

# Causes of Delay in Completion of Construction Projects in Oman

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**Abstract**—A field study was conducted on a number of construction projects in Muscat area to identify problems resulting from delays in completion of construction projects. The collected data was classified into two groups of projects, the first group included projects constructed during the period 2007-2008 and the second group comprised projects constructed during the period 2009-2010. It was found that 40 per cent of both groups have experienced delay in completion. Another finding was that the causes of delay are changing with the time in a pattern depending on different variables. Owner related causes were found to be the dominant reason for delay and contrarily the first to seek solutions.

**Keywords**— Delay, Construction Projects, Oman

## I. INTRODUCTION

**D**ELAY in construction projects is inevitable and expensive due to possible construction loan involved which costs interest, management staff with time dependent expenses, and ongoing escalation in wages and material prices. The effect of delay as a phenomenon can be a destructive factor for all construction plans if it is not tackled properly. Therefore, it is a necessity to develop a set of remedies to minimize problems related to delay in construction projects.

The main objective of this research is to clarify the size of delay problem in Muscat, and the reasons leading to delay in construction project as well.

Many researchers discussed delay problems from different aspects in quantitative and qualitative approaches. Some researchers linked delay to many variables and criteria that would be helpful in tackling delay consequences.

Al-Momani [1] found that the main causes of delay in construction of public projects in Jordan were related to designer and user changes, weather, site conditions, late deliveries, economic conditions and increase in quantities.

Odeh and Battaineh [2] showed that owner interference, inadequate contractor experience, financing and payments, labor productivity, slow decision making, improper planning, and sub-contractors are among the top ten most important factors causing delay in Jordan.

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Kim et al [3] introduced a methodology called "Delay Analysis Method Using Delay Section" (DAMUDS) as a mean of overcoming two limitations of existing methods: (1) inadequate accounting of concurrent delay and (2) inadequate accounting of time-shortened activities. The DAMUDS method builds upon the widely used method of contemporaneous period analysis. Assaf and Al-Hejji [4] identified Seventy three causes of delay in construction projects in Saudi Arabia. The delay was between 10 per cent to 30 per cent of planned duration. The most common cause of delay was "change order". Sambasivan and Soon [5] identified 10 most important causes of delay as: (1) contractor's improper planning, (2) contractor's poor site management, (3) inadequate contractor experience, (4) inadequate client's finance and payments for completed work, (5) problems with subcontractors, (6) shortage in material, (7) labor supply, (8) equipment availability and failure, (9) lack of communication between parties, and (10) mistakes during the construction stage.

## II. DELAY CAUSES IN CONSTRUCTION PROJECTS

Many reasons can be identified for different sources in delay problem. These reasons are:

1. Design related delay:
  - a. Possible change in initial design.
  - b. Complexity of the project.
2. Construction related delay:
  - a. Variations and claims.
  - b. Change of scope of project
3. Financial/ economic- related delay:
  - a. Financial ability of the owner
  - b. Not enough funds
4. Management/ Administrative- related delay:
  - a. Unavailability of suitable management team.
  - b. Unspecialized subcontractors.
  - c. Lack of project management.
  - d. Lack of experience of the consultant
  - e. Lack of experience of the contractor
5. Regulations and code- related key delays:
  - a) New legal instructions or rules.

## III. METHODOLOGY

The source of raw data collected was the clients, and consultants' records, which represent the actual records of all activities and considered unbiased. Data collection form was designed by the authors to unify data collection for all the

studied projects. Each reason of delay was assigned a specific value that measures its impact on the overall delay in construction projects. The authors used the following indices for delay for comparison:

- Percentage of delay: this indicator is calculated as in Equation (1)
- Percentage of delay = (actual time elapsed - planned time)/ planned time \*100  
(1)
- Average delay percentage: arithmetical mean is to be calculated in Equation (2)

$$\text{Average delay} = \frac{\sum \text{percentage of delay for research sample}}{\text{sample size}} \quad (2)$$

Standard deviation to show the distribution of data collected (see Equation 3).

