



**ARAB ACADEMY FOR SCIENCE AND TECHNOLOGY  
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**COLLEGE OF ENGINEERING AND TECHNOLOGY  
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**Analysis of Time and Cost Overrun in Educational Building  
Projects in Egypt**

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قَالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا إِلَّا مَا عَلَّمْتَنَا إِنَّكَ  
أَنْتَ الْعَلِيمُ الْحَكِيمُ.

صدق الله العظيم

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## *Dedicated to my family*

Who are the source of my inspiration, encouragement, guidance and happiness, and who share my goals and aspirations may almighty *ALLAH* bless and protect them.

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***WALID KHOLIF***

## **Abstract**

This thesis is studying the main causes of time and cost overruns in educational building projects in Egypt, as Educational building projects are considered one of the most important construction projects in Egypt. As 20% from the gross domestic products goes to the ministry of education moreover about 12% from it goes to the authority of educational building, so the problem of time and cost overruns are critical issues that badly affect project delivery, leading to lose the goal of building larger number of educational projects to decrease the capacity of the student in class to improve the overall education system.

The objective was to find out the high factors causing time and cost overruns in educational building projects, ranking them according to their relative importance and develops statistical regression models that can be taken as a new approach in expected cost and time overruns of any projects in the future.

A brief look is taken to the previous researchers studies to identify the main factors causes' time and cost overruns in construction projects in many countries in the world, a questionnaire survey was conducted on 53 factors to identify the most important 14 cause's The identified causes were categorized according to their relative importance and level of severity. To address the study objectives, data were collected for 102 educations projects collected from 12 cities implemented from 2007 to 2011 by the Authority of Educational Building in Egypt, finally estimating a statistical regression model for both time and cost overruns using **Statistical Package for the Social Sciences (SPSS)**.

The concluding chapter five clarified that difficulties in getting work permit from government/ high cost of skilled labor / financial difficulties of contractor / high insurance and high interest rate/ bureaucracy in bidding/ tendering method / inaccurate cost estimate/ mistakes in soil investigation, are the most high factors affecting time and cost overruns in the educational buildings projects in Egypt, moreover thirty three of the selected projects have exposed to cost overrun, on the other side, time overrun was only noticed on twenty nine projects, also using SPSS program for developing the regression models for time and cost overruns and the effect of the highest factors on them clearly identified.

Testing the validity of the developed cost and time overruns regression models clearly show that the developed model can accurately assess in expected cost and time overruns of any future projects at level of confidence 95 % and 93 % respectively.

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**CHAPTER ONE**  
**INTRODUCTION**

# **Chapter 1**

## **Introduction**

Time and cost overrun generally result from factors that occur at various phases of the project life cycle. These factors include increase in project scope, design error, mistakes in soil investigation, difficulty in getting work permit from government, bureaucracy in bidding/tendering method.

Construction project time overrun can be defined as an extension of time beyond the contractual time. Cost overrun can also defined as an extra cost beyond the estimated. Cost overrun and time overrun generally result from many factors that occur at the different phases of the project life cycle. Several studies have sought to determine the magnitude of the cost overrun problem. Akinci and Fischer (1998) stated that risk factors include those associated with the project design, construction and project environment. It was found that the main causes for cost overruns were the complexity of the project, inflationary increases in material costs and inaccurate materials estimates.

Kaming et al.(1997) stated that the main causes of time delay were related to inadequate planning, design changes, and poor labor productivity. Also, Al-Momani (2000) investigated the causes of time delays on public projects (residential, office and administration buildings, school buildings, medical centers, and communication facilities) and found that the delays were related to designers, user changes, weather, site conditions, late deliveries, economic conditions and increase in quantity.

### **1.1 Problem Statement**

Many problems have arisen during the construction projects implementation out of which two main concerns are time and cost overruns. Time and cost overruns in educational building projects in Egypt are critical issues that affect project delivery and lose the goal of building larger number of educational projects to improve the overall education system in Egypt, political insecurity instability, litigation, project location, reduction of profit margin and loss of belief of citizen in government funded projects, the mentioned factors are some of the causes that affect the educational building projects in Egypt.

For educational buildings in Egypt cost and time overruns may leads to the cause of liquidated damages to the contractors and failure for the government to achieve its goal. So it is important to identify accurately and analyze the causes that affect the educational buildings and leads to time and cost overruns to prevent any loses.

## **1.2 Study Objectives**

The objectives of this study are:-

- 1- To find out the main causes of time and cost overruns in educational building projects in Egypt.
- 2- To rank these causes according to their relative importance and severity.
- 3- To investigate the expected effects of the previously identified factors on the cost and time overruns of selected sample from educational building projects in Egypt.
- 4- To provide new insights into the factors that affect time and cost overruns by the development of a statistical regression models using SPSS program.

## **1.3 Study Scope and Methodology**

It has to be noted that the scope of this study is mainly concerned with the educational building projects only, the study was conducted as follows:

- 1- A literature review was carried out to cover the previous studies regarding the construction project cost and time overruns. Based on this review, the different causes that are expected to affect cost and time overruns will be clearly identified.
- 2- Based on the previously identified factors, a questionnaire survey was conducted to identify the most important causes of time and cost overruns of the educational buildings in Egypt. The identified causes were categorized according to their relative importance and level of severity.
- 3- To address the study objectives, data were collected for 102 educational building projects implemented from 2007 to 2011 by the Authority of Educational Building. This section describes these items, how they were selected and measured, and how to interpret them in the context of the modeling results.
- 4- Finally the collected data and the questionnaire survey were analyzed to:
  - (a) Define the main causes influencing cost and time overruns in educational building projects.
  - (b) Investigate the relationship between the selected factors and time and cost overruns
  - (c) Develop two statistical regression models for time and cost overruns.

## **1.4 Thesis organization**

This thesis is divided into five chapters, as follows:

Chapter 1. Contain an introduction which was intended to give an overview to the importance of time and cost overruns in construction projects, followed by the problem statement, the objective of the research and the methodology and scope.

Chapter 2. Presents a literature reviews concerning the major causes of time and cost overruns in educational buildings in Egypt, by defining the project time and cost overruns, then introduce the previous researchers work in different countries and finally we are going to conclude the main causes that affect the educational buildings projects in Egypt.

Chapter 3. Discusses how the data collection was carried out such as the projects information, the Questionnaire survey to whom and how the survey was done, the sample size and how the survey data was analyzed, which leads us to identify exactly the main causes that affects the educational building projects in Egypt.

Chapter 4. Presented design of two regression models for cost and time overruns. These two regression models were backward and forward regression models and were developed based on the most effective factors that were identified in Chapter 3.

Chapter 5. Present conclusions and recommendations that would help in analyzing the problem of time and cost overruns in educational buildings in Egypt.

**CHAPTER TWO**  
**LITERATURE REVIEW**

## **Chapter 2**

### **Literature Review**

Time and cost overruns are of the most important problems in the educational buildings projects in Egypt. Their magnitude varies considerably from project to project. Time and cost overruns occur in every construction project. So it is essential to define the actual causes of time and cost overruns in order to minimize and avoid the delays and increasing cost in any construction project. So it is essential to define the actual causes of delays in order to minimize and avoid the delays in any construction project.

Delays in construction projects are a general phenomenon. They are almost accompanied by cost overruns. Construction project delays have a debilitating effect on all parties (owner, contractor and consultant) to a contract in terms of a growth in adversarial relationships, distrust, litigation, arbitration, cash-flow problems, and a general feeling of apprehension towards each other.

Cost is among the major considerations throughout the project management life cycle and can be regarded as one of the most important parameters of a project and the driving force of project success. Despite its proven importance it is not uncommon to see a construction project failing to achieve its objectives within the specified cost. Cost overrun is a very frequent phenomenon and is almost associated with nearly all projects. This chapter literature reviews concerning to identify the major causes of time and cost overruns in educational buildings in Egypt, by defining the project time and cost overruns, Then previous researchers work in different countries was introduced and finally the main causes that affect the educational buildings projects in Egypt was concluded and the regression models for cost and time overruns was developed.

#### **2.1 Project Time**

Project time has been defined as the completion of the project on the date stated in the contract or completion dates required for phases of the work. It is also defined as the duration that is needed to complete the work starting from site processions until finished.

“Duration” is the time usually in days taken to complete the entire project from starting the first task to finishing the last one. Unfortunately, this is like trying to predict the future.

## **2.2 Project Cost**

Project cost has been defined as the amount of commitment in terms of money that is required to produce a construction product such as building. Project cost to the building contractor represents all those items included under the heading of the expenditures. Project cost is quantitative assessments of the likely costs of the resources (labor, materials, supplies, etc) required to complete all project activities, (Duncan 1990). It can be concluded that project cost is the amount of money that is required to complete all project activities.

## **2.3 Time Overrun**

According to Kaming *et al.* (1997), time overrun is the extension of time beyond planned completion dates traceable to the contractors. Elinwa and Joshua (2001) defined it as the lapse between the agreed estimation or completion date and the actual date of completion. If the project works complete less than 100% but more than 80% the contractor could ask the owner to extend the project and the additional cost handled by them. If the owner agrees with the contractor's request, the contractor has to finish the work on time with the extended time requested. If the contractor still cannot finish the project on time the contractor must pay a sum of money referred as a penalty maximum 5% from the contract values per-day to the owner. In general project delays occur as a result of project activities that have both external and internal cause and effect relationship. Project delays are those that cause the project completion date to be delayed, (Al- Gahtani et al.2007). Delay could be defined as the time overrun either beyond completion date specified in a contract or beyond the date that the parties agreed upon for delivery of a project.

It is a project slipping over its planned schedule and is considered as common problem in construction projects. In some cases to the contractor delay means higher overhead costs because of longer work period, higher material costs through inflation and due to labor cost increases. From above, time overruns is defined as the time increased to complete the project after planned date which caused by internal and external factors surrounded the project.



## **2.4 Cost Overrun**

Elinwa and Joshua (2001) defined cost overrun with time overrun as the lapse between the agreed estimation or completion data and the actual data of completion.

Cost overrun is defined as the change in contract amount divided by the original contract award amount.  $\text{Cost overrun} = \text{Final actual cost} - \text{Original budget cost}$ .

From above cost overrun is defined as the excess of actual cost over budget, cost overrun is called cost escalation, cost increase or budget overrun.

## **2.5 Previous Work**

Jahren and Ashe (1990) found that a cost overrun rate of 1 to 11% is more likely to occur on biggest projects compared to overruns on smaller projects but mentioned that managers on big projects typically make special efforts to keep cost-overrun rates low. Jahren and Ashe also determined that the risk of high cost overrun rates is greater when the winning bid amount is less than the engineer's estimate and further identified some cost-overrun factors such as the contract document quality, nature of interpersonal relations on the project and contractor policies. Hinze et al. (1992) analyzed cost overruns associated with Washington State highway projects and found that the cost overruns expressed as a percentage of the contract amount tended to increase with project size. In an economic and efficiency audit study for the state of Delaware, Wagner (1998) found that state's department of transportation experienced cost overruns averaging 13.9% between 1994 and 1996, largely due to changes in the work scope and incorrect estimates of work quantities in the original bid specifications. The most important time and cost overrun factors according to contractors were preparation and approval of shop drawings, time and cost overrun in contractors' progress, payment by owners and design changes by owner (Assaf et al. 1995). In a study by Florida's Office of Program Policy Analysis and government Accountability it was determined that the state suffered from an average 9% cost overrun rate.

Aibinu and Odeyinka (2006) indicated that Nigerian construction industry experienced a mean percentage cost overruns of 17.34%. A research conducted by Flyvberg et al. (2004) concluded that nine out of ten transportation infrastructure projects costs are underestimated and that for all project types the actual costs are on average 28% higher than estimated costs.

Forty four percent (44%) of the respondent in the research undertaken on the Nigerian construction industry by Elinwa and Joshua (2001) indicate that time overrun often occurred. Adequate planning at early stages of project execution is an important factor in reducing delays (time) and cost overrun in developing countries, Chalabi and Camp (1984). Contractors do not honor contract deadlines and use shortages of materials as an excuse and these problems can be averted if professionals are more prudent in their design and more knowledgeable about the availability and usage of materials (Okpala et al. 1988). The need for a clear intention and understanding of the technical specifications could also reduce bottlenecks in the execution of projects (Jackson1990).

Poor site management and supervision, unforeseen ground conditions, low speed of decision making involving all project teams, client initiated variations and necessary variations of works indicated by Chan and Kumaraswamy (1997), as the main causes of time and cost overruns in Hongkong. Mansfield et al. (1994), investigated the important factors responsible for delays and cost overruns in highway construction projects in Nigeria such as poor contract management, material shortages, inaccurate estimating and overall price fluctuations.

Kaming *et al.* (1997), identifies the factors that influences construction time and cost overrun and analyze the relationship of these factors to enhance understanding construction delays and cost overruns. Results of Kaming *et al.* (1997) research reflected the construction management problems on time and cost overrun factors which are limited to high rise projects in Indonesian big cities such as Jakarta and Yogyakarta, the construction management problems on time and cost overrun in Sumatera particularly in Padang and Pekanbaru. This research studies the problems that were faced by big and medium companies, where most of these companies concentrate on low-rise projects such as housing, road and others simple buildings because Padang and Pekanbaru still in developing the city areas concept, Kaming *et al.* (1997) also investigated five productivity problems that cause time and cost overruns among seven regions in Indonesia namely Jakarta, Yogyakarta, West Java, Central Java, East Java, Western and Eastern Indonesia. Five Specific problems were identified, i.e lack of materials, rework, absenteeism, lack of equipment and tools and gang interference. In Indonesia Kaming et al. (1997) identified variables that have an impact upon construction time and cost overruns. In their work time and cost overrun variables were grouped into factors and their relationships were analyzed. It was found that the main causes for cost overruns were the complexity of the project, inflationary increases in material costs, and inaccurate material estimates.

Kaming et al. (1997) stated that the main causes of time delay were related to inadequate planning, design changes and poor labor productivity. Although their results are specific to conditions in Indonesia the researchers stated that the results reflect construction management problems in developing countries.

Chan and Kumaraswamy (1997) using data from Hong Kong determined and evaluated the relative importance of significant factors causing time delays. They concluded that the major causes for delays included poor site management, poor supervision, poor decision making, unexpected ground conditions and client initiated variations. Abd. Majid et al. (1998), Al-Khalil et al. (1999) have all show that time overruns occur on the majority of major civil engineering contracts and that this is a most common problem. Akinci and Fischer, (1998) stated that risk factors include associated with the project design, construction and project environment. Abd. Majid et al. (1998), Al-Khalil et al. (1999) have all show that time overruns occur on the majority of major civil engineering contracts and that this is a most common problem. Completing projects within the time is an indicator of an efficient construction industry (Chan and Kumaraswamy 1997), the ability to estimate the completion time is normally dependent on the individual intuition, skill and experience of the planning engineer (Mezher et al. 1998). however noted that time overruns in Lebanon construction industry are costing the country a lot of money and that there is a need to find more effective methods to overcome the problem. In other studies the reasons for cost overruns have been found to include rising costs of labor & materials, inadequate analysis poor costing methods, poor control and scheduling, inadequate information (Akpan et al. 2001 ).

Chang (2002) categorized the reasons for cost and time increases in engineering design projects as those within the owner's control for which the owner is responsible, those within the consultant's control for which the consultant is responsible and those beyond the control of the owner or the consultant, such as increased work scope, changes in Legislation or changes in standards and archeological discoveries. There is a relationship between schedule, the scope of work and project conditions. Changes to any one or more of these three can affect the compensation level and time of completion. It has been argued that it is necessary to create awareness of causes of project schedule delays, their frequency and the extent to which they adversely affect project delivery (Al-Khalil et al. 1999).

Al-Momani (2000) investigated the causes of time delays on public projects residential office and administration buildings, school buildings, medical centers and communication facilities and found that the delays were related to designers, user changes, weather, site conditions, late deliveries, economic conditions and increase in quantity.

Aibinu et al. (2002) delay is a situation when the contractor and the project owner jointly or severally contribute to the non-completion of the project within the agreed contract period. Delays in construction projects are frequently expensive since there is usually a construction loan involved which charges interest, management staff dedicated to the project whose costs are time dependent and ongoing inflation in wage and material prices. Cost overrun studies in developing countries (Flyvbjerg et al. 2003) stated that cost escalation is a pervasive phenomenon in transport infrastructure projects irrespective of project type, geographical location and historical period.

Frimpong et al. (2003) studied the factors that cause time and cost overruns in groundwater and construction projects in Ghana. The results of their study indicated that time and cost overruns are related to payment difficulties from agencies, poor contractor management, material procurement, poor technical performances and material cost escalation. Flyvbjerg et al. (2004) found that cost escalation is strongly influenced by the implementation phase length and project type, and suggested that decision makers and planners should be duly concerned about long implementation phases.

Trigunarsyah (2004) survey results point to the fact that contractor involvement in pre-construction phases could reduce time and cost problems during site operation. The studies in other countries also highlighted the appropriate practices to reduce the overrun problems such as in Japan, USA, UK and Malaysia construction projects. There are also studies about the process and procedures which are provide a framework about time and cost management stages that can be adopted to reduce overrun problems. It is good to refer to other practices because it will help in finding a better way to achieve the best results.

Ogunlana (1996) said that, construction industry problems in developing countries could be nested in problems of shortages or inadequacies in industry infrastructure, problems caused by clients and consultants and problems caused by contractor's incompetence/inadequacies. It also could say that by adapting developing countries practices processes or the procedures could help avoid being ambushed by unexpected overrun problems especially on time and cost during the construction process. Construction delays are delays in progress compared to the baseline construction schedule. Construction delays in residential and light construction are often the result of miscommunication between contractors, subcontractors, and property owners.

These types of misunderstandings and unrealistic expectations are usually avoided through the use of detailed critical path schedules which specify the work and timetable to be used but most importantly the logical sequence of events which must occur for a project to be completed. Virginia's Joint Legislative Audit and Review Committee found that underestimation of construction costs were common and typically led to serious consequences such as postponement or cancellation of other projects.

Kaliba et al. (2009) concluded from their study that the major causes of delay in road construction projects in Zambia were delayed payments, financial deficiencies on the part of the client or contractor, contract modification, economic problems, material procurement, changes in design drawings, staffing problems, equipment unavailability, poor supervision, construction mistakes, poor coordination on site, changes in specifications, labor disputes and strikes. Agaba (2009) attributes delays in construction projects to poor designs and specifications, and problems associated with management and supervision.

Abdel-Razek et al. (2008) found that delayed payments, coordination difficulty, and poor communication were important causes of delay in Egypt. Sambasivan and Soon, (2007) established poor planning, poor site management, inadequate supervisory skills of the contractor, delayed payments, material shortage, labor supply, equipment availability and failure, poor communication and rework were the most important causes of delays in the Malaysian Construction Industry. Koushki et al. (2005) identified the main factors affecting cost and time overrun as inadequate/inefficient equipment, tools and plant, unreliable sources of materials on the local market and site accidents. Le-Hoai et al. (2008) ranked the three top causes of cost overruns in Vietnam as material cost increase due to inflation, inaccurate quantity take off and labor cost increase. Kaliba et al. (2009) conclude that cost escalation of construction projects in Zambia are caused by factors such as inclement weather, scope changes, environment protection and mitigation costs, schedule delay, strikes, technical challenges and inflation. Time and cost are the two common concerns of construction management. Many factors relate to delay and cost overruns and vary along with types of project, locations, sizes and scopes. Large construction projects with their features of complexity and capital requirement have resulted interest to many researchers. Delay and cost increase are common phenomena in projects worldwide. However these are especially severe in developing countries.

With person interview survey of 450 randomly selected private residential project owners and developers in Kuwait, Koushki et al. (2005) identified estimates of time delays and cost increases and their causes. The three main causes of delays are changing orders, owners' financial constraints, and owners' lack of experience.

And three first causes of cost overruns are contractor related problems, material related problems and owners' financial constraints. They recommended that to minimize time delays and cost overruns project owners should require the availability of adequate funds, Allocation of sufficient time and money in the design phase and selection of a competent consultants and reliable contractor to carry out the work.

Frimpong et al. (2003) carried out a questionnaire survey in Ghana groundwater construction projects. They listed and ranked 26 factors responsible for project delays and cost overruns. The Kendall's coefficient of concordance was used to test the degree of agreement between owners, contractors and consultant and concluded that there was insignificant degree of disagreement. Chang (2002) identified through 4 case project documents the reasons for cost and schedule increase and further quantified their contributions to this problem for engineering design projects. These reasons were grouped into three headings mainly within the owner's control, mainly within the consultant's control and beyond either the owner's or consultant's control.

Williams (2005) compared the performance of neural networks and regression in explaining highway project cost deviations in Texas on the basis of bidding information such as bidding ratio, mean bid and second lowest bid. Fuzzy or neuro-fuzzy models have been used by (Dweiri and Kablan 2006). Knight and Fayek (2002) and Shaheen et al. (2007) to study the problem of time overruns or time delays in construction projects. From the perspective of modeling technique used there have been a number of studies that have blazed the trail for investigation of the issue of cost overruns and time delays. For example Attalla and Hegazy (2003) presented an interesting study that pioneered the comparison of the performance of different techniques they considered artificial neural networks and regression in predicting cost deviation in reconstruction projects.

Zheng et al. (2005) investigated time and cost deviations and Touran and Lopez (2006) modeled uncertainty in cost escalation in large infrastructure projects. Neural networks and fuzzy models are very useful tools but must be used with extreme caution because their estimation processes are relatively more complex and may be computationally cumbersome Lord and Mannering (2010).

When these tools are used properly as in Attalla and Hegazy (2003) and Shaheen et al. (2007) they can contribute to a better understanding and quantification of the causes of cost overruns.

Nassar et al. (2005) used the Weibull statistical method commonly used in failure analysis and reliability engineering to evaluate cost and schedule performance of construction projects. Late completion of works may be caused by any party to the contract and may be a direct result of one or more circumstances. A contract delay has adverse effects on both the owner and contractor (either in the form of lost revenues or extra expenses) and it often raises the contentious issue of delay responsibility which may result in conflicts that frequently reach the courts. Recently Gkritza and Labi (2008) determined that larger projects and longer duration projects were more likely to incur cost overruns and provided mathematical relationships between project size and overrun likelihood. Around the world many other researchers have been attracted on project delays and cost overruns problems. Many of them have paid attention to Asian and African countries. In Vietnam, large construction projects were studied by Long et al. (2004) to identify project success factors and general problems. Regarding these problems, Vietnamese government has also acknowledged the construction delays and cost overruns problems as the big headache now.

Lord et al. (2010) have studied the simultaneous relationship between cost and time overruns by using data from Indiana highway projects to provide empirical evidence that a simultaneous relationship exists between cost and time overruns and that analysis of these two contractual outputs need to take due cognizance of such simultaneity by Using the three-stage least-squares technique, The models developed can help agencies enhance the estimation of the expected overruns of final cost and the delay in the planning stages. To do this the following equations system is considered:

$$c = \alpha_c + \beta_c X_c + \lambda_c t + \epsilon_c \quad \dots\dots\dots (2.1)$$

$$t = \alpha_t + \beta_t X_t + \lambda_{t-c} c + \epsilon_t \quad \dots\dots\dots (2.2)$$

Where c and t = cost overruns and time overruns (as defined above), X<sub>c</sub> and X<sub>t</sub>= vectors of factors affecting cost overruns and time overruns respectively, β<sub>s</sub>=vectors of estimable parameters, λ<sub>s</sub>=estimable scalars, ε<sub>s</sub>=disturbance terms that capture unobserved effects.

This equation system is set up such that time overruns influence cost overruns. [The inclusion of t as an independent, right hand-side variable in Eq. (2.1)].

And that cost overruns influence time overruns [the inclusion of  $c$  as an independent, right-hand side variable in Eq. (2.2)] If Eqs. (2.1) and (2.2) are estimated separately using ordinary least squares (OLS), one of the key OLS assumptions is violated because the right-hand-side variables  $t$  and  $c$  are endogenous meaning that changes in the left-hand-side variable (left of the equal sign) will change the value of these right-hand-side variables (right of the equal sign). So for example in Eq. (2.1), as the cost overrun changes ( $c$  on the left side), the time overrun ( $t$  on the right side) will also change because  $t$  is a function of  $c$  as shown in Eq. (2.2). OLS regression has desirable estimation properties only when the right-hand-side variables are exogenous (which means the left-hand-side variable does not influence the values of right-hand-side variables).

Amer (1994) discussed the construction delay problems via studying and analyzing the causes that contribute to construction delays in order to improve the ability to implement construction projects without delays. Results of this study indicates that the major causes of delay in construction projects in Egypt are poor contract management, unrealistic scheduling, lack of owner's financing/payment for completed work, design modifications during construction and shortages in materials such as cement and steel. The study was conducted over one decade ago and the nature of the construction industry in Egypt has changed and rapidly developed ever since. Many multinational firms have expanded their operations in Egypt in addition to a noticeable improvement in construction management practices in large projects. Due to the influence of multinational firms the initial compilation of delay causes list depended on international studies and was further compared against the causes identified in Amer (1994) and checked for appropriateness to Egypt within the expert interviews.

Abdel-Razek et al. (2008) was carried out to determine the causes of delay in building construction projects in Egypt. A questionnaire survey was carried out to confirm the causes and identify the most important delay factors. Based on the survey results, the top five delay causes were: financing by contractor during construction, delays in contractor's payment by owner, design changes by owner or his agent during construction, partial payments during construction and non-utilization of professional construction management. Also financial difficulties faced by the contractor and too many change orders by the owner are the leading causes of construction delay. Both research outcomes showed that financial difficulties were important factors causing delays in Egypt. This factor will be included in the questionnaire survey of the present research.



Mubarak (2004) discussed the role of consultancy in minimizing the delays of large projects and showed possible categorizations of causes of delay such as internal and external, financial and nonfinancial. Other studies from Hong Kong include the work by Lo et al. (2006) who examined the distribution of construction delays, six most significant causes of construction delay were found these are: unforeseen ground conditions, poor site management and supervision, client variations, inexperienced contractor, slow coordination and seeking of approval from concerned authorities and inadequate contractor resources. This indicates that these construction delay problems still exist and that further action for improvement is required, the highest five important causes in different developing countries were listed as shown in Table (2.1).

**Table (2.1) The five most important causes of time and cost overruns in different developing countries by the past researchers**

Author	Major causes				
	1	2	3	4	5
Long et al. (2004)	Poor site management and supervision	Poor project management assistance	Financial difficulties of owner	Financial difficulties of contractor	Design changes
Sambasivan et al. (2007)	Improper planning	Site management	Inadequate contractor experience	payments of completed work	Subcontractors
Al-Khalil et al. (1999).	Cash flow and financial difficulties	Difficulties in getting work permit	Practice of assigning contract to lowest bidder	Underestimate project duration	Ineffective planning and scheduling by contractors
Lo et al. (2006)	Inadequate resources due to contractor/lack of capital	Unforeseen ground conditions	Exceptionally low bids	Inexperienced contractor	Works in conflict with existing utilities
Chan and Kumaraswamy, (1997).	Poor site management	Unforeseen ground condition	Low speed of decision making	Client-initiated variation	Necessary variations of works
Odeh et al. (2002).	Inadequate contractor experience.	Owner interference	Finance and payments of completed work	Slow decision making by owners	Labor productivity
Koushki et al. (2005)	Change orders	Financial constraints	Owner's lack of experience	Materials	Weather
Frimpong et al. (2003)	Monthly payment difficulties	Poor contract management	Material procurement	Inflation	Contractor's financial difficulties
Aibinu et al. (2006)	Contractors' financial difficulties	Clients' cash flow problem	Architects' incomplete drawing	Subcontractor's slow mobilization	Equipment breakdown & maintenance problem
Abd El-Razek et al. (2008)	poor contract management	unrealistic scheduling	lack of owner's financing/payment for completed work	design modifications during construction	shortages in materials

## 2.6 Summary

One of the most important problems in the Educational building projects in Egypt is time and cost overrun. (Either in the form of lost revenues or extra expenses) Delays occur in every construction project and the magnitude of these delays varies considerably from project to project. Underestimation of construction costs was common and typically led to serious consequences such as postponement or cancellation of projects. So it is essential to define the actual causes in order to minimize and avoid time and cost overruns in any Educational projects in Egypt. There is a wide range of views for the causes of time and cost overrun in Educational projects. However, through literature study that has been reviewed by researcher there is no published previous research on this topic in Egypt Educational projects. Building on the findings of past research, this thesis seeks to provide new insights into the factors that affect time and cost overruns in educational projects in Egypt through the development of a statistical model that simultaneously considers both time & cost overruns. From the above literature review, discussion with practitioners of all parties involved in educational buildings projects in Egypt were carried out, **the concluded 53 causes** that affect time and cost overruns in educational buildings projects in Egypt as shown in Table (2.2).

**Table (2.2). The concluded 53 causes that affect time and cost overruns in educational building projects in Egypt**

No	Causes
1	Financial difficulties of owner
2	Slow payment of completed works
3	Low speed of decision making
4	Delay to furnish and deliver the site to the contractor by the owner.
5	Slow inspection of completed works
6	Mistakes in design
7	Practice of assigning contract to lowest bidder
8	Inaccurate bill of quantities.
9	Long period between design and time of bidding/ tendering
10	Waiting for approval of shop drawings and material samples
11	Mistakes in soil investigation

**Table (2.2). The concluded 53 causes that affect time and cost overruns in educational building projects in Egypt (cont.)**

No	Causes
12	weakness of qualified supervisor
13	Inflexibility (rigidity) of consultant
14	Original contract duration is too short
15	Poor site management and supervision
16	Financial difficulties of contractor
17	Mistakes during construction
18	Ineffective planning and scheduling by contractors
19	inexperienced contractor
20	Poor financial control on site
21	Inaccurate cost estimation
22	Poor relationship between management and labor
23	rework due to poor work / wrong materials by the contractor
24	poor monitoring and control
25	Lack of database in estimating activity duration and resources
26	Lack of administrative employee
27	Incompetent subcontractors
28	environmental restrictions
29	Design changes
30	Additional works
31	Lack of communication between parties
32	Occurrence of site accidents during construction
33	personality clash between contractor agent and engineering supervisor
34	Escalation of material prices (Inflation)
35	Inadequate production of raw materials in the country
36	Shortages of materials
37	Shortages of skilled workers / technical personnel
38	High cost of skilled labor
39	Poor labor productivity
40	High equipment maintenance costs
41	Poor equipment productivity
42	Unforeseen site (ground) conditions
43	Difficulties in getting work permit from government

**Table (2.2). The concluded 53 causes that affect time and cost overruns in educational building projects in Egypt (cont.)**

No	Causes
44	Bureaucracy in bidding/ tendering method
45	Unavailability of utilities in site (such as, water, electricity, telephone, etc.)
46	High insurance and high interest rates
47	political insecurity instability
48	project location
49	Stealing and waste on site
50	Litigation
51	High transportation costs
52	Bad weather.
53	uncontrollable external factors

**CHAPTER THREE**  
**DATA COLLECTION AND ANALYSIS**

## **Chapter 3**

### **Data Collection and Analysis**

This chapter deals with the analysis of the information gathered from the previous literature review and the use of a questionnaire survey targeted at contractors and consultant in Egypt and includes the identification of the critical causes of time and cost overruns. This chapter discusses how the data collection was carried out such as the projects information, the Questionnaire survey to whom and how the survey was done, the sample size and how the survey data was analyzed, which lead to identify exactly the main causes that affects the educational building projects in Egypt, ranking these causes from high important index to low also to show the effect of these causes on the sample projects collected from different cities in Egypt, which affects the Egyptian contractors to carry on the work within the specified time and budget.

The following steps were used to study the methodology in this chapter that lead to determine the highest important factors that affects the contractors and causes time and cost overruns in educational building projects in Egypt as follows:

- 1- Literature review from the previous chapter.
- 2- Questionnaire survey targeted at Contractors and consultant.
- 3- Index analysis (frequency index, severity index and important index).
- 4- Ranking the factors from high to low and identify the highest 14 factors.
- 5- Data of 102 projects collected from 12 different cities and the effect of the 14 highest causes on them.

#### **3. 1. Factors affecting time and cost overrun**

From the previous literature review the identified 53 factors that lead the educational building projects in Egypt to time and cost overruns were grouped into six groups as shown in Table (3.1).

**Table (3.1). Grouping the 53 factors that lead the Educational Building projects in Egypt to Time and Cost Overruns**

Group	Causes
A-Owner related group	<ul style="list-style-type: none"> <li>1-Financial difficulties of owner.</li> <li>2-Slow payment of completed works.</li> <li>3-Low speed of decision making.</li> <li>4-Delay to furnish and deliver the site to the contractor by the Owner.</li> </ul>
B-Consultants- related group	<ul style="list-style-type: none"> <li>1-Slow inspection of completed works.</li> <li>2-Mistakes in design.</li> <li>3-Practice of assigning contract to lowest bidder.</li> <li>4-Inaccurate bill of quantities.</li> <li>5-Long period between design and time of bidding/ tendering.</li> <li>6-Waiting for approval of shop drawings and material samples.</li> <li>7-Mistakes in soil investigation.</li> <li>8-Weakness of qualified supervisor.</li> <li>9-Inflexibility (rigidity) of consultant.</li> <li>10-Original contract duration is too short.</li> </ul>
C-Contractor-related group	<ul style="list-style-type: none"> <li>1-Poor site management and supervision.</li> <li>2-Financial difficulties of contractor.</li> <li>3-Mistakes during construction.</li> <li>4-Ineffective planning and scheduling by contractors.</li> <li>5-Inexperienced contractor.</li> <li>6-Poor financial control on site.</li> <li>7-Inaccurate cost estimation.</li> <li>8-Poor relationship between management and labor.</li> <li>9-Rework due to poor work / wrong materials by the contractor.</li> <li>10-Poor monitoring and control.</li> <li>11-Lack of database in estimating activity duration &amp; resources</li> <li>12-Lackof administrative employee.</li> <li>13-Incompetent subcontractors.</li> </ul>
D-Project-related group	<ul style="list-style-type: none"> <li>1-Environmental restrictions.</li> <li>2-Design changes.</li> <li>3-Additional works.</li> <li>4-Lack of communication between parties.</li> <li>5-Occurrence of site accidents during construction.</li> <li>6-Personality clash between contractor agent &amp; engineering Supervisor.</li> </ul>

**Table (3.1). Grouping the 53 factors that lead the Educational Building projects in Egypt to Time and Cost Overruns (cont.)**

Group	Causes
E-Resources- related group	1-Escalation of material prices. (Inflation) 2-Inadequate production of raw materials in the country. 3-Shortages of materials. 4-Shortages of skilled workers / technical personnel. 5-High cost of skilled labor. 6-Poor labor productivity. 7-High equipment maintenance costs. 8-Poor equipment productivity.
F-External factors- related group	1-Unforeseen site (ground) conditions. 2-Difficulties in getting work permit from government. 3-Bureaucracy in bidding/ tendering method. 4-Unavailability of utilities in site (such as, water, electricity, Telephone, etc.). 5-High insurance and high interest rates. 6-Political insecurity instability. 7-Project location. 8-Stealing and waste on site. 9-Litigation. 10-High transportation costs. 11-Bad weather. 12-Uncontrollable external factors.

