

The study of permitted delays on costs in construction projects (Case study of irrigation and drainage network)

Mohammad Ali Soleiman Nejad, Mehdi Mahdavi Adeli *

Department of civil Engineering, Collage of Engineering, Shoushtar Branch, Islamic Azad University, Shoushtar, Iran

Abstract: Nowadays, one of the most important and key indices in measuring the success of construction projects is their implementation in due time and cost. The employer's failure to comply with his obligations is one factor that prevents its fulfillment. Because of increased time due to permitted delays, the contractor may incur unexpected losses that are considered in the documents for compensation; thus, the present study seems to be necessary. Therefore, in addition to the study of the effects of permitted delay on costs, irrigation and drainage project of Doirej has been studied and strategies have been presented to compensate the damages to contractor.

Key words: Contractor; Costs; Delays; Construction projects

1. Introduction

Article 1- section 10 of approved budget 1972 defines construction project as a collection of certain operations and services that are implemented based on "technical, economic or social justification by the executive authority during certain period and with certain credit to fulfill the objectives of 5-year construction projects" in form of constant investment (Harrisi, 2008). One of the most pervasive and common problems of construction projects, especially in 3-agent contracts is elongation of executive section and delay in on time utilization of them. During past decades, this phenomenon has happened in simple construction projects to the most complex ones such as petrochemical projects, dam making and nuclear power plants such that mean weight of national projects implementation in the country had been 11.50 years in fourth development plan according to the report of construction projects' operation. Fig. 1 indicates the abovementioned claims (Soleiman Nejad, 2015).

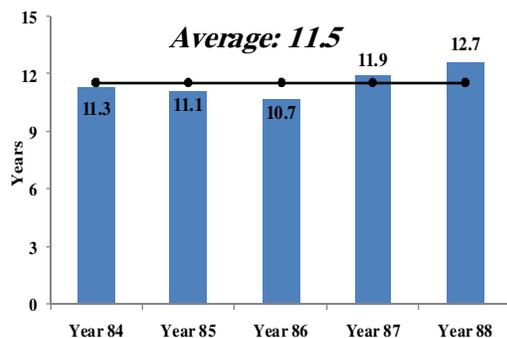


Fig. 1: Mean weight of implementation duration of completed national projects

On time completion according to the predicted costs in each project is one of the main criteria of its success. The project's nature in 3-agent contracts is such that time is considered the effective factor on it. Although the contractors prefer a certain completion date for project, concerning the realities and the sensitivity of the project activities to various events including delay in payment to contractor, delay in land delivery, materials and unpredicted events at the end of project, it is almost impossible to complete the project at this time.

Thus, it is seen that all the contract's items are flexible according to the determined completion date and include clear items according to which the possibility of extending the contract's time for the contractor to fulfill his obligations is provided. According to the construction projects' operation in fourth development plan, the fulfillment rate of national construction projects has been 61.90% that is showed in Fig. 2.

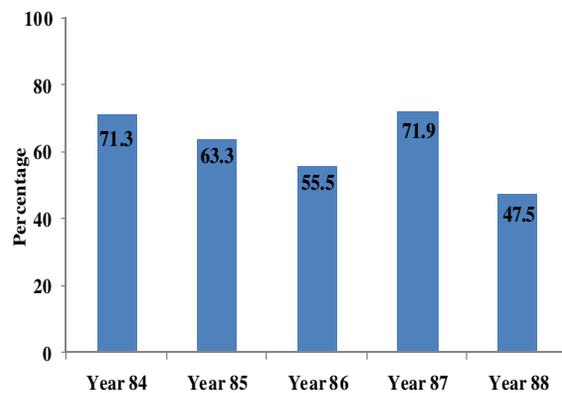


Fig. 2: The fulfillment rate of annual objectives of national construction projects

* Corresponding Author.

