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AN INTRODUCTION TO 4-D DECODING METHOD OF DEVELOPMENT PROJECT REPORTS

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Generally, the tool of comparison between performances of each stage in the life of a project, is the percentage of project progress, which in most cases is only determined as One-Dimensional with referring to one factor (Physical / Time or Cost). In many projects in developing countries, there are controversies on accuracy and the way of analyzing progress. Identifying weakness points of One-Dimensional look on project and determining a reliable and engineering approach for multi-dimensional decoding information receivable from reports is of great importance in project management. This can be a tool to help identification of hidden diseases and problems before appearing irreversible symptoms that are usually delay or increased costs of execution. The method used in this paper is defining and developing a hypothetical project (based on several real project situations and restrictions) as an example and investigates distinct scenarios and numerical comparison of them, and finally, by analyzing different scenarios, the possibility or impossibility of predicting the occurrence is examined through the evidence of One-dimensional method.

Keywords: Project control, Physical progress (P.p), Time progress (T.p), Financial progress (F.p), Delays, Critical path method (CPM).

1 INTRODUCTION

In developed countries, there is a main strategic approach to Human resource management and a special attention to line it up with the values, Mission and Vision of the Organization (Hays *et al*. 2001). So, all proceedings are happening based on a predetermined plan to achieve the main goal, even personnel's job promotion. Researches show that although developing countries apparently use the employment and promotion pattern based on Meritocracy, but actually most of them tend to focus more on some other factors such as: race, language, social level, political view, loyalty and so on, for hiring and promoting. Even in those few countries which claim to use Meritocracy as a criterion for employment and promotion, finding a correct definition of 'Merit' is a challenge (Haque 1997).

However, according to professional nature of development projects, job promotion based on relationship, doesn't seem rational or functional and needs more professional reasons even for pretense. So that's why we can find some reports that emphasize on fabulous performance while the project face significant problems which could failed it. Another problem of huge and patient projects is that the life of a project is more than

the professional life of its managers and the quality control tool is the percentage of progress with referring to one of the three factors (Physical, Time or Cost).

2 HYPOTHETICAL PROJECT

Before entering the main discussion for showing weakness of One-Dimension method, the hypothetical project (based on experiences in most similar situation and restriction on real projects during 2003 to 2014 is defined[1]. See Table 1.

Table 1. Hypothetical project details.

Code	Executive Departments	Quantity	Total Volume of Concrete in the Department	Estimated Duration for Department	Unit Cost of Concrete Operation	Total Cost for Department
			m^3	**Day**	**$**	**$**
DP1	Small Bridges	100	5000	200	12	60,000
DP2	Main Bridges	4	1000	200	50	50,000
DP3	Reinforced Walls	50	6000	100	25	150,000
DP4	Other Walls	20	8000	50	5	40,000

Assumptions of the project (to be investigated from three different points of view):

F1. Max. Number of the same structure that can be simultaneously executed is one.

F2. The optimal production capacity of concrete is 120 m^3/Day, so 120 m^3 up to 145 m^3 will cost plus \$2/m^3 and more than 145 m^3 will cost \$4/m^3 more…

F3. The maximum rate of Budget-Flow is \$1,900/Day. If more Budget/Day is necessary, it requires borrowing which means increasing the costs to a 20% because of inflation.

F4. All the initial project estimations and planning are accurate, and the main parameter to calculate the Physical Progress is concrete volume.

3 SCENARIOS

3.1 1st Scenario

Now, we shall review the project from the perspective of a client who considers Physical Progress as the basis for project control.

[1] With the help of the practical experience in various projects (2003-2014) such as: Pol-e-sefid to Ghaemshahr Highway (2011-14) / B3-Mahestan Residential Tower (2004-7) / Pars Airport Runway (2003-4) / Harbor of Chabahar (2005-6) / IGATV Pipeline Booster Gas (2005-5) /Chahnime IV Soil Dam in Zabol (2006-11) /Ati-shahr Residential Towers(2006-8) / Site Development of Milad-Tehran Tower (2006-7).

Table 2. Project progress report in different times based on work.

