contractor in the event of price increases materials and equipment before signing the contract.

Significant dollar increase escalation clauses are calculated to reimburse the subcontractor only for the large price increases, which occur in materials or equipment between the bid or contract date and the date of installation. This type of escalation transfers the responsibility for the small increase in prices to the subcontractor, while the large price increase transfers responsibility to the general contractor or the owner.

Delay escalation clauses are this type of escalation allows the contractor to get advantages if the project is delayed for a certain number of days, it does not bear the problems of escalating costs. The contractor does not bear excessive prices and expenses that arise during the delay period in the project. (Stokes, 2010).

Cost escalation has negative implications for both construction stakeholders and the industry in general. The increasing level of fragmentation in construction projects fostered its complexity; raising the significance of rigid coordination that assures high level of integration amongst stakeholders (demand and supply sides) if the project to be

successfully completed. In addition, close interaction with suppliers necessitates information flow, cooperation, openness and transparency (Malkat & Byung, 2012).

Industrialized construction applies production processes and technologies from the manufacturing sector to construction in order to improve key project objectives of time, cost, quality, environment and safety. It is much more complex with various overlapping definitions used throughout the literature, including: off-site production, offsite manufacturing, Prefabrication, modern methods of construction, Industrialized Construction, and modular construction. Found a saving of up to 20% compared to on-site construction time, following adoption of off-site prefabrication. It is a point to numerous indirect cost benefits associated with offsite prefabrication associated with reduced site preliminary costs, reduced site congestion, and earlier income generation for clients, also reduce safety risks due to, less site congestion and removing operatives from a dangerous site environment to a controlled factory environment with better working conditions (Goh & Loosemore, 2017).

The problem of high costs of construction contracts has become a permanent problem for projects, despite the full knowledge of the reasons for the problem of high costs of contracts, but it occurs in almost all projects and the main reason is the inaccuracy of the estimate or increase the actual cost of the estimated cost. The three most important items as agreed by the three professions are:

- Shortage of materials;
- Finance and payment for completed works;
- Poor contract management.

Shortage of materials may result from any or all of the following:

1. Lack of proper estimation of the availability of the materials used in the project in the local market;
2. Fluctuations in the prices of materials used as a result of economic or political conditions;
3. Vary long average waiting time and uncertainty in the delivery of ordered materials;
4. Shortage of funds to procure materials and inadequacy in transportation.

This has a direct impact on the weakness of the construction industry in the society because of the direct dependence on materials, techniques and equipment imported from abroad. It is also the result of the design without knowing the details and information about the project. The weakness is also not due to their reliance on imported materials but also the lack of an appropriate working environment (Okpala & Aniekwu, 2006).

Cost escalation is often called several names, such as inaccurate cost estimates or cost overruns. All construction costs measure actual costs minus estimated costs in percent of estimated costs. The actual cost of the project is known when the actual and real construction costs incurred by the project and determined at the completion of the construction phase. Estimated costs are defined as budgeted, or forecasted, construction costs at the time of decision to build. Although the project planning process varies with project type, country, and time. During this stage, anyone has the right to request any unknown point in the stages of the project or change any activity before making the decision to start work. Usually a cost estimate was available at this point in time for the decision makers. If not, then the closest available estimate was used, typically a later estimate resulting in a conservative bias in our measure for inaccuracy. Various cost estimates are made at different stages of the process: project planning, decision to build, tendering, contracting, and later renegotiations. Where the accuracy of the estimates at each stage from the previous because of the clarity of ideas and activities to be implemented so that more details and more accurate quantities and information on prices are identified (Flyvbjerg, Holm, & Buhl, 2002).

## 2.8 Summary of the Literature Review

Price increase or escalation is a major problem of the construction industry in both developed and developing countries according to most of the researchers.

The causes of cost escalation in construction projects are different and sometimes difficult to manage. There are two types of causes of price escalation envisaged, internal cause, which can be controlled by the estimator, and external in which the estimator does not take control of and governed globally.

According to the review, project owners identified five reasons for project cost escalation: these reasons were, incomplete drawings, poor pre-planning process, escalating cost of materials, lack of timely decisions and excessive change orders. Contractors identified reasons of cost escalation these reasons were, supervision, knowledge of owner, material availability, payment, price fluctuations. Project consultants identified five reasons for project cost escalation; these reasons were poor management, inaccurate estimations, shortage in material, delay, inspection and testing.

Furthermore, cost escalation is attributed to problems in finance and payment arrangements, poor contract management, material shortages, changes in site conditions, design changes, mistakes and discrepancies in contract documents, mistakes during constructions, price fluctuations, inaccurate estimating, delays, additional work and shortening of contract periods.

## Chapter 3 Methodology

### 3.1 Introduction

The previous chapter presented reviewed literature on the problem of escalation costs in the construction projects in the world in general and the Gaza Strip in particular. In this chapter, we talk about a complete outline of the study methods used in the search, target locations, the target sample, size, the expansion of statistical factors and including validity and stability, as well as opportunities used in this research and the characteristics of the research analysis methods.

### 3.2 The Research Type

This research deals with a problem that emerged through monitoring the local market and its impact on construction projects, supplemented by research questionnaires designed to assess the factors that affect on cost escalation of construction project in Gaza strip.

In this research, the projects are examined to explore the problems and factors that lead to the escalation of costs in construction projects in the Gaza Strip.

It is also descriptive in that it aims at describing the possible effects of cost escalation of construction projects in Gaza and identifies the variables for the cause of the occurrence.

### 3.3 Methodology for This Research

The main objective of this research is to identify the factors that affect the cost escalation in construction projects in the Gaza Strip. The methodology of this research is to achieve the following objectives:

**3.3.1 Concerning objective one:** (To review the current situation of cost escalation in construction project)

It's shown from previous studies discusses in literature view that problems in project costs and cost estimates lead to the failure of construction projects where there are many reasons and problems that lead to this result. In Gaza strip, there are many construction projects fail due to cost escalation. In Gaza strip, construction projects cost escalation problem appears through different directions and stages. There are many

construction projects fail in labour, material, changes objective and others indicators that causes escalation.

### **3.3.2 Concerning objective two:** (To identify the factors that affect cost escalation of construction projects)

The literature on the problem of rising costs in construction projects has been reviewed in order to identify factors that affect the cost escalation in projects. In addition, other factors have been added to the research that are suitable for the construction projects in order to suit the research of the reality of the Gaza Strip. These factors were the recommendations of expert engineers in the field of construction. These factors are permits and regulatory approvals, the availability of materials and problems of the site.

In the previous studies and literature, 36 factors were chosen to escalation costs. These factors were divided into six groups, each of which was complemented by a number of factors, including close relationships. These groups aim to provide a comprehensive summary of the problem of rising costs in construction projects. Where the factors are selected and the factors recommended by the engineers that fit the construction projects in the Gaza Strip are added.

### **3.3.3 Concerning objective three:** (To investigate the reasons that increases the cost escalation of construction projects)

Investigate and study the factors that lead to cost escalation in projects, conduct appropriate statistical analyzes and make recommendations and suggestions on the problem of escalating costs in the Gaza Strip.

To determine the importance of each factor form other to the target parties of the questionnaire from the owner, contractor and consultant, the performance index RII was used as a guideline. It is calculated by the following equation (Ugwu and Haupt, 2007):

$$RI = \frac{\sum w}{A \times N} \quad Eq \dots (1)$$

Where:

- W is the weight given to each factor from 1 to 5
- A = 5
- N = total sample number

### 3.4 Research Methodology Diagram

To give full description of the research process, several steps should followed to organize the research flow. Figure (3.1) shows the steps of research, which followed in this thesis.

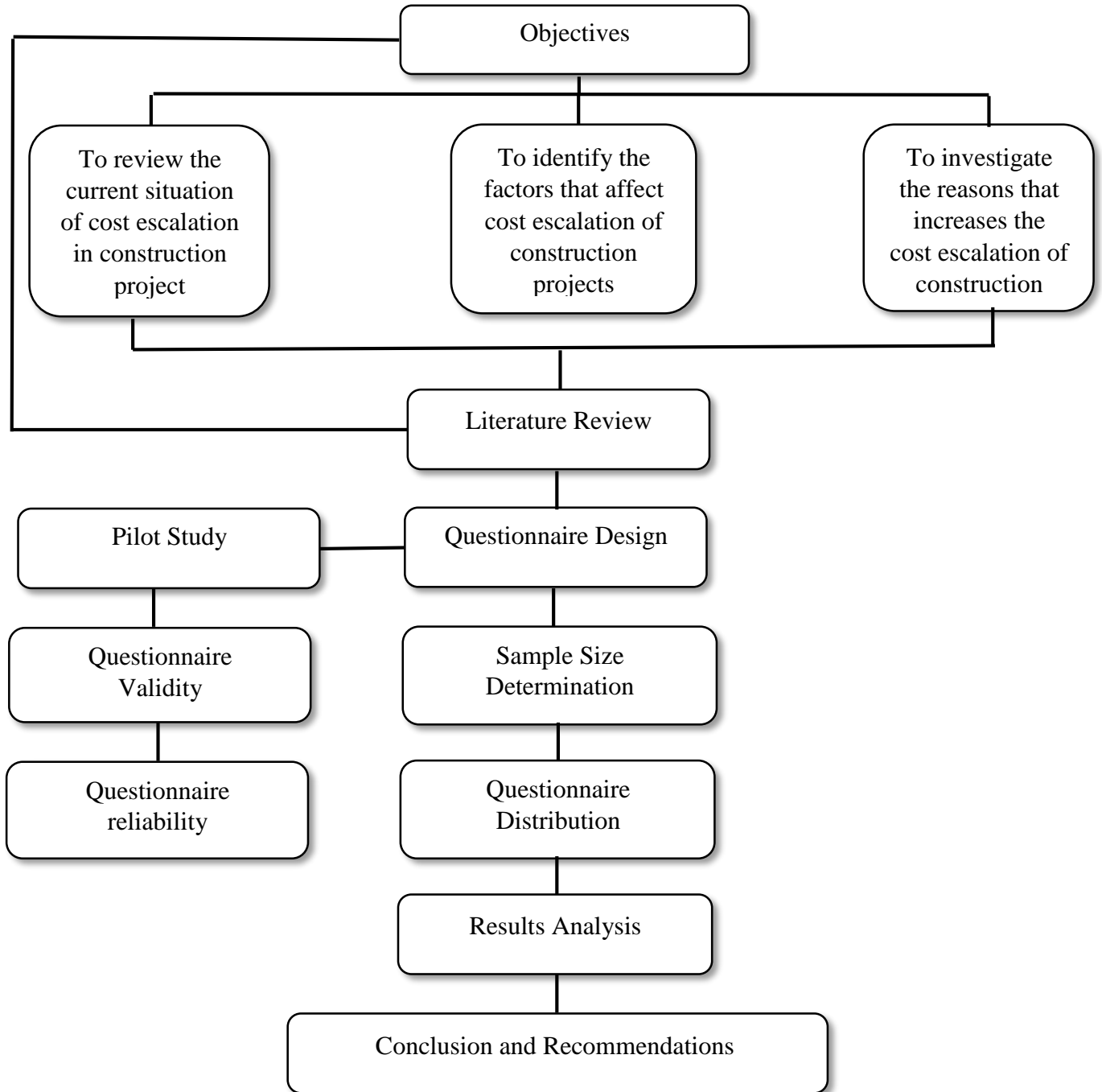


Figure 3.1 Research Methodology Diagram



### 3.5 The Study Scope and Limitation

Cost escalation of construction in Gaza has been a major growing challenge of construction over the last decade as explained in the previous section. Therefore, to address the matter, the researcher found it appropriate to target populations from stakeholders in the construction industry that is contractors, consultants and employer.

Since the assessment of the cause and effects of cost escalation of construction project in Gaza is a topic that has not been well covered by earlier researchers, unavailability of adequate documented information related to the subject matter has created inconveniency and has made it difficult for the researcher to construct ideas easily based on the objective of this research.

The major limitations of the research were lack of willingness of professionals in the construction industry to provide cost information and the amount of considerable time laps it took to complete and return the questionnaires by the respondent.

### 3.6 Data Source and Collection

The data collection approach adopted for conducting this research includes basic documents, respondents and archival documents. Besides desk study as the primary data source for this research.

Clients (project owners), contractors and consultants were the target groups included under the framework of the questionnaire. Contract documents, Tender documents, correspondence letters, Bid documents, Civil engineering journals, Internet sources, as well as reviewing related archival documents were the main source of archival documents used to supplement the findings of this research.

The questionnaire was designed to obtain a response rate from the target group at high accuracy. A Likert's scale was used to determine the answers from 1 to 5 , as shown in the Table 3.1.

**Table 3.1 Likert's scale**

<b>Item</b>	<b>Very Low Important</b>	<b>Low Important</b>	<b>Medium Important</b>	<b>High Important</b>	<b>Very High Important</b>
<b>Scale</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>

The two reasons given why this simple scale approach is adopted are:

- Data collection in an easy way:
- Use an easy and simple way to answer questions.

Likert's-scale is used to determine the opinion of the respondents. Where the respondent must clarify his opinion with the appropriate scale.

Identifying the variables due to the cost escalation of construction projects in the Gaza Strip is the first task envisaged in the research. Respondents are then asked to agree on these variables to influence the escalation cost of the Gaza Strip project. Respondents therefore choose one of the following based on their expectations.

Upon completion of data collection on the reasons for the escalating costs of construction projects in Gaza, responsible parties from industry stakeholders should be identified for cost escalation; then questionnaires are prepared in such a way that detailed information can be collected in a regularly prepared matrix table.

