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Analyzing the Performance of Mega Construction Projects in Oman: A Study of Selected Projects from Oil & Gas Sector

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Abstract
This study investigates Omani O&G project's performance and analyzes the most common time and cost overrun causes. In addition, the effects of delays are examined further along with the key enablers for efficient project delivery. This study adopts a mix method of research to improve the level of credibility of the study. A sample of 160 respondents is employed following both quantitative and qualitative method where a well-structured questionnaire was used for interviews with the concerned personnel. Following the quantitative method, this study revealed that 8% of the respondents, says the projects have completed ON time where the response rate was 80%. Besides, the qualitative part backed up this data as most of them have experienced delay of 3 months to 2 years of delay. For cost, 3% of the respondents have experienced projects finishing ON budget and the interviewees have expressed that the average cost overrun is between 10%-30%. In terms of time overrun group factors, the top group time-overrun factors among all the three parties are management factors, where it is ranked first by all stakeholders. The sub-group factor that affects more is the project planning and control. Poor understanding of scope of work during tendering factor is ranked first with main contractor and second with both the client and engineering firms. This factor is most factors that has similar ranking between all. As matter of fact is the only factor that exists between in the top 10 among all stakeholders. This study claimed that understanding the scope of work of the project properly and giving its time to be grasped by the contractors is one of the key solutions to tackle the top factor of this research. Also, the SOW must be detailed as possible to avoid any conflict between the parties, one of the recommended details to have WBS included.

Keywords: Mega Construction Projects, Oil & Gas Sector, Delay, Management Factors, Overrun Group Factors, Oman.

1. Introduction

Since Oman is a developing country like any other neighboring country, many projects are in progress and many of them are yet to go underway. It also struggles with same phenomenon of overruns. Mega Construction Projects in Oman of public and private sectors suffer from time & cost Overrun. Oyegoke et al. (2017) listed five important projects that didn't complete on the agreed date. One of them has a delay as many as over six years. In a case study conducted by (Alnuaimi & Almohsin, 2013)in Construction Projects, the delay was around 59% in 2007-2008 period and 42 % in 2009-2010.And for the years after 2011 till 2014, in 40 construction public projects, 38% of them suffered an over run in schedule (Ruqaishi & Bashir, 2014**).** For the oil and gas projects in Oman, there is no formal record found indicating the performance of such projects, however, based on the following, the researcher is safe to say that there is significant time and budget overrun in O&G projects as well.

Furthermore, there are four levels of project being successful according to: level one is achieving the basic triangle of Project management (Time, Budget, Quality and Scope) asking the question: Has the project met these targets. Second level has to do with aftermath of the project, has it been a bad experience for stakeholders (project team, client and others)? Has there been many conflicts within, and has project resources been utilized properly? If the answer is no, according to the author even if the project met its level one targets, this might not be considered as successful one.

End user satisfaction is the third level. The project has to solve the original problem to per customer needs otherwise it would be a failure, the following question must be answered: was the completed product is really the one the end user want? The last and not the least level is the organizational improvement according to the author. Have the lessons learnt been captured and maintained properly in order to be used for future projects? Will the same mistakes be repeated?

1.1 Research Objectives

- To identify the factors contributing to delay in mega construction projects in O&G sector.
- To identify consequences of delay in mega construction projects in O&G sector.
- To investigate the Factors causing delay in mega construction projects in O&G sector.
- To assess consequences of delay in mega construction projects in O&G sector.
- To develop the practical frameworks of improving project performance in construction industries in Oman.

2. Literature Review

2.1 Project Success and Performance

Scholars and experts in project management have not reached on one agreement on what a project success is (Chan et al., 2004; Lientz and Rea, 1995). A.Ika (2009) and Lientz & Rea (1995) have pointed out the concept of project success a quite ambiguous and vague. McCoy (1996) claimed that it is important that to identify the "criteria" on which to consider a project is successful or not. De Wit (1988) also claimed that "success criteria" has to do with Project success while "*success factors*" is dealt with the project management success. Cook-Davies (2002) defined Success criteria are those "*measures"* that the success of a project is "*judged*" against whereas **success factors** as "*those inputs to the management system that lead directly or indirectly to the success of the project or business*".

In one of project management Journals, by (A.IKa, 2009)**,** where he reviewed articles between 1986-2004, one of the findings had been that the term "Project Success" has been used to mean more than just "iron triangle" . Project success has involved many other factors like the client satisfaction with other stakeholders (just like what Gary (R.Heerkens, 2002)said. In addition, the author argued that it is not necessary if a project failed in terms of time and cost, to be considered as failure. He mentioned an example of Sydney Opera house where it miserably failed its basic targets of time and cost. However, this project has turned out to be one of the best projects in Australia and attracts many tourists every year. IKA (2009) has drawn distinction between Project Management Success and Project Success, where he considered PMS is all about the Iron triangle while PS as the more comprehensive meaning which covers more than the iron triangle.

2.2 Overall time and cost factors for Oil and Gas

The average delay in oil and gas projects ranges from 5-20% (Salama, et al., 2008), however it is been found that the average of delay in some Iranian petrochemical plants were around 63% of the planned (Naimi, et al., 2008) and only four projects have been completed on time out of thirty four projects, and that is huge. In terms of budget, it has been found that average of cost overrun is 18% among 200 projects studied in oil and gas business (Rui, et al., 2016)**.**

Although it has been mentioned construction projects are all similar, the assumption is that the main causes of time overrun in oil and gas projects are different from the rest (Salama, et al., 2008). Moreover, It has been found that in Execution phase, the time slippage occurs more than other phase of the project (Salama, et al., 2008)and the construction phase out of the execution phase is the main concern in a project cycle (Pham & Hadikusumo, 2014).Also, according Independent project analysis (IPA) 2011 78% of Oil and Gas projects especially the upstream one suffered either from time or cost overrun (EY report in 2014, EYGM limited) and in the same report, it reveals that Middle east region has a more delay percentage than the mentioned above percentage. There is a real necessity to analyze the oil and gas project performance, one for the cliché that says time means money, second there has been limited studies. 64% of O&G Mega projects facing cost overrun and 73% in schedule in the world, where Middle East is the worst region in that department: 87% proportion of projects suffers from time overrun and 89% in cost (EY report in 2014).

2.3 Features of Mega projects in Oil and Gas

Oil and Gas Mega projects have similar features to other type of industries with perhaps additional uniqueness. O&G mega projects sites are more likely to be constructed on harsh extreme conditions and isolated areas and often there is more lack of competent resources for project delivery. Also, construction phase in these projects starts even before the design is completed (Chanmeka et al., 2012). In addition, interfaces in Mega O&G projects are huge and cannot be underestimated. The risks are even greater in those projects and must be sometimes managed by a higher level of authority than the project team (Jergeas, 2008). There is a high tendency that the O&G project will go over a few changes at early stage of its cycle till it settles down at later stage like execution phase. These changes may very well

affect the initial planned completion date and budget (Olniran et al., 2015; Loch, 2006; Love et al., 2014).Last feature but not the least in Mega O&G projects is the technology. It has reached a high level of advancement and sometimes such technology has not been tested yet. (Merrow, 2011).

2.4 Major factors of Budget performance

As the author is going through literature review, have found that most of the past researchers that analyzing the causes of time overrun associate cost overrun in the same context, and giving the results as an overall factor of both. It is no coincidence, as it is known that time and cost overruns are correlated as shown in the triangle of project management: Time, Cost, and Quality. Based on books and literature reviews, cost overrun, and time overrun are correlated. Studies by Flyvbjerg, Holm and Buhl (2004) done on large projects revealed that when an execution phase of project delayed by one year the cost overrun increases by approximate 4.64 %.

Moreover, studies like (Sambasivan & Soon, 2006)**,** (Motaleb & kishk, 2010)and (Memon, et al., 2011) where they studied effects of delays, they found that the top two effects are: time overrun and cost overrun. This suggests highly of correlation between time and cost overrun. In other words, the moment a project is delayed, the budget of the projects increases.

