

Factors Leading to Cost Overrun Occurrence in Construction Projects

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ABSTRACT

Cost is the fundamental component for any construction project. While observations indicate that the cost overrun is a major phenomenon in construction industry worldwide. Hence, there are several factors responsible for cost overruns. So, a lot of studies have been conducted to investigate it. The aim of this paper is to identify the latest top major factors causing construction cost overrun construction projects in both of developed and developing countries (in particular) according to many variables during last three decades. through a comprehensive literature review, most common and frequently occurring causes of cost overrun worldwide and developing countries in particular were listed, factors were prioritized according to their occurrence, it is concluded that however cost overrun factors vary considerably across countries, the study of causing factors of cost overrun in construction projects will provide a reference for other projects that might be executed in similar circumstances and will also provide valuable information for international companies which intend to provide construction projects.

Keywords: Construction Projects, Factors, Planned Cost, Actual Cost, Cost Overrun.

1. INTRODUCTION

Cost is the fundamental component for any construction project. However, cost overrun is observed as one of the most frequently occurring issues in construction projects worldwide and need to be more studied to alleviate this issue in the future [1].

Cost overrun (CO) has become a norm, rather than an exception in the construction industry. So, it is normal to expect that the final cost of a project exceed the initial budget [2]. CO was defined as situation where the amount of money used is greater than the estimated cost of project [3].

In addition, CO in construction project is an indication of project failure so, the key to success is to realize and understand the challenges early in the planning process, to develop strategies to address them and to establish accurate and achievable expectations. Moreover, it provides the decision makers with early warning devices to reduce the cost overrun problems. So, understanding these factors allows for appropriate actions to mitigate factor impacts. Project participants can take action to curtail or control the effects of these identified cost escalation factors throughout the life of the project. Indeed, cost overrun occurs due to many factors that differ from one country to another.

Previous studies show that, the ranking of factors

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causing cost overrun is different from one country to another because of the different circumstances that surround construction industry. So, the main objective of this paper is to determine and discuss the most influencing factors in the cost of construction projects and causing cost overrun occurrence. This was fulfilled through literature review of different studies on this problem that aimed at:

- Identifying the latest factors that cause of cost overrun in construction projects.
- Classifying factors regarded to their related categories.
- Conducting a comparison among factors causing cost overrun in developed and developing countries.

2. COST OVERRUN IN CONSTRUCTION INDUSTRY

Cost is the common factor of any construction project. However, cost overrun is one of the most occurring risks construction projects and the most severe in developing countries, where these overruns sometimes exceed 100% of the estimated budget [1]. Construction cost which is out of control adds investment pressure, increases construction cost, affect investment decision-making. Hence, it is important to identify the factors that contribute to cost overrun to avoid and reduce the problems [4]. So, the increase in cost of project (cost overrun) can reduce the feasibility of the project [5].

Table1: The global experiments with cost overrun in construction projects [6]

The project	PC/ million dollar	AC/ million dollar	CO %
Suez Canal (Egypt-1869)	200	600	300
Brooklyne Bridge (USA-1883)	15	30	100
Sydney Opera house (Australia-1973)	7	102	1457
The ryugyong Hotel (North Korea-1992)	230	750	326
Scottish Parliament Building (UK-2004)	10	414	935
Burj Al-khalifa (UAE-2010)	800	1500	187.5

The problem of CO in construction projects is not confined to developing countries only but also in global projects as clarified in table1. Also, large construction projects have been plagued by cost and schedule overruns [6]. In general, if the increase's rate exceeds the 15% in project's cost; it will be considered as cost overrun. Hence, the normal range of cost overrun is between 0 and 15%. [7].

