A study on how to improve PMBOK guidelines performance by simulation Case Study: National Gas Company of Lorestan province

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Abstract

The project-oriented organizations are more appropriate for sustainable environments. Any effective project-oriented organization should institutionalize its project management processes in such a manner to yield the greatest possible profits. The aim of this paper is to study the relationship between the project management PMBOK guideline (Project Management Body of Knowledge) and simulation technology in project-oriented organizations. The methodology involves using five steps for applying these two tools aimed at enhancing project management processes in the Lorestan Gas Corporation, as one of the project-oriented organization. Results show the implementation of such management approach leads to a 5% performance improvement and using PMBOK can be instrumental in effective delay management. The implementation of the aforementioned improvement package was effective in improving the efficiency of organizational processes; in terms of optimizing the resource utilization that has manifested itself in resource losses and cost reductions.

Keywords: Project-orientation, processes, PMBOK, optimization.

1. Introduction

The project management, by its virtue, is considered as one of the major organizational parameters, the importance of which for survival of the system makes it paramount to nurture and develop sound foundations for sustainable organizational progress, growth and survival. Effective project management paves the way for selection of sound approaches which are responsive to the internal and external organizational requirements. One of these requirements is paying attention to improving organizational competitiveness through institutionalization of innovation on product services quality that enhances the economic position of the organization in its turbulent environment (Abrantes & Figueiredo, 2013). Because of this consideration, some organizations treat their projects as temporary or transient organization (Bredillet, Yatim& Ruiz,2010).The distinctive features of project-oriented organizations compared with traditional ones, are their dynamism and flexibility as well as their ability to support their data base systems(Thiry& Deguire, 2007).The competitive nature and dynamism which technological development has helped to achieve, post-modern organizations are bound to have the capability to implement various projects, which make it possible comprehensive management and converging strategies requires for optimum resources use (Voss & Kock, 2013).Jaferi et al (2014) , in a study have evaluated processes related to projects according to the risk area of PMBOK guideline in a project-based organization. They showed the importance of risk management analysis in recognizing major risk-generation areas required to take suitable measures in overcoming unexpected operational and performance challenges that affect organizational survival. Jaferi et al (2014) , in a article have presented the application of communication management field of PMBOK guideline in processes associated with the projects of a project-oriented organization for effective communications management. they showed that creating correct communication in an organization will eliminate many of the existing delays in the processes. Fang and Marle (2012), have used risk network model based on Monte Carlo simulation to suggest a decision making supporting system for modeling, project risk management and risk interactions. As they put, since project face high complexity, lack of certainty numerous limitations, considering risk management is a crucial activity in project management. Moreover, available classic method include some limitations from modeling the complexity of risk projects. In their suggested model, it is possible to re-evaluate risk and priorities. This model also support project manager in decision making for reaction risks. Seifi et al (2008), have studied project timetable with resource limitation in multi-criteria model, maximizing the current value of the project. Positive and negative cash movements are considered in the model. Two various modes for positive cash movements are taken in to account to make the model closer to authentic one. In order to solve the model, 2 simulation metaheuristic algorithms GA and SA are used. Carlos et al (2001), have suggested a project management approach focusing on adopting a strategic point of view in project implementing process. According to this strategic attitude, considering the project objective is highlighted as a principle. They offered discrete-even simulation during project implementing to introduce new attitude of project limited management methods. In a study Sheng Chou (2011) simply introduces Mont Carlo simulation approach with evaluation of random processes of entrance probability distribution through hypothesis assessment and features of correlation among simulated variables. He uses manufacturing project history as a study to make a cost balance in primary phases to dedicate the budget. Although the function of simulation approach has been presented. It is shown that the result of cost simulation demonstrate more exact findings. Generally, he points out that when organized simulated approaches are presented, accuracy and absolute error will be acceptable. In spite of expanded use of simulation in management, correlated simulation models for cost estimation are not discovered yet especially for manufacturing and management engineering. Cost simulation approach is a simple decision making tool to evaluate manufacturing cost and the lack of creating based on project managers ' experience judgment. Youzafer (2013),has presented a simulation model for strategic management process of software projects. Thus model shows the consequences of strategic decision-making based on factors such as cost. Risk, budget and software project management. The main advantage of the model is that a unified framework for risk management relation. Cost estimation and project management planning provides software expansion projects for strategic management process. Findings of project management planning shows budget as well as required programs for a project. Rodríguez (2013), has used Mont Carlo simulation to predict the results of project implementing to define and set its way map, and studied a practical example to show its strength. He has focused on some features of a more expanded research based examining the capability of Mint Carlo simulation for project management. Furthermore, bi –polar timetable approach is developed for multi-model; the structure of activity list show is employed and results are analyzed for a set of problems of electronic library for project timetable. In fact, managers in each organization try to optimize the use of resources of organization objectives.

