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RISK ASSESSMENT & ANALYSIS IN HIGHWAY CONSTRUCTION CAUSE COST &TIME OVERRUN IN PROJECT OF AFGHANISTAN CONSTRUCTION INDUSTRY

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Abstract

The construction sector in Afghanistan has undergone significant improvements in recent years, but the lack of attention to risk assessment and analysis remains a major concern. Many construction projects have experienced cost and time overruns due to unforeseen events and risks that could have been mitigated with proper risk management planning. **As seen in the case study of highway construction, a risk assessment was conducted before the project commenced, but despite this, the project still experienced several cost and time overruns.** These overruns were caused by factors such as delays in obtaining permits and approvals, security concerns, unforeseen geological conditions, and shortages of skilled labor and equipment. Studies on select sample projects in Afghanistan have shown that neglecting risk assessment and analysis can lead to significant schedule and expense overruns, potentially resulting in project failure. Therefore, it is essential for construction businesses in Afghanistan to prioritize risk management planning to minimize the impact of unforeseen events and mitigate risks that could cause cost and time overruns. In conclusion, while Afghanistan's construction sector has made significant improvements in recent years, there is still a need for greater attention to risk assessment and analysis to ensure that projects are completed on time and within budget. It is crucial for construction businesses in Afghanistan to prioritize risk management planning to minimize the impact of unforeseen events and mitigate risks that could lead to project failure.

Keywords: Construction, Highway, Afghanistan, Neglecting

1. INTRODUCTION

The building business got its start in prehistoric times when people started making their own shelters, such huts, out of the local natural materials. The sector has changed tremendously since then, particularly in developed economies, but the fundamentals remain the same. Building continues to be the same as human beings employing the natural resources at their disposal to create things, such as private homes, public structures used for humanitarian purposes, or highways. (Painting-, 2017)The nation's economy heavily depends on the building sector. Infrastructure construction projects' consistency in terms of schedule, budget, and quality of the final result are frequently used to assess a nation's economic health. As stated by the U.S. More than $993 billion was spent on construction projects in 2014, according to the Census.

The second largest employment in India after agriculture is the construction industry, which employs more than 35 million people. (Mr. Salim S. Mulla, 2015,)Cement, steel, technology, talent development, and other related businesses are all impacted by any advancement in the construction sector. According to government figures, the industry is worth more than $126 billion.(H, 2016) Also, it represents more than 60% of all infrastructure spending. The

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infrastructure sector accounts for around half of demand, with the remainder being driven by the real estate market and other industrial pursuits. According to a research by DMG Events India, India presents enormous prospects in the building industry. According to the report, the Indian construction industry would expand by up to 8% annually for the next ten years.

The construction sector is one of the many industries that any nation has to keep its economy expanding. For instance, we can say that many countries don't have specific industries like car manufacturing, rocket manufacturing, shipping, and many more, but we can't say that a country doesn't have Construction industry to some extent. (Zidanea, 2015)This is due to the unique nature of the construction industry compared to other industries. Although it is conceivable and usual to import construction tools or raw materials, it is not possible to import finished products such as buildings, roads, tunnels, or other construction materials. This stresses the significance of the construction sector.

1.1 Definition to Risk

As far as we are aware, the size and complexity of a project have an impact on how many risks and uncertainties exist during the building process. (Azis, 2013)According to a study, the construction business has the greatest amount of risk and uncertainty. The primary cause of this is the complexity of the processes, environments, and organizational structures involved in the construction industry. There are several dangerous dangers associated with highway building activities. The involvement of several parties, including the design department team, construction contractors, subcontractors, and employees, results in these hazards.

Highway project risks will prevent the anticipated project goals from being realized.(Nabil Al-Hazim, 2017) The risk that is inherent in highway construction can have negative effects such delays, cost overruns, and decreased resource availability.

Risk assessment is carried out for highway construction projects in order to minimize negative effects at the design or planning stage, to rank risks and preventive measures, to maintain project cost and quality, and to ensure project completion on time.