### 3.7 Sample Size Determination

The sample size that represents the targeted population, which classified by Palestinian contractor union and calculated from following Cochran formula equation:

$$n = \frac{n'}{[1 + (n'/N)]} \quad Eq \dots (3.2)$$

Where:

- N = population number
- n= sample size of population
- n' = sample size from infinite population  $n' = \frac{S^2}{V^2}$

Where  $S^2$  is the variance of population and V is a standard error in population sampling usually  $S = 0.5$  and  $V = 0.05$  (Bartlett, 2001).

Based on Palestinian contractor union (2016), it is shown that there is (252) classified companies. The size of the sample calculated by using the equation (3.2),

$$n = \frac{0.5^2/0.5^2}{\left[1 + \left(\frac{0.5^2/0.5^2}{252}\right)\right]} = 67.75$$

The sample was selected from engineering offices for 2016, where they selected a consultant classification = 69

$$n = \frac{0.5^2/0.5^2}{\left[1 + \left(\frac{0.5^2/0.5^2}{69}\right)\right]} = 30.22$$

The total target sample consisted of government institutions and associations NGOS operating in the field of construction the population of owners = 50

$$n = \frac{0.5^2/0.5^2}{\left[1 + \left(\frac{0.5^2/0.5^2}{50}\right)\right]} = 26.1$$

In this research, 120 questionnaires were distributed, (82) questionnaires were returned completed, 23 losses and 15 incomplete. Showing (69 %) response rate divided as (30) contractors, (31) owners and (21) consultants, which is accepted in respect to the unstable construction industry conditions in the Gaza strip.

### **3.8 Data Collection**

In this research, the questionnaire was selected as a means of data collection, as the questionnaire is probably the most commonly used data collection technique for conducting surveys. The questionnaires were widely used in descriptive and analytical surveys to identify facts, views and perspectives (Naoum, 2013).

### **3.9 Research Location**

This research is aimed at the construction projects are water and wastewater, buildings, roads and transportation in the Gaza Strip. This research focuses on the governorates of the Gaza Strip, which consist of five governorates: North Gaza, Gaza, Central, Khan Yunis and Rafah.

### **3.10 Pilot Study**

Pilot study is a method and tool used to identify and correct the defects in the questionnaire by presenting them to a group of experts in the field of study. The pre-test phase of the questionnaire is an important stage to determine the validity and reliability of the data used in the questionnaire. The questionnaire was discussed with seven experts who are working in construction companies. The pilot study led to some modification to the questions. Some other questions were added. Some questions have

been rearranged to give a more relevant, consistent meaning and some redrafted questions.

### **3.11 Validity of the Research**

Validity in scientific research represents the accuracy of the research on the measurement of the purpose for which it is designed, the extent to which the research tool is provided with information related to the research problem from the study community itself. Some many understand Validity as a reward for dishonesty, but this is a misconception. Truth is linked to a specific goal. There are several classifications of Validity in scientific research: Virtual Validity, that refers to any level that measures the measure of the data collection tool for which the study was designed in a virtual way. Trigonometric Validity, which means the degree to which the scale of research can distinguish between persons who are known to differ in origin. Predictive Validity and aims to know the extent to which the measure of honesty prediction in providing the academic researcher with information to help him to identify and determine the variances and future differences. Content Validation, the validity of the content defines the extent to which the measure reaches the measurement of the characteristics of the object that the research aims to measure. (Heffner, 2004). The first test is the relevant validity test standard (Spearman test) that measures the correlation coefficient between each paragraph in one field and the entire field (Polit & Hunger, 1985).

#### **Criterion Related Validity**

The survey sample measures the consistency between the coefficients and the main group, which consists of six groups by measuring the correlation coefficients between each paragraph in one field and the whole sum. Validation test results for all categories of questionnaire shown in Tables 3.2.

#### **Structure Validity of the Questionnaire**

The validity of the structure is the statistical test used to test the validity of each field and thus test the validity of the entire questionnaire. Measure the correlation coefficient between a field and all areas of the questionnaire that have the same level of Likert scale. Table 3.2 shows the correlation coefficient for each category and a complete questionnaire. The values of p (Sig.) are less than 0.05, so the correlation coefficients for all fields are significant at  $\alpha = 0.05$ , thus producing the validity of the

fields and the validity of the questionnaire and thus achieving the desired objectives of the research.

**Table 3.2 Spearman Correlation**

No.	Field	Spearman Correlation Coefficient	P-Value (Sig.)
1.	Project level	0.942	0.0005
2.	Supervisory level	0.905	0.0002
3.	Activity level	0.813	0.0006
4.	Owner level	0.873	0.0000
5.	Labour level	0.797	0.0007
6.	Equipment level	0.784	0.0003

### 3.12 Reliability of the Research

Stability is also indicated by reliability, and the extent to which data collection tools are free from measurement errors is the extent to which the test is measured for the attribute that the researcher wants to measure. Test scores are constant when the test measures a given feature in a consistent measure in different circumstances that may lead to measurement errors. Stability is therefore useful for accuracy in measurement and also for the effect of random errors of measurement on the stability of grades. Stability is also known as the ability of the instrument to achieve the same results in the case of re-measurement more than once on the same person and in the same circumstances (Polit & Hunger, 1985).

$$\alpha = \frac{k \times r}{1 + (k - 1) \times r} \quad Eq \dots (3.3)$$

The coefficient of Alpha Chronbach was calculated for each field of the questionnaire. Alpha-identical values that the mean and differences in the original measurements are not very different, so unification does not make a big difference in alpha.

**Table 3.3 Chronbach's coefficient alpha**

No.	Field	Cronbach's Alpha
1.	Project level	0.856
2.	Supervisory level	0.843
3.	Activity level	0.851
4.	Qwner level	0.775
5.	Labour level	0.717
6.	Equipment level	0.840
Total		0.968

Alpha values are shown in Table 3.3 showing the reliability of each field of the questionnaire and the entire questionnaire. Where the alpha values reflect a higher degree of consistency. Alpha Chronbach's values range from zero to one. Where the values of alpha Chronbach's in the range of 0.7 and 0.856 as shown in Table 3.3. This range is high reliability and the result ensures the reliability of each field of the questionnaire. Alpha Chronbach's equals 0.968 for the entire questionnaire and the result of the high reliability is therefore the complete questionnaire has a high reliability.

### 3.13 Hypothesis Test

This method is used to test the differences in opinion between the target parties in the research by owner, contractor and consultant regarding factors affecting cost escalation in construction projects, Kendall's Coefficient of Concordance is also used according to two hypotheses. These hypotheses are:

The Null Hypothesis (H0) is:

*There is no agreement in the ranking of factors affecting cost escalation in construction projects in Gaza strip between groups of respondents.*

The Alternative Hypothesis (HA) is:

*There is an agreement in the ranking of factors affecting cost escalation in construction projects in Gaza strip between groups of respondents.*

Kendall coefficient of compatibility ranges from the lowest value of zero to the highest value of one. The Kendall coefficient is used to determine if there is an agreement between the factors and groups that affect the escalating costs of construction projects for each owner, contractors and consultants. The following equation illustrates how the Kendal coefficient is calculated (Frimpong et al, 2003):

$$W = \frac{12U - 3m^2 \times n(n-1)^2}{m^2 \times n(n-1)} \quad \text{Eq .... (3.4)}$$

Where:

$$U = \sum_{i=1}^n (\sum R)^2 \quad \text{Eq .... (3.5)}$$

- n = number of factors;
- m = number of groups;
- j = the factors 1,2,...,N.

If the calculated value of p as shown in Table 3.4 is greater than the critical value, hypothesis H0 is rejected, meaning between the groups there is evidence that there is statistical significance. If the calculated value of p is less than the critical value, hypothesis H0 is accepted, meaning that between the groups there is no evidence of statistically significant agreement.

**Table 3.4 Summary of correlation test on the ranking of factors affecting price escalation**

Field	W	Chi-Square	P-value	Decision
Project Level	0.552	144.072	0.0007	Reject H0
Supervisory Level	0.33	86.13	0.506	Don't reject H0
Activity Level	0.527	137.547	0.0003	Reject H0
Owner Level	0.537	140.157	0.0005	Reject H0
Labour level	0.586	152.946	0.0009	Reject H0
Equipment level	0.507	132.327	0.001	Reject H0

### 3.14 The One-Way ANOVA Test

The One-Way ANOVA ("analysis of variance") test used to compare averages or a decision on the existence or absence of differences between the performance averages of groups with different treatments in order to arrive at the factors that make average averages different from other averages. ANOVA measures the relationship between Population Characteristics and Main Groups.

**The null and alternative hypotheses of one-way ANOVA can be expressed as:**

The Null Hypothesis (H0) is:

*There is no statistically significant differences attributed to the personal information of the respondents at the level of  $\alpha \leq 0.05$  about the cost escalation factors in construction projects in Gaza strip.*

$$H_0: \mu_1 = \mu_2 = \mu_3 = \dots = \mu_k$$

all k population, population means are equal

The Alternative Hypothesis (H1) is:

*There is a statistically significant differences attributed to the personal information of the respondents at the level of  $\alpha \leq 0.05$  about the cost escalation factors in construction projects in Gaza strip.*

$H_1$ : At least one  $\mu_i$  different

At least one of the  $k$  population means is not equal to the others

Where

- $\mu_i$  is the population mean of the  $i^{\text{th}}$  group ( $i = 1, 2, \dots, k$ )

The F statistic is computed as:

$$F = \frac{MS_B}{MS_W} \quad \text{Eq .... (3.6)}$$

Where

$MS_B$  : within-group mean square =  $S_W / f_W$

$F_w$  : within-group degrees of freedom =  $a \times (n - 1)$

$S_w$  : within-group sum of square

### **View related results the relationship between Population Characteristics and Main Groups.**

- There is no a statistically significant differences attributed to the relationship between the work executed of the respondents at the level of  $\alpha \leq 0.05$  about the cost escalation factors in construction projects in Gaza strip.
- There is no a statistically significant differences attributed to the relationship between the respondent's designation of the respondents at the level of  $\alpha \leq 0.05$  about the cost escalation factors in construction projects in Gaza strip.
- There is no a statistically significant differences attributed to the relationship between the experience of respondents of the respondents at the level of  $\alpha \leq 0.05$  about the cost escalation factors in construction projects in Gaza strip.
- There is no a statistically significant differences attributed to the relationship between the cost of projects executed by the organization of the respondents at the level of  $\alpha \leq 0.05$  about the cost escalation factors in construction projects in Gaza strip.
- There is no a statistically significant differences attributed to the relationship between the number of projects executed of the respondents at the level of  $\alpha \leq 0.05$  about the cost escalation factors in construction projects in Gaza strip.



# Chapter 4 Data Analysis and Discussion

## 4.1 Introduction

The previous chapter dealt with the presentation of the methodology of research and the target group of research and methods of statistical analysis. This chapter deals with the analysis and discussion of the results obtained and comparing them with the previous studies. This survey identifies the main reasons that contribute to the escalation of costs through the data obtained from the target group of the contractor, consultant and owner in the Gaza Strip.

## 4.2 Respondent Characteristics

In this section deals with the basic information of the target group in terms of the nature of the company, the work carried out by the companies, information about engineers in companies, the number of projects carried out and the volume of business carried out by companies.

### 4.2.1 Type of Respondents Organization

In Figure 4.1, the nature of the target group of the questionnaire indicates that the number of consultants was 25.6% and the percentage of the owner was 37.8% and the percentage of the contractor was 36.6%. The percentage of all the target group of the questionnaire 69%. The number of questionnaires that collected 82 from the total of 120 questionnaires with a loss rate of 38 questionnaires.

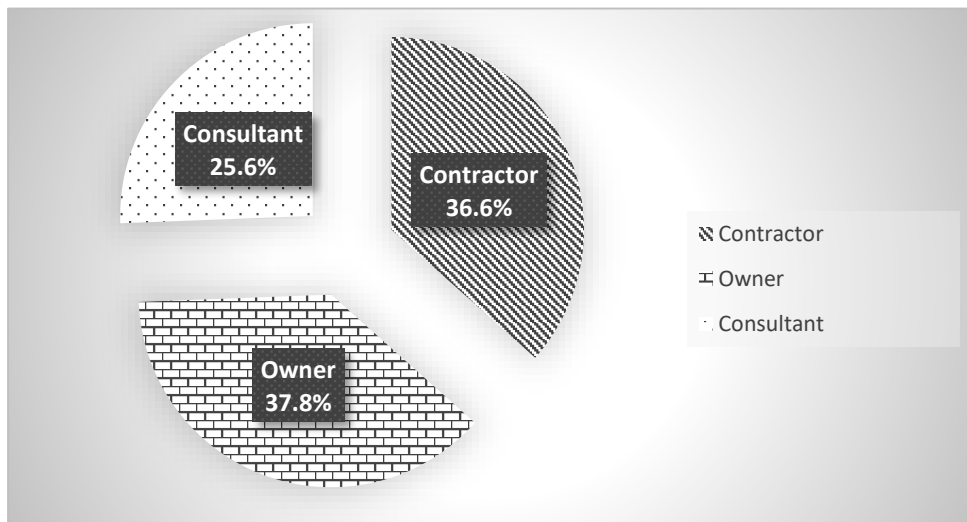


Figure 4.1 Type of respondents` organization

The reason for the lack of questionnaires filled by the contractor is the frequent work done by them and preoccupation throughout the working hours in monitoring and follow-up work and workers, the affinity between the owner and the contractor will have the same effect on the factors.

#### 4.2.2 Type of Work Executed by the Respondents Organization

Figure 4.2 shows that the building works represents was the highest field of work with 59.8 % (49), 22 % (18) of work was in roads, 18.3 % (15) in water and sewage projects. Most of respondents from building works so these results is reflects on the works of buildings in the Gaza Strip.

