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ABSTRACT

Construction sector is developing every year due to use of new technologies and need of skilled labours to perform required designs. Hence, it is becoming more critical to ensure proper management of construction works to complete the project according to assigned objectives and specifications. The success of any construction work relies mainly on cost, time, and quality of work. Hence, proper management was done in order to ensure completion of projects according to expected and assigned budget. Nevertheless, projects in developing countries are yet suffering from potential overrun of cost due to multiple factors. There are multiple authors in literature that indicated the main problems faced by projects that prevents them from completing the project according to expected budget (Apolot *et al.*, 2012), and (Memon *et al.*, 2012). Hence, it became quite urgent to investigate reasons that lead to overrun of cost in construction works. Therefore, the major goal of this study is to investigate sources of cost overrun in construction projects in Egypt. The study will concentrate mainly on commercial projects due to the fact that most of these projects are extremely expensive and would require proper management to prevent any increase in its cost. The method of data collection is a questionnaire survey that included risk factors collected from previous literature. The expected outcome will be in the form of estimating reasons that lead to cost overrun, and impact of cost increase on performance of construction projects.

KEYWORDS: Construction industry, causes of cost overrun, Impact of cost overrun.

1. INTRODUCTION

The success of any construction project is known as accomplishing objectives and goals that were assigned in the original plan of the project. Frimpong (2003) stated that the success of any project depends on getting required technical goals, maintaining original schedule of work, completing the project according to the budgeted cost, and overall performance of work. Construction works are becoming quite complex due to use of modern methods and sophisticated equipment that are becoming more difficult to be used. Therefore, because of this increased complexity, several projects are suffering from increase in project's cost that might not directly result in failure of project, but could lead to failure in completing the project successfully. Cost overrun in construction works is defined as the variation between the actual cost of work in the project and the originally estimated budget at the beginning of work. Harisaweni (2007) indicated that any work that suffers from overrun of cost is related to having some problems that prevented the completion of the project on the budget that was originally agreed between contract parties

2. CAUSES OF COST OVERRUN

The reasons of having overrun of cost in project was investigated and studied several times during the past few years. It is a developing problem that is not yet solved in many countries that tackled this problem. This section provides some of these studies in addition to real causes of this problem.

Changes in Design During Construction Stage

Even though that it is not expected to deliver any project without presenting some changes or variations during construction phase, but having so many changes in the project might have a huge negative influence on cost of the project. Changing some aspects in the design is considered a common practice due to nature of work in construction sector and use of a complex design that is not clearly understood by most parties working in the

project. The other main reason for having changes in design is related to not involving the contractor in the design stage. However, any change in the design can result in delaying progress of work on site and waiting for owner's approval before completing progress of work. Hence, this factor was estimated to be one of the main reasons project suffer from potential increase in their costs including Korea, Vietnam, Nigeria, and Indonesia (Alsuliman *et al.*, 2012).

Contractor Financial Status

It is common in construction works that contractor suffer from different problems in terms of payment during construction stage in terms of providing payment for their workers starting from first day of work until completion of the whole project. Therefore, contractors must provide sufficient budget and funding for the project to make sure that progress of work in the project will keep on flowing. In addition, there should be some financial examination during construction stage to ensure that the contractor will ensure progress of payment without facing any problems in cash flow. Improper control over the cost might result in increasing cost of work in the project in addition to liquidated damages by the owner. Thus, in case the contractor suffers from any problems in financial operations, the procedure of work in the project will be directly affected. Hence, according to reached statistics, it was estimated that most contractors usually suffer from problems during construction stage (Himansu, 2011).

Delay in Payments by Owner

Slow in providing payments by the owner to complete progress of work on site is considered the main complaint that is always used by contractors. This form of cost overrun was mainly presented in public projects due to the fact that most payments that are provided by the government take longer durations than usual which results in poor progress of work by the contractor in order to gain more advantage and money (Hoen *et al.*, 2009). In case the scheduled and assigned payments are not provided on time for the contractor, it could result in limiting his capability to accomplish objectives of the project or provide payments for his workers. It should be taken into account that late submission of payments does not only affect time and cost of the project, but also has a direct influence on relationship between owner and contractor. In addition, any delay in giving payments might result in increasing project's cost and the contractor might request additional cost for this delay (Assaf *et al.*, 2001).

