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# ENGINEER'S DECISION EFFECT ON DELAYED GOVERNMENTAL CONSTRUCTION PROJECT WITH BUDGET ABUNDANCE (CASE STUDY)

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## ABSTRACT

*The continuity of infrastructure development one of the most community necessity & a high priority of governmental foundations and ministries, so the governmental projects is one of the main sources which ensure providing different essential general services, in addition, to support the economic sector by offering new jobs and reduce the poverty.*

*The study aims to view and track number of delayed governmental projects execution at which local companies are the contractors between years ( 2008 – 2014 ) where all projects funds allotments is secured and located at regions had a good security conditions to determine the project delay reasons focusing on staff engineering decisions which lead to exceeding contract time or execution stop. The study sample is focused on conventional construction projects like schools, dispensaries, and other governmental public building and study the delay effects on the general services given to end users. The engineering staff performance was put under a light to evaluate its effect on governmental construction project execution with reducing or increase execution percent.*

*The project schedule that delivered by the contractor and approved by owner is considered a judgment scale wither the project is delayed or not, taking into consideration stopped work period which is delivered by the contractor and approved by the owner.*

*The research samples were selected from traditional, repetitive and non-specialized projects in order to avoid the case of the link between the speed of completion and the delay of execution due to the lack of specialized cadres or activities that require importation of materials, mechanisms and special expertise from outside the country.*

*The delay causes for each project is recorded separately. Meetings with construction, administration, and design staff were held in order to get optimum design each item questionnaire paper.*

**Key words:** Delay, Construction Project, Engineers decision.

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## 1. INTRODUCTION

Local authorities and government efforts success is highly correlated with fast and accurate construction projects completion which is listed in its annual plan even the execution depends on contracting or self - executing or any other type of execution system which depends on project final service or outcome. The construction projects delay effect on overall annual plan progress which is highly correlated with citizen's daily life.

The project is defined as a set of interrelated and restricted activities with a specific purpose, budget, and schedule to provide the financial assets required to achieve the strategic objectives of the organization or entity concerned. [1]

Project successful execution responsibilities highly depend on engineering management abilities for work dividing to multiple activities and tasks. The scheduling of activities and tasks should ensure fast and accurate execution. The project execution also depends on resources availability like skilled staff, machines and raw materials which are necessary to complete each phase of project phases. Resources should be prepared for each activity with required quantity and quality in order to finish each activity according to required specifications without any unnecessary expenditures to ensure fluent work progress without any execution schedule delay (project timetable). Project management responsibilities vary and end to ensure obstacles overcome which may affect final project outcome quantity, quality, and expenditure at each execution time unit.

## 2. CONSTRUCTION MANAGEMENT CHARACTERISTICS

Construction management defines as “knowledge and abilities application using technologies and different tools in executed planned activities to get required a completed structure that matches owner requirement. Construction management defined by Al – Jalaly as human and materials resources guide and arrange art during project life cycle using modern techniques to get pre-specified goals.

The most important successful construction project characteristic is completing work within a specified time is precise activities scheduling, effective management planning, execution administration, optimum resources allocation and financial management that ensure required work funding. All these points should have same goals which ensure work continuity within planned budget, minimum construction time and higher quality of the final product which minimize operation and maintenance cost. [2]

## 3. PROJECT TIMETABLE

After project objectives determination process is preparing a work plan which can be summarized by prepare project timetable. According to project timetable, entire work will be divided into a number of phases, each phase will consist of a number of activities and tasks. All tasks are connected and arranged logically. Work type, quantity, required specification, resources availability and task working time considered main factors in preparing for project work plan which is the main guide for work timetable. The critical path technique is a popular method to get overall project time which needs to focus on the importance of each activity

and its effect on total work time, required resources (financial, human and technical), suitable activity execution technique at which many activities can be executed at the same time or start to end. Executive potentials should be determined, studied and compared with execution requirements. The work plan should be designed to ensure minimum external support and maximum profit without exceed project deadlines.