According to the reports of Islamic Council research center, the uncompleted projects' disinterest makes annually more than 12000 billion dollars losses to national economy (i.e. more than 2/3 of annual construction project of the country). These delays are caused by various factors, one of the most important one is failure to comply with financial obligations mentioned in general condition of contract by the employer that in addition to exerting severe damage to the economy has harmful effect on the financial flow of contractor and is one of the main causes of referring the conflict to technical council of planning and strategic supervision deputy of president (Shakeri and Baqerian Marandi, 2015).

2. Method and materials

2.1. Project delays

The time interval between the predicted date for completion of the project according to contract (time plan) and real data of project completion is called delays (Sadeghi, 2009) that generally include permissible and non-permissible delays. That kind of delay which is due to contractor's negligence and mostly roots in failure to fulfill employers' obligation is permissible delays whose conditions are included in article 30 of general condition of contract.

When permissible delay happens, it is required to increase the estimated time for performing the activities (Journal 4311, 2005) and extra costs for supplying the expenses due to delay such as overhead costs are also considered.

2.2. Classification of project delays

Project delays can be classified from various aspects. The most common categorization is based on the source, time and the possibility of compensation that is shown in Fig. 3.



Fig. 3: Classification of delays

2.2.1. Classification of project delays based on origin

By origin of delays, it means that the delays are due to which beneficiary of the project. In this approach, the origins of delays are classified to those

created by employer, contractor and third party. This is shown in Fig. 2.

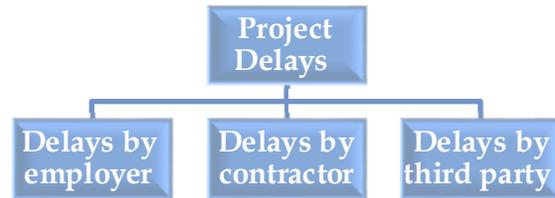


Fig. 4: The classification of delays based on the origin

2.2.2. Classification of project delays based on compensability

Delays based on compensability are divided into unacceptable and acceptable delays. Figure3 presents this classification:

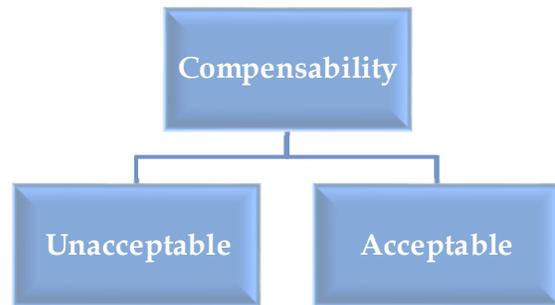


Fig. 5: The classification of delays based on compensability

2.2.2.1. Unacceptable delays

This includes that kind of delay that is under the control of contractor or his subordinate contractors. In this kind of delays, it might happen that the employer decides to settle down the damages by the contractor. In overall, the damages and losses value is extracted from the contract as "Settling down of losses". The classification of delays based on compensability means consideration of time and cost due to delays for their classification. According to article 50 of general contractor condition, at the project completion, if the duration of project implementation is longer that the time determined in contract, the consultant determines the impermissible delay of contractor according to article 30 and the causes of delay so that after employer's approval, the criterion for calculation of damages will be determined as follow:

1. If the total impermissible delay doesn't exceed one tenth of the contract duration, for each day of delay, 0.001 of the payment related remaining

work that is delayed becomes the criterion for calculation of damage,

2. If the total impermissible duration exceeds one tenth of contract duration, the damage is determined for one tenth of contract duration according to clause 1 and for each day of delay until one fourth of contract duration, 1/2000 of the payment related to remaining work that is delayed becomes the criterion for damage calculation (Journal 4311, 2005).

2.2.2.2. Acceptable delays

This includes that kind of delay that has not occurred due to performance or negligence of contractor and is out of contractor's control. In other words, the contractor is not the sole responsible for the delay; thus, the employer increases the permissible time for implementation of the project for the contractor based on the effect that the delays have had on the contractor timing to enable the contractor to complete the project. When the permissible contractual time for contractor is extended as some kind of compensation, it is clear that the time criterion based on which the employer decides on calculation of damages will also changes.

