

Systematic Project Management Using Controlling Indicators

Eghbal Shakeri¹, Amir Golroo², Amirnojan Naderi³, Hossein Hajarolasvadi⁴, Ghazal Naderi⁵

^{1,2}Assistant professor at Amirkabir University of Technology

³PHD's Student in Construction Engineering and Management, Amirkabir University of Technology

⁴Master's student in construction engineering and management, Amirkabir University of Technology

⁵Master's student in MBA, Edinburgh University

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ABSTRACT

The huge volume of data and difficulty of useful and necessary data separation is among the current organizational problems in large project-oriented organizations. Therefore, there is a need for data classification, prioritization and separation. The utilization of evaluation indicators in different aspects of each project can be a strong support for management of large project-oriented organizations. On the other hand, the role of powerful tools of information technology (IT) as well as the possibility of implementing the predesigned algorithms in project management can make the use of these indicators systematic and intelligent. The utilization of indicators for evaluating the status of projects along with the information systems and project management knowledge can be the strong support for management of project-oriented large organizations, enhances their power in managing the projects and maintains the required quality in nine scopes of project management.

KEYWORDS: Project management, Controlling indicators, Management model

1- INTRODUCTION

In the project management scope, If the quality is important, it should be controlled and in the case of control, the project portfolio should be managed[1]. The project controlling sector is the weakest sector, which raises the time of construction projects according to a statistical survey and investigation results. Currently, the lack of project control system in construction projects is the main problem in this regard because either the construction companies have no project control sectors, or the project control is integrated in technical office and play a very poor role at workshops. The construction project management is another problem according to another study on the causes of weakness in project progress. The third problem refers to the weakness of contracting companies in planning for ending the project at the due time and it determines the importance of management and proper management of construction projects [2]. Another section investigates the movement model of research and the weaknesses of current state by conducting the interviews in order to determine the required scope.

2- Interview and questionnaire

This section indicates the current status of management and control systems in local reputable companies by raising the questions and conducting the interviews with managers. Afterwards, the advantages and weaknesses, which are created by utilizing the introduced management model, are then presented.

- 1- How are the company's organizational chart and its compliance with project portfolio management model?
- 2- How many rows of hierarchy are there from the lowest to highest level?
- 3- What cases of information flow are done systematically and without paper?
- 4- How many work and information flow algorithms are there in the organization?
- 5- What is the relationship between the posts and use of system in the organization?
- 6- How the personnel are trained? What unit is responsible for this case?
- 7- With what types of control systems the managers are familiar?
- 8- Do the managers have the needs to improve the management model?
- 9- What levels of organization managers are familiar with project management knowledge and have degrees?
- 10- What indicators are defined to assess the performance in the organization?
- 11- How much integrity do these indicators have?
- 12- What processes are done automatically using the information technology?
- 13- In what scopes the project manager regularly reports?

- 14- What reports including the consultant or owner's comments are asked from the project team?
 15- How documentation is done?
 16- What does the project inspection process by the Head Office consist of?

The aim of this section is to introduce the quantitative indicators to assess the status of projects in each project portfolio. Therefore, each of these indicators are monthly measured for each project and then the report of indicators, which briefly indicate the project status and management, is sent for different levels of organization after comparing it with the mean of that index in projects of organization. At the next stage, the parameters are ranked based on the impact of utilizing the Likert scale by interviewing with construction industry experts.

3- Preparing a list of effective indicators

The new indicators are introduced in order to prepare a list of indicators through the domain experts' and author's comments, and the sum of these indicators and indicators of study resources constitute the initial list of indicators. After creating the initial list of indicators, they are ranked by Likert scale. The last column of Table 1 represents the results of questionnaire by Likert method [3-5].