1.2 Objective of the Study

- To identify risk factors causing failure or time and cost overrun in highway Construction Industry
- To analyze their order of significance, level of severity on project objectives refer to any party involved in the project. (Client, consultant, contractor, external factors) and rank the factors

2. REVIEW OF LITREATURE

Mohammad.f.Daib, Khalid Naser 2015 He assesses and analyses various risk factors in US highway construction projects. (Adnan Enshassi, 2009)In his research on the risk assessment method, he demonstrated how about 31 risk drivers were discovered and analyses based on historical data were used to evaluate the risk effect on project interim of cost and schedule

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performance time on the motorway building project. Fisher exact test and the square probability test were used to conduct this research investigation.

Remonfayek Aziz 2014 In his study, he demonstrated the worst effects of disregarding risk management in construction projects. Statistic analysis revealed that, in the UK, almost 30% of construction work—or 3,6% of the total project cost—has been redone as a result of inadequate risk management, translating to 36% of highway projects in Australia.

PatelKashanRajiv Bhatt 2017 Critical risk variables for building construction projects have been identified, and a thorough risk management methodology that includes risk identification, risk categorization, risk assessment, and risk response has been provided. (Shabbab Al Hammadi, 2016)They also provided information on the fundamentals of risk management and the advantages that may be attained by applying risk management approaches to construction projects, not just building projects but to all types of construction projects.

M. EL Sayegh Mohammad Mansoor 2015 He shown in his study that there are 23 risk variables connected to the construction of a motorway in the United Arab Emirates(Salim S. Mulla, 2015). He analyses all the risk factors and classifies them using the RII Method.

AwedShanna 2015 She concentrated on outlining the danger signs of improper funding for highway development projects. (Wa'elAlaghbari, 2007)Nine misallocation criteria were evaluated as part of her research study, which was created to identify the greatest risk of misallocation in projects involving the construction of highways as well as to offer recommendations on how to allocate these risks.

YogitaHonora 2016 In his research, he demonstrated the many causes of infrastructure projects. He also performed an analysis of the risks caused by those causes, ranking them according to the frequency, severity, and importance of those risks. (Ahmed Senouciaand AlaaIsmailb, 2016)52 delay variables were examined, including those connected to the contractor, consultant, and external environment.

Ankit Vishwakarma-2016.36 risk indicators were found in their study on the risk assessment in the building of highway projects, and those components were then analysed and ranked using the refractive relevance index (RII) based on a questionnaire survey to determine the 10 most important risk factors.

Hariharan .S et al-2012 concluded their researches on Indian infrastructure projects to find the relation between time and cost overrun in Construction projects. They stated that there is a strong correlation between time and cost overrun and the driver of time and cost overrun are not the same. (AftabHameedMemon, s-2012.)While time overrun is attributed to scope change, delay in finalization of tender document and short bid submission time, lack of commitment of project participants, poor coordination, etc. Cost overrun is attributed to variation between quantities estimated and actually executed.

John EbhohimenIdiake et al-2015 In Abuja, Nigeria, he performed a survey on the link between time and cost in private buildings, and the results showed that time spent on building projects is acknowledged as one of the benchmarks used to gauge project performance and

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project organisation effectiveness. (Sawant, 2012)Both the customer and the contractor want the construction project to be finished on time since delays in completion usually result in increased costs and lost opportunities for revenue for both parties.

3. RESEARCH METHODOLOGY

3.1 Research Design

Designing a research study involves creating a strategy that will direct the collecting and analysis of the data. Research design is the organization or plan of a scientific inquiry.

3.2 Population

The population of this study which measures and analyses risk that results in time and cost overruns in building projects in Afghanistan is made up of construction enterprises that are legally registered with the Afghan government, consultants, and clients.

3.3 Sampling and Size

The Sample Size of the Study was 40 clients and Consultants

3.4 Research Location

Research was carried out across Afghanistan due to the nation's nearly uniform economic, political, geographical, and environmental features and the concentration of huge, large-scale construction companies in the capital (Kabul).