### **3.2. Identifying the main factors affecting time and cost overrun**

The study uses face to face survey using a set of prepared detailed questionnaires to collect the data, it was sent to the selected respondent from contractors and consultants, the owner here is the government (Ministry of Education). The method is considered appropriate for this type of research because it is:

- Ideally examines the perception of the sample
- Is less time consuming
- Is better able to reach a wider respondent.

The questionnaire also offers some level of confidentiality and allows respondents to give true opinions on issues asked. Also several different means such as email and post are also



employed. Because the mother tongue of most people working in construction in Egypt is Arabic it was necessary to provide an Arabic questionnaire format, the data were gathered in person. Because of the difficulty in gathering questionnaires by post.

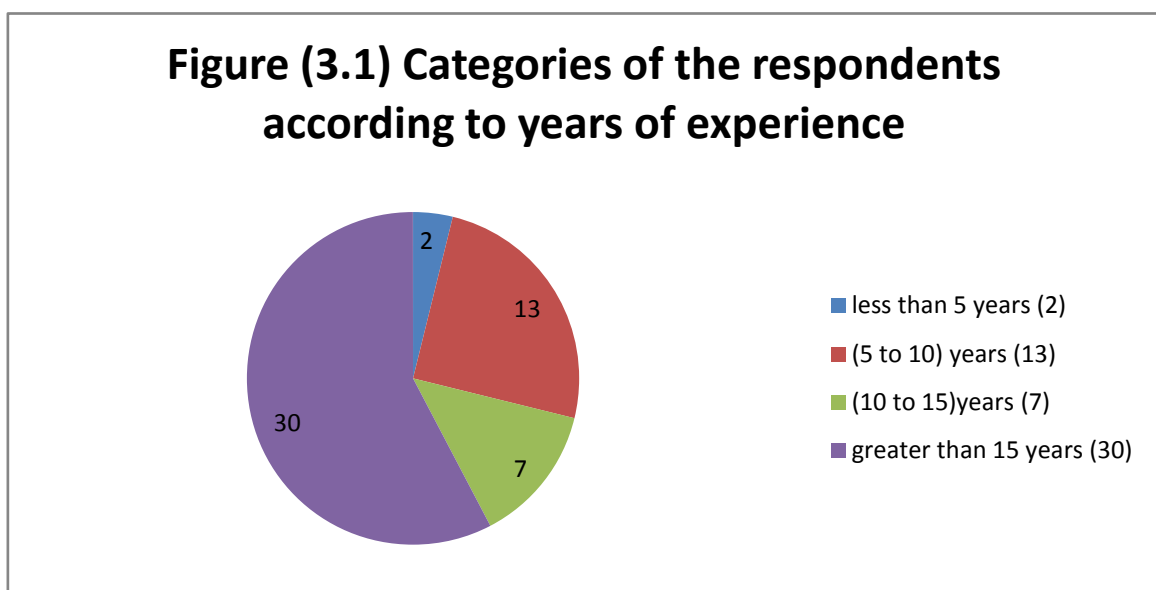
The scope of this study was targeted on (21300) contractors and consultants in 2011, where about 16800 were the total Egyptian contracting companies registered with the Egyptian contractors union and about 4500 engineer were working at the general Authority of Educational Building. So, the following formula by Yamane (1967) was used to determine the *sample size*:

$$n = \frac{N}{1 + N(e)^2}$$

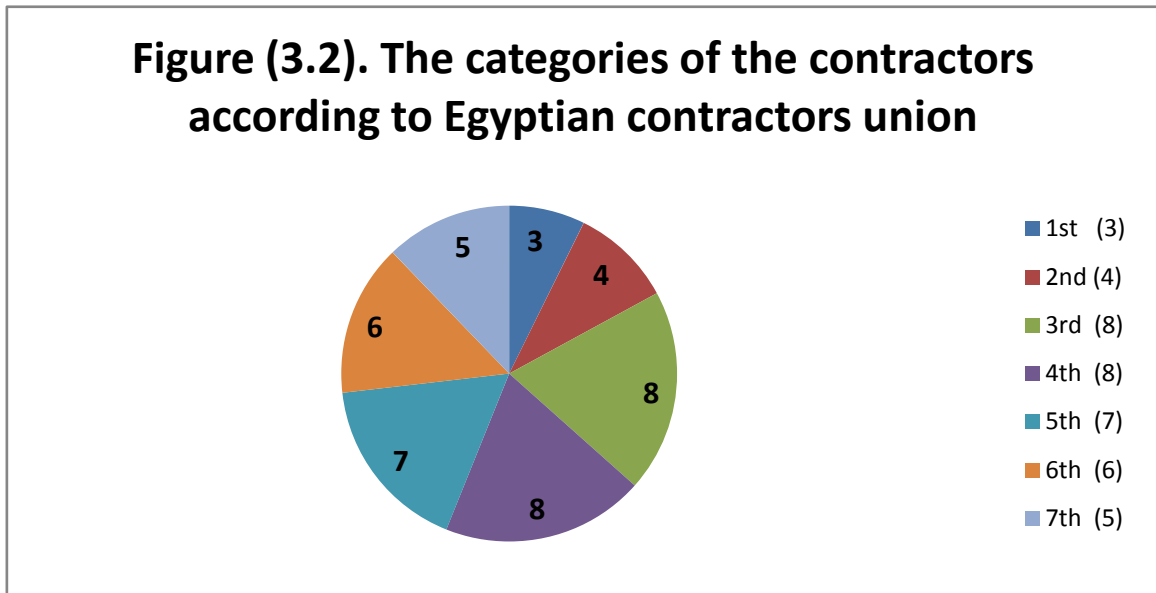
Where, n is the sample size, N is number of targeted population and e the acceptable sampling error at 95% confidence level.

$$n = \left[ \frac{21300}{1 + (21300 \times (0.15)^2)} \right] = 44.35 \quad (3.1)$$

So our sample size is 45. A total of 80 questionnaires are sent to construction professionals involved in educational building project in Egypt. The chosen projects locate in 12 cities (Cairo, Alexandria, Giza, Qalubya, Daqahlya, Behera, Gharbya, Asyut, Sohag, Luxor, Minya and Qena). Questionnaires are collected the incomplete data are eliminated. **Fifty two** full responses are obtained (41Contractor and 11Consultant) showing a response rate of 65%, (78.85% contractors and 21.15% consultants). The categories of the respondents according to years of experience are according to the following figure (3.1).



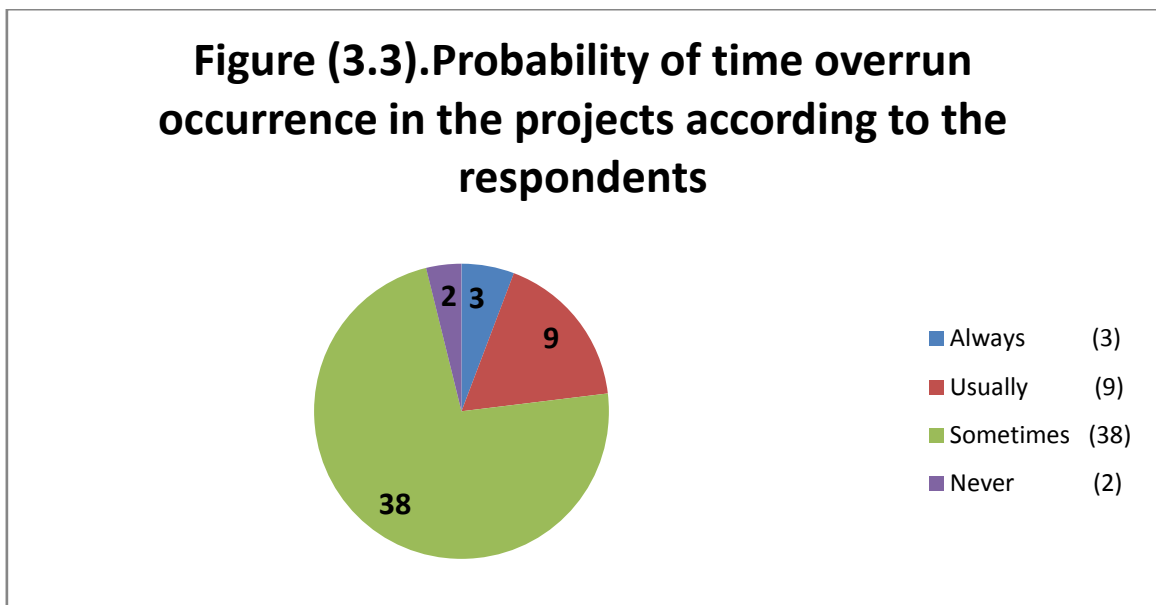
From the figure regarding number of years involved in construction, 4% of respondents have less than or equal to 5 years, 25% of those have between 5 and 10 years. And 13% of those have between 10 and 15 years and 58% of those have 15 years or more. The percentage of respondents whose experiences are 15 years or more is the highest this gives us an accurate questionnaires result. The categories of the respondents according to Egypt contractors union are according to the following figure (3.2).



Also the respondents are allowed to answer two questions about time and cost overrun in educational building projects in Egypt as follows:

- 1-How many times occur time delay in the projects?
- 2-How many times occur cost overrun in the projects?

The answer was according to the following figures (3.3), (3.4).



**Figure (3.4).Probability of cost overrun occurrence in the projects according to the respondents**



### 3.3. Questionnaire Design

This research has adopted field survey methodology to uncover factors influencing on time and cost overruns arising during all stages of the projects. To identify the time and cost overrun factors in educational building projects in Egypt, literature reviews, case analysis published on newspaper and discussion with practitioners of all parties involved in educational building projects were carried out.

After that a pilot questionnaire was prepared. The designed questionnaire was randomly distributed to two principal construction parties (consultant and contractor).

For each factor the respondents were requested to answer both frequency of occurrence and severity. A five-point scale of 1 to 5 is adopted for evaluating the effect of each factor. These numerical values are assigned to the respondents rating, 1 = very low, 2 = low, 3 = Medium, 4 = high, 5 = very high for frequency & 1 = very low, 2 = low, 3 = Medium, 4 = high, 5 = very high for severity. In order to fit into conditions in educational building projects in Egypt a pilot test was performed for preliminary questionnaire.

Twelve experts were involved in this pilot test. They are three consultants in educational building projects, manager of the authority of educational building projects, five contractors and three professional project managers in educational building projects. All of them have more than 15 years of experience in Educational building projects in Egypt. They were asked to critically review the design and structure of the questionnaire. Their valuable comments were used to revise the research questionnaire. After revising the questionnaire the second pilot questionnaire was resent to these twelve experts. At this time the comments received were positive and no change was necessary.

The questionnaire form (presented in appendix) was ready to survey, in the structured part of the questionnaire; **Fifty three** causes drawn from previous steps are listed in six respective groups:

*A-Owner-related group consists of*, financial difficulties of owner, slow payment of completed works, Low speed of decision making and delay to furnish and deliver the site to the contractor by the owner.

*B- Contractor-related group consists of*, poor site management and supervision, financial difficulties of contractor, Mistakes during construction, Ineffective planning and scheduling by contractors, inexperienced contractor, poor financial control on site inaccurate cost estimation, poor relationship between management and labor, rework due to poor work / wrong materials by the contractor, poor monitoring and control, lack of database in estimating activity duration and resources and lack of administrative employee and incompetent subcontractors.

*C- Consultants-related group consists of*, slow inspection of completed works, mistakes in design, practice of assigning contract to lowest bidder, inaccurate bill of quantities, long period between design and time of bidding/ tendering, waiting for approval of shop drawings and material samples, mistakes in soil investigation, weakness of qualified supervisor, inflexibility (rigidity) of consultant and original contract duration is too short.

*D- Project-related group consists of*, environmental restrictions, design changes, Additional works, lack of communication between parties, occurrence of site accidents during construction and personality clash between contractor agent and engineering supervisor.

*E-Material and labor group consists of*, escalation of material prices (inflation), inadequate production of raw materials in the country, shortages of materials, shortages of skilled workers / technical personnel, high cost of skilled labor, poor labor productivity, high equipment maintenance costs and Poor equipment productivity.

*F- External factors-related group consists of*, unforeseen site (ground) conditions, difficulties in getting work permit from government, bureaucracy in bidding/ tendering method, unavailability of utilities in site (such as, water, electricity, telephone, etc.), High insurance and high interest rates, political insecurity instability, project location, stealing and waste on site, litigation, high transportation costs, bad weather and Uncontrollable external factors.

### 3.4. Index Analysis

The data are processed through three types of indices:

• **Frequency index:**

This index expresses occurrence frequency of factor responsible for time and cost overruns. It is computed as per following formula:

$$F.I = \Sigma a * n / Total\ score \dots\dots\dots (3-2).$$

Where: a = constant expressing the weight assigned to each responses (ranges from 1 for very low to 5 for very high), n = frequency of each response.

• **Severity index:**

This index expresses severity of factor that caused delay and cost overruns. It is computed as per following formula:  $S.I = \Sigma a * n / Total\ score \dots\dots\dots (3-3).$

Where: a = constant expressing the weight assigned to each responses (ranges from 1 for very low to 5 for very high), n = frequency of each response.

• **Importance index:**

This index expresses the overview of factor based on both their frequency and severity. It is computed as per following formula:  $IMP.I = F.I \times S.I. \dots\dots\dots (3-4).$

The respondents' value in the distributed questionnaire was as shown in Table (3.2).

**Table (3.2). The respondents answer in the distributed questionnaire.**

No	Causes	probability of Occurrence					Impact if occurred				
		V.L	L	M	H	V.H	V.L	L	M	H	V.H
<b>A</b>	<b><u>Owner related group consists of</u></b>										
1	Financial difficulties of owner	6	13	7	19	7	3	9	11	17	12
2	Slow payment of completed works	4	10	22	12	4	0	6	14	21	11
3	Low speed of decision making	9	19	12	8	4	6	10	14	13	9
4	Delay to furnish and deliver the site to the contractor by the owner.	18	22	10	1	1	9	15	20	5	3
<b>B</b>	<b><u>Consultants related group consists of</u></b>										
1	Slow inspection of completed works	9	23	13	7	0	4	6	25	13	4
2	Mistakes in design	25	20	4	2	1	8	10	8	19	7
3	Practice of assigning contract to lowest bidder	6	6	11	18	11	1	3	9	24	15
4	Inaccurate bill of quantities.	5	14	18	7	8	5	4	17	13	13
5	Long period between design and time of bidding/ tendering	7	14	16	7	8	16	5	15	11	5

**Table (3.2). The respondents answer in the distributed questionnaire (cont.)**

No	Causes	probability of Occurrence					Impact if occurred				
		V.L	L	M	H	V.H	V.L	L	M	H	V.H
6	Waiting for approval of shop drawings and material samples	5	15	18	13	1	6	10	12	19	5
7	Mistakes in soil investigation	8	14	14	8	8	2	8	17	14	11
8	weakness of qualified supervisor	15	18	14	5	0	10	5	14	18	5
9	Inflexibility (rigidity) of consultant	8	11	22	9	2	8	6	19	9	10
10	Original contract duration is too short	6	15	21	8	2	6	7	14	21	4
<b>C</b>	<b><u>Contractor-related group consists of</u></b>										
1	Poor site management and supervision	12	20	16	4	0	3	10	10	21	8
2	Financial difficulties of contractor	7	7	11	20	7	2	6	15	16	13
3	Mistakes during construction	21	20	10	1	0	5	9	16	20	2
4	Ineffective planning and scheduling by contractors	12	20	12	7	1	12	9	17	7	7
5	inexperienced contractor	22	18	8	3	1	9	4	15	14	10
6	Poor financial control on site	16	22	7	2	5	5	8	12	10	17
7	Inaccurate cost estimation	7	15	14	8	8	3	7	18	12	12
8	Poor relationship between management and labor	22	17	9	3	1	12	5	14	10	11
9	rework due to poor work / wrong materials by the contractor	23	18	8	2	1	6	9	9	13	15
10	poor monitoring and control	24	16	3	6	3	9	6	9	17	11
11	Lack of database in estimating activity duration and resources	16	23	10	2	1	8	7	21	11	5
12	Lack of administrative employee	21	8	19	4	0	8	10	24	9	1
13	Incompetent subcontractors	10	17	15	9	1	6	7	12	18	9
<b>D</b>	<b><u>Project-related group consists of</u></b>										
1	environmental restrictions	22	11	14	4	1	11	11	18	9	3
2	Design changes	14	20	13	5	0	6	16	12	17	1
3	Additional works	5	13	15	12	7	12	9	16	12	3
4	Lack of communication between parties	13	21	12	6	0	6	8	16	15	7
5	Occurrence of site accidents during construction	26	20	6	0	0	12	17	15	4	4
6	personality clash between contractor agent and engineering supervisor	15	21	11	5	0	9	7	17	14	5

**Table (3.2). The respondents answer in the distributed questionnaire (cont.)**

No	Causes	probability of Occurrence					Impact if occurred				
		V.L	L	M	H	V.H	V.L	L	M	H	V.H
<b>E</b>	<b><u>Material and labor and Equipment group consists of</u></b>										
1	Escalation of material prices (Inflation)	2	4	9	13	24	4	9	12	11	16
2	Inadequate production of raw materials in the country	14	14	15	5	4	3	8	11	15	15
3	Shortages of materials	11	16	19	5	1	3	7	9	22	11
4	Shortages of skilled workers / technical personnel	7	15	14	14	2	4	7	16	16	9
5	High cost of skilled labor	3	9	18	11	11	3	6	15	16	12
6	Poor labor productivity	8	15	19	8	2	1	13	19	14	5
7	High equipment maintenance costs	12	18	10	12	0	5	13	15	15	4
8	Poor equipment productivity	16	12	21	3	0	6	9	19	15	3
<b>F</b>	<b><u>External factors-related group consists of</u></b>										
1	Unforeseen site (ground) conditions	7	16	19	9	1	4	8	18	13	9
2	Difficulties in getting work permit from government	2	6	21	9	14	3	6	8	13	22
3	Bureaucracy in bidding/ tendering method	6	11	9	20	6	2	7	18	14	11
4	Unavailability of utilities in site (such as, water, electricity, telephone, etc.)	4	15	21	8	4	4	9	17	14	8
5	High insurance and high interest rates	7	8	16	17	4	1	6	14	22	9
6	political insecurity instability	3	8	12	17	12	2	2	5	14	29
7	project location	5	18	25	4	0	3	9	21	11	8
8	Stealing and waste on site	5	19	13	14	1	4	6	19	11	12
9	Litigation	17	17	16	1	1	6	12	12	11	11
10	High transportation costs	6	13	19	7	7	3	6	18	14	11
11	Bad weather.	19	19	13	1	0	12	7	25	6	2
12	uncontrollable external factors	42	8	2	0	0	6	7	6	8	25

### 3.5. Ranking of Factors

Table (3.3) and (3.4). Show the frequency indices, the severity indices of *fifty three* causes and their rankings. These causes are rated by two different respondent groups. It can be seen from these two tables that there small difference in the ranking orders of occurrence and severity by overall. It means that the more the cause frequently happens the more it severely impacts the project duration and budget. The deviation of the occurrence ranking order from the severity ranking order in each respondent group is small.

The first fourteen causes in overall ranking have a good agreement between two parties of projects. Escalation of material prices, political insecurity instability, Difficulties in getting work permit from government, Practice of assigning contract to lowest bidder, High cost of skilled labor, Bureaucracy in bidding/ tendering method, high insurance and high interest rates, Slow payment of completed works, Financial difficulties of contractor, Financial difficulties of owner, Inaccurate bill of quantities, High transportation costs, Inaccurate cost estimation, Mistakes in soil investigation. All these problems belong to five different parties. Five of them belong to external factors, three causes belongs to consultant group, and the other causes belongs to (Two from material, labor and equipment group, two from owner group and two from contractor group). All of these factors are popular in education building project in Egypt and in developing countries, leading the project to time and cost overruns, the frequency index and ranking results as shown in Table (3.3).

**Table (3.3). Frequency index and ranking**

Causes	Overall		Contractors	Consultants	Group
	F.I	Rank	F.I	F.I	
Escalation of material prices (inflation)	0.804	1	0.8488	0.6364	Resources
political insecurity instability	0.704	2	0.7122	0.6727	external
Difficulties in getting work permit from government	0.704	3	0.7366	0.5818	external
Practice of assigning contract to lowest bidder	0.685	4	0.7122	0.5818	consultant
High cost of skilled labor	0.669	5	0.7122	0.5091	Resources
Bureaucracy in bidding/ tendering method	0.627	6	0.6293	0.6182	external
High insurance and high interest rates	0.612	7	0.6439	0.4909	external
Slow payment of completed works	0.608	8	0.6293	0.5273	owner
Financial difficulties of contractor	0.650	9	0.6732	0.5636	contractor
Financial difficulties of owner	0.630	10	0.6390	0.6000	owner
Inaccurate bill of quantities.	0.596	11	0.6000	0.5951	consultant
High transportation costs	0.585	12	0.6000	0.5273	external
Inaccurate cost estimation	0.581	13	0.5951	0.5273	contractor
Mistakes in soil investigation	0.577	14	0.5951	0.5091	consultant



**Table (3.3). Frequency index and ranking (cont.)**

Causes	Overall		Contractors	Consultants	Group
	F.I	Rank	F.I	F.I	
Long period between design and time of bidding/ tendering	0.573	15	0.5951	0.4909	consultant
Unavailability of utilities in site (such as, water, electricity, telephone, etc.)	0.573	16	0.5854	0.5273	external
Waiting for approval of shop drawings and material samples	0.562	17	0.5756	0.5091	consultant
Shortages of skilled workers / technical personnel	0.558	18	0.5610	0.5455	Resources
Stealing and waste on site	0.550	19	0.5805	0.4364	external
Original contract duration is too short	0.542	20	0.5366	0.5636	consultant
Inflexibility (rigidity) of consultant	0.546	21	0.5610	0.4909	consultant
Additional works	0.527	22	0.5073	0.6000	project
Poor labor productivity	0.527	23	0.5366	0.4909	Resources
Unforeseen site (ground) conditions	0.527	24	0.5415	0.4727	external
Low speed of decision making	0.519	25	0.5561	0.3818	owner
project location	0.508	26	0.5268	0.4364	external
Incompetent subcontractors	0.500	27	0.4927	0.5273	contractor
Inadequate production of raw materials in the country	0.488	28	0.4732	0.5455	Resources
High equipment maintenance costs	0.485	29	0.4732	0.5273	Resources
Shortages of materials	0.481	30	0.4878	0.4545	Resources
Slow inspection of completed works	0.469	31	0.4780	0.4364	consultant
Ineffective planning and scheduling by contractors	0.465	32	0.4537	0.5091	contractor
Poor site management and supervision	0.446	33	0.4244	0.5273	contractor
Lack of communication between parties	0.442	34	0.4341	0.4727	project
Poor equipment productivity	0.442	35	0.4390	0.4545	Resources
Poor financial control on site	0.438	36	0.4000	0.5818	contractor
weakness of qualified supervisor	0.435	37	0.4293	0.4545	consultant
Design changes	0.435	38	0.4439	0.4000	project
Lack of administrative employee	0.423	39	0.4049	0.4909	contractor
personality clash between contractor agent and engineering supervisor	0.423	40	0.4244	0.4182	project
Litigation	0.415	41	0.4244	0.3818	external

**Table (3.3). Frequency index and ranking (cont.)**

Causes	Overall		Contractors	Consultants	Group
	F.I	Rank	F.I	F.I	
environmental restrictions	0.412	42	0.4244	0.3636	project
Lack of database in estimating activity duration and resources	0.404	43	0.3805	0.4909	contractor
poor monitoring and control	0.400	44	0.3756	0.4909	contractor
Delay to furnish and deliver the site to the contractor by the owner.	0.388	45	0.3854	0.4000	owner
Bad weather.	0.385	46	0.3854	0.3818	external
Poor relationship between management and labor	0.385	47	0.3707	0.4364	contractor
inexperienced contractor	0.381	48	0.3659	0.4364	project
rework due to poor work / wrong materials by the contractor	0.369	49	0.3415	0.4727	contractor
Mistakes during construction	0.365	50	0.3415	0.4545	contractor
Mistakes in design	0.346	51	0.3463	0.3455	consultant
Occurrence of site accidents during construction	0.323	52	0.3171	0.3455	project
uncontrollable external factors	0.246	53	0.2488	0.2364	external

The severity index and ranking results were shown in Table (3.4).

**Table (3.4). Severity index and ranking**

Causes	Overall		Contractors	Consultants	Group
	S.I	Rank	S.I	S.I	
political insecurity instability	0.854	1	0.8878	0.7273	external
Practice of assigning contract to lowest bidder	0.788	2	0.8244	0.6545	consultant
Difficulties in getting work permit from government	0.773	3	0.8098	0.6364	external
Slow payment of completed works	0.742	4	0.7512	0.7091	owner
High insurance and high interest rates	0.723	5	0.7512	0.6182	external
Financial difficulties of contractor	0.722	6	0.7300	0.6909	contractor
High cost of skilled labor	0.708	7	0.7317	0.6182	Resources
Bureaucracy in bidding/ tendering method	0.704	8	0.7268	0.6182	external
Financial difficulties of owner	0.699	9	0.7122	0.6545	owner
Escalation of material prices (inflation)	0.700	10	0.7220	0.6182	Resources
Inaccurate bill of quantities.	0.696	11	0.7317	0.5640	consultant

**Table (3.4). Severity index and ranking (cont.)**

Causes	Overall		Contractors	Consultants	Group
	S.I	Rank	S.I	S.I	
Inaccurate cost estimation	0.696	12	0.7122	0.6364	contractor
Mistakes in soil investigation	0.692	13	0.7122	0.6182	consultant
High transportation costs	0.692	14	0.7122	0.6182	external
Stealing and waste on site	0.681	15	0.7317	0.4909	external
Shortages of skilled workers / technical personnel	0.673	16	0.6732	0.6727	Resources
Incompetent subcontractors	0.665	17	0.6732	0.6364	contractor
Poor site management and supervision	0.663	18	0.6800	0.6000	contractor
poor monitoring and control	0.658	19	0.6829	0.5636	contractor
Unforeseen site (ground) conditions	0.658	20	0.6927	0.5273	external
rework due to poor work / wrong materials by the contractor	0.655	21	0.6600	0.6364	contractor
Inadequate production of raw materials in the country	0.650	22	0.6630	0.6000	Resources
Unavailability of utilities in site (such as, water, electricity, telephone, etc.)	0.650	23	0.6732	0.5636	external
Shortages of materials	0.648	24	0.6610	0.6000	Resources
project location	0.646	25	0.6732	0.5455	external
Inexperienced contractor	0.646	26	0.6780	0.5273	contractor
Poor financial control on site	0.642	27	0.6530	0.6000	contractor
uncontrollable external factors	0.640	28	0.6800	0.4909	external
Original contract duration is too short	0.638	29	0.6439	0.6182	consultant
Mistakes in design	0.636	30	0.6390	0.6250	consultant
Poor labor productivity	0.635	31	0.6439	0.6000	Resources
Low speed of decision making	0.635	32	0.6585	0.5455	owner
Lack of communication between parties	0.635	33	0.6585	0.5455	project
Litigation	0.635	34	0.6878	0.4364	external
Slow inspection of completed works	0.627	35	0.6537	0.5273	consultant
Waiting for approval of shop drawings and material samples	0.627	36	0.6537	0.5273	consultant
Inflexibility (rigidity) of consultant	0.627	37	0.6585	0.5091	consultant
Mistakes during construction	0.619	38	0.6390	0.5455	contractor
weakness of qualified supervisor	0.612	39	0.6341	0.5273	consultant
Poor relationship between management and labor	0.612	40	0.6146	0.6000	contractor
High equipment maintenance costs	0.600	41	0.5951	0.6182	Resources

Causes	Overall		Contractors	Consultants	Group
	S.I	Rank	S.I	S.I	
Poor equipment productivity	0.600	42	0.6195	0.5273	Resources
personality clash between contractor agent and engineering supervisor	0.596	43	0.6146	0.5273	project
Lack of database in estimating activity duration and resources	0.592	44	0.6049	0.5455	contractor
Design changes	0.565	45	0.5805	0.5091	project
Ineffective planning and scheduling by contractors	0.554	46	0.5610	0.5273	contractor
Additional works	0.542	47	0.5415	0.5455	project
Lack of administrative employee	0.542	48	0.5610	0.4727	contractor
Long period between design and time of bidding/ tendering	0.538	49	0.5512	0.4909	consultant
environmental restrictions	0.531	50	0.5561	0.4364	project
Bad weather.	0.519	51	0.5366	0.4545	external
Delay to furnish and deliver the site to the contractor by the owner.	0.515	52	0.5268	0.4727	owner
Occurrence of site accidents during construction	0.488	53	0.5024	0.4364	project

Table (3.5). Show the importance index and ranking consistent with various parties causing time and cost overruns in educational building projects in Egypt.

**Table (3.5). Importance index and ranking**

Code	Causes	Overall (F.I*S.I)		Overall	Overall	GROUP
		IMP.I	Rank	F.I	S.I	
F6	political insecurity instability	0.601	1	0.7038	0.8539	external
E1	Escalation of material prices (Inflation)	0.563	2	0.8039	0.7009	Resources
F2	Difficulties in getting work permit from government	0.544	3	0.7039	0.7731	external
B3	Practice of assigning contract to lowest bidder	0.540	4	0.6846	0.7885	consultant
E5	High cost of skilled labor	0.474	5	0.6692	0.7077	Resources
C2	Financial difficulties of contractor	0.469	6	0.6500	0.7194	contractor
A2	Slow payment of completed works	0.451	7	0.6077	0.7654	owner
F5	High insurance and high interest rates	0.442	8	0.6115	0.7231	external
F3	Bureaucracy in bidding/ tendering method	0.441	9	0.6269	0.7047	external
A1	Financial difficulties of owner	0.441	10	0.6308	0.6986	owner
B4	Inaccurate bill of quantities.	0.415	11	0.5962	0.6962	consultant

**Table (3.5). Importance index and ranking (cont.)**

Code	Causes	Overall (F.I*S.I)		Overall	Overall	GROUP
		IMP.I	Rank	F.I	S.I	
F10	High transportation costs	0.405	12	0.5846	0.6899	external
C7	Inaccurate cost estimation	0.404	13	0.5807	0.6944	contractor
B7	Mistakes in soil investigation	0.399	14	0.5786	0.6906	consultant
F8	Stealing and waste on site	0.378	15	0.5500	0.6873	external
E4	Shortages of skilled workers / technical personnel	0.375	16	0.5577	0.6730	Resources
F4	Unavailability of utilities in site (such as, water, electricity, telephone, etc.)	0.373	17	0.5731	0.6500	external
B6	Waiting for approval of shop drawings and material samples	0.352	18	0.5615	0.6269	consultant
F1	Unforeseen site (ground) conditions	0.347	19	0.5269	0.6577	external
B10	Original contract duration is too short	0.346	20	0.5423	0.6385	consultant
B9	Inflexibility (rigidity) of consultant	0.342	21	0.5462	0.6269	consultant
E6	Poor labor productivity	0.334	22	0.5269	0.6346	Resources
C13	Incompetent subcontractors	0.333	23	0.5000	0.6654	contractor
A3	Low speed of decision making	0.330	24	0.5192	0.6346	owner
F7	project location	0.328	25	0.5077	0.6462	external
E2	Inadequate production of raw materials in the country	0.317	26	0.4885	0.6497	Resources
E3	Shortages of materials	0.312	27	0.4808	0.6481	Resources
B5	Long period between design and time of bidding/ tendering	0.309	28	0.5731	0.5385	consultant
C1	Poor site management and supervision	0.296	29	0.4461	0.6631	contractor
B1	Slow inspection of completed works	0.294	30	0.4692	0.6269	consultant
E7	High equipment maintenance costs	0.291	31	0.4846	0.6000	Resources
D3	Additional works	0.286	32	0.5269	0.5423	project
C6	Poor financial control on site	0.281	33	0.4385	0.6418	contractor
D4	Lack of communication between parties	0.281	34	0.4423	0.6346	project
B8	weakness of qualified supervisor	0.266	35	0.4346	0.6115	consultant
E8	Poor equipment productivity	0.265	36	0.4423	0.6000	Resources
F9	Litigation	0.264	37	0.4154	0.6346	external
C10	poor monitoring and control	0.263	38	0.4000	0.6577	contractor

**Table (3.5). Importance index and ranking (cont.)**

Code	Causes	Overall (F.I*S.I)		Overall	Overall	GROUP
		IMP.I	Rank	F.I	S.I	
C4	Ineffective planning and scheduling by contractors	0.258	39	0.4654	0.5538	contractor
D6	personality clash between contractor agent and engineering supervisor	0.252	40	0.4231	0.5962	project
D2	Design changes	0.246	41	0.4346	0.5654	project
C5	inexperienced contractor	0.246	42	0.3808	0.6462	contractor
C9	rework due to poor work / wrong materials by the contractor	0.242	43	0.3692	0.6550	contractor
C11	Lack of database in estimating activity duration and resources	0.239	44	0.4038	0.5923	contractor
C8	Poor relationship between management and labor	0.235	45	0.3846	0.6115	contractor
C12	lackof administrative employee	0.229	46	0.4231	0.5423	contractor
C3	Mistakes during construction	0.226	47	0.3654	0.6192	contractor
B2	Mistakes in design	0.220	48	0.3462	0.6361	consultant
D1	environmental restrictions	0.218	49	0.4115	0.5308	project
A4	Delay to furnish and deliver the site to the contractor by the owner.	0.200	50	0.3885	0.5154	owner
F11	Bad weather.	0.200	51	0.3846	0.5192	external
F12	uncontrollable external factors	0.158	52	0.2462	0.6400	external
D5	Occurrence of site accidents during construction	0.158	53	0.3231	0.4885	project

All parties met an agreement that the highest 14 factors are as shown in Table (3.6).