2.5 Cost overrun in Oil and gas Projects

It has been found that average of cost overrun is 18% among 200 projects studied in oil and gas business (Rui, et al., 2016)**.** In developing countries like Iran, in gas projects, (Vafaiee, et al., 2010) found that the cost overrun reached up to 20%.A more scary stats, Earlier report cited in paper of(Olaniran, et al., 2015)from Mackenzie, 2011 the average cost over in Mega oil and gas project in Europe around 91% and in Asia 92%. These projects has an average of 2000 M USD a project in Europe and 1400 11000 MUSD in Asia.

Things have not improved much over the years, EY report in 2014 revealed that 64% of O&G Mega projects faced cost overrun in the world, where middle east is the worst region in that department: **89**% proportion of projects suffer from cost overrun. This also backs up the claim by (Zadjali, et al., 2014) that cost overrun in developing countries is more severe and worse.

2.6 Success factors or key enablers details

Sambasivan and Soon (2006) have classified the success factors as per the stakeholder, client, owner, main contractor and consultant in Malaysian construction sector. For the client, the authors recommend avoiding the contract to the lowest bidder, but rather, the contractor who could show "*sufficient experience, technical capability, financial capability, and sufficient manpower to execute the project*". The second recommendation for the client is reduce the major changes in design especially during construction. Such action leads usually to put the progress of work on hold till the new change is implemented. The third recommendation is that client should have enough fund and cash flow in order to make the progress payments to contractors on time, so that the contractor is able to procure the needed material and equipment to finish the construction project.

As for the main contractor, (Sambasivan & Soon, 2006)have recommended the contractor not to take the construction contract from the beginning if they don't have enough experience teams to execute the project. One of those professionals that an experience is a must to have is the construction managers. The last not the last recommendation for the main contractor, is the same of the client's one: enough funding. The main construction contractor shall have enough cash flow during the all cycles of the project to make sure, not to delay progress because of money. Sambasivan and Soon (2006) urged the consultant to approve the necessary drawings and documents on timely manner and they should have close supervision on the work done to ensure consistency with drawings and standards.

2.7 Engineering Factors

Engineering factors has been part of the major factors of time and budget overrun in many of the past studies; it includes the specification, drawings, design etc. These articles are, not limited to: A. Assaf and Al-Hejji (2005) found "Late in reviewing and approving design documents by owner" as the top 2 factor causing time overrun. Doloi et al. (2011) found 2nd top factor "non-availability of drawing/design on time". Le-Hoai et al. (2008) found "design changes" one of the top five ranked. Hwang et al. (2012) found third top factor contributing a delay is "design changes by owners". Alnuaimi and Almohsin (2013) "change in initial design" is third important factor in commercial buildings in Oman. Some more recent papers are (Jarkas & Younes, 2014) found "frequent change/variation orders issued by the employer and lack of coordination among design disciplines" are the top third and fourth respectively (Elawi et al., 2015)."Redesigning-line services" is the second top factor in Mecca construction projects. Kalkkani and Malek (2016) found 2nd top factor in Indian projects are "Drawing revision and clearances from consultant/client/PMC".

Thus, as it is seen design issues are one of the main factors contributing to an expansion of the completion date of a project and could cause a cost overrun. The researcher suggested to reclassify the heading of all related to design and technical issues to be an Engineering Factor.

The following a framework of Design errors effects based on the discussed literature review above:

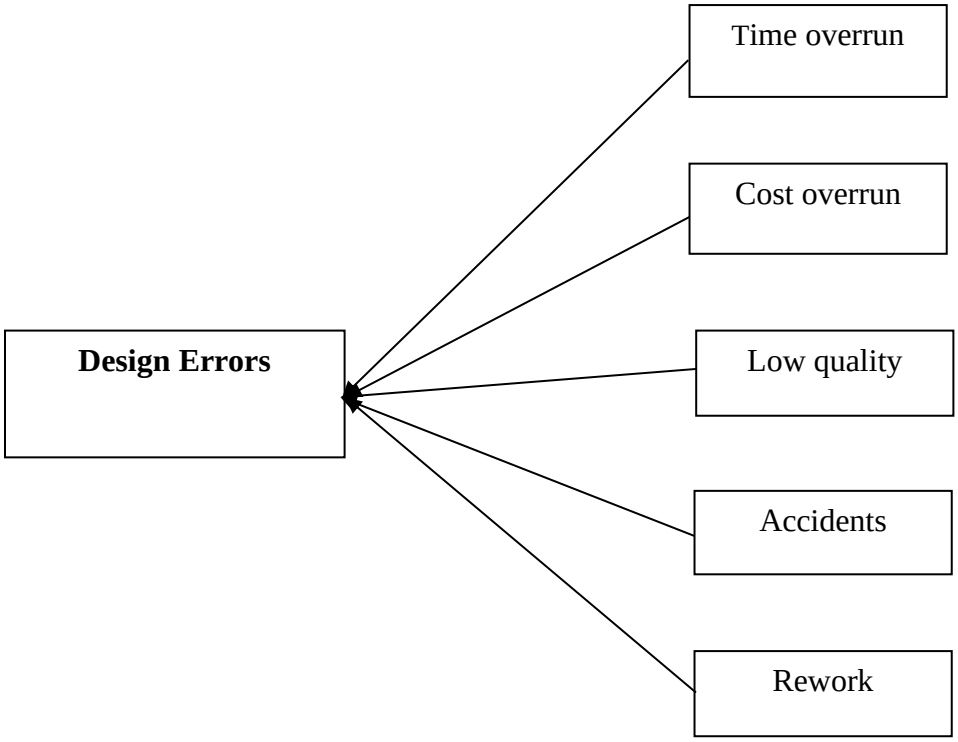

Figure 1. Framework of Design Errors

2.8 Finance Factors

In transition from engineering factors to Finance ones, the first topic can be discussed further are the claims. As seen from last section in the literature review, change or variation order is mainly causes by changes in design, and although most of these changes are not desired to be at that time of the project cycle, owners is obligated to implement them for sake of completing the project in quality and timely manner. Moreover, typically these changes are agreed by all parties especially between the owner and the main construction contractor afterwards, officially. Also, it is seen from the past section that one of the effects of Variation order is claims. Explicitly found in (Ali S. Alnuaimi, et al., 2010)finding when they collected their data, claims were the second top effect of change order after the effect of time overrun of the project. Also, in (DESAI, et al., 2015), it has been mentioned that claims is mainly originated from variation orders, and it is one their main outcome. Moreover, Claims has been found as one of the main factors of projects delays and cost overrun, these articles are, not limited to (Alnuaimi & Almohsin, 2013; Memon et al., 2011). There are many types of claims, which will be discussed shortly, however it is needed to highlight that in oil and gas industry, the word "claims" which is often by the main contractor, is often known as those requested payments that were not originally fully agreed by the owner.

2.9 External Factors

External factors have been listed in the past studies, among the potential causes that could affect the project performance in terms of time and cost. A comprehensive agreement among all scholars and researchers that the external factors are unfamiliarity & changes with local laws, construction permits, social & cultural and weather conditions. Those studies are, not limited to, (A.Assaf & Al-Hejji, 2005),(Doloi, et al., 2011), (Jarkas et al, 2014), (Sambasivan & Soon, 2006)and (Frimpong, et al., 2002). In more particular articles, the external factors has been ranked first in the overall top causes of time overrun for example (Alnuaimi & Almohsin, 2013)when they have done their study on the first period2007-08, weather conditions was ranked first factor contributing to delays of the

commercial buildings. A more recent paper By (Alamri & Amoudi, 2017) where they have studies the DAMs Projects in Oman, their finding revealed that "*severe weather conditions*" is also the top causes of time overrun for those projects. Another external factor which has to do with the laws and permits, (Elawi, et al., 2015) found "*Land acquisition*" is the first ranked cause that contributes to delay the completion date of project in Mecca-Saudi Arabia.