3.5 Source of Data and data collection

The majority of the data utilized in this study came from respondents to a questionnaire that was presented to them.

If secondary data is accessible through an open channel, it may be quickly and affordably acquired from users or sources other than users. These details are essential for choosing the primary subjects and assessing the literature review.

3.6 Tools used for Data analysis

In the Current Study we analyse the data thrown:

Analysis Of Variance (ANOVA): To determine if there is a significant difference in mean values across groups, analysis of variance (ANOVA) is employed. It evaluates whether the means of distinct groups are comparable or dissimilar. The variance is really compared rather than the means in this case since we are using ANOVA to determine whether or not the means differ across groups (hence the name is Analysis of Variance).

We are using ANOVA to compare how the three groups in our study—client, contract, and consultant—perceive the means of the various variables.

There are three different forms of ANOVA: one-way, two-way, and n-way. We are using one way ANOVA to analyse the data since we are only looking at one component at a time.

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(T-TEST): The T-test is employed to determine whether or not the means of two groups are statistically different from one another. In contrast to ANOVA, which compared the means of more than three groups or distinct groups, this analysis is used whenever we wish to compare the means of two groups.

4. CASE STUDY

Project Name – Construction of Kabul tank logger 7km highway

The project experienced significant cost and time overruns. The cost overrun for this project was reported to be 688021538, which is a considerable increase in the project's initial estimated cost. In addition to this, the project also suffered from a time overrun of 2 years, resulting in significant delays in the project's completion. Cost and time overruns can have a severe impact on any project, and this project is no exception. It can lead to increased expenses, reduced project efficiency, and lower quality outcomes. These overruns can be caused by several factors, such as unexpected changes in design, labor disputes, weather conditions, or even inadequate project planning and management.

To mitigate these issues in the future, it is essential to have a robust project management plan in place that addresses all potential risks and uncertainties. This plan should include realistic cost and time estimates, a clear project timeline, and contingency plans for any potential issues that may arise during the project's execution. Overall, it is essential to take this cost and time overruns seriously and works towards preventing them in future projects. By doing so, we can ensure that projects are completed on time, within budget, and to the expected quality standards.

Risk Assessment

Before the project's commencement, a risk assessment was conducted to identify potential risks and develop a risk management plan. The risks identified included:

- Political instability and security risks in the area where the highway was to be constructed.
- Geographical and environmental risks such as landslides, floods, and earthquakes.
- Availability of materials, equipment, and skilled labor in the region.
- Technical risks, such as changes in design and construction methods.

Risk Analysis

The identified risks were analyzed to determine the likelihood of occurrence and their potential impact on the project. Based on the analysis, the following risk response strategies were developed

- Political instability and security risks - The project team worked closely with the government and security agencies to ensure the safety of workers and equipment. The

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project was also divided into smaller phases to minimize the impact of any potential security incidents.

- Geographical and environmental risks - The project team conducted detailed environmental and geological studies to identify potential hazards and design appropriate mitigation measures. The team also developed contingency plans to address any unforeseen events.
- Availability of materials, equipment, and skilled labor - The project team worked with local suppliers and contractors to ensure the availability of resources. They also provided training programs to improve the skills of the local workforce.
- Technical risks - The project team established a robust change management process to ensure that any changes to the project's design or construction methods were thoroughly assessed before implementation.

Results

Despite the risk management plan, the project still experienced several cost and time overruns due to various reasons, including:

- Delays in obtaining necessary permits and approvals from the government and other regulatory agencies.
- Difficulties in accessing the construction site due to security concerns and poor road conditions.
- Unforeseen geological conditions, such as unstable soil and rock formations, which required additional excavation and stabilization measures.
- Shortages of skilled labor and equipment, resulting in delays in construction.

4. RESULT AND DISCUSSION

4.1 General Characteristics of the Respondents

The following figures show the respondent's characteristics, such as gender, age, job status, relevant work experience, and educational background.