Section of the project life	Total volume of concrete (m^3)	Finished Vol. of Concrete (m^3)	Physical Progress (%)
100th Day	20,000	14,500	73
150th Day		16,000	80
200th Day		17,500	88
Predictable Delays = 84 Days			

On the 100th day, according to Table 2 report has announced as 73% or equivalent to 14,500 m^3 of concrete pouring. Apparently, this shows the positive performance of manager which in half of the planned time has gained more than 73%. On the 150th day, report of performance is as following: "The total volume of concrete pouring is 16,000 m^3, or 80%", that apparently represents weak management, as during 25% of time, achieved only about 7%, but general performance of project has been acceptable and the client gets ready for project inauguration even before the 200th day. In the final section of the project, when the client is preparing for inauguration, Project report is: "The total volume of concrete pouring is 17,500 m^3 or 88% and inauguration of project will be done with 84 days delay". It's a familiar scene in most development projects in developing countries, and we want to know, despite the performance of the first half was brilliant, what happened that caused significant delay?

i. Have we made a mistake in the progress calculations? If not, has the concrete been a good choice for calculating physical progress?

ii. Was choosing Physical Progress as the basis for project control wrong and there should be revision in parameter selection?

iii. Could we identify the problem of project earlier by existing tools?

iv. Is it feasible to identify this growing problem behind the significant reports?

In the following, after reviewing the two other different scenarios, we will try to find the answers to these questions.

3.2 2nd Scenario

Reviewing the project from the point of view of a client who considers Financial Progress as the criteria for project control.

Again, imagine the above hypothetical project in 100th day, according to the Table 3, the (F.p) is 63% equivalent to $188,000. Once again, this report remarks positive performance that in half of the planned duration gained about 63%. On 150th day, report is as follows. "(F.p) equal to 76% or $227,500", so during the time equal to 25%, it has just gained 13% progress. But still overall report of project performance is acceptable (76%) and the client gets ready for inauguration on 200th day. In the final section of the project, the summary of the project is:" (F.p) is 92%, equal to $ 27,500, and inauguration of project is delayed for 70 days".

Table 3. Project progress report in different times based on cost.

Section of the project life	Total Estimated Project Cost ($)	Financed Cost ($)	Financial Progress (%)
100th Day	300,000	188,000	63
150th Day		227,500	76
200th Day		275,000	92
Predictable Delays = 70 Days			

3.3 3rd Scenario

The client's experience with the delayed lead him to change the strategy. So now he focuses on the priorities based on the C.P.M. and choses Time as the control parameter.

Table 4. Project progress report in different times based on time.

Section of the project life	Total Estimated Duration (Day)	Effective Duration (Day)	Time Progress (%)
100th Day	200	100	50
150th Day		150	75
200th Day		200	100
Predictable Delays = 0 Days			

On the 100th day, based on Table 4, the progress of the activities on CPM is 50% and based on scheduling there is no delay. On 150th day, again does not observe any delay and the client with full satisfaction with the new policy gets ready for inauguration on 200th day. On inauguration day, while the employer was extremely happy to inaugurate on time, was received a bill include an additional $14,300 as the cost of buying extra concrete (F2), and the excess cost of $15,600 due to borrowing loans (F3). This outcome that the project is finished by costs beyond the initial estimates but in specified time is also something common. Of course, this issue is by assuming no change in the technical specifications and preliminary estimates (F4). The next section contains broad investigation of what happened in each scenario that cause delay or increase in cost by numerical defendable calculations.

4 ONE-DIMENSIONAL NUMERICAL ANALYSIS OF THE SCENARIOS

4.1 One-Dimensional Analysis of the 1st Scenario with Priority on (WORK)

As it is seen in Table 5, status report on 100th day shows of 73% with priority in Dp3 & Dp4. Since bulk of concrete pouring is in them, the manager identifies these two as the efficient parts for showing his good performance and tries to give priority to them. Slowness of operations in other periods is quite evident in Dp1 & Dp2 in result of restrictions on operation (based on assumption # F1).

4.2 One-Dimensional Analysis of the 2nd Scenario with Priority on (COST)

As it is shown in Table 6, here, status report on 100th day shows of 63% with priority in DP3 & DP2 since the price of executing concrete pouring in these two parts is

considerable and more effective to show good performance of project. This trend is examined again in period between 100th&150th day and seen in numerical summary of 150th day's report. Slowness of executive operations in the last 50 day period is quite evident in Dp1 & Dp4 in result of restrictions on operation (based on assumption #F1). This obligatory slowness in concrete pouring operations in Dp1 & Dp4, eventually leads to only 92% financial progress and delay of 70 days.

Table 5. Project Progress detail report based on work.

