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# Reasons of cost overrun in construction projects

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## ملخص البحث

تعد صناعه التشيد و البناء من اهم الصناعات في مصر و العالم اجمع, و ترجع تلك الاهميه الي كونها احد اهم المكونات الرئيسيه للاقتصاد المصري و الدولي, بالاضافه الي اعتمادها و استحواذها علي العديد من الايدي العامله بها او بالصناعات المصاحبه لها. هذا بالاضافه الي ان تكلفه المشروع تعد العنصر و المحرك الاساسي لاي مشروع و من الموشرات الهامه الداله علي نجاح او فشل المشروع.

لذا يهدف هذا البحث الي التعرف علي اسباب زياده تكلفه مشاريع التشييد و البناء لمحاوله تفاديها و تجنب تلك الزياده. و ذلك من خلال استعراض العديد من الابحاث السابقه في مختلف انحاء العالم و التي تحدثت فى نفس الصدد لاستنتاج الاسباب الرئيسيه لزياده تكلفه مشاريع التشييد و البناء.

## Abstract

Cost is considered one of the important parameters of any construction project and it is also an indicator to its success. This can explain why projects managers give priority and care to the project cost and make large efforts to control it and avoid/minimize any overruns.

Project cost is quantitative assessments of the likely costs of the resources (labor, materials, etc) required to complete all project activities. **(Duncan 1990)**

Cost overrun can be defined as an extra cost beyond the estimated, in other words cost overrun can be defined as "when the project objectives are not achieved within estimated budget" **(Avots 1983 ).** Cost overrun sometimes also called "cost escalation", "cost increase" or "budget overrun" **(Zhu et al 2004);** it is generally results from many factors that occur at the different phases of the project life cycle. Several studies took place to determine the magnitude of cost overrun problem and 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.

According to a very comprehensive research done by **(Flyvbjerg 2002)** in global construction, it was found that 9 out of 10 construction projects suffer cost overrun. From the main factors that affect project success is the ability of the contractor to finish the project within budget and within good profit margin; this requires good ability of cost control during all the project phases specially the construction stage to avoid any cost overruns. This can be achieved if the reasons of cost overrun are well defined to know how to deal with each of them, and this is what this study aims to. The study focuses to the reasons of cost overrun in construction projects.

**Hani M. Gharaibeh ( 2013 )** studied reasons behind problem of cost overrun in mega projects using Delphi method for two different power transmission projects in Canada, and the top ten reasons of cost overrun problem were reached as follows: High employee turnover rate, inaccurate initial estimate, misunderstanding of the scope of work by the contractor, staff movement in the middle of the project, being optimistic in terms of achieving the project mile stones, poor procurement practices, continuous design changes in the late detailed engineering phase, inflated bid prices, changing the

requirements of the project during the execution phase and original scope of the project is not enough detailed by the client. **Jin-Kyung Lee (2008)** studied the cost overrun phenomenon in Korean transportation projects through the analysis of characteristics of 161 completed projects of different transportation projects, he found that 95 % of roads projects in Korea have cost overrun with average percentage 50 % of the total project cost. Also the main causes for cost overrun problem were identified as follows: changes in scope, construction delays, no practical use for the earned value management system and the un reasonable estimation and adjustment of project cost due to the lowest bid price concept for the Korean government in choosing construction companies for its projects.

**Charles T. Jahren and Andrew M.Ashe (1989)** studied the cost overrun for group of naval facilities construction projects, the authors defined the cost overrun rate as the percentage difference between final contract cost and cost award amount where the final contract cost is the cost including change orders and claims, while the project award cost amount is the dollar value at which the contract was awarded. Authors collected data from reports of 1576 construction projects and categorized it according to the project size and type, then extracted table for relation between cost overrun rate and probability of occurrence and project size. The study showed that cost overrun rate ranges from (1% to 11%) And more likely to happen in larger projects than smaller ones. Also the study summarized the factors affecting cost overrun rate in to the following: Size of the project- type of construction- level of competition between competitors and quality of contract documents.

**Panagiotis Ch.Anastasopoulos, John E- Haddock and Srinivas Peeta (2014)** studied cost overrun in public – private partnerships for high way projects maintenance and rehabilitation through comparing the contract winning bid cost with the final as built cost for 601 completed high way maintenance and rehabilitation projects during the period between 1996 and 2007 to get reasons and percentage of cost overrun problem. It was found that there is number of project characteristics affect the like hood and amount of cost overrun for ppp projects (public – private partner ships projects) which is: planned project duration, accuracy of cost estimate and work activities included in the contract and its number.

**Aibinu and Odeyinka (2006)** studied cost overrun in Nigerian construction projects and it was found that construction industry in Nigeria suffers cost overrun with mean percentage of 17.34 %. **Hinze et al. (1992)** analyzed cost overruns associated with Washington state high way projects and found that cost overruns expressed as a percentage of the contract amount tended to increase with the project size.