Table 1 List of suggested indicators by experts

Suggested index	Score
Financial indicators	
Ratio of Dollar function to allocated resources by organization	3.5
Ratio of number of contractors to superiors	1.1
Average time of collecting the receivables	2.4
Ratio of total debt of project to assets acquired from project	4.2
Ratio of approved claim to the last statement	3.3
Ratio of debt to project credit	4.3
Ratio of accounting profit to the contract amount	3.8
Ratio of current liquidity of project to contract prepayment	1.8
Labor efficiency	
Ratio of statement to cost of superior labor	1.2
Staff satisfaction index	1.4
The individual competence for their posts (organization inspector's report)	3.3
The influence of defined work culture of organization in project	3
Ratio of value added to the number of human resources	4.4
Managerial power	
The sum of "number of contractor's days of delay" * "his contract price"	3.4
Compliance of project process based on the strategic/ portfolio process	3.5
Motivating and delegating the project team by project manager,	4.5
The percentage of success in delivery/ percentage of success in portfolio	1.2
Evaluation of suppliers or subcontractors in terms of ability to adapt to possible changes in design	4.3
Capital productivity	
Ratio of realized profit to expected profit	1.2
Ratio of cost to Dollar function/ this ration in initial estimate	3
Ratio of project profit to investment of company in project	2.3
Ratio of equipment involved in the project to income from the project compared to the portfolio project	4.3
Optimized project implementation	
Maximum of (sum of rent for each machine to its worth)	1.4
The real cost of faults in implementation or designing to cumulative function	1.2
Percentage of activities needed to be refined and reworked	3.6
Average response time to consultant's letters	1.3

Percentage of poor and rejected services by employer	3.4
Average advisor's satisfaction index and other regulatory factors	3.6
Ratio of real to planned progress	4.1
Percentage of real physical progress to contract volumes/ comparable to portfolio	2.8
Project implementation process	
Analysis and report of risk management plans	1.4
Employer's satisfaction: cost performance index (CPI)	1.3
Employer's satisfaction: schedule performance index (SPI)	3.6
Percentage of work delay in 10 main activities per month/ portfolio index	2.9
Ratio of achieved milestones to program milestone	2.7
The rate of project documentation on the official website of organization	2.6
Success in contract management (report of inspector in organization)	3.3
The use of information systems in headquarters of organization	4.3
Success in achieving the professional team (report of inspector in organization)	3.6
Innovation	
Percentage of revenue from new products and service in project	4
Ratio of people aware of goals and strategies in each sector	3.5
Time required to develop a new generation of services in project	4.4
Education, learning and development	
Total key members' turnover in project team	4
The use of enterprise system center and updating with it	2.2
Ratio of number of submitted proposals to the number of human resources	2.7
The amount of information available to employees	2.9
The regular and scheduled meetings with employer for common understanding of project	4
Project manager's membership in forums and attending in conferences and specialized seminars	3.5

4- Definition and quantification of some proposed indicators

Each of these indicators can be compared with the mean of organizational projects and they can be defined with the mean of industry according to the statistical data in the lack of appropriate data, and according to the project management team's viewpoint on the type of project when none of them exist. Some of the mentioned indicators are explained and quantified as follows.

4-1- Ratio of Dollar function to resources allocated by organization

This financial ratio is obtained from dividing the contractor's approved cumulative function by organization's resources allocated to project. These resources include the financial, human, and equipment resources, etc. which are converted to Dollar by project manager. This high ratio compared with the mean project portfolio indicates the optimal use of resources by project management.

4-2- Ratio of number of contractors to superiors

If there is a common belief in this principle that implementing the project by subcontractors is generally cost effective for company, the less rate of superior force for management and planning in the workshop indicates the high efficiency of labor and proper management. This index can be calculated by adding the contractors' salary to superiors' salary or as the measured number; this ratio is prior to the mean project portfolio.

4-3- Ratio of total project debt to asset resulting from project

Each project has involved the number of total debt including the current and long-term debts in accounting. On the other hand, the obtained asset from project including the cash, machinery and regardless of certified credits are recorded in accounting. Therefore, the more this number is reduced, the more the project has proper financial status and low risk.

