

Artificial Intelligence Approach for Information Technology Projects Portfolio Management and Services

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Abstract:

Most of E-Government projects do not succeed and reach their objectives. This fact is due to the challenging nature of Information Technology (IT) project management in general. IT project management suffers from high complexity, uncertainty and nonlinearity. These challenges have huge impact on the sustainability of EGovernment sector in any country. This research is concerned about the uncertainty of time management, the complexity of cost management and the nonlinearity that arises in time and cost management when multiple projects are managed at the same time as projects portfolio. To overcome these issues, this research proposes the use of Artificial Intelligence (AI) because of its ability to handle complex non-linear problems. Specifically, two AI techniques will be the focus of our methodology. These techniques are Fuzzy Inference and Artificial Neural Network. The scope of this research will cover time and cost management.

Keywords: *Information Technology; Project Portfolio Management; Artificial Intelligence; Fuzzy Inference; Neural Networks*

I. INTRODUCTION

IT management in E-Government projects is a very complex process that has many dimensions and requires advanced managing skills. Management of multiple and concurrent projects at the same time is called Projects Portfolio Management and it is based on Modern Portfolio Theory (MPT) [5]. This theory has been extremely instrumental as an important tool of identifying and assessing risks that projects can be subjected to and the returns that such project investments are bound to bring to business organizations [5]. Markowitz assumed that investors are normally risk-averse, and creating a basket of portfolios, he attempted to mathematically maximize return for a given risk perception, or minimize risk for a given amount of expected return. Risk is measured in terms of various quantities, such as Alpha, Beta, and R-Squared among others. While MPT was mainly used for financial analysis, in the latter half of the twentieth century its lessons and insights were also applied to the emerging field of IT Project Management [6]. This gave rise to Project Portfolio Management (PPM), which is the centralized management of a group of existing projects by a Project Management Office (PMO) or a project manager.

There are several different definitions of IT PPM exist, this research will adopt the definition proposed in [4], which is as follows:

“Continuous process to manage IT projects, application and infrastructure assets and their interdependencies, in order to maximize portfolio benefits, minimize risk and cost, and ensure alignment with organizational strategy over the long run”

A PPM framework should subscribe to project areas, or capability definitions, as defined by the Project Management Institute (PMI) as part of its Project Management Body of Knowledge (PMBOK). These nine areas are as follows: Integration Management, Scope Management, Time Management, Cost Management, Quality Management, Human Resource Management, Communications Management, Risk Management and Procurement Management [3]. Obviously, IT project portfolio keeps changing over time. However, these changes have to be within organization constrains and limitations. In other words, there is no global set of rules to manage projects portfolio everywhere. Every projects portfolio has its own best way of management. This viewpoint of management is called Contingency Theory [7]. This study fundamentally seeks to establish the extent of which artificial intelligence can be used to benefit the management processes of project portfolios in information technology (IT) based Contingency Theory.

II. MOTIVATION AND SCOPE

A. Motivation

The central focus of this research is based on the approaches that need to be adopted to improve the evaluation of IT projects or project portfolios. There are various problems that have been associated with these phases of project development. Quite fortunately, there are various solutions that have been provided by artificial intelligence technologies, tools and models, which can be used in the enhancement of portfolio management processes. In the use of these AI technologies, tools and models, it is important to understand what needs to be done in order to make sound and informed conclusions as well as recommendations in this research, which is what this thesis seeks to do.

One of the most critical dimensions of project portfolio management in this research is risk management [2]. Project portfolios have been associated with a significant number of risks. About 70 percent of IT projects do not achieve the set objectives because they fail to effectively manage the risks. Many projects failure have also been associated with great uncertainties. The need to establish AI technologies, tools and models that can be used in better dealing with these uncertainties has been, therefore, a compelling force in this research. AI is appealing because of the cyclic nature of IT project management process. This cyclic behavior will lead to forming pattern inside IT project management process which can be extracted by artificial intelligence tools. This fact is the major motivation behind adopting AI as the main methodology in this research.

B. Scope

This research study aims at covering a number of dimensions of portfolio management and how its management can be enhanced through the use of artificial intelligence. The study basically focuses on IT project portfolios cost and time management.

Project cost has, in recent years, also come up as a considerable issue in the study of project portfolio management. Different projects have different budgetary constraints which have to be taken to account before the selection, development, implementation or even the evaluation of any It project begins. Fortunately, there are various

technologies, approaches and models that are used in making sure that cost management is facilitated and the project objectives are achieved. These are the general issues that will be discussed as well as the relationships they have with the overall discussion.

The other important part of this discussion that has immense considerations in the literature review, which has to be incorporated in the study, is time management. Information technology projects are associated with numerous complexities that have to be understood prior to the commencement of any phase of a project or a project portfolio consideration. This necessitates the discussion and understanding of all aspects of time and completion deadlines as well as their relationships with cost management [1]. This is important in all of the project phases, which include the selection, development, implementation and monitoring and evaluation.

III. PROBLEM STATEMENT

Project development, as a result of its multifaceted formation, particularly in the field of Information Technology, could frequently come across numerous unexpected setbacks, leading to project delays, overbudgeting and poor quality results. Even though such issues cannot be entirely eradicated, they can be managed and limited by implementing adequate and appropriate risk management techniques. Nevertheless, the issue with current and rare methods is that they fail to address the precision or accurately estimate budget and timeline necessary for creation of a perfect product.