3. FACTORS LEADING TO COST OVERRUN IN CONSTRUCTION PROJECTS

There are many factors causing of project cost deviation in other words, causes of variations between estimated cost or planned cost (PC) and actual cost (AC) of project which will be explained in details later. Hence, the researcher reviewed a lot of studies concern with the causing factors of cost overrun in construction projects. Many studies show that 90% of construction projects have underestimated costs and this percentage increases in the developing countries because of the lack of experience in the project management process. So, there are many factors can cause cost overrun that are different from one project to another and from one place to another. Cost overrun will be identified, its reasons will be clarified, and many of previous studies will be analyzed [8].

3.1. PREVIOUS STUDIES RELATED TO STUDY'S SUBJECT

There are a number of researches about factors leading to cost overrun occurrence in construction projects in several countries (developed and developing countries), as follow. However, it should be performed more such studies in developing countries, in particular Egypt to face the critical problem of cost overrun in construction field. Past researchers studied the factors affecting construction costs from various perspectives. However, different countries have different cost factors for

consideration. After the literature review, the researcher extracted the following facts:

Whereas, *Ekab*, (2009) mentioned that poor review of drawings and Changes in design is the most influencing factor in cost overrun of construction projects in Iraq then, poor contracts management and fluctuation in material prices [9]. Besides, the viewpoint of *Bageis and Fortune*. (2009) and *Alfouzan*, (2013) that there are many factors lead to cost overrun in construction projects in KSA as Decision-making regarding tenders which depend on the size of contractor, contractor's classification status and type of main client, corruption in selling lands and government's poor role in monitoring materials prices [10][11]. Whereas, *Zujo et al.* (2010) the main only factor causes cost overrun in Bosnia and Herzegovina is the delay in project's handing over [12]. In addition, *Ameh et al.* (2010) extracted that the junior factors cause cost overrun in Nigeria are the economic stability, shortage of materials, government policies (laws and regulations), domination of construction industry by foreign firms and aids, project location and absence of construction cost data [13]. But, *Singh et al.* (2011) and *Shanmuganathan and Baskar*, (2015) mentioned that the junior factors cause cost overruns in India are uncompleted initial designs and poor contracts, ineffective construction management, poorly established cost control systems, poor project (site) management, poor cost control, additional work, Improper planning and changes or discrepancies which occur during the construction period [14][15].

Gajewska, and Ropel, (2011) stated that the delay in diction making, miscalculation, and not finding the right contractor are the most influencing factors of delay the construction projects which leading to cost overrun occurrence in Sweden [16]. In addition, *Memon et al*, (2011), *Toh et al*, (2012) and *Abd-Karim et al*, (2013) mentioned that client requirements on quality, poor design and delays in design, unrealistic contract duration and requirements imposed lack of experience, late delivery of materials and equipment, relationship between management and labor, fluctuation of prices of materials, cash flow and financial difficulties faced by contractors and shortages of materials are the most influencing factors in cost overrun in Malaysia [7][17] [18].

In addition, *Mahamid et al.* (2011) the junior factors cause cost overrun in Palestine are Materials price fluctuation, Insufficient duration for estimation, Lake of experience in contracts, Size of contract and Poor review of drawings [19], but, *Bosenena,** (2011) saw that the only factor causes cost overrun in Jordan is The Delay (Increase in duration) [5]. Whereas, *Arcila*, (2012) stated that the most common cause of cost overrun in projects in UK are clients changing their mind during the course of the project, financial performance of the job contracts management, insufficiency in planning and design quality [2]. Whereas, *Banaitiene and Banaitis*, (2012) stated that

lack of experience, design errors, scheduling errors and failure to comply with contractual quality requirements, and technology changes in Croatia [20]. In addition, *Apolot et al.*, (2012) stated that the most influencing factors of cost overrun in Uganda are lack of project management during execution: insufficient and ineffective working, delays, changes in scope of work and location, law and order [21]. Besides, *Doloi*, (2013) clarified that the planning and scheduling deficiencies, Methods/techniques of construction, effective monitoring and feedback process, complexity of design and construction, improper control over site resource allocations and contractor's deficiencies in planning and scheduling at tender stage are the main causes of cost overrun of construction projects in Australia [22]. But, *Siemiatycki*, (2015) briefly mentioned that economic and political factors cause cost overrun in construction projects in Canada [23].