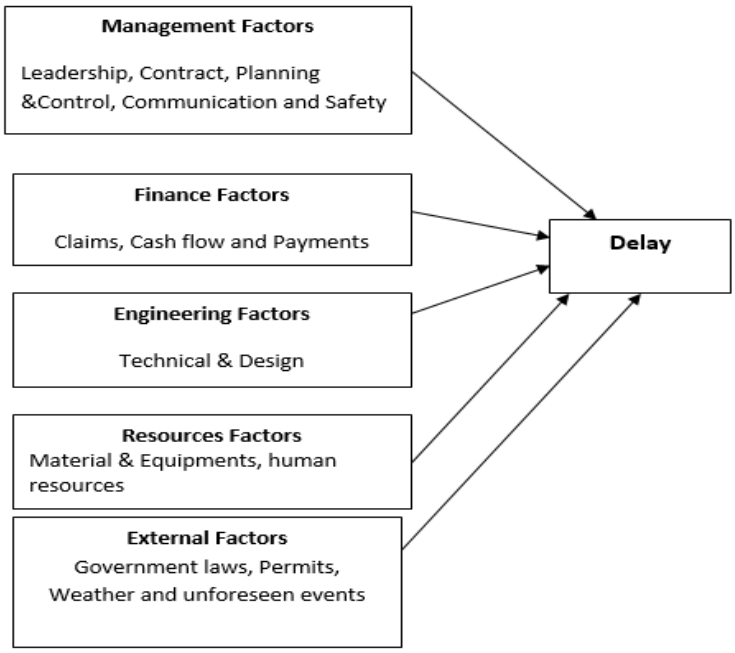

Figure 2. The Framework of the Study

3. Methodology

This study adopts a mix method of research to improve the level of credibility of the study. A sample of 160 respondents is employed following both quantitative and qualitative method where a well-structured questionnaire was used for interviews with the concerned personnel. The questionnaires were a normal word document paper given to respondents by hands, while some others by emails. The target population includes high experience key personnel in the project delivery like construction manager, project manager procurement manager, and engineering managers. Convenience sampling technique was applied in this study. Pilot study was completed before conducting the main survey among 15 samples that were excluded from the final survey then. The English version of questionnaire was translated from English to local language by a native language expert.

3.1 Instrumentation

For collecting the qualitative data, we used some interview questions which are *"What is the current performance of mega projects in O&G sector", "What are the major causes of mega projects failing to meets its target of schedule and budget?", "What are the consequences of construction Delays in Mega Projects in O&G sector?", "What are the major causes of mega projects failing to meets its target of schedule and budget?", and "What are the key enablers of successful performance in Mega projects?* Semi-Structured Interviews have been conducted as second method for this study. For collecting the quantitative data, five Likert Scale was employed which range from "Not important to=1" to "Very important=5" and "Never=1" to "always=5" which was administered by the researchers. The SPSS Version 23 was used to analyze the quantitative data.

4. Findings

4.1 Respondents' characteristics

Table 1. Respondents' characteristics

	Population	Percentage	Required Sample Size	**Responses collected**	Percentage
Client	214	52%	103	75	73%
Engineering	102	25%	50	44	88%
Main Construction Contractor	94	23%	46	41	89%
Total	**410**	**100%**	**199**	**160**	**80%**

The total respondents were 177, but there are invalid number surveys were 17. Therefore, the complete questionnaires were **160** which represents **80**% response rate.

4.2 Respondents profiles

Table 2. Gender

	Frequency	Percent
Male	154	96.3
Female	6	3.7
Total	160	100

Table 3. Education

	Frequency	Percent
Diploma	13	8.1
Bachelor	111	69.4
Master	34	21.3
Doctorate (PhD)	2	1.2
Total	160	100

Table 4. Work Experience

	Frequency	Percent
Less than 5 Years	18	11.3
between 5 and 10 Years	31	19.3
between 10 and 15 Years	39	24.3
between 15 and 20 Years	28	17.5
between 20 and 25 Years	26	16.3
between 25 and 30 Years	10	6.3
More than 30 Years	8	5
Total	160	100

As seen from the above tables 4.4 around **70%** perctange of the repsondets are having more than 10 years of experince. This gives a good wieght to the found resutls. In addtions, repsondets who posses projects experince for more than 20 years, they resrpesnt aorund **28 % which is almost thrid.**

Table 5. Frequency Distribution of respondents

	Frequency	Percent
Project Manager	25	15.6
Project Engineer	18	11.3
Construction Manager	11	6.9
Contract Engineer	11	6.9
Engineering Manager	8	5.0
Planner	16	10.0
Procurement Manager	4	2.5
Discipline Enginner	67	41.8
Total	160	100.0

In iterms of positions, 25 of the respsondets are project managers who are the focal point of the project itself. They look into it as holistic veiw which gives the advantage of seeing everyhting, meaning, isssues and key enablers. The higher percentage of the respondents were discipline engineers, that Electrical, Instrument, Mehcnical, commissioning, operation and others from all stackholders.

4.3 Project Performance

Table 6. Project Performance

period	count	percent
1 month	8	18.2%
2 months	4	9.1%
3 months	7	15.9%
4 months	5	11.4%
5 months	3	6.8%
6 months	15	34.1%
8 months	2	4.5%
total	44	100.0%

period	count	percent
1 year	17	51.5%
2 years	8	24.2%
3 years	6	18.2%
4 years	1	3.0%
5 years	1	3.0%
total	33	100.0%

Table 7. Project variation

period	count	percent
10% or less	34	48.6%
11% - 20%	19	27.1%
21% - 30%	10	14.3%
31% - 40%	4	5.7%
41% - 50%	1	1.4%
51% - 60%	1	1.4%
71% - 80%	1	1.4%
total	70	100.0%

4.4 Completed

Table 8. Project completion

period	count	percent
completed	12	92.3%
On time	1	7.7%
total	13	100.0%

The following section will answer the first question of research:

- *What is the current performance of mega projects in O&G sector?*

The tables above show the performance of projects in terms of time and were derived from the responses of the questionnaires. The question was in the project profile section: "*how much time overruns this project suffers*". The possible answers were in months, years or in percentage.

4.*5 Months and years*

As shown in the table, there is **42** project respondents suffered delay from **6 months** and below and 2 projects within 8 months. The delay affected 17 respondents within **12 months** behind the overall project schedule that is almost **11%** of the sample. There are 14 projects couldn't complete on time, and instead, they were delayed by 2-3 years. In other words, **9%** of Mega oil and gas projects participants in Oman suffer a time overrun **of 2 to 3 years.** Even worse, there were two projects that experienced a delay of 4 and 5 years respectively. Although one seems to be a low number, however it is absurd to think that a project can exceed its planned target of schedule by 4 or 5 years**.**

4.6 Completed on time

A total of **13** projects have been indicated to be completed within agreed schedule. So, only **8%** participants in O&G projects in Oman have been successfully completed on time. In other words, there are **92%** of participants have experienced project delay of different periods. As mentioned earlier in this study, there was a report from EY Reports that indicated that Middle East has an average of delay in O&G projects of 87%.This study revealed that is somewhat aligned with worlds reports, and it is proven by the data collected from the questionnaires.

4.7 Cost

The performance of projects in terms of cost, which were derived from the responses of the questionnaires. The question was in the project profile section. "*How much cost overrun this project suffered*"? The possible answers were in percentage or USD. **38** of project respondents experienced a cost overrun of 10% or less and 15 of them experienced between 11– 20 %. 19% of participants have found an average of cost overrun to be 21%-30% while **10.5 %** of them have seen an average cost overrun of 31-50%. 2 projects have suffered cost overrun of 51% - 60% and 71% - 80% respectively. There is one project that suffered from an over budget of 100%, and that is huge. In terms of million US dollars, there are **4** projects have different values of cost overrun, it ranges from **100-200**, and these values of runs is worth almost a new project at its own. There was one project where it was indicated to have saving when it is completed.