Inexperienced Contractor

Most construction works are getting more complicated than before which results in higher pressure on contractors to complete the project according to expected time and cost. In case the assigned contractor has weak experience in the type of the project or its location, this could result in increase in project's cost and several rework in the project that could be prevented from the first place by assigning skilled contractor. It was estimated that choosing the wrong inexperienced contractor could result in multiple problems in the project. It was estimated that use of inexperienced contractor is the main reason for cost overrun in Ghana and Indonesia (Arian *et al.*, 2006).

Poor Estimation of Cost

One of the main problems that is faced in construction works is mainly related to estimating the cost in a wrong manner. Cost estimation is defined as measuring required expenses of resources and supplies that are required to complete the project according to drawings and specifications. The procedure of estimating the cost properly required proper data collection, retrieval, and manipulation of a huge amount of data for cost and nonrelated cost information in a small amount of time to ensure that the project will begin on expected duration. Hence, it is considered a complex practice that require a lot of time. Even though that techniques used for cost estimation were developed dramatically, but yet not considered perfect. Thus, one of the main issues that could lead to increase in project's cost can be related to improper estimation of project's cost that surprises all parties when the project starts and result in increasing in project's cost. Hence, proper estimation of cost can lead to ensuring that it will not increase after start of construction work.

3. PREVIOUS STUDIES

Apolot *et al.* (2012) estimated the main reasons that lead to delay and cost overrun in construction projects and especially public ones in Uganda. The target of this study is to estimate the real causes and provide a ranking according to their impact, importance, and frequency of occurring. There are several factors that were estimated including delay in giving payments, poor control and inspection of work, changing scope of work, high capital cost, and political problems. All these factors are considered significant and must be dealt with properly.

Abusafiya and Suliman (2017) proposed the cause and effect of cost overrun on construction projects that are done in Bahrain in the Middle East. One of the best measurements that is used to estimate the success of any project is cost performance. Even though that it is well known between all parties working in projects that cost performance is vital, yet there are several works and projects fail to finish on the expected budget and specified cost at the beginning of the project. Therefore, this study helped in identifying the causes of overrun of cost in construction projects in Bahrain and then assessed the effect of each factor on the presence of cost overrun in projects. In order to collect all causes that were used in questionnaire survey, the author used a comprehensive literature review, previous records of project, and opinion of several experts and engineers working in this sector. Therefore, the researcher collected 45 different risk factors and were then shortlisted to fit into a questionnaire survey that was used to obtain the numbering of each factor from clients, consultants, and contractors that worked and currently working in projects located in Bahrain. Then, after obtaining all values from participants, the researcher used some data analysis methods to classify all factors and provide a final ranking of all factors that are faced in projects. The reached outcomes indicated that most significant factors that result in cost overrun are delay in schedule of work, mistakes by the contractor during construction stage, and consistent changes in the design of work, all these factors played a major role in proposing significant problems in construction sector in Bahrain.

A study was conducted by (Durdye et al, 2012) in order to investigate the factors that lead to increasing the cost of construction projects. Any construction activity requires proper attention and investment in order to be done properly without any problems especially in developing countries that suffer from potential problems that lead to increase in project's cost. In order to determine major factors that lead to overrun of cost, the author conducted a questionnaire survey on developing countries especially turkey due to the fact that most projects that are conducted in this study are suffering from cost overrun. The author used a relative importance index technique that involved quantitative analysis of data. The survey contained around 40 factors that are related to sources of cost overrun in the project. The factors were categorized in multiple conditions and elements according to each party that is responsible on this risk factor. The below are the estimated classification of factors that lead to overrun of cost.