It is evident that starting IT projects is sometimes hard; this is allied to the fact that IT projects commonly entail numerous dynamic features; nevertheless, they are commonly constrained by finite circumstances. Some of the said features consist of measures of implementing control systems, structures, variables as well as methods. Likewise, this may include other aspects such as change control along with risk management. Depending on the nature of the IT project, it has been established that delivery framework is another factor that is allied to the success or failure of any IT project. This is more correlated to the application of system development structures towards the anticipate project.

When starting an IT project, it would be advisable to consider those dynamics, which are within attainable level. Time is of great importance since if well managed it helps in overcoming structural and administrative variables, which can limit the projects perimeters. Other essential dynamics include identifying the projects specific deliverables, how to handle administrative crisis, financial inadequacies as well as operational breakdown.

Estimation of time and cost are considered to be the basic criterion to project success. It is very problematic to predict the time and cost accurately as unexpected events and urgent work are not taken into consideration. Sudden occasions may involve internal and external meetings, sickness and holidays of key staff, equipment breakdown, missed deliveries, quality control rejections, etc. The greatest risk throughout estimation is board's constant assertion for rapid actions during the procedure.

The majority of estimation techniques convey a form as quantification for the dimension of the object to be anticipated. If to found on this idea, a time as an appropriate form (effort) is expanded from the amount of costs, which can be obtained. The project administrator is required to further render the early "sophisticated" project description into a detailed project map that tackles the simplest degrees of execution details.

Time and cost estimation are closely intertwined as time estimation is a key factor of price determining and, hence, the project profitability. Time also makes influence on reliability and competence assessment. Cost estimations

greatly depend upon accurate assessments of resources and time. Estimating time accurately is considered to be one of the most complicated tasks as it takes experience and profound understanding of the project. One of the most common issues is that project managers overlook that the execution of this task may take longer than expected.

Each project task will have a cost including the cost of the labor hours of a computer programmer, cost of equipment breakage, total time needed for the project, etc. When the budget of a project is prepared, the cost and time of each task are calculated and totaled. Nonetheless, it is difficult to predict all prices and time due to price change and other unpredicted events. Thus, the effort estimation process within Information Technology has been noted as cost estimation, which is the result of time, schedule and effort evaluation. Due to the complexity and a variety of factors that influence estimation accuracy, there is a need to develop a model which might take all possible factors into consideration.

The problem of accurately estimating time and cost gets worse when multiple projects are being performed at the same time. Each project in the projects portfolio will have indirect effect on the other projects. Sometimes, this effect can be a kind of Butterfly Effect where all parameters start behaving chaotically. Chaotic parameters are exponentially very hard to estimate. Each project in the portfolio has a set of tasks to be completed. Each one of these tasks has a cost and timeframe based on its nature.

Different techniques have been used to solve the problem of time and cost estimation including statistic techniques (correlations), a model based on adjusted curves. The main disadvantage of the above mentioned techniques is that the size is considered as a free variable whereas it remains unknown until the end of the project. Considering all factors and difficulties of cost and time estimation, the issue should be studied under the framework of artificial intelligence approaches.

IV. RESEARCH OBJECTIVES

The focus of this study lies in the use of artificial intelligence to address problems associated with selection, implementation and monitoring, and evaluation of projects in information technology. The use of PPM is taken into deep consideration and how AI can be integrated into it. The following objectives have, therefore, been set for accomplishment.

To establish ways through which project selection can achieve choices that have the highest benefit and the best chances of success as part of the project portfolio

To balance project portfolio on account of their cumulative risks in an effort to achieve the best cumulative performance over the project implementation and evaluation period

To allocate the available resources in an optimal way such that no project is depending on other projects in the portfolio

To establish ways in which artificial intelligence can best be used to improve the selection, implementation and monitoring, and evaluation of information technology project portfolios

In the appreciation of the fact that the selection, implementation and monitoring, and evaluation have will result in the introduction of new technologies, systems, models and approaches, the study also seeks to establish ways to achieve the highest possible of scalability and absolute adaptability so that not much of the existing infrastructure can be affected by the new developments.

V. EXPECTED RESULTS AND EXPECTED LIMITATIONS

This research will use several performance metrics to evaluate the proposed solutions. The most essential performance metrics are project time, project expending, accumulated delays, risk exposure, resources utilization, average number of concurrent projects in the portfolio, etc. The major expected results are:

- Reduction in average project time of projects portfolio.
- Reduction in average project budget of projects portfolio.
- Increase of available resource utilization.
- Increase of concurrent managed projects.
- Reduction of all sort of risk exposure.

In addition, this research will provide very important insight of how artificial intelligence techniques can be used to enhance the management process of IT projects portfolio.

The main feature of artificial intelligence is its ability to extract patterns. For patterns to emerge, some sort of repetition is required. In our case, IT projects, if these projects in the portfolio are not similar in a way or another, the expected improvement after implementing the proposed solution will not be high. The reason behind this is that projects do not have common activities among and each activity may happen only one time. For example, our brain can associate the word “NOKIA” with cellphones and telecommunications because we heard it many times in relation with cellphones and telecommunications context. If we only heard it once in our life, we will not be able to associate it with cellphones and telecommunications. The same is applied to any artificial intelligence technique. However, we can overcome this issue by insuring that projects in any portfolio are related.

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