Project timetable is considered one of the contractor's responsibilities which are delivered to the owner to approve in order to be used as the main document for judgment on contractors effort if it's acceptable or not. Even the daily, weekly and monthly work reports made by administration staff will be compared with project timetable taking into consideration executive work which is listed in periodically installment. Most of the governmental authorities depend on the work items mentioned in last updated installment paid to the contractor as a primary reference to judge on contractor's effort translated as technical and financial accomplishment percent depending on executed work quantities and its prices as mentioned in the bill of quantities.

An experienced engineering team is required to prepare a work plan and project timetable for a specific project having a wide knowledge and clear vision for each activity details and required resources to complete it within required specification and specified time and cost. The team should study contractor execution abilities at all sectors such as staff, technical resources, logistic support, financial budget, regional material resources even cost, quality, and the quantity of each item mentioned earlier and if it's suitable to get required specification or not.

#### **4. MANAGEMENT PLANNING AND EXECUTION ADMINISTRATION.**

Management planning includes preparing technical professional staff, tools, machinery required to execute each work activity in addition to equip construction materials which are passed in laboratory test to ensure work continuity without any delays. The management should have a precise review and studying procedure of project document, site conditions, work plans and sheets to decide best activity executive scenario which is easier, cheaper, faster, safer and fulfill specification requirement. Even the construction requirement for respective activities which depend on previous activities should be checked and illustrated in specific sketch provided to the executive staff. A periodic and systematic cost monitoring process should be checked for each activity in order not pass the planned budget. One of the most important management tasks is quality control monitoring starting from the labors level to engineers.

The priorities of management administration are varied starting from updating project timetable according to site news, Working activities, quantities, current staff and machinery, raw materials available on site, work environment, cooperate with owner's staff, answering owner's communication, documenting any contractor's rights like non work days, technical advising, check request, any extra work tasks and many more.

#### **5. RESOURCE ALLOCATION**

The resources allocation includes knowing type and quantity of resources required during each time unit of project timetable, for each stage of the project and its compared with the contractor's potentials and resources available in size and quantity levels. The resources allocated to each activity should be exactly as required because any lack of required resources will lead to delay in execution and if the resources delivered larger than required quantity will

lead to unnecessary financial disbursements, which should be avoided at any stage of the project taking into consideration the quality of resources for different activities.

One of the important points which should be considered is to compare the potential of the contractor with the required capabilities of work during each phase of the project and provide an alternative strategies of execution in case of inability to provide them, such as the use of specialized secondary contractors and ensure from their own ability to perform the activities assigned to them without use of any other similar agreements within the duration required and according to the specifications. Often the agreements with secondary contractors shall be on the specifications of the activities mentioned in bill of quantities and shorter duration of execution than mentioned in project timetable with lower prices to maintain the appropriate profit margin to the main contractor and the payment will be given after finishing work, accepted by the owners engineering staff and the payment is delivered to the contractor from owner for this activity.

The quality of the structural materials processed from the aspects affecting the speed and cost of execution as the failure of construction materials in engineering tests lead to delay is not feasible, not required and when failure is repeated the contractor should raise the material from the site and prepare a new quantity and the start of laboratory testing again and this process is a waste of money, time and human efforts.

## **6. FINANCIAL MANAGEMENT**

One of the most difficult problems in work execution continuity is to provide sufficient money to ensure execution process according to execution policies of the construction agency during each stage of the project, whether it is matching with the project timetable or a decision should be made to speed up work execution which make number of activities executed simultaneously.

Because of a huge number of companies that obtained the establishment licenses after 2003, the process of applying for construction projects became more like a race to obtain more governmental bids in all fields like construction or equipping. Many companies compete on projects bids that do not have the executive ability to complete them due to lack of experience and self – potentials and mismanagement. In that case, the company money will be divided between all projects, work on company projects will be delayed due to lack of money. At the and to obtain new money sources the contractor will apply for new bids to obtain preliminary operational advances, which will spend on the company's other projects and that will accelerate company collapse financially and technically. Day by day the company will lose its human resources which considered one of the most valuable potentials.