**Table (3.6). The highest 14 factors causes time and cost overrun**

<b>Code</b>	<b>Causes</b>	<b>Imp. I</b>	<b>Rank</b>	<b>GROUP</b>	<b>symbol</b>
F6	political insecurity instability	0.601	1	External	X1
E1	Escalation of material prices (Inflation)	0.563	2	Resources	X2
F2	Difficulties in getting work permit from government	0.544	3	External	X3
B3	Practice of assigning contract to lowest bidder	0.540	4	Consultant	X4
E5	High cost of skilled labor	0.474	5	Resources	X5
C2	Financial difficulties of contractor	0.470	6	Contractor	X6
A2	Slow payment of completed works	0.451	7	Owner	X7
F5	High insurance and high interest rates	0.442	8	External	X8
F3	Bureaucracy in bidding/ tendering method	0.441	9	External	X9
A1	Financial difficulties of owner	0.441	10	Owner	X10
B4	Inaccurate bill of quantities.	0.415	11	Consultant	X11
F10	High transportation costs	0.405	12	External	X12
C7	Inaccurate cost estimation	0.404	13	Contractor	X13
B7	Mistakes in soil investigation	0.399	14	Consultant	X14

Political insecurity instability, escalation of material prices (inflation), difficulties in getting work permit from government, practice of assigning contract to lowest bidder, high cost of skilled labor, Financial difficulties of contractor, slow payment of completed works, high insurance and high interest rates, bureaucracy in bidding/ tendering method and financial difficulties of owner, these are the highest important causes of time and cost overruns in Educational projects in Egypt.

The first cause was political insecurity instability (external group), this cause has high effect on the projects in Egypt in the year 2011 after the Egyptian revolution, so we are going to eliminate this factor.

The second cause was escalation of material prices (inflation) (material, labor & equipment group), it was concluded from the central agency for public in Egypt that the inflation varies from 11.8 to 10.5% during the last five years,

The percentage of the Gross Domestic Product (GDP) in Egypt in the last five years varies from 7.1% in 2007 to 1.8 % in 2011 (CIA world fact book).

The third cause was difficulties in getting work permit from government (external group), this cause have a high direct effect especially on the contractors due to the routine applied in the government in all the cities which have a direct effect on the projects duration which leads to an excess cost by the contractors to overcome this cause.

The fourth cause was practice of assigning contract to lowest bidder (consultant group), which is seen in open tender where any contractor regard of his rank in the contractor union or his previous experience could win the project. And with the strong specifications made by the authority of educational buildings this contractor cannot complete the project with the specified time and budget leads him to liquidated damage,

As in our sample this cause has high effect on the projects time and cost overruns in Egypt. The fifth cause was high cost of skilled labor (material, labor & equipment group), which has high effect on the project cost to overcome the specifications of authority of educational buildings and made the project with the time schedule to overcome any liquidated damage.

The sixth cause financial difficulties of contractor (contractor group), In our projects sample when the project size increases the cost overrun increases which means that the contractor financial management in most projects in Egypt is very weak, so this factor have high effect on the education building projects in Egypt.

The seventh cause slow payment of completed works (owner group), as we know here the owner is the ministry of education, As Egypt is a developing country so the payment for completed work is very slow which leads to cost and time overruns to small contractors and leads them to be out of schedule so as we seen this is a very high cause that leads to time and cost overruns to most of the projects in Egypt.

The eighth cause was high insurance and interest rates (external group), this factor directly affect the contractors if they depends on the bank to finance the project, according to the central agency for public in Egypt the average interest varies from 8 to 10% during the last 5 years so on the major projects in the sample this factor have slightly effect on the project time and cost overruns.

The ninth cause was bureaucracy in bidding/tendering method (external group), which leads us to select the unsuitable contractor for the work so there must be a new rules to assign the suitable contractor for each specific project according to the purpose of the project so this cause have a high effect on selecting the contractor and the quality of the projects.



The tenth cause was financial difficulty of the owner (owner group), this cause have high effect on the projects as the owner here is the government so it affect the project schedule and affect the contractor to pay an excessive money to overcome this cause and go on with the schedule.

### 3.6. Projects Data

The scope of this study is confined on 2000 educational building projects implemented from 2007 to 2011 by the Authority of Educational Building. Hence the target of ministry of education was from 300 to 400 educational building per year. So, the *sample size* was determined using equation (3.5) developed by Yamane (1967):

$$n = \frac{N}{1 + N(e)^2}$$

Where, n is the sample size, N is the number of projects and e the acceptable sampling error at 95% confidence level.

$$n = \left[ \frac{2000}{1+(2000 \times (0.1)^2)} \right] = 95.24 \quad (3.5)$$

So our sample size is 96 projects, but we will take it 102 projects as we have collected.

Data were collected from contractors (by E-mail or by hand) on **102 Educational building** projects in Egypt comprising small, medium and large projects. Methods involved are traditional design & build, construction management, Management contracting and project management. Tendering methods were (open tender, limited tender and selective).

***The data collected for 102 projects include*** (name of the educational building - city – company - estimated cost - actual cost- estimated schedule - actual schedule – start date – date of completion - any additional time and the effect of highest quantitative factors affecting the 102 projects. We have collected the data for the effect of the highest qualitative factors affecting the 102 projects by making an interview with the parties involved in the projects and expert, each effect of the qualitative factors on the projects was given criteria as follows:

### 1-Difficulties in getting work permit from government

Cairo + Alexandria + Giza	High	3
Behera + Gharbya + Qalubya + Daqahlya	Medium	2
Sohag + Asyut + Minya + Qena + Luxor	Low	1

### 2-Financial difficulties of contractor

Cairo + Alexandria + Gharbya + Minya	High	3
Qena + Giza + Asyut + Daqahlya	Medium	2
Sohag + Qalubya + Behera + Luxor	Low	1

### 3-Slow payment of completed work

Cairo + Gharbya + Minya	High	3
Behera + Alexandria + Qalubya + Daqahlya+ Giza+ Asyut	Medium	2
Sohag + Qena + Luxor	Low	1

### 4-Bureaucracy in bidding/ tendering method

Cairo + Gharbya + Minya + Qena	High	3
Behera + Qalubya + Daqahlya + Alexandria	Medium	2
Sohag + Asyut + Giza + Luxor	Low	1

### 5-Practice of assigning contract to lowest bidder

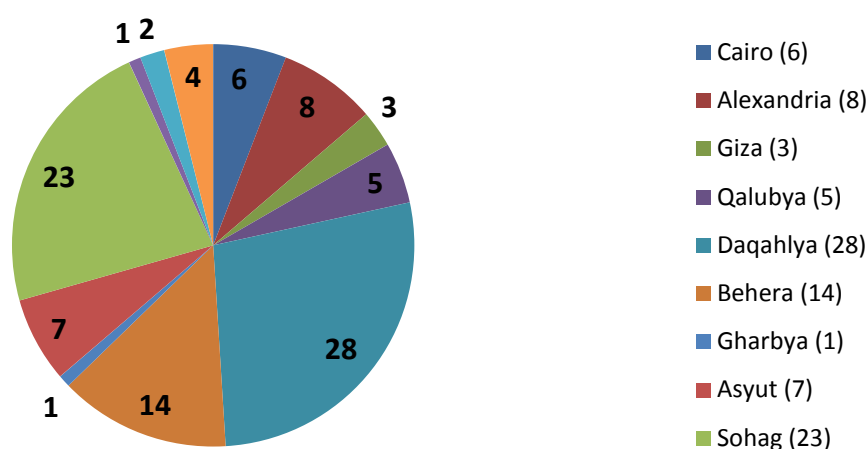
Projects having total budget greater than five million	20% from total budget
Projects having total budget from one to five million	15% from total budget
Projects having total budget less than one million	10% from total budget

### 6-Mistakes in soil investigation

Minya + Behera	High	3
Gharbya + Asyut + Qena + Giza	Medium	2
Sohag + Alexandria + Daqahlya + Luxor + Cairo + Qalubya	Low	1

All the projects were completed between years 2007 to 2011; the collected projects locate in 12 cities in Egypt as shown in figure (3.5).

**Figure (3.5). Project location for 102 sample projects**



The distribution of the projects according to time and cost overruns were as shown in the following Table (3.7).

**Table (3.7). Distribution of project by time and cost overrun**

		Ratio of actual project construction duration to planned project construction duration		Total
		≤ 1	More than 1	
Ratio of actual as built cost to winning bid amount	≤ 1	69	0	69
	More than 1	4	29	33
Total		73	29	102

33 projects out of 102 projects having cost overruns with percentage 32.35%. Moreover, about 87.88% of this projects have time overruns as shown in table 3.9, while 29 projects having time delay with percentage 28.43% of total projects, 15 projects have fallen in liquidated damages with percentage 14.7%.

The projects size and duration are classified into three groups as shown in the following Tables (3.8) and (3.9).

**Table (3.8). Classification of project according to Project size**

<b>Projects size</b>	<b>No of projects</b>	<b>Cost overrun</b>	<b>% of projects</b>	<b>% of Average value of cost overrun</b>
<b>Less than 1 million</b>	17	3	17.65	14.13
<b>Between 1 to 5 million</b>	69	19	27.54	7.51
<b>More than 5 million</b>	16	11	68.75	5.91
<b>Total</b>	102	33	32.35	

The collected projects were classified into three groups according to their tender price. The first group includes projects with a tender price less than 1 million EGP. The tender prices of the other two groups are smaller and greater than 5 million EGP respectively. A closer inspection to Table (3.8), clearly show that the percentage of projects that have cost overrun 17.65%, 27.54% and 68.75% for the three groups respectively.

Such result clearly indicates that the probability of occurrence that the cost overrun increase as the project size increase. Moreover, the average percentage value of cost overruns was found to be 14.13%, 7.51% and 5.91% for the three groups respectively. This clearly indicates that the severity of cost overrun is inversely proportional to the project size.

**Table (3.9). Classification of project according to Project durations**

<b>Projects durations</b>	<b>No of projects</b>	<b>Time overrun</b>	<b>% of projects</b>	<b>% of Average value of time overrun</b>
<b>Less than 8 months</b>	9	0	0	0
<b>Between 8 to 12 months</b>	65	18	27.69	19.18
<b>More than 12 months</b>	28	11	39.29	9.67
<b>Total</b>	102	29	28.43	

The collected projects were classified into three groups according to their project scheduled time. The first group includes projects with scheduled time less than 8 months.

The project scheduled time of the other two groups is smaller and greater than 12 months respectively. A closer inspection to Table (3.9), clearly show that the percentage of projects that have time overrun 0%, 27.69% and 39.29% for the three groups respectively. Such result clearly indicates that the probability of occurrence that the time overrun increase as project scheduled time increase. Moreover, the average percentage value of time overruns was found to be 0%, 19.18% and 9.67% for the three groups respectively. This clearly indicates that the average percentage of time overrun was found to be gradually decrease as the project scheduled time increase.

**CHAPTER FOUR**  
**DEVELOPMENT OF REGRESSION MODELS**

## Chapter 4

### Development of Regression Models

This chapter presented the design of two multiple regression models for estimating a model for cost and time overruns. These two multiple regression models were backward and forward regression models and were developed based on the most effective factors that were previously identified in Chapter three. Both backward and forward regression models (BRM and FRM) were employed using **Statistical Package for the Social Sciences** (SPSS) version 16 for estimating regression model for cost and time overruns. The SPSS program is more preferable than any other method because of its simplicity to be used by the contractors.

#### 4.1 Data Collection

The data used in development of the backward and forward regression models were collected from observation of 102 Educational building projects between years 2007 to 2011 at 12 cities were used to design the two regression models. The other 30 Educational building projects were collected from years 2011-2012 and were used to validate these two regression models.

#### 4.2 Regression Analysis

Regression analysis is an extremely powerful tool that enables the researcher to learn more about the relationships within the data being studied (Smith 1998). In multiple regression models, there is one dependent variable and several independent variables on the other hand; simple regression has one dependent variable and one independent variable. Therefore, multiple linear regression models (MLR) will be used to determine the statistical relationship between a response (e.g., time and cost overruns in Educational building projects in Egypt) and the significant variables (e.g., Escalation of material prices (Inflation), Difficulties in getting work permit from government, etc).

MLR models are generally able to describe the data better than a simple linear model which is based on a single explanatory variable. However, it is usually the objective of the researcher to reduce the model to its most efficient form (Williams 2005).

The form of multiple linear regression models is described as below:

$$Y_i = K + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \dots + \beta_k X_k + \varepsilon \dots \dots \dots$$

(4-1)

Where  $Y_i$  is the observed time or cost overruns corresponds to the explanatory variables.  $X_1$  to  $X_k$  are the explanatory variables;  $N$  is the number of explanatory variables.  $\beta_1$  to  $\beta_k$  are the coefficients of explanatory variables,  $K$  is constant and  $\varepsilon$  are errors that create scatter around the linear relationship.

### 4.3 Description of the Two Regression Models

Backward and forward regression models were employed using SPSS version 16. *Forward stepwise regression* begins with no variables in the equation, enters the most significant variable at the first step, and continues adding and deleting variables until none can significantly improve the fit. On the other hand, *backward regression model* begins with all candidate variables, then removes the least significant variable at the first step and continues until no insignificant variables remain Attalla and Hegazy (2003). Having identified the most important factors that could impact time and cost overruns in Educational building projects in Egypt, Actual data are required to develop the two regression models for identifying the most significant factors affecting time and cost overruns.

### 4.4 Two Regressions on Time and Cost overrun

Once the highest important 14 factors (quantitative and qualitative) that could impact time and cost overruns in Educational building projects in Egypt were identified, *The Input Data* to be examined using SPSS version 16 was the severity of these factors on the 102 educational building projects sites from years 2007 to 2011. *The Output* is to develop the two regression models to be used for future consideration to assess in expected cost and time overruns of any future educational building projects. Both BRM and FRM were employed using Statistical Package for the Social Sciences (SPSS) version 16. Using this software, a regression equation is fitted to the significant independent variables in chapter 2 Table (2.3).

102 projects were used to design the two regression models, and the other 30 projects were used to validate these two regression models.



*Backward regression model* was slightly more accurate in predicting time and cost overruns in Educational building projects in Egypt because it has a higher squared multiple  $R^2$  and a lower mean square error for the residuals as indicated in Table (4.1) and Table (4.2). Backward regression model is preferable to forward regression model because the first has the advantage of looking at all the available variables in the early stages of the model development process Attalla and Hegazy (2003).

#### **4.5 Significant and Insignificant Factors (T- test value)**

A decision is made as to whether all the explanatory variables are significant. If the variable is significant it remains in the model; otherwise, it is removed and the regression analysis repeated (Smith 1998). Removing one of the factors is not only necessary in a statistical sense, but it is also helpful in an analytical sense because the factor that is not included in the regression equation can be considered as standard condition .To identify the factors that are significant in the backward regression model, for example, the critical T-test value should be calculated. At a level of significance of 5%, the critical T-test is calculated at  $(0.05; n- p- 1)$ . Where n is the number of data points (102 projects), and p is the number of significant variables ( $p = 14$ ). Then the term  $n-p-1 = 87$  and the critical T-test value is 1.98 (this number was taken from Levin and Rubin tables). This implies that all variables with an absolute T-ratio less than 1.98 are not significant to the regression equation. In other words, the most significant variables that affect time and cost overruns in Educational building projects in Egypt are those that have T value greater than critical T-test value. It is noted from table 4.1 that the number of significant variables for time overrun in the BRM was 11 factors, while the number of significant variables in FRM was 8 significant factors. While from table 4.4 the number of significant variables for cost overrun in the BRM was 7 factors, while the number of significant variables in FRM was 5 significant factors. All explanatory variables together should explain the variability observed in output. The hypothesis formulation and significance test were as in the following tables:

Table 4.1 indicates the coefficients, T-test, Beta for the backward regression models for time overrun as shown.

**Table (4.1). Coefficients of variables, of final run using backward stepwise regression for time overrun**

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	0.453	0.036		12.46	2.74E-21
Difficulties in getting work permit from government	0.123	0.015	0.24	8.05	3.15E-12
Practice of assigning contract to lowest bidder	8.59E-07	4.02E-07	1.35	2.14	0.04
High cost of skilled labor	-2.29E-07	1.22E-07	-0.19	-1.88	0.064
Financial difficulties of contractor	-0.123	0.014	-0.35	-8.95	4.5E-14
Slow payment of completed works	0.064	0.017	0.144	3.67	0.0004
High insurance and high interest rates	-1.44E-06	8.4E-07	-0.92	-1.72	0.1
Bureaucracy in bidding/tendering method	0.06	0.02	0.143	2.999	0.004
Inaccurate bill of quantities	-1.8E-06	2.06E-07	-1.4	-8.73	1.27E-13
Inaccurate cost estimate	2.5E-07	5.5E-08	0.2	4.6	1.36E-05
Mistakes in soil investigation	0.197	0.03	0.39	6.99	4.7E-10
High transportation costs	1.37E-06	1.45E-07	1.265	9.4	4.6E-15

Table 4.2 indicates Anova statistics using backward regression models for time overrun.

**Table (4.2). Anova Statistic using backward stepwise regression for time overrun**

Model	Sum of Squares	df	Mean Square	F	Sig.	
4	Regression	10.203	11	.928	144.741	.000 <sup>d</sup>
	Residual	.577	90	.006		
	Total	10.780	101			

Table 4.3 indicates model summary statistic backward regression model for time overrun.

**Table (4.3). Model summary statistic using backward stepwise regression for time overrun**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.973 <sup>a</sup>	.947	.939	.08076
2	.973 <sup>b</sup>	.947	.940	.08031
3	.973 <sup>c</sup>	.947	.940	.07993
4	.973 <sup>d</sup>	.946	.940	.08005

From Table (4.1) to Table (4.3). Model (4) which contains the variables (Difficulties in getting work permit from government, Practice of assigning contract to lowest bidder, High cost of skilled labor, Financial difficulties of contractor, Slow payment of completed works, High insurance and high interest rates, Bureaucracy in bidding/ tendering method, Inaccurate bill of quantities, Inaccurate cost estimate, Mistakes in soil investigation, High transportation costs) is the most significant regression model it have strong correlation coefficient R equal to 0.973 and the coefficient of determination R square equal 0.946 which is a best fit which means that 94.6% of the total variation in time overrun can be explained by the model. Also it has 8.005 standard percentage errors.

Table 4.4 indicates the coefficients, T-test, Beta for the backward regression models for cost overrun as shown.

**Table (4.4). Coefficients of variables, of final run using backward stepwise regression for cost overrun**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
8	(Constant)	.873	.014		64.7	.000
	Difficulties in getting work permit from government	.016	.006	.14	2.816	.006
	High cost of skilled labor	5.3E-8	.000	.19	1.9	.060
	Financial difficulties of contractor	.032	.005	.39	6.1	.000
	High insurance and high interest rates	-9.2E-8	.000	-.25-	-2.4-	.021

	<b>Bureaucracy in bidding/ tendering method</b>	-.043-	.009	-.43-	-5.1-	.000
	<b>Inaccurate cost estimate</b>	9.5E-8	.000	.31	4.4	.000
	<b>Mistakes in soil investigation</b>	.076	.012	.64	6.3	.000

Table 4.5 indicates Anova statistics using backward regression models for cost overrun.

**Table (4.5). Anova Statistic using backward stepwise regression for cost overrun**

<b>Model</b>		<b>Sum of Squares</b>	<b>df</b>	<b>Mean Square</b>	<b>F</b>	<b>Sig.</b>
<b>8</b>	<b>Regression</b>	.484	7	.069	58.109	.000 <sup>h</sup>
	<b>Residual</b>	.112	94	.001		
	<b>Total</b>	.596	101			

Table 4.6 indicates model summary statistic backward regression model for cost overrun.

**Table (4.6). Model summary statistic using backward stepwise regression for cost overrun**

<b>Model</b>	<b>R</b>	<b>R Square</b>	<b>Adjusted R Square</b>	<b>Std. Error of the Estimate</b>
<b>1</b>	.906 <sup>a</sup>	.821	.792	.03502
<b>2</b>	.906 <sup>b</sup>	.821	.794	.03482
<b>3</b>	.906 <sup>c</sup>	.821	.797	.03464
<b>4</b>	.906 <sup>d</sup>	.821	.799	.03446
<b>5</b>	.905 <sup>e</sup>	.818	.798	.03449
<b>6</b>	.903 <sup>f</sup>	.815	.797	.03463
<b>7</b>	.902 <sup>g</sup>	.813	.797	.03457
<b>8</b>	.901 <sup>h</sup>	.812	.798	.03450

From Table (4.4) to Table (4.6). Model (8) which contains the variables (Difficulties in getting work permit from government, High cost of skilled labor, Financial difficulties of contractor, High insurance and high interest rates, Bureaucracy in bidding/ tendering method, Inaccurate cost estimate, Mistakes in soil investigation) is the most significant regression model as it have strong correlation coefficient R equal to 0.901 and the coefficient of determination R square equal 0.812 which is a best fit which means that

81.2% of the total variation in cost overrun can be explained by the model. Also it has 3.45 standard percentage errors.

#### 4.6 Hypothesis Test (F- test)

$H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \dots = \beta_k = 0.0$	←	Null Hypothesis: Y doesn't dependent on all explanatory variables (no model exists).
$H_1: \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \dots \neq \beta_k \neq 0.0$	←	Alternative Hypothesis: Y is dependent on all explanatory variables (model exists).

An F-Test was used to test the null hypothesis and was calculated based on the following equation:

$$F \text{ test} = \frac{SSR/k}{SSE/(n - k - 1)}$$

Where SSR is the sum of squares of errors for the explained part (regression), SSE is the sum of squares of errors for unexplained part (residuals), n is the number of data points (102 projects), And k is the number of explanatory/significant variables (k=14 in backward model). According to the results noted in table 4.1 for the backward regression model, SSR=10.203, SSE=0.577, n=102, and k =14 variables. By subsisting in the above equation:

$$F \text{ test} = \frac{10.203/14}{0.577/(102-14-1)} = 109.89 \tag{4.2}$$

If F = 109.89 is greater than F ( $\alpha=0.05$ ; k, n - k - 1), then reject  $H_0$  (null hypothesis), accept  $H_1$  (alternative hypothesis), and conclude that the regression model is an adequate and a whole significant. F ( $\alpha=0.05$ ; 14, 87) is 2.2 (this number was taken from tables in Levin and Rubin book) at a significance level of 5%. BRM and FRM had F value greater than 2.2, then reject  $H_0$  (null hypothesis), accept  $H_1$  (alternative hypothesis), and conclude that the regression model is an adequate and a whole significant. The F value equals to 109.89

using backward regression. On the other hand, the F value for FRM is 99.12. Therefore, the two regression models are a whole significant.

#### **4.7 Coefficient of Determination R<sup>2</sup>**

The robustness or the strength of the regression model can be determined by examining the model coefficient of determination. The coefficient of determination R<sup>2</sup> represents the total variability in time and cost overrun in educational building projects in Egypt.

Backward regression model explained over 94.6% of the variation in time overrun and over 81.2% of the variation in cost overrun in educational building projects in Egypt explained by explanatory variables. On the other hand, forward regression model explained over 94.1% of the variation in time overrun and over 80.1% of the variation in cost overrun in educational building projects in Egypt explained by explanatory variables. As a result of considering 11 significant variables in the backward stepwise regression, the model for time overrun explained the major factors that affect the time overrun in educational building project in Egypt better than the forward stepwise regression. On the other hand 7 significant variables in the backward stepwise regression, the model for cost overrun explained the major factors that affect the cost overrun in educational building project in Egypt better than the forward stepwise regression.

#### **4.8 Derived the Equations of the Two Regression Models for time and cost overrun in educational building projects in EGYPT**

##### **4.8.1 - Time Overrun Model**

Table (4.1) indicated the final results of backward regression equation and its ANOVA statistics. BRM explained over 94.6% of the variation in time overrun in educational building projects in Egypt explained by explanatory variables.

This means that the backward regression model is an adequate and a whole significant. The derived equation for the backward regression model is illustrated as following:

$$\begin{aligned} \text{Time overrun} = & 0.453 + 0.123 \times \text{Difficulties in getting work permit from government} \\ & + 8.592 \times 10^{-7} \times \text{Practice of assigning contract to lowest bidder} - 2.293 \times 10^{-7} \times \text{High} \\ & \text{cost of skilled labor} - 0.123 \times \text{Financial difficulties of contractor} + 0.064 \times \text{Slow} \\ & \text{payment of completed works} - 1.444 \times 10^{-6} \times \text{High insurance and high interest rates} \\ & + 0.061 \times \text{Bureaucracy in bidding/ tendering method} - 1.799 \times 10^{-6} \times \text{Inaccurate bill} \end{aligned}$$

*of quantities + 2.533 × 10<sup>-7</sup> × Inaccurate cost estimate + 0.197 × Mistakes in soil investigation + 1.369 × 10<sup>-6</sup> × High transportation costs.*

A careful inspection to Table (4.1) clearly indicated that the eleven of the fourteen factors were being considered in the developed model. The regression model have strong correlation coefficient R equal to 0.973 and the coefficient of determination R square equal 0.946 which is a best fit which means that 94.6% of the total variation in time overrun can be explained by the model. Also it has 8.005 as average percentage error. According to the results of final model for forward regression equation and its ANOVA statistics. FRM explained over 94.1% of the variation in time overrun in educational building projects in Egypt explained by explanatory variables.

This means that the backward regression model is an adequate and a whole significant. The derived equation for the forward regression model is illustrated as the following:

*Time overrun = 0.484 + 0.129 × Difficulties in getting work permit from government – 0.13 × Financial difficulties of contractor + 0.057 × Slow payment of completed works + 0.072 × Bureaucracy in bidding/ tendering method – 1.37 × 10<sup>-6</sup> × Inaccurate bill of quantities + 3.055 × 10<sup>-7</sup> × Inaccurate cost estimate + 0.19 × Mistakes in soil investigation + 1.286 × 10<sup>-6</sup> × High transportation costs.*

#### **4.8.2 - Cost Overrun Model**

Table (4.4) indicated the final results of backward regression equation and its ANOVA statistics. BRM explained over 81.2% of the variation in cost overrun in educational building projects in Egypt explained by explanatory variables. This means that the backward regression model is an adequate and a whole significant. The derived equation for the backward regression model is illustrated as following:

*Cost overrun = 0.873 + 0.016 × Difficulties in getting work permit from government + 5.306 × 10<sup>-8</sup> × High cost of skilled labor + 0.032 × Financial difficulties of contractor – 9.214 × 10<sup>-8</sup> × High insurance and high interest rates - 0.043 × Bureaucracy in bidding/ tendering method + 9.48 × 10<sup>-8</sup> × Inaccurate cost estimate + 0.076 × Mistakes in soil investigation.*

The regression model have strong correlation coefficient R equal 0.901 and the coefficient of determination R square equal 0.812 which is a best fit which means that 81.2% of the total variation in cost overrun can be explained by the model. Also it has 3.45 as average percentage error. It has to be noted that seven of the previously identified fourteen input factors were only considered by the developed model. This clearly indicates that the other

seven factors were found to have no significant effect on the project cost overrun. According to the results of final model for forward regression equation and its ANOVA statistics. FRM explained over 80.1% of the variation in cost overrun in educational building projects in Egypt explained by explanatory variables. This means that the backward regression model is an adequate and a whole significant. The derived equation for the forward regression model is illustrated as the following:

$$\text{Cost overrun} = 0.867 + 0.19 \times \text{Difficulties in getting work permit from government} + 0.31 \times \text{Financial difficulties of contractor} - 0.46 \times \text{Bureaucracy in bidding/ tendering method} + 7.627 \times 10^{-8} \times \text{Inaccurate cost estimate} + 0.81 \times \text{Mistakes in soil investigation}.$$

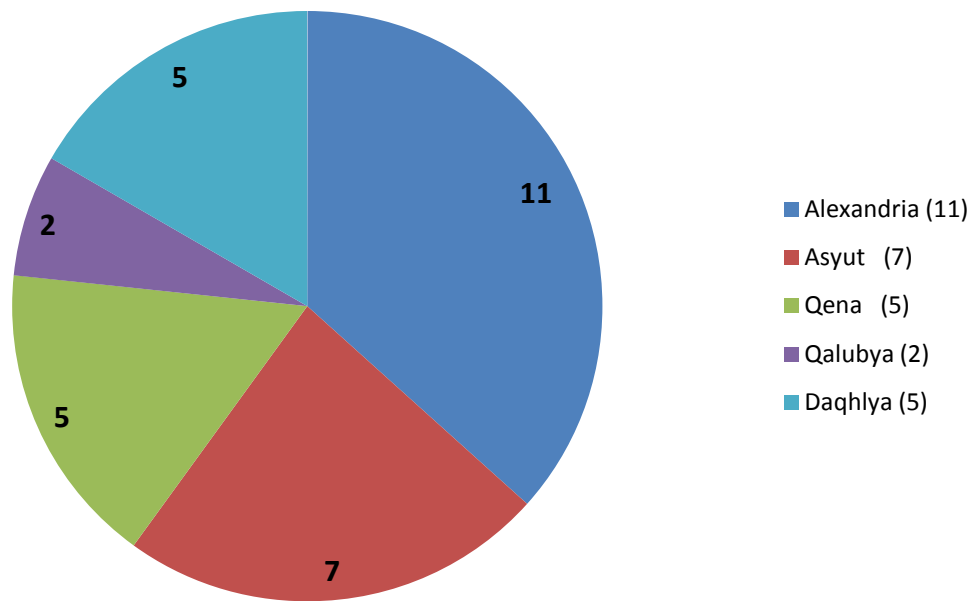
## **4.9 Validation of the Two Regression Models**

### **4.9.1- Project data validation**

To examine the validity of the two regression models for time and cost overrun in educational building projects in Egypt; Data were collected on 30 Educational building projects in Egypt comprising medium projects from 1 to 5 million. Methods involved are traditional design and build, construction management, management contracting and project management. Two tendering methods were considered (open tender, closed tender and selective tender). All projects were completed in the years 2011 - 2012; the collected projects were located in 5 cities in Egypt, as shown in figure (4.1).



**Figure (4.1). Project location for 30 projects**



8 projects out of 30 projects having time and cost overruns with percentage 26.67%,  
 8 projects have fallen in liquidated damages with percentage 26.67%.

**Table (4.7).Project durations**

Projects durations	No of projects	Time Overruns	% of time overruns
Between 8 to 12 months	21	7	33.33
More than 12 months	9	1	11.11
<b>Total</b>	30	8	<b>26.67</b>

Therefore, it was concluded that the problem of time delay is present across projects durations between 8 to 12 months and is particularly prevalent in projects where planned projects durations is greater than 12 months, the percentage of average value of time overruns are greater in projects duration between 8 to 12 months.

#### 4.9.2 –Time overruns validation

The data collected was examined by calculating the actual time overrun for the 30 educational building projects then we are going to calculate the estimated time overrun by substituting the data for 30 project in the estimated time overrun regression model, then we are going to calculate the percentage of error of the time overrun according to the following equation:

$$\text{Percentage of Error} = \text{ABS} \left( \frac{\text{Actual time /cost overrun} - \text{Estimated time /cost overrun}}{\text{Actual time /cost overrun}} \right) \quad (4.3)$$

In Table (4.8) and Table (4.9) the percentage of error for time and cost overruns were shown on the collected 30 projects from 5 different cities.

**Table (4.8).Time overruns validation**

No	Project Name	Actual Time Overrun	Estimated Time Overrun	% Of Error
1	صلاح الدين الابتدائية الصباحية	1.273	1.159	8.928
2	الخلفاء الراشدين ب المشتركة	1.019	1.188	16.566
3	اسماعيل القباني ع بنين	1.000	1.045	4.508
4	بغداد ب	1.150	1.177	2.386
5	سند ( 2 ) الابتدائي	1.364	1.213	11.042
6	اسكان العبور	1.000	1.026	2.609
7	العمراوى ب المشتركة	1.000	0.918	8.178

8	ناصر الابتدائية المشتركة	1.000	0.951	4.865
9	حسن صبحي الإعدادية	1.318	1.250	5.162
10	شباب المستقبل	1.273	1.266	0.544
11	أمير الشعراء للتعليم الأساسي	1.182	1.183	0.061
12	محمد فريد الإعدادية	0.889	1.010	13.579
13	الحواتكة الابتدائية المشتركة	0.920	0.957	3.988
14	بني هلال الابتدائية المشتركة	0.870	0.841	3.279
15	بني شقير ب المشتركة الجديدة	0.857	0.789	7.928
16	رزق محمد صالحين اساسي	1.000	0.915	8.509
17	الخواند الابتدائية الجديدة	1.000	0.935	6.499
18	الدوير للتعليم الاساسي	1.000	0.954	4.606
19	نجع الكوم الابتدائية المشتركة	0.913	1.043	14.239
20	نجع حامد احمد رمضان ت أ	0.957	1.004	4.935
21	قصير بخانس الثانوية العامة	1.045	1.027	1.768
22	السمطا بحري الإعدادية	0.957	0.895	6.425
23	أبو بكر الصديق ع بالصبريات	1.000	1.025	2.467
24	الحرس الوطني ب	0.844	0.977	15.748
25	اساسي بعزبة الكبار	1.000	1.128	12.839
26	أم السعود ت ا	1.000	0.856	14.406
27	ميت غراب الابتدائية	0.950	1.027	8.072
28	كفر بدواي اساسي	0.923	1.003	8.605
29	دمو الاعدادية	0.957	0.979	2.346
30	الحرية ت ا	1.000	0.989	1.145
Average Time Overrun Error percentage				6.87

From Table (4.8) the average percentage error is very low, equal to 6.87%.which means that the validity of the time overrun regression model is excellent.

#### 4.10.3 –Cost overrun validation

The data collected was examined by calculating the actual cost overrun for the 30 educational building projects then we are going to calculate the estimated cost overrun by substituting the data for 30 projects in the estimated cost overrun regression model, then we are going to calculate the percentage of error of the cost overrun according to the equation (4.3).

**Table (4.9).Cost overruns validation**

No	Project Name	Actual Cost Overrun	Estimated Cost Overrun	% Of Error
1	صلاح الدين الابتدائية الصباحية	1.100	1.031	6.298
2	الخلفاء الراشدين ب المشتركة	1.025	1.023	0.168
3	اسماعيل القباني ع بنين	0.917	0.996	8.650
4	بغداد ب	1.067	1.030	3.402
5	سند ( 2 ) الابتدائي	1.100	1.039	5.541

6	اسكان العبور	0.971	0.993	2.211
7	العمراوى ب المشتركة	0.975	0.993	1.887
8	ناصر الابتدائية المشتركة	0.994	0.997	0.264
9	حسن صبحي الإعدادية	1.100	1.043	5.197
10	شباب المستقبل	1.100	1.050	4.508
11	أمير الشعراء للتعليم الأساسي	1.080	1.037	3.976
12	محمد فريد الإعدادية	0.968	1.064	9.943
13	الحواتكة الابتدائية المشتركة	0.989	1.059	7.035
14	بني هلال الابتدائية المشتركة	0.934	1.029	10.181
15	بني شقير ب المشتركة الجديدة	0.998	1.067	7.014
16	رزق محمد صالحين اساسي	0.926	1.041	12.416
17	الخوالد الابتدائية الجديدة	0.896	1.045	16.620
18	الدوير للتعليم الاساسي	0.920	1.041	13.123
19	نجع الكوم الابتدائية المشتركة	0.980	0.971	0.993
20	نجع حامد احمد رمضان ت أ	0.928	0.965	4.029
21	قصير بخانس الثانوية العامة	1.020	0.976	4.334
22	السمطا بحري الإعدادية	0.929	0.941	1.344
23	أبو بكر الصديق ع بالصبريات	0.950	0.966	1.630
24	الحرس الوطني ب	0.907	0.893	1.543
25	اساسي بعزبة الكبار	0.990	0.933	5.779
26	أم السعود ت ا	0.940	0.923	1.847
27	ميت غراب الابتدائية	0.993	0.959	3.435
28	كفر بدواي اساسي	0.957	0.943	1.431
29	دمو الاعدادية	0.946	0.942	0.437
30	الحرية ت ا	0.894	0.932	4.200
Average Cost Overrun Error percentage				4.98

From Table (4.9) the average percentage error is very low, equal to 4.98%.which means that the validity of the cost overrun regression model is excellent.