4.8 Ranking of time only for different stakeholder (top 10)

The following table answers part of the research question of

- *What are the major causes of mega projects failing to meet its target of schedule and budget?*

Table 9. Ranking of time overrun

	Main Construction Contractor			Client			Engineering		
order	no.	question	Mean	no.	question	Mean	no.	question	Mean
1	4	Poor understanding of scope of work during tendering (contractor)	4.68	17	Ineffective planning and scheduling by the main contractor	4.51	52	Shortage in material & equipment	4.11
2	48	Delay in start of purchasing long-lead items	4.64	4	Poor understanding of scope of work during tendering (contractor)	4.38	4	Poor understanding of scope of work during tendering (contractor)	4.10
3	9	Unrealistic contract durations imposed by client	4.55	34	major changes in design during construction	4.37	2	Poor site management and supervision(contractor)	3.95
4	50	Delay in manufacturing long lead items	4.55	14	Poorly defined or vague scope of work (contracts)	4.34	6	Conflicts among joint owners of the project (for joint-venture projects)	3.90
5	59	Lack of leadership qualities in managers	4.48	49	Contractor poor procurement managements	4.29	22	Inadequate application of safety rules and regulations by contractor	3.89
6	75	Excessive bureaucracy in project owner operation	4.48	48	Delay in start of purchasing long-lead items	4.29	11	Contract strategy (EPC,EP+C,E+P+C)	3.80
7	1	Slow decision making by owners	4.45	19	poor monitoring and control	4.26	21	Accidents during construction – labor injuries – infectious disease (contractor)	3.79
8	49	Contractor poor procurement managements	4.45	23	Poor communication and coordination by contractor with other Parties	4.26	33	Clients' change orders — large quantities of extra work	3.79
9	17	Ineffective planning and scheduling by the main contractor	4.43	18	Poor management of contractor's schedule	4.23	5	Inappropriate construction methods implemented	3.76
10	19	poor monitoring and control	4.43	2	Poor site management and supervision(contractor)	4.20	18	Poor management of contractor's schedule	3.74

The above tables show the ranking of time overrun factors from the point of view of the main stakeholders who involved in project delivery. In attempt to analyze if there are similarities of these delay factors among the three parties, one could see that "*Poor understanding of scope of work during tendering (contractor)"*is the most factor that is most agreed upon. It is ranked **first** with main construction contractor and ranked **second** for both the client and the engineering. It is astonishing that this delay factor has been agreed by the client and engineering firm and it is ranked it second. The above factor which has to do with full understanding of the project scope mainly from the main contractor point of view shows it high importance to deal with in order to reduce the risk of time overrun.

"*Delay in start purchasing long lead items*" is ranked **second** with main construction contractor and **Fifth** or sixth with client, since they have the same Mean number. "*Contractor poor procurement managements*" is ranked **fifth** from the client point of view, and **seventh** or eighth from the main construction contractor. "*Ineffective planning and scheduling by the main contractor*" is ranked **first** with client and the main construction contractor ranked it **ninth**." *Poor monitoring and control*" delay factor is ranked **tenth** with main construction contractor and **seventh** with client.*" Poor management of contractor's schedule*" is ranked ninth with the client and **tenth** with engineering firm. "*Poor site management and supervision (contractor)"* is viewed a **third** most delay factor with engineering firm and viewed **tenth** from the client perspective.

4.9 Correlation between the stakeholders and the ranking of the top 10 delay Factors

50% of the highest 10 ranked time overrun factors exist between these two stakeholders. Only**10**% of the top 10 has been agreed upon. There is **30**% agreement between these two in ranking the top 10 delay causes.

4.10 Correlations between the stakeholders and the ranking of all possible delay factors

The results showed the following:

Table 10. Ranking of delay factors

Stakeholder	Spearman's rank	Sig. level
Main Construction Contractor and Client /Owner	0.72	0.95
Main Construction Contractor and Engineering	0.68	0.95
Client /Owner and Engineering	0.74	0.95

The results showed that there is a **HIGH** agreement between all stakeholders in ranking the time over factors where highest agreement is between **Client and Engineering firm (0.74)**.Despite the Correlation between Main Construction Contractor and Engineering being high; it is still relatively lower than the two associations **(0.68).** The table shows also that the client interfaces stakeholder has the higher agreement than non-client stakeholder**.** It can be safely concluded that there is huge agreement in the ranking of time overrun factors among the involved stakeholders which make the results of the research more reliable.

4.11Kruskal Wallis Test and Chi-Square Tests

Table11. At a glance performance of stakeholder's perception

Factors	**Asymp. Sig.**	**Chi-Square**
Poor understanding of scope of work during tendering (contractor)	0.045	3.4
Ineffective planning and scheduling by the main contractor	0.01	13.6
Delay in start of purchasing long-lead items	0.02	11.8
Contractor poor procurement managements	0.01	13.2
Poor site management and supervision(contractor)	0.181	3.4
Poor management of contractor's schedule	0.025	7.4
major changes in design during construction	0.02	12.7
Delay in manufacturing long lead items	0.04	11.8
poor monitoring and control	0.02	12.1
Shortage in material & equipment	0.795	0.45
Slow decision making by owners	0.018	8.6
Contractor's poor cash flow management	0.024	7.4

From the above table, it can be implied that there is NO significance difference in the perception of the stakeholders (Client, Main CC, Engineering) on the top 12 causes of time overrun (except for 2, Poor site management and supervision (contractor), and Shortage in material & equipment) since Asymp Sig is less than 0.05.

4.12 Correlation among the top 12 times overrun causes

Table 12. Relationship among overrun cause

	Slow decision making by owners	Poor site management and supervision(contractor)	Poor understanding of scope of work during tendering (contractor)	Ineffective planning and scheduling by the main contractor	Poor management of contractor's schedule	poor monitoring and control	major changes in design during construction	Contractor's poor cash flow management	Delay in start of purchasing long-lead items	Contractor poor procurement managements	Delay in manufacturing long lead items	Shortage in material & equipment
	1	.311**	0.2	.255*	.349**	.358**	.286*	0.18	.299**	.349**	.263*	0.14

Slow decision making by owners		0.01	0.1	0.03	0	0	0.013	0.12	0.01	0	0	0.22
Poor site management and supervision(contractor)	.311**	1	0.2	0.11	.332**	.317**	0.222	.247*	0.18	0.11	0.1	0.03
	0.006		0.2	0.36	0	0	0.055	0.03	0.11	0.35	0.2	0.79
Poor understanding of scope of work during tendering (contractor)	0.205	0.16	1	.237*	.373**	.465**	.300**	.315**	.356**	.313**	.268*	0.19
	0.073	0.16		0.04	0	0	0.009	0.01	0	0.01	0	0.1
Ineffective planning and scheduling by the main contractor	.255*	0.11	.237*	1	.729**	.670**	.387**	.399**	.353**	.505**	.420**	0.23
	0.028	0.36	0		0	0	0.001	0	0	0	0	0.05
Poor management of contractor's schedule	.349**	.332**	.373**	.729**	1	.807**	.407**	.449**	.376**	.449**	.399**	.278*
	0.002	0	0	0		0	0	0	0	0	0	0.02
poor monitoring and control	.358**	.317**	.465**	.670**	.807**	1	.470**	.457**	.334**	.485**	.381**	.278*
	0.002	0.01	0	0	0		0	0	0	0	0	0.02
major changes in design during construction	.286*	0.22	.300**	.387**	.407**	.470**	1	.412**	.463**	.427**	.433**	.237*
	0.013	0.06	0	0	0	0		0	0	0	0	0.04
Contractor's poor cash flow management	0.181	.247*	.315**	.399**	.449**	.457**	.412**	1	.446**	.461**	.365**	.246*
	0.117	0.03	0	0	0	0	0		0	0	0	0.03
Delay in start of purchasing long-lead items	.299**	0.18	.356**	.353**	.376**	.334**	.463**	.446**	1	.563**	.625**	.382**
	0.009	0.11	0	0	0	0	0	0		0	0	0
Contractor poor procurement managements	.349**	0.11	.313**	.505**	.449**	.485**	.427**	.461**	.563**	1	.692**	.528**
	0.002	0.35	0	0	0	0	0	0	0		0	0
Delay in manufacturing long lead items	.263*	0.14	.268*	.420**	.399**	.381**	.433**	.365**	.625**	.692**	1	.495**
	0.023	0.24	0	0	0	0	0	0	0	0		0
Shortage in material & equipment	0.142	0.03	0.2	0.23	.278*	.278*	.237*	.246*	.382**	.528**	.495**	1
	0.221	0.79	0.1	0.05	0.02	0	0.041	0.03	0	0	0	
**. Correlation is significant at the 0.01 level (2-tailed).												
*. Correlation is significant at the 0.05 level (2-tailed).												