Table 1: Ranking of major sources of cost overrun according to literature

Causes	Frimpong et al (2003)	Apolot et al (2012)	Koushki et al (2005)	Memon et al (2011)	Hoai et al (2008)
material procurement	√				
monthly payment circumstances	√				
poor management from contractor	√				
changes in prices of materials	√				
delay in giving payments		√			
poor control and inspection of work		√		√	
changing scope of work		√			
political problems		√			
high capital cost		√			
lack of experience of owners			√		
change order			√		

financial problems faced by the owner			√		√
delay in completion of project's design				√	
unrealistic duration of work				√	
errors in construction method				√	
late of delivery of materials				√	
poor management of labours				√	
poor scheduling				√	
governmental risks					√
slow in taking decisions					√
poor quality from workers					√
design errors					√
poor estimation of project's cost					√

Objectives

- Determine most important risk factors that lead to overrun of cost in projects according to previous researchers that tackled the same scope.
- Use this list of factors to measure the reasons of cost overrun in real construction works in Egypt.
- Estimate a suitable cost control method that can be used in future works to ensure completion of projects according to expected budget.

In case these objectives are adequately involved, then determining the causes of cost overrun in commercial projects in Egypt and suggesting an effective cost overrun technique can help in reducing the influence of these parameters on the success of commercial projects.

Methodology

- Present a literature review of studies that presented reasons of cost overrun.
- Choose several projects in Egypt that are under construction works to conduct a personal interview with managers and engineers working in the project to provide a proper understanding about major sources of cost overrun in commercial projects.
- Decide the right action that can be taken in case any of the mentioned risks are faced in the project according to the point of view of engineers and managers according to their experience in the field and capability to detect the right solution for these problems before it results in overrun of cost.
- Reach final results about main reasons of cost overrun in commercial projects in Egypt.
- Present multiple recommendations to ensure that future commercial projects will not suffer from potential increase in their costs.

Questionnaire Survey

The main method of data collection that was used in this research is a questionnaire survey. It was divided mainly into 2 different sections, the first one is related to extracting personal information about the engineers that are working in this sector such as their names, company working in, and their job title at this company. The second section of this questionnaire survey concentrated on estimating the major causes of cost overrun in commercial projects in Egypt through the use of relative importance index. Each participant was requested to provide a factor that ranges from 1 until 5 where 1 is the lowest value possible that represents the least effect, 2 represent low effect, 3 is related to medium effect, 4 is quite severe effect, and finally 5 is highest major effect.

Relative Importance Index Results

In order to estimate causes of delay, there are 20 participants that were part of this questionnaire survey who were contractors, consultants, and owners in building projects in Egypt. The no. of experts are 30 because the study done on building projects which is limited in Egypt not like residential buildings. The next table 2 and figure 1 shows the results of these relative importance indexes for causes of cost overrun in commercial projects in Egypt.

$$RII = \frac{\sum W}{A * N}$$

Table2: Relative Important Index for the most important causes of cost overrun

Category	Causes	Total W	N	Relative Index
Economic Factors	Increase in prices of materials	80	20	0.8
	high cost of machines	58	20	0.58
	change in interest rates in the national banks	67	20	0.67
	inflation of economy	67	20	0.67
	effect of global economy	58	20	0.58
Workforce Factors	Lack of labours with sufficient skills	63	20	0.63
	performance of labours	63	20	0.63
	high cost of labours	62	20	0.62
	high cost of insurance	39	20	0.39
	absence of labours	55	20	0.55
	additional cost in case of any labour accident on site	37	20	0.37
Finance Factors	high cost of resources used in the project	76	20	0.76
	high price of land	62	20	0.62
	additional cost due to rework	72	20	0.72
	poor cost control	85	20	0.85
	Financial difficulties faced by owner	73	20	0.73
	waste of materials on site	74	20	0.74
	cost of machine's maintenance	55	20	0.55
	Choosing lowest bid contractor during tendering stage	72	20	0.72
	Delay in scheduled payments by owner	67	20	0.67
Management Factors	cost related to any disputes and litigation during construction work on site	55	20	0.55
	poor planning of work	76	20	0.76
	poor estimation of project's cost,	85	20	0.85
	lack of adequate coordination between all parties working in the project	68	20	0.68
	poor estimation of project's time	74	20	0.74
	poor site management	74	20	0.74
	variation order by owner	70	20	0.7
	Frequent changes in project's design	84	20	0.84
	poor site investigation	82	20	0.82
	Error in design of the project	87	20	0.87
	choosing wrong construction method	75	20	0.75
External Factors	Choosing inexperienced subcontractors	81	20	0.81
	consistent interference of owner in procedure of work in the project	65	20	0.65
	Soil conditions	76	20	0.76
	weather conditions	55	20	0.55
	Number of projects managed by the same contractor at the exact time of the project	61	20	0.61
	natural disasters	71	20	0.71