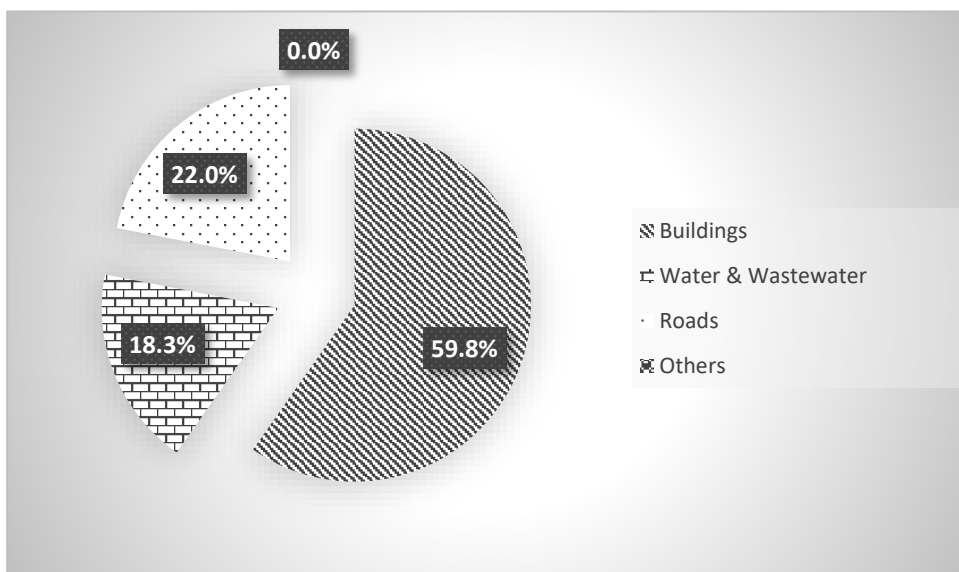


Figure 4.2 Type of work

#### 4.2.3 Respondents designation

Figure 4.3 shows that 40.2 % (33) of contracting companies respondents were Project manager, 52.4 % (43) were site engineer, 7.3 % (6) were quantity surveyor in construction organization. The proportion of project managers is large so that the experience factor from their point of view was more specific and credible in obtaining the results while the percentage of the quantity surveyor are small so they do not have a significant impact on the results.

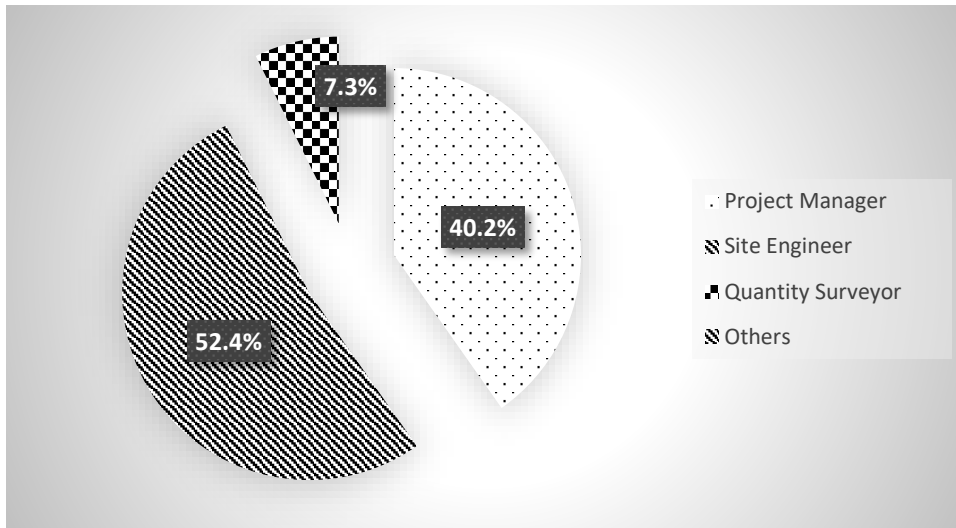


Figure 4.3 Respondents designation

#### 4.2.4 Experience of Respondents

Figure 4.4 shows that 3.7% (3) of the respondents firm have experience less than 5 years, 22% (18) between 5 to 10 years at construction works, 17.1% (14) between 10 to 15 years and 57.3% (47) have experience more than 15 years. The results show that most of the engineers who completed the questionnaire have a long history in construction and this is strengthen of the information collected through the questionnaire, where the ratio of newly graduated engineers amounted to a very small percentage, and this is another indication of the strength of information.

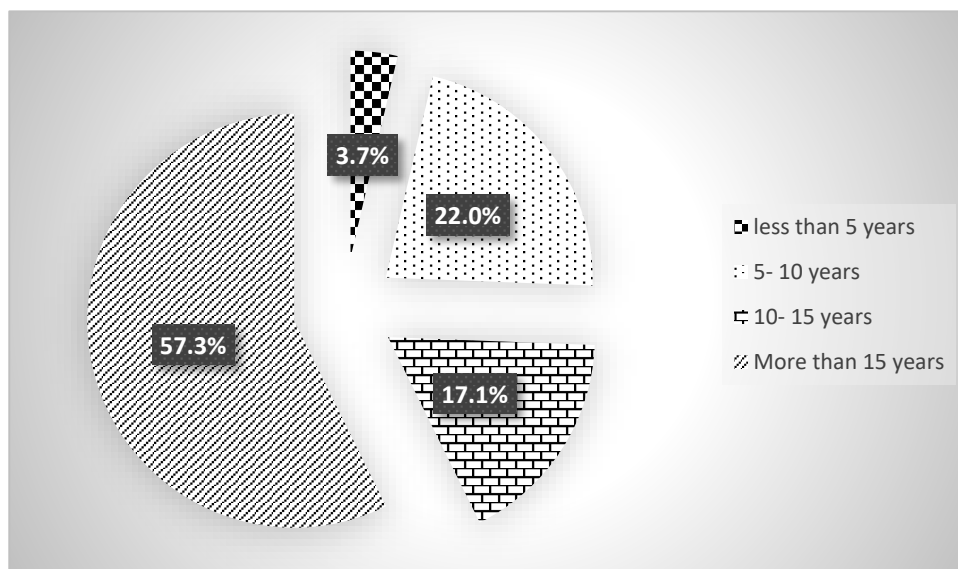


Figure 4.4 Experience of respondents

#### 4.2.5 Cost of Projects Executed by the Organization

Figure 4.5 shows that the number of companies implementing projects at a cost of \$ 5 million is 13.4 percent, while the proportion of companies that have implemented projects at a cost of \$ 5-10 million is 26.8%,The proportion of companies that implemented projects between 10 to 20 million dollars is 20.7% and the proportion of companies that have implemented projects at a cost of more than 20 million dollars is 39 %. The results means that, the companies, which included in this research have huge values of constructed projects, which need to more planning and strategies to win tender. The companies used deferent actions according to cost estimation process to win the tender.

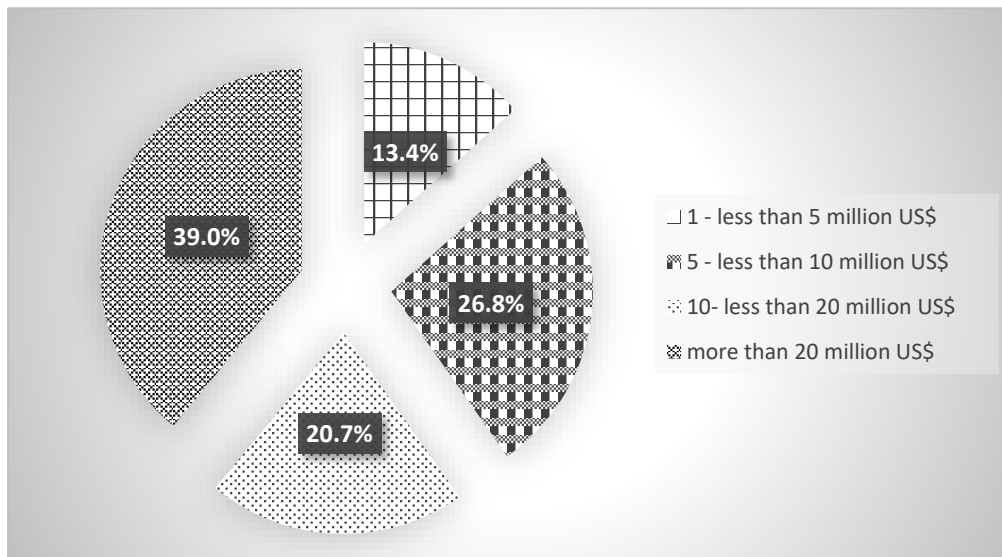


Figure 4.5 Value of executed projects

#### 4.2.6 Number of Executed Projects

Figure 4.6 shows that 39 % (32) of construction company executed between 1 to 10 projects in last five years, 14.6 % (12) of construction company executed between 11 to 20 projects in last five years, 17.1% (12) of construction company executed between 21 to 30 projects in last five years and 31.7% (26 ) of construction company executed more than 30 projects in last five years. It is clear that there is variety of projects carried out by construction companies between long-term projects and short-term projects during the past five years.

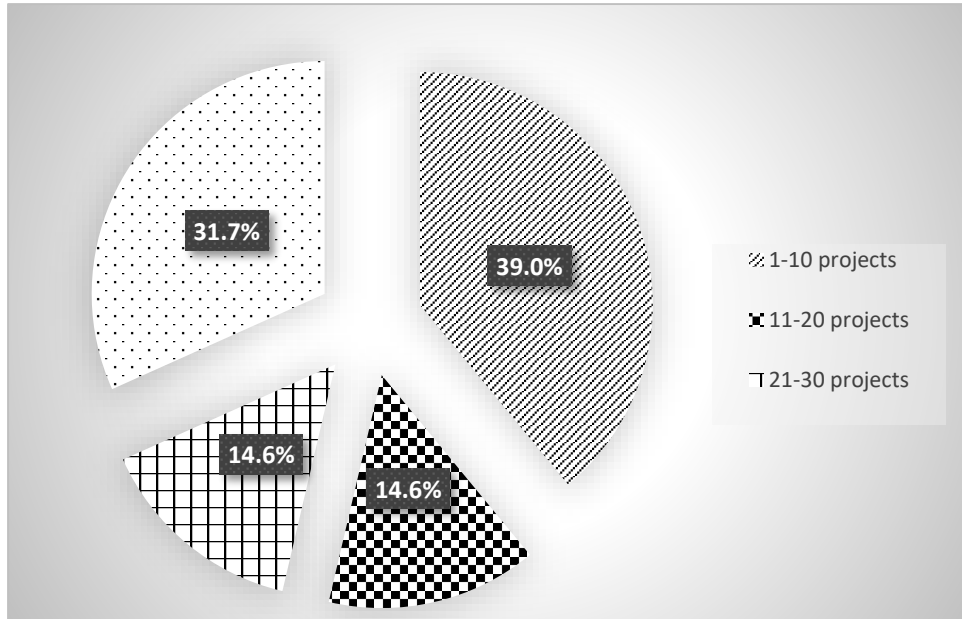


Figure 4.6 Number of executed projects

### 4.3 Part Two: Factors Influencing Cost Escalation in Construction Projects

This part shows the results regarding the six groups that considered as competitive advantages in contracting companies, which affect the cost estimation process as shown in Table 4.1:

Table 4.1 Groups of cost escalation factors

Group no.	Group name	Numbers of sub-factors
Group 1	Project level	7
Group 2	Supervisory level	3
Group 3	Activity level	7
Group 4	Owner level	4
Group 5	Labour level	9
Group 6	Equipment level	6

#### 4.3.1 Group One: Project Level

##### Contractors view

Table 4.2 shows that the contractor participating in the survey classified "regulatory approvals / Permits" in the first place with the importance index (R.I.I = 81.3 %), which indicates the high importance of permits/regulatory approvals of the work from the owner, doner and others party. Material that needs permits from the Gaza Reconstruction Mechanism (GRM). Israel imposes restrictions on the entry of

construction materials into the Gaza Strip, identifying them as dual use items that can be used for military purposes. The Israeli authorities must agree to international traders, organizations and residents interested in rebuilding their homes before they can import building materials. In addition, regulatory agencies may have permit or approval authority over portions of the proposed project.

Second important factor ranked by respondents contractors was "Project location" with importance index (R.I.I = 67.3 %). The importance of the place of the project in the identification of entrances and exits, places of installation, places of engineers and workers and the processing of the site with all the necessary technical connections from the supply of water, electricity, sanitation and other necessary supplies.

Table 4.2 shows that the respondents contractors ranked the "Weather conditions "(R.I.I=53.3 %) as the last factor because the weather don't mean to them any cost. The Gaza Strip weather almost in all seasons is stable for work expect the heavy rainfall days.

**Table 4.2 Factors at project level**

Groups/Factors	Contractor		Owner		Consultant		All respondents	
	RII	Rank	RII	Rank	RII	Rank	RII	Rank
Project size	0.667	3	0.735	1	0.657	4	0.690	2
Project location	0.673	2	0.574	4	0.581	6	0.612	4
Insufficient/ incomplete drawings	0.640	4	0.697	3	0.667	3	0.668	3
Permits/regulatory approvals	0.813	1	0.735	1	0.790	1	0.778	1
Ground conditions	0.580	5	0.568	5	0.610	5	0.583	6
Weather conditions	0.533	7	0.523	7	0.467	7	0.512	7
Unexpected utilities	0.580	5	0.555	6	0.743	2	0.612	4

### Owners view

Table 4.2 shows that the owners respondents ranked the "Permits/regulatory approvals and project size" (R.I.I = 73.5 %) as the first factors causing escalation in these group. The owners give the two factors the same important index. As the project size increases, the complexity of the project will often increase based on the total

available financial resources, the number of team members participating and the time to submit.