$$\text{Std. Deaviation} = \sqrt{\frac{\sum(x-\bar{x})^2}{n}} \quad (3)$$

Where  $(x - \bar{x})$  = difference from mean  
n= sample size

- Maximum delay percentage: maximum value of percentages calculated Equation (1) for research sample
- Minimum delay percentage: minimum value of percentages calculated Equation (1) for research sample
- Rank of delay reason(s) by calculating the relative importance factor of each reason as calculated in Equation 3.

$$RII = \frac{\sum W}{A*N} \quad (4)$$

Where W: weighting given for each factor by the respondents (ranging from 1-3 for low, medium, and high influence reason respectively.)

A the highest weight (3 in this case)

N total number of respondents

RII: value of relative importance factor (generally 0-1)

#### IV. RESULTS AND ANALYSIS

Research samples represents a number of construction projects in Oman in which research records have been collected, they were from different clients and consultants. Based on the data collected a full analysis showing details for each period was carried out as given below:

##### A. Sample of percentage calculation

Project: Commercial building

Planned time: 360 days

Actual time: 416 days

Percentage of delay = (416-360/360)\*100% =15.56%

Delay reasons:

1. Possible changes in initial designs
2. Weather
3. Bad subcontractor
4. Variation and claims

##### B. Delay analysis for the period 2007-2008

During this time interval and based on the data collected and analyzed; the results as follows:

Sample size: 32

Average delay: 59.53 per cent

Minimum delay: 8.33 per cent

Maximum delay: 300 per cent

Std. deviation: 57.45

Reasons of delay are ranked in Table 1.

TABLE I  
DELAY REASONS 2007-2008

Reason	Importance
Weather	1
Variations and claims.	2
Change in initial design.	3
Not enough funds	4
New legal instructions or rules.	5
Nature of ground	6
Materials not available	7
Lack of project management.	8
Lack of experience for the contractor	9
Lack of experience for the consultant	10
Financial ability of the owner.	11
Dispute between owner and contractor	12
Complexity of the project.	13
Bad subcontractors.	14
Availability of suitable management team.	15

##### C. Delay analysis for 2009-2010

The following result was found for this period:

Sample size: 14

Average delay: 42.18 per cent

Minimum delay: 3.57 per cent

Maximum delay: 200 per cent

Std. deviation: 54.76

Reasons of delay are ranked in Table 2

TABLE II  
DELAY REASONS 2009-2010

Reason	Importance
Planning and programming construction work	1
Poor construction experience	2
Shortage in material	3
Fail in practical the work programs.	4
Changes in initial design	5
Poor site management	6
Lack of financial management	7
Late approval of shop drawings and samples	8
Labor supply and Late approval of labor	9
Problems with sub-contractors	10
Lack of communication between parties	11
Availability of suitable management team given firm's current work load.	12
Completeness and timeliness of project information	13
Fluctuation of material's prices	14
Previous working relationship	15
Financial ability	16
Previous working relationships	17

Priority on construction time	18
Equipment availability and failure	19
Finance arrangement and payments for the project	20
Failure to learn from mistakes	21
Mistakes during the construction stage	22
Poor quality management	23
Previous performance of site management team	24
Provision for ease of communication	25
Priority on construction time	26
Specified sequence of completion	27
Miscommunication with other parties	28
Build-ability of design	29
Function or end use (office, residential, industrial...)	30
Regulations	31
Location	32
Weather	33
legal undertakes (water, gas, etc.)	34

## V. RESULTS DISCUSSION

### A. Comparison on percentage of time delay of the periods 2007-2008 and 2009-2010

The average delay was decreased from 59.53 per cent in the first period to 42.12 per cent in the second period showing 29.25 per cent decrease in average delay. The minimum delay was reduced in the second period by 55.82 per cent and the maximum was reduced by 33.33 per cent.

Standard deviation stayed at the same value for the two intervals, but the value itself is very high indicating diversity of delay values.