	political problems	83	20	0.83
	revolution	85	20	0.85
	Location of project	70	20	0.7

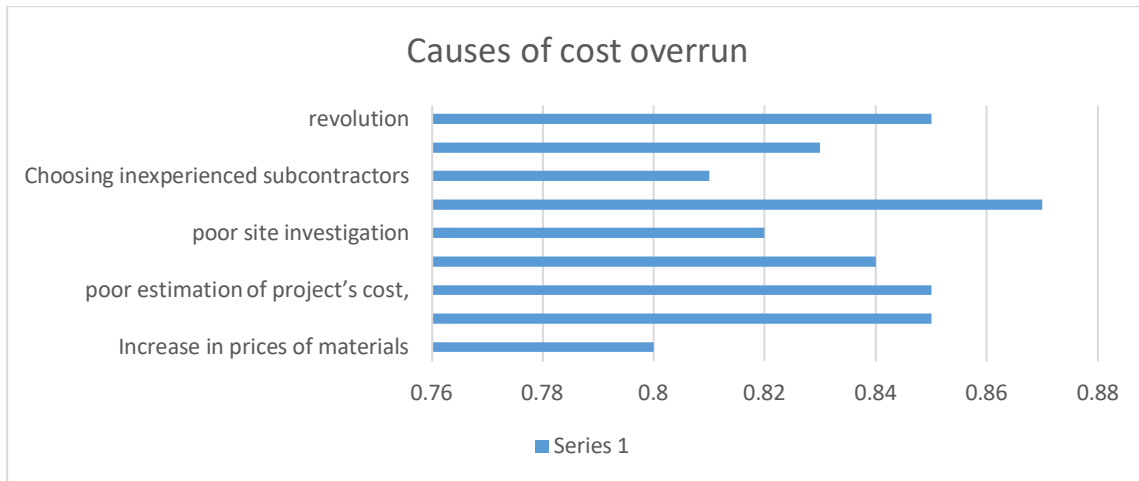


Figure 3: Causes of cost overrun and their relative importance index

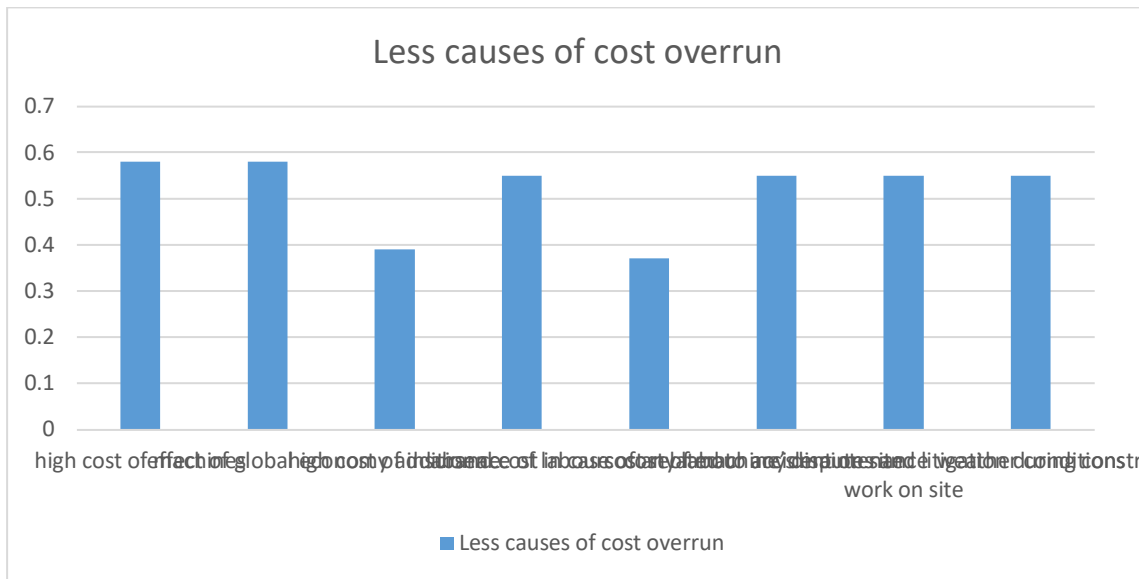


Figure 4: Less causes of cost overrun

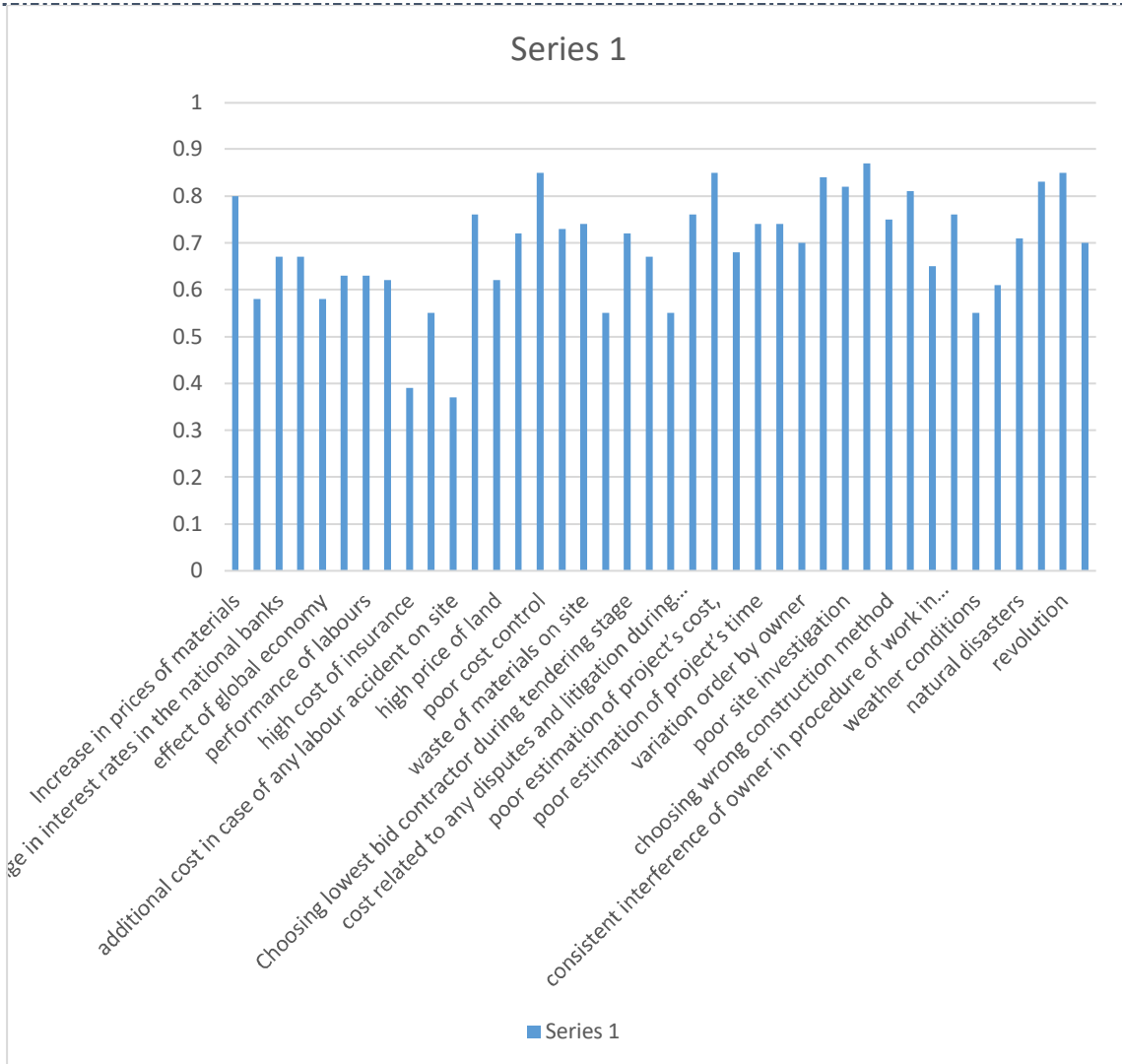


Figure5: Relative index results for all causes of cost overrun in the case study

Recommended Actions

Table3: Top causes and some recommended actions

Causes of cost overrun in Commercial projects	Recommended actions
Error in Design of the project	A detailed technical design intent must be prepared carefully depending on the owner's desires and on a good site investigation to avoid any errors in the design of the project.
Poor cost control	A project cost plan must be prepared according to the resource loaded approved baseline schedule and periodical cost reports must be conducted to control the project's cost perfectly
Poor estimation of Project's cost	The tendering team must make a reasonable cost estimation for the project during bidding phase before signing the contract
Revolution	This risk is considered as an unforeseeable force Majeure risk in all international contracts formulas as FIDIC but it could be avoided by studying the expected political conditions before starting the project
Frequent changes in project's design	A detailed technical design intent must be prepared carefully depending on the owner's desires and on a good site investigation to avoid any changes in the design of the project