Finally, *Shaqour*, (2014); *Khodeir and Hamdy*, (2015) and *Yakoub*, (2016) mentioned that the junior factors cause cost overrun in Egypt are changes in project scope, material prices, Poor estimation of project cost, additional works at owner's request, donor policy in bidding to the lowest price, fluctuations in the cost of building materials, delay in project completion time, fraudulent practices, kickbacks, corruption and economic instability/ political insecurity [6] [24] [25].

3.2. MUTUAL COST OVERRUN FACTORS BETWEEN DEVELOPED AND DEVELOPING COUNTRIES

The factors causing cost overrun (CFFO) occurrence in construction projects between developed and developing countries, that comparison results in some mutual factors between developed and developing countries as poor estimation, poor planning, additional works, unqualified labor, design changes, delay in projects completion and environmental factors. As shown in the following figure:

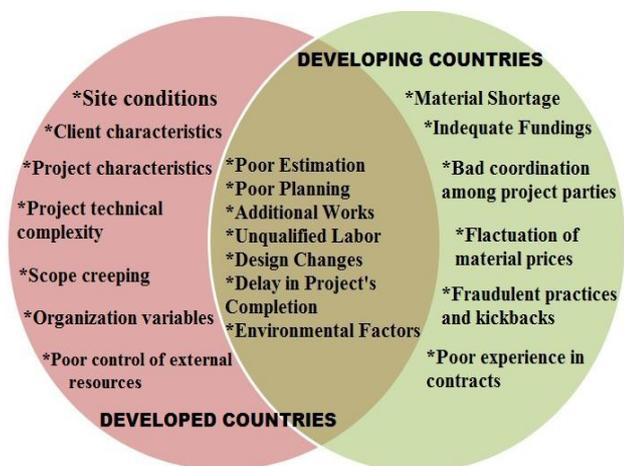


Figure 1: A comparison between developed and developing countries

This comparison indicated to some facts as construction projects in developing countries suffer from managerial, financial, contractual and project resource problems, so the decision makers should take those factors in consideration to avoid cost overrun occurrence.

4. CLASSIFICATION OF COST OVERRUN FACTORS OF CONSTRUCTION PROJECTS

The following structure of cost overrun factors is extracted from the previous studies analysis in both of developed and developing countries. Hence, it consists of six main groups of cost overrun factors as technical group, financial and economic group, political situation group, managerial group, project resources group and environmental factors group.

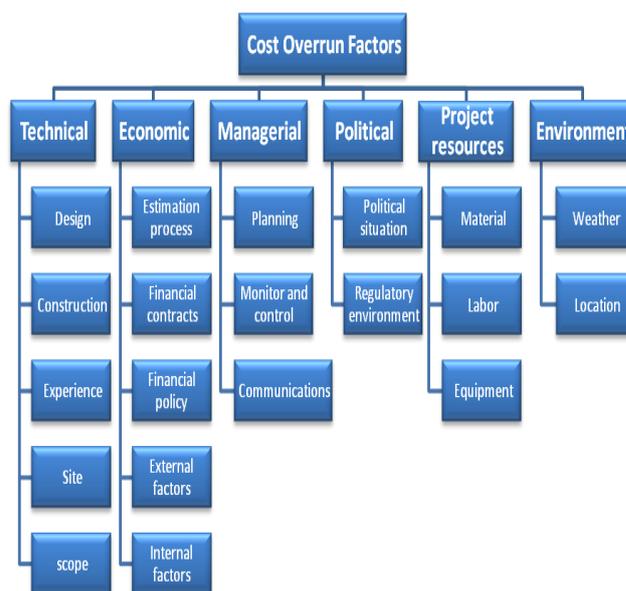


Figure 2: Factors causing cost overrun according to previous studies

Hence, each group has many categories according to the nature of included factors. Consequently, the researcher allocates the appropriate category for its factors in tables (2), (3), (4), (5), (6), and (7) as follow:

Table 2: The factors of technical group

Design	The related factors to this category are Poor review of drawings and Changes in design [2][6][7][9][14][15][17][18][19][20][22][24][25].
Construction	The related factors to this category are Poor technical performances, changes or discrepancies that may occur during the construction period, technical complexity of a project and Delay in a project's handing over [5][7][12][16][17][18][20][21].