# **CHAPTER FIVE**

## **SUMMARY, CONCLUSIONS AND RECOMENDATIONS**

### **Chapter 5**

#### **Summary, Conclusions and Recommendations**

##### **5.1 Summary**

The first objective of this study is to find out the main causes of delay and cost overruns in educational buildings in Egypt. Second rank these causes according to their relative

importance and level of severity. Third, investigate the expected effects of the previously identified factors on the cost and time overruns of a selected sample of the educational building projects in Egypt. Fourth, to provide new insights into the factors that affects time and cost overruns by estimating a statistical model for both time and cost overruns.

To study the methodology that leads determine the highest important factors that causes the delays in time and cost overruns in educational building projects in Egypt, developing two regression models and finally testing the validity of these models by:

- 1- A literature review was carried out to cover the previous studies regarding the construction project cost and time overruns based on this review, the different causes that are expected to affect cost and time overruns will be clearly identified.
- 2- Based on the previously identified factors, a questionnaire survey targeted at Contractors and consultant was conducted to identify the most important causes of time and cost overruns in the educational buildings in Egypt.
- 3- The identified causes were also categorized according to their relative importance. (Frequency index, severity index and important index).
- 4- To address the study objectives, data was collected for 102 educations projects implemented from 2007 to 2011 by the Authority of Educational Building.
- 5- Finally the collected data and the questionnaire survey were analyzed to:
  - (a) Define the main causes influencing cost and time overruns in educational building projects.
  - (b) Investigate the relationship between the selected factors and time and cost overruns
  - (c) Develop two statistical regression models for time and cost overruns using SPSS version 16 program.

## **5.2-Conclusions**

1-Thirty three of the selected projects (about 32.35%) have exposed to cost overrun. On the other side, time overrun was only noticed on 29 projects (about 28.43%).

2-The probability of occurrence of cost overrun increase as the project size increase. While the severity of cost overrun is inversely proportional to the project size.

3-The probability of occurrence that the time overrun increase as project scheduled time increase. While the average percentage of time overruns was found to be gradually decrease as the project scheduled time increase.

*5-Time Overrun Model = 0.453+0.123× Difficulties in getting work permit from government + 8.592 × 10<sup>-7</sup> × Practice of assigning contract to lowest bidder – 2.293 × 10<sup>-7</sup> × High cost of skilled labor – 0.123 × Financial difficulties of contractor + 0.064 × Slow payment of completed works – 1.444 × 10<sup>-6</sup> × High insurance and high interest rates + 0.061 × Bureaucracy in bidding/ tendering method – 1.799 × 10<sup>-6</sup> × Inaccurate bill of quantities + 2.533 × 10<sup>-7</sup> × Inaccurate cost estimate + 0.197 × Mistakes in soil investigation + 1.369 × 10<sup>-6</sup> × High transportation costs.*

*6-Cost Overrun Model = 0.873+0.016× Difficulties in getting work permit from government + 5.306 × 10<sup>-8</sup> × High cost of skilled labor + 0.032 × Financial difficulties of contractor – 9.214 × 10<sup>-8</sup> × High insurance and high interest rates - 0.043 × Bureaucracy in bidding/ tendering method + 9.48 × 10<sup>-8</sup> × Inaccurate cost estimate + 0.076 × Mistakes in soil investigation.*

7-The concluded seven significant factors from the regression models affecting time and cost overruns in educational building projects in Egypt are:

- 1- Difficulties in getting work permit from government.
- 2- High cost of skilled labor.
- 3- Financial difficulties of contractor.
- 4- High insurance and high interest rates.
- 5- Bureaucracy in bidding/ tendering method.
- 6- Inaccurate cost estimation.
- 7- Mistakes in soil investigation.

8- Testing the validity of the developed cost and time overruns regression models clearly show that the developed models can be taken as a new approach in expected cost and time overruns of any projects at level of confidence 95% and 93% respectively.

### **5.3-Recommendations**

- 1- Government is recommended to facilitate the difficulties in getting license by finishing all license needed before starting any project.
- 2-Government is advised to facilitate the bureaucracy of bidding/tendering method by minimizing the duration between them and the documentations needed.
- 3-Government is advised to spread in constructing technical school in order to graduate a larger number of skilled labors to overcome their high cost.
- 4-Pay progress payment to the contractor on time, because any delay impairs the contractors ability to finance the project.
- 5-Contractors can use the developed models as a new approach in predicting time and cost overruns in any educational building by upgrading their engineers to use the models and to update the criteria with the general authority of educational building in Egypt, to avert the problem of overruns from occurrence.

#### **5.4-Recommendations for Future Work**

- 1-The criteria for the qualitative factors in the developed models should be updated after a period of time to match the situation in the general authority of educational building in Egypt.
- 2-The general authority of educational building in Egypt is advised to use serial tendering (procurement strategy which provides an incentive to the contractor based on performance) because of its advantages for the owner to achieve better quality with minimal cost, and enhance relation between the owner and contractor.

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## **Appendix A**

### **Questionnaire Form (in Arabic)**

## A- Questionnaire Form (in Arabic)

بسم الله الرحمن الرحيم

سعادة /

السلام عليكم ورحمة الله وبركاته وبعد.....

أود أن أفيدكم بأنني أحد طلاب الدراسات العليا بالأكاديمية العربية للعلوم والتكنولوجيا والنقل البحري بالقاهرة في جمهورية مصر العربية ومتقدم حاليا للحصول على شهادة الماجستير في برنامج هندسة التشييد وإدارة المشروعات وقد تقدمت بالرسالة التي عنوانها :-

**" تحليل الأسباب التي أدت الى التجاوز في الكلفة و الوقت للمشاريع الخاصة بالمنشآت التعليمية فى مصر "**

وبصفتكم أحد العاملين بمجال تشييد المشاريع الخاصة بالمنشآت التعليمية في جمهورية مصر العربية فان مشاركتكم في تعبئة الاستبيان بالمعلومات المطلوبة تشكل عنصرا مهما في نجاح البحث وتقديم نتائج مفيدة للجميع. نأمل تعاونكم بالإجابة على هذا الاستبيان الذي يأخذ 45 دقيقة تقريبا من وقتكم الثمين كما نؤكد لكم أن جميع المعلومات التي سيتم الحصول عليها سوف يتم تحليلها بصورتها الإجمالية وسوف تستخدم لغرض البحث العلمي فقط. نأمل تعبئة هذا الاستبيان وإعادته بأقرب فرصة ممكنة.

شاكرين لكم تعاونكم....وتقبلوا تحياتنا

الأستاذ المشرف

الباحث

أ.د/ عبدالمنعم ياسين سند

م/ وليد أحمد سيد أحمد خليف

أ.د/ حسام الدين حسنى محمد

الرجاء قراءة الملاحظة التالية قبل تعبئة الاستبيان:

**مقدمة**

يهدف هذا الاستبيان لتحديد وتحليل الأسباب التي يمكن أن يتعرض لها مقاولي التشييد في جمهورية مصر العربية أثناء تنفيذ المشاريع للهيئة العامة للأبنية التعليمية في مختلف المحافظات والتي تؤثر على تكلفة ومدة تنفيذ هذه المشاريع .

ويشمل الاستبيان قسمان , القسم الأول معلومات عامة تتعلق بخبرتك في مجال تشييد المشاريع والقسم الثاني يشمل لائحة بالأسباب التي يمكن أن يتعرض لها مقاولي التشييد أثناء تنفيذ مشاريع المنشآت التعليمية والتي سيتطلب منكم اختيار احتمالية حدوث كل سبب وكذلك تأثير هذا السبب على سير المشاريع.

## تعريفات

الأسباب هو عبارة عن الأسباب الغير مؤكد حدوثها , وفي حالة حدوثها يكون لها تأثير سلبي على المشروع.  
احتمالية الحدوث هو احتمالية حدوث الأسباب وتعني إلى أي مدى احتمالية حدوث الأسباب أثناء التشييد.  
درجة التأثير هي درجة تأثير السبب على المقاول وتعني إلى أي مدى يؤثر هذا السبب على المقاول في حالة حدوثه أثناء تنفيذ المشاريع.

## طريقة الإجابات

للقسم الثاني من الاستبيان وضعت خمس درجات لكل من احتمالية الحدوث وتأثير كل سبب .  
تتطلب الإجابة بوضع علامة (✓) مقابل الإجابة المناسبة وهي كالتالي :-

### احتمالية الحدوث

- 1- منخفضة جدا :- احتمالية حدوث السبب منخفضة جدا.
- 2- منخفضة :- احتمالية حدوث السبب منخفضة.
- 3- متوسطة :- احتمالية حدوث السبب متوسطة.
- 4- مرتفعة :- احتمالية حدوث السبب مرتفعة.
- 5- مرتفعة جدا :- احتمالية حدوث السبب مرتفعة جدا.

### درجة التأثير

- 1- منخفضة جدا :- السبب له أقل درجة من التأثير على المقاول في حالة حدوثه.
- 2- منخفضة :- السبب له تأثير صغير على المقاول في حالة حدوثه.
- 3- متوسطة :- السبب له تأثير متوسط على المقاول في حالة حدوثه.
- 4- مرتفعة :- السبب له تأثير كبير على المقاول في حالة حدوثه.
- 5- مرتفعة جدا :- السبب له أعلى درجة من التأثير على المقاول في حالة حدوثه.



القسم الأول  
" معلومات عامة "

الإسم / الوظيفة / المحافظة /

س1: كم سنوات خبرة ( لديكم / لشركتكم ) في تنفيذ المشاريع الإنشائية ؟

- ج1: أ- أقل من 5 سنوات ( ) ب- 5-10 سنوات ( )  
ج- 10-15 سنوات ( ) د- أكثر من 15 سنة ( )

س2: ما هي درجة التصنيف في مجالات البناء حسب تصنيف الاتحاد المصري للمقاولين ؟

- ج2: أ- أولى ( ) ب- ثانية ( )  
ج- ثالثة ( ) د- رابعة ( )  
هـ- خامسة ( ) و- سادسة ( )  
ز- سابعة ( ) ح- غير مصنف ( )

س3: ما مدى تكرار حدوث زيادة في مدة المشروع عن المخطط له نتيجة لتعرض المقاول للأسباب التي تؤثر عليه أثناء تنفيذ المشروع؟

- ج3: أ- دائما ( ) ب- عادة ( )  
ج- أحيانا ( ) د- لا يحدث أبدا ( )

س4: ما مدى تكرار حدوث زيادة في تكلفة المشروع عن المخطط له نتيجة لتعرض المقاول للأسباب التي تؤثر عليه أثناء تنفيذ المشروع؟

- ج4: أ- دائما ( ) ب- عادة ( )  
ج- أحيانا ( ) د- لا يحدث أبدا ( )

القسم الثاني :- الأسباب التي يتعرض لها مقاولي التشييد

تشمل اللائحة أدناه الأسباب التي يمكن أن يتعرض لها مقاولي التشييد أثناء تنفيذ مشاريع للهيئة العامة للأبنية التعليمية.

نأمل الإجابة بمرنيتكم عن السؤالين التاليين :-

س1: ما هو احتمالية حدوث كل من الأسباب التالية ؟

س2: ما هي درجة تأثير كل سبب على المقاول أثناء تنفيذ المشروع؟

Table (A.1). Questionnaire Form in Arabic

درجة التأثير في حالة حدوث السبب					احتمالية حدوث السبب					الأسباب التي يمكن أن يتعرض لها المقاول أثناء التشييد	م
مرتفعة جدا (5)	مرتفعة (4)	متوسطة (3)	منخفضة (2)	منخفضة جدا (1)	مرتفعة جدا (5)	مرتفعة (4)	متوسطة (3)	منخفضة (2)	منخفضة جدا (1)		
										أ-أسباب متعلقة بالمالك	
										1	الصعوبات المالية للمالك
										2	الدفع البطيء للأعمال المكتملة
										3	البطء في اتخاذ القرارات
										4	التأخر في تسليم الموقع للمقاول
										ب-أسباب متعلقة بالإستشاري	
										1	الاستلام البطيء للأعمال المنتهية
										2	أخطاء في التصميم
										3	ترسية المشروع لأقل عطاء
										4	وجود كميات خاطئة بقياسه الأعمال
										5	وقت طويل بين فترة التصميم و طرح الأعمال للمناقصة
										6	التأخر في اعتماد الرسومات و العينات للمواد
										7	أخطاء في تقارير و ابحاث التربة
										8	ضعف مؤهلات الجهاز الاستشاري المشرف
										9	لا مرونة من الاستشاري المشرف على المشروع
										10	قصر مدة التنفيذ المحددة بالعقد للمشروع
										ج-أسباب متعلقة بالمقاول	
										1	سوء الإدارة و الاشراف على الموقع
										2	الصعوبات المالية للمقاول
										3	الأخطاء أثناء التنفيذ
										4	التخطيط و الجدولة الغير مؤثرة من قبل المقاول
										5	قلة خبرة المقاول
										6	الرقابة المالية السيئة على الموقع
										7	التقدير الخاطيء لتكاليف المشروع
										8	العلاقة السيئة بين الإدارة و العمال

Table (A.1). Questionnaire Form in Arabic (cont.)

درجة التأثير في حالة حدوث السبب					احتمالية حدوث السبب					م	الأسباب التي يمكن أن يتعرض لها المقاول أثناء التشييد	
مرتفعة جدا (5)	مرتفعة (4)	متوسطة (3)	منخفضة (2)	منخفضة جدا (1)	مرتفعة جدا (5)	مرتفعة (4)	متوسطة (3)	منخفضة (2)	منخفضة جدا (1)			
											9	إعادة العمل نتيجة سوء العمل و استخدام مواد رديئة
											10	مراقبة و سيطرة سيئة للعمل
											11	قلة قاعدة البيانات في تخمين المدة و مصادر النشاط
											12	نقص الموظفين الإداريين للمقاول
											13	التأخير نتيجة عجز مقاولي الباطن
												د-أسباب متعلقة بالمشروع
											1	القيود البيئية
											2	التغيير في التصميم
											3	الأعمال الإضافية
											4	قلة الاتصالات بين جميع الأطراف (المقاول و المالك و الاستشاري )
											5	حدوث حوادث بالموقع أثناء البناء
											6	حدوث خلافات بالموقع بين المقاول و المهندس المشرف
												هـ-أسباب متعلقة بالمواد و العمالة و المعدات
											1	الصعود في اسعار المواد ( التضخم )
											2	نقص في انتاج المواد الاولية في البلاد
											3	النقص في المواد
											4	نقص في العمالة المهرة
											5	التكلفة العالية للعمالة المهرة
											6	معدل ضعيف لانتاجية العمال
											7	تكلفة عالية لصيانة المعدات
											8	معدل انتاجية المعدة ضعيف
												و-أسباب خارجية
											1	الظروف الغير متوقعة بالموقع مثل (تعارض العمل مع المرافق الموجودة )
											2	صعوبات في الحصول على التراخيص من الحكومة
											3	البيروقراطية في الطرح و المناقصة
											4	عدم توافر المرافق بالموقع ( الماء - الكهرباء - التليفونات - ... )
											5	تأمين عالي و سعر فائدة عالي على المقاول
											6	عدم الاستقرار و عدم الامان السياسى
											7	موقع المشروع
											8	السرقاات و النفايات بالموقع
											9	المنازعات القضائية و الاحتكام الى ادارة الفتوى بمجلس الدولة
											10	تكاليف النقل عالية
											11	سوء الاحوال الجوية
											12	عوامل خارجية خارج السيطرة ( كوارث طبيعية 00 )

Table (A.1). Questionnaire Form in Arabic (cont.)

درجة التأثير في حالة حدوث السبب					احتمالية حدوث السبب					م	الأسباب التي يمكن أن يتعرض لها المقاول أثناء التشييد
مرتفعة جدا (5)	مرتفعة (4)	متوسطة (3)	منخفضة (2)	منخفضة جدا (1)	مرتفعة جدا (5)	مرتفعة (4)	متوسطة (3)	منخفضة (2)	منخفضة جدا (1)		
											الرجاء كتابة أي أسباب أخرى والتي ترونها مهمة لم يتم ذكرها بهذه اللوحة:

## **Appendix B**

### **Questionnaire Form in English**

Table (B.1). Questionnaire Form in English

No	Causes	probability of Occurrence					Impact if occurred				
		V.L	L	M	H	V.H	V.L	L	M	H	V.H
A	<u>Owner related group consists of</u>										
1	Financial difficulties of owner										
2	Slow payment of completed works										
3	Low speed of decision making										
4	Delay to furnish and deliver the site to the contractor by the owner.										
B	<u>Consultants related group consists of</u>										
1	Slow inspection of completed works										
2	Mistakes in design										
3	Practice of assigning contract to lowest bidder										
4	Inaccurate bill of quantities.										
5	Long period between design and time of bidding/ tendering										
6	Waiting for approval of shop drawings and material samples										
7	Mistakes in soil investigation										
8	weakness of qualified supervisor										
9	Inflexibility (rigidity) of consultant										
10	Original contract duration is too short										
C	<u>Contractor-related group consists of</u>										
1	Poor site management and supervision										
2	Financial difficulties of contractor										
3	Mistakes during construction										
4	Ineffective planning and scheduling by contractors										
5	inexperienced contractor										
6	Poor financial control on site										
7	Inaccurate cost estimation										
8	Poor relationship between management and labor										
9	rework due to poor work / wrong materials by the contractor										
10	poor monitoring and control										
11	Lack of database in estimating activity duration and resources										
12	Lack of administrative employee										
13	Incompetent subcontractors										

Table (B.1). Questionnaire Form in English (cont.)

No	Causes	probability of Occurrence					Impact if occurred						
		V.L	L	M	H	V.H	V.L	L	M	H	V.H		
D	<u>Project-related group consists of</u>												
1	environmental restrictions												
2	Design changes												
3	Additional works												
4	Lack of communication between parties												
5	Occurrence of site accidents during construction												
6	personality clash between contractor agent and engineering supervisor												
E	<u>Material and labor and Equipment group consists of</u>												
1	Escalation of material prices (Inflation)												
2	Inadequate production of raw materials in the country												
3	Shortages of materials												
4	Shortages of skilled workers / technical personnel												
5	High cost of skilled labor												
6	Poor labor productivity												
7	High equipment maintenance costs												
8	Poor equipment productivity												
F	<u>External factors-related group consists of</u>												
1	Unforeseen site (ground) conditions												
2	Difficulties in getting work permit from government												
3	Bureaucracy in bidding/ tendering method												
4	Unavailability of utilities in site (such as, water, electricity, telephone, etc.)												
5	High insurance and high interest rates												
6	political insecurity instability												
7	project location												
8	Stealing and waste on site												
9	Litigation												
10	High transportation costs												
11	Bad weather.												
12	uncontrollable external factors												

## **Appendix C**

**Data of the contractors participating in the  
questionnaire survey**



Table (C.1). Data of the contractors participating in the questionnaire survey

ج- بيانات المقاولين المشاركين في الاستبيان

م	إسم المقاول	الوظيفة	سنوات الخبرة	فئة المقاول/الشركة	المحافظة	ملاحظات
1	م/عبدالمنعم العدوى	صاحب شركة العدوى للمقاولات	أكثر من 15	2	القاهرة	
2	م/ دعاء محمود شلبي	مهندسة معمارية بشركة أبناء شلبي	من 5 الى 10	3		
3	م/عبد الرحمن أحمد عبد الرحمن	صاحب شركة المهندسون المتحدون	من 5 الى 10	3		
4	م/ طارق خلف الله إمام	مدير موقع بالشركة الدولية للمقاولات	أكثر من 15	7		
5	م/عبد السلام أحمد عبد الرحمن	نائب مدير شركة المهندسون المتحدون	من 5 الى 10	3		
6	م/ عبد الجواد شلبي	صاحب شركة أبناء شلبي للمقاولات	أكثر من 15	3		
7	م/ وحيد محمود شعبان	مدير موقع بشركة الفراغة للمقاولات و التصدير	من 10 الى 15	5		
8	م/ وائل الصيفى	صاحب شركة وائل الصيفى للمقاولات	من 5 الى 10	5		
9	م/ هبة محمود شلبي	نائب مدير شركة أبناء شلبي للمقاولات	أكثر من 15	3		
10	م/ محمد حسن أحمد ابوالحسن	صاحب شركة التوحيد للمقاولات	أكثر من 15	5		
11	م/ هشام الشاذلى	صاحب شركة الكرنك للمقاولات	من 10 الى 15	5		
12	م/ عادل السيد أحمد	المدير المسنول بالشركة الثلاثية للتصميم و الأثاث و الديكور	أكثر من 15	5		
13	م/ عبد الرحمن محمد عبد الرحمن	رئيس الإدارة المركزية للطرق و الكبارى بجهاز التعمير	أكثر من 15	1		
14	م/ أحمد حسن حسين أبو الغيط	مدير مشروعات	من 10 الى 15	7		
15	م/ سامى مسعد التابعى	صاحب شركة طيبة للمقاولات	أكثر من 15	6	دمياط	
16	أ/ أكرم حامد البنا	نائب مدير الجمعية التعاونية للإنشاء و التعمير بدمياط	أكثر من 15	1		
17	م/ زكريا أحمد الحلو	مهندس مدنى	أكثر من 15	7		
18	طارق نعمان الشريف	صاحب شركة للمقاولات	أكثر من 15	4		

Table (C.1). Data of the contractors participating in the questionnaire survey (cont.)

ملاحظات	المحافظة	فئة المقاول/الشركة	سنوات الخبرة	الوظيفة	إسم المقاول	م
	الشرقية	4	أكثر من 15	صاحب شركة للمقاولات	م/ على محمد سعد	19
	أسيوط	1	أكثر من 15	نائب مدير شركة المهندسين للمقاولات	م/ حسام محمد حسن	20
	الجيزة	2	من 10 الى 15	صاحب شركة للمقاولات	م/ طارق محمد عبد العزيز	21
	القليوبية	4	من 5 الى 10	صاحب شركة للمقاولات	م/ مجدى محمد البدرى	22
		4	أكثر من 15	صاحب شركة الخليل للمقاولات	م/ سامح محمد خليل	23
		3	أكثر من 15	صاحب شركة أفكو للمقاولات	م/ عفيفى حسين عمر	24
		2	أكثر من 15	مهندسة مدنى	م/ هالة إبراهيم	25
		6	من 5 الى 10	صاحب الشركة المتحدة للمقاولات	م/ محمد حسنى شرف	26
		6	من 5 الى 10	صاحب مكتب الإسراع للمقاولات	م/ طارق مصطفى	27
		4	من 10 الى 15	صاحب مكتب سلامة للمقاولات	سلامة إبراهيم محمد متولى	28
		المنوفية	2	من 5 الى 10	مهندس مدنى	م/ محمود محمد سليمان
	المنيا	4	أكثر من 15	صاحب شركة للمقاولات	م/ عزت سيد زايظ	30
		7	أقل من 5	مقاول	مينا ناجى فايق	31
	سوهاج	3	أكثر من 15	رئيس مجلس إدارة الجمعية التعاونية للإتشاء و التعمير بسوهاج	م/ محمد عبد الرحيم القاضى	32
		6	من 5 الى 10	مهندس مدنى	م/ محمد السيد محمد رشوان	33
		1	أكثر من 15	مقاول	محمد أحمد إسماعيل	34
		5	من 5 الى 10	مهندس مدنى	م/ محمد أحمد عبد القادر	35
		6	من 5 الى 10	مقاول	هشام فتحى كلحى	36
		6	أقل من 5	مهندس مدنى	م/ خالد أحمد محمود رضوان	37
		4	من 5 الى 10	مهندس مدنى	م/ عبد الناصر صابر أحمد	38
		4	من 5 الى 10	مهندس مدنى	م/ عبد الناصر محمود مرسى	39
		3	أكثر من 15	مقاول	ابوحزام عبدالله حسن	40
		7	من 10 الى 15	مهندس مدنى	زغلول فؤاد محمد	41

## **Appendix D**

**Data of the consultants participating in the  
questionnaire survey**

Table (D.1). Data of the consultants participating in the questionnaire survey

د - بيانات الإستشاريين المشاركين فى الإستبيان

ملاحظات	المحافظة	سنوات الخبرة	الوظيفة	إسم المقاول	م
	القاهرة	أكثر من 15	مدير عام المقاييسات بهيئة الأبنية التعليمية	م/ حسانين رضوان محمد	1
			وكيل وزارة ( مدير عام الصيانة بهيئة الأبنية سابقاً )	م/ محمد حجازى محمد على	2
			إستشارى بالأبنية التعليمية	م/ رضا عبد العظيم أحمد	3
			مدير عام المنطقة الشمالية بفرع القاهرة بهيئة الأبنية	م/ نبيل سيد عبد الرحيم	4
			مدير عام إستشارى معمارى بالأبنية التعليمية	م/ عماد الدين عبد المنعم	5
			مدير عام المنطقة الجنوبية بفرع القاهرة بهيئة الأبنية	م/ مجدى محمود	6
			مهندس معمارى بالأبنية التعليمية	م/ فائق مختار احمد الموجى	7
			مهندس بالمكتب الفنى بالفرع الرئيسى بهيئة الأبنية	م/ إمام السيد عودة	8
	القليوبية		رئيس قطاع تنفيذ بهيئة الأبنية	م/ ياسر عبد القادر	9
			أستاذ بكلية الهندسة ( إستشارى للأبنية )	م/ ماهر عبد الرحمن آدم	10
	سوهاج		إستشارى ضبط جودة بالأبنية التعليمية	م/ عادل فوزى خلف عبد الغنى	11

## **Appendix E**

**Data of the collected 102 sample projects**

Table (E.1). Data of the collected 102 sample projects

No	المدرسة	المحافظة	الشركة المنفذه	القيمة التقديرية للشركة لتنفيذ الأعمال (بالجنية)	قيمة الأعمال المنفذة الفعلية (بالجنية)	percentage of cost overrun for contractor	value of cost overrun for contractor (L.E)
1	الحواط الابتدائية	القاهرة	الدولية	824,075	927,241	11.13%	103167
2	سوزان مبارك	القاهرة	الدولية	1,228,136	1,275,512	3.71%	47376
3	ثانوى عام بنوى	القليوبية	الدولية	2,955,000	3,324,014	11.10%	369014
4	زهرة المدائن بالنزهمه	القاهرة	الدولية	5,550,000	6,181,184	10.21%	631184
5	اسكان المستقبل بالعبور	القاهرة	م/ مجدى البدرى	2,404,500	2,284,275	-5.26%	-120225
6	ابتدائى بقرية البرادعة	القليوبية	م/ مجدى البدرى	3,552,000	3,480,960	-2.04%	-71040
7	ثانوى عام بالبرادعة	القليوبية	م/ مجدى البدرى	1,760,000	1,724,800	-2.04%	-35200
8	الجهاد للتعليم الساسى	الجيزة	م/ مجدى البدرى	3,546,980	3,430,654	-3.39%	-116326
9	ثانوى عام بقلوب	القليوبية	م/ مجدى البدرى	3,392,000	3,273,500	-3.62%	-118500
10	القراموص	الاسكندرية	المهندسون المتحدون	790,000	744,000	-6.18%	-46000
11	الحمادين ام عثمان	الاسكندرية	المهندسون المتحدون	881,000	1,052,000	16.25%	171000
12	الشهيد طلعت نعمان	الاسكندرية	المهندسون المتحدون	900,000	1,064,900	15.49%	164900
13	جلال الدسوقى	الاسكندرية	المهندسون المتحدون	924,000	1,062,550	13.04%	138550
14	آمون	الاسكندرية	المهندسون المتحدون	702,000	860,000	18.37%	158000
15	البكاتوش	الاسكندرية	المهندسون المتحدون	6,350,000	6,112,000	-3.89%	-238000
16	القرية السياحية	الجيزة	المهندسون المتحدون	9,922,000	9,356,000	-6.05%	-566000
17	اسكان العبور	الجيزة	المهندسون المتحدون	1,988,000	1,956,000	-1.64%	-32000
18	العمراوى	الاسكندرية	المهندسون المتحدون	960,000	942,000	-1.91%	-18000
19	محمود صدقى	الاسكندرية	المهندسون المتحدون	950,000	932,500	-1.88%	-17500

Table (E.1). Data of the collected 102 sample projects (cont.)

No	المدرسة	المحافظة	الشركة المنفذه	القيمة التقديرية للشركة لتنفيذ الأعمال (بالجنية)	قيمة الأعمال المنفذة الفعلية (بالجنية)	percentage of cost overrun for contractor	value of cost overrun for contractor (L.E)
21	شطب للتعليم الاساسى	اسيوط	جمعية ابو نيج	1,700,000	1,700,000	0.00%	0
22	شوقى محمد زيدان الابتدائية	اسيوط	جمعية ابو نيج	2,350,000	2,400,000	2.08%	50000
23	نجع مكى اسماعيل الاعدادية	الاقصر	جمعية ابو نيج	2,200,000	2,150,000	-2.33%	-50000
24	ام المؤمنين الابتدائية المشتركة	اسيوط	جمعية ابو نيج	2,300,000	2,323,000	0.99%	23000
25	القال القبلى الثانوية	اسيوط	جمعية ابو نيج	1,500,000	1,500,000	0.00%	0
26	دكران الاعدادية المشتركة	اسيوط	جمعية ابو نيج	1,600,000	1,550,000	-3.23%	-50000
27	تعلية منشأة الوكيل تعليم اساسى	البحيرة	جمعية البحيرة	979,583	838,262	-16.86%	-141321
28	نظارة سمريس الاعدادية المشتركة	البحيرة	جمعية البحيرة	1,020,000	985,000	-3.55%	-35000
29	مرتانة الابتدائية المشتركة	البحيرة	جمعية البحيرة	1,840,000	1,620,000	-13.58%	-220000
30	صفر للتعليم الاساسى	البحيرة	جمعية البحيرة	1,965,000	1,900,000	-3.42%	-65000
31	أبو المطامير الاعدادية بنات	البحيرة	جمعية البحيرة	2,120,000	2,015,000	-5.21%	-105000
32	المحمودية الفنية للإدارة و الخدمات	البحيرة	جمعية البحيرة	1,720,000	1,615,000	-6.50%	-105000
33	كوم النصر للتعليم الاساسى	البحيرة	جمعية البحيرة	2,510,000	2,380,000	-5.46%	-130000
34	محمد عبد الحميد صفر الاعدادية	البحيرة	جمعية البحيرة	1,320,000	1,180,000	-11.86%	-140000
35	منشأة الوكيل تعليم اساسى	البحيرة	جمعية البحيرة	5,730,000	4,850,000	-18.14%	-880000
36	يونس عرقوب الاعدادية المشتركة	البحيرة	جمعية البحيرة	1,430,000	1,340,000	-6.72%	-90000
37	محمد عبدة الحمامسى	البحيرة	جمعية البحيرة	1,590,000	1,440,000	-10.42%	-150000
38	محمد سالم حسن الابتدائية	البحيرة	جمعية البحيرة	1,011,000	923,000	-9.53%	-88000
39	بولين الفوايد للتعليم الاساسى	البحيرة	جمعية البحيرة	1,295,000	1,260,000	-2.78%	-35000
40	العرقوب الابتدائية المشتركة	البحيرة	جمعية البحيرة	1,013,000	980,000	-3.37%	-33000

**Table (E.1). Data of the collected 102 sample projects (cont.)**

No	المدرسة	المحافظة	الشركة المنفذه	القيمة التقديرية للشركة لتنفيذ الأعمال (بالجنية)	قيمة الأعمال المنفذة الفعلية (بالجنية)	percentage of cost overrun for contractor	value of cost overrun for contractor (L.E)
41	محلة انجاق الابتدائية	الدقهلية	المقاولون المتحدون (السعيد التميمي)	1,460,260	1,374,000	-6.28%	-86260
42	احمد محمد النجار الاعدادية بنات	الدقهلية	المقاولون المتحدون	1,863,680	1,733,000	-7.54%	-130680
43	تلبانة تعليم الاساسى	الدقهلية	المقاولون المتحدون	2,036,160	2,121,000	4.00%	84840
44	المنصورة الثانوية العسكرية	الدقهلية	المقاولون المتحدون	3,045,700	3,206,000	5.00%	160300
45	على مبارك الابتدائية	الدقهلية	المقاولون المتحدون	1,659,230	1,609,000	-3.12%	-50230
46	شربين تعليم اساسى	الدقهلية	المقاولون المتحدون	2,830,440	2,335,000	-21.22%	-495440
47	المنيل الاعدادية المشتركة	الدقهلية	المقاولون المتحدون	2,037,420	1,958,000	-4.06%	-79420
48	الضهرية الابتدائي 1	الدقهلية	المقاولون المتحدون	1,896,920	1,800,000	-5.38%	-96920
49	اللغات المتميزة بالحوال	الدقهلية	المقاولون المتحدون	5,989,329	6,304,557	5.00%	315228
50	حسين حماد الثانوية بنات	الدقهلية	المقاولون المتحدون	5,385,373	5,329,670	-1.05%	-55703
51	مجمع عرفة عبد المطلب	الدقهلية	المقاولون المتحدون	16,460,800	16,980,000	3.06%	519200
52	احمد كامل السيد	الدقهلية	المقاولون المتحدون	3,088,840	3,286,000	6.00%	197160
53	د/ عبد الحافظ الكردي	الدقهلية	المقاولون المتحدون	3,317,400	3,420,000	3.00%	102600
54	على بن ابى طالب	الدقهلية	المقاولون المتحدون	1,388,480	1,332,000	-4.24%	-56480
55	الترزى الابتدائية المشتركة	الدقهلية	المقاولون المتحدون	1,953,140	1,893,000	-3.18%	-60140
56	ابن لقمان الاعدادية بنين	الدقهلية	المقاولون المتحدون	2,800,000	2,746,000	-1.97%	-54000
57	طلخا الابتدائية الجديدة ( 1 )	الدقهلية	المقاولون المتحدون	7,856,000	8,011,000	1.93%	155000
58	طلخا الابتدائية الجديدة ( 2 )	الدقهلية	المقاولون المتحدون	6,615,400	6,745,400	1.97%	132555
59	طلخا الثانوية بنات الجديدة	الدقهلية	المقاولون المتحدون	6,560,150	6,694,150	2.04%	136737



Table (E.1). Data of the collected 102 sample projects (cont.)