Political problems	This risk is considered as an unforeseeable force Majeure risk in all international contracts formulas as FIDIC but it could be avoided by studying the expected political conditions before starting the project
Poor site investigation	A high-quality geotechnical soil investigation report must be done carefully to avoid any defects in foundations and structural design
Choosing inexperienced subcontractors	The Subcontractors must be chosen through an obvious criterion depending on their experience, quality, capacity and cost, and it is preferable to choose subcontractors from similar projects
Increase in prices of materials	Add Materials Escalation Formula in the Project's Contract
High cost of resources used in the project	The cost team must make a reasonable cost estimation for the project's available resources before starting of the project in addition to adding a cost escalation formula in the project contract to avoid any changes in resources price

4. CONCLUSION

It was found that the top ranked risks were political instability, low production rate by labours, lack of sufficient training for labours, poor site supervision and management, and poor communication and coordination between the project's team. A brief comparison was then demonstrated for the results of this study and previous one showed the need for applying the same methodology on each region as the causes might be different from one location to the other. Hence, the next section shows some recommendations that are extremely important to prevent the occurrence of cost overrun, and for future studies.

5. RECOMMENDATIONS

The below are some general recommendations that are reached after conducting this study, it aims to ensure the proper dealing with cost overrun sources, and indicate some significant aspects that must be taken into account by future studies. One of the best solution that was proposed by this study is to decrease the influence of cost overrun in various construction works through the proper analysis of materials, human resources, and technical capabilities of all parties working in the project due to the fact that poor management of resources is considered the most significant factor that lead to potential increase in project's cost.

In addition, proper communication and coordination between all parties even stakeholders can help in ensuring the success of construction works and decrease the possibility of suffering from cost overrun as each party understand their main assignment and aim to prevent such circumstances. The government can help contractors in finding proper ways for managing their budget and financial resources to make sure that projects will be completed on the expected budget by providing the capability to loan money from banks and other sources of finding that could be vital for contractors to keep their work in projects.