Modern techniques help managers. Simulation is a powerful tool used to recognize the current status of system and test various option needed to improve the organization and to help managers make a decision. Moreover, making a simulation model and using it to test various scenarios result in increasing efficiency of organization. Managers can use simulated

model to observe the results of their decision before doing them in organization. The PMBOK standard can be helpful if domesticated for the organization. Among the advantages of this research, we can mention the simultaneous use of simulation technology and PMBOK guideline in processes related to projects in a project-oriented organization which is to improve project management processes as well as boosting efficiency. There for five step methodology is adopted which is shown in a practical model. As seen in review, no study was found dealing with simulation and PMBOK guideline in the case of processes related to projects in a project-based organization which is the upside of the study.

2. Methodology

The standard project management PMBOK guideline and simulation technique can be applied as the tools for improving the process efficiency in project-oriented organizations. The methodology involves using five-steps for enhancing performance efficiency in project-oriented organizations, the exact method of which is described later in the paper. The five steps includes:

1. Data collection related to applied method and processes related to the projects in the organization
2. Information analysis and system recognition
3. specification of the logic in simulated model along with manufacture of the simulated model for project-based organization
4. Information assessment based on PMBOK and suggestion of improvement strategies for the organization
5. Running the improvement suggestions in the simulated model and evaluating their findings and selecting the best option for the organization

After collecting data on inputs and outputs of each sub-system and their working relationships, they were then analyzed, using PMBOK analytical framework, the results of which, were therefore, tested for reliability using simulation technique. The proposed steps in improving the performance by rectifying the deficiencies are implemented. The results of each case are compared to identify the most appropriate case.

3. Practical example

In order to show how the suggested methodology is performed, the National Gas Company, Lorestan province branch in Iran has been selected as a project-based organization and related processes to projects are examined. In this organization, project package is commanded to be designed right after confirming gas distribution in an area and will be performed by the contractor after getting through various phases. Next, project exploitation and settlement will be done in organization, as well.

4. Carrying out the methodology in the organization

The first step is collect data through interviewing staff of different units and studying collected documents. In order to verify the data, the method Delphi is employed. Next step deals with analysis. Inputs and outputs of each unit in the organization are specified to lead in determining their relation, depicting the diagram of categorized data and finally, recognizing the way of operation in the system. In the third step, after analyzing data and recognizing the system, model logic is identify and simulated by using a simulating software such as Arena. Times stated by staff are in modeling. Tracing approach is adopted to validate the simulated model of organization. Figure1 shows the simulated model. The figure illustrates a sample of second portion of the proposed methodology (the logical model simulation), which would be different for different logical-model organizations. Hence, in order to comprehend the applications of the proposed methodology, it is not compulsory to detect the logical model of the case-studied organization . Based on the nature of the topic, a 10-year period of simulation, including 260 7-hour days, was considered for each of 10 replications of the simulation model. The input/output of the model are the number of projects designed/performed during these 10 years. The projects in Lorestan Gas Company are of two types of tender and inquiry. The shaping-up rate (arrival rate) of these entities in the company are best fitted to Exp(20.22) and Exp(2.9) days, respectively. Every project should pass some confirmation steps including Engineering, Cargos, Financial, Contracts, and the CEO; then the implementation and full-delivery stages come. The distribution functions of each step is fitted and assigned to the model, the details of which are listed in the M.Sc. thesis of the first author. The Arena software package evaluates the number of inputs for a 10-year period and calculated the number of outputs based on the model logic.

The sum of inputs is divided by the sum of outputs to equal efficiency. The efficiency of the organization is accordingly 48% .the findings of these repetitions are in table 1.

Table 1 .input and output of simulated model in organization

Replication	1	2	3	4	5	6	7	8	9	10	sum
Input (for 10 years)	1367	1653	1717	1604	1651	1598	1575	1672	1757	1568	16432
Output(for 10 years)	886	739	1229	525	946	492	713	767	880	649	7829

Efficiency =16432/7829=0.48

The fourth step includes information analysis based on PMBOK guideline in the organization. According to collected data, organization was analyzed in 9 knowledge area of PMBOK; hence, some changes were defined for process modification that are expressed as follow.

4.1 Project integration management area: providing project charter and providing project management plan are the examples of project integration management processes. They don't exist in the organization thus, are defined.

4.2 Project scope management area: work breakdown structure has been defined and job scope is specified in the organization.

4.3 Project time management area: needed time is estimated based on collected data. Also, activities relation is specified in simulated model. Simulated model depicts timetable according to time estimation that can be adopted to control time schedules.

4.4 Project cost management: In order to avoid the lack of budget, a budget re-order point has been defined in the organization.

4.5 Project quality management area: in order to make sure of the quality of activities, some suggestion are made including reporting output average of each unit for input average entering each unit to project management and examining the output of each unit based on its time scheduling and making sure of output validity.

4.6 Project human resource management area: according to work breakdown structure as well as simulated model, required resources for the organization has been defined and analyzed. Each unit has a member in project team who submits the reports of related unit to the project manager. Training project team members is defined to manage the project and improve group work in the organization.

4.7 Project communication management area: for each unit the average output projects for each average unit is monthly reported to project manager. Then, project manager reports the job improvement monthly to the chief. Moreover, budget and storage inventory are reported monthly to chief and project manager. Take certificates and submitted to the contractor at due time.