4.1.1 Gender of the respondents

Table 1: Respondents gender information

Gender	Frequency	Percentage
Male	**30**	**75**
Female	**10**	**25**

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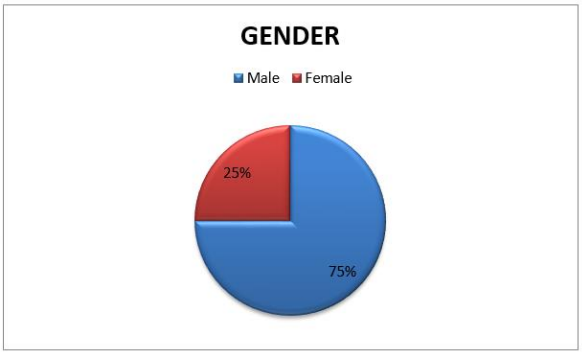
Figure 1: Respondents gender information



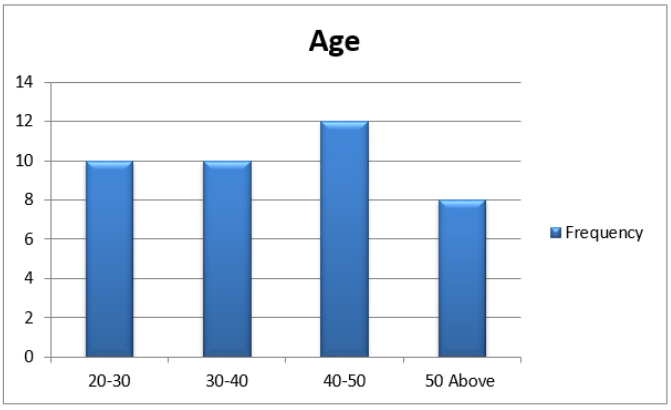
According to the graph, 10 respondents are female, making up 25% of the overall number of respondents, while 30 respondents are male, making up 75% of the total number of respondents to the questionnaire.

4.1.2 Age of the respondents

Table 2: Respondent age (year)

Age	Frequency	Percentage
20-30	**10**	**4**
30-40	**10**	**4**
40-50	**12**	**4.8**
50 Above	**8**	**3.2**

Figure 2: Respondent age (year)



According to the above graph, 10 of the respondents, or 25% of all respondents, were between the ages of 20 and 30 years, and 10 respondents, or 25% of all respondents, were between the ages of 30 and 40 years. Twelve respondents or 30% of all respondents between the ages of 40 and 50, followed by eight more respondents, or 3.2% of all respondents above the age of 50.

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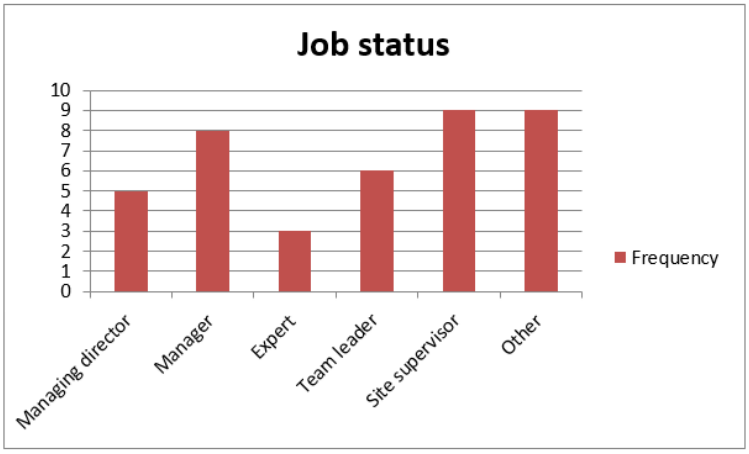
4.1.3 Job status or positions of the respondents

Table 3: Respondents' job status in their organizations

Variables	Frequency	Percentage
Managing director	**05**	**2**
Manager	**08**	**3.2**
Expert	**03**	**1.2**
Team leader	**06**	**2.4**
Site supervisor	**09**	**3.6**
Other	**09**	**3.6**

Figure 3: Respondents' job status in their organizations



This statistic shows that respondents are in a variety of positions in our survey. Of the total respondents, 5 are managing directors, which represents 2% of the total, 8 are managers, which represents 3.2% of the total, 3 are construction experts, which represents 10% of the total, 6 are team leaders, which represents 2.4% of the total, and 6 are site supervisors, which represents 3.6% of the total.