In other words, that kind of delay is considered acceptable for contractor that has happened based on one of the following conditions:

- The cause of delay is employer's control
- The cause of delay is employer's mistake
- The cause of delay is employer's negligence

Thus, these delays can happen in different conditions, for example, it is possible to refer to the following cases:

- Employer's failure in delivery of project site to contractor at the previous agreed time
- Change of condition and location of project site
- Change of orders and working area by the employer
- Delayed approval of documents
- Failure to present required information to contractor by the employer
- Project suspension by the employer
- Incomplete maps and technical specifications by the employer
- Improper designs

In acceptable and compensable delay, in addition to extension of permissible work time, the contractor's damage costs such as overhead costs will be compensated by the employer. To this end, the contractor should show that the delay is

unreasonable and prove that extra costs have been imposed on him. Un-compensable delays are those delays for which the compensation is just temporal and no cost compensation is considered for contractor.

In fact this kind of delay is acceptable and cannot be attributed to the employer or contractor. Delays due to unpredictable events (force majeure) or deficiency of materials and workforce in the condition when the expected values had been different at the time of contract are considered of this kind. In this condition, extension of project time is the only compensation and no cost compensation is considered for any party. In overall, all the involved parties in the project pay the imposed costs due to unacceptable and un-compensable delays themselves. Usually the causes for these delays are listed in one of the contract's Para Fig. s as force majeure. The title of delays caused by employer is usually brought in the contract as "lack of damage payment". On this Para Fig. s, it is tried to impose all the losses due to delay to the contractor and limit the contractor for extension of the project time. When delay occurs in the project and the project is temporally extended, the sources are used for a longer time period that was generally predicted while the total employer payment has not changed (Karimi and Hossein Ali Pur, 2010).

3. Field study

To specify the contractor's costs due to permissible delays, effective factors with imposed financial burden on contractor's financial flow have been studied in "Construction of irrigation and drainage system of Doirej" in Ilam. The imposed costs on each party have been specified as a percentage of the contract's initial budget and at the end, the total loss has been determined by summing all the effective factors.

3.1. Introducing the studied project

According to base price of irrigation and drainage of 2006, this contract has been predicted with early contract budget of 124,990,987,660 IRR and implementation time of 30 months (Water engineering, 2011) that due to employer's failure to comply with obligations, is implementing with permissible extension of 44 months with 75% physical progress.

Table 1: The results of case study findings

Rank	Delay explanation	Total delay (day)
1	Delay in paying temporary bills and failure to pay prepayment	1000
2	Problems due to lack of land ownership	220
3	Increased project's values	164

3.2. Overhead costs

The list price of Budget and Planning Organization just includes the price of each work unit without coefficients and for compensation of the following costs; a coefficient is allocated to the

contract that in estimation (in respect to Rial) should be multiplied by the all functions.

Table 2: Analysis of overhead costs

Row	Item description	Average cost percentage
1	Tax	1
2	Interest	10
3	Central office costs	2.5
4	Continuous workshop cost	7.85
5	Cost of guarantees	1.5
6	Training fund	0.2
	Total	23.05

3.2.1. Cost of contractor's central office

The cost of contractor's central office is considered as general overhead price and has been predicted as 2.5% of contract's initial cost in overhead coefficient. The cost of contractor's central office includes traveling cost of employees and managers of contractor, the salary of central office personnel, paper, copy, renting, equipment's depreciation and all maintenance costs of central

office of employer and continues during the project implementation.

According to inquiries from the authorities of Strategic Management Organization of President, the compensation of this cost during extension period has not been predicted (Ghanavati and Amir) Thus, the mentioned cost will be imposed on contractor's financial system without any negligence on part of him. The share of the studied project from the costs of contractor's central office is as Table 3.