No	المدرسة	المحافظة	الشركة المنفذه	القيمة التقديرية للشركة لتنفيذ الأعمال (بالجنية)	قيمة الأعمال المنفذة الفعلية (بالجنية)	percentage of cost overrun for contractor	value of cost overrun for contractor (L.E)
60	طلخا التجريبية المتميزة	الدقهلية	المقاولون المتحدون	5,380,650	5,335,000	-0.85%	-45263
61	طلخا الاعدادية بنين الجديدة	الدقهلية	المقاولون المتحدون	3,528,000	3,675,000	4.17%	153125
62	جمال مبارك الثانوية المشتركة بالجمالية	الدقهلية	المقاولون المتحدون	3,417,333	3,523,024	3.09%	108960
63	الحاج موسى عبد الشافى ابراهيم الثانوية	الدقهلية	المقاولون المتحدون	2,924,446	3,111,113	6.38%	198582
64	الثانوية بنات بشربين	الدقهلية	المقاولون المتحدون	1,571,184	1,503,249	-4.32%	-64998
65	عمر بن الخطاب الثانوية بنين	الدقهلية	المقاولون المتحدون	2,847,033	2,731,993	-4.04%	-110392
66	مجمع بهوت الثانوى	الدقهلية	المقاولون المتحدون	2,869,262	2,784,648	-2.95%	-82119
67	العزيزة الثانوية المشتركة	الدقهلية	المقاولون المتحدون	3,514,273	3,495,127	-0.54%	-19042
68	دميرة الثانوية المشتركة	الدقهلية	المقاولون المتحدون	1,385,155	1,299,147	-6.21%	-80668
69	الحبيلات الشرقية تعليم اساسى	قنا	جمعية سوهاج	1,500,000	1,480,300	-1.31%	-19441
70	الاعدادية بنات بمشطا	قنا	جمعية سوهاج	500,000	455,000	-9.00%	-40950
71	ابو شوشة البلد	قنا	جمعية سوهاج	350,000	341,200	-2.51%	-8579
72	الجرامون بنجع حمادى	قنا	جمعية سوهاج	950,000	776,800	-18.23%	-141623
73	جاد الكريم و اخية ابراهيم احمد الثانوية	سوهاج	جمعية سوهاج	1,250,000	1,209,000	-3.28%	-39655
74	فاوولى تعليم اساسى	سوهاج	جمعية سوهاج	500,000	450,000	-10.00%	-45000
75	بيت خلاف الاعدادية	سوهاج	جمعية سوهاج	800,000	767,400	-4.08%	-31272
76	الكتكاتة الابتدائية	سوهاج	جمعية سوهاج	1,500,000	1,455,600	-2.96%	-43086
77	المنشأة الابتدائية	سوهاج	جمعية سوهاج	1,450,000	1,439,000	-0.76%	-10917
78	النجع الكبير الابتدائية	سوهاج	جمعية سوهاج	700,000	644,800	-7.89%	-50847
79	خارفة جرجا الاعدادية	سوهاج	جمعية سوهاج	600,000	563,000	-6.17%	-34718

Table (E.1). Data of the collected 102 sample projects (cont.)

No	المدرسة	المحافظة	الشركة المنفذه	القيمة التقديرية للشركة لتنفيذ الأعمال (بالجنية)	قيمة الأعمال المنفذة الفعلية (بالجنية)	percentage of cost overrun for contractor	value of cost overrun for contractor (L.E)
80	السوالم الجديدة الابتدائية	سوهاج	جمعية سوهاج	1,600,000	1,556,300	-2.73%	-42506
81	دار السلام الاعدادية	سوهاج	جمعية سوهاج	1,100,000	1,084,900	-1.37%	-14893
82	الكشح الاعدادية الجديدة	سوهاج	جمعية سوهاج	700,000	803,601	14.80%	118934
83	بنى منصور الابتدائية المشتركة	سوهاج	جمعية سوهاج	1,500,000	1,654,400	10.29%	170293
84	نجع حمودة تعليم اساسى	سوهاج	جمعية سوهاج	1,400,000	1,378,100	-1.56%	-21557
85	سوهاج الثانوية الزخرقية	سوهاج	جمعية سوهاج	1,150,000	1,125,000	-2.17%	-24457
86	مجمع بناويط الاعدادية	سوهاج	جمعية سوهاج	1,700,000	1,607,300	-5.45%	-87645
87	محمد عبد الجواد حسين	سوهاج	جمعية سوهاج	3,000,000	2,872,100	-4.26%	-122447
88	السلامونى تعليم اساسى	سوهاج	جمعية سوهاج	2,500,000	2,452,700	-1.89%	-46405
89	طهطا الثانوية بنين	سوهاج	جمعية سوهاج	1,336,500	1,485,000	11.11%	165000
90	البلينا التجريبية الابتدائية	سوهاج	جمعية سوهاج	3,800,000	3,604,500	-5.14%	-185442
91	المراغة الثانوية الجديدة	سوهاج	جمعية سوهاج	2,700,000	2,600,800	-3.67%	-95555
92	نجع الكراعى	سوهاج	جمعية سوهاج	2,400,000	2,364,700	-1.47%	-34781
93	تونس الثانوية	سوهاج	جمعية سوهاج	2,200,000	2,191,400	-0.39%	-8566
94	مجمع البربا الابتدائية	سوهاج	جمعية سوهاج	5,400,000	5,129,700	-5.01%	-256770
95	الذناقلة ثانوى صناعى	سوهاج	جمعية القوصية	10,023,178	11,136,864	11.11%	1237429
96	الشيخ عمران ت.أ	اسيوط	جمعية القوصية	3,890,441	4,322,712	11.11%	480301
97	تعليم اساسى بسنديون	القليوبية	ابناء شلبى للمقاولات	4,110,706	4,567,451	11.11%	507494
98	السيدة سمية	القاهرة	ناصر للمقاولات	2,536,841	2,818,712	11.11%	313190
99	أرض أشرف نوار ع	القاهرة	ناصر للمقاولات	5,225,296	5,805,884	11.11%	645098
100	الجلاء للتربية الفكرية	الغربية	الأمان للمقاولات	5,252,620	5,836,244	11.11%	648471
101	منشأة بدينى تعليم ت.أ	المنيا	المدينة المنورة	5,441,864	6,046,516	11.11%	671836
102	سوزان مبارك ثانوى صناعى	المنيا	خلفاء مكرم	5,803,592	5,862,214	1.01%	59214

Table (E.1). Data of the collected 102 sample projects (cont.)

No	المدرسة	المحافظة	مدة المشروع بالعدد (باليوم)	تاريخ استلام الموقع	المدة المخططة من الشركة لتنفيذ الأعمال (بالشهر)	المدة الفعلية للتسليم الإبتدائى (بالشهر)	مدد اضافية (بالشهر)	تاريخ التسليم طبقا لاستلام الموقع	غرامة التأخير
1	الحواط الابتدائية	القاهرة	300	26/06/2007	9	10		21/04/2008	
2	سوزان مبارك	القاهرة	390	20/06/2006	10	12		15/07/2007	
3	ثانوى عام بنوى	القليوبية	345	21/05/2009	8	19.5		01/05/2010	10%
4	زهرة المدائن بالنزهه	القاهرة	330	15/04/2009	10	28	3	11/03/2010	10%
5	اسكان المستقبل بالعبور	القاهرة	360	06/11/2008	12	12		01/11/2009	
6	ابتدائى بقرية البرادعة	القليوبية	390	06/11/2008	13	13		01/12/2009	
7	ثانوى عام بالبرادعة	القليوبية	360	06/11/2008	12	12		01/11/2009	
8	الجهاد للتعليم الساسى	الجيزة	420	28/05/2009	14	14		22/07/2010	
9	ثانوى عام بقليوب	القليوبية	360	18/01/2010	12	12	9	13/01/2011	
10	القراموص	الاسكندرية	300	25/07/2006	10	10		21/05/2007	
11	الحمادين ام عثمان	الاسكندرية	300	16/10/2006	8	10		12/08/2007	
12	الشهيد طلعت نعمان	الاسكندرية	330	15/12/2006	10	11		10/11/2007	
13	جلال النسوقى	الاسكندرية	315	08/04/2007	10	10.5		17/02/2008	
14	أمون	الاسكندرية	270	22/05/2007	8.5	10		16/02/2008	
15	البكاتوش	الاسكندرية	540	03/04/2008	15	14		25/09/2009	
16	القرية السياحية	الجيزة	480	05/06/2011	15	14	9	27/09/2012	
17	اسكان العبور	الجيزة	390	26/05/2011	13	13		19/06/2012	
18	العمراوى	الاسكندرية	240	03/07/2011	8	8		28/02/2012	

Table (E.1). Data of the collected 102 sample projects (cont.)

No	المدرسة	المحافظة	مدة المشروع بالعقد (باليوم)	تاريخ استلام الموقع	المدة المخططة من الشركة لتنفيذ الأعمال (بالشهر)	المدة الفعلية للتسليم الإبتدائي (بالشهر)	مدد اضافية (بالشهر)	تاريخ التسليم طبقا لاستلام الموقع	غرامة التأخير
19	محمود صدقى	الاسكندرية	330	03/07/2011	10	9		28/05/2012	
20	عبد الرقيب احمد للتعليم الاساسى	اسيوط	240	01/01/2008	8	7		28/08/2008	
21	شطب للتعليم الاساسى	اسيوط	285	01/01/2008	9.5	8		12/10/2008	
22	شوقى محمد زيدان الابتدائية	اسيوط	285	25/12/2007	8	9.5		05/10/2008	
23	نجع مكى اسماعيل الاعدادية	الاقصر	345	19/02/2008	11.5	10		29/01/2009	
24	ام المؤمنين الابتدائية المشتركة	اسيوط	345	10/02/2008	11	11.75		20/01/2009	1%
25	القال القبلى الثانوية	اسيوط	270	10/03/2008	7	7		05/12/2008	
26	دكران الاعدادية المشتركة	اسيوط	285	27/09/2009	8	8		09/07/2010	
27	تعلية منشأة الوكيل تعليم اساسى	البحيرة	120	10/04/2011	4	3		08/08/2011	
28	نظارة سمريس الاعدادية المشتركة	البحيرة	300	03/04/2011	9	9		28/01/2012	
29	مرتانة الابتدائية المشتركة	البحيرة	300	27/03/2011	10	10		21/01/2012	
30	صفر للتعليم الاساسى	البحيرة	345	27/03/2011	11.5	11		06/03/2012	
31	أبو المطامير الاعدادية بنات	البحيرة	345	04/04/2011	11	10.5		14/03/2012	
32	المحمودية الفنية للإدارة و الخدمات	البحيرة	345	03/04/2011	11	10.5		13/03/2012	
33	كوم النصر للتعليم الاساسى	البحيرة	435	03/04/2011	12.5	10.5		11/06/2012	
34	محمد عبد الحميد صقر الاعدادية	البحيرة	315	04/04/2011	10.5	10.5		13/02/2012	
35	منشأة الوكيل تعليم اساسى	البحيرة	435	27/03/2011	14.5	8		04/06/2012	
36	يونس عرقوب الاعدادية المشتركة	البحيرة	315	04/04/2011	10.5	10.5		13/02/2012	
37	محمد عبدة الحمامسى	البحيرة	315	03/04/2011	10.5	10.5		12/02/2012	

Table (E.1). Data of the collected 102 sample projects (cont.)

No	المدرسة	المحافظة	مدة المشروع بالعقد (باليوم)	تاريخ استلام الموقع	المدة المخططة من الشركة لتنفيذ الأعمال (بالشهر)	المدة الفعلية للتسليم الإبتدائي (بالشهر)	مدد اضافية (بالشهر)	تاريخ التسليم طبقا لاستلام الموقع	غرامة التأخير
38	محمد سالم حسن الابتدائية	البحيرة	300	04/04/2011	10	10		29/01/2012	
39	بولين الفوائد للتعليم الاساسى	البحيرة	315	27/03/2011	10.5	10.5		05/02/2012	
40	العرقوب الابتدائية المشتركة	البحيرة	315	27/03/2011	10.5	10.5		05/02/2012	
41	محلة انجاق الابتدائية	الدقهلية	300	11/03/2007	9	9		05/01/2008	
42	احمد محمد النجار الاعدادية بنات	الدقهلية	345	11/03/2007	11.5	10		19/02/2008	
43	تلبانة تعليم الاساسى	الدقهلية	345	11/03/2007	10.5	11.5		19/02/2008	
44	المنصورة الثانوية العسكرية	الدقهلية	345	11/03/2007	10.5	11.5		19/02/2008	
45	على مبارك الابتدائية	الدقهلية	285	11/03/2007	9	8.5		21/12/2007	
46	شربين تعليم اساسى	الدقهلية	345	26/03/2007	12	8		05/03/2008	
47	المنيل الاعدادية المشتركة	الدقهلية	330	03/06/2007	11	10		28/04/2008	
48	الضهرية الابتدائية ( 1 )	الدقهلية	345	25/10/2007	11.5	11.5		04/10/2008	
49	اللغات المتميزة بالحوال	الدقهلية	450	21/10/2007	13	15		13/01/2009	
50	حسين حماد الثانوية بنات	الدقهلية	435	21/10/2007	14.5	12.5		29/12/2008	
51	مجمع عرفة عبد المطلب	الدقهلية	480	13/11/2008	16	16		08/03/2010	
52	احمد كامل السيد	الدقهلية	345	13/11/2008	11.5	11.5		24/10/2009	
53	د/ عبد الحافظ الكردي	الدقهلية	345	13/11/2008	11.5	11.5		24/10/2009	
54	على بن ابى طالب	الدقهلية	345	22/04/2009	11.5	10		02/04/2010	
55	الترزى الابتدائية المشتركة	الدقهلية	300	22/04/2009	10	9		16/02/2010	
56	ابن لقمان الاعدادية بنين	الدقهلية	180	20/12/2009	6	6	2	18/06/2010	

Table (E.1). Data of the collected 102 sample projects (cont.)

No	المدرسة	المحافظة	مدة المشروع بالعدد (باليوم)	تاريخ استلام الموقع	المدة المخططة من الشركة لتنفيذ الأعمال (بالشهر)	المدة الفعلية للتسليم الإبتدائي (بالشهر)	مدد اضافية (بالشهر)	تاريخ التسليم طبقا لاستلام الموقع	غرامة التأخير
57	طلخا الابتدائية الجديدة 1	الدقهلية	540	07/05/2009	18	18.5		29/10/2010	2%
58	طلخا الابتدائية الجديدة 2	الدقهلية	540	07/05/2009	18	18.5		29/10/2010	2%
59	طلخا الثانوية بنات الجديدة	الدقهلية	540	07/05/2009	18	18.5		29/10/2010	2%
60	طلخا التجريبية المتميزة	الدقهلية	540	07/05/2009	18	18		29/10/2010	
61	طلخا الاعدادية بنين الجديدة	الدقهلية	375	07/05/2009	12.5	12.5	2	17/05/2010	
62	جمال مبارك الثانوية المشتركة بالجمالية	الدقهلية	390	20/10/2010	12	13		14/11/2011	
63	الحاج موسى عبد الشافي ابراهيم الثانوية	الدقهلية	390	20/10/2010	12	13		14/11/2011	
64	الثانوية بنات بشربين	الدقهلية	330	20/10/2010	11	9		15/09/2011	
65	عمر بن الخطاب الثانوية بنين	الدقهلية	345	20/10/2010	11.5	11		30/09/2011	
66	مجمع بهوت الثانوى	الدقهلية	390	20/10/2010	13	12		14/11/2011	
67	العزيزة الثانوية المشتركة	الدقهلية	420	20/10/2010	14	11		14/12/2011	
68	دميرة الثانوية المشتركة	الدقهلية	270	20/10/2010	9	8	1	17/07/2011	
69	الحبيبات الشرقية تعليم اساسى	قنا	345	17/06/2007	11.5	10		27/05/2008	
70	الاعدادية بنات بمشطا	قنا	300	01/07/2007	10	7		26/04/2008	
71	ابو شوشة البلد	قنا	285	01/07/2007	9.5	7		11/04/2008	
72	الجرامون بنجع حمادى	قنا	110	05/12/2007	8	3	2	24/03/2008	
73	جاد الكريم و اخية ابراهيم احمد الثانوية	سوهاج	255	17/02/2007	9	8	7 يوم	30/10/2007	
74	فاوولى تعليم اساسى	سوهاج	315	01/07/2007	11	10		11/05/2008	
75	بيت خلاف الاعدادية	سوهاج	300	21/07/2007	10	8		16/05/2008	

Table (E.1). Data of the collected 102 sample projects (cont.)

No	المدرسة	المحافظة	مدة المشروع بالعقد (باليوم)	تاريخ استلام الموقع	المدة المخططة من الشركة لتنفيذ الأعمال (بالشهر)	المدة الفعلية للتسليم الإبتدائي (بالشهر)	مدد اضافية (بالشهر)	تاريخ التسليم طبقا لاستلام الموقع	غرامة التأخير
76	الكتكاتة الابتدائية	سوهاج	375	02/08/2007	13	12		11/08/2008	
77	المنشأة الابتدائية	سوهاج	345	29/07/2007	11.5	11	16 يوم	08/07/2008	
78	النجع الكبير الابتدائية	سوهاج	300	22/10/2007	10	6		17/08/2008	
79	خارفة جرجا الاعدادية	سوهاج	220	25/12/2007	7.5	6		01/08/2008	
80	السوالم الجديدة الابتدائية	سوهاج	255	24/12/2007	9	8.5	15 يوم	04/09/2008	
81	دار السلام الاعدادية	سوهاج	255	03/01/2007	7	7		15/09/2007	
82	الكشج الاعدادية الجديدة	سوهاج	255	03/01/2007	8.5	9.5		15/09/2007	
83	بنى منصور الابتدائية المشتركة	سوهاج	235	25/12/2007	8.5	9.5	8 يوم	16/08/2008	
84	نجع حمودة تعليم اساسى	سوهاج	247	01/01/2008	9	8	17 يوم	04/09/2008	
85	سوهاج الثانوية الزخرافية	سوهاج	240	03/01/2009	8	8		31/08/2009	
86	مجمع بناويط الاعدادية	سوهاج	230	17/01/2009	8	7	17 يوم	04/09/2009	
87	محمد عبد الجواد حسين	سوهاج	370	15/01/2009	12.5	12		20/01/2010	
88	السلامونى تعليم اساسى	سوهاج	320	18/01/2009	11	10		04/12/2009	
89	طهطا الثانوية بنين	سوهاج	330	07/10/2008	11	14		02/09/2009	10%
90	البلينا التجريبية الابتدائية	سوهاج	600	23/02/2009	20	14		16/10/2010	
91	المراغة الثانوية الجديدة	سوهاج	240	02/03/2009	8	7.5	17 يوم	28/10/2009	
92	نجع الكراعى	سوهاج	360	31/08/2010	12	10		26/08/2011	
93	ثونس الثانوية	سوهاج	360	27/03/2011	12	6		21/03/2012	
94	مجمع البربا الابتدائية	سوهاج	600	28/02/2009	20	20		21/10/2010	

**Table (E.1). Data of the collected 102 sample projects (cont.)**

No	المدرسة	المحافظة	مدة المشروع بالعدد (باليوم)	تاريخ استلام الموقع	المدة المخططة من الشركة لتنفيذ الأعمال (بالشهر)	المدة الفعلية للتسليم الإبتدائي (بالشهر)	مدد اضافية (بالشهر)	تاريخ التسليم طبقا لاستلام الموقع	غرامة التأخير
95	الذناقلة ثانوى صناعى	سوهاج	600	10/03/2009	20	23.75		31/10/2010	10%
96	السيدة سمية	القاهرة	330	16/12/2007	11	29		10/11/2008	10%
97	تعليم اساسى بسنديون	القليوبية	345	09/11/2008	11.5	15.5		20/10/2009	10%
98	الشيخ عمران تعليم اساسى	اسيوط	480	23/06/2009	16	19		16/10/2010	10%
99	أرض أشرف نوار الاعدادية	القاهرة	330	06/11/2008	11	22		02/10/2009	10%
100	الجلاء للتربية الفكرية	الغربية	450	17/11/2008	15	19		10/02/2010	10%
101	منشأة بدينى تعليم اساسى	المنيا	345	14/10/2008	11.5	14.5		24/09/2009	10%
102	سوزان مبارك ثانوى صناعى	المنيا	390	26/01/2009	13	13.25		20/02/2010	1%



**Table (E.2). Severity of highest factors on 102 sample projects**

No	المدرسة	المحافظة	Escalation of material prices (Inflation) (L.E)	Difficulties in getting work permit from government	Practice of assigning contract to lowest bidder (L.E)	High cost of skilled labor (L.E)	Financial difficulties of contractor
1	الحواط الابتدائية	القاهرة	101997	2	92724	139086	3
2	سوزان مبارك	القاهرة	140306	3	191327	191327	3
3	ثانوى عام بنوى	القليوبية	392234	3	498602	498602	1
4	زهرة المدائن بالنزهه	القاهرة	729380	3	1236237	927178	1
5	اسكان المستقبل بالعبور	القاهرة	267260	1	342641	342641	1
6	ابتدائى بقرية البرادعة	القليوبية	407272	1	522144	522144	1
7	ثانوى عام بالبرادعة	القليوبية	201802	1	258720	258720	1
8	الجهاد للتعليم الساسى	الجيزة	404817	1	514598	514598	1
9	ثانوى عام بقلوب	القليوبية	363359	1	491025	491025	1
10	القراموص	الاسكندرية	81840	1	74400	74400	1
11	الحمادين ام عثمان	الاسكندرية	115720	3	157800	105200	3
12	الشهيد طلعت نعمان	الاسكندرية	117139	2	159735	106490	3
13	جلال الدسوقى	الاسكندرية	116880	2	159383	106255	3
14	آمون	الاسكندرية	94600	2	86000	86000	3
15	البكاتوش	الاسكندرية	715104	2	1222400	611200	1
16	القرية السياحية	الجيزة	982380	2	1871200	1403400	1
17	اسكان العبور	الجيزة	205380	2	293400	293400	1
18	العمراوى	الاسكندرية	98910	2	94200	94200	1
19	محمود صدقى	الاسكندرية	97913	2	93250	93250	1

**Table (E.2). Severity of highest factors on 102 sample projects (cont.)**

No	المدرسة	المحافظة	Escalation of material prices (Inflation) (L.E)	Difficulties in getting work permit from government	Practice of assigning contract to lowest bidder (L.E)	High cost of skilled labor (L.E)	Financial difficulties of contractor
20	عبد الرقيب احمد للتعليم الاساسى	اسيوط	175500	2	225000	75000	2
21	شطب للتعليم الاساسى	اسيوط	198900	2	255000	85000	2
22	شوقى محمد زيدان الابتدائية	اسيوط	264000	3	360000	120000	3
23	نجع مكى اسماعيل الاعدادية	الاقصر	251550	1	322500	107500	1
24	ام المؤمنين الابتدائية المشتركة	اسيوط	2691	2	348450	116150	3
25	القال القبلى الثانوية	اسيوط	175500	3	225000	75000	2
26	دكران الاعدادية المشتركة	اسيوط	182900	2	232500	77500	1
27	تعليية منشأة الوكيل تعليم اساسى	البحيرة	88018	1	83826	83826	1
28	نظارة سمريس الاعدادية المشتركة	البحيرة	103425	2	98500	98500	1
29	مرتانة الابتدائية المشتركة	البحيرة	170100	1	243000	162000	1
30	صفر للتعليم الاساسى	البحيرة	199500	2	285000	190000	1
31	أبو المطامير الاعدادية بنات	البحيرة	211575	2	302250	201500	1
32	المحمودية الفنية للإدارة و الخدمات	البحيرة	169575	2	242250	161500	1
33	كوم النصر للتعليم الاساسى	البحيرة	249900	1	357000	238000	1
34	محمد عبد الحميد صقر الاعدادية	البحيرة	123900	1	177000	118000	1
35	منشأة الوكيل تعليم اساسى	البحيرة	509250	1	727500	485000	1
36	يونس عرقوب الاعدادية المشتركة	البحيرة	140700	2	201000	134000	1
37	محمد عبدة الحمامسى	البحيرة	151200	2	216000	144000	1
38	محمد سالم حسن الابتدائية	البحيرة	96915	2	92300	92300	1
39	بولين الفوايد للتعليم الاساسى	البحيرة	132300	2	189000	126000	1

**Table (E.2). Severity of highest factors on 102 sample projects (cont.)**

No	المدرسة	المحافظة	Escalation of material prices (Inflation) (L.E)	Difficulties in getting work permit from government	Practice of assigning contract to lowest bidder (L.E)	High cost of skilled labor (L.E)	Financial difficulties of contractor
40	العرقوب الابتدائية المشتركة	البحيرة	102900	2	98000	98000	1
41	محلة انجاك الابتدائية	الدقهلية	151140	2	206100	137400	1
42	احمد محمد النجار الاعدادية بنات	الدقهلية	190630	1	259950	173300	1
43	تلبانة تعليم الاساسى	الدقهلية	233310	2	318150	212100	3
44	المنصورة الثانوية العسكرية	الدقهلية	352660	2	480900	320600	3
45	على مبارك الابتدائية	الدقهلية	176990	2	241350	160900	1
46	شربين تعليم اساسى	الدقهلية	256850	1	350250	233500	1
47	المنيل الاعدادية المشتركة	الدقهلية	215380	2	293700	195800	1
48	الضهرية الابتدائية ( 1 )	الدقهلية	198000	2	270000	180000	1
49	اللغات المتميزة بالحوال	الدقهلية	693501	2	1260911	630456	3
50	حسين حماد الثانوية بنات	الدقهلية	586264	1	1065934	532967	1
51	مجمع عرفة عبد المطلب	الدقهلية	1986660	1	3396000	1698000	3
52	احمد كامل السيد	الدقهلية	384462	2	492900	328600	3
53	د/ عبد الحافظ الكردى	الدقهلية	400140	2	513000	342000	3
54	على بن ابى طالب	الدقهلية	157176	1	199800	133200	1
55	الترزى الابتدائية المشتركة	الدقهلية	223374	2	283950	189300	1
56	ابن لقمان الاعدادية بنين	الدقهلية	324028	2	411900	274600	1
57	طلخا الابتدائية الجديدة ( 1 )	الدقهلية	945298	1	1602200	801100	3
58	طلخا الابتدائية الجديدة ( 2 )	الدقهلية	795957	1	1349080	674540	3
59	طلخا الثانوية بنات الجديدة	الدقهلية	789910	1	1338830	669415	3

**Table (E.2). Severity of highest factors on 102 sample projects (cont.)**

No	المدرسة	المحافظة	Escalation of material prices (Inflation) (L.E)	Difficulties in getting work permit from government	Practice of assigning contract to lowest bidder (L.E)	High cost of skilled labor (L.E)	Financial difficulties of contractor
60	طلخا التجريبية المتميزة	الدقهلية	629530	2	1067000	533500	1
61	طلخا الاعدادية بنين الجديدة	الدقهلية	433650	2	551250	367500	3
62	جمال مبارك الثانوية المشتركة بالجمالية	الدقهلية	391056	1	528454	352302	3
63	الحاج موسى عبد الشافى ابراهيم الثانوية	الدقهلية	345334	1	466667	311111	3
64	الثانوية بنات بشربين	الدقهلية	166861	1	225487	150325	1
65	عمر بن الخطاب الثانوية بنين	الدقهلية	303251	2	409799	273199	1
66	مجمع بهوت الثانوى	الدقهلية	309096	2	417697	278465	1
67	العزيزة الثانوية المشتركة	الدقهلية	387959	1	524269	349513	2
68	دميرة الثانوية المشتركة	الدقهلية	144205	1	194872	129915	1
69	الحبيبات الشرقية تعليم اساسى	قنا	162833	1	222045	74015	1
70	الاعدادية بنات بمشطا	قنا	50050	1	45500	22750	2
71	ابو شوشة البلد	قنا	37532	1	34120	17060	1
72	الجرامون بنجع حمادى	قنا	85448	1	77680	38840	1
73	جاد الكريم و اخية ابراهيم احمد الثانوية	سوهاج	132990	1	181350	60450	1
74	فاوولى تعليم اساسى	سوهاج	49500	2	45000	22500	1
75	بيت خلاف الاعدادية	سوهاج	84414	1	76740	38370	1
76	الكتكاتة الابتدائية	سوهاج	160116	2	218340	72780	1
77	المنشاة الابتدائية	سوهاج	158290	2	215850	71950	1
78	النجع الكبير الابتدائية	سوهاج	70928	1	64480	32240	3
79	خارفة جرجا الاعدادية	سوهاج	61930	1	56300	28150	1

**Table (E.2). Severity of highest factors on 102 sample projects (cont.)**

No	المدرسة	المحافظة	Escalation of material prices (Inflation) (L.E)	Difficulties in getting work permit from government	Practice of assigning contract to lowest bidder (L.E)	High cost of skilled labor (L.E)	Financial difficulties of contractor
80	السوالم الجديدة الابتدائية	سوهاج	171193	2	233445	77815	1
81	دار السلام الاعدادية	سوهاج	119339	2	162735	54245	1
82	الكشاح الاعدادية الجديدة	سوهاج	88396	3	80360	40180	3
83	بنى منصور الابتدائية المشتركة	سوهاج	181984	3	248160	82720	3
84	نجع حمودة تعليم اساسى	سوهاج	161238	1	206715	68905	1
85	سوهاج الثانوية الزخرفية	سوهاج	132750	2	168750	56250	1
86	مجمع بناويط الاعدادية	سوهاج	189661	1	241095	80365	1
87	محمد عبد الجواد حسين	سوهاج	338908	2	430815	143605	1
88	السلامونى تعليم اساسى	سوهاج	289419	2	367905	122635	1
89	طهطا الثانوية بنين	سوهاج	173745	2	222750	74250	3
90	البلينا التجريبية الابتدائية	سوهاج	425331	1	540675	180225	1
91	المراغة الثانوية الجديدة	سوهاج	306894	2	390120	130040	1
92	نجع الكراعى	سوهاج	262482	1	354705	118235	1
93	تونس الثانوية	سوهاج	230097	1	328710	109570	1
94	مجمع اليربا الابتدائية	سوهاج	605305	2	1025940	256485	1
95	الذناقلة ثانوى صناعى	سوهاج	1314150	1	2227373	556843	3
96	السيدة سمية	القاهرة	310058	3	422807	422807	2
97	تعليم اساسى بسنديون	القليوبية	534392	1	685118	685118	3
98	الشيخ عمران تعليم اساسى	اسيوط	510080	1	648407	216136	3
99	أرض أشرف نوار الاعدادية	القاهرة	679288	3	1161177	870883	3
100	الجلال للتربية الفكرية	الغربية	682841	1	1167249	583624	3
101	منشأة بدينى تعليم اساسى	المنيا	707442	2	1209303	302326	3
102	سوزان مبارك ثانوى صناعى	المنيا	691741	2	1172443	293111	3

Criteria given by expertise to the highest qualitative factors, 1 for low, 2 for medium and 3 for high.