In general, for both intervals the average delay is significantly high, even when this delay has become less in the second interval. The only explanation of this delay is wasting more than 40 per cent of project planned time. Decreasing or minimizing delay in construction would support the whole construction industry and the development process in the country as well. Adding to that the efforts, energy, human resources consumed in extra time in terms of delay at these construction projects.

It's clear that the construction projects suffering from delay should be re-evaluated for risk management to make sure that no more delay can appear.

Benchmarking of delay problem and the size of this problem is the first step toward more investigations and studies in detailing, explaining and remedies for delay problem.

As a part of discussion, the authors to present a justification for the differences between delay reasons at 2007-2008 and 2009-2010. Here are some points which led to the above differences.

1. Sample size might affect the difference to a limit.
2. Projects taken in the first period seems to be not in the same category of that at the second period.

3. The effect of hurricane Guno which hit Oman in June 2007 causing many legal and contractual problems for ongoing projects.
4. Projects started by the mid of 2008 onward were subjected to another restriction which was financial crisis effect hit on the world and gulf countries in particular.

### B. Differences in delay reasons

It is clear that the top three reasons for delay in the first period are different from the top three reasons in the second period. Both periods showed that the client is the first responsible one. Contractors are not exempted from delay origination; this can be highlighted during 2007-2008.

The remaining reasons were found to be similar in both periods in many perspectives as:

1. Financial problems for both client and contractor, reflecting many other reasons represented in lack of financial study and lack of experience.
2. The lack of study for both client and contractor has led to weak understanding of the project which resulted in term of delay in project.

With respect to the previous studies (Al-Momani [1] and, Odeh and Battaineh [2]) it is clear that the reasons resulting in delay of completion of construction projects are similar in many developing countries particularly those mentioned in the previous studies brings into the picture the nature of construction industry of these countries where the governments are highly affected by the policies, regulations and global trends.

Owners in most of the construction projects in developing countries are directorates of the central and local governments which are directly or indirectly affected by a mean of bureaucracy, a system in these countries which is already in progress.

One of the semi equal reasons is the problem in contractor experience which indicates embedded disqualification of owner, because of clear problems in selecting contractor.

To start tackling delay problem and its consequences there is an actual need to review and study construction projects at early stages, conceptual design and feasibility study phases are assessing objectives and measures of success and failure. In many construction projects meeting assigned budget is the first priority while in other words time is not the same or first priority; this reflects the wrong or the confused perception about time in construction projects. Exceeding planned time with more than 40 per cent indicates that the contractor and owner would bear additional charges in terms of indirect cost represented by all facilities required for construction projects not in direct relation to the production, indirect cost of construction projects is penalty for those who are allowing delay in their projects where the cost of delay is simply: monthly over heads multiplied by delay time in months. A review of the research sample in term of delay cost will lead to millions of Omani Rials resulting spending money for overheads in delayed time.

One of the proposed remedies is hiring project management companies, in early stages of construction projects to assure achieving project objective(s) or to develop rational objectives that may save money and resources.

## VI. CONCLUSIONS

Problems caused by delay in completion of construction projects in Oman have been diagnosed and assessed; many points have been concluded as follows:

1. Delay in construction projects in Oman during 2007-2009 is more than 40 per cent of the planned time, this percentage is considered high.
2. Maximum delay during 2007-2009 was about 300 per cent which indicates the importance of studying the planning and efficiency of some of the specialized construction projects.
3. Owner who is highly concerned about delay in construction projects is required to develop abilities of studying their projects in all stages.
4. Despite the fact that the first three reasons are different for the two intervals, the study indicated that the client is the main source of delay.
5. There is a need to continue this research work by:
  - a. Studying the cost of delay and consequences.
  - b. Studying practical remedies to eliminate or reduce the delay and its consequences.
  - c. Studying the best project delivery plan which reflects the effect of owner's contribution in project management.
6. Developing countries have to develop a new strategy of management in construction projects taking into account the considerations of size, nature, cost, and importance of the project leading to minimize the delay in public construction projects.
7. Most of contractor problems can be solved if the owner has studied the construction project properly.

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