Experience	The related factors to this category are Decision-making in tendering processes, Lack of experience and Delays between design and procurement phases [10][11][19][20][24][25].
Site	The related factors to this category are Unforeseen site conditions and Poor site organization [14][15].
Scope	The related factors to this category are Additional work at owner's request, Changing orders and Poor scope definition [2][16][21][24][25].

Table 3: The factors of Economic and financial group

Financial Contracts	The related factors to this category are Donor policy in bidding to the lowest price, Lack experience in contracts and Poor contracts management [2][6][9][14][15][19][20][24][25].
Financial policy	The related factors to this category are Poor investment decisions, Inadequate funding and Methods of financing and payments for completed works [2][6][24][25].
Internal	The related factors to this category are Poor contractor management, organizational variables, Project characteristics and Client characteristics [6][10][11][19][24][25].
External	The related factor to this category is Fluctuation in money exchange rate, domination of construction industry by foreign firms and aids, government policies (laws and regulations) and economic instability [6][13][21][23][24][25].

Table 4: The factors of political and regulation group

Political Situation	The related factors to this category are Unsupportive governmental policies and Governmental control and regulations [6][13][19][23][24][25].
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Table 5: The factors of Management group

Estimation process	The related factors to this category are inaccurate or poor estimation of Original Cost, Incorrect/inappropriate methods of cost estimation and Estimating process risk [6][16][19][24][25].
Planning	The related factors to this category are inadequate project analysis, Improper planning and scheduling and Poor planning [2][6][7][14][15][16][17][18][19][20][21][22][24][25].

Monitor & control	The related factors to this category are Poor site management, Poor cost control, Complexity of organizational structure of a project, absence of construction cost data and Fraudulent practices and kickbacks [6][7][11][13][17][18][19][21][22].
Communication	The related factors to this category are Poor coordination among the project participants and Lack of leadership knowledge [21][24].

Table 6: The factors of project resources group

Category	Factors
Labor	The related factors to this category are Lack of labor and Unqualified labor [19][25].
Material	The related factors to this category are Fluctuations in the cost of building materials, The shortage in construction materials in markets and Materials problem [6][9][10][11][13][14][15][19][24][25].
Equipment	The related factors to this category are - High cost of machineries and Lack of equipment [7][17][18].

Table 7: The factors of environment group

Location	The related factor to this category is Poor field investigation [13][21].
Weather condition	The related factors to this category are Unpredictable weather conditions and Unsuitable climate to work [14][22].

5. RESULTS AND DISCUSSION

In fact, construction overrun is not unique to developing countries. It is a worldwide issue worsened by the global financial crisis; so, it is a major problem in construction industry development and a regular feature in construction industry.

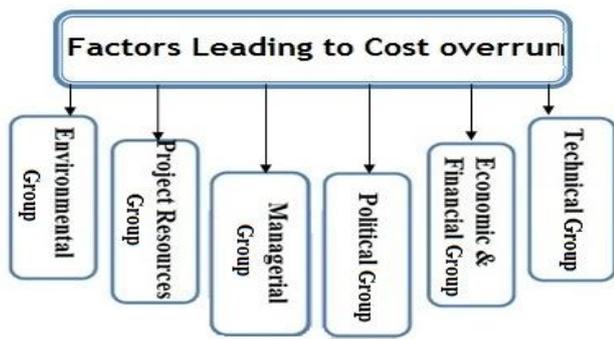


Figure 5: The groups of factors leading to cost overrun in construction projects

In addition, the main findings of the paper can be summarized as follows:

- The factors cause cost overrun in construction projects differ from one country to another because of the different circumstances that surround construction industry in each country.
- Most of the factors are related to financial issues. The most frequent factors in previous studies.
- Factors related to planning category are the main factors contribute to cost overrun in the projects of developing countries.
- Factors related to material category are the main factors contribute to cost overrun in the projects of developed countries.
- The scholars see that environmental factors are not serious problems, so the authors consider that they are not very important for cost overrun occurrence.