If the project don't have permits the cost of the project will increase more than the estimation of the project and makes delay of all activities of the projects.

On the other hand, the last important factor is "Weather conditions" with R.I.I of (52.3%). This means that, Gaza Strip weather almost in all years is stabile to work except the heavy rainfall days.

### **Consultants view**

Table 4.2 shows that the consultants respondents ranked the Permits/regulatory approvals (R.I.I = 79 %) as the first factor causes escalation. Owner, contractor and consultant give the permits the first important factor of this group.

The second factor cause escalation was "Unexpected utilities" (R.I.I = 74.3 %). The consultant likes to work within a clear plan and under working conditions so gives unexpected utilities that may appear in the work of great importance.

The consultants respondents as shown in Table 4.2 classify "Weather conditions"(R.I.I = 46.7 %) as the least factor that causes escalation in this group.

### **Kendall coefficient of concordance**

The values of Kendall coefficient of concordance (W) and the significance level (p) are found out to be 0.552 and 0.0007 respectively. As the coefficient of concordance (W) is more than 0.5 and significance level (P) is less than 0.05, the agreement among the parties is found acceptable with confidence level of more than 95%.

In the construction works that require the formation and approval of specific materials or equipment, the contractor shall move quickly to obtain such permits and approvals in order not to delay the work and to adopt any schemes requiring special permits, both at the work site and in the office. The contractor is responsible for obtaining the required permits and approvals where the work can be suspended unless the statements are obtained from the concerned authorities (Spot, 1999).

The three most important factors related to the project that affect the bias in estimating the early stage were the purchase method, the location and the size of the

project. It was believed that the consistency of the estimates is mostly influenced by the three factors but with the order of the project size first ( Pasco & Aibinu, 2012).

### 4.3.2 Group 2: Supervisory Level

#### Contractors view

Table 4.3 shows that contractors with respondents rated the "inspection / testing time" in the first place with the importance index (R.I.I = 87.3%). This means that the contractor knows that the establishment of bad relationships and disagreements with the supervisory staff will complicate all the project activities and delays to take the decisions to complete the work, tests and inspection, which will increase the costs of construction and increase the duration of the implementation of activities.

The contractor wants the inspection team to have the tests and inspections for work ready as soon as possible and without modifications so that he can carry out the activity and move to the following activities. Where the supervision team finds amendments and errors, the contractor must amend them and then re-request the inspection and testing of the workers before covering the activity and start the next activity. The completion of the inspection and inspection procedures increases the costs and delays of the activities. The contractor carries out the activities and the workers without obtaining the permits and approvals from the supervision team, is forced to stop the work and thus completely stop the project. (Spot, 1999).

The second important factor ranked by respondents contractors was availability of supervision (R.I.I = 82.7 %). The contractor needs the availability of the supervision in order to absolve himself of responsibility for the work done.

#### Owners view

Table 4.3 shows that the owner rated "availability of supervision" as the first factor in this group and the important index (R.I.I = 83.06%). The second important factor is the quality of supervision and the important index (R.I.I = 76.5%). This result is identical need good supervision to make high quality of the projects. The owner must appoint administrative and technical staff once the project is granted to arrange for it to be completed within a specified time with the required quality and estimated cost. The requirements of the owner of the supervision team is to implement the project at the



lowest cost, the best quality and the lowest possible time and implement the project according to the objectives of the owner (SGS Acquires the Assets of Geostrada, 2017).

### Consultants view

Table 4.3 shows that the responding consultants rated the "quality of supervision" as the first factor and the important index (R.I.I = 70.5%). The second factor that led to the escalation was the availability of supervision and the important index (R.I.I = 67.8%). The consultant have the same rank in this gropes as owner because they need to get work without increases cost and to meet quality. Lack of experience of staff, lack of attention and delay in taking decisions are factors that lead to the failure of the project and not to be based on the plan and specifications required (SGS Acquires the Assets of Geostrada, 2017).

**Table 4.3 Supervisory level**

Groups/Factors	Contractor		Owner		Consultant		All respondents	
	RII	Rank	RII	Rank	RII	Rank	RII	Rank
Quality of supervision	0.773	3	0.768	2	0.705	1	0.755	2
Availability of supervision	0.827	2	0.774	1	0.678	2	0.767	1
Time to await inspections/tests	0.873	1	0.542	3	0.619	3	0.683	3

### Kendall coefficient of concordance

The values of Kendall coefficient of concordance (W) and the significance level (p) are found out to be 0.33 and 0.506 respectively. As the coefficient of concordance (W) is less than 0.5 and significance level (P) is more than 0.05, the agreement among the parties is not found and not acceptable with confidence level of less than 95%.

### 4.3.3 Group3: Activity Level

#### Contractors view

Table 4.4 shows that contractors respondents ranked "Amount of rework" in the first position with importance index (R.I.I =74 %), which indicates that the rework affect both cost and schedule performance throughout the construction industry that's need from contractor to pay more attention. Re-work is an activity or task more than

once and is a waste of effort, time and money. Disposal of this phenomenon is impossible, but can be mitigated and minimized by the knowledge of the disadvantages of the adoption may be errors in design or lack of communication between the parties, the lack of information, the difficulty of implementation and complications in the work. In Canada, 108 field rework costs were summarized as follows: engineering 61% to 65%, human resource capacity 20-49%, materials and equipment supply 14.81%, contract planning and scheduling 2.61% while driving and communication 0.45% (Fayek , Dissanayake, & Campero , 2003). In South Africa, rework cost was found to be 13% of the value of completed project. It was also reported that rework cost in a research conducted by the Association General contractors of American on Time projects was 12.4% of the project cost (Rhode & Smallwood , 2002).

The contractor classified the importance of the complexity of the activity as a second factor with important index (R.I.I = 72.7%). Complexity impacts high risks, cost, time, law quality and more instructions with supervisors. Construction projects are complex because they contain many complex activities that increase uncertainty and change and lead to increased cost and time in construction projects. From the result of the refurbished/renovated buildings, wall experienced the highest contribution to rework costs 13.59%, followed by doors and windows 6.07%, next to this is finishing 5.603%, the result of this is not unexpected due to the degree of uncertainty and complexity of the work to be done ( Oyewobi, et al., 2011).

"Unrealistic schedule" (R.I.I = 70.83 %) was ranked as the last factor to cause escalation at this group. The contractor don't give the schedule any importance in Gaza projects.

### **Owners view**

Table 4.4 shows that the owners respondents ranked "Inaccurate estimate" (R.I.I = 77.4%) as the first factor to cause escalation at this category, and the "Unrealistic schedule" (R.I.I=77.4 %). This result is identical the inaccurate estimate make owner in risk price forcing the owner to compensate these risks from the contingency for price risk. The unrealistic schedule leads to escalation in project, noting that the owner needs finish project as soon as possible. The owner must follow the basic steps to control the project during the life cycle of the project from the idea to the operation. The estimated budget of the project should be adopted early on the basis of its estimates taking into

account the changes that may occur in stages The use of detailed estimates used in the budget because they reflect the state of the project progress and points that need to be followed up and attention. During the construction phase, the owner must match the actual cost of the project with the estimated cost and available budget. Reviewing costs is a necessity as they may have been shown as a result of orders of change by the owner or a rise in prices or a mistake in the budget estimate. Research has shown that project costs are constantly being depreciated. This reduction has been found to occur in 9 out of 10 transport infrastructure projects worldwide ( Flyvbje, Holm, & Buhl, 2002).

Respondents owners as shown in Table 4.4 ranked the "Repetitiveness of activity" (R.I.I=59.4 %) as the less important factor in this group.

### **Consultants view**

Table 4.4 shows that consultants respondents ranked the "Construction methods" (R.I.I=82.9 %) as the first factor causes escalating at this category. One of the most important things chosen by the consultant is the construction methods that's get most safe, lowest cost and quickly done. In the construction tunnel projects show the importance of using different methods of implementation and comparison of many methods of implementation and choose the best of the most important factors that contribute to reduce the costs in construction of those projects ( Ioannou & Martinez, 1996).

The second factor to cause of escalation was "Inaccurate estimate "(R.I.I = 80 %). This result reflects that both owner and the consultant agree that the correct assessment is the most important things for the success of the project.

The consultants respondents as shown in Table 4.4 classified "Repetitiveness of activity" (R.I.I = 55.2%) as the least factor to cause escalation at this category. This result reflects that both owner and the consultant agree that repetitiveness of activity don't have any effects in escalation cost.

**Table 4.4 Activity level**

Groups/Factors	Contractor		Owner		Consultant		All respondents	
	RII	Rank	RII	Rank	RII	Rank	RII	Rank
Sequence of activities	0.700	4	0.697	5	0.610	6	0.676	6
Repetitiveness of activity	0.713	3	0.594	7	0.552	7	0.627	7
Complexity of activity	0.727	2	0.748	3	0.667	4	0.720	3
Construction methods	0.680	5	0.748	3	0.829	1	0.744	1
Amount of rework	0.740	1	0.690	6	0.667	4	0.702	5
Inaccurate estimate	0.673	6	0.774	1	0.800	2	0.744	1
Unrealistic schedule	0.667	7	0.768	2	0.714	3	0.717	4

**Kendall coefficient of concordance**

The values of Kendall coefficient of concordance (W) and the significance level (p) are found out to be 0.527 and 0.0003 respectively. As the coefficient of concordance (W) is more than 0.5 and significance level (P) is less than 0.05, the agreement among the parties is found acceptable with confidence level of more than 95%.

**4.3.4 Group 4: Owner Level****Contractors view**

Table 4.5 shows that respondents contractors ranked "Competence/knowledge of owner" in the first position with importance index (R.I.I = 80%). The important things for the contractor is knowledge of the owner in the nature of the project and the methods of construction to avoid the changes that done by owner and stop the work activities of the project. If the owner have properly prepared his documents ,properly scoped the work and properly administer the contract, changes should be able to kept to minimum, all that depend in owner knowledge in project (Griffin, 1993).

**Owners view**

Table 4.5 shows that the owners respondents ranked "Number of change/extra work orders"(R.I.I = 75.3%) as the first factor to cause escalation in this category. The changes and extra work that appear in the project are the most important things that affect the escalation of costs in the areas of the owner because they need additional

costs and additional time and may result in problems between the owner and the contractor on the cost of implementing these additional works. The main factors that are caused by the owner are the amendments in all its forms, whether adjustments in goals or modifications in the materials used or the replacement and addition of items and activities, where all these things result in an increase in costs (Knight & Fayek, 2000).

### Consultants view

Table 4.5 shows that the respondents consultants ranked the "Amount of interference or stop work orders"(R.II = 76.2 %). The consultants shows the interference demonstrated by stops work order, retesting, with holding of payments, threatened loss of an early completion, and other action geared to coerce the contractor to comply with the owners scheduling and rescheduling directives. The stop work orders of arrest appear when the supervisory team finds works or parts of the building that pose a danger and are incorrect. The arrest orders are in order to protect all parties from workers, engineers and all employees of the site or the end user of the building ( NASA Johnson Space Center, 2010).

**Table 4.5 Owner level**

Groups/Factors	Contractor		Owner		Consultant		All respondents	
	RII	Rank	RII	Rank	RII	Rank	RII	Rank
Competence/knowledge of owner	0.800	1	0.761	2	0.619	4	0.739	3
Amount of interference or stop work orders	0.780	2	0.755	3	0.762	1	0.766	2
Number of change/extra work orders	0.753	3	0.819	1	0.743	2	0.776	1
Time required to make a decision by owner	0.753	3	0.710	4	0.638	3	0.707	4

### Kendall coefficient of concordance

The values of Kendall coefficient of concordance (W) and the significance level (p) are found out to be 0.537 and 0.0005 respectively. As the coefficient of concordance

(W) is more than 0.5 and significance level (P) is less than 0.05, the agreement among the parties is found acceptable with confidence level of more than 95%.

### 4.3.5 Group 5: Labour Level

#### Contractors view

Table 4.6 shows that the respondents contractors ranked "Subcontractors and suppliers" in the first position with relative importance index (82%). The result indicates that underperformance in projects caused by subcontractors and suppliers as poor quality, low productivity and more cost and time that make bad relationships between contractor and clients. An outstanding feature of the construction industry is the contracting between the general contractor, the subcontractor and the suppliers. In the construction project (57%) of the works and parts that are carried out in the project by the subcontractor either in new construction works or the maintenance of buildings. The larger and more complex the project, the more subcontractors will be subcontracted ( Ajayi, Ayanleye, Achi, & Johnson, 2010).

The second important factor ranked by respondents contractors was the "Turnover and absenteeism" (R.I.I = 80.7 %). One of the most important things for the contractor is the absence of workers, which leads to the interruption of some work and the processing of it until the return of workers or contracting with other people. Absenteeism hurts productivity and costs money. One of the main problems affecting the construction industry and its employees, especially the contractor, is the absence of workers and turnover. These factors have been found to be the most important factors affecting the rising costs of the contractor because workers working in projects make between 40 percent and 60 percent of project costs. Therefore, the contractor needs to pay attention to the employment available to him to avoid absence and turnover ( Hanna , 2006). As a result of the absence of workers in projects, the contractor costs a large amount of time and money lost, as the more absent workers the more time and cost. This result appears in areas with low working manpower is more influential than others. Where the replacement of absentee workers with new workers will need to re-train and explain the nature of the business where they are not familiar with the work. The impact of the absence of skilled workers and experienced may be four days delay for each worker is missing. ( Intergraph Corporation, 2012).

Table 4.6 shows that contractors respondents ranked the "Amount of overtime worked" (R.I.I = 61.3 %) as the least factor that cause escalation. Unfortunately, in the Gaza Strip, contractors do not care about the amount of work carried out by the workers and they do not have the outcome without the workers' rights being preserved. Due to the absence of the role of accountability for the rights of workers and work in the Palestinian market with the spread of unemployment in society.