**Table (E.2). Severity of highest factors on 102 sample projects (cont.)**

No	المدرسة	المحافظة	Slow payment of completed works	High insurance & high interest rates (L.E)	Bureaucracy in bidding/ tendering method	Financial difficulties of owner
1	الحواط الابتدائية	القاهرة	3	27817	2	2
2	سوزان مبارك	القاهرة	3	63776	2	2
3	ثانوى عام بنوى	القليوبية	3	166201	3	2
4	زهرة المدائن بالنزهه	القاهرة	3	494495	3	2
5	اسكان المستقبل بالعبور	القاهرة	2	114214	1	2
6	ابتدائى بقرية البرادعة	القليوبية	2	174048	1	2
7	ثانوى عام بالبرادعة	القليوبية	2	86240	1	2
8	الجهاد للتعليم الساسى	الجيزة	2	171533	1	2
9	ثانوى عام بقليوب	القليوبية	2	163675	1	3
10	القراموص	الاسكندرية	2	22320	1	2
11	الحمادين ام عثمان	الاسكندرية	3	52600	2	2
12	الشهيد طلعت نعمان	الاسكندرية	2	53245	2	2
13	جلال الدسوقى	الاسكندرية	2	53128	2	2
14	آمون	الاسكندرية	1	25800	2	2
15	البكاتوش	الاسكندرية	1	488960	1	2
16	القرية السياحية	الجيزة	1	748480	1	1
17	اسكان العبور	الجيزة	2	97800	1	1
18	العمراوى	الاسكندرية	2	28260	1	1
19	محمود صدقى	الاسكندرية	1	27975	1	1
20	عبد الرقيب احمد للتعليم الاساسى	اسيوط	1	75000	1	2

**Table (E.2). Severity of highest factors on 102 sample projects (cont.)**

No	المدرسة	المحافظة	Slow payment of completed works	High insurance & high interest rates (L.E)	Bureaucracy in bidding/ tendering method	Financial difficulties of owner
21	شطب للتعليم الاساسى	اسيوط	1	85000	1	2
22	شوقى محمد زيدان الابتدائية	اسيوط	3	120000	2	2
23	نجع مكى اسماعيل الاعدادية	الاقصر	1	107500	1	2
24	ام المؤمنين الابتدائية المشتركة	اسيوط	2	116150	3	2
25	القال القبلى الثانوية	اسيوط	2	75000	1	2
26	دكران الاعدادية المشتركة	اسيوط	2	77500	1	2
27	تعلية منشأة الوكيل تعليم اساسى	البحيرة	1	25148	2	1
28	نظارة سمريس الاعدادية المشتركة	البحيرة	2	29550	1	1
29	مرتانة الابتدائية المشتركة	البحيرة	2	81000	1	1
30	صفر للتعليم الاساسى	البحيرة	1	95000	1	1
31	أبو المطامير الاعدادية بنات	البحيرة	1	100750	1	1
32	المحمودية الفنية للإدارة و الخدمات	البحيرة	1	80750	1	1
33	كوم النصر للتعليم الاساسى	البحيرة	1	119000	1	1
34	محمد عبد الحميد صقر الاعدادية	البحيرة	2	59000	1	1
35	منشأة الوكيل تعليم اساسى	البحيرة	1	242500	2	1
36	يونس عرقوب الاعدادية المشتركة	البحيرة	2	67000	1	1
37	محمد عبدة الحمامسى	البحيرة	2	72000	1	1
38	محمد سالم حسن الابتدائية	البحيرة	2	27690	1	1
39	بولين الفوايد للتعليم الاساسى	البحيرة	2	63000	1	1
40	العرقوب الابتدائية المشتركة	البحيرة	2	29400	1	1
41	محلة انجاق الابتدائية	الدقهلية	2	68700	1	2

**Table (E.2). Severity of highest factors on 102 sample projects (cont.)**

No	المدرسة	المحافظة	Slow payment of completed works	High insurance & high interest rates (L.E)	Bureaucracy in bidding/ tendering method	Financial difficulties of owner
42	احمد محمد النجار الاعدادية بنات	الدقهلية	1	86650	1	2
43	تلبانة تعليم الاساسى	الدقهلية	2	106050	2	2
44	المنصورة الثانوية العسكرية	الدقهلية	2	160300	2	2
45	على مبارك الابتدائية	الدقهلية	1	80450	1	2
46	شربين تعليم اساسى	الدقهلية	1	116750	3	2
47	المنيل الاعدادية المشتركة	الدقهلية	1	97900	1	2
48	الضهرية الابتدائية ( 1 )	الدقهلية	2	90000	1	2
49	اللغات المتميزة بالحوال	الدقهلية	3	504365	2	2
50	حسين حماد الثانوية بنات	الدقهلية	1	426374	1	2
51	مجمع عرفة عبد المطب	الدقهلية	2	1358400	1	2
52	احمد كامل السيد	الدقهلية	2	164300	1	2
53	د/ عبد الحافظ الكردى	الدقهلية	2	171000	1	2
54	على بن ابى طالب	الدقهلية	1	66600	1	2
55	الترزى الابتدائية المشتركة	الدقهلية	1	94650	1	2
56	ابن لقمان الاعدادية بنين	الدقهلية	2	137300	1	2
57	طلخا الابتدائية الجديدة ( 1 )	الدقهلية	2	640880	3	2
58	طلخا الابتدائية الجديدة ( 2 )	الدقهلية	2	539632	3	2
59	طلخا الثانوية بنات الجديدة	الدقهلية	2	535532	3	2
60	طلخا التجريبية المتميزة	الدقهلية	2	426800	1	2
61	طلخا الاعدادية بنين الجديدة	الدقهلية	2	183750	1	2
62	جمال مبارك الثانوية المشتركة بالجمالية	الدقهلية	2	176151	2	3



**Table (E.2). Severity of highest factors on 102 sample projects (cont.)**

No	المدرسة	المحافظة	Slow payment of completed works	High insurance & high interest rates (L.E)	Bureaucracy in bidding/ tendering method	Financial difficulties of owner
63	الحاج موسى عبد الشافى ابراهيم الثانوية	الدقهلية	2	155556	2	3
64	الثانوية بنات بشربين	الدقهلية	1	75162	1	3
65	عمر بن الخطاب الثانوية بنين	الدقهلية	1	136600	1	3
66	مجمع بهوت الثانوى	الدقهلية	1	139232	1	3
67	العزيزة الثانوية المشتركة	الدقهلية	1	174756	1	3
68	دميرة الثانوية المشتركة	الدقهلية	1	64957	1	3
69	الحبيلات الشرقية تعليم اساسى	قنا	1	74015	1	2
70	الاعدادية بنات بمشطا	قنا	1	13650	1	2
71	ابو شوشة البلد	قنا	1	10236	1	2
72	الجرامون بنجع حمادى	قنا	1	23304	3	2
73	جاد الكريم و اخية ابراهيم احمد الثانوية	سوهاج	1	60450	1	2
74	فاو جلى تعليم اساسى	سوهاج	1	13500	1	2
75	بيت خلاف الاعدادية	سوهاج	1	23022	1	2
76	الكتكاتة الابتدائية	سوهاج	1	72780	1	2
77	المنشأة الابتدائية	سوهاج	1	71950	1	2
78	النجع الكبير الابتدائية	سوهاج	1	19344	1	2
79	خارفة جرجا الاعدادية	سوهاج	1	16890	1	2
80	السوالم الجديدة الابتدائية	سوهاج	1	77815	1	2
81	دار السلام الاعدادية	سوهاج	2	54245	1	2
82	الكشع الاعدادية الجديدة	سوهاج	3	24108	2	2
83	بنى منصور الابتدائية المشتركة	سوهاج	3	82720	2	2

**Table (E.2). Severity of highest factors on 102 sample projects (cont.)**

No	المدرسة	المحافظة	Slow payment of completed works	High insurance & high interest rates (L.E)	Bureaucracy in bidding/ tendering method	Financial difficulties of owner
84	نجع حمودة تعليم اساسى	سوهاج	1	68905	1	2
85	سوهاج الثانوية الزخرفية	سوهاج	2	56250	1	2
86	مجمع بناويط الاعدادية	سوهاج	1	80365	1	2
87	محمد عبد الجواد حسين	سوهاج	1	143605	1	2
88	السلامونى تعليم اساسى	سوهاج	1	122635	1	2
89	طهطا الثانوية بنين	سوهاج	3	74250	3	2
90	البلينا التجريبية الابتدائية	سوهاج	1	180225	1	2
91	المراغة الثانوية الجديدة	سوهاج	1	130040	1	2
92	نجع الكراعى	سوهاج	1	118235	1	3
93	تونس الثانوية	سوهاج	1	109570	1	1
94	مجمع البربا الابتدائية	سوهاج	2	410376	1	2
95	الدناقلة ثانوى صناعى	سوهاج	3	890949	3	2
96	السيدة سمية	القاهرة	3	140936	3	2
97	تعليم اساسى بسنديون	القليوبية	3	228373	3	2
98	الشيخ عمران تعليم اساسى	اسيوط	3	216136	3	2
99	أرض أشرف نوار الاعدادية	القاهرة	3	464471	3	2
100	الجلء للتربية الفكرية	الغربية	3	466900	3	2
101	منشأة بدينى تعليم اساسى	المنيا	3	483721	3	2
102	سوزان مبارك ثانوى صناعى	المنيا	2	468977	3	2

**Table (E.2). Severity of highest factors on 102 sample projects (cont.)**

No	المدرسة	المحافظة	Inaccurate bill of quantities. (L.E)	Inaccurate cost estimation (cost overrun) (L.E)	Mistakes in soil investigation	High Transportation Cost (L.E)
1	الحواط الابتدائية	القاهرة	46362	103167	2	139086
2	سوزان مبارك	القاهرة	102041	47367	2	191327
3	ثانوى عام بنوى	القليوبية	150441	369014	3	498602
4	زهرة المدائن بالنزهه	القاهرة	218118	631184	3	927178
5	اسكان المستقبل بالعبور	القاهرة	182742	-120225	1	342641
6	ابتدائى بقرية البرادعة	القليوبية	278477	-71040	1	522144
7	ثانوى عام بالبرادعة	القليوبية	137984	-35200	1	258720
8	الجهاد للتعليم الساسى	الجيزة	274452	-116326	1	514598
9	ثانوى عام بقليوب	القليوبية	261880	-118500	1	491025
10	القراموص	الاسكندرية	37200	-46000	1	89280
11	الحمادين ام عثمان	الاسكندرية	84160	171000	2	126240
12	الشهيد طلعت نعمان	الاسكندرية	85192	164900	2	127788
13	جلال النسوقى	الاسكندرية	85004	138550	2	127506
14	أمون	الاسكندرية	43000	158000	3	103200
15	البكاتوش	الاسكندرية	611200	-238000	1	733440
16	القرية السياحية	الجيزة	935600	-566000	1	1122720
17	اسكان العبور	الجيزة	156480	-32000	1	234720
18	العمراوى	الاسكندرية	47100	-18000	1	113040
19	محمود صدقى	الاسكندرية	46625	-17500	1	111900
20	عبد الرقيب احمد للتعليم الاساسى	اسيوط	120000	0	1	120000
21	شطب للتعليم الاساسى	اسيوط	136000	0	1	136000

**Table (E.2). Severity of highest factors on 102 sample projects (cont.)**

No	المدرسة	المحافظة	Inaccurate bill of quantities. (L.E)	Inaccurate cost estimation (cost overrun) (L.E)	Mistakes in soil investigation	High Transportation Cost (L.E)
22	شوقى محمد زيدان الابتدائية	اسيوط	192000	50000	1	192000
23	نجع مكى اسماعيل الاعدادية	الاقصر	172000	-50000	1	172000
24	ام المؤمنين الابتدائية المشتركة	اسيوط	185840	23000	2	185840
25	القال القبلى الثانوية	اسيوط	120000	0	1	120000
26	دكران الاعدادية المشتركة	اسيوط	124000	-50000	1	124000
27	تعلية منشأة الوكيل تعليم اساسى	البحيرة	41913	-141321	1	100591
28	نظارة سمريس الاعدادية المشتركة	البحيرة	49250	-35000	1	118200
29	مرتانة الابتدائية المشتركة	البحيرة	129600	-220000	1	194400
30	صفر للتعليم الاساسى	البحيرة	152000	-65000	1	228000
31	أبو المطامير الاعدادية بنات	البحيرة	161200	-105000	1	241800
32	المحمودية الفنية للإدارة و الخدمات	البحيرة	129200	-105000	1	193800
33	كوم النصر للتعليم الاساسى	البحيرة	190400	-130000	1	285600
34	محمد عبد الحميد صقر الاعدادية	البحيرة	94400	-140000	1	141600
35	منشأة الوكيل تعليم اساسى	البحيرة	388000	-880000	1	582000
36	يونس عرقوب الاعدادية المشتركة	البحيرة	107200	-90000	1	160800
37	محمد عبدة الحمامسى	البحيرة	115200	-150000	1	172800
38	محمد سالم حسن الابتدائية	البحيرة	46150	-88000	1	110760
39	بولين الفوائد للتعليم الاساسى	البحيرة	100800	-35000	1	151200
40	العرقوب الابتدائية المشتركة	البحيرة	49000	-33000	1	117600
41	محلة انجاك الابتدائية	الدقهلية	109920	-86260	1	164880
42	احمد محمد النجار الاعدادية بنات	الدقهلية	138640	-130680	1	207960

**Table (E.2). Severity of highest factors on 102 sample projects (cont.)**

No	المدرسة	المحافظة	Inaccurate bill of quantities. (L.E)	Inaccurate cost estimation (cost overrun) (L.E)	Mistakes in soil investigation	High Transportation Cost (L.E)
43	تلبانة تعليم الاساسى	الدقهلية	169680	84840	2	254520
44	المنصورة الثانوية العسكرية	الدقهلية	256480	160300	2	384720
45	على مبارك الابتدائية	الدقهلية	128720	-50230	1	193080
46	شربين تعليم اساسى	الدقهلية	186800	-495440	1	280200
47	المنيل الاعدادية المشتركة	الدقهلية	156640	-79420	1	234960
48	الضهرية الابتدائية ( 1 )	الدقهلية	144000	-96920	1	216000
49	اللغات المتميزة بالحوال	الدقهلية	630456	315228	2	756547
50	حسين حماد الثانوية بنات	الدقهلية	532967	-55703	1	639560
51	مجمع عرفة عبد المطلب	الدقهلية	1698000	519200	1	2037600
52	احمد كامل السيد	الدقهلية	262880	197160	1	394320
53	د/ عبد الحافظ الكردى	الدقهلية	273600	102600	1	410400
54	على بن ابى طالب	الدقهلية	106560	-56480	1	159840
55	الترزى الابتدائية المشتركة	الدقهلية	151440	-60140	1	227160
56	ابن لقمان الاعدادية بنين	الدقهلية	219680	-54000	1	329520
57	طلخا الابتدائية الجديدة 1	الدقهلية	801100	155000	2	961320
58	طلخا الابتدائية الجديدة 2	الدقهلية	674540	132555	2	809448
59	طلخا الثانوية بنات الجديدة	الدقهلية	669415	136737	2	803298
60	طلخا التجريبية المتميزة	الدقهلية	533500	-45263	1	640200
61	طلخا الاعدادية بنين الجديدة	الدقهلية	294000	153125	1	441000
62	جمال مبارك الثانوية المشتركة بالجمالية	الدقهلية	281842	108960	2	422763
63	الحاج موسى عبد الشافى ابراهيم الثانوية	الدقهلية	248889	198582	2	373334

**Table (E.2). Severity of highest factors on 102 sample projects (cont.)**

No	المدرسة	المحافظة	Inaccurate bill of quantities. (L.E)	Inaccurate cost estimation (cost overrun) (L.E)	Mistakes in soil investigation	High Transportation Cost (L.E)
64	الثانوية بنات بشربين	الدقهلية	120260	-64998	1	180390
65	عمر بن الخطاب الثانوية بنين	الدقهلية	218559	-110392	1	327839
66	مجمع بهوت الثانوى	الدقهلية	222772	-82119	1	334158
67	العزيزة الثانوية المشتركة	الدقهلية	279610	-19042	1	419415
68	دميرة الثانوية المشتركة	الدقهلية	103932	-80668	1	155898
69	الحبيلات الشرقية تعليم اساسى	قنا	118424	-19441	1	118424
70	الاعدادية بنات بمشطا	قنا	22750	-40950	1	36400
71	ابو شوشة البلد	قنا	17060	-8579	1	27296
72	الجرامون بنجع حمادى	قنا	38840	-141623	1	62144
73	جاد الكريم و اخية ابراهيم احمد الثانوية	سوهاج	96720	-39655	1	96720
74	فاو جلى تعليم اساسى	سوهاج	22500	-45000	1	36000
75	بيت خلاف الاعدادية	سوهاج	38370	-31272	1	61392
76	الكتكاتة الابتدائية	سوهاج	116448	-43086	1	116448
77	المنشأة الابتدائية	سوهاج	115120	-10917	1	115120
78	النجع الكبير الابتدائية	سوهاج	32240	-50847	1	51584
79	خارفة جرجا الاعدادية	سوهاج	28150	-34718	1	45040
80	السوالم الجديدة الابتدائية	سوهاج	124504	-42506	1	124504
81	دار السلام الاعدادية	سوهاج	86792	-14893	1	86792
82	الكشح الاعدادية الجديدة	سوهاج	40180	118934	2	64288
83	بنى منصور الابتدائية المشتركة	سوهاج	132352	170293	2	132352
84	نجع حمودة تعليم اساسى	سوهاج	110248	-21557	1	110248

**Table (E.2). Severity of highest factors on 102 sample projects (cont.)**

No	المدرسة	المحافظة	Inaccurate bill of quantities. (L.E)	Inaccurate cost estimation (cost overrun) (L.E)	Mistakes in soil investigation	High Transportation Cost (L.E)
85	سوهاج الثانوية الزخرفية	سوهاج	90000	-24457	1	90000
86	مجمع بناويط الاعدادية	سوهاج	128584	-87645	1	128584
87	محمد عبد الجواد حسين	سوهاج	229768	-122447	1	229768
88	السلامونى تعليم اساسى	سوهاج	196216	-46405	1	196216
89	طهطا الثانوية بنين	سوهاج	118800	165000	3	118800
90	البلينا التجريبية الابتدائية	سوهاج	288360	-185442	1	288360
91	المراغة الثانوية الجديدة	سوهاج	208064	-95555	1	208064
92	نجع الكراعى	سوهاج	189176	-34781	1	189176
93	تونس الثانوية	سوهاج	175312	-8566	1	175312
94	مجمع البربا الابتدائية	سوهاج	512970	-256770	2	410376
95	الدناقلة ثانوى صناعى	سوهاج	1113686	1237429	3	890949
96	السيدة سمية	القاهرة	225497	313190	3	922807
97	تعليم اساسى بسنديون	القليوبية	565396	507494	3	685118
98	الشيخ عمران تعليم اساسى	اسيوط	345817	480301	2	345817
99	أرض أشرف نوار الاعدادية	القاهرة	580588	645098	3	870883
100	الجلاء للتربية الفكرية	الغربية	583624	648471	2	700349
101	منشأة بدينى تعليم اساسى	المنيا	604652	671836	3	483721
102	سوزان مبارك ثانوى صناعى	المنيا	586221	59214	2	468977

## **Appendix F**

**Data of the collected 30 projects for Models validation**



**Table (F.1). Data of the collected 30 projects for models validation**

NO	المدرسة	المحافظة	الشركة المنفذه	القيمة التقديرية للشركة لتنفيذ الأعمال (بالجنية)	قيمة الأعمال المنفذة الفعلية (بالجنية)	percentage of cost overrun	value of cost overrun (L.E)	cost overrun
1	صلاح الدين الابتدائية الصباحية	الاسكندرية	الدولية	1,673,091	1,840,400	9.09%	167309	1.100
2	الخلفاء الراشدين ب المشتركة	الاسكندرية	سمكو للمقاولات	2,807,456	2,877,731	2.44%	70275	1.025
3	اسماعيل القباني ع بنين	الاسكندرية	سمكو للمقاولات	2,228,725	2,043,714	-9.05%	-185011	0.917
4	بغداد ب	الاسكندرية	الضاني للمقاولات	2,369,260	2,527,434	6.26%	158174	1.067
5	سند ( 2 ) الابتدائي	الاسكندرية	الفتح للمقاولات	2,433,612	2,676,973	9.09%	243361	1.100
6	اسكان العبور	الاسكندرية	المهندسون المتحدون	2,970,062	2,884,076	-2.98%	-85986	0.971
7	العمراوى ب المشتركة	الاسكندرية	المهندسون المتحدون	1,302,036	1,269,405	-2.57%	-32631	0.975
8	ناصر الابتدائية المشتركة	الاسكندرية	المهندسون المتحدون	1,509,542	1,500,364	-0.61%	-9178	0.994
9	حسن صبحي الإعدادية	الاسكندرية	الدولية	2,721,779	2,993,957	9.09%	272178	1.100
10	شباب المستقبل	الاسكندرية	الدولية	3,571,668	3,928,835	9.09%	357167	1.100
11	أمير الشعراء للتعليم الأساسي	الاسكندرية	الدولية	2,944,636	3,180,207	7.41%	235571	1.080
12	محمد فريد الإعدادية	أسيوط	جمعية أبوتيج	4,412,352	4,272,090	-3.28%	-140262	0.968
13	الحواتكة الابتدائية المشتركة	أسيوط	جمعية أبوتيج	4,007,703	3,964,745	-1.08%	-42958	0.989
14	بني هلال الابتدائية المشتركة	أسيوط	جمعية أبوتيج	3,704,348	3,458,807	-7.10%	-245541	0.934
15	بنى شقير ب المشتركة الجديدة	أسيوط	جمعية أبوتيج	5,364,119	5,350,881	-0.25%	-13238	0.998
16	رزق محمد صالحين اساسي	أسيوط	جمعية أبونوب	2,348,725	2,175,708	-7.95%	-173017	0.926
17	الحوالد الابتدائية الجديدة	أسيوط	جمعية أبونوب	1,592,149	1,426,425	-11.62%	-165724	0.896
18	الدوير للتعليم الاساسي	أسيوط	جمعية أبونوب	3,607,972	3,320,964	-8.64%	-287008	0.920
19	نجع الكوم الابتدائية المشتركة	قنا	جمعية سوهاج	1,846,194	1,810,089	-1.99%	-36105	0.980

**Table (F.1). Data of the collected 30 projects for models validation (cont.)**

NO	المدرسة	المحافظة	الشركة المنفذه	القيمة التقديرية للشركة لتنفيذ الأعمال (بالجنية)	قيمة الأعمال المنفذة الفعلية (بالجنية)	percentage of cost overrun	value of cost overrun (L.E)	cost overrun
20	نجع حامد احمد رمضان ت أ	قنا	جمعية سوهاج	1,405,909	1,304,163	-7.80%	-101746	0.928
21	قصير بخانس الثانوية العامة	قنا	جمعية سوهاج	2,111,603	2,153,835	1.96%	42232	1.020
22	السمطا بحري الإعدادية	قنا	جمعية سوهاج	3,679,882	3,418,153	-7.66%	-261730	0.929
23	أبو بكر الصديق ع بالصبريات	قنا	جمعية سوهاج	1,785,787	1,697,134	-5.22%	-88653	0.950
24	الحرس الوطني ب	القليوبية	الكرنك	3,157,177	2,862,446	-10.30%	-294731	0.907
25	اساسي بعزبة الكبار	القليوبية	الكرنك	4,018,833	3,979,163	-1.00%	-39670	0.990
26	أم السعود ت ا	الدقهلية	المقاولون المتحدون	3,455,693	3,248,287	-6.39%	-207406	0.940
27	ميت غراب الابتدائية	الدقهلية	المقاولون المتحدون	2,037,990	2,024,183	-0.68%	-13807	0.993
28	كفر بدواي اساسي	الدقهلية	المقاولون المتحدون	3,689,206	3,529,840	-4.51%	-159366	0.957
29	دمو الاعيادية	الدقهلية	المقاولون المتحدون	3,205,694	3,032,806	-5.70%	-172888	0.946
30	الحرية ت ا	الدقهلية	المقاولون المتحدون	2,875,710	2,572,203	-11.80%	-303507	0.894

**Table (F.1). Data of the collected 30 projects for models validation (cont.)**

م	المدرسة	المحافظة	الشركة المنفذه	مدة المشروع بالعقد باليوم	تاريخ استلام الموقع	المدة المخططة من الشركة لتنفيذ الأعمال	تاريخ التسليم الإبتدائي الفعلي	غرامة التأخير
1	صلاح الدين الابتدائية الصباحية	الاسكندرية	الدولية	330	1/4/2012	11	14	10%
2	الخلفاء الراشدين ب المشتركة	الاسكندرية	سمكو للمقاولات	390	10/10/2011	13	13.25	1.0%
3	اسماعيل القباني ع بنين	الاسكندرية	سمكو للمقاولات	390	1/11/2011	13	13	
4	بغداد ب	الاسكندرية	الصناني للمقاولات	300	15/11/2011	10	11.5	6.0%
5	سند ( 2 ) الإبتدائي	الاسكندرية	الفتح للمقاولات	330	19/9/2011	11	15	10%

**Table (F.1). Data of the collected 30 projects for models validation (cont.)**

م	المدرسة	المحافظة	الشركة المنفذه	مدة المشروع بالعقد باليوم	تاريخ استلام الموقع	المدة المخططة من الشركة لتنفيذ الأعمال	تاريخ التسليم الإبتدائي الفعلي	غرامة التأخير
6	اسكان العبور	الاسكندرية	المهندسون المتحدون	390	26/9/2011	13	13	
7	العمراوى ب المشتركة	الاسكندرية	المهندسون المتحدون	240	1/12/2011	8	8	
8	ناصر الابتدائية المشتركة	الاسكندرية	المهندسون المتحدون	390	15/8/2011	13	13	
9	حسن صبحي الإعدادية	الاسكندرية	الدولية	330	15/10/2011	11	14.5	10%
10	شباب المستقبل	الاسكندرية	الدولية	330	22/10/2011	11	14	10%
11	أمير الشعراء للتعليم الأساسي	الاسكندرية	الدولية	330	29/10/2011	11	13	8%
12	محمد فريد الإعدادية	أسيوط	جمعية أبوتيج	405	19/6/2011	13.5	12	
13	الحواتكة الابتدائية المشتركة	أسيوط	جمعية أبوتيج	370	12/7/2011	12.5	11.5	
14	بني هلال الابتدائية المشتركة	أسيوط	جمعية أبوتيج	345	1/8/2011	11.5	10	
15	بنى شقير ب المشتركة الجديدة	أسيوط	جمعية أبوتيج	420	10/8/2011	14	12	
16	رزق محمد صالحين اساسي	أسيوط	جمعية أنوب	300	16/10/2011	10	10	
17	الخوالد الابتدائية الجديدة	أسيوط	جمعية أنوب	285	20/10/2011	9.5	9.5	
18	الدوير للتعليم الاساسي	أسيوط	جمعية أنوب	300	22/1/2012	10	10	
19	نجع الكوم الابتدائية المشتركة	قنا	جمعية سوهاج	345	15/9/2011	11.5	10.5	
20	نجع حامد احمد رمضان ت أ	قنا	جمعية سوهاج	345	22/9/2011	11.5	11	
21	قصير بخانس الثانوية العامة	قنا	جمعية سوهاج	330	10/12/2011	11	11.5	2%
22	السمطا بحري الإعدادية	قنا	جمعية سوهاج	345	24/8/2011	11.5	11	
23	أبو بكر الصديق ع بالصبريات	قنا	جمعية سوهاج	330	1/9/2011	11	11	
24	الحرس الوطنى ب	القليوبية	الكرنك	480	1/12/2011	16	13.5	

**Table (F.1). Data of the collected 30 projects for models validation (cont.)**

م	المدرسة	المحافظة	الشركة المنفذه	مدة المشروع بالعقد باليوم	تاريخ استلام الموقع	المدة المخططة من الشركة لتنفيذ الأعمال	تاريخ التسليم الإبتدائي الفعلي	غرامة التأخير
25	اساسي بعزبة الكبار	القلبوية	الكرنك	330	15/11/2011	11	11	
26	أم السعود ت ا	الدقهلية	المقاولون المتحدون	270	10/10/2011	9	9	
27	ميت غراب الابتدائية	الدقهلية	المقاولون المتحدون	300	23/10/2011	10	9.5	
28	كفر بدواي اساسي	الدقهلية	المقاولون المتحدون	390	13/11/2011	13	12	
29	دمو الاعدادية	الدقهلية	المقاولون المتحدون	345	10/11/2011	11.5	11	
30	الحرية ت ا	الدقهلية	المقاولون المتحدون	300	15/11/2011	10	10	

**Table (F.2). Severity of the highest factors on 30 projects for models validation**

NO	المدرسة	conclusion of cost overrun Predicted	percentage of error of Cost overrun	cost overrun predicted	conclusion of time overrun Predicted	percentage of error of Time overrun	time overrun Predicted	time overrun ACTUAL
1	صلاح الدين الابتدائية الصباحية	ACCEPTED	6.30	1.03	ACCEPTED	3.90	1.22	1.27
2	الخلفاء الراشدين ب المشتركة	ACCEPTED	4.03	1.07	ACCEPTED	10.58	1.13	1.02
3	اسماعيل القباني ع بنين	ACCEPTED	9.85	1.01	ACCEPTED	10.71	1.11	1.00
4	بغداد ب	ACCEPTED	0.63	1.07	ACCEPTED	2.65	1.18	1.15
5	سند ( 2 ) الابتدائي	ACCEPTED	5.28	1.16	ACCEPTED	3.62	1.41	1.36
6	اسكان العبور	ACCEPTED	3.34	1.00	ACCEPTED	8.81	1.09	1.00
7	العمراوى ب المشتركة	ACCEPTED	3.01	1.00	ACCEPTED	1.98	0.98	1.00
8	ناصر الابتدائية المشتركة	ACCEPTED	1.37	1.01	ACCEPTED	1.34	1.01	1.00
9	حسن صبحي الإعدادية	ACCEPTED	5.62	1.16	ACCEPTED	10.01	1.45	1.32
10	شباب المستقبل	ACCEPTED	0.60	1.09	ACCEPTED	0.31	1.27	1.27

**Table (F.2). Severity of the highest factors on 30 projects for models validation (cont.)**

NO	المدرسة	conclusion of cost overrun Predicted	percentage of error of Cost overrun	cost overrun predicted	conclusion of time overrun Predicted	percentage of error of Time overrun	time overrun Predicted	time overrun ACTUAL
11	أمير الشعراء للتعليم الأساسي	ACCEPTED	0.01	1.08	ACCEPTED	0.32	1.19	1.18
12	محمد فريد الإعدادية	ACCEPTED	1.21	0.96	ACCEPTED	1.95	0.87	0.89
13	الحواتكة الابتدائية المشتركة	ACCEPTED	8.23	0.91	ACCEPTED	4.38	0.88	0.92
14	بني هلال الابتدائية المشتركة	ACCEPTED	5.99	0.88	ACCEPTED	12.13	0.76	0.87
15	بني شقير ب المشتركة الجديدة	ACCEPTED	3.81	1.04	ACCEPTED	1.04	0.85	0.86
16	رزق محمد صالحين اساسي	ACCEPTED	4.32	0.97	ACCEPTED	9.89	1.10	1.00
17	الحوالد الابتدائية الجديدة	ACCEPTED	0.23	0.89	ACCEPTED	7.80	0.92	1.00
18	الدوير للتعليم الاساسي	ACCEPTED	1.39	0.93	ACCEPTED	12.01	0.88	1.00
19	نجع الكوم الابتدائية المشتركة	ACCEPTED	3.39	1.01	ACCEPTED	7.56	0.98	0.91
20	نجع حامد احمد رمضان ت أ	ACCEPTED	5.22	0.98	ACCEPTED	11.42	1.07	0.96
21	قصير بخانس الثانوية العامة	ACCEPTED	1.20	1.01	ACCEPTED	1.29	1.03	1.05
22	السمطا بحري الإعدادية	ACCEPTED	2.53	0.95	ACCEPTED	0.06	0.96	0.96
23	أبو بكر الصديق ع بالصيريات	ACCEPTED	6.15	1.01	ACCEPTED	2.77	1.03	1.00
24	الحرس الوطني ب	ACCEPTED	3.20	0.94	ACCEPTED	0.93	0.85	0.84
25	اساسي بعزية الكبار	ACCEPTED	1.80	1.01	ACCEPTED	5.56	0.94	1.00
26	أم السعود ت ا	ACCEPTED	5.25	0.89	ACCEPTED	2.11	0.98	1.00
27	ميت غراب الابتدائية	ACCEPTED	3.44	0.96	ACCEPTED	1.34	0.96	0.95
28	كفر بدواي اساسي	ACCEPTED	1.43	0.94	ACCEPTED	1.67	0.94	0.92
29	دمو الاعدادية	ACCEPTED	0.44	0.94	ACCEPTED	4.34	0.91	0.96
30	الحرية ت ا	ACCEPTED	0.62	0.90	ACCEPTED	11.16	1.11	1.00

**Table (F.2). Severity of the highest factors on 30 projects for models validation (cont.)**

NO	المدرسة	value of time overrun (days)	Escalation of material prices (Inflation) (L.E)	Difficulties in getting work permit from government (L.E)	Practice of assigning contract to lowest bidder (L.E)	High cost of skilled labor (L.E)	Financial difficulties of contractor	Slow payment of completed works
1	صلاح الدين الابتدائية الصباحية	90	193242	3	202444	276060	3	2
2	الخلفاء الراشدين ب المشتركة	7	302162	3	345328	431660	3	2
3	اسماعيل القباني ع بنين	0	214590	3	245246	306557	3	2
4	بغداد ب	42	265381	3	303292	379115	3	2
5	سند ( 2 ) الابتدائي	120	281082	3	321237	401546	3	2
6	اسكان العبور	0	302828	2	346089	432611	3	2
7	العمراوى ب المشتركة	0	133288	2	139635	190411	3	2
8	ناصر الابتدائية المشتركة	0	157538	2	165040	225055	3	2
9	حسن صبحي الإعدادية	105	314365	3	359275	449094	3	2
10	شباب المستقبل	90	412528	3	510749	589325	3	2
11	أمير الشعراء للتعليم الأساسي	60	333922	3	413427	477031	3	2
12	محمد فريد الإعدادية	-45	448569	3	598093	213605	2	2
13	الحوائكة الابتدائية المشتركة	-30	416298	2	515417	198237	2	2
14	بني هلال الابتدائية المشتركة	-45	363175	1	449645	172940	2	2
15	بني شقير ب المشتركة الجديدة	-60	561843	3	802632	267544	2	2
16	رزق محمد صالحين اساسي	0	228449	1	261085	108785	2	2
17	الحوالد الابتدائية الجديدة	0	149775	1	156907	71321	2	2
18	الدوير للتعليم الاساسي	0	348701	2	431725	166048	2	2
19	نجع الكوم الابتدائية المشتركة	-30	190059	1	199110	90504	2	1
20	نجع حامد احمد رمضان ت أ	-15	136937	1	143458	65208	2	1

**Table (F.2). Severity of the highest factors on 30 projects for models validation (cont.)**

21	قصير بخانس الثانوية العامة	15	226153	1	258460	107692	2	1
22	السمطا بحري الإعدادية	-15	358906	1	444360	170908	2	1
23	أبو بكر الصديق ع بالصبريات	0	178199	1	186685	84857	2	1
24	الحرس الوطني ب	-75	300557	1	343494	429367	1	2
25	اساسي بعزية الكبار	0	417812	2	517291	596874	1	2
26	أم السعود ت ا	0	341070	1	422277	324829	2	2
27	ميت غراب الابتدائية	-15	212539	2	242902	202418	2	2
28	كفر بدواي اساسي	-30	370633	2	458879	352984	2	2
29	دمو الاعدادية	-15	318445	2	394265	303281	2	2
30	الحرية ت ا	0	270081	2	308664	257220	2	2

**Table (F.2). Severity of the highest factors on 30 projects for models validation (cont.)**

NO	المدرسة	High insurance & high interest rates	Bureaucracy in bidding/ tendering method	Financial difficulties of owner 2	Inaccurate bill of quantities.	Inaccurate cost estimation	Mistakes in soil investigation	High Transportation Cost
1	صلاح الدين الابتدائية الصباحية	73616	2	3	92020	167309	1	276060
2	الخلفاء الراشدين ب المشتركة	143887	2	3	172664	70275	1	431660
3	اسماعيل القباني ع بنين	102186	2	3	122623	-185011	1	306557
4	بغداد ب	126372	2	3	151646	158174	1	379115
5	سند ( 2 ) الابتدائي	133849	2	3	160618	243361	1	401546
6	اسكان العبور	144204	2	3	173045	-85986	1	432611
7	العمراوى ب المشتركة	50776	2	3	63470	-32631	1	190411
8	ناصر الابتدائية المشتركة	60015	2	3	75018	-9178	1	225055