4-4- Ratio of approved claim to the last statement

A part of the contractor's statement is not approved by the consultant in each project. The more the contractor's performance is increased by these non-confirmed amounts through subsequent consultations, the more the higher value is created for project profitability and this indicates the high bargaining power of technical management team. In comparison, this high number indicates the strong management in this regard.

4-5- Ratio of project debt to credit

This ratio is similar to the ratio 4, but the certified and paid credits are among the denominator of index in this ratio. The low index indicates the project profitability, but it does not indicate the risk of lack of liquidity and the risk of bankruptcy.

4-6- Ratio of accounting profit to contract price

The project accounting profit is obtained after paying the tax and insurance. A balanced index of profit is obtained by dividing this number to the price of contract and this high number indicates the positive financial performance of project.

4-7- Ratio of project current liquidity to contract prepayment

The liquidity of project is a prominent factor for implementing the project activities. This value becomes significant through dividing the liquidity to prepayment value. The interval close to the mean portfolio is appropriate for this number. The higher number indicates the excess liquidity and its improper application, and the low number indicates the lack of liquidity and inability to timely implementation for project.

4-8- Staff satisfaction index

The staff satisfaction with workplace is a key factor in their appropriate performance. This satisfaction is monthly measured by inspectors with its results are presented to various levels of management.

4-9- Individual competence for their posts (organization inspector's report)

The adaptation of individual education, skill and ability to the post is an effective index in personnel optimal performance and it is evaluated by inspector through check lists and then the score of each team will be measured.

4-10- The sum of "number of contractor's days of delay" * "his contract price"

The contractor's delay is classified into the authorized and unauthorized categories. The project team is blameworthy in authorized delay and the contractor in unauthorized delay. In both cases, the project will lead to the failure. The subcontractor's delay rate is weighted through multiplying his delay by his contract amount, and averaging on the first case reflects the inability of project team in constructing the proper work context and the second case indicates the improper selection of subcontractor. The high value of this index indicates the managerial weakness.

4-11- Ratio of realized profit to expected profit at the beginning of project

Reduction of expected profit can be due to the initial wrong estimation or the lack of proper performance by team project. If there are reliable initial estimates in the organization, this index can be utilized to control the project performance.

4-12- Percentage of delay in 10 main activities per month/ portfolio index

This report is monthly calculated. After determining 10 main activities of project, the delay of each item is measured towards the program. This index reflects the success of project team in delivery of main project activities.

4-13- The rate of project documentation on the official website of organization

Each project should put defined documents and information for documentation on the official website. This information is widely used for accumulation of knowledge in the organization and determining the faults in projects. Since there is a low tendency towards this case in project managers, the project documentation is encouraged by defining the bonus system.

4-14- Percentage of revenue from new products and service in project

The use of new products and services in the project leads to the distinguished contractor and higher profitability for him in addition to gaining the employer's satisfaction. This index is utilized to encourage the management to invest in this area and take effort to create new products. The numerator represents the cumulative function due to the new products and the denominator indicates the total function of project. The new products can be defined as the items which are upgraded in terms of method and type during a meeting with an advisor.

4-15- Total key members' turnover in project team

The experts' turnover is one of the fundamental problems in organizations. Retaining these employees is an important factor in long-term survival of organization. Recording these employees' turnover in corporate system warns the project management that his performance is recorded in the case of non-effort to retain the key employees.

4-16- Ratio of number of submitted proposals to the number of human resources

The project team members' sense of collaboration and responsibility is so effective in the success of project. Therefore, their suggestions for work promotion are recorded in system and the case study is conducted on those confirmed proposals. An index is obtained from the personnel collaboration through dividing this number by the total number of human resources in project.

4-17- Project manager's membership in forums and attending in conferences and specialized seminars

The project management expertise and its proficiency level in today's management sciences can play the main role in dynamics of project team. Therefore, considering the scores for managers, who have attended in conferences and seminars, are the members of management forums, and have received the degrees in project management from institutes, they are encouraged to learn the project management sciences.