4.13 Overall Group Factors combining all three stakeholders Ranking by **Group** factors:
Table 13. Highest ranked factors for time overrun

Order	Group	Sub-Group	Mean	Std. Deviation
1	**Management Factors:**	C. Project Planning & Control	4.08	0.782
2	**Management Facotrs:**	General	4.05	0.848
3	**Resources Factors:**	A. Materials & Equipments	3.99	0.840

The listed above table are the highest Ranked Group factors that causes time overrun in oil and gas Mega Projects in Oman. These results were done by merging all responses from the client, main construction contractor and the engineering parties that are involved in the study. The **first and two** group delay factors are from **Management factors** while the third one is from Resources Factors. The first subgroup factor in this study that causes O&G projects failing to meet its time target is the "*Project Planning & Control*" which has the details in the below table:

Table 14. Integrated means of stakeholders with ineffective planning

Project Planning & Control	**Mean**	**SD**
Ineffective planning and scheduling by the main contractor	4.28	0.820
Poor management of contractor's schedule	4.15	0.833
poor monitoring and control	4.13	0.905
Inadequate Quality assurance control	3.95	0.837

Again, this is the integrated Means of all responses from all stakeholders which starts off with "*ineffective Planning* "of the main construction contractor. It is clearly that is in the burden of the stakeholder of Main construction contractor. The second delay factor under the group is the management of this plan which is the roles and accountability of **Client,** in this research. In most past studies, such factor is under the responsibility of the consultant like Mohammed (Ruqaishi & Bashir, 2014).

Table 15. Integrated means of stakeholders with management issues

Management		
General	Mean	SD
Poor understanding of scope of work during tendering (contractor)	4.39	0.83
Poor site management and supervision (contractor)	4.15	0.74
Slow decision making by owners	4.12	1.019
Management of Subcontractor	3.92	0.855
Inappropriate construction methods implemented	3.88	0.868
Conflicts among joint owners of the project (for joint-venture projects)	3.83	1.063

The second top delay group after the integration of all stakeholders' responses is the general management factors shown in the above table. Ruqaishi and Bashir (2014) who wrote their article in Oman, listed "poor understand of scope during tendering" under the roles of main construction contractor, and this research follow this same thing. Such factor is ranked first in the time overrun Management group factor of this study. As matter of fact, failure to understand the scope of the project especially from the main construction contractor is ranked **first** in overall delay factor among the 77 possible factors, which has a mean of 4.39.In addition, it is ranked first from the point of view of Main construction contractor, and second from both Engineering and the client perspective as mentioned earlier. In the second overall delay group, another delay factor is that is under the burden of the main construction contractor, which is "*Poor site management and supervision*" that comes second in the ranking. This delay Factor has been adopted yet again from (Ruqaishi & Bashir, 2014) and is ranked fifth in overall delay factor of this research.

The **third** factor in this delay group factor is the "*Slow decision making by owners"* which is obviously of the roles of the client. This factor is ranked 11th in the overall combined ranking and listed in the following articles of: Odeh and Battaineh (2002), Salama et al. (2008), Ruqaishi and Bashir (2014) and Oyegoke and Kiyumi (2017).

Table 16. Resource Factors

Materials &Equipments	**Mean**	**SD**
Delay in start of purchasing long-lead items	4.25	0.881
Contractor poor procurement managements	4.17	0.812
Delay in manufacturing long lead items	4.15	0.954
Shortage in material & equipment	4.13	0.869
Slow delivery of materials	4.03	0.979
Non-adherence of material specifications – provided by client –to drawings	3.95	0.951
Quality and productivity of materials	3.95	0.884
Low ability of contractor to provide imported material	3.83	0.999
Construction plant and equipment breakdowns	3.83	0.978
Poor inspection and testing of equipment and material at supplier site	3.78	0.974

The top third delay group **factor** found in this study is the **resources** factors, where the **Materials & Equip**ment's is ahead in ranking than the human resources. "*Delay in start of purchasing long-lead items*" is the top factor in this group as shown in the above table and is ranked **third** in the integrated delay factor list that is heaving a mean of **4.25.** This delay factor has been mentioned in (Salama, et al., 2008) article that was done in O&G sector as well and It was not classified under which stakeholder it goes to. Similarly for this research, Procuring long lead items depend on what contract strategy and type it is, if it is EPC, this goes to the contractor, if it is EP+C and reimbursement type, this responsibility is under the shoulder of the owners.

"*Contractor poor procurement managements*" comes next in this delay group and it is listed in (Fallahnejad, 2012) article where he investigated O&G projects issues in IRAN. This factor is ranked **fourth** in the overall delay list, which has a mean of **4.17.** "*Delay in manufacturing long lead items*" is ranked third in this delay group and **eighth** in overall list that combines all stakeholder perceptions. This is factor has been listed in (Pham & Hadikusumo, 2014)article where they studied the O&G projects inVitenam."Shortage in material & equipment" has been ranked important in the following articles: Odeh and Battaineh (2002), Fallahnejad (2002), Salama et al. (2008) and Ruqaishi and Bashir (2014).This delay factor is ranked tenth in the overall delay causes and has a mean of **4.13.**

Table 17. Integrated means of stakeholders with communication issues

Communication	Mean	SD
Lack of communication between client and project team	4.03	1.039
Poor interaction with vendors in the engineering and procurement stages	4.00	0.973
Poor communication and coordination by contractor with other Parties	3.97	1.013
Lack of communication between designers and contractors	3.96	0.992
Poor communication between site management and labor force	3.93	1.031
Inadequate coordination among designers from different disciplines	3.87	1.018

As it was discussed in the literature review thoroughly, an evidence of that, in this study, Communication Subgroup delay factors appears **Second** in the list from the client point of view. Despite that it is ranked **21st** (with a mean of 4 anyway) in overall delay factors, the client ranked it 13th with a mean of 4.14, which has "**high**" importance. In the same table such communication comes **third** in the communication factor subgroup.

4.14 Overall delay factors

Table 18. Overall delay factors

Question	**Mean**	**Std. Deviation**	**order**
Poor understanding of scope of work during tendering (contractor)	4.39	0.83	1
Ineffective planning and scheduling by the main contractor	4.28	0.82	2

Delay in start of purchasing long-lead items	4.25	0.881	3
Contractor poor procurement managements	4.17	0.812	4
Poor site management and supervision(contractor)	4.15	0.74	5
Poor management of contractor's schedule	4.15	0.833	6
major changes in design during construction	4.15	1.062	7
Delay in manufacturing long lead items	4.15	0.954	8
poor monitoring and control	4.13	0.905	9
Shortage in material & equipment	4.13	0.869	10
Slow decision making by owners	4.12	1.019	11
Contractor's poor cash flow management	4.08	1.004	12
Poorly defined or vague scope of work (contracts)	4.08	0.937	13
Insufficient data collection and survey before design	4.07	0.97	14

4.15 The least ranked delay groups

Table 19. Least delay factors

Order	Group	Sub-Group	Mean	Std. Deviation
8	Finance Factors		3.81	0.925
9	Management Factors:	B. Contract Management	3.71	0.998
10	External Factors:		3.65	0.940

As shown the above table, the least ranked delay groups Finance, Contract Management and External Factors, respectively. This is compared to the other delay groups which some has been discussed earlier. It is listed at the end, because of they have lower Mean values compared, and these values are still considered **"high**" important factors according to the classification in statistics. Moreover, some factors that belong to those just mentioned delay groups, are still ranked top **15th**overall, like "*Contractor's poor cash flow management"* and "*Poorly defined or vague scope of work (contracts)*", they are ranked **12th and 13th** respectively. Therefore, such issues should not neglect, but rather focused at.