### **Owners view**

Table 4.6 shows that the respondents owners ranked "Quality of work (by subcontractors)" (R.I.I = 81.9 %) as the first factor. The owner always cares about the quality of the product so the quality of the subcontractor was given the highest rating.

"Availability of skilled labour" (R.I.I = 76.8 %) was ranked as the second factor by owners. In the construction projects, skilled workers are important factors that have an impact on the quality of the business and facilitate the delivery of the business in the least time and less costs and thus lead to the success of the project. The low productivity in the project and the frequent change orders and delay delivery of activities as a result of the adoption of the contractor a few skilled labor Or labor who do not have experience in the field of work. The lack of skilled labor is considered a danger to the completion of projects at all stages in construction of the project (Long & Burke , 2005).

Respondents owner as shown in Table 4.6 ranked the "Amount of overtime worked" (R.I.I= 59.4 %) as the least factor. In addition, the owner does not care about the extra time of the worker.

### **Consultants view**

Table 4.6 shows that the respondents consultants ranked the "Quality of work (by subcontractors)" (R.I.I = 81.9 %) as the first factor to cause escalation. The consultant's main tasks are to monitor the quality of the work and thus agree with the owner of this factor.

The second factor to cause escalation was "Subcontractors and suppliers and Availability of skilled labour" ( R.I.I =76.2 %) the two factors have the same rank. The respondents consultants as shown in Table 4.6 classify the "Overmanning and crowding" (R.I.I = 56.2 %) as the least factor. The consultant gave the least assessment

of this factor because the overmanning and crowding did not matter as much as the work done in time.

**Table 4.6 Labour level**

Groups/Factors	Contractor		Owner		Consultant		All respondents	
	RII	Rank	RII	Rank	RII	Rank	RII	Rank
How well crew works together	0.753	5	0.703	5	0.695	5	0.720	5
Morale/motivation of crew	0.720	7	0.639	7	0.619	7	0.663	7
Availability of skilled labour	0.800	3	0.768	2	0.762	2	0.778	2
Amount of work/workload	0.740	6	0.723	4	0.714	4	0.727	4
Overmanning and crowding	0.653	8	0.613	8	0.562	9	0.615	8
Amount of overtime worked	0.613	9	0.594	9	0.581	8	0.598	9
Subcontractors and suppliers	0.820	1	0.742	3	0.762	2	0.776	3
Quality of work (by subcontractors)	0.780	4	0.819	1	0.819	1	0.805	1
Turnover and absenteeism	0.807	2	0.684	6	0.629	6	0.715	6

### **Kendall coefficient of concordance**

The values of Kendall coefficient of concordance (W) and the significance level (p) are found out to be 0.586 and 0.0009 respectively. As the coefficient of concordance (W) is more than 0.5 and significance level (P) is less than 0.05, the agreement among the parties is found acceptable with confidence level of more than 95%.

### **4.3.6 Group 6: Equipment Level**

#### **Contractors view**

Table 4.7 shows that contractors respondents ranked "Availability" in the first position with importance index (R.I.I = 92.7 %). Availability of equipment is important to the contractor in order to get the job done quickly. Lack of equipment causes many problems such as: dependence on labor rather than equipment, low productivity and difficulty of implementation. The main factors affecting construction costs are materials, labor, equipment, overhead and profit. The cost of equipment for



the construction industry in construction projects is estimated to range from 25 to 40 percent of the total project cost (Iseley & Gokhale, 2003).

The second important factor that respondents rated as respondents was "materials" and significance coefficients (R.I.I = 90.2%). This is the result of the financial and political instability in the Gaza Strip, the result of the frequent closure and closure of the crossings. In the event of closure of the crossings, the materials disappear from the market and double prices, which is a major obstacle to the contractor. In order for the contractor to have an effective role to make the project a success, he needs to have plans and scheduling for all the activities and actions he undertakes to avoid rising prices of materials that occur in the market. Where the new material planning distinguishes the contractor's ability from the other so that it becomes more competitive (WSDOT Projects, 2008).

Table 4.7 shows that the contractor classified the on-site accessibility as the least of the factors in terms of cost escalation and the importance factor (R.I.I = 72%).

### **Owners view**

Table 4.7 shows that the owner classifies the material with a coefficient of significance (R.I.I = 88.4%) as the first factor causing escalation. The owner rated the second important factor is the "quality of materials" with significance factor (R.I.I = 80.6%). This result is identical in terms of arrangement with the contractor, although the owner cares about the quality of materials and the importance of matching these materials to the required specifications.

Respondents owners as shown in Table 4.7 ranked "Amount of waste"(R.I.I = 72.3%) as the last factor.

### **Consultants view**

Table 4.7 shows that respondents ranked "material" as the first important factor to cause escalation with a significance factor (R.I.I = 87.6%). The owner, the contractor and the consultant agreed on the importance of the availability of materials due to the problems of the interruption of materials in the Gaza Strip markets.

The second factor to cause escalation was "Material quality" (R.I.I = 84.8 %). The quality of materials is the responsibility of the consultant to ensure that these materials conform to the specification because the contractor wishes to use the lowest

materials in order to maximize profits. The materials variable was ranked the second by the consultant. The quality of the materials for the consultant is important because its work is to ensure the materials and quality during the various stages of material management during the process of construction and includes ensuring the quality of materials, conformity to specifications and movement of materials within the site (Alwi & Hampson, 2003).

Respondents as shown in Table 4.7 consultants ranked accessibility on the site with an important index (64.8%) as the lowest factor.

**Table 4.7 Equipment level**

Groups/Factors	Contractor		Owner		Consultant		All respondents	
	RII	Rank	RII	Rank	RII	Rank	RII	Rank
Availability	0.927	1	0.768	3	0.819	3	0.845	2
Suitability	0.760	4	0.764	4	0.771	4	0.764	5
Materials	0.920	2	0.884	1	0.876	1	0.895	1
Accessibility on site	0.720	6	0.742	5	0.648	6	0.710	6
Material quality	0.753	5	0.806	2	0.848	2	0.798	3
Amount of waste	0.900	3	0.723	6	0.676	5	0.776	4

### **Kendall coefficient of concordance**

The values of Kendall coefficient of concordance (W) and the significance level (p) are found out to be 0.507 and 0.001 respectively. As the coefficient of concordance (W) is more than 0.5 and significance level (P) is less than 0.05, the agreement among the parties is found acceptable with confidence level of more than 95%.

### 4.3.7 Tests for Agreements on Cost Escalation Factor

This section of the thesis summarizes the testing of the correlation by using equation in last chapter equation 3.4:

$$W = \frac{12U - 3m^2 \times n(n - 1)^2}{m^2 \times n(n - 1)}$$

Where:

$$U = \sum_{i=1}^n (\sum R)^2$$

- n = factors number;
- m = groups number;
- j = the factors 1, 2,..., N.

**Table 4.8 Summary of correlation test on the ranking of factors affecting price escalation**

Field	W	Chi-Square	P-value	Decision
Project level	0.552	144.072	0.0007	Reject H0
Supervisory level	0.33	86.13	0.506	Don't reject H0
Activity level	0.527	137.547	0.0003	Reject H0
Owner level	0.537	140.157	0.0005	Reject H0
Labour level	0.586	152.946	0.0009	Reject H0
Equipment level	0.507	132.327	0.001	Reject H0

For groups project level, activity level, owner level, labour level, and labour level, We find that the values of p are less than the values of P = 0.05 and here we reject the null hypothesis that there is no agreement between the parties and the factors of cost escalation. We accept the alternative hypothesis, H1 is accepted. Therefore, it can be said that there is a great deal of agreement between owners, contractors and consultants related the factors affecting the rising cost of construction projects in the Gaza Strip.

On the other hand, for the supervisory level, we find that the values of p are greater than the values of P = 0.05. In this case, we can not reject the null hypothesis that there is no agreement of the target group of the sample and factors that increase costs. It can be argued that there is insufficient evidence to support alternative hypothesis H1 and therefore there is little agreement between owners, contractors and

consultants regarding the factors influencing the escalating costs of construction projects in the Gaza Strip.

Table (4.8) shows that there is agreement among the sample (contractor, owner and consultant) through their answers to the questionnaire on the factors mentioned in the questionnaire and divided to groups, ( project, owner, equipment and labour level) that contribute to the escalation costs in construction projects.

As for the factors at the level of supervision, it is not possible to prove that the respondents agree that these factors affect the escalation of costs, but there is a variance and difference between opinions.

This is reflected in the importance of these factors, which have been obtained from the escalation cost of construction projects in Gaza Strip.

#### 4.3.8 Relationship between Population Characteristics and Main Groups

This section of the thesis summarizes the testing of the One Way ANOVA by using equation in last chapter equation 3.6:

The F ratio:

$$F = \frac{MS_B}{MS_W}$$

Where

- $MS_B$  : within-group mean square =  $S_W / f_W$
- $F_w$  : within-group degrees of freedom =  $a \times (n - 1)$
- $S_w$  : within-group sum of square

#### Relationship between the executed work and main groups

Table (4.9) which show that the Sig-value equal 0.489 which is greater than 0.05, and the value of  $F_{total} = 0.982$  which is less than  $F_{critical} = 3.14$ , we don't reject the null hypothesis that's means there is no statistically significant differences attributed to the relationship between the work executed of the respondents at the level of  $\alpha \leq 0.05$  about the cost escalation factors in construction projects in Gaza strip.

It is concluded from the results of the nature of the work (buildings, sewage, roads, etc.) that these factors have an impact on all types of construction projects because of the small area of the Gaza Strip and the interdependence of the factors and the nature of the projects need much to the same materials and the same conditions.

**Table 4.9 Relationship between the executed work and main groups**

No.	Field	F	Sig. value
1.	Project level	0.950	0.423
2.	Supervisory level	2.394	0.078
3.	Activity level	0.615	0.608
4.	Owner level	0.349	0.790
5.	Labour level	0.747	0.528
6.	Equipment level	0.841	0.512
All fields		0.982	0.489

### **Relationship between respondent's designation in construction and main groups**

Table (4.10) which show that the Sig.-value equal 0.543 which is greater than 0.05, and the value of  $F_{total} = 1.258$  which is less than  $F_{critical} = 3.14$ , we don't reject the null hypothesis. that's means there is no a statistically significant differences attributed to the relationship between the respondent's designation of the respondents at the level of  $\alpha \leq 0.05$  about the cost escalation factors in construction projects in Gaza strip.

It is clear from the above that whatever the career ladder you are working in the field of construction you will find that you are affected by the same factors that affect the escalation of costs, whether you are a project manager or a site engineer or others with a different size of responsibility for project managers.

**Table 4.10 Relationship between respondent's designation in construction and main groups**

No.	Field	F	Sig. value
1.	Project level	0.292	0.423
2.	Supervisory level	2.426	0.528
3.	Activity level	0.637	0.836
4.	Owner level	2.037	0.608
5.	Labour level	0.394	0.790
6.	Equipment level	0.897	0.078
All fields		1.113	0.543

## Relationship between experience of respondents and main groups

Table (4.11) which show that the Sig.-value equal 0.488 which is greater than 0.05, and the value of  $F_{total} = 0.977$  which is less than  $F_{critical} = 3.14$ , we don't reject the null hypothesis. That's means there is no a statistically significant differences attributed to the relationship between the experience of respondents of the respondents at the level of  $\alpha \leq 0.05$  about the cost escalation factors in construction projects in Gaza strip.

From the above, we conclude that the more experienced construction engineers, the greater their knowledge and ability to understand the nature and impact of the factors influencing the cost escalation in the projects in which they work, and the use of the best methods of mitigation and access to the completion of projects with the best results.

**Table 4.11 Relationship between experience of respondents and main groups**

No.	Field	F	Sig. value
1.	Project level	0.389	0.680
2.	Supervisory level	1.857	0.165
3.	Activity level	0.351	0.705
4.	Owner level	1.978	0.148
5.	Labour level	0.746	0.645
6.	Equipment level	0.541	0.585
All fields		0.977	0.488

## Relationship between the cost of projects executed by the organization and main groups

Table (4.12) which show that the Sig.-value equal 0.471 which is greater than 0.05, and the value of  $F_{total} = 1.071$  which is less than  $F_{critical} = 3.14$ , we don't reject the null hypothesis. That's means there is no a statistically significant differences attributed to the relationship between the cost of projects executed by the organization of the respondents at the level of  $\alpha \leq 0.05$  about the cost escalation factors in construction projects in Gaza strip.

It is clear from the above that the higher the cost of the investment and the increase in the number of workers and the increase in the duration of time of the project, it leads to increase the emergence of the cost of the project and the difficulty of controlling these factors in the late stages. However, should be familiar from the

beginning of the project especially large projects with a large cost of implementation and a large period of implementation, which leads to the project to be exposed to the various economic and political fluctuations experienced by the Gaza Strip.

**Table 4.12 Relationship between the cost of projects executed by the organization and main groups**

No.	Field	F	Sig. value
1.	Project level	0.245	0.784
2.	Supervisory level	2.882	0.064
3.	Activity level	0.662	0.591
4.	Owner level	1.422	0.250
5.	Labour level	0.327	0.723
6.	Equipment level	0.889	0.417
All fields		1.071	0.471

### **Relationship between the number of projects executed and main groups**

Table (4.13) which show that the Sig.-value equal 0.508 which is greater than 0.05, and the value of  $F_{total} = 1.001$  which is less than  $F_{critical} = 3.14$ , we don't reject the null hypothesis. that's means there is no a statistically significant differences attributed to the relationship between the number of projects executed of the respondents at the level of  $\alpha \leq 0.05$  about the cost escalation factors in construction projects in Gaza strip. It is clear from the above that the greater the number of projects established by companies, it is exposed to more factors, become more knowledgeable, and experience the nature of these factors. The increase in the number of projects leads to increased exposure to these factors and thus more knowledge to deal with these factors and the accuracy of their determination and impact.