**Table (F.2). Severity of the highest factors on 30 projects for models validation (cont.)**

NO	المدرسة	High insurance & high interest rates	Bureaucracy in bidding/ tendering method	Financial difficulties of owner 2	Inaccurate bill of quantities.	Inaccurate cost estimation	Mistakes in soil investigation	High Transportation Cost
9	حسن صبحي الإعدادية	149698	2	3	179637	272178	1	449094
10	شباب المستقبل	235730	2	3	275018	357167	1	589325
11	أمير الشعراء للتعليم الأساسي	190812	2	3	222614	235571	1	477031
12	محمد فريد الإعدادية	299046	1	1	341767	-140262	2	341767
13	الحواتكة الابتدائية المشتركة	277532	1	1	277532	-42958	2	317180
14	بني هلال الابتدائية المشتركة	207528	1	1	242116	-245541	2	276705
15	بني شقير ب المشتركة الجديدة	428070	1	1	535088	-13238	2	428070
16	رزق محمد صالحين اساسي	108785	1	1	130542	-173017	2	174057
17	الخواند الابتدائية الجديدة	57057	1	1	71321	-165724	2	114114
18	الدوير للتعليم الاساسي	199258	1	1	232467	-287008	2	265677
19	نجع الكوم الابتدائية المشتركة	72404	3	2	90504	-36105	2	144807
20	نجع حامد احمد رمضان ت أ	52167	3	2	65208	-101746	2	104333
21	قصير بخانس الثانوية العامة	107692	3	2	129230	42232	2	172307
22	السمطا بحري الإعدادية	205089	3	2	239271	-261730	2	273452
23	أبو بكر الصديق ع بالصبريات	67885	3	2	84857	-88653	2	135771
24	الحرس الوطني ب	143122	2	1	171747	-294731	1	343494
25	اساسي بعزية الكبار	238750	2	1	278541	-39670	1	477500
26	أم السعود ت ا	194897	2	1	227380	-207406	1	389794
27	ميت غراب الابتدائية	101209	2	1	121451	-13807	1	242902
28	كفر بدواي اساسي	211790	2	1	247089	-159366	1	423581
29	دمو الاعدادية	181968	2	1	212296	-172888	1	363937
30	الحرية ت ا	128610	2	1	154332	-303507	1	308664



## **Appendix G**

**Input data to SPSS**

**Fig. (G.1). Input data to SPSS for 102 projects.**

\*data.sav [DataSet1] - SPSS Data Editor

	T.overnun	E1	F2	B3	E5	C2	A2	F5	F3	A1	B4	C7	B7	F10	C.overnun	var
1	1.11	101997.00	2.00	92724.00	139086.00	3.00	3.00	27817.00	2.00	2.00	46362.00	103167.00	2.00	139086.00	1.12	
2	1.20	140306.00	3.00	191327.00	191327.00	3.00	3.00	63776.00	2.00	2.00	102041.00	47367.00	2.00	191327.00	1.04	
3	2.44	392234.00	3.00	498602.00	498602.00	1.00	3.00	166201.00	3.00	2.00	150441.00	369014.00	3.00	498602.00	1.12	
4	2.80	729380.00	3.00	1236237.00	927178.00	1.00	3.00	494495.00	3.00	2.00	218118.00	631184.00	3.00	927178.00	1.11	
5	1.00	267260.00	1.00	342641.00	342641.00	1.00	2.00	114214.00	1.00	2.00	182742.00	120225.00	1.00	342641.00	0.95	
6	1.00	407272.00	1.00	522144.00	522144.00	1.00	2.00	174048.00	1.00	2.00	278477.00	71040.00	1.00	522144.00	0.98	
7	1.00	201802.00	1.00	258720.00	258720.00	1.00	2.00	86240.00	1.00	2.00	137984.00	35200.00	1.00	258720.00	0.98	
8	1.00	404817.00	1.00	514598.00	514598.00	1.00	2.00	171533.00	1.00	2.00	274452.00	116326.00	1.00	514598.00	0.97	
9	1.00	363359.00	1.00	491025.00	491025.00	1.00	2.00	163675.00	1.00	3.00	261880.00	118500.00	1.00	491025.00	0.96	
10	1.00	81840.00	1.00	74400.00	74400.00	1.00	2.00	22320.00	1.00	2.00	37200.00	46000.00	1.00	89280.00	0.94	
11	1.25	115720.00	3.00	157800.00	105200.00	3.00	3.00	52600.00	2.00	2.00	84160.00	171000.00	2.00	126240.00	1.19	
12	1.10	117139.00	2.00	159735.00	106490.00	3.00	2.00	53245.00	2.00	2.00	85192.00	164900.00	2.00	127788.00	1.18	
13	1.05	116880.00	2.00	159383.00	106255.00	3.00	2.00	53128.00	2.00	2.00	85004.00	138550.00	2.00	127506.00	1.15	
14	1.18	94600.00	2.00	86000.00	86000.00	3.00	1.00	25800.00	2.00	2.00	43000.00	158000.00	3.00	103200.00	1.22	
15	0.93	715104.00	2.00	1222400.00	611200.00	1.00	1.00	488960.00	1.00	2.00	611200.00	238000.00	1.00	733440.00	0.96	
16	0.93	982380.00	2.00	1871200.00	1403400.00	1.00	1.00	748480.00	1.00	1.00	935600.00	566000.00	1.00	1122720.00	0.94	
17	1.00	205380.00	2.00	293400.00	293400.00	1.00	2.00	97800.00	1.00	1.00	156480.00	32000.00	1.00	234720.00	0.98	
18	1.00	98910.00	2.00	94200.00	94200.00	1.00	2.00	28260.00	1.00	1.00	47100.00	18000.00	1.00	113040.00	0.98	
19	0.90	97913.00	2.00	93250.00	93250.00	1.00	1.00	27975.00	1.00	1.00	46625.00	17500.00	1.00	111900.00	0.98	
20	0.88	175500.00	2.00	225000.00	75000.00	2.00	1.00	75000.00	1.00	2.00	120000.00	0.00	1.00	120000.00	1.00	
21	0.84	198900.00	2.00	255000.00	85000.00	2.00	1.00	85000.00	1.00	2.00	136000.00	0.00	1.00	136000.00	1.00	
22	1.19	264000.00	3.00	360000.00	120000.00	3.00	3.00	120000.00	2.00	2.00	192000.00	50000.00	1.00	192000.00	1.02	

\*data.sav [DataSet1] - SPSS Data Editor

	T.overnun	E1	F2	B3	E5	C2	A2	F5	F3	A1	B4	C7	B7	F10	C.overnun	var
22	1.19	264000.00	3.00	360000.00	120000.00	3.00	3.00	120000.00	2.00	2.00	192000.00	50000.00	1.00	192000.00	1.02	
23	0.87	251550.00	1.00	322500.00	107500.00	1.00	1.00	107500.00	1.00	2.00	172000.00	50000.00	1.00	172000.00	0.98	
24	1.07	2691.00	2.00	348450.00	116150.00	3.00	2.00	116150.00	3.00	2.00	185840.00	23000.00	2.00	185840.00	1.01	
25	1.00	175500.00	3.00	225000.00	75000.00	2.00	2.00	75000.00	1.00	2.00	120000.00	0.00	1.00	120000.00	1.00	
26	1.00	182900.00	2.00	232500.00	77500.00	1.00	2.00	77500.00	1.00	2.00	124000.00	50000.00	1.00	124000.00	0.97	
27	1.00	88018.00	1.00	83826.00	83826.00	1.00	1.00	25148.00	2.00	1.00	41913.00	141321.00	1.00	100591.00	0.86	
28	1.00	103425.00	2.00	98500.00	98500.00	1.00	2.00	29550.00	1.00	1.00	49250.00	35000.00	1.00	118200.00	0.97	
29	1.00	170100.00	1.00	243000.00	162000.00	1.00	2.00	81000.00	1.00	1.00	129600.00	220000.00	1.00	194400.00	0.88	
30	0.96	199500.00	2.00	285000.00	190000.00	1.00	1.00	95000.00	1.00	1.00	152000.00	65000.00	1.00	228000.00	0.97	
31	0.95	211575.00	2.00	302250.00	201500.00	1.00	1.00	100750.00	1.00	1.00	161200.00	105000.00	1.00	241800.00	0.95	
32	0.95	169575.00	2.00	242250.00	161500.00	1.00	1.00	80750.00	1.00	1.00	129200.00	105000.00	1.00	193800.00	0.94	
33	0.84	249900.00	1.00	357000.00	238000.00	1.00	1.00	119000.00	1.00	1.00	190400.00	130000.00	1.00	285600.00	0.95	
34	1.00	123900.00	1.00	177000.00	118000.00	1.00	2.00	59000.00	1.00	1.00	94400.00	140000.00	1.00	141600.00	0.89	
35	0.92	509250.00	1.00	727500.00	485000.00	1.00	1.00	242500.00	2.00	1.00	388000.00	88000.00	1.00	582000.00	0.85	
36	1.00	140700.00	2.00	201000.00	134000.00	1.00	2.00	67000.00	1.00	1.00	107200.00	90000.00	1.00	160800.00	0.94	
37	1.00	151200.00	2.00	216000.00	144000.00	1.00	2.00	72000.00	1.00	1.00	115200.00	150000.00	1.00	172800.00	0.91	
38	1.00	96915.00	2.00	92300.00	92300.00	1.00	2.00	27690.00	1.00	1.00	46150.00	88000.00	1.00	110760.00	0.91	
39	1.00	132300.00	2.00	189000.00	126000.00	1.00	2.00	63000.00	1.00	1.00	100800.00	35000.00	1.00	151200.00	0.97	
40	1.00	102900.00	2.00	98000.00	98000.00	1.00	2.00	29400.00	1.00	1.00	49000.00	33000.00	1.00	117600.00	0.97	
41	1.00	151140.00	2.00	206100.00	137400.00	1.00	2.00	68700.00	1.00	2.00	109920.00	86260.00	1.00	164880.00	0.94	
42	0.87	190630.00	1.00	259950.00	173300.00	1.00	1.00	86650.00	1.00	2.00	138640.00	130680.00	1.00	207960.00	0.93	
43	1.10	233310.00	2.00	318150.00	212100.00	3.00	2.00	106650.00	2.00	2.00	169680.00	84840.00	2.00	254520.00	1.04	
44	1.10	352660.00	2.00	480900.00	320600.00	3.00	2.00	160300.00	2.00	2.00	256480.00	160300.00	2.00	384720.00	1.05	

**Fig. (G.1). Input data to SPSS for 102 projects (cont.).**

\*data.sav [DataSet1] - SPSS Data Editor

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11:

	<i>T.overnun</i>	<i>E1</i>	<i>F2</i>	<i>B3</i>	<i>E5</i>	<i>C2</i>	<i>A2</i>	<i>F5</i>	<i>F3</i>	<i>A1</i>	<i>B4</i>	<i>C7</i>	<i>E7</i>	<i>F10</i>	<i>C.overnun</i>
45	0.94	176990.00	2.00	241350.00	160900.00	1.00	1.00	80450.00	1.00	2.00	128720.00	50230.00	1.00	193080.00	0.97
46	0.96	256850.00	2.00	350250.00	233500.00	1.00	1.00	116750.00	3.00	2.00	186800.00	495440.00	1.00	280200.00	0.82
47	0.91	215380.00	2.00	293700.00	195800.00	1.00	1.00	97900.00	1.00	2.00	156640.00	79420.00	1.00	234960.00	0.96
48	1.00	198000.00	2.00	270000.00	180000.00	1.00	2.00	90000.00	1.00	2.00	144000.00	96920.00	1.00	216000.00	0.95
49	1.15	693501.00	2.00	1260911.00	630456.00	3.00	3.00	504365.00	2.00	2.00	630456.00	315228.00	2.00	756547.00	1.05
50	0.86	586264.00	1.00	1065934.00	532967.00	1.00	1.00	426374.00	1.00	2.00	532967.00	55703.00	1.00	639560.00	0.99
51	1.00	1986660.00	1.00	3396000.00	1698000.00	3.00	2.00	1358400.00	1.00	2.00	1698000.00	519200.00	1.00	2037600.00	1.03
52	1.00	384462.00	2.00	492900.00	328600.00	3.00	2.00	164300.00	1.00	2.00	262880.00	197160.00	1.00	394320.00	1.06
53	1.00	400140.00	2.00	513000.00	342000.00	3.00	2.00	171000.00	1.00	2.00	273600.00	102600.00	1.00	410400.00	1.03
54	0.87	157176.00	1.00	199800.00	133200.00	1.00	1.00	66600.00	1.00	2.00	106560.00	56480.00	1.00	159840.00	0.96
55	0.90	223374.00	2.00	283950.00	189300.00	1.00	1.00	94650.00	1.00	2.00	151440.00	60140.00	1.00	227160.00	0.97
56	1.00	324028.00	2.00	411900.00	274600.00	1.00	2.00	137300.00	1.00	2.00	219680.00	54000.00	1.00	329520.00	0.98
57	1.03	945298.00	1.00	1602200.00	801100.00	3.00	2.00	640800.00	3.00	2.00	801100.00	155000.00	2.00	961320.00	1.02
58	1.03	795957.00	1.00	1349080.00	674540.00	3.00	2.00	539632.00	3.00	2.00	674540.00	132555.00	2.00	809448.00	1.02
59	1.03	789910.00	1.00	1338830.00	669415.00	3.00	2.00	535532.00	3.00	2.00	669415.00	136737.00	2.00	803298.00	1.02
60	1.00	629530.00	2.00	1067000.00	533500.00	1.00	2.00	426800.00	1.00	2.00	533500.00	45263.00	1.00	640200.00	0.99
61	1.00	433650.00	2.00	551250.00	367500.00	3.00	2.00	183750.00	1.00	2.00	294000.00	153125.00	1.00	441000.00	1.04
62	1.08	391056.00	1.00	528454.00	352302.00	3.00	2.00	176151.00	2.00	3.00	281842.00	108960.00	2.00	422763.00	1.03
63	1.08	345334.00	1.00	466667.00	311111.00	3.00	2.00	155556.00	2.00	3.00	248889.00	198582.00	2.00	373334.00	1.06
64	0.82	166861.00	1.00	225487.00	150325.00	1.00	1.00	75162.00	1.00	3.00	120260.00	64998.00	1.00	180390.00	0.96
65	0.96	303251.00	2.00	409799.00	273199.00	1.00	1.00	136600.00	1.00	3.00	218559.00	110392.00	1.00	327839.00	0.96
66	0.92	309096.00	2.00	417697.00	278465.00	1.00	1.00	139232.00	1.00	3.00	222772.00	82119.00	1.00	334158.00	0.97
67	0.79	387959.00	1.00	524269.00	349513.00	2.00	1.00	174756.00	1.00	3.00	279610.00	19042.00	1.00	419415.00	1.00

\*data.sav [DataSet1] - SPSS Data Editor

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11:

	<i>T.overnun</i>	<i>E1</i>	<i>F2</i>	<i>B3</i>	<i>E5</i>	<i>C2</i>	<i>A2</i>	<i>F5</i>	<i>F3</i>	<i>A1</i>	<i>B4</i>	<i>C7</i>	<i>E7</i>	<i>F10</i>	<i>C.overnun</i>
68	0.89	144205.00	1.00	194872.00	129915.00	1.00	1.00	64957.00	1.00	3.00	103932.00	80668.00	1.00	155898.00	0.94
69	0.87	162833.00	1.00	222045.00	74015.00	1.00	1.00	74015.00	1.00	2.00	118424.00	19441.00	1.00	118424.00	0.99
70	0.70	50050.00	1.00	45500.00	22750.00	2.00	1.00	13650.00	1.00	2.00	22750.00	40950.00	1.00	36400.00	0.91
71	0.74	37532.00	1.00	34120.00	17060.00	1.00	1.00	10236.00	1.00	2.00	17060.00	8579.00	1.00	27296.00	0.98
72	0.75	85448.00	1.00	77680.00	38840.00	1.00	1.00	23304.00	3.00	2.00	38840.00	141623.00	1.00	62144.00	0.82
73	0.89	132990.00	1.00	181350.00	60450.00	1.00	1.00	60450.00	1.00	2.00	96720.00	39655.00	1.00	96720.00	0.97
74	0.91	49500.00	2.00	45000.00	22500.00	1.00	1.00	13500.00	1.00	2.00	22500.00	45000.00	1.00	36000.00	0.90
75	0.80	84414.00	1.00	76740.00	38370.00	1.00	1.00	23022.00	1.00	2.00	38370.00	31272.00	1.00	61392.00	0.96
76	0.92	160116.00	2.00	218340.00	72780.00	1.00	1.00	72780.00	1.00	2.00	116448.00	43086.00	1.00	116448.00	0.97
77	0.96	158290.00	2.00	215850.00	71950.00	1.00	1.00	71950.00	1.00	2.00	115120.00	10917.00	1.00	115120.00	0.99
78	0.60	70928.00	1.00	64480.00	32240.00	3.00	1.00	19344.00	1.00	2.00	32240.00	50847.00	1.00	51584.00	0.92
79	0.80	61930.00	1.00	56300.00	28150.00	1.00	1.00	16890.00	1.00	2.00	28150.00	34718.00	1.00	45040.00	0.94
80	0.94	171193.00	2.00	233445.00	77815.00	1.00	1.00	77815.00	1.00	2.00	124504.00	42506.00	1.00	124504.00	0.97
81	1.00	119339.00	2.00	162735.00	54245.00	1.00	2.00	54245.00	1.00	2.00	86792.00	14893.00	1.00	86792.00	0.99
82	1.12	88396.00	3.00	80360.00	40180.00	3.00	3.00	24108.00	2.00	2.00	40180.00	118934.00	2.00	64288.00	1.15
83	1.12	181984.00	3.00	248160.00	82720.00	3.00	3.00	82720.00	2.00	2.00	132352.00	170293.00	2.00	132352.00	1.10
84	0.89	161238.00	1.00	206715.00	68905.00	1.00	1.00	68905.00	1.00	2.00	110248.00	21557.00	1.00	110248.00	0.98
85	1.00	132750.00	2.00	168750.00	56250.00	1.00	2.00	56250.00	1.00	2.00	90000.00	24457.00	1.00	90000.00	0.98
86	0.88	189661.00	1.00	241095.00	80365.00	1.00	1.00	80365.00	1.00	2.00	128584.00	87645.00	1.00	128584.00	0.94
87	0.96	338908.00	2.00	430815.00	143605.00	1.00	1.00	143605.00	1.00	2.00	229768.00	122447.00	1.00	229768.00	0.96
88	0.91	289419.00	2.00	367905.00	122635.00	1.00	1.00	122635.00	1.00	2.00	196216.00	46405.00	1.00	196216.00	0.98
89	1.27	173745.00	2.00	222750.00	74250.00	3.00	3.00	74250.00	3.00	2.00	118800.00	165000.00	3.00	118800.00	1.11
90	0.70	425331.00	1.00	540675.00	180225.00	1.00	1.00	180225.00	1.00	2.00	288360.00	185442.00	1.00	288360.00	0.95

**Fig. (G.1). Input data to SPSS for 102 projects (cont.).**

\*data.sav [DataSet1] - SPSS Data Editor

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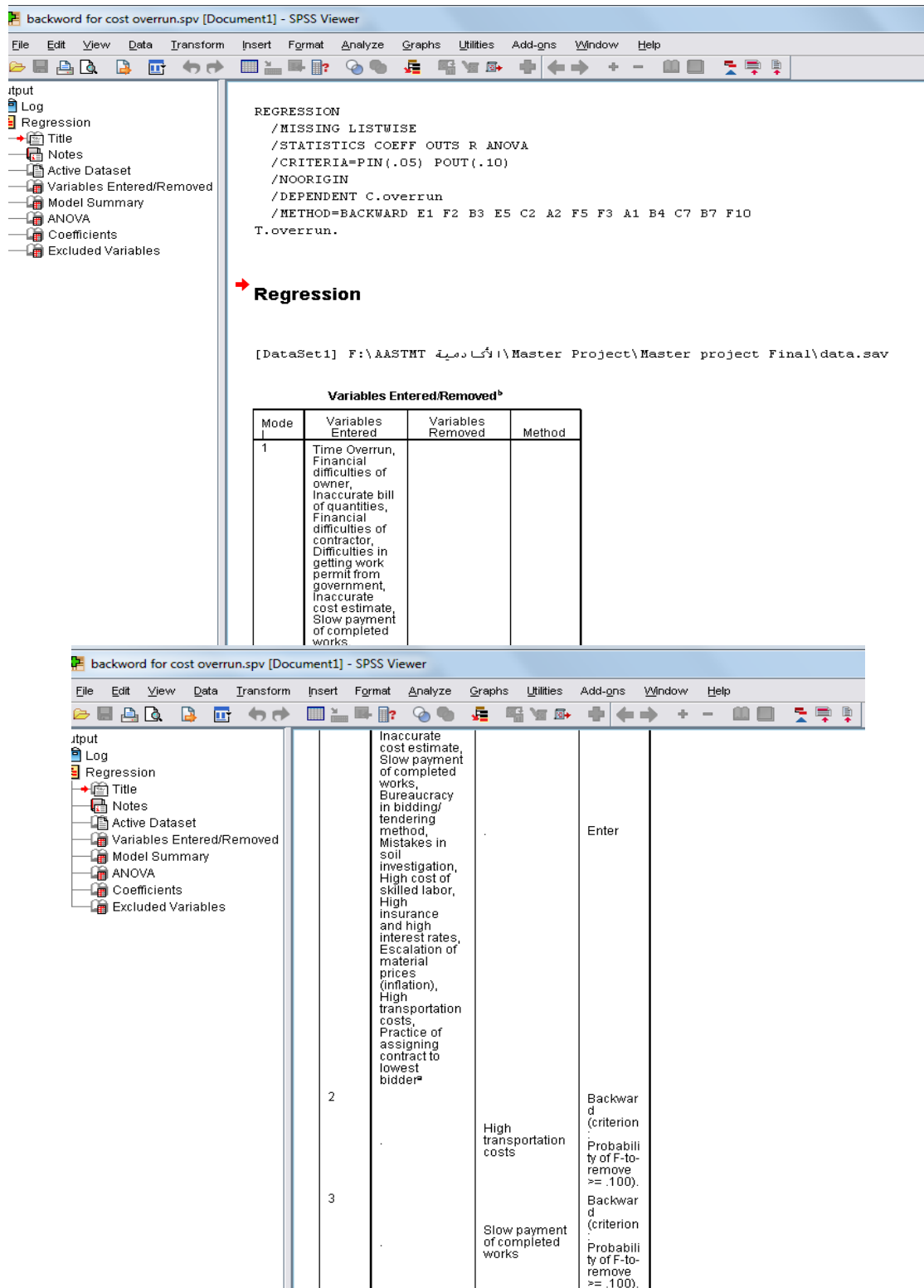
11:

	<i>T.overnun</i>	<i>E1</i>	<i>F2</i>	<i>B3</i>	<i>E5</i>	<i>C2</i>	<i>A2</i>	<i>F5</i>	<i>F3</i>	<i>A1</i>	<i>B4</i>	<i>C7</i>	<i>B7</i>	<i>F10</i>	<i>C.overnun</i>
90	0.70	425331.00	1.00	540675.00	180225.00	1.00	1.00	180225.00	1.00	2.00	288360.00	185442.00	1.00	288360.00	0.95
91	0.94	306894.00	2.00	390120.00	130040.00	1.00	1.00	130040.00	1.00	2.00	208064.00	95555.00	1.00	208064.00	0.96
92	0.83	262482.00	1.00	354705.00	118235.00	1.00	1.00	118235.00	1.00	3.00	189176.00	34781.00	1.00	189176.00	0.98
93	0.50	230097.00	1.00	328710.00	109570.00	1.00	1.00	109570.00	1.00	1.00	175312.00	8566.00	1.00	175312.00	1.00
94	1.00	605305.00	2.00	1025940.00	256485.00	1.00	2.00	410376.00	1.00	2.00	512970.00	256770.00	2.00	410376.00	0.95
95	1.19	1314150.00	1.00	2227373.00	556843.00	3.00	3.00	890949.00	3.00	2.00	1113686.00	1237429.00	3.00	890949.00	1.11
96	2.64	310058.00	3.00	422807.00	422807.00	2.00	3.00	140936.00	3.00	2.00	225497.00	313190.00	3.00	922807.00	1.11
97	1.35	534392.00	1.00	685118.00	685118.00	3.00	3.00	228373.00	3.00	2.00	565396.00	507494.00	3.00	685118.00	1.11
98	1.19	510080.00	1.00	648407.00	216136.00	3.00	3.00	216136.00	3.00	2.00	345817.00	480301.00	2.00	345817.00	1.11
99	2.00	679288.00	3.00	1161177.00	870883.00	3.00	3.00	464471.00	3.00	2.00	580588.00	645098.00	3.00	870883.00	1.11
100	1.27	682841.00	1.00	1167249.00	583624.00	3.00	3.00	466900.00	3.00	2.00	583624.00	648471.00	2.00	700349.00	1.11
101	1.26	707442.00	2.00	1209303.00	302326.00	3.00	3.00	483721.00	3.00	2.00	604652.00	671836.00	3.00	483721.00	1.11
102	1.02	691741.00	2.00	1172443.00	293111.00	3.00	2.00	468977.00	3.00	2.00	586221.00	59214.00	2.00	468977.00	1.01
103															
104															

## **Appendix H**

**Output Data Using SPSS Backward Regression for Cost Overrun**

**Fig.(H.1). Output data using SPSS backward regression  
for cost overrun**



**Fig.(H.1). Output data using SPSS backward regression for cost overrun (cont.)**

backword for cost overrun.spv [Document1] - SPSS Viewer

File Edit View Data Transform Insert Format Analyze Graphs Utilities Add-ons Window Help

Output

- Log
- Regression
  - Title
  - Notes
  - Active Dataset
  - Variables Entered/Removed
  - Model Summary
  - ANOVA
  - Coefficients
  - Excluded Variables

4		Escalation of material prices (inflation)	remove >= .100). Backward (criterion Probability of F-to- remove >= .100).
5		Financial difficulties of owner	Backward (criterion Probability of F-to- remove >= .100).
6		Inaccurate bill of quantities	Backward (criterion Probability of F-to- remove >= .100).
7		Time Overrun	Backward (criterion Probability of F-to- remove >= .100).
8		Practice of assigning contract to lowest bidder	Backward (criterion Probability of F-to- remove >= .100).

a. All requested variables entered.  
b. Dependent Variable: Cost Overrun

backword for cost overrun.spv [Document1] - SPSS Viewer

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Output

- Log
- Regression
  - Title
  - Notes
  - Active Dataset
  - Variables Entered/Removed
  - Model Summary
  - ANOVA
  - Coefficients
  - Excluded Variables

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.906 <sup>a</sup>	.821	.792	.03502
2	.906 <sup>b</sup>	.821	.794	.03482
3	.906 <sup>c</sup>	.821	.797	.03464
4	.906 <sup>d</sup>	.821	.799	.03446
5	.905 <sup>e</sup>	.818	.798	.03449
6	.903 <sup>f</sup>	.815	.797	.03463
7	.902 <sup>g</sup>	.813	.797	.03457
8	.901 <sup>h</sup>	.812	.798	.03450

a. Predictors: (Constant), Time Overrun, Financial difficulties of owner, Inaccurate bill of quantities, Financial difficulties of contractor, Difficulties in getting work permit from government, Inaccurate cost estimate, Slow payment of completed works, Bureaucracy in bidding/ tendering method, Mistakes in soil investigation, High cost of skilled labor, High insurance and high interest rates, Escalation of material prices (inflation), High transportation costs, Practice of assigning contract to lowest bidder

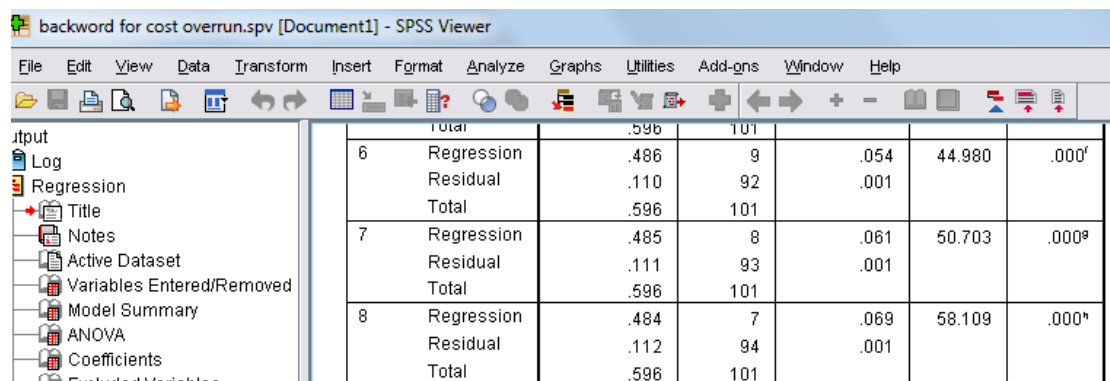
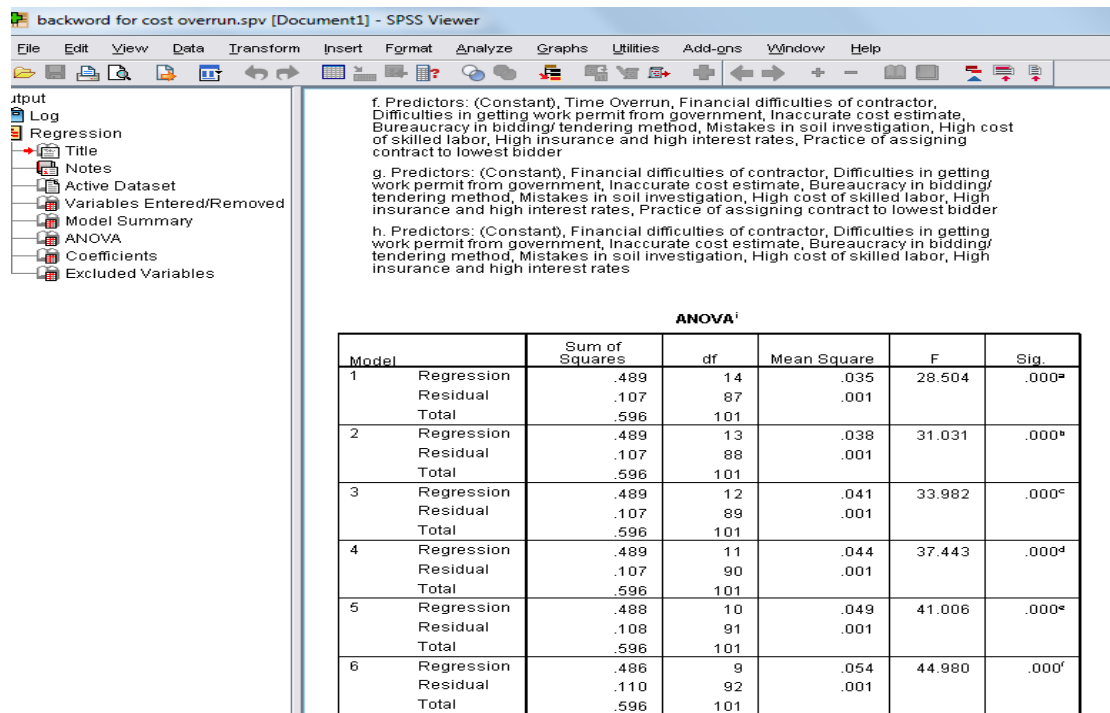
b. Predictors: (Constant), Time Overrun, Financial difficulties of owner, Inaccurate bill of quantities, Financial difficulties of contractor, Difficulties in getting work permit from government, Inaccurate cost estimate, Slow payment of completed works, Bureaucracy in bidding/ tendering method, Mistakes in soil investigation, High cost of skilled labor, High insurance and high interest rates, Escalation of material prices (inflation), Practice of assigning contract to lowest bidder

c. Predictors: (Constant), Time Overrun, Financial difficulties of owner, Inaccurate bill of quantities, Financial difficulties of contractor, Difficulties in getting work permit from government, Inaccurate cost estimate, Bureaucracy in bidding/ tendering method, Mistakes in soil investigation, High cost of skilled labor, High insurance and high interest rates, Escalation of material prices (inflation), Practice of assigning contract to lowest bidder

d. Predictors: (Constant), Time Overrun, Financial difficulties of owner, Inaccurate bill of quantities, Financial difficulties of contractor, Difficulties in getting work permit from government, Inaccurate cost estimate, Bureaucracy in bidding/ tendering method, Mistakes in soil investigation, High cost of skilled labor, High insurance and high interest rates, Practice of assigning contract to lowest bidder

e. Predictors: (Constant), Time Overrun, Inaccurate bill of quantities, Financial difficulties of contractor, Difficulties in getting work permit from government, Inaccurate cost estimate, Bureaucracy in bidding/ tendering method, Mistakes in soil investigation, High cost of skilled labor, High insurance and high interest rates, Practice of assigning contract to lowest bidder

**Fig.(H.1). Output data using SPSS backward regression for cost overrun (cont.)**





**Fig.(H.1). Output data using SPSS backward regression for cost overrun (cont.)**

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Practice of assigning contract to lowest bidder

f. Predictors: (Constant), Time Overrun, Financial difficulties of contractor, Difficulties in getting work permit from government, Inaccurate cost estimate, Bureaucracy in bidding/ tendering method, Mistakes in soil investigation, High cost of skilled labor, High insurance and high interest rates, Practice of assigning contract to lowest bidder

g. Predictors: (Constant), Financial difficulties of contractor, Difficulties in getting work permit from government, Inaccurate cost estimate, Bureaucracy in bidding/ tendering method, Mistakes in soil investigation, High cost of skilled labor, High insurance and high interest rates, Practice of assigning contract to lowest bidder

h. Predictors: (Constant), Financial difficulties of contractor, Difficulties in getting work permit from government, Inaccurate cost estimate, Bureaucracy in bidding/ tendering method, Mistakes in soil investigation, High cost of skilled labor, High insurance and high interest rates

i. Dependent Variable: Cost Overrun

**Coefficients<sup>a</sup>**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.876	.030		29.020	.000
	Escalation of material prices (inflation)	3.085E-8	.000	.117	.252	.802
	Difficulties in getting work permit from government	.024	.009	.204	2.767	.007
	Practice of assigning contract to lowest bidder	1.706E-7	.000	1.139	.658	.513
	High cost of skilled labor	6.671E-8	.000	.238	1.208	.230
	Financial difficulties of contractor	.026	.008	.306	3.051	.003
	Slow payment of completed works	.002	.008	.019	.235	.815
	High insurance and high interest rates	-4.218E-7	.000	-1.146-	-.887-	.378
	Bureaucracy in bidding/ tendering method	-.039-	.009	-.388-	-4.146-	.000
	Financial difficulties of owner	.008	.008	.053	1.045	.299
	Inaccurate bill of quantities	-1.398E-7	.000	-.463-	-1.135-	.260
	Inaccurate cost estimate	1.057E-7	.000	.350	3.836	.000