4.16 Time overrun Group Correlations

Table 20. Time overrun group co relation at a glance

	Management	**Technical_Design**	**Finance**	**Resources**	**External**
Management	1	.809**	.697**	.764**	.511**
		0.000	0.000	0.000	0.000
Technical_Design	.809**	1	.701**	.774**	.516**
	0.000		0.000	0.000	0.000
Finance	.697**	.701**	1	.790**	.595**
	0.000	0.000		0.000	0.000
Resources	.764**	.774**	.790**	1	.685**
	0.000	0.000	0.000		0.000
External	.511**	.516**	.595**	.685**	1
	0.000	0.000	0.000	0.000	

As shown in the above table, all the five independent group variables are highly correlated to each other. Such strong relationship signifies its great relevance to the subject of schedule performance in Mega O&G projects. Management, Technical & design, Finance, Resources and External Factors are highly correlated to each other, with the first four time-overrun factor groups having a higher correlation coefficient. This is in line with the descriptive raking results that shows External Factors are the bottom of the list.

4.17 Cost

Table 21. The integrated overall list of cost overrun factors

Question	Mean	Std. Deviation	Order
Major changes in design during construction	4.13	0.793	1
Poor management of contractor's schedule	3.98	0.852	2
Poor understanding of scope of work during tendering	3.97	1.014	3
Variations and claims	3.97	0.829	4
Inadequate main contractor experience	3.97	0.882	5
Poorly defined or vague scope of work (contracts)	3.94	0.801	6
Delay in start of purchasing long-lead items	3.93	0.936	7
Clients' change orders — large quantities of extra work	3.9	0.817	8
Poor communication and coordination within all stakeholders:	3.89	0.857	9
Shortage in material & equipment	3.89	0.858	10
Slow decision making by owners	3.88	1.03	11

The above table shows the integrated overall list of cost overrun factors in O&G Mega projects in Oman. Failure to grasp the complete scope of the project at early stage comes third highest factor that causes an over run in the budget of the project. Variations and lack of the experience of the contractors are ranked **4th and 5th** respectively.

Table 22. Consequences of delays

Question	Mean	Std. Deviation	Order
Dispute	3.65	0.818	1
Reduced profit	3.23	0.988	2
Penalties	3.22	0.87	3
Reduction in project Quality	3.2	0.91	4
Loss of reputation of main construction contractor:	3.16	1.027	5
Arbitration:	2.95	1.075	6
Litigation:	2.8	1.072	7
Total Abandonment	2.67	1.142	8

The research question that discusses the above topic was:

- *What are the consequences of construction Delays in Mega Projects in O&G sector?*

Comparing the outcomes of the consequences or effects of time and cost overrun in projects between the three main stakeholders participated, **Dispute** occurs more frequent that any other listed effects. Dispute that takes place between the client and contractors that is seen the most frequent, comes **first** from the point of view of each stakeholder as shown in the table. "*Loss of reputation for the main construction contractor*" is ranked **second** and **fifth** for both the client and engineering firms in the frequency list.

Engineering and Owners have agreed that a "**reduction in project quality**" is one of effects of time and cost overrun in O&G projects in Oman, and it is listed **third** from their point of view. This is a reminder of the Iron triangle of project management that is quality is part of, and it is one of the projects drivers. "*Penalties*" comes **fourth** in the list for the main construction contractor and the engineering firms and there is "*reduced profit*" in case of missing the project targets from the point of view of the client.

When disputes cannot be resolved internally, that is within the stakeholder boundaries, arbitration process takes place, which is more **frequent** than going to the courts according to the main construction contractor and the client. "*Total Abandonment*" of projects is the **least** frequent as an effect of time and cost overrun in O&G projects in Oman.

4.18 Kruskal Wallis Test and Chi-Square Tests

Table 23. Factors of disputes and reputation

Factor	Asymp. Sig.	Chi-Square
Dispute	0.012	8.8
Reduced profit	0.111	4.4

Penalties	0.102	4.5
Reduction in project Quality	0.219	13.2
Loss of reputation of main construction contractor	0.007	9.8
Arbitration	0.055	5.8
Litigation	0.118	4.2
Total Abandonment	0.113	4.3

4.19 Spearman's rho Correlation: Between the effect variables

Table 24. At a glance the Spearman's rho correlation of factors

	Dispute	**Arbitration**	**Litigation**	**Total Aband**	**Reduced profit**	**Penalties**	**Loss of reputation of main construction contractor**	**Reduction in project Quality**
Dispute:	1	.536**	.385**	0.194	.373**	.399**	.583**	.366**
		0.000	0.002	0.124	0.002	0.001	0.000	0.004
Arbitration:	.536**	1	.560**	.443**	.337**	0.177	.516**	.415**
	0		0.000	0.000	0.006	0.166	0.000	0.001
Litigation:	.385**	.560**	1	.640**	.383**	.292*	.541**	.509**
	0.002	0.000		0.000	0.002	0.02	0.000	0.000
Total Aband	0.194	.443**	.640**	1	.311*	0.118	.434**	.603**
	0.124	0.000	0.000		0.012	0.357	0.000	0.000
Reduced profit	.373**	.337**	.383**	.311*	1	.565**	.529**	.508**
	0.002	0.006	0.002	0.012		0.000	0.000	0.000
Penalties	.399**	0.177	.292*	0.118	.565**	1	.430**	.341**
	0.001	0.166	0.02	0.357	0.000		0.000	0.008
Loss of reputation of main construction contractor:	.583**	.516**	.541**	.434**	.529**	.430**	1	.566**
	0.000	0.000	0.000	0.000	0.000	0.000		0.000
Reduction in project Quality	.366**	.415**	.509**	.603**	.508**	.341**	.566**	1
	0.004	0.001	0.000	0.000	0.000	0.008	0.000	
**. Correlation is significant at the 0.01 level (2-tailed).								
*. Correlation is significant at the 0.05 level (2-tailed).								

From the above table, disputes and Loss of reputation are the only ones that are less than 0.05, who could suggest that there is NO significance difference at ranking from the point of view of the stakeholders. While there is minor difference with rest of effects, this could imply that Disputes and loss of reputation of the main construction contractor are the great consequences that take place when projects are delayed and suffer from cost overrun, which have been concurred by all different stakeholders.

4.20 Correlations between the stakeholders and the ranking of all possible Effects

The results showed the following:

Table 25. Correlation between stakeholders

Stakeholder	**Spearman's rank**	**Sig. level**
Main Construction Contractor and Client /Owner	0.508	0.95
Main Construction Contractor and Engineering	0.346	0.95
Client /Owner and Engineering	0.391	0.95

The results showed that there is a **moderate** agreement between all stakeholders in ranking the consequences where highest agreement is between **Client and Main Construction Contractor firm (0.508).** Despite the Correlation between Main Construction Contractor and Engineering being moderate, it is still relatively lower than the two associations **(0.346),** and this is the same with the correlation delay factors & Stakeholders**.** The table shows

also that the client interfaces stakeholder has the higher agreement than non-client stakeholder, which is again like time overrun factors and stakeholder's correlation.

5. Discussion

5.1 Ineffective planning and scheduling by the main contractor

Based on the interviews, this is so related to understanding the scope of the project, if the contractor has grasped the SOW fully and completely, the chances of have the scope planned properly is higher. Ineffective planning might be derived from the fact some contractors focus on "commodities" not the critical path and that is dangerous, as found in one of the interviews. The risk is that when there is no priorities set in the plan of the project, there is a high chance that the project plan is slipped, since there is neither focus nor effectiveness. An example has been given is that; small foundation is very important piping completion and the latter is vital for instrumentation works and etc., so "sequential" activities are always there in O&G Mega projects in Oman, and such sequence is vital no matter how small the job is, in order to complete one work package and eventually the whole project. Such issue has been agreed more than 5 interviewees, contractor discipline engineers are among them as well.