When the contractor's money decreases, he is obliged to take several decisions to reduce expenses to ensure work continuity like using of low-quality construction materials and low skilled workers, which can lead to successive losses to the executive, especially if the owner is not satisfied with the performed work. The loss will be a disaster at the end of work if it's finished according to required specification conforming to the specifications and it's may be rejected, the order will be given by the owner to demolish and remove the work out of site it and therefore the loss at the cost and time cannot be compensated. In order to avoid these problems, an independent budget should be allocated for each project implemented by the company and the financial planning of each construction project within the specified budget.

In order to find out the amounts disbursed to a number of projects (research sample), a diagram was drawn up showing the amounts of the advances disbursed to the contractors against the period as shown in the figure (1). Although the daily work reports confirm the

amounts paid to the contractor (financial achievement) and compare them with the works actually carried out on the ground and approval by the owner's representative (technical achievement), some of the works performed are not included in the advances owed to the contractor for several reasons, may be outside the control of the owner and the contractor in addition to the routine procedures undergone by the payment of advances after approval by the owner engineering committees, which exceed a minimum period of fourteen days and increase than that at most cases.

Despite the budget abundance availability in the period (2008 – 2014), many construction projects have not been completed within the stipulated period, even its traditional projects such as schools, health clinics, and other governmental buildings. The local contractor is often unable to complete the work because of the financial accumulations resulting from the completion of part of the work entrusted to it.

"Financial planning for construction projects includes cost estimation before delivery of the offer or negotiation of the contract, estimating project income and expenses (or cash flow) and determining the amount of work the company can perform simultaneously and safely." (Al - Jalali, Mohamed 2005) [1]

One of the most important priorities of the companies executing the projects is to ensure good execution within the legal period of the contract and the lowest possible cost. Because of the execution changing conditions, it is impossible to work during certain periods and for the various circumstances outside contractor control demanding an additional period as compensation for the period of work interruption which is often not fully granted to the contractor. Extending the duration of the project (even if sometimes accompanied by financial compensation) is a loss to the company's human and financial potentials.

The execution of the works and paragraphs within the specifications and technical requirements mentioned in the contract document, even if the relatively higher cost will be in some manner a benefit to the contractor if compared with the cost of non-acceptable work (out of specification) of the delay and the cost of maintenance or re-work of damaged works after the end of the maintenance period.

The disputes arising from the additional disclosures and requests for additional periods by the contractors are among the main problems associated with projects execution. The difference in design plans and the bill of quantities on the actual reality of the projects leads to multiple and exhaustive communications to all parties. To reduce these disputes, the local government's approach turned towards the adoption of a turnkey system for project execution.

A turnkey contract is defined as a type of construction contract in which the preparation of the final specifications of the project and its objectives are carried out by the beneficiary where the executing agency responsible about the preparation of designs and completion of the works till the final product or services delivered. In some cases, the contract may be extended to operation and maintenance according to the specifications required by the beneficiary.

However, this action did not meet the required success, as it did not avoid the obvious delay and stopped many projects even after taking several actions to accelerate the pace of execution or maintain the level of achievement required. As many companies submitted bill of quantities for turnkey projects so that the prices of the foundation activities which carried out at the beginning of work with the reduction of prices for the activities carried out at the

end of the project and thus the execution rate at the beginning of the project is high and gradually slow down till the work stopped.

As the bill of quantity submitted by many companies with very low prices and close to cost price, which forced the experienced, classified and reputational companies getting away from the submission of such projects in addition to the validity of the principle of lowest bids acceptance in the committees of assignment because of fear from legal liability and corruption suspicions led to projects bidding to companies cannot complete the according to the prices, contractual terms and required technical specification.

## 7. ANALYSIS AND DISCUSSION OF DATA

An open questionnaire and interviews were held for a number of experts, section managers and experienced engineers in research field to determine the main reasons behind projects execution delay of a repetitive nature for the design of the closed questionnaire form. The proposed form was distributed to the engineering staff at various levels in terms of certificate, specialization, practical experience and others more. The staff distributed between a number of design agencies, supervisors of government projects, subordinates of local governments and a number of government departments of various federal ministries in addition to the engineering staff working within the various executive bodies of government and private companies.