This case study focused on a small population only due to the current circumstances (Covid-19), but future studies should consider involving more participants and mixed ones (contractors, owners, and consultants) to reach a variety of conclusions and propose a more accurate weight. The other significant matter is to involve an expert into the survey to look over the risks and ensure that these risks are applicable to the region that is being investigated on as this matter can help in eliminating risks that are not sufficient or applicable to the region, and add other risks that could be more effective and vital to the cause.

REFERENCES

- [1] a. H. Memon, I. A. (2012). Time And Cost Performance In Construction Projects In Southern And Central Regions Of Peninsular Malaysia. *International Journal Of Advances In Applied Sciences*, 45-65.
- [2] Abdulelah Aljohani, D. A.-D. (2017). Construction Projects Cost Overrun: What Does The Literature Tell Us? *International Journal Of Innovation, Management And Technology*, 137-143.
- [3] Apolot, R. A. (2012). An Investigation Into The Causes Of Delay And Cost Overrun In Uganda's Public Sector Construction Projects. *Second International Conference On Advances In Engineering And Technology*. .
- [4] Assaf, S. A. (2001). The Management Of Construction Company Overhead Costs. *International Journal Of Project Management*, 303-305.
- [5] C. C. Cantarelli, B. F. (2012). Geographical Variation In Project Cost Performance: The Netherlands Versus Worldwide. *Journal Of Transport Geography*, 324-331.
- [6] Cantarelli, C. C. (2011). Cost Overruns In Large-Scale Transport Infrastructure Projects: A Theoretical And Empirical Exploration For The Netherlands And Worldwide. *Delft University Of Technology*, 198-201.
- [7] Dibonwa, P. (2008). Identifying Causes And Remedies For Cost Overruns In Botswana's Public Construction. *University Of The Witwatersrand*.
- [8] F. M. Arain, L. S. (2006). Contractors' Views Of The Potential Causes Of Inconsistencies Between Design And Construction In Saudi Arabia," . *Journal Of Performance Of Constructed Facilities*, 74-83.
- [9] Frimpong, Y. O. (2003). Causes Of Delay And Cost Overruns In Construction Of Groundwater Projects In Developing Countries: Ghana As A Case Study. *International Journal Of Project Management*, 321-326.
- [10] Higgins, G. (2009). Quantitative Versus Qualitative Methods: Understanding Why Quantitative Methods Are Predominant In Criminology And Criminal Justice. *Journal Of Theoretical And Philosophical Criminology*,, 23-37.
- [11] Himansu, B. (2011). "Avoid Cost Overrun For Megaprojects. *Project And Technology Management Foundation*, 2-4.
- [12] J. Alsuliman, G. B. (2012). Current Practice Of Variation Order Management In The Saudi Construction Industry. In *Proc. 28th Annual Arcom Conference*. Edinburgh.
- [13] Kaliba, C. M. (2009). Cost Escalation And Schedule Delay In Road Construction Projects In Zambia. *International Journal Of Project Management*, 522-531.



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- [14] Koushki, P. A.-R. (2005). Delays And Cost Increases In The Construction Of Private Residential Projects In Kuwait. *Construction Management And Economics*, 285-294.
- [15] Memon, A. R. (2011). Preliminary Study On Causative Factors Leading To Construction Cost Overrun, . *International Journal Of Sustainable Construction Engineering & Technology*, 57-71.
- [16] Odeck, J. (2004). Cost Overruns In Road Construction-What Are Their Sizes And Determinants? *Transport Policy*, 43-53.
- [17] Olatunji, A. (2010). Influence On Construction Project Delivery Time. University Of Nelson Mandela Metropolitan University.
- [18] Suliman, H. A. (2017). Causes And Effects Of Cost Overrun On Construction Project In Bahrain: Part I (Ranking Of Cost Overrun Factors And Risk Mapping). *Modern Applied Science*, 20-27.