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tendering method

Financial difficulties of owner

Inaccurate bill of quantities

Inaccurate cost estimate

Mistakes in soil investigation

High transportation costs

Time Overrun

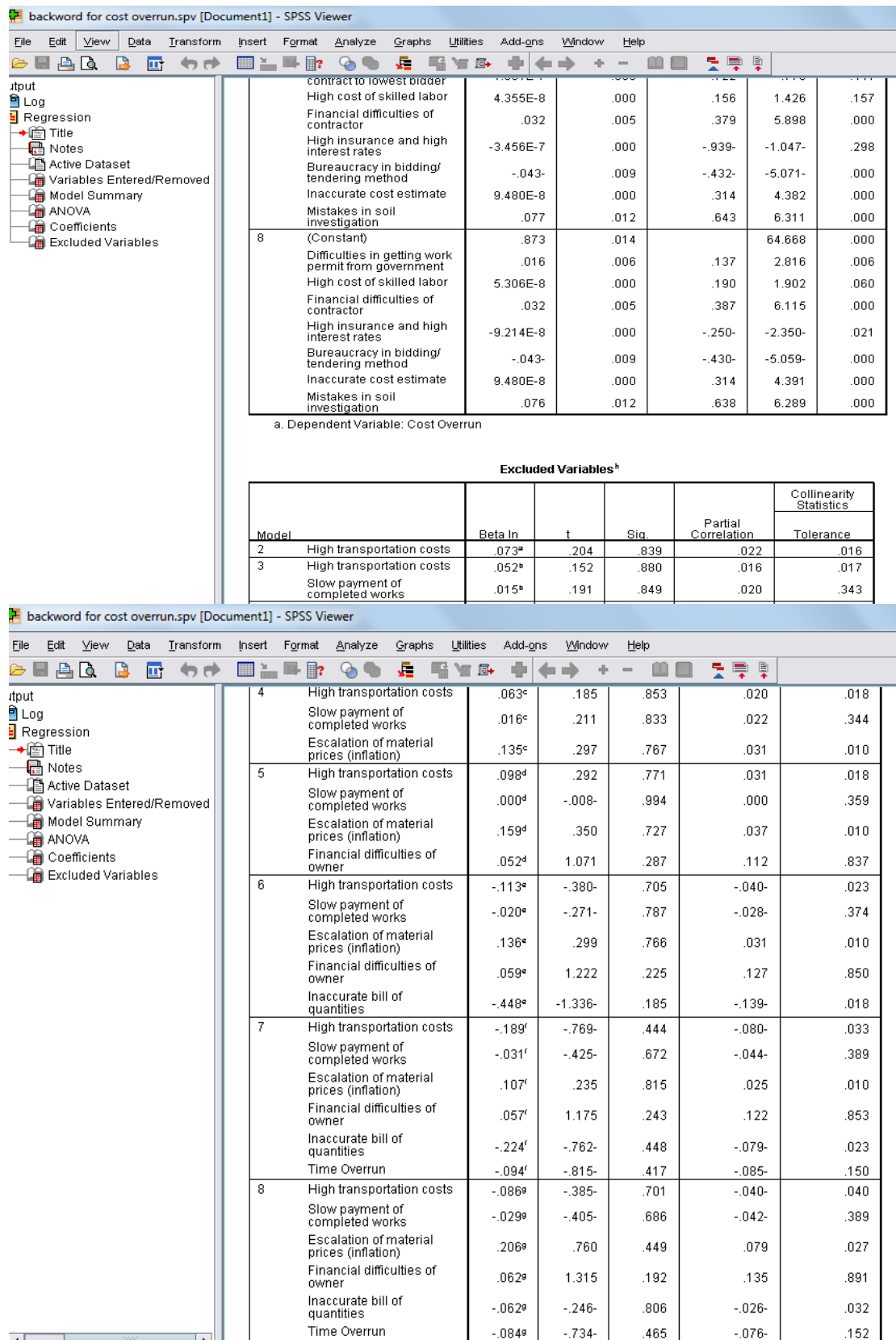
2

(Constant)	.873	.025		34.913	.000
Escalation of material prices (inflation)	3.417E-8	.000	.129	.283	.778
Difficulties in getting work permit from government	.024	.008	.198	2.945	.004
Practice of assigning contract to lowest bidder	1.677E-7	.000	1.120	.651	.517
High cost of skilled labor	7.461E-8	.000	.267	1.903	.060
Financial difficulties of contractor	.026	.008	.315	3.462	.001
Slow payment of completed works	.002	.008	.015	.191	.849
High insurance and high interest rates	-4.203E-7	.000	-1.142-	-.888-	.377
Bureaucracy in bidding/ tendering method	-.039-	.009	-.391-	-4.230-	.000
Financial difficulties of owner	.008	.007	.053	1.061	.292
Inaccurate bill of quantities	-1.267E-7	.000	-.420-	-1.211-	.229
Inaccurate cost estimate	1.044E-7	.000	.346	3.922	.000
Mistakes in soil investigation	.085	.014	.713	6.056	.000
Time Overrun	-.045-	.033	-.190-	-1.366-	.175

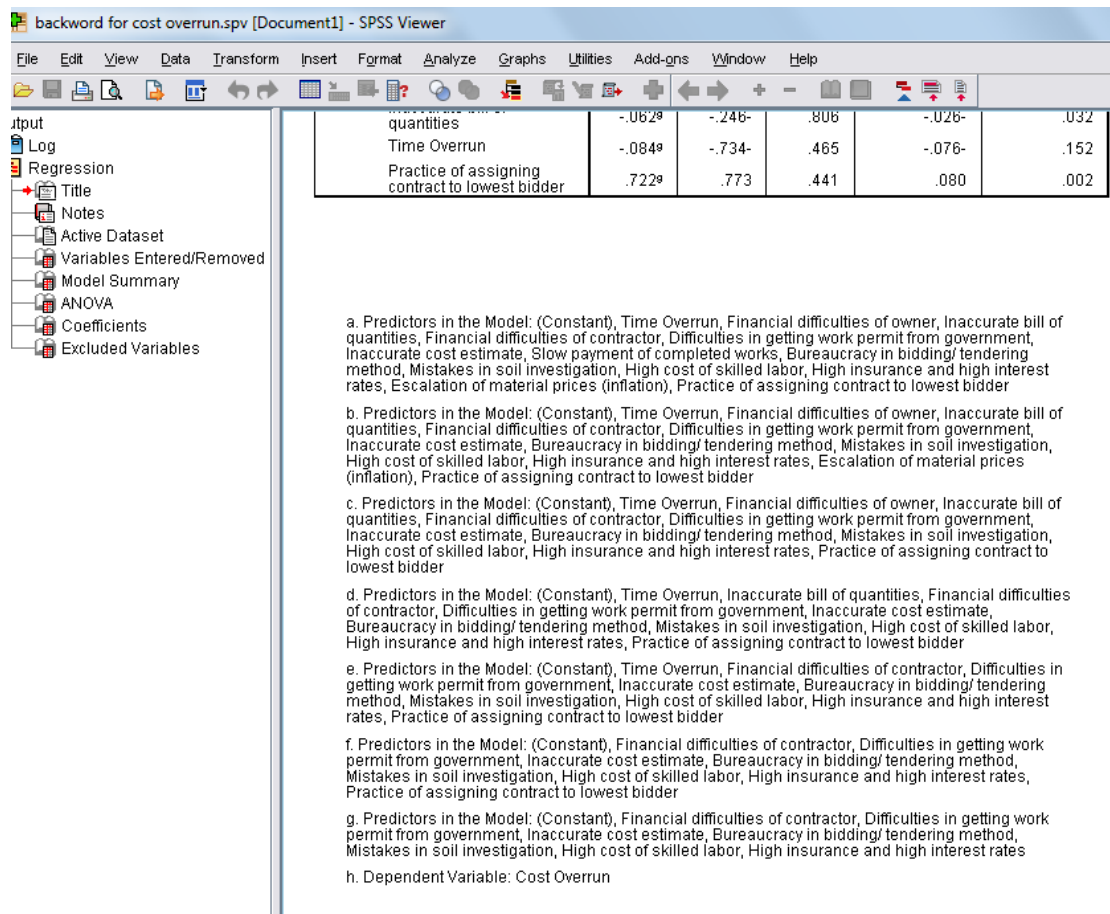
**Fig.(H.1). Output data using SPSS backward regression  
for cost overrun (cont.)**

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Input	3	(Constant)	.873	.025		35.308	.000
		Escalation of material prices (inflation)	3.566E-8	.000	.135	.297	.767
		Difficulties in getting work permit from government	.024	.008	.200	3.007	.003
		Practice of assigning contract to lowest bidder	1.631E-7	.000	1.089	.640	.524
		High cost of skilled labor	7.463E-8	.000	.267	1.914	.059
		Financial difficulties of contractor	.027	.007	.320	3.709	.000
		High insurance and high interest rates	-4.154E-7	.000	-1.129-	-.884-	.379
		Bureaucracy in bidding/ tendering method	-.039-	.009	-.390-	-4.249-	.000
		Financial difficulties of owner	.008	.007	.052	1.049	.297
		Inaccurate bill of quantities	-1.232E-7	.000	-.408-	-1.203-	.232
		Inaccurate cost estimate	1.053E-7	.000	.349	4.055	.000
		Mistakes in soil investigation	.085	.014	.712	6.087	.000
		Time Overrun	-.043-	.031	-.183-	-1.371-	.174
	4	(Constant)	.874	.025		35.623	.000
		Difficulties in getting work permit from government	.024	.008	.197	3.008	.003
		Practice of assigning contract to lowest bidder	2.164E-7	.000	1.445	1.199	.234
		High cost of skilled labor	7.394E-8	.000	.264	1.909	.059
		Financial difficulties of contractor	.027	.007	.319	3.722	.000
		High insurance and high interest rates	-4.986E-7	.000	-1.355-	-1.328-	.187
	Bureaucracy in bidding/ tendering method	-.039-	.009	-.393-	-4.337-	.000	
	Financial difficulties of owner	.008	.007	.052	1.071	.287	
	Inaccurate bill of quantities	-1.219E-7	.000	-.404-	-1.197-	.234	
	Inaccurate cost estimate	1.070E-7	.000	.354	4.233	.000	
	Mistakes in soil investigation	.085	.014	.710	6.111	.000	
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Input		Time Overrun	-.042-	.031	-.179-	-1.358-	.178
	5	(Constant)	.888	.021		42.677	.000
		Difficulties in getting work permit from government	.022	.008	.187	2.877	.005
		Practice of assigning contract to lowest bidder	2.613E-7	.000	1.745	1.487	.141
		High cost of skilled labor	7.146E-8	.000	.255	1.847	.068
		Financial difficulties of contractor	.028	.007	.333	3.918	.000
		High insurance and high interest rates	-5.912E-7	.000	-1.606-	-1.617-	.109
		Bureaucracy in bidding/ tendering method	-.040-	.009	-.403-	-4.468-	.000
		Inaccurate bill of quantities	-1.351E-7	.000	-.448-	-1.336-	.185
		Inaccurate cost estimate	1.084E-7	.000	.359	4.294	.000
		Mistakes in soil investigation	.086	.014	.719	6.202	.000
		Time Overrun	-.042-	.031	-.180-	-1.367-	.175
	6	(Constant)	.878	.020		44.778	.000
		Difficulties in getting work permit from government	.021	.008	.177	2.735	.007
		Practice of assigning contract to lowest bidder	1.197E-7	.000	.799	.850	.397
		High cost of skilled labor	6.221E-8	.000	.222	1.628	.107
		Financial difficulties of contractor	.028	.007	.333	3.906	.000
		High insurance and high interest rates	-3.949E-7	.000	-1.073-	-1.175-	.243
		Bureaucracy in bidding/ tendering method	-.041-	.009	-.408-	-4.500-	.000
	Inaccurate cost estimate	1.054E-7	.000	.349	4.172	.000	
	Mistakes in soil investigation	.082	.014	.683	6.032	.000	
	Time Overrun	-.022-	.027	-.094-	-.815-	.417	
7	(Constant)	.868	.015		57.133	.000	
	Difficulties in getting work permit from government	.017	.006	.143	2.897	.005	
	Practice of assigning contract to lowest bidder	1.081E-7	.000	.722	.773	.441	

**Fig.(H.1). Output data using SPSS backward regression for cost overrun (cont.)**



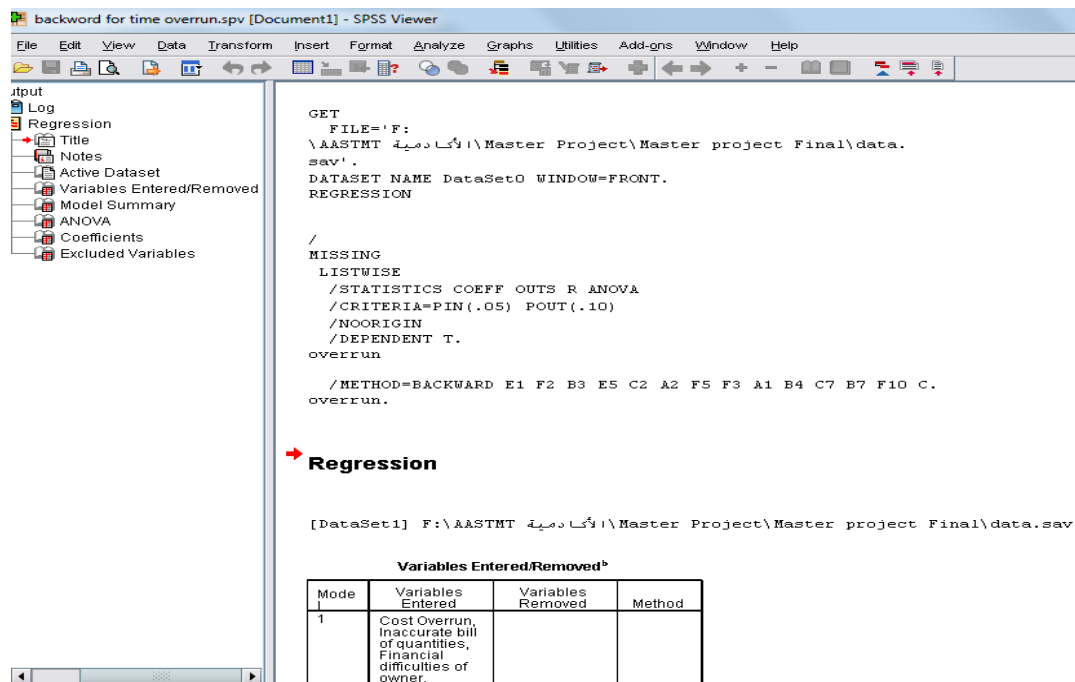
**Fig.(H.1). Output data using SPSS backward regression for cost overrun (cont.)**



## **Appendix I**

**Output Data Using SPSS Backward Regression for Time Overrun**

**Fig.(I.1). Output data using SPSS backward regression for time overrun**



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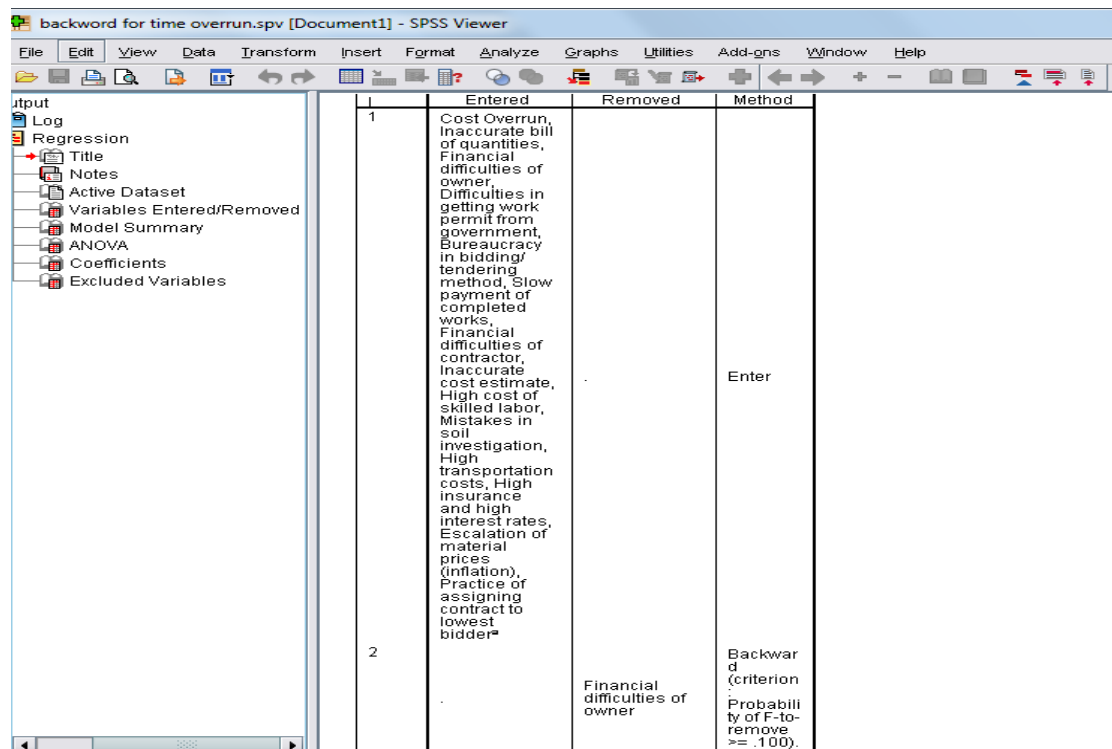
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**Regression**

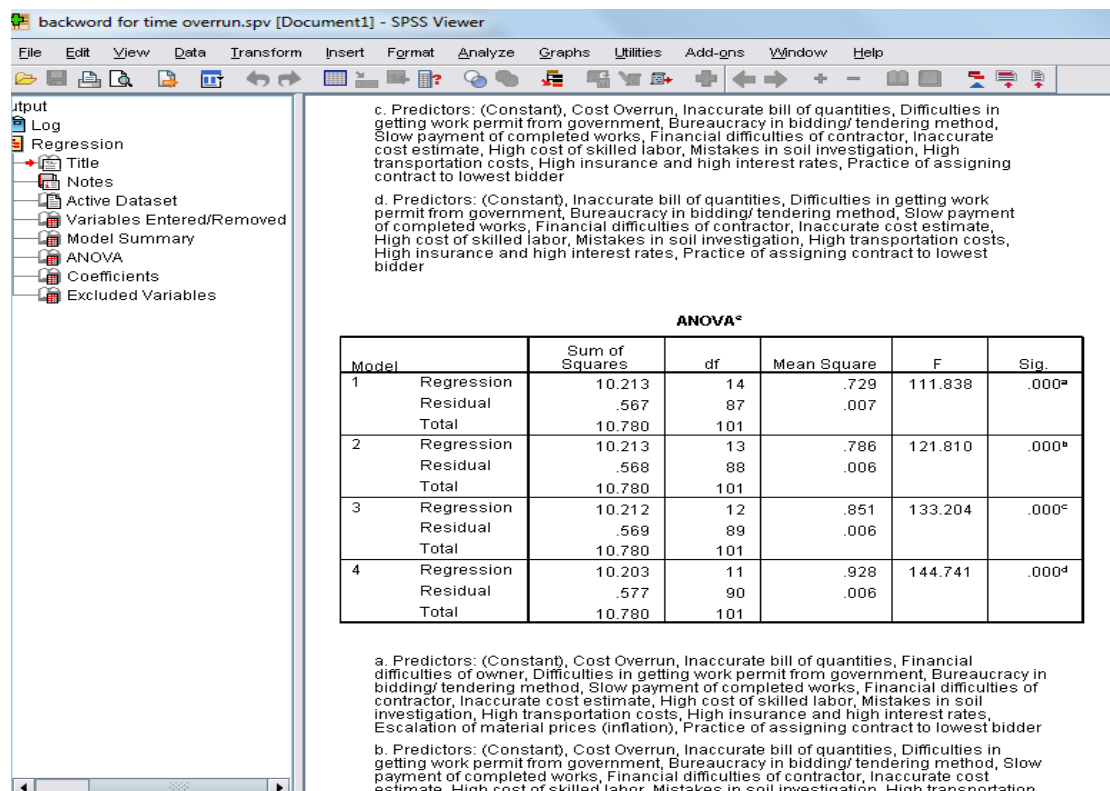
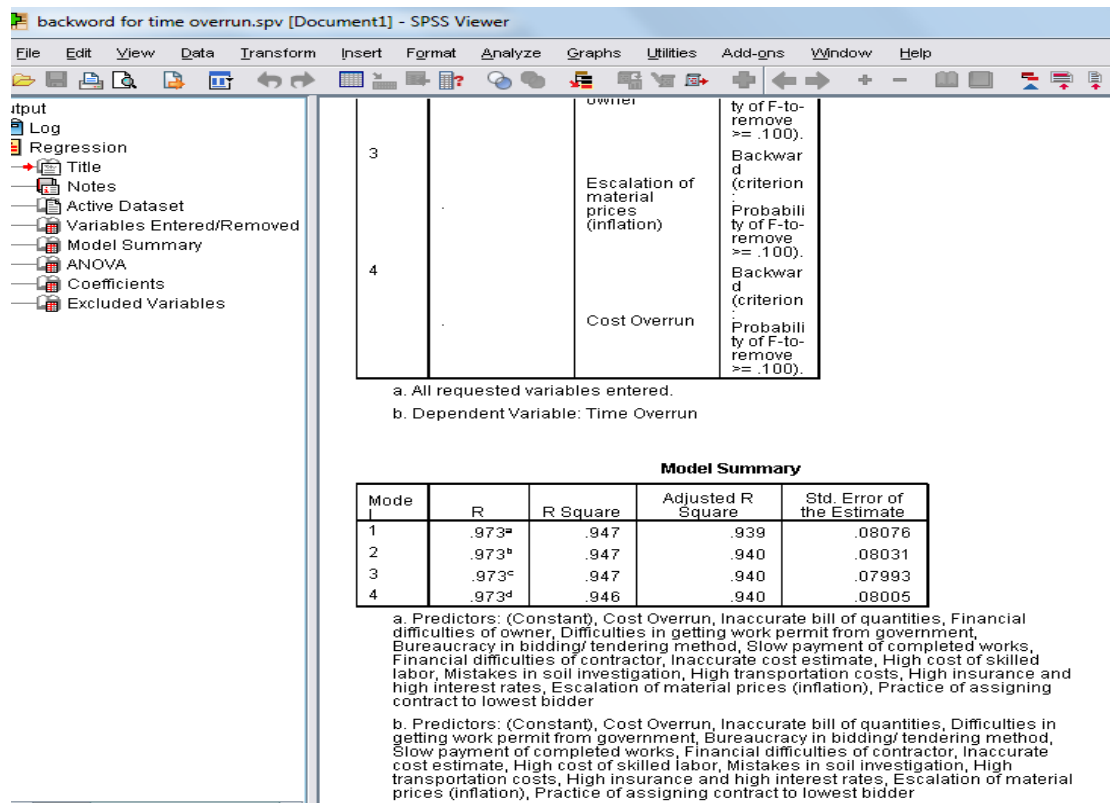
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Mode	Variables Entered	Variables Removed	Method
1	Cost Overrun, Inaccurate bill of quantities, Financial difficulties of owner,		



Mode	Variables Entered	Variables Removed	Method
1	Cost Overrun, Inaccurate bill of quantities, Financial difficulties of owner, Difficulties in getting work permit from government, Bureaucracy in bidding/ tendering method, Slow payment of completed works, Financial difficulties of contractor, Inaccurate cost estimate, High cost of skilled labor, Mistakes in soil investigation, High transportation costs, High insurance and high interest rates, Escalation of material prices (inflation), Practice of assigning contract to lowest bidder		Enter
2		Financial difficulties of owner	Backward (criterion: Probability of F-to-remove >= .100).

**Fig.(H.1). Output data using SPSS backward regression for cost overrun (cont.)**



**Fig.(H.1). Output data using SPSS backward regression for cost overrun (cont.)**

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ANOVA  
Coefficients  
Excluded Variables

estimate, High cost of skilled labor, Mistakes in soil investigation, High transportation costs, High insurance and high interest rates, Practice of assigning contract to lowest bidder

d. Predictors: (Constant), Inaccurate bill of quantities, Difficulties in getting work permit from government, Bureaucracy in bidding/ tendering method, Slow payment of completed works, Financial difficulties of contractor, Inaccurate cost estimate, High cost of skilled labor, Mistakes in soil investigation, High transportation costs, High insurance and high interest rates, Practice of assigning contract to lowest bidder

e. Dependent Variable: Time Overrun

**Coefficients<sup>a</sup>**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.690	.215		3.206	.002
	Escalation of material prices (inflation)	-1.140E-7	.000	-.101-	-.403-	.688
	Difficulties in getting work permit from government	.127	.016	.250	7.817	.000
	Practice of assigning contract to lowest bidder	1.078E-6	.000	1.693	1.832	.070
	High cost of skilled labor	-2.153E-7	.000	-.181-	-1.705-	.092
	Financial difficulties of contractor	-.115-	.016	-.322-	-7.043-	.000
	Slow payment of completed works	.064	.018	.144	3.558	.001
	High insurance and high interest rates	-1.826E-6	.000	-1.166-	-1.683-	.096
	Bureaucracy in bidding/ tendering method	.048	.023	.113	2.085	.040
	Financial difficulties of owner	.002	.017	.003	.102	.919
	Inaccurate bill of quantities	-1.814E-6	.000	-1.413-	-8.641-	.000
	Inaccurate cost estimate	2.843E-7	.000	.222	4.615	.000
	Mistakes in soil investigation	.218	.034	.430	6.373	.000
	High transportation costs	1.364E-6	.000	1.260	9.158	.000
	Cost Overrun	-.272-	.246	-.064-	-1.110-	.270

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ANOVA  
Coefficients  
Excluded Variables

2	(Constant)	.691	.214		3.231	.002
	Escalation of material prices (inflation)	-1.125E-7	.000	-.100-	-.401-	.689
	Difficulties in getting work permit from government	.127	.016	.250	7.926	.000
	Practice of assigning contract to lowest bidder	1.084E-6	.000	1.703	1.864	.066
	High cost of skilled labor	-2.165E-7	.000	-.182-	-1.730-	.087
	Financial difficulties of contractor	-.115-	.016	-.321-	-7.139-	.000
	Slow payment of completed works	.064	.018	.143	3.630	.000
	High insurance and high interest rates	-1.841E-6	.000	-1.176-	-1.722-	.089
	Bureaucracy in bidding/ tendering method	.048	.023	.113	2.095	.039
	Inaccurate bill of quantities	-1.817E-6	.000	-1.415-	-8.764-	.000
	Inaccurate cost estimate	2.846E-7	.000	.222	4.652	.000
	Mistakes in soil investigation	.218	.034	.430	6.412	.000
	High transportation costs	1.365E-6	.000	1.261	9.240	.000
	Cost Overrun	-.270-	.243	-.063-	-1.111-	.269
3	(Constant)	.690	.213		3.245	.002
	Difficulties in getting work permit from government	.128	.016	.251	8.084	.000
	Practice of assigning contract to lowest bidder	9.174E-7	.000	1.440	2.269	.026
	High cost of skilled labor	-2.096E-7	.000	-.176-	-1.699-	.093
	Financial difficulties of contractor	-.114-	.016	-.320-	-7.164-	.000
	Slow payment of completed works	.063	.017	.142	3.627	.000
	High insurance and high interest rates	-1.582E-6	.000	-1.010-	-1.865-	.065
	Bureaucracy in bidding/ tendering method	.049	.023	.115	2.153	.034
	Inaccurate bill of quantities	-1.815E-6	.000	-1.414-	-8.800-	.000
	Inaccurate cost estimate	2.799E-7	.000	.218	4.686	.000



**Fig.(H.1). Output data using SPSS backward regression for cost overrun (cont.)**

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		Beta In	t	Sig.	Partial Correlation	Tolerance
	Mistakes in soil investigation	.219	.034	.431	6.461	.000
	High transportation costs	1.357E-6	.000	1.253	9.326	.000
	Cost Overrun	-.273	.241	-.064	-1.133	.260
4	(Constant)	.453	.036		12.456	.000
	Difficulties in getting work permit from government	.123	.015	.242	8.054	.000
	Practice of assigning contract to lowest bidder	8.592E-7	.000	1.349	2.139	.035
	High cost of skilled labor	-2.293E-7	.000	-.193	-1.875	.064
	Financial difficulties of contractor	-.123	.014	-.345	-8.946	.000
	Slow payment of completed works	.064	.017	.144	3.667	.000
	High insurance and high interest rates	-1.444E-6	.000	-.922	-1.718	.089
	Bureaucracy in bidding/ tendering method	.061	.020	.143	2.999	.004
	Inaccurate bill of quantities	-1.799E-6	.000	-1.401	-8.728	.000
	Inaccurate cost estimate	2.533E-7	.000	.197	4.604	.000
	Mistakes in soil investigation	.197	.028	.389	6.987	.000
	High transportation costs	1.369E-6	.000	1.265	9.421	.000

a. Dependent Variable: Time Overrun

**Excluded Variables<sup>d</sup>**

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics
						Tolerance
2	Financial difficulties of owner	.003 <sup>a</sup>	.102	.919	.011	.789
3	Financial difficulties of owner	.002 <sup>a</sup>	.082	.935	.009	.791
	Escalation of material prices (inflation)	-.100 <sup>a</sup>	-.401	.689	-.043	.010

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- ANOVA
- Coefficients
- Excluded Variables

		Beta In	t	Sig.	Partial Correlation	Tolerance
	High transportation costs	1.369E-6	.000	1.265	9.421	.000

a. Dependent Variable: Time Overrun

**Excluded Variables<sup>d</sup>**

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics
						Tolerance
2	Financial difficulties of owner	.003 <sup>a</sup>	.102	.919	.011	.789
3	Financial difficulties of owner	.002 <sup>a</sup>	.082	.935	.009	.791
	Escalation of material prices (inflation)	-.100 <sup>a</sup>	-.401	.689	-.043	.010
4	Financial difficulties of owner	-.001 <sup>c</sup>	-.045	.964	-.005	.801
	Escalation of material prices (inflation)	-.111 <sup>c</sup>	-.443	.659	-.047	.010
	Cost Overrun	-.064 <sup>c</sup>	-1.133	.260	-.119	.184

a. Predictors in the Model: (Constant), Cost Overrun, Inaccurate bill of quantities, Difficulties in getting work permit from government, Bureaucracy in bidding/ tendering method, Slow payment of completed works, Financial difficulties of contractor, Inaccurate cost estimate, High cost of skilled labor, Mistakes in soil investigation, High transportation costs, High insurance and high interest rates, Escalation of material prices (inflation), Practice of assigning contract to lowest bidder

b. Predictors in the Model: (Constant), Cost Overrun, Inaccurate bill of quantities, Difficulties in getting work permit from government, Bureaucracy in bidding/ tendering method, Slow payment of completed works, Financial difficulties of contractor, Inaccurate cost estimate, High cost of skilled labor, Mistakes in soil investigation, High transportation costs, High insurance and high interest rates, Practice of assigning contract to lowest bidder

c. Predictors in the Model: (Constant), Inaccurate bill of quantities, Difficulties in getting work permit from government, Bureaucracy in bidding/ tendering method, Slow payment of completed works, Financial difficulties of contractor, Inaccurate cost estimate, High cost of skilled labor, Mistakes in soil investigation, High transportation costs, High insurance and high interest rates, Practice of assigning contract to lowest bidder

d. Dependent Variable: Time Overrun

## **ARABIC SUMMARY**

## Arabic Summary

### الخلاصة

حدوث الزيادة فى الوقت والتكلفة بمشروعات التشييد والبناء فى مصر تعتبر من أهم الأسباب التى تؤدى الى عدم النهوض بقطاع التشييد، حيث أن هذه المشكلة نتيجة عدة عوامل تحدث فى جميع مراحل المختلفة للمشروع.

إذا فالهدف من الرسالة هو تحليل الأسباب التى تؤدى الى حدوث المشكلة وصولاً الى تحديد أهم الأسباب حتى نتفادى حدوث هذه المشكلة ومحاولة إستنتاج معادلات باستخدام برنامج SPSS للوصول الى منهج حديث فى توقع المشكلة قبل حدوثها.

لقد تمت دراسة وتحليل أسباب حدوث الزيادة فى التكلفة والوقت على المشروعات التعليمية لوزارة التربية والتعليم (المدارس التى تقوم بطرحها الهيئة العامة للأبنية التعليمية فى مصر)، حيث أن ميزانية وزارة التربية والتعليم طبقاً لتقارير وزارة المالية تمثل 20% من إجمالى الناتج القومى منها 12% تخصص لهيئة الأبنية التعليمية، لذا فقد تركزت الدراسة على المشروعات التعليمية لما لها من تأثير إيجابى على تطور منظومة التعليم فى مصر بزيادة إنشاء المدارس للمراحل المختلفة للتعليم مما يؤدى الى تقليل الكثافة بالفصول لزيادة القدرة الإستيعابية للطلاب للإرتقاء بمستواهم الفكرى.

تم تصميم إستبيان يضم عدد 53 عامل يؤدوا الى زيادة فى الوقت والتكلفة تم تجميعهم من خلال المراجع والأبحاث المعده من الأساتذة والباحثين فى هذه المشكلة ومن آراء الخبراء والمقاولين الممارسين لهذه المشاريع وتم إرسال الإستبيان الى عدد 80 خبير وتمت الإستجابة بالرد من عدد 52 (عدد 11 إستشارى + عدد 41 مقاول)، تم تحليل الإستبيان بالمعادلات الاستاتيكية وترتيب العوامل من الأكثر الى الأقل خطورة والتوصل الى أعلى 14 عامل مؤثرين على الزيادة فى التكلفة والوقت للمشروعات التعليمية.

تم تجميع بيانات لعدد 102 مشروع (مدارس من الهيئة العامة للأبنية التعليمية) من عام 2007 حتى عام 2011 بعدد 12 محافظة وكذا تم دراسة تأثير 14 عامل على هذه المشاريع. تم إستخدام برنامج SPSS لتحليل بيانات هذه المشاريع مع أهم العوامل المؤثرة عليهم والتوصل الى معادلات تساهم فى حل هذه المشكلة مستقبلاً.

تم تجميع بيانات لعدد 30 مشروع خلال عامى 2011-2012 بعدد 5 محافظات لإجراء الإختبار على دقة المعادلات التى تم إستنتاجها.

تم إستنتاج الآتى:

- 1- أهم 14 عامل يؤدوا الى حدوث الزيادة فى التكلفة والوقت بالمشروعات التعليمية بمصر.
- 2- تم إستنتاج عدد 2 معادلة بإستخدام برنامج SPSS يمكن إستخدامهم كمنهج جديد فى إستنتاج حدوث الزيادة فى التكلفة والوقت للمشروعات التعليمية المستقبلية.

من أهم التوصيات الحالية هو التوسع فى بناء المدارس الفنية فى مصر، إستخراج التصاريح وإدخال المرافق وإنهاء المستندات اللازمة لبدء العمل قبل طرح المشاريع للمناقصة وتدريب المقاولين لإستخدام برنامج SPSS لإمكانية إستخدام المعدلات.

ومن أهم التوصيات المستقبلية هو استخدام نظام SERIAL TENDERING فى المناقصات من هيئة الأبنية و تحديث البيانات المستخدمة فى برنامج SPSS مع الأبنية كل فترة.