The Likert scale method was used to express questionnaires opinion of research sample on the various reasons mentioned in the questionnaire. The questionnaire questions were focused on staff and engineers performance of all execution parties from the designer, supervisor, and executive staff. Paper and electronic questionnaire (Google Forms) to distribute and collect the forms and analyze the results by IBM SPSS.

The size of the sample was examined in a Kaiser-Meyer-Olkin method, according to this method the sample is suitable for study and research if the coefficient is greater than 0.5. Table (4) shows Kaiser-Meyer-Olkin Measure of Sampling Adequacy.

After examining the data collected by the Cronbach's Alpha coefficient to determine the degree of confidence in the results in which the questionnaire will be considered acceptable if the value of the coefficient (0.7) as shown in Table (5).

After analyzing the results of the questionnaire, the participants found that the most important reasons for projects delay, which arranged below from the highest to least:

- Failure to observe the required execution time allocated for each activity.
- Legal and management difficulty of work withdrawal procedure and procedures to avoid delay execution.
- Poor central planning of projects involved in the development and 5<sup>th</sup>-year plans.
- The political and security situation of the country.
- The inefficiency of legislation and laws and their suitability to the conditions of execution.
- Poor financial management of the project by the contractor.
- Inadequate schedule of work progress and lack of compliance with the conditions of execution.
- Lack of powers granted to the supervisor.
- Bill of quantities does not match actual reality.

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While the lowest reasons for delay construction projects according to the questionnaire are:

- Failure of grant additional time periods due to the contractor during the required time.
- Lack of designer powers.

**Table 1** Project delay causes

Sr.	Reason	Mean	Median	Std. Deviation	Variance
1	Delay designs works.	3.1273	3.00	1.32014	1.743
2	Delay of designs approval procedures.	3.0545	3.00	1.20828	1.460
3	Design errors.	2.7818	3.00	1.16573	1.359
4	Complexity of Modification of Designs.	2.8545	3.00	1.22351	1.497
5	Lack of designer experience with the execution conditions.	2.9818	3.00	1.28367	1.648
6	Communication delay between designer, supervising engineer, and executor.	3.1091	3.00	1.14944	1.321
7	Lack of designer powers.	3.6545	4.00	1.04027	1.082
8	Lack of experience of the supervisory staff.	3.1636	3.00	1.31605	1.732
9	Delay of site delivery procedures.	3.1818	3.00	1.14003	1.300
10	Lack of supervisor Eng. cooperation with executive Eng. to overcome executive obstacles.	3.5091	4.00	1.10341	1.218
11	Lack of understanding of the supervisor of powers and duties.	3.5455	4.00	1.15178	1.327
12	Delay in decisions making and directives by supervisor Engineer.	3.4545	4.00	1.10249	1.215
13	Lack of powers granted to the supervisor.	2.5091	2.00	1.30345	1.699
14	Lack of confidence of the supervising engineer in the executive staff.	3.2727	3.00	1.14592	1.313
15	A poor sampling of construction materials and laboratory tests for the completed activities.	3.0727	3.00	1.05153	1.106
16	Delay in laboratory tests and results delay.	3.1455	3.00	1.17722	1.386
17	Lack of coordination with the beneficiary during the construction period.	3.2182	3.00	1.08339	1.174
18	The complexity of the procedures for acceptance of completed activities.	3.0000	3.00	1.13855	1.296
19	Delay in advances procedures of completed activities.	2.4909	3.00	.99764	.995
20	The difficulty of administrative and routine procedures in supervising authority departments.	2.3636	2.00	1.16052	1.347
Sr.	Reason	Mean	Median	Std. Deviation	Variance
21	Administrative corruption of decision makers.	2.4545	2.00	1.35835	1.845
22	Legal and management difficulty of work withdrawal procedure and procedures to avoid execution delay.	2.0909	2.00	1.02330	1.047
23	The supervisory authority did not endure any of project delay risks.	3.1636	3.00	1.21356	1.473
24	Failure of grant compensation periods to the contractor because of non-working days.	3.5818	4.00	1.04865	1.100
25	Experience lack of administrative and technical executive staff.	2.9636	3.00	1.17005	1.369
26	The inefficiency of the work progress schedule	2.2727	2.00	1.16197	1.350