Code	Executive Departments	Quantity	Total Volume of Concrete in the Dep.	100th Day			150th Day			200th Day		
				Number of completed structures	Finished volume of concrete	Physical Progress	Number of completed structures	Finished volume of concrete	Physical Progress	Number of completed structures	Finished volume of concrete	Physical Progress
			m^3		m^3	%		m^3	%		m^3	%
DP1	Small Bridges	100	5000	8	400	8	33	1,650	33	58	2,900	58
DP2	Main Bridges	4	1000	0.4	100	10	1.4	350	35	2.4	600	60
DP3	**R. Walls**	**50**	**6000**	**50**	**6,000**	**100**	**50**	**6,000**	**100**	**50**	**6,000**	**100**
DP4	**Other Walls**	**20**	**8000**	**20**	**8,000**	**100**	**20**	**8,000**	**100**	**20**	**8,000**	**100**
Total		**-**	**20,000**	**-**	**14,500**	**73**	**-**	**16,000**	**80**	**-**	**17,500**	**88**

Table 6. Project progress detail report based on cost.

Code	Executive Departments	Quantity	Estimated Cost for the Dep.	100th Day			150th Day			200th Day		
				Number of completed structures	Financed Cost	Financial Progress	Number of completed structures	Financed Cost	Financial Progress	Number of completed structures	Financed Cost	Financial Progress
			$		$	%		$	%		$	%
DP1	S. Bridges	100	60,000	15	9,000	15	40	24,000	40	65	39,000	65
DP2	**M. Bridges**	**4**	**50,000**	**2**	**25,000**	**50**	**3**	**37,500**	**75**	**4**	**50,000**	**100**
DP3	**R. Walls**	**50**	**150,000**	**50**	**150,000**	**100**	**50**	**150,000**	**100**	**50**	**150,000**	**100**
DP4	Other Walls	20	40,000	2	4,000	10	8	16,000	40	18	36,000	90
Total		**-**	**300,000**	**-**	**188,000**	**63**	**-**	**227,500**	**76**	**-**	**275,000**	**92**

4.3 One-Dimensional Analysis of the 3rd Scenario with Priority on (TIME)

As evident in Table 7, the priority of project manager is focused on Dp1&Dp2 that their execution time is longer, and meanwhile had eye on the other executive departments. In this condition, implementing Dp3&Dp4 that have the bulk of concrete pouring operations, due to short time of execution, and not being on the critical path, was transferred to the last days and the maximum Free-Float of tasks was used. This required extra financial resources and the high density of concrete production beyond the capacity of the project in the last 50day period (based on F2&F3), and which ultimately increased actual costs of the project without any good reason.

Now, let us return to try to answering questions "i" & "ii". In overall response to

Table 7. Project progress detail report based on time.

Code	Executive Departments	Quantity	Total Estimated Duration	100th Day			150th Day			200th Day		
				Num. of completed structures	Effective Duration	Time Progress	Num. of completed structures	Effective Duration	Time Progress	Num. of completed structures	Effective Duration	Time Progress
			Day		Day	%		Day	%		Day	%
DP1	**S. Bridges**	**100**	**200**	**50**	**100**	**50**	**75**	**150**	**75**	**100**	**200**	**100**
DP2	**M. Bridges**	**4**	**200**	**2**	**100**	**50**	**3**	**150**	**75**	**4**	**200**	**100**
DP3	R. Walls	50	50	5	5	10	7.5	7.5	15	50	50	100
DP4	Other Walls	20	100	1	5	5	11	55	55	20	100	100
Total		**-**	**200**	**-**	**100**	**50**	**-**	**150**	**75**	**-**	**200**	**100**

those questions, it should be said that calculations have been accurate and choosing concrete pouring and the physical progress as control tools is an acceptable choice in project. For the question "iii" we will never reach a logical and concise answer by One-dimensional analysis. However, some vague signals of problems can be found. Investigating the scenarios proved that there is always the possibility that problems are being hidden behind the impressive numbers presented in progress reports. So, even in this simple hypothetical project we cannot determine absolute point to beginning of the problem based on this dissection analysis. In order to answer the questions "iv" as the key question, we need to look beyond the One-dimensional analysis that is called a 4-D analysis which exceed the scope of this article and will present in subsequent papers.

5 CONCLUSIONS

Since in developing country, the life of project is more than the professional life of managers, there is no direct relation between the success degree of projects and its temporary managers' performance. So, the simple way for managers to show their performance is the project control report based on the view that the client prefer. So, they try to manage project policy on this way. Therefore, it is highly likely that the client or director of a large and complex project cannot identify hidden problems of the project by using One-dimensional decoding of information which is sometimes too satisfying and prevents paying attention to potential weaknesses that lead to illness. Hence, it is necessary to introduce a new way different from existing method to recognize these weaknesses and prevent irreversible symptoms such as delay or increase in costs of execution which is referred to the 4-D decoding method.

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