**M. Gopal Naik and D. Rupesh Kumar (2015)** studied the project of construction of 512 houses as a case study to develop a model for cost and time optimization by using artificial neural network technique (ANN), the idea of the model was that ANN has listed out various combinations of costs and duration for a given activity and the most feasible combination is chosen so that cost and duration for certain activities can be reduced, hence optimized. The results of this study showed that duration of each block was optimized from 150 to 142 days and the total cost decreased by 3.91%.

**Frimpong et al. (2003)** studied the factors that cause time and cost overrun for construction projects in Ghana. Ground water construction projects were studied in details, results showed that time and cost overruns were related to the following reasons: poor contract management, poor technical performances, difficulties of payments from

agencies, materials cost escalation and poor procurement performance. **Kaliba et al. (2009)** studied cost escalation of construction projects in Zambia and it was found that most of the studied projects suffer cost overrun.
Causes of cost overrun were identified in this study as follows: inclement weather, scope changes, schedule delay, technical challenges, strikes, environment protection and mitigation costs and inflation. **A. M. El -Khouly (2015)** had studied cost overrun in construction projects in Egypt through introducing two models for predicting cost overrun percentage. The first one is CBR model ( case based reasoning model ) while the second one based on regression analysis through gathering 44 factors affecting cost performance in construction projects that gathered from literature, then through questionnaire to Egyptian contractors the most eleven significant causes were obtained as follows : financial condition of the owner, cash flow of contractor, materials cost increase due to inflation, project size, method of procurement ( open tender or selective tender ), competition at tender stage ( aggressive or not ), fluctuations in currency of payments, delay in design and approvals, drawings ( detailed or not ), inaccurate material estimate, Risk retained by client for quantity variations.

**Musirikate Mihigo Amandin and Julius Warren Kule (2016)** studied the main causes for construction projects delay and the accompanied cost overruns for public projects in Kigali city – Rwanda. Data were collected for 42 public construction projects that had been ongoing for the period between (2009 and 2012), project delay and accompanied cost overrun percentage for those projects were calculated and the results showed that 65.7% of the projects were delayed and only 5.2% of those delayed ones suffered cost overruns which means that not all the delayed projects should suffer from cost overrun and vice versa.
**Jesper Kranker Larsen et al. (2015)** analyzed the factors affecting time, cost and quality to discover if these factors are the same or not and to discover if effects of these factors are different from each other or not. It was found that the most important factors that affect time, cost and quality were as follows:
For time: lack of project funding, for cost: errors or omissions in consultant materials and for quality: errors or omissions in construction work. So that the study revealed that project schedule, budget and quality affected in different ways, according to different factors and unequally, so that project managers can't control schedule delay or cost overrun by just focusing to the project time or budget.

**Gkritza and Labi (2008)** determined that larger projects and longer duration ones were more likely to face cost overruns that increases directly proportional with the increase of the project time or size. The authors also provided mathematical relationships between project size and cost overrun likelihood. **Flyvberg et al. (2004)** concluded that nine out of ten transportation infra structure projects costs are under estimated and that for all other construction projects types, the actual costs are on average 28% higher than estimated costs.

**Burcu Akinci and Martin Fischer (1998),** despite contractors used to be able to cover their cost overburdens with their markups, with the diminishing markups any cost overruns can lead to financial overburden, there for the authors identified the uncontrollable risk sources that affect the contractor's risk of cost overburden considering that the contractor is aware with the controllable ones. These factors should be considered during project early stages because as once construction stage started, it will be very difficult to control these factors except by some limited ways. These factors

categorized according to their effect as follows: factors affecting cost estimate, design and specific factors, factors affecting final cost of the project, economic, political and environmental factors and contract specific factors. **Andrew Shing – Tao Chang, P.E. (2002)** studied cost and schedule increase during engineering / design stages and identified the causes as follows:
Additional work by owner, optimistic schedule, omissions, failure of owner to provide sufficient information, consultants inability, under estimates and miss coordination between stake holders.
**Long Le – Hoai, Young Dai Lee and Jun Young Lee (2008)** studied the delay and cost overruns for large construction projects in Vietnam through interviewing 87 Vietnamese construction experts. The major causes for cost overrun and schedule delay were identified as follows: poor site management and supervision, poor project management, financial difficulties of owner, financial difficulties of contractor and design changes. At the end of this study a comparison between those reasons and the top five reasons for cost overrun and schedule delay in some countries took place, which showed that each country and construction market differs than the other for its own nature and factors affecting cost and schedule of its projects. **Morris (1990)** studied the causes of cost overrun in public sector projects; he studied 133 construction projects and found that 25% to 30% of the cost increase was due to inflation. During this study Morris extracted the most important ten factors that cause cost overrun as follows: inadequate project preparation, supply of raw materials and equipments, change in scope, resources constraint, and delay in decision making by government, inappropriate choice of site, technical incompetence, labor un rest, natural calamities, lack of experienced consultants.