	and lack of compliance with the implementation conditions.				
27	Lack of or lack of specialized equipment and mechanisms necessary for implementation.	2.4364	2.00	1.11826	1.251
28	The site is not equipped with good quality construction materials and required quantities.	2.8364	3.00	1.28760	1.658
29	Poor financial management of the project by the contractor.	2.2909	2.00	1.01238	1.025
30	Failure to observe the specific execution time for each paragraph.	1.9091	2.00	1.07622	1.158
31	Failure to involve the supervisory staff in the operational problems.	3.0727	3.00	1.01570	1.032
32	Failure to observe the application of technical specifications required during implementation.	2.7818	3.00	1.21245	1.470
33	The political and security situation of the country.	2.2364	2.00	1.21661	1.480
34	The inefficiency of legislation and laws and their suitability to the conditions of implementation.	2.3636	2.00	1.22268	1.495
35	Poor central planning of projects included in development plans.	2.0909	2.00	1.14298	1.306
36	Bill of Quantities does not match actual reality.	2.2545	2.00	1.18974	1.415

**Table 2** Respondents Certificate

	Frequency	Percent	Valid Percent	Cumulative Percent
<b>diploma</b>	4	7.3	7.3	7.3
<b>bachelor</b>	45	81.8	81.8	89.1
<b>High Diploma</b>	2	3.6	3.6	92.7
<b>Master</b>	4	7.3	7.3	100
<b>Total</b>	55	100	100	

**Table 3** Respondents specialist

Specialist	Frequency	Percent	Valid Percent	Cumulative Percent
Civil	35	63.6	63.6	63.6
Electrical	5	9.1	9.1	72.7
Mechanical	13	23.6	23.6	96.4
Surveyor	1	1.8	1.8	98.2
Environment	1	1.8	1.8	100.0
Total	55	100.0	100.0	

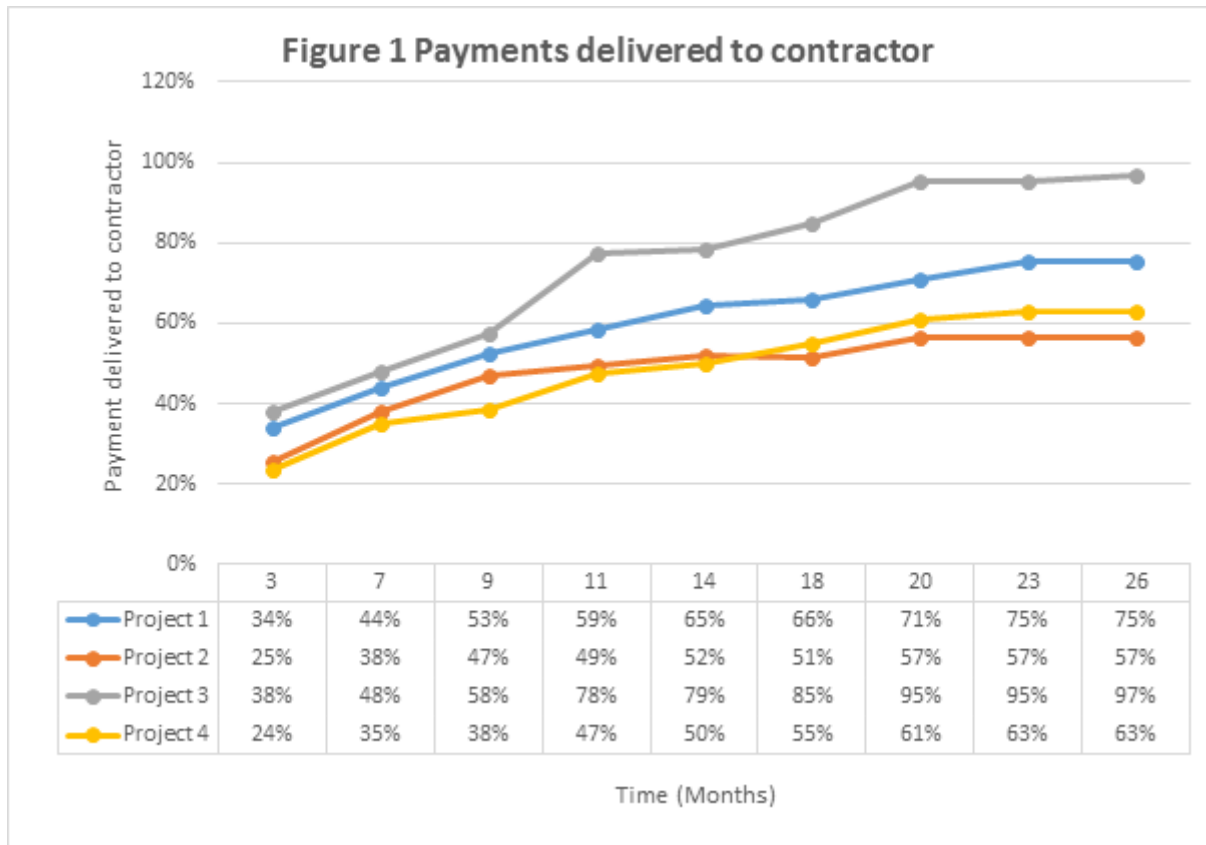
**Table 4** Measure of Sampling Adequacy