The performance of each unit is reported to project team and then the performance of both will be reported the chief. Besides, using computer communication systems is suggested within the organization.

4.8 Project risk management area: risk were identified in the organization and some policies were suggested to prevent them. These items include training staff, designing inventory system and re-order point for budget, acquiring financial budget before ending and determining budget re-order point and getting necessary licenses before starting project performance.

4.9 Project procurement management area: it is required to take the essential certificates to start the project, steps of certificate taking and to make sure of having an on time procedure of certification. Data analysis shows that before starting project, contractor had one month delay due to lack of goods and time. Moreover, some project designing package, faced budget lack and are counted in line of financial matters.

According to modification for processes based on PMBOK guidelines, it is possible to state that elimination of goods and budget shortage is one of the solution in fifth step, suggested policy is implemented in simulated model of the organization. The settings of simulated model is exactly the same as the previous one. The numbers of designed/performed projects (inputs and outputs of the organization) are demonstrated based on the model policy which are obtained from the Arena reports (Figure 1). Performing the policy in model results in increasing the efficiency of the organization from 48% to 53% , in other words, 5% improvement is visible. Table 2 shows inputs and outputs of suggested method.
It is substantial that the 5% performance improvement in the system is obtained from the simulation model and is suggested to the real case to implement in practice.

Table 2. inputs and outputs of suggested method

Replication	1	2	3	4	5	6	7	8	9	10	Sum
Input(for10 years)	1582	1656	1722	1685	1673	1631	1749	1542	1775	1615	16630
Output(for10years)	845	670	1038	773	862	948	1119	769	1076	740	8930

efficiency =16630/8930 =0.53

Solutions including increasing labor force in some units are also considerable, however, when they are implemented in simulated model, efficiency will be less than current status. Also, another important options is to modify the process of project package circulation in the organization in which referring to the past steps and unnecessary categories are omitted.
Another option is modifying the method of fulfilling the objectives of organization. Distributing gas to different zones of the province is among the objectives of Gas company of Lorestan, performed in form of small projects (by inquiries) and large projects (by tenders) projects. Figure 2 shows the diagram of number of small projects (blue) and the number of big project (red) which are done for about 10 years.

Figure 1 shows the inputs in terms of small projects (by inquiries) and large projects (by tenders)based on the distribution defined in Arena, and is applicable to analyzing organizational processes.

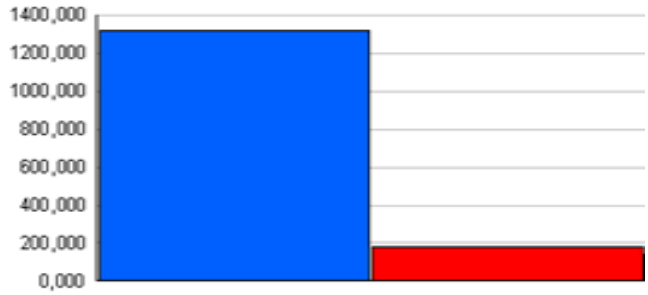

Figure1. Diagram of number of small projects (blue) and big projects (red) in the organization

It is observed that number of small projects is almost 7 times more than the number of big ones. According to this face that work volume for small projects is less, it is possible to keep them as small job packs in mind whose number is high and can push the organization toward long-term goal by small steps. However big project have bigger work volume. Big project are regarded as big job packs pushing the organization with big steps. Due to this fact that consumed time on relevant processes for both projects by staff is nearly same, it is recommended increasing the number of big projects and decreasing small projects in order to decrease the work traffic in units and make organization fulfill its goal.

5. Results and discussions

Results show that application of modern management techniques, or PMBOK, is in effect, instrumental in improving the organizational performance. Results also suggest that the simulated organizational performance has shown to have enhanced the organizational efficiency by 53%. Results further show that the proposed technique based on the PMBOK guideline in simulation model, has led to 5% improvement in organizational performance. This has identified the process improvement methods, as the instruments for achieving organizational objectives. Simulation technique has also made it possible to identify factors that help to improve organizational performance like the way of caching organizational goals. Results also

show that simulation technique can make it possible to control and regulate management processes in terms of time and costs and any other production factors and the intra as well as the inter relations between them. The study shows that simulation model is an appropriate analytical framework for PMBOK guideline human resource requirements.

The overall conclusion being that the proposed methodology and the results obtained in this study can be generalized to other organizational settings of project-orientation. The management can use the proposed methodology to simulate, project or anticipate his organizational performance as a means of reducing operational costs, project completion time and supporting the organizational capitals.

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Biography

Moslem Parsa is a Masters of Engineering in Systems Analysis at National Iranian Gas Company (NIGC). He earned B.A. in Economic Sciences from Lorestan University of Management and Economics, Iran, MSc in Management and system efficiency in Industrial Engineering from Arak Branch, Islamic Azad University, Iran. He has published papers in prestigious journals and conferences. His research interests include optimization, Project Management, scheduling, and Decision Sciences.