5.2 Contractor poor procurement managements

There is unmatched agreement among all interviewees (from different stakeholder) on this factor that there is a large room for improvement in the contractor procurement processes. Procurement department in companies especially main construction contractors can be the decider and difference maker whether a project is meeting its targets or not. So, there is good number of contractors in Oman that in order to procure anything even a shelve item, this process is taken too much time. Negotiation before making the purchase order takes more than what it should be excessive period. This seems to find the cheapest buyer available in the market by the contractor, in order to save money and increase profit. Most of the construction consumables materials in Oman are imported so having those delivered to site is going to take time. Plus, there is limited vendors for those items to be ordered from, a sometimes they will dictate the terms of delivery duration.

5.3 Poor site management and supervision (contractor)

The construction contractor sometimes doesn't have enough number of supervisors who could cover all the activities in parallel at the same time. Lack number of supervisors is an issue that has been agreed by most of the interviewees from different stakeholder. The competency and the skill of those supervisors sometimes are not up to the desired level. Role of s supervisors is also forecasting the plan ahead, understand priorities and be proactive in order to anticipate any constraints that might come up that hinders the progress**.** Some projects in Oman, getting the right Manpower needed is hindered by the Labor Local Law where it limits number of Expat in one contract.

5.4 Major changes in design during construction

Even if the construction contractor could absorb some changes while construction, it will come a point where the contractor cannot take it anymore and those changes will affect the progress of the project. Because, the contractor is supposed to spend the Man-hours on the original plan of the project, instead, here is some change needs to be executed, so the original plan is put on hold. The probability of the changes in design during engineering phase is high, and that could be rooted from the fact that there are many interfaces involved in this stage. There are different vendors inputs are needed and client input and intervention as well. Therefore, changes could not only come from the design company only, it could come from the vendors themselves, or the owner could make change after some particular document has been finalized.

5.5 Shortage in material & equipment

As seen before in the delay factor of "*Delay in start of purchasing long-lead items"* and "*Contractor poor procurement managements*" materials and equipment in Oman are mostly ordered from abroad and most of the items for Mega Oil and gas projects are imported materials. So, this is one of issues and constraints in regard to "**Shortage in material & equipment"** as being one of top time over factors found in this study. Although the bigger the problem is that materials don't reach site on time is due to the longer procurement processes especially from the contractor side, shortage of material in Oman should not be neglected. Most of contractor interviewees expressed their concern that even small, less complicated consumables items like electrical Lugs and wooden plates, they have to import it from outside of Oman.

5.6 Slow decision making by owners

Although this delay factor is ranked **11th** overall and **7th**from the point of view of the Main construction contractor, this factor has been mentioned by the interviews a lot. The owners in Oil and gas Projects in Oman play a vital role in delaying some business decision in projects which lead to cause projects to exceed the planned finish date. Some of the issues in the factor as expressed in interviews.

5.7 Contractor's poor cash flow management

This factor is ranked 11th overall and 1st in the Finance Delay factor group. Most of cash flow issues take place with main construction contractors, not much with engineering contracts. The main construction contractor bids low in his quotation in order to win the contractor, then after winning the bidding contract to install and construct the project and after some time, they found themselves have cash issues.

5.8 Time and cost factors correlation

Most of interviews showed and confirmed that every time a project is exceeding its plan and schedule, the budget of the project is exceedingly as well. For the factors that affect both time and cost, most of the conducted interviewees have agreed that the top factors that cause project to delay, these same factors are causing cost overrun to the project as well. Some of them have cited examples like the poor understanding of SOW and major changes in design during construction.

5.9 How much of time and cost overrun

Most interviewees have revealed that the average delay of projects they have experienced along their career is between 6 months – 2 year. Only one Project manager have gone through two projects and stated that those two projects were on time. When the data of this research revealed to the interviewees, that only 8% of Questionnaires participants have experienced on time completed projects, they have expressed that this is the hard truth of projects in Oman; such low percentage is no surprise to them.

5.10 Contract strategy and time and cost overrun

From the interviews, it has been concluded that theoretically, EP+C contract strategy is faster to be executed for the following reason: a fast track project execution philosophy. In other words, the engineering phase starts, and before it ends, procurement process already got started, and before EP finishes all its deliverables, main construction contractor has been appointed and the construction activities can commence. There is overlap between all main phases of the execution of the project, Engineering, Procurement and Construction.

5.11 Research Questions with findings

This study has answered the Research Questions proposed at the beginning and below is the summary:

- *What is the current performance of mega projects in O&G sector?*

147 out of 160 respondents have experienced and reported Time overrun in projects they were involved in. Only 13 responses have showed there were some Mega projects have completed on time that is 8%**.** For the budget, 70% of the respondents have experienced cost overrun in their projects up to 30%, and only 3% of the participants have seen the project budget in line with planned one.

The second Research Question is:

- *What are the major causes of mega projects failing to meet its target of schedule and budget?*

There is some agreement in the ranking of top 10-time overrun factors between the three main stakeholders and the agreement between the client and main construction contractor in those factors are more, compared to any other combination of parties. *"Poor understanding of scope of work during tendering"* factor is ranked **first** with main contractor and **second** with both the client and engineering firms. This Factor is most factors that has similar ranking between all. As matter of Fact is the only Factor that exists between in the 10 among all stakeholders. This signifies its importance and its frequent occur in Mega O&G projects in Oman. Also, the main construction contractor is not shy away from admitting that this factor is vital, although it is under responsibilities, they could have easily said it is not our problem and start the blame game.

For **overall** results combining the responses of all stakeholders in time overrun Factors, the most ranked groups are of this study are, The Management group followed by resources Group.

The above table shows the integrated overall list of cost overrun factors in O&G Mega projects in Oman. Major Changes in the engineering during the construction phase of a project tops this list followed by the management of the contractor's schedule. Failure to grasp the complete scope of the project at early stage comes third highest factor that

causes an over run in the budget of the project. Variations and lack of the experience of the contractors are ranked **4th and 5th** respectively.

Changes during construction has been ranked 7th in time overrun overall factors and 1st in the cost overrun. Management of contractor's schedule is second in the cost overrun and 6th in the time overrun factors. Understanding the scope stg tendering is ranked first in time overrun and it is 3rd in the cost overrun factors. **It is safe to conclude that, top factors that affect time, it also affects cost in the O&G projects in Oman.**

For the Third Research Question:

- *What are the consequences of construction Delays in Mega Projects in O&G sector?*

Comparing the outcomes of the consequences or effects of time and cost overrun in projects between the three main stakeholders participated, **Dispute** occurs more frequent that any other listed effects. Dispute that takes place between the client and contractors that is seen the **most** frequent, comes first from the point of view of each stakeholder as shown in the table. The relationship between time versus contractor strategy, this thesis showed that EP+C contracts have more tendency to cause time overrun although in theory it should not as the client is present always of the execution phase (client interface engineers).

5.12 Contribution of This Research

This study has revealed the key causes that contribute to time and cost overrun in Mega Projects of Oil and gas sector in Oman which have not been done before. Ranking those causes brings more focus and attention by the main stakeholders running the project. Elaboration in investigating the root causes of the time and cost overrun factor will help mitigates the risks involved in project delivery. A conceptual framework got generated by the researcher in the classification of Factors that causes time and cost. This Framework represents the holistic view of all causes which is unique among the literature on project management. Shedding the light on the consequences of failing delivering the Mega O&G project targets, is an eye opening for the project teams to be knowledgeable of how severe sometimes the consequences.

5.13 Limitations and Future studies

Forming the questionnaires was time consuming which took around 5 months. That is due to the large number of time and cost Factors in the literature review. Data collection period also was long. The results of this study did not differentiate contract strategies, contractor classification or type of organizations; rather it included all types of those. This research is first of its kind in exploring project performance key barriers and their Key enablers in depth In Oman. Therefore, this study could be considered as foundation and a reference for more local studies to come in Oil and gas projects which are highly recommended. Comparatives studies could be done on time & cost Factors with different type of Oil and gas project categories: upstream, downstream, pipelines etc. Future studies can take one or two major Delay and cost overrun Factor and look in depth its root causes and effect of mediocre project performance In Oman Oil and gas projects. Examples are: Design changes Change order, Construction claims, Construction permits and ranking of cost overrun factors.