Previous Studies Worldwide

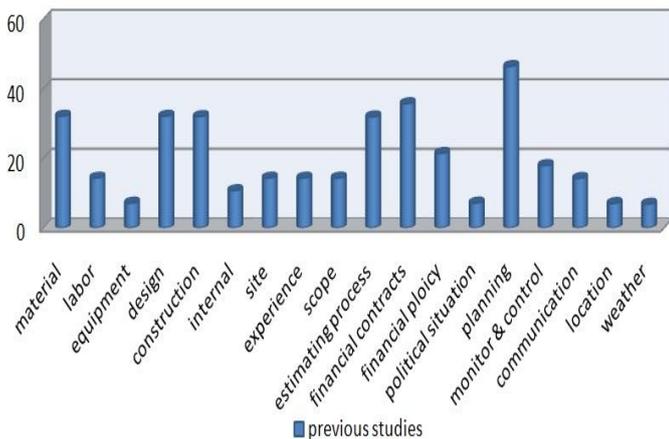


Figure 6: Analysis of previous studies worldwide

According to the previous studies' view, table 8 shows the top five (high-priority) categories of factors that affecting cost overrun in building construction projects. In a descending order they are: planning, financial contracts, estimating process, design and construction.

Previous Studies in Developing Countries

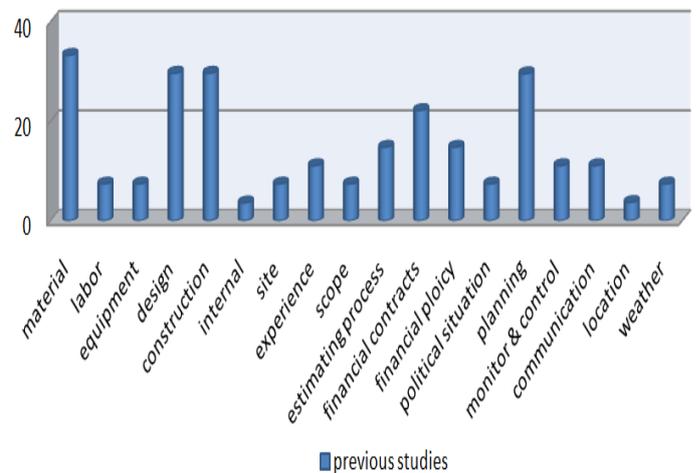


Figure 7: Analysis of previous studies in developing countries

Previous studies were conducted in the many developing countries as Ethiopia, Uganda, Ghana, Nigeria, Indonesia, Thai, India, Pakistan, Kuwait, Jordan and KSA. These studies result in some facts as, material, planning, design, construction and financial contracts are the top categories of influencing factors in cost overrun occurrence.

Table 8 shows the top five priority categories that affecting cost overrun in building construction projects globally and at the level of developing countries in a descending order, as a comparison between global and developing countries' previous studies according to the ranking of causing factors categories in cost overrun.

Table 8: A Comparison for ranking the categories of cost overrun factors

Ranking	Worldwide	Developing countries	Egypt
1	Planning	Material	Scope
2	Financial contracts	Planning	Estimation process
3	Estimating process	Design	Political situation
4	Design	Construction	Planning
5	Construction	Financial contracts	External factors

6. CONCLUSION

Cost overrun is considered an obvious indicator of project's failure, that a situation of a construction project in which budgetary estimate exceeds estimation, budget exceeds budgetary estimate, and settlement exceeds budget is a universal phenomenon.