**Kaming et al. (1997)** examined the factors influencing construction cost overruns on high rise projects in Indonesia. It was found that most of these projects suffer cost overrun and that cost overrun problem occurred more frequently than time overrun problem in that type of construction projects in Indonesia. According to the study, the factors influencing cost overrun are the following: materials cost increase, inflation, in accurate materials estimate and project degree of complexity. **Chimwaso (2001)** studied the cost performance for ten construction projects, results had shown that seven out of ten projects suffered cost overruns. The author had identified the factors influencing cost overruns, ranked them and categorized according to the final account reports of the projects. The four categories were: variations, contractual claims, provisional works measurements and fluctuations in cost of labors and materials.

**Jomah Mohammed Al-Najjar (2008)** studied cost and time overruns for construction projects in Gaza Strip. It was found that most of the reasons are related to the special political and economical conditions of Palestine. Reasons of cost and time overruns can be summarized as follows: un employment of workers in comparison with number of projects, borders closure and shortage of materials in market, dependency on Israel and other countries for getting construction materials, un stable economic situation, continuous increase of materials prices and dependency on donors countries to get cash for construction and infra structure projects.
**Edem O.P Akpan and Odinaka Igwe (2001)** had seen that the causes of cost overrun are well known to all the parties involved in the construction industry, but the methodology used in handling its evaluation is very inadequate, so the authors developed a model for evaluation of cost overrun for the project during execution phase. The model based mainly on discounted cash flow of the expected income compared

with the actual payment at various time periods with inflationary rate as the discounted factor. The model was used successfully in evaluating price variations of two construction projects in Nigeria.

**Shane, Molenar, Anderson and Schexnayder (2009)** had point of view that cost overrun problem has severe effect on transportation projects, as these projects have long lead times between planning and construction in addition; most of these projects are public ones. Thus any project exceeds its budget, others will be dropped from the program or the scope will be reduced to provide necessary funds to cover the cost increase happened. This will cause deterioration of the state's transportation infra structure. The study also showed that approximately 50 % of the active large transportation projects in united states suffer cost overrun, thus through interviews with 20 high way agencies in united states, the 18 top factors causing cost overrun were identified to control cost overruns in future projects.

| Source | Cost escalation factor |
|---|---|
| Internal | • Bias<br>• Delivery/procurement approach<br>• Project schedule changes<br>• Engineering and construction complexities<br>• Scope changes<br>• Scope creep<br>• Poor estimating<br>• Inconsistent application of contingencies<br>• Faulty execution<br>• Ambiguous contract provisions<br>• Contract document conflicts |
| External | • Local concerns and requirements<br>• Effects of inflation<br>• Scope changes<br>• Scope creep<br>• Market conditions<br>• Unforeseen events<br>• Unforeseen conditions |

**Huimin Li, David Arditi and Zhuofu Wang (2013)** studied the transaction costs of construction projects to identify methods to minimize it. Transaction costs: "are but not limited to costs of preparing the bidding package, estimation costs, drawing up the contract and costs of dealing with any deviations from contract conditions". Transaction cost is an important part of the owner's budget, thus to minimize it some actions should be taken by owner. As per that study the actions are the following: 1) ensuring that engineering design is as complete as possible before bids are sought from contractors, 2) exploring the possibility of adopting integrated project delivery methods that would allow the owner to engage the services of a contractor early in the design phase, 3) agreeing to share some of the risks with the contractors, 4) well understand to the behavior of contractors, and 5) paying close attention to project management efficiency.

**Assaf et al. (1995)** had studied factors causing time and cost overrun. They found that the most important ones from contractor's point of view were the following: preparation and approval of shop drawings, delay of payments by owner and design changes.
**Chan and Kumaraswamy (1997)** had studied the main causes of time and cost overruns in construction projects in Hongkong. The study showed the causes are: poor site management and supervision, un foreseen / un expected ground conditions, low speed of decision making involving all project teams and client initiated variations. **Trigunarsyah (2004)** conducted survey about how to minimize time and cost problems in construction projects, results of the survey showed that the contractor involvement in pre-construction phase could help to reduce time and cost problems in execution phase. **Zheng et al. (2005)** also investigated time and cost deviations in construction projects. **Touran and Lopez (2006)** modeled uncertainty in cost escalation in large construction projects.