4.1.4 Respondents relevant working experience (year)

Table 4: Respondents' job status in their organizations

Variables	Frequency	Percentage
1 to 5	**10**	**4**
5 to 10	**09**	**3.6**
10 to 15	**09**	**3.6**
15 above	**12**	**4.8**

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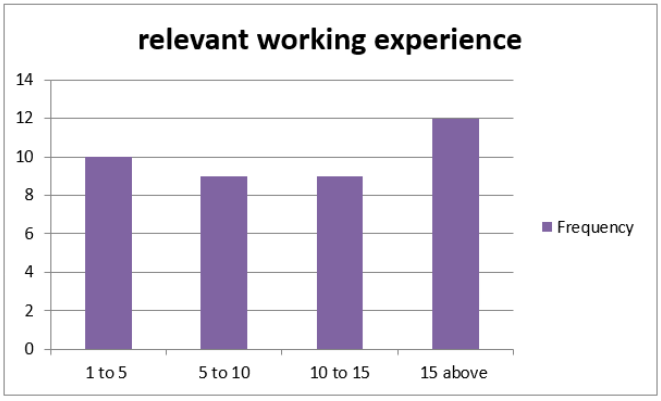
Figure 4: Respondents' job status in their organizations



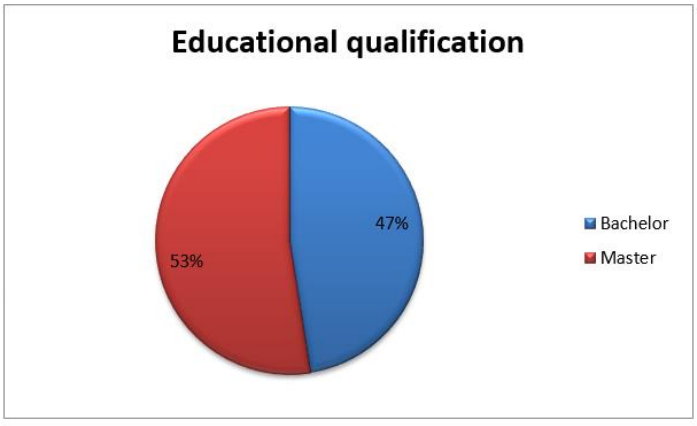
This graph depicts respondents' working experience in the field of construction as of the current year. It reveals that 10 respondents have experience in the field of construction between 1 and 5 years, making up 4% of the total respondents in this survey, 9 respondents have experience in the field of construction between 5 and 10 years, making up 3.6% of the total respondents, 9 respondents have experience in the field of construction between 10 and 15 years, making up 4.8% of the total respond

4.1.5 Respondent's educational qualification

Table 5: Respondents' educational qualification

Variables	Frequency	Percentage
Bachelor	**19**	**7.6**
Master	**21**	**8.4**

Figure 5: Respondents' educational qualification



While we inquired about different levels of education, the replies from the respondents show that they have Bachelor's and Master's degrees in education. According to the following graph, 7.6% of respondents, or 19 respondents, have a bachelor's degree, and 7.6% of respondents, or

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21 respondents, have a master's degree.