4-18- Average time of collecting the deliverables

This index reflects the management ability to collect the deliverables. According to the existing rules, 20 days after submission of each statement, the employer will have to pay. Therefore, the number of excess days of 20 days is divided by the price of each statement, and then these numbers are averaged and compared to the industry index. The higher numbers indicate the weaknesses of management group in collection of deliverables and providing the liquidity.

4-19- Ratio of statement to cost of superior labor

This index is utilized for ensuring the project portfolio management with personnel's high efficiency. To make it significant, the superior cost is added to the cost of statement in fraction. The higher number than the benchmark index indicates the proper management in human resources' efficiency.

5- Investigation of validity and reliability

In all research projects, the researcher should consider important issues such as the ability to generalize the results, validity, reliability, as well as the degree of trust and confidence. In general, it can be concluded that a good test should have the desirable features such as the objectivity, ease of performance, practicality, ease of interpretation, validity, reliability in order to lead to accurate results. Among these features, the reliability and validity are more important. Here, alpha Cronbach's method which is more common than other methods is studied in this regard. alpha Cronbach's coefficient method can be utilized for determining the reliability of questionnaire or test with an emphasis on the internal correlation. In this method, the components or parts of questionnaire are utilized for measuring the reliability coefficient of test [6].

$$ra = \frac{J}{J-1} \left(1 - \frac{\sum s_j^2}{s^2} \right)$$

Where:

J: The number of subset of questions in the questionnaire or test

Sj²: Variance of sub-test j

S²: Total variance of test

alpha Cronbach's coefficient ranges from zero to one; the greater the ratio, the greater the reliability of scale. According to the rule, alpha should be at least 70% in order to be considered as the scale with reliability. Therefore, SPSS software is utilized for measuring alpha Cronbach. The obtained outcome is equal to 87% for 10 questions and it is acceptable.

6- Definition of objective function

Each organization should have a unique objective function according to its own situation. Using this function, the organization can summarize the status of each project by a single number and determine the proximity of project status to objectives of organization. This function should be achieved by defined indexes, and should be in fact the sum of them. The features of this function are investigated as follows:

- It should have a positively correlation with improvement of each index.
- In the case that each index has the critical status, this index should be severely declined, so that the high mean of other indexes cannot hide a crisis.
- The indexes, which are more important, should have higher weights in the function.
- The priorities of management team to various groups of indexes (financial, productivity, etc.) should be defined as the input to function.
- It should be understood and has the ability to be changed by management team.
- The high amount of an index should have no exponential and fake impact on it.

7- Summary and Conclusion

In this paper, a brief introduction to project management and control procedures is presented with regard to the current problems as well as seeking to simplify the complex construction project management.

The following benefits can be obtained using the introduced technique:

1. Transparency of the work process is among the benefits of this model. In other words, these indexes facilitate the tasks which are assigned to people, and thus the management becomes in line with the procedures of activities, the causes of delayed activities are clarified for him and the responsible person is determined in this work process.
2. Just in time reporting of various sectors in project team is among the advantages of this system. These reports help the project success by intelligent distribution among different levels of management.
3. According to the documentation of activities, this system allows the full control of management team over the changes and helps the management of changes in project.
4. It helps the standardization of reports.
5. Motivating the staff due to measurement of positive performance of them.
6. It helps the management of costs according to the just in time information and by assistance of this system.
7. Avoiding the duplicate data entry and maintenance, and ease of access for different working groups to classified information.
8. Upgrading the individual knowledge through education, increasing the speed of personnel work and enhancing the productivity.
9. Scrutiny of administrative weaknesses and trying to overcome them.
10. Determining the algorithms of work and flow of information and clarifying the individual responsibilities for those activities.
11. Taking advantage of a variety of important indexes according to managers' views and controlling the project conditions.
12. Increasing the mastery of project management and the possibility of increasing the number of projects due to the higher organizational ability.
13. Determining the types of reports and graphs required to expedite notification and defining the required data for each post.
14. Encouraging thinking about the objective function of organization and helping to shape it.
15. Utilizing the bonus system in organization and ranking the projects based on the overall index.
16. Taking advantage of combined data due to their integration.

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