Table 3: Price list of contractor's central office

Row	Description	Monthly cost (IRR)
1	The transportation of managers and supervisors of contractor	20,000,000
2	Salary of central office personnel	60,000,000
3	Maintenance cost of central office and other costs	12,000,000
	Sum (monthly cost)	92,000,000
	Total cost during permissible delay period (44 months)	4,048,000,000

3.2.2. Continuous workshop costs

This is considered in overhead costs and has been predicted as 7.85% of initial budget of contract in overhead coefficient. These costs include items such as wage of workforce, general supervision of workshop, technical office, official, financial costs and all the forces whose salaries have not been considered in the list price and equipping of the workshop, cost of workforce in service sector that are determined by the employer and consultant for supervision and examination, food costs of

employees and workers of contractor, workshop hosting cost, post cost, workshop authorities travelling, transportation costs for workshop, copy, print, accessories costs and the costs of safety, health and environment (HSE) and work protection.

By declaring these permissible delays, these costs continue and no extra cost will be proposed by the employer for compensation of financial load and will be imposed as unpredicted cost to the financial flow of contractor. The explanations of continuous workshop costs in the studied project are presented in Table 3.

Table 4: List of continuous workshop costs

Row	Explanation	Monthly cost (IRR)
1	Wage of workshop head	100,000,000
2	Wage, transportation cost and technical unit services	70,000,000
3	Wage, transportation service and official- financial services	100,000,000
4	Service sector personnel at the service of employer	40,000,000
5	Food cost of contractor's personnel	200,000,000
6	Cost of copy and other costs	50,000,000
	Sum of monthly continuous workshop cost (IRR)	560,000,000
	Sum of cost in permissible delay period	24,640,000,000

3.3. Losses due to release of warranties

Different kinds of contract warranties in terms of their application in contract include tender guarantee, guarantee of obligations, advance payment guarantees, performance guarantees and valid warranties including warranty issued by the bank or institution that is approved by the bank,

cash or promissory notes signed by owners of authorized signatures and other guarantees approved in the Management and Planning Organization (subject to Para Fig. (e)) (Management and Planning, 2003).

Warranty of performing obligations equals to 5% of the contractor's proposed price and performance warranty equals 10% of contractor's performance including bill, balance, materials rate difference and

similar payments and then after its deduction, it is kept in deposit account. The mentioned warranties are kept by the employer until temporary delivery; thus, due to project's delay, some cost is imposed on the contractor for keeping the mentioned warranties.

In the studied project, the sum of obligation guarantees and performance bond guarantees (by consideration of adjustment value) is calculated in respect to common bank interest (one-year deposit) and presented in table 5.

Table 5: Calculation of the obligation warranty and performance bond interests

Row	Type of warranty	Warranty value (IRR)	Bank interest (for 44 months)
1	Performing obligations	6,249,549,383	4,386,670,005
2	Performance bond (with consideration of adjustment)	20,499,098,766	14,388,683,476
Sum of unreleased warranties			18,775,352,481

3.4. Losses due to change of adjustment coefficient

To update the operation costs during the project implementation, coefficients proportionate to inflation growth rate will be proposed by the organization of strategic management of presidential office. The application of these coefficients in contractor's functions updates the income earned by implementation of the project [8]. In the contracts that have been completed at the early time mentioned in agreement and are temporary handed,

0.95 is converted to 1 in adjustment coefficient; however, in the contracts that are completed with delay (initial time and permissible delay) and delivered, 0.95 converts to 0.975 in adjustment coefficient (Management and Planning, 2003). When the contract enters the permissible extension time due to mentioned reasons, the contractor loses 2.5% of the whole adjustment cost (declared for updating the operation cost) without having any negligence. Adjustment price difference in the studied project is determined as table 6.

Table 6: Calculation of adjustment coefficient difference

Row	Explanation	Cost (IRR)
1	Approximate adjustment price by coefficient 0.975	80,000,000,000
2	Approximate adjustment price by coefficient 1.00	82,000,000,000
3	Difference	2,000,000,000

3.5. Continuous costs for equipping workshop

Equipping workshop means the operations, measures and activities that should be temporary implemented to facilitate the initialization and performing the operation subject to contract according to the documents and contract (Haqayeqi, 2004).