Causes of time and cost overrun								
One way Analysis Of Variances (ANOVA)								
No	**Factors**	**Comparison**	**SS_{bt}**	**df**	**MS_{bt}**	**F**	**p-valu**	**Result**
1	Security condition of the Construction areas	Btw groups	1.81	2	0.88	1.24	0.341	Not significant
2	Administrative corruption and Bureaucracy	Btw groups	0.305	2	0.02	0.03	0.981	Not significant
3	Delay in progress payments by client	Btw groups	0.50	2	0.31	0.34	0.729	Not significant
4	**Frequent change order by client during construction phase**	**Btw groups**	**4.07**	**2**	**2.05**	**2.100**	**0.07**	**Significant**
5	Late approval of material and Construction related documents	Btw groups	1.82	2	0.95	1.11	0.353	Not significant

The table presents the comparison of the between-groups sum of squares (SSbt), degrees of freedom (df), mean square (MSbt), F-value, and p-value for each factor. The F-value indicates the significance of the factor, and the p-value determines whether the factor is significant or not.

Based on the table, it can be concluded that the factors of security condition of the construction areas, administrative corruption and bureaucracy, and delay in progress payments by the client are not significant in causing time and cost overruns in construction projects. On the other hand, the factor of frequent change orders by the client during the construction phase is significant in causing time and cost overruns in construction projects, with a p-value of 0.07, which is close to the significance level of 0.05.

T-test with two samples of different variances									
No	**Variables**	**Groups**	**Pair**	**Mean diff**	**df**	**t-statistic**	**t-critical**	**p-valu**	**Sig.**
Causes of time and cost overrun									
4	Frequent change order by client during construction phase	A-B	1	0.77	18	2.045	1.735	0.056	**Significant**
		A-C	2	0.49	20	2.132	1.730	0.048	**Significant**
		B-C	3	-0.32	9	-1.00	1.835	0.345	Not-Signi
41	Lack of timely decision	A-B	1	0.82	17	2.265	1.740	0.039	**Significant**
		A-C	2	0.01	16	-0.1426	1.749	0.889	Not-Signi
		B-C	3	-0.82	18	-1.960	1.736	0.069	**Significant**

The table shows the pair numbers, mean difference, degrees of freedom (df), t-statistic, t-critical value, p-value, and significance level for each pair of groups. The t-statistic represents the difference between the sample means in terms of standard error units, and the t-critical

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value is the value of t that corresponds to a particular significance level and degrees of freedom.

Based on the table, it can be concluded that frequent change orders by the client during the construction phase is a significant cause of time and cost overruns in construction projects for pairs A-B and A-C, with p-values of 0.056 and 0.048, respectively. However, for the B-C pair, the difference is not significant, with a p-value of 0.345.

Similarly, lack of timely decision is a significant cause of time and cost overruns in construction projects for pairs A-B and B-C, with p-values of 0.039 and 0.069, respectively. However, for the A-C pair, the difference is not significant, with a p-value of 0.889.

5. CONCLUSION

The overall result and conclusion of this research work is that the majority of the road Construction project in (M.KUMARASWAMY-., 1995,)Afghanistan has experienced schedule delay and cost overrun. Despite there is no survey conducted to show the number of affected projects by overruns, still there are a large number of Construction projects affected by schedule delay from few months to more than 10 years and from a small amount of budget to more than 350 USD Million in a single project have experienced cost overrun in different part of the country. **Risk assessment and analysis are essential tools for managing construction projects, especially in high-risk environments such as Afghanistan. However, even with a comprehensive risk management plan, unforeseen events can still occur, resulting in cost and time overruns. Project teams must be proactive in identifying and addressing potential risks to minimize their impact on the project's schedule and budget.**