**Table (1) Sample for some previous studies in different countries**

| No. | Author | Year | Country | Type of projects studied |
|---|---|---|---|---|
| 1 | Hani M. Gharaibeh | 2013 | Canada | Industrial |
| 2 | Jin-Kyung-Lee | 2008 | Korea | Transportation |
| 3 | Frimpong et al. | 2003 | Ghana | Ground Water |
| 4 | Kaliba et al. | 2009 | Zambia | General Construction Projects |
| 5 | A.M.El Khouly | 2015 | Egypt | General Construction Projects |
| 6 | Long Le – Hoai, Young Dai Lee and Jun Young Lee | 2008 | Vietnam | Mega Projects |
| 7 | Kaming et al. | 1997 | Indonesia | High Rise Buildings |
| 8 | Jomah M.El Najjar | 2008 | Palestine | General Construction Projects |
| 9 | Edem O.P Akpan and Odinaka Igwe | 2001 | Nigeria | General Construction Projects |
| 10 | Musirikate Mihigo Amandin and Julius Warren Kule | 2016 | Rwanda | Public Projects |
| 11 | Chan and Kumarswamy | 1997 | Hong Kong | General Construction Projects |
| 12 | Hinze et al. | 1992 | United States Of America | Highway |
| 13 | Aibinu and Odeyinka | 2006 | Nigeria | General Construction Projects |

## Summary

It was well recognized through this chapter that the problem of cost overrun in construction projects is not new and not only the Egyptian construction projects suffer cost overrun but also many construction projects in many countries all over the world suffer the same problem. The cost overrun percentage varies from project to another according to its size and nature, and from country to another according to the nature of the country and the construction market in it.

Thus it was essential to well define and understand the main causes behind such problem through the literature review and past researchers' studies then to avoid and reduce the effect of such problem on construction projects in Egypt.

The table below shows the concluded 49 causes for cost overrun problem.

**Table (2) causes of cost overrun problem**

| No. | Causes |
|---|---|
| **1** | The un sufficient details of the original scope by the client. |
| **2** | The lack of the required specifications in the tender documents. |
| **3** | Client's financial ability of meeting the cost of works and claims. |
| **4** | Payments delay of the completed works. |
| **5** | The regular changes of the client's requirements during execution phase. |
| **6** | The delay of the client in accepting the variation orders. |
| **7** | The inaccuracy of the cost estimate. |
| **8** | The misunderstanding of the scope of work by the contractor. |
| **9** | Slowness of contractor in decision making. |
| **10** | The poor definition of the scope of work by the contractor to the subcontractors and suppliers. |
| **11** | The mistakes during the execution works and rework. |
| **12** | The incomplete planning. |
| **13** | The shortage of shop drawings and materials during execution phase. |
| **14** | Project size is bigger than the contractor and its capabilities. |
| **15** | Choosing unqualified subcontractors. |
| **16** | Slowness of information between the engineering departments in the construction company. |
| **17** | The inaccurate estimation of the costs of environment protection and mitigation by the contractor. |
| **18** | Schedule delay (slow performance by the contractor). |
| **19** | Technical challenges and the ability of the contractor to overcome it. |
| **20** | Poor financial control in the site by the contractor. |
| **21** | Over optimism of the contractor in achieving the key mile stone. |
| **22** | Low experience of contractor in the field of the project. |
| **23** | Penalties due to violation of authority regulations and rules. |
| **24** | Financial difficulties of contractor (financial situation of contractor) |
| **25** | Design mistakes. |
| **26** | In experienced or newly qualified construction supervisors. |
| **27** | The delay of shop drawings and materials samples approval by the consultant. |
| **28** | Un clear borehole log or mistakes in soil investigation. |
| **29** | Un clear bill of quantities. |

| | |
|---|---|
| **30** | Extremely complex design by the consultant (design complexity level). |
| **31** | Inspection rate of the completed works (slow inspection rate). |
| **32** | Range of float in the contract schedule. |
| **33** | Flexibility of the consultant and its coordination with the contractor (not flexible consultant). |
| **34** | Strikes. |
| **35** | Bad weather conditions. |
| **36** | Accidents and thefts. |
| **37** | Miss communication between parities (owner, consultant and contractor) |
| **38** | The change of any partner from the project partners in late stage. |
| **39** | Shortage of qualified resources. |
| **40** | Staff movement in the middle of the project. |
| **41** | Lack of contingency, labors cost and escalation of materials cost in the cost estimate. |
| **42** | Regular equipments breakdown. |
| **43** | Construction materials delay. |
| **44** | Prices fluctuations of construction materials. |
| **45** | Wasting and losing a lot of materials in site during the execution works. |
| **46** | Delays or long processes times by public authorities. |
| **47** | Political and economical environment in Egypt (disturbance of political and economical environment). |
| **48** | Inadequate production of raw materials in the country. |
| **49** | Shortage of utilities (water, electricity, telephones, etc…..). |