**Table 4.13 Relationship between the number of projects executed and main groups**

No.	Field	F	Sig. value
1.	Project level	0.101	0.959
2.	Supervisory level	1.285	0.289
3.	Activity level	0.658	0.581
4.	Owner level	2.645	0.058
5.	Labour level	0.769	0.516
6.	Equipment level	0.551	0.650
All fields		1.001	0.508

#### 4.4 Part Three: General on Project Cost Estimation, Escalation and the Practices Concerning the Factors Affecting the Escalation of Construction Projects

**Table 4.14 Cost escalation factors**

Factors	Respondents	
	RI	Rank
Is inflation or increase in the cost of construction materials a factor for project cost/price escalation?	0.910	1
Do you think fluctuations in the cost of labor, equipment or any other matter affecting the cost breakdown of activities at tender preparation?	0.776	2
Insufficient bidding data concerning the project is expected to be one of the factors that cause cost escalation ? What could be your response?	0.737	3

#### All Respondents

Table 4.14 shows three factors that affect the cost escalation so that the first factor gets the highest rating "inflation or increase in the cost of construction materials a factor for project cost/price escalation". The ever increasing cost of these construction inputs supplemented with market inflation and other unforeseen national and international factors are hypothetically believed to have strongly contributed to construction project contracts price inflation ( Reina & Angelo, 2003).

For the second factor, there is no fluctuations in the prices of labor and equipment in general so that labor prices are low and there is no fluctuations over the previous five years.

Third factor in most tenders "there is no shortage of tender data", where contractors ask about the ambiguous matters in the tender through the preliminary meeting.



#### **4.4.1 Proper Market Data Collection of Price and Documentation is Critical in Cost Estimating of Projects**

Figure 4.7 shows that 42.68 % (35) of engineers in contracting companies were strongly agree that make of data collection of price is critical in cost estimating, 45.12 % (33) of engineers in contracting companies respondents were agree, 12.2 % (43) of engineers in contracting companies respondents were neutral.

The process of estimating the cost of the projects based on the price range allowed by the local market of the availability of materials and equipment necessary to complete the project, where data are collected from the market and then compared with the company's policy in entering the tender or not to enter the tender based on the percentage of profit and nature of the project. If the value of the tender corresponds to the company's policies, then the decision to enter the tender will be taken either by increasing the percentage of profits or reducing them based on the number of competitors. In the case of reducing the percentage of profit, without the basis of the fundamental characteristics of the owner and the quality required for the project (Mochtar & Arditi, 2000).

Cost estimates are presented using the dollar price difference in 2006 from previous years and the continued sudden change in the value of the dollar and no allowance for escalation that would occur over an extended construction duration has been included at this time. Construction cost inflation averages were between 2 and 3% prior to 2003. Since then, construction cost inflation has become much more volatile, approaching 10% or more per year. It is recommended that a risk-based approach to estimating costs and inflation factors be used during feasibility level cost estimate development (Touran & Lopez, 2005).

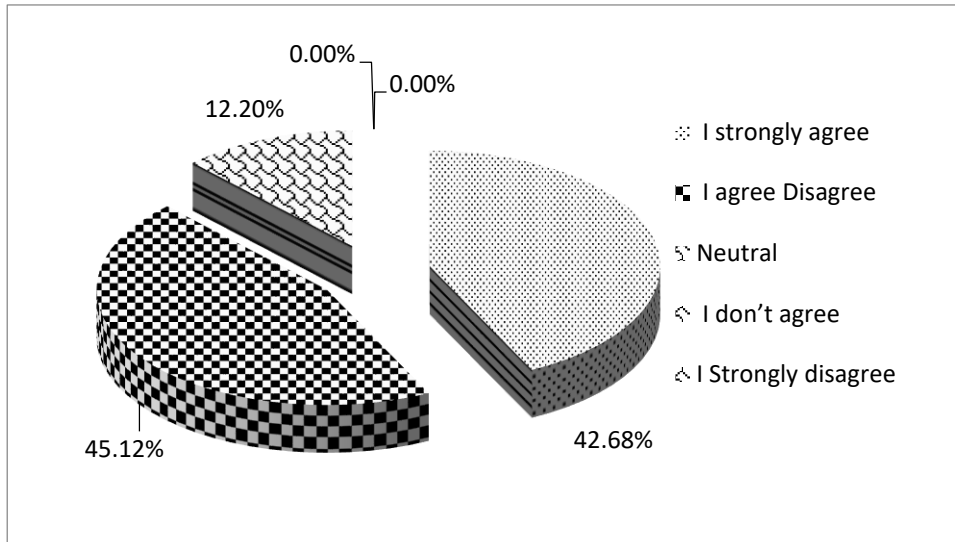


Figure 4.7 Market data collection

#### 4.4.2 Little Data Collection and Documentation Problem

Figure 4.8 shows that 50 % (41) of engineers in contracting companies respondents were "Lack of technical and managerial skills", 24% (20) of engineers in contracting companies respondents were "Problems attributed to the contractor capacity", 15 % (12) of engineers in contracting companies respondents were "Lack of conducive environment for practicing", 6 % (5) of engineers in contracting companies respondents were "Lack of awareness of stakeholders" and 5% (4) of engineers in contracting companies respondents were "Lack of competent and experienced professionals". These reasons are the result of lack of experience in the work team by either the contractor or the owner, lack of accuracy in the data collected by the team in the event of the collection of data and lack of consistency in collecting and storing data.

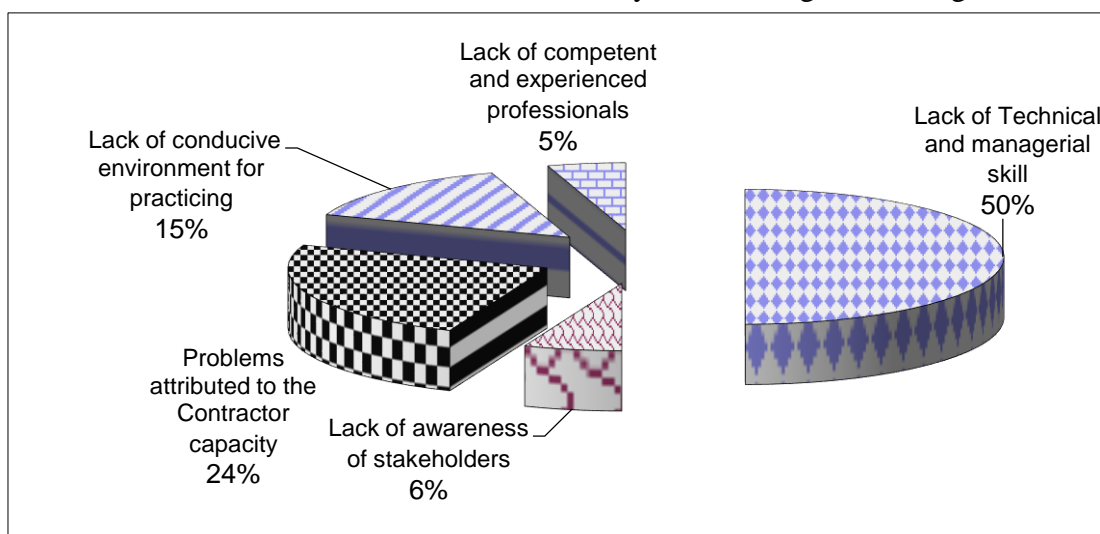


Figure 4.8 Little data collection and documentation

#### 4.4.3 A Company, During Tendering of a Project, Impose a Strict Methodology to Handle Project Cost

Figure 4.9 shows that 74.39 % (61) of engineers in contracting companies respondents were in agreement that company impose strict methodology to hand project cost and 26.61% (21) of engineers in contracting companies respondents were not agreed. Most companies impose a methodology to deal with the cost of the project but their main objective is to win the tender without considering the other risks. The main objective of bidding for the contractor is to win the tender and get profits so there is a convergence in the results that some of the contractors insist to develop a methodology to obtain the tender and profit, while others want to win the tender in order to keep his staff even a small margin of profit at times few tenders and few projects.

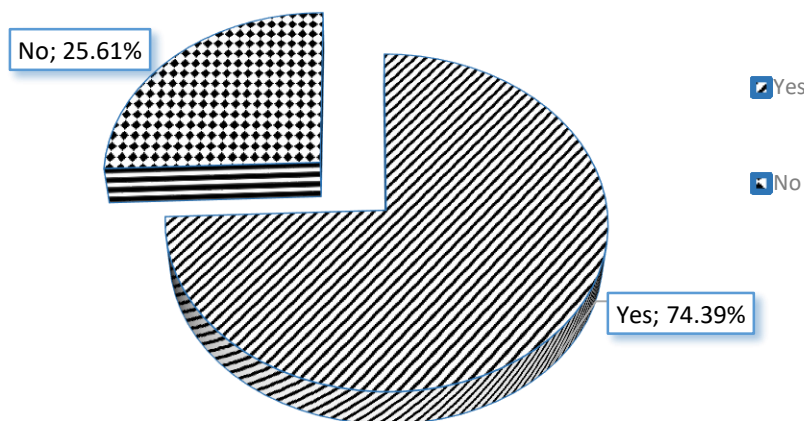


Figure 4.9 A company impose strict methodology to handle project cost

#### 4.4.4 The Final Cost of Construction may be Different from Forecast at Tendering Stage Due to Many Reasons

Figure 4.10 shows that 43% of engineers in contracting companies respondents were "the effect of competition in the market", 20.73% of engineers in contracting companies respondents were "The amount of design information available", "Change introduced by the client" have respondents 17%, "The estimator's skill and method used" have respondents 15.8% and 2.44% of assures respondents were "The amount and quality of historical data available". Competition in the market is the first reason

for the change in prices in the tender stage to the final stage because the contractor is reducing the profit and the size of risk on the project in order to win the project. The higher the number of applicants, the greater the competition and therefore the owner got the lowest prices and the profit of the contractor in order to obtain the tender.

Competition between construction companies are factors that affect the costs of construction projects and the impact on the price of the project. The level of supply for construction work usually refer in terms of intensity or degree of competition and consequently an increase of contractors causes decreases in price levels, the likely number of competitors in the market and the degree of competition will depend on the market conditions (Warsame, Wigren, & Wilhelmsson, 2013).

Insufficient or incorrect design data is one of the main reasons for project escalation. The problem occurs because of the poor attachment provided by the owner, the insufficient time allowed for the design, poor architect skill, and the landlord's responsibilities for changes during the construction process (Najafi & Vidalis, 2002).

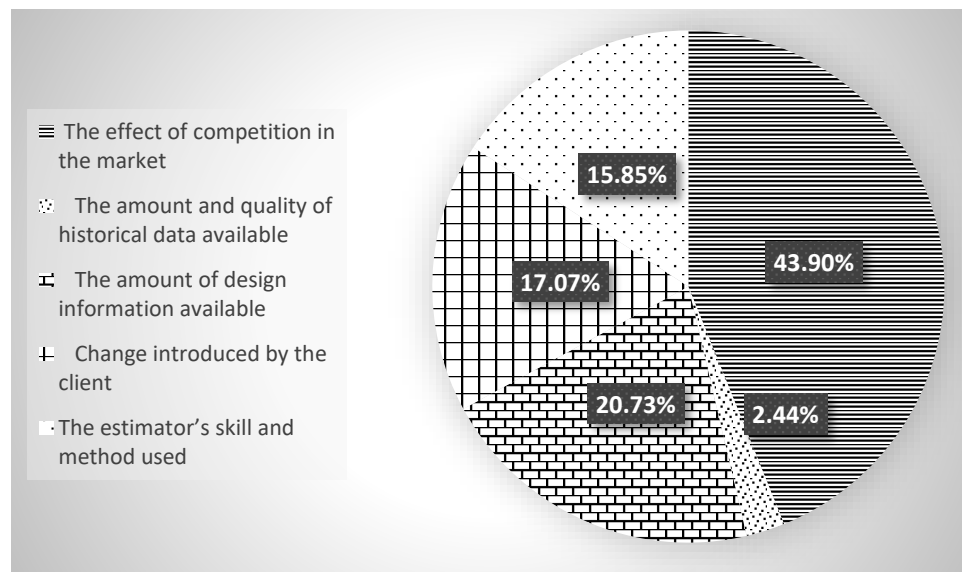


Figure 4.10 Final and forecast cost difference's

#### 4.4.5 The Cost Schedule Associated with the Difference Estimated Time Schedule

Table 4.15 shows that construction organizations often use cost schedule associated with the estimated time schedule with 43.9%, 25.61% of construction company don't use cost schedule associated with time schedule and 30.49 of construction company uses in some time. This association helps organizations assess cost and time

performance together at any stage of project construction. This will help construction organizations to find out whether the project is ahead or too late for the schedule and if it has exceeded the limit or is underestimated (Kimberly & James, 1999).

There are also a large number of contractors do not link the schedule to the cost table because of lack of skill and knowledge of the usefulness of this process in reducing the cost of escalating the costs of the project, especially for the project has more than components and a large size.

**Table 4.15 Cost and time schedule associated with the difference estimated time schedule**

<b>Do you have the cost schedule associated with the estimated time schedule?</b>	<b>Frequency</b>	<b>Percent</b>
yes	36	43.90%
No	21	25.61%
Sometimes	25	30.49%

#### **4.4.6 Actual Value and Earned Value Concept in Controlling Cost for the Project**

Table 4.16 shows that most answers apply the actual value and earned value concept in controlling cost for the project, 15% don't apply controlling cost and 26.83% apply in some time. The concept of earned value in construction projects provides a system for assessing project performance by integrating cost, schedule and project work. This will help to assess the cost and time performance of projects.