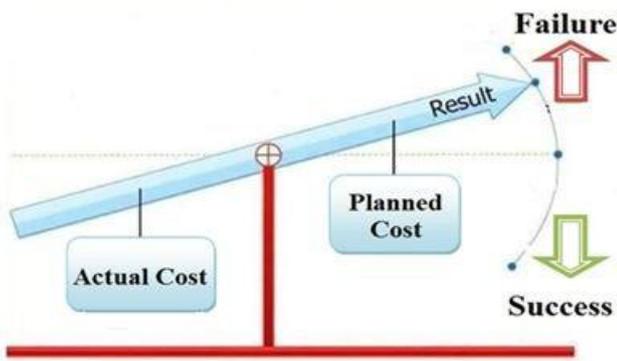


Figure 3: The impact of Cost overrun on Project Situation

1- The methodology used in this paper consisted of steps similar to ones used in most of the previous qualitative studies. This research is carried out in two stages. (literature review and analysis of findings). So, the researcher used the descriptive analytical approach depending on literature review and analysis of studies which deal with the factors affecting costs of construction projects.

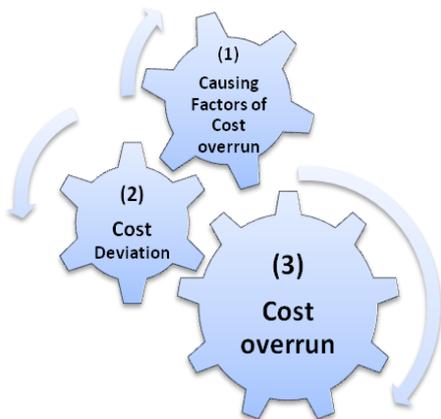


Figure 4: The dynamism of cost overrun occurrence in construction projects

2- The cost overrun factors lead to project cost growth have been documented through a large number of studies. So they were identified from literature survey worldwide. Consequently, these cost factors are grouped into six groups, these six main groups, namely: technical, economic & financial, political & regulation, management, project resources and environmental factors.

3- The groups contain about 20 categories of factor causing cost overrun in construction projects. Despite some differences in viewpoints held by each scholar, there are areas of agreement among them. All the groups felt that poor estimation of project costs, poor planning, additional works, unqualified labor, design changes, delay in project's completion and environmental factors are the major causes of cost overrun.

7. RECOMMENDATIONS

1. Construction companies should establish a data base of FCCO and use an effective tool to control these factors in their projects for improving the performance and increase the profits.
2. Avoid unnecessary additions to the project scope that don't add a value to the performance or functionality of the construction components or elements and focus on client's need.
3. The project's owners should depend on a scientific way in contractors' selection instead of the donor policy in bidding to the lowest price to guarantee executing the project without any financial stumbles and delay.
4. Developing the construction contracts by imposition more fines and restrictions in order to control project parties' claims and disputes related to cost overrun amount that is expected to occur in future.
5. Using modern techniques in cost estimation and project planning to improve their accuracy as cost management, risk management and value engineering.
6. Expanding the number of material choices on a given project and considering allowing alternate materials by providing flexibility in specifications or by allowing other material options to the contractors.
7. Adoption of tools and techniques i.e.: value Management, lean thinking, and total quality management to face the problem of Delay in project completion time.
8. Monitoring the design changes to avoid reassessment implementation cancelling unless the opportunity outweighs the threat. It is preferred to take more time during design to get it right in the first place.
9. Accept cost saving proposals from contractors during bidding and construction. Hence, the contractors may be more motivated to submit such proposals when potential cost savings are shared and it should be negotiated in contracts or meetings of stakeholders.

8. NOMENCLATURE

CO	Cost overrun
FCCO	Factors causing cost overrun
PC	Planned Cost
AC	Actual Cost

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