References

Alnuaimi, A.S., & Mohsin, M. (2013). December.Causes of delay in completion of construction projects in Oman.In *International Conference on Innovations in Engineering and Technology*, 267-270.

Assaf, S. A., & Al-Hejji, S. (2006). Causes of delay in large construction projects. *International journal of project management*, *24*(4), 349-357.

Alamri, N., Amoudi, O., & Njie, G. (2017). Analysis of construction delay causes in dams projects in Oman. *European Journal of Business and Social Sciences*, *6*(2), 19-42.

Alnuaimi, A.S. & Mohsin, M. (2013). December.Causes of delay in completion of construction projects in Oman.In *International Conference on Innovations in Engineering and Technology*, 267-270.

Alnuaimi, A.S., Taha, R.A., Al Mohsin, M., & Al-Harthi, A.S. (2010). Causes, effects, benefits, and remedies of change orders on public construction projects in Oman. *Journal of Construction Engineering and Management*, *136*(5), 615-622.

Chan, A. P. C., Scott, D., & Chan, A. P. L. (2004). Factors Affecting the Success of a Construction Project. *Journal of Construction Engineering and Management, 130(*1), 153-155.

Chanmeka, A., Thomas, S. R., Caldas, C. H., & Mulva, S. P. (2012). Arpamart Chanmeka, Assessing Key factors impacting the performance and productivity of oil and gas projects in Alberta. *Can.J. Civ.Eng. 39*,259-270.

Cooke-Davies, T. (2002). The "real" success factors on projects. *International journal of project management*, *20*(3), 185-190.

De Wit, A. (1988). Measurement of project success. *International journal of project management*, *6*(3), 164-170.

Desai, N., Pitroda, J.A.Y.E.S.H.K.U.M.A.R., & Bhavsar, J. (2015). A review of change order and assessing causes affecting change order in construction. *International Academic Research for Multidisciplinary*, *2*(12), 152-162.

Doloi, H., Sawhney, A., Iyer, K. C., & Rentala, S. (2012). Analysing factors affecting delays in Indian construction projects. *International journal of project management, 30*(4), 479-489.

Elawi, G.S.A., Algahtany, M., Kashiwagi, D., & Sullivan, K. (2015). Major factors causing construction delays in Mecca. *Journal for the Advancement of Performance Information and Value*, *7*(1), 75-75.

Fallahnejad, M. H. (2013). Delay causes in Iran gas pipeline projects. *International Journal of project management*, *31*(1), 136-146.

Flyvbjerg, B. (2014). What You Should Know About Megaprojects and Why: An Overview. *Project Management Journal*, *45*(2), 6–19.

Frimpong, Y., Oluwoye, J., & Crawford, L. (2003). Causes of delay and cost overruns in construction of groundwater projects in a developing countries; Ghana as a case study. *International Journal of project management*, *21*(5), 321-326.

Heerkens, G. R. (2002). *Gestión de proyectos* (No. 658.404 H459g). Madrid, ES: McGraw-Hill Interamericana.

Hwang, B. G., Zhao, X., & Ng, S. Y. (2013). Identifying the critical factors affecting schedule performance of public housing projects. *Habitat International, 38*, 214-221.

Ika, L.A. (2009). Project success as a topic in project management journals. *Project management journal*, *40*(4), 6-19.

Jarkas, A.M., & Younes, J. H. (2014). Principle factors contributing to construction delays in the State of Qatar. *International Journal of Construction Project Management*, *6*(1), 39.

Jergeas, G. (2008). Analysis of the front-end loading of Alberta mega oil sand projects.. *Project Management Journal, 39*(4),95-104.

Kalkani, K., & Malek, S. (2016). Analyzing causes of delay in construction projects. *International Journal for Innovative Research in Science and Technology*, *2*(12), 136-41.

Le-Hoai, L., Lee, Y. D., & Lee, J. Y. (2008). Delay and cost Overrun in Vietnam large construction projects: A comparison with other selected countries. *KSCE Journal Of civil Engineering,12*(6), 367-377.

Lientz, B.P., & Rea, K. P. (1995). San Diego, Academic. *Project management for the 21st century*.

Loch, C.H., DeMeyer, A., & Pich, M. (2011). *Managing the unknown: A new approach to managing high uncertainty and risk in projects*.John Wiley & Sons.

Love, P.E., Sing, C.P., Wang, X., Irani, Z., & Thwala, D.W. (2014). Overruns in transportation infrastructure projects. *Structure and Infrastructure Engineering*, *10*(2), 141-159.

McCoy, F. (1996). *Measuring success: Establishing and maintaining a baseline.* s.l., PMI Annual Seminar/Symposium, Montreal.

Memon, A. H., Abdul Rahman, I., & Aziz, A.A.A. (2011). Time overrun in construction projects from the perspective of project management consultant (PMC). *Journal of Surveying, Construction and Property*, *2*(1).

Merrow, E.W. (2011). Industrial Megaprojects: Concepts, Strategies, and Practices for Success John Wiley & Sons. *Inc., Hoboken, New Jersey*.

Naimi, M., Elhag, T., & Fenn, P. (2008). Delay and its consequences in construction of Iranian petrochemical plants.In *International Conference on Multi-National Construction Projects*.

Memon, A.H., Rahman, I.A., &Azis, A.A.A. (2011). Preliminary study on causative factors leading to construction cost overrun. *International Journal of Sustainable Construction Engineering and Technology*, *2*(1).

Motaleb, O., & Kishk, M. (2010). An investigation into causes and effects of construction delays in UAE. In *Procs 26th Annual ARCOM Conference* (pp. 6-8).

Odeh, A. M., & Battaineh, H. T. (2002). Causes of construction delays: Traditional contracts. *International Journal of Project Management 20*,67-73.

Olaniran, O. J., Love, P. E., Edwards, D., Olatunji, O. A., & Matthews, J. (2015). Cost overruns in hydrocarbon megaprojects: A critical review and implications for research. *Project Management Journal*, *46*(6), 126-138.

Oyegoke, A. S., & Kiyumi, N. A. (2017). The causes, impacts and mitigations of delay in megaprojects in the Sultanate of Oman. *Journal of Financial Management of Property and Construction*, *22*(3), 286-302.

Pham, L. H., & Hadikusumo, H. (2014). Schedule Delays in engineering, procurement , and construction petrochemical projects in Vietnam: a qualitative research study. *International Journal of energy sector management, 8*(1), 3-26..

Rui, Z., Peng, F., Ling, K., Chang, H., Chen, G., & Zhou, X. (2017). Investigation into the performance of oil and gas projects. Journal of natural gas science and engineering, 38, 12-20.

Ruqaishi, M., & Bashir, H. A. (2015). Causes of delay in construction projects in the oil and gas industry in the gulf cooperation council countries: a case study. *Journal of Management in Engineering, 31*(3), 05014017.

Salama, M., El Hamid, M. A., & Keogh, B. (2008, September). Investigating the causes of delay within oil and gas projects in the UAE. In 24th annual ARCOM conference (pp. 1-3).

Sambasivan, M., & Soon, Y. W. (2007). Causes and effects of delays in Malaysian construction industry. International Journal of project management, 25(5), 517-526.

Vafaiee, M., Owlia, M. S., Vahdat, M. A., & Vafaiee, M. (2010, January). Procurement management challenges in gas projects of Iran. In Proc. of the 10th International Conference on Industrial Engineering and Operations Management (pp. 9-10).

Zadjali, Z. A. A., Bashir, H. A., & Maqrashi, A. A. (2014). Factors Causing Project Cost Overrun in the Telecommunications Industry in Oman. *International Journal of Information Technology Project Management, 5*(3), 84-95.