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	0.530
Bartlett's Test of Sphericity	Approx. Chi-Square 1376.900

**Table 5** Reliability Test

Cronbach's Alpha	N of Items
.907	36





## 8. CONCLUSIONS

- Delay of any engineering project is considered delayed for the comprehensive development plan and a major loss of effort and financial technical capabilities, whether the local governments or the executive authorities and delayed the implementation of a series of steps prepared for the execution of other engineering projects successively.
- The contractor's requirement go through a complex and lengthy process within the supervisory and owner authorities for the various constructional issues, starting from the procedures of site delivery, the advances requests (payment), technical consultations, requests for additional works, and the additional periods ending with the procedures of project delivery to the owner.
- The supervision and owner staff is under pressure to speed up the work within the highest technical specifications and as a result of any defect in any activity a high legal responsibility may be charged and multiple charges up to waste public money and exploitation of the job for personal purposes and therefore it is imperative for the supervisor not to show any flexibility during implementation.
- Most of these projects are referred to companies having many projects that are larger than their constructional capacity. Therefore, the delay can be classified more clearly if it is on the basis of the companies that have to be taken into consideration when announcing new projects.
- The most affected parties due to delayed completion of projects are the citizens and the contractors despite the effects of these projects on services performance of government agencies.
- The contractor is considered the weakest part during projects life cycle and he is sometimes subject to unfair undertakings in order to obtain some of his rights as he waives contractual or legal rights and is forced to accept them as a result of the complexity of the proceedings.

## 9. RECOMMENDATIONS

- The exceptional situation experienced by the country and the state of the dilapidated infrastructure necessitates procedures, laws and exceptional decisions should be implemented to improve the status of services provided by various governmental agencies and institutions.
- The need for a specialized, fast – response executive system to dialing with delayed projects construction and then proceed with the contractor works and rights after receiving the project according to last constructional conditions.
- Review the procedures of the additional statements and follow the modern engineering programs for the purpose of conducting the drawings on the design drawings before announcing the tenders.
- Increase the working time and not to stop work in projects during the holidays, increasing and sometimes unjustified to reduce the duration of construction.
- Change the mechanism of construction materials testing so that the test will be done in the quarries and not in the workplace to avoid the delay of work due to the failure of engineering materials tests and the adoption of tests of the standardization and quality control of national products and laboratories and quarries managed by government agencies.

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