Since paying the equipment and installation costs of workshop are sectioned and cannot be increased according to the inquiries from strategic management organization of presidential office during extension period (Amiri, 2010), the continuous costs and costs of workshop maintenance in permissible extension period are imposed on the contractor and no place has been considered for its compensation. The mentioned costs in the studied project are presented in table 7.

Table 7: The calculation of continuous costs of workshop equipping during permissible extension period

Row	Explanation of costs for equipping during permissible extension period	Cost of permissible extension period
1	Consultant and employer food cost	220,000,000
2	Electricity consumption cost (2 counters with 3 phases)	2,200,000,000
3	Consumption water cost of workshop (washing and drinking)	440,000,000
4	Workshop phone bill cost	44,000,000
5	Cost of supplying and maintenance of consultant and employer offices	150,000,000
6	Cost of supplying and maintenance of contractor office	100,000,000
7	Supplying the working clothes, shoes and protection hat of workers	120,000,000
Sum		3,274,000,000

3.6. The loss of company disinterest in new tenders

The maximum monetary (IRR) value of the contracts of contractual companies is related to the obtained ranks and is specified and declared in the

decrees proposed by the Strategic Management Organization of Presidential Office. Thus, if the contract enters to the permissible delay period, one of the working quotas of the contractor will be blocked and the contractor is now allowed to participate in new tender; thus, he will incur disinterest loss of getting new contracts.

Assuming that the contractor of studied project would attempt to obtain a contract with similar budget and duration to the current project after his

working capacity is released and considering the predicted profit in overhead cost, the disinterest loss will be according to table 8.

Table 8: The calculation of contractor's disinterest loss in new tenders

Row	Description	Cost (IRR)
1	Alternative assumed contract budget	100000000000
2	Duration of prohibition from participation in tender	44 months
3	Assumed monthly performance cost	4166366255
4	Assumed performance cost in 44-month period	183320115220
5	Earned profit (based on predicted coefficient in overhead)	14666609217

3.7. The analysis results

At the end, relying on the presented calculations and discussions in this paper, it is possible to

observe the loss due to permissible delays risk on the financial flow of contractor in table 9.

Table 9: The total imposed costs on contractor during permissible delay

Row	Explanation	Total cost	Percentage of total
1	Central office cost	4048000000	6
2	Workshop continuous cost	24640000000	36.56
3	Cost of non-releasing warranties	18775352481	27.85
4	Cost due to change of adjustment coefficient	2000000000	2.97
5	Continuous cost of equipping workshop	3274000000	4.86
6	Loss of company disinterest in new tender	14666609217	21.76
Total imposed costs on contractor during extension (IRR)		67403961698	100

Weight frequency of each effective factor is different. Workshop continuous cost with 36.65% is in first rank and failure to release warranties with 27.85% is in the next rank. The weight percentages of these costs are specified in table 8.

Concerning the case study, extra costs of contractor due to 44-month delay are equal to 53.90% of the initial contract budget. If it is divided on the permissible delay duration, the share of each month is 1.22%; in other words, the contractor loses its predicted profit during the first 5 months of permissible delay and incurs losses by continuance of delays.

4. Conclusion and recommendation

Employer's failure to comply with his obligations, especially, financial obligations has great effect on financial cycle of contractor and according to the case study; it leads to un-compensable loss on the financial system of contractor although the contractor might not have any negligence. Thus, familiarization and precise prediction of risk due to permissible delays in three-agent projects and the price list based on which is the general condition of current contract have critical role in financial cycle of contractor. Thus, it is recommended that if the contractor's claims are not paid, the declared bank interest by central bank to be allocated to him proportionate to the performance and delay.

This study showed that the losses due to permissible delays are not just related to direct costs such as continuous cost and equipment of the workshop and a great share of this loss is due to hidden costs such as company's disinterest in new tender and lack of deposit release.

One reason for delay in construction projects of the country is employer's failure to comply with obligations that concerning the observations, it's reason might be failure to predict the losses' compensation or applying fines for employers in case of not complying with their obligations. Thus, it is proposed that to prevent the abovementioned cases, the fine or compensation to the contractor system to be predicted and the employer to be obliged to pay it.

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