The Malaysian Auditor's report for 2008 indicates that cost overruns significantly affect the feasibility of construction projects in Malaysia because of the traditional method of monitoring project costs based on simple criteria using two data sources: budget expenditure and actual expenditure. Because of this problem, it is important to analyze earned value as an effective time and cost tool to monitor project cash flows (Khamidi, Khan, & Idrus, 2011).

The basic elements of earned value management for any construction project are the earned value, the planned value and the actual cost. Therefore, that it uses the earned value management to give you a basic overview of the status of the project. The earned value is the value of the work actually performed so far, the planned value is the value that you must have obtained according to the schedule, and the actual cost is the amount

spent on the project so far. Once you have this information in hand, you can find the situation and compare it to planned progress (Usmani, 2012).

**Table 4.16 Actual value and earned value concept**

<b>Do you apply the actual value and earned value concept in controlling cost for the project?</b>	<b>Frequency</b>	<b>Percent</b>
Yes	47	57.32%
No	13	15.85%
Sometimes	22	26.83%

#### **4.4.7 Give Right and Authority for Line Managers to Manage the Actual Expenses**

Table 4.17 shows that most answers give right and authority for line managers to manage the actual expenses with 50%, respondents who don't give right and authority for line managers to manage the actual expenses were 23.17 % and 26.8% some time gives. It was observed that the delegation of authority by the managers of the lowest level of them leads to three benefits for the managers are to reduce time, save energy and effort on things that may be small and do not require the orders of managers, reduce workload in managers thus reduce the physical pressure and give opportunity for managers to devote themselves to their work on top management matters, as well as five attributes that appear in people who have the power to self-rule, independence in making decisions, taking responsibility for their work, permanent effective, participation in project activities, constant stimulation and satisfaction with the work they are doing. All of these features demonstrate the importance of power sharing between managers and principals that lead to the success of the team and the success of the project (Kumara, 2010).

**Table 4.17 Right and authority**

<b>Do you give right and authority for line managers to manage the actual expenses?</b>	<b>Frequency</b>	<b>Percent</b>
Yes	41	50.00%
No	19	23.17%
Sometimes	22	26.83%

#### 4.4.8 Apply Software to Plan, Monitor, and Control Cost

Table 4.18 shows that most construction organization use software program in order to facilitate planning, monitoring and controlling cost. The most program used in construction organization in order to control and monitor cost is Excel.

**Table 4.18 Software control cost**

<b>Do you apply any software to plan, monitor, and control cost?</b>	<b>Frequency</b>	<b>Percent</b>
Yes	48	58.54%
No	17	20.73%
Sometimes	17	20.73%

#### 4.4.9 The Actual Cost of Projects is more than the Estimated Cost Because of Gaza Strip Political Conditions

Table 4.19 shows that most owners, consultants and contractors agree actual cost of projects was more than the estimated cost .This is due to many reasons, the frequent closure of the crossings on the Israeli side, the political instability in the Sinai region, which leads to the closure of the crossings from the Egyptian side, the severe restrictions from GRM system on the entry of materials and rapid access and escalation of building materials in case of interruption. All these reasons are helping to escalating costs in construction projects in the Gaza Strip (World Bank, 2014).

**Table 4.19 Gaza strip political conditions**

<b>Did the actual cost of projects be more than the estimated cost because of Gaza strip political conditions?</b>	<b>Frequency</b>	<b>Percent</b>
Yes	61	74.39%
No	6	7.32%
Sometimes	15	18.29%

# Chapter 5 Conclusions and Recommendations

## 5.1 Introduction

This is the final chapter in this research, which contains recommendations and conclusions that hope will contribute to solving the problem of cost escalation in construction projects for owners, consultants and contractors in the Gaza Strip.

## 5.2 Conclusions

In accordance and in line with the analysis result drawn up from the desk study and respondents responses of the questionnaires regarding on an assessment of cost escalation factors in construction projects in Gaza strip, the research hereby summarizes six groups of factors. The aim of this research was broken down into the following objectives:

### 5.2.1 Reviewing the current situation of cost escalation in construction projects

Literature review discuss the most important problems facing the construction industry is the escalation of costs in construction projects of various types' roads, buildings, sewage and water. In chapter two contains previous studies of the problem of escalation costs in the world and in Gaza strip especially, and the current situation of construction and escalation costs, ways to reduce cost escalation, factors that lead to escalation costs, cost overrun factors led to escalation, a table shows cost escalation factors for scientific papers reported by research, the implications of escalating costs in projects and damage size, methods of analysis cost escalation.

### 5.2.2 Identify the factors that affect cost escalation of construction projects

The factors identified from literature review and listed 36 factors affecting cost escalation of construction projects are selected. These factors are grouped into 6 groups based on literature review. These groups can give a comprehensive summary of the main key escalation indicators. In this research, 120 questionnaires were distributed, (82) questionnaires were returned showing (69 %) response rate divided as (30) contractors, (31) owners and (21) consultants, which is accepted in respect to the



unstable construction industry conditions in the Gaza strip. Consequently, the result of the questionnaire appear:

At project level, according to owners, consultants and contractors the premits and regularity approvals of materials was the most important factor of cost escalation as it has the first rank among all factors with RII = 0.735 for owners, 0.79 for consultants and 0.813 for contractors. This agreement between all the target groups is due to the difficult political situation in the Gaza Strip. Israel imposes restrictions on the entry of construction materials into the Gaza Strip, identifying them as dual use items that can be used for military purposes. These problems can be seen as an obstacle to projects.

At the supervisory level, the first class owner factors in this group is the availability of supervision by RII = 0.774. The contractor and consultant also rated availability of supervision as the second most important factor in this group. The importance of the availability of supervision for the three parties in the project is necessary to appoint the supervisory body at the beginning of the project in order to take the necessary measures and monitor the work in the project. This factor affects significantly and directly on the cost and quality of the project and the time of completion activities.

At activity level, the first class owner factors in this group is the inaccurate estimate with RII equal 0.787 and the consultants has been ranked the second position with RII equal 0.80. This result is indicated the inaccurate estimate make projects in risk price, this will reduce the things that will be accomplished for the project or stop the project at a certain stage due to a budget deficit. This result reflects that both owner and the consultant agree that the correct assessment is the most important things for the success of the project. Amount of rework has been ranked by the contractors respondents in the first position with RII equal 0.74 because the rework affect both cost and schedule throughout the construction industry that's need from contractor to pay more attention.

At owner level, number of change and extra work orders has been ranked by the owners respondents in the first position with RII equal 0.819, it has been ranked by the consultants respondents in the second position with RII equal 0.743, because change and extra work need additional costs and additional time. Competence and knowledge of owner has been ranked by the contractor respondents in the first position with RII equal 0.8. The important things for the contractor is knowledge of the owner in the

nature of the project and the methods of construction to avoid the changes and stop the work activities of the project.

At labour level, results show that the "quality of work by subcontractors" has been ranked in the first position at this group, by consultant and owner. This result indicates owner and consultant always cares about the quality of the product so the quality of the subcontractor was given the highest rating. Quality of work affects the level of project quality, facilitate the handing of the completed works and perform the work successfully. The results indicate that contractor has ranked "subcontractors and suppliers" in the first position in this group. The result indicates that underperformance in projects caused by subcontractors and suppliers as poor quality, low productivity and more cost and time that make bad relationships between contractor and clients.

At equipment level, contractor Class The first factor in this package is the availability of equipment. This result shows the importance of having the equipment in place in order to complete the work on time, as the shortage of equipment leads to several problems, including dependence on labor, lack of productivity and difficulty of implementation. Also important factors in this group agreed upon by all parties of the project from the contractor and owner and consultant is the lack of materials in the market as a result of frequent closures.

### **5.2.3 Investigated the reasons that increases the cost escalation of construction projects**

Kendall's Coefficient of Concordance is used to determine significant difference of opinion between the three parties owner, contractor and consultant regarding factors affecting cost escalation in construction projects.

The One-Way ANOVA ("analysis of variance") test used to compare averages or a decision on the existence or absence of differences between the performance averages of groups with different treatments in order to arrive at the factors that make average averages different from other averages. ANOVA measures the relationship between population characteristics and main groups.

Investigation of essential factors that lead to escalation of construction and proffering solutions on how to reduce construction cost escalation in Gaza strip. From the analysis of these factors get: The research affirmed that about 91% of the respondents answer supports the idea that inflation or increase in the cost of

construction materials a factor for project cost escalation in construction project in Gaza strip. The research affirmed that about 77% of the respondents answer the fluctuations in the cost of labor, equipment or any other matter affecting the cost breakdown of activities at tender preparation. There is a general insufficient bidding data concerning the project is expected to be one of the factors that cause cost escalation 73% response from respondents. This problem is the result of poor design review follow up by the project owners coupled with insufficient time given to consultants to prepare tender documents which ultimately leads to pre-tender cost estimate escalation of projects. Based the importance of proper market data collection of price and documentation, the most of respondents affirmed that is critical in cost estimation and escalation of project. The research affirmed that little data collection and documentation problem a result appears lack of technical and marginal skill and problems attributed to the contractor capacity. According to the research study, the final cost of construction may be different from forecast at tendering stage due: the effect of competition in the market and the amount of design information available. The most frequent cost escalation factors of construction project in Gaza strip are; lack of proper budgetary planning & less emphasis given to planning by clients and financiers, change in foreign exchange rate (for imported materials) and cost inflation of construction materials whereas, insufficient time given to tender document preparation by owners, inaccurate quantity estimate and unclear specifications or changes to specification. There is strong correlation on the responses of the three group's owner, contractor and consultant of respondents in ranking of cost escalation factor in construction project on Gaza strip.

### **5.3 Recommendations**

In respect to this research finding, the following basic recommendations are expected to be exercised by key role players of the construction industry, i.e. owners, Consultants and Contractors in order to minimize or avoid cost escalation of construction projects in Gaza strip.

## **Recommendation to consultant**

Consultant should take sufficient time to prepare tender documents and deploy competent and experienced professionals in the field in order to avoid committing discrepancy of design documents against the actual field data.

It is recommended that the consultant review and approve the design documents, executive drawings and contractor payments to avoid any delay or escalation in cost. Consultant should consistently keep record of and make proper market price assessment for construction materials.

It is recommended for the consultant to qualify his team of engineers in order to avoid errors of lack of knowledge in the supervisory body.

Consultants should hold themselves responsible for collection of accurate data and optimal solution during work.

It is recommended for the consultant to give the powers to the engineers within the site and not rely on the central decisions of the senior management.

The consultant is advised to be flexible during work and within the site in order to complete the project.

It is recommended for the consultant to ensure the presence of skilled workers in the site, especially in the main and complex work in order to achieve the work quality required.

The consultant is recommended to follow-up work of the work team of workers and subcontractors and technicians.

It is recommended for the consultant to ensure that the owner's requirements and project objectives are met.

The consultant is advised to speed up time to await inspections.

## **Recommendation to owner**

It is recommended for the owner to review the contract documents in a precise manner such as specifications, charts, bill of quantities and designs. This is in order to avoid the differences that occur as a result of lack of designs and design errors and non-caffeinated information.

Pay progress payment to the contractor on time because it impairs the contractors ability to finance the work.

It is recommended for the owner to make prequalification for consultants and the engineers who work for him.

Owners should be able to short list reputable professional consultants based on their service in order to assign for feasibility study of projects, design and tender document preparation.

Owners should give more weighting criteria on financial responsiveness of bids that is adopting engineers estimate method for financial qualification criteria to avoid excessive and over exaggerated bid offers.

Owners should make proper risk allocation and enforce the rules of the contract.

It is recommended that the owner reconcile the estimated cost with the actual cost of knowing the budget capacity of the project.

It is recommended for the owner to check the availability of materials in the market at the time of the contract, adjust the contractor's ability to provide these materials and not rely on the lowest prices in the contract.

## **Recommendation to contractor**

It is recommended that the contractor take the necessary measures for quality control and establish a quality system for the whole project in order to avoid errors resulting from non-conformity of specifications.

Contractors should properly conduct site visit with detailed exploratory material investigation of the project area in order to come up with a realistic tender offer.

It is recommended for the contractor to provide sufficient technical and administrative staff for the project. Also provide skilled workers to accomplish the activities properly without the need to re-work and raise problems with the supervisory body.

It is recommended to the contractor in case of absence of the materials specified in the contract, alternative materials are available that are close to the materials specified in the contract after the approval of the supervisor.

It is recommended for the contractor to develop a computerized system and a precise timetable, to know the amount of work and activities required each day and the duration of implementation.

It is recommended for the contractor to use the program of matching the expenses with the value of the works performed in the project.

It is recommended that the contractor reconcile the estimated schedule with the actual schedule of the project to avoid delaying problems of financial and other penalties.

It is recommended for the contractor to follow up on the situation of the market and the availability of materials on a daily basis due to the political and economic conditions affecting the Gaza Strip and the rapid overcoming of prices of materials in the local market.

It is recommended that the contractor ensure that the project will be installed on the black market or will coordinate the entry of materials from the Israeli side in order to identify the risks that will occur if it is adopted on the local market.

Contractors should deploy competent and experienced estimator or quantity surveyor to fill bid prices of projects activities when tendering a project.

It is recommended for the contractor to control and reduce the amount of waste material and follow-up materials at the site.

It is recommended for the contractor to monitoring and control costs during work activities to avoid an increase in time and cost of activities.

It is recommended for the contractor to use conforming materials, avoid using bad materials and control activities to avoid failure in tests, which will lead to rework and escalating costs.