References

1. Ghulam Abbas Niaziaand Noel Painting-2017. Significant Factors Causing Cost Overruns in the Construction Industry in Afghanistan. (7th International Conference on Engineering, Project, and Production Management, Procedia Engineering 182 (2017) 510 – 517)
2. Mr. Salim S. Mulla, Prof. Ashish P. Waghmare-2015. A Study of Factors Caused for Time & Cost Overruns in Construction Project & their Remedial Measures. (ISSN : 2248-9622, Vol. 5, Issue 1, (Part -6) January 2015, pp.48-53)
3. Anant Narayan Shete, VaibhavDurwas Kothawade-2016.An Analysis of Cost Overrns and Time Overruns of Construction Projects in India. (International Journal of Engineering Trends and Technology (IJETT) – Volume-41 Number-1 - November 2016)
4. Prof. Pankaj P. Bhangale Head of Civil Department, S.S.G.B. C.O.E.T. Bhusawal, Maharashtra, India-2016. Analysis Of Time And Cost Overrun To Key Success Of High-Rise Commercial Building Projects.(International Journal of Civil Engineering and Technology (IJCIET) Volume 7, Issue 4, July-August 2016, pp. 400–405 Article ID: IJCIET_07_04_035.
5. Youcef J-T. Zidanea, AgnarJohansenb, BjørnAndersena, Erfan Hoseinia-2015.Time-thieves and bottlenecks in the Norwegian construction projects. (8th Nordic Conference on Construction Economics and Organization Procedia Economics and Finance 21 (2015) 486 – 493).
6. Ade Asmi Abdul Azis, AftabHameedMemon, Ismail Abdul Rahman and Ahmad TarmiziAbd. KarimUniversitas Bakrie, Indonesia- 2013. Controlling Cost Overrun Factors in Construction Projects in

ISSN 1533-9211

DOI 10.17605/OSF.IO/TSNZJ

Malaysia. (Research Journal of Applied Sciences, Engineering and Technology (2621-2629, 2013, ISSN: 2040-7459; e-ISSN: 2040-7467).

7. Nabil Al-Hazim, Zaydoun Abu Salem, Hesham Ahmad-2017. Delay and Cost Overrun in Infrastructure Projects in Jordan. (7th International Conference on Engineering, Project, and Production Management,Procedia Engineering 182 (2017) 18 – 24).
8. Adnan Enshassi, Jomah Al-Najjar and Mohan Kumaraswamy-2009. Delays and cost overruns in the construction projects in the Gaza Strip. (Journal of Financial Management ofProperty and Construction Vol. 14 No. 2, 2009 pp. 126-151)
9. Shabbab Al Hammadi, M. Sadique Nawab-2016. Study of Delay Factors in Construction Projects. (International Advanced Research Journal in Science, Engineering and Technology Vol. 3, Issue 4, April 2016)
10. Salim S. Mulla, Ashish P. Waghmare-2015. Influencing Factors caused for Time & Cost Overruns in Construction Projects in Pune-India & their Remedies. (IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 2 Issue 10, October 2015, ISSN 2348 – 7968)
11. Wa'elAlaghbari, Mohd. Razali A. Kadir, AzizahSalim and Ernawati-2007. The significant factors causing delay of building construction projects in Malaysia. (Engineering, Construction and Architectural Management Vol. 14 No. 2, 2007 pp. 192-206)
12. Ahmed SenouciaandAlaaIsmailb, Neil Eldina-2016. Time Delay and Cost Overrun in Qatari Public Construction Projects. (Creative Construction Conference 2016, CCC 2016, 25-28 June 2016, Procedia Engineering 164 (2016) 368 – 375)
13. AftabHameedMemon, Ismail Abdul Rahman and Ade Asmi Abdul Azis-2012. Time and Cost Perfomance in Costruction Projects in Southern and Cenrtal Regions of Penisular Malaysia. (International Journal of Advances in Applied Sciences (IJAAS) Vol.1, No.1, March 2012, pp. 45~52 ISSN: 2252-8814)
14. Hariharan.S and P.H Sawant-2012. Analysis of relationship between time and cost overrun in some infrastructure projects (NICMAR-Journal of Construction management, VolXXVII, No 2&3 Apr-June & Jul-Sep 2012)
15. Daniel W.M. Chan and Mohan M.Kumaraswamy-1995, A study of factors affecting construction duration in Hong Kong (Construction management and economic 13, 319-333)- Department of Civil and structure engineering the university of Hong Kong.