It is recommended that the Contractor avoids the loading of items on other items during the bid price because in any circumstances it may lead to the deletion of items from the contract which will lead to the escalation of the cost of items.

It is recommended for the contractor when pricing the tender to inquire about ambiguous and unclear points in the contract and any matters that need to be clarified.

## **5.4 Future Studies**

In order to enforce further the finding of the thesis and for the sake of the totality of this research, the following core study areas that are believed to replenish further the concept of cost escalation of construction industry are proposed for future studies.

- i. Develop a tool for mitigate the effect of cost escalation in construction project.
- ii. Method of financing, procurement system and contract administration of construction projects.
- iii. Conducting up-to-date field studies of existing projects for in-depth study of escalation costs in projects.
- iv. Comparison between similar studies in the natives of the West Bank and Gaza Strip.
- v. Assessment of the impact of price escalation of construction projects on government and Donors.
- vi. A study of the GRM system used to approve the materials allowed into the Gaza Strip.

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## Appendix 1: Questionnaire in English



ISLAMIC UNIVERSITY  
ENGINEERING FACULTY  
CIVIL ENGINEERING DEPARTMENT

Master Program in Construction Management  
(Questionnaire)

Factors Affecting Cost Escalation of Construction Projects  
in the Gaza Strip

العوامل المؤثرة في تصاعد الاسعار في المشاريع الانشائية في قطاع غزة

The aim of this questionnaire is to study the factors affecting the cost escalation of construction projects in the Gaza Strip. This questionnaire is required to be filled with exact relevant facts as much as possible. All data included in this questionnaire will be used only for academic research and will be strictly confidential. After all questionnaires are collected and analyzed, interested participants of this study will be given feedback on the overall research results.

Submitted by

Abdelhadi Hassn Eleyan

Supervised by

Associate Prof. Nabil El-Sawalhi

Part 1: General Information about Respondents: Please add (√) as appropriate:

**1.1** On what discipline is your company engaged for in the construction sector?

- Contractor  Owner  Consultant

**1.2** Designation

- Project Manager  site Engineer  quantity surveyor

Others : state \_\_\_\_\_

**1.3** Company filed of work

- Building Construction  Water & Wastewater  Roads & transportation  Others : state \_\_\_\_\_.

**1.4** How long has your organization been involved in construction sector (Year of establishment):

- less than 5 years  between 5 and 10 years  
 between 10 and 15 years  more than 15 years

**1.5** Volume of construction work **in the last 10** year

- 1 - less than 5 million US\$  10- less than 20 million US\$  
 5 - less than 10 million US\$  more than 20 million US\$

**1.6** Number of projects executed in the last five years :

- 1-10  11-20  21-30  more than 30



## Part Two: Factors affecting cost escalation in construction projects.

Below are numbers of factors affecting the cost escalation of construction projects? From your experience, please express your opinion on the importance of the following factors as cost escalation indicators of construction projects in the Gaza strip. (Please tick the appropriate box).

Groups/Factors	Very low important	Low Important	Medium important	High important	Very high important
<b><i>Project level</i></b>					
Project size					
Project location					
Insufficient/incomplete drawings					
Permits/regulatory approvals					
Ground conditions					
Weather conditions					
Unexpected utilities					
<b><i>Supervisory level</i></b>					
Quality of supervision					
Availability of supervision					
Time to await inspections/tests					
<b><i>Activity level</i></b>					
Sequence of activities					
Repetitiveness of activity					
Complexity of activity					
Construction methods					
Amount of rework					
Inaccurate estimate					
Unrealistic schedule					
<b><i>Owner</i></b>					
Competence/knowledge of owner					
Amount of interference or stop work orders					
Number of change/extra work orders					
Time required to make a decision by owner					
<b><i>Labour</i></b>					
How well crew works together					
Morale/motivation of crew					

Availability of skilled labour					
Amount of work/workload					
Overmanning and crowding					
Amount of overtime worked					
Subcontractors and suppliers					
Quality of work (by subcontractors)					
Turnover and absenteeism					
<b>Equipment</b>					
Availability					
Suitability					
Materials					
Amount of waste					
Material quality					

**Part Three: General on Project Cost Estimation, Escalation and The Practices Concerning with the Factors Affecting the escalation of Construction Projects:**( Very low Important =1 , Low Important =2 , Medium Important =3, High Important =4, Very high Important =5)

Factors	1	2	3	4	5
Is inflation or increase in the cost of construction materials a factor for project cost/price escalation?					
Do you think fluctuations in the cost of labor, equipment or any other matter affecting the cost breakdown of activities at tender preparation?					
Insufficient bidding data concerning the project is expected to be one of the factors that cause cost escalation ? What could be your response?					

3.1 Proper market data collection of price and documentation is critical in cost estimating of projects. How do you level your agreement regarding data collection and documentation to meet the acceptable standard?

- I strongly agree
  I Strongly disagree  
 I don't agree
  Neutral  
 I agree Disagree

3.2 Where do you think little data collection and documentation problem arises?

- Lack of Technical and managerial skill
- Lack of awareness of stakeholders
- Problems attributed to the Contractor capacity
- Lack of conducive environment for practicing
- Lack of competent and experienced professionals

3.3 Does a company, during tendering of a project, impose a strict methodology to handle Project cost?

- Yes
- No

3.4 Most of the time, the final cost of construction may be different from forecast at tendering stage due to many reasons. What could be your answer related to the fact?

- The extent of repairs in a maintenance contract can be difficult to foresee
- The effect of competition in the market
- The amount and quality of historical data available
- The amount of design information available
- Change introduced by the client
- The estimator's skill and method used

3.5 Do you have the cost schedule associated with the estimated time schedule?

- Yes
- No
- Sometimes

3.6 Do you apply the actual value and earned value concept in controlling cost for the project?

- Yes
- No
- Sometimes

3.7 Do you give right and authority for line managers to manage the actual expenses?

- Yes
- No
- Sometimes

3.8 Do you apply any software to plan, monitor, and control cost?

- Yes
- No
- Sometimes

3.9 Did the actual cost of projects be more than the estimated cost because of Gaza strip political conditions?

- Yes
- No
- Sometimes

## Appendix 2: Questionnaire in Arabic

The Islamic University – Gaza

Higher Education Deanship

Faculty of Engineering

Civil Engineering

Construction Project Management



الجامعة الإسلامية – غزة

عمادة الدراسات العليا

كلية الهندسة

قسم الهندسة المدنية

إدارة المشاريع الهندسية

استبيان حول دراسة

## Factors Affecting Cost Escalation of Construction Projects in the Gaza Strip

العوامل المؤثرة في التصاعد الأسعار في المشاريع الإنشائية في قطاع غزة

والهدف من هذا الاستبيان هو دراسة العوامل المؤثرة في تذبذب الاسعار في مشاريع البناء في قطاع غزة.

ويلزم ملء هذا الاستبيان بالوقائع ذات الصلة الدقيقة قدر المستطاع. وسوف تستخدم جميع البيانات الواردة

في هذا الاستبيان فقط للبحوث الأكاديمية، وسوف تكون سرية للغاية. بعد جمع جميع الاستبيانات وتحليلها،

سيتم إعطاء المشاركين المهتمين من هذه الدراسة ردود الفعل على نتائج البحوث العامة.

الباحث:

م. عبدالهادي حسن عليان

اشراف:

الدكتور : نبيل الصوالحي

نوفمبر 2017

الجزء الأول: معلومات عامة عن المؤسسة: يرجى إضافة (✓) بالفراغ المجاور للخيار المناسب للمعلومات التالية:

1- ما هو الوصف المناسب للمؤسسة التي تعمل بها ؟

مقال  مالك  استشاري

2- حدد طبيعة المشاريع التي تم تنفيذها عبر مؤسستكم؟

مباني  مياه وصرف صحي  طرق

مشاريع أخرى، رجاء التوضيح

3- ما هو الوصف الأنسب لطبيعة عملك في المؤسسة التي تعمل فيها؟

مدير مشروع  مهندس موقع  حاسب كميات

طبيعة عمل أخرى، رجاء التوضيح \_\_\_\_\_

4- عدد سنوات خبرة المؤسسة العملية في مجال التشييد (حسب تقديرك) :

أقل من 5 سنوات  5-10 سنوات  10-15 سنة  أكثر من 15 سنة

5- القيمة التقريبية للمشاريع التي نفذت خلال السنوات الخمس الماضية :

(1-5) m US\$  (5-10) m US\$  (10-20) m US\$  أكثر من 20 m US\$

6- عدد المشاريع التي نفذتها الشركة خلال الخمس سنوات:

10-1  11-20  21-30  أكثر من 30

الجزء الثاني: العوامل المؤثرة في تذبذب الأسعار في المشاريع

وفيما يلي عدد من العوامل التي تؤثر تذبذب تكاليف مشاريع البناء؟ من تجربتك، يرجى التعبير عن رأيك حول أهمية العوامل التالية كمؤشرات ارتفاع التكاليف لمشاريع البناء في قطاع غزة. (الرجاء اختيار الخانة المناسبة).

عالي الأهمية جدا	عالية الأهمية	متوسط الأهمية	قليل الأهمية	قليل الأهمية جدا	المجموعات/العوامل
على مستوى المشروع					
					حجم المشروع
					مكان المشروع
					نقص وعدم كفاية المخططات
					التصاريح والموافقات
					طبيعة التربة
					طبيعة الطقس
					مواقف غير متوقعة
على مستوى الاشراف					
					كفاءة المشرف
					توافر جهاز الاشراف
					الوقت لانتظار التفتيش / الاختبارات
على مستوى النشاطات					
					تسلسل الأنشطة
					تكرار النشاط
					تعقيدات النشاط
					طرق الانشاء
					إعادة العمل
					تقدير غير دقيق
					جدولة زمنية غير واقعية



عالي الأهمية جدا	عالة الاهمية	متوسط الاهمية	قليل الاهمية	قليل الأهمية جدا	المجموعات/العوامل
على مستوى المالك					
					كفاءة ومعرفة المالك
					كمية التدخل او وقف العمل
					عدد التغييرات او الاعمال الاضافية
					وقت لاتخاذ القرار للمالك
على مستوى العمال					
					كفاءة عمل الطاقم بشكل جماعي
					معنويات وتحفيز الطاقم
					توافر العمالة الماهرة
					مقدار العمل وحجم العمل
					ازدحام الموقع
					مقدار العمل الاضافي
					توافر مقاولين الباطن والموردين
					جودة العمل للمقاولين الباطن
					غياب العمال
على مستوى المعدات					
					توافر المعدات
					ملائمة المعدات
					توافر المواد
					سهولة الوصول للموقع
					كمية الفاقد

الجزء الثالث: نظرة عامة على تقدير تكاليف المشروع والتذبذب والممارسات المتعلقة بالعوامل المؤثرة على تذبذب التكاليف في مشاريع البناء:

1. إن جمع البيانات المناسبة للسوق من حيث الأسعار والتوثيق أمر بالغ الأهمية في تقدير تكاليف المشاريع. كيف تقيم مستوى موافقتك فيما يتعلق بجمع البيانات والتوثيق للوفاء بالمعيار المقبول

موافق بشدة

موافق

غير موافق

محايد

غير موافق بشدة

2. أين من الأمور التالية هي السبب الأساسي لمشكلة نقص جمع البيانات أسعار السوق والتوثيق؟

نقص المهارات الفنية والإدارية  نقص الوعي لدى أصحاب المصلحة

المشاكل التي تعزى إلى قدرة المقاول  عدم وجود بيئة مواتية للممارسة

الافتقار إلى المهنيين ذوي الكفاءة والخبرة

3. هل تفرض الشركة، أثناء مناقصة المشروع، منهجية صارمة للتعامل مع تكلفة المشروع؟

نعم  لا

4. في معظم الوقت، قد تختلف التكلفة النهائية للمشاريع عن التوقعات في مرحلة المناقصة لأسباب عديدة. ماذا يمكن أن يكون السبب حسب اعتقادك؟

تأثير المنافسة في السوق

كمية ونوعية البيانات التاريخية المتاحة

كمية معلومات التصميم المتاحة

التغيير الذي قدمه العميل

مهارة مقدر التكاليف وطريق استخدامه للأساليب التقدير

5. هل يعتبر التضخم أو الزيادة في تكلفة مواد البناء عاملاً من عوامل ارتفاع تكلفة المشروع / ارتفاعه؟

موافق بشدة

موافق

غير موافق

محايد

غير موافق بشدة

6. هل تعتقد أن التقلبات في تكلفة العمالة والمعدات أو أي مسألة أخرى تؤثر على توزيع تكاليف الأنشطة في إعداد العطاءات؟

موافق بشدة

موافق

غير موافق

محايد

غير موافق بشدة

7. من المتوقع أن تكون بيانات العطاءات غير الكافية المتعلقة بالمشروع من العوامل التي تؤدي إلى ارتفاع التكاليف؟ ماذا يمكن أن يكون ردكم؟

موافق بشدة

موافق

غير موافق

غير موافق بشدة

محايد

8. هل لديك جدول التكلفة المرتبط بالجدول الزمني المقدر؟

نعم

لا

احيانا

9. هل تطبق القيمة الفعلية ومفهوم القيمة المكتسبة في السيطرة على تكلفة المشروع؟

نعم

لا

احيانا

10. هل تعطي الحق والسلطة للمديرين التنفيذيين لإدارة النفقات الفعلية؟

نعم

لا

احيانا

11. هل تطبق أي برنامج لتخطيط ومراقبة التكلفة؟

نعم

لا

احيانا

12. هل كانت التكلفة الفعلية للمشاريع أكثر من التكلفة المقدرة بسبب الظروف السياسية في قطاع غزة؟

نعم

لا

احيانا