

# FINANCIAL DECISION MAKING AND FORECASTING TECHNIQUES ON PROJECT EVALUATION: A PLANNING, DEVELOPMENT AND ENTREPRENEURIAL PERSPECTIVE

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## ABSTRACT

*The application of forecasting techniques as part of project evaluations is an indispensable task as without applying proper forecasting procedure, appropriate financial decision making could not be achieved. The current study attempts to lay down a comprehensive account of the available forecasting techniques that aid a given project with its financial decision-making requirements. Through a comprehensive literature review, it has been found that a number of forecasting techniques are applied in making appropriate financial decisions as part of project evaluation. The technique of “Markov PERT” analysis has recently been used to accurately assess the time of project completion and the cost at completion. It has also been revealed that the application of hybrid algorithms and the use of artificial intelligence is growing for accurate forecasting results. However, it is found that in evaluating a project, the success of the application of various financial forecasting techniques such as NPV, ARR, IRR, Payback Period, Support Vector Machine, Monte Carlo Simulation, S curve and others, essentially depends upon the project nature and environment. It is, therefore, recommended that financial decision making should not only be done based on statistical error margins but only on the reliability of the warning signals as generated by any forecasting techniques.*

**Keywords:** Forecasting Techniques, Project Evaluation, Financial Decision-Making, Financial Forecasting.

## INTRODUCTION

In today's uncertain business environments, project managers and financial experts are continually pressed to take appropriate decisions by using the various forecasting techniques available (Wang et al., 2018). The methodology of forecasting, as applied in conjunction with the requirements of project evaluation, forms the groundwork, which decides the motivation for the project sponsors, management team and other stakeholders to pursue or reject any given venture. Without the aid of the various forecasting techniques, the necessary cost-benefit analysis of any project could not have been accurate, and it thus provides a reason to study the available literature on project evaluation and forecasting. Despite being widely acknowledged as a critical and mandatory technique, the appropriate use of forecasting methods is often disregarded by many project managers, on account of credibility issues. As noted by Wang et al. (2018), in

project evaluation and forecasting, one of the hardest problems is to accurately predict the completion date. And, as such if comprehensive details on the error dimensions as well as reliability of the existing forecasting methods are not known, the selection of one for a particular project becomes tough choice. The current study aims to search the existing literature on the role of forecasting techniques in tandem with project evaluation methodologies, so a comprehensive work could be formed that shows the subject's significant relationship with the requirement of judicious decision making with respect to any given project's financial aspects and choices. For business projects to be successful it is of utmost importance that the same does not overrun the time and cost constraints, and for this to be a case, it is desired that prudent financial decisions are made.

## LITERATURE REVIEW

As per the view of Ballesteros-Pérez et al. (2020) in real life project evaluation tasks, for making smart financial decisions, it is not desired to consider all of the factors that might happen to impact the project, but selecting the right scope for the same is necessary to come up with a dependable set of financial forecasts. For example, as shown by the existing literature, the first question that needs answering is the "time horizon of the analysis". Once the schedule of the WBS ("Work Breakdown Structure"), as associated with any project is determined, the following parameters would have to be affixed, "quantity, value and the timing of occurrence of various goods, services and costs as part of the project activities" for initiating the forecasting process. By technical definition DCFR ("Discounted Cash Flow Rate"), is the interest rate required to turn the summation of the present value of the project investment exactly the same as the total of the present values of each of the project year's "net cash flows". As observed by Harris and Wonglimpiyarat (2020), to apply the DCFR method, it is essential to apply suitable financial models for being able to come up with the future cash flows, and for that, the model has to accurately project the various revenue streams, expenses and investments. From this finding, it can be assessed that the choice of financial modelling technique, as part of this method, would determine the result accuracy. According to Eti (2021), all of the necessary financial forecasts for a project evaluation could be achieved through establishing the "income statements" and the "balance sheets". Therefore, without having any set of reliable historic data, proceeding with this method could be fraught with risks. As pointed out by Ballesteros-Pérez et al. (2020), the parameter of IRR ("Internal Rate of Return") is one of the key standards for determining the nature of capital budgeting. In its technical definition, the IRR represents the "annualized effective compound rate of return of a project". As put forward by Celik et al. (2019), the concept of WACC or "Weighted Average Cost of Capital" is another critical thing for making apt financial decisions as related to the selection or execution style of projects. As stated by Harris and Wonglimpiyarat (2020), only those projects should be commenced where the value of the "discounted NPV" is more than the expected investments costs. The formula for calculating the NPV for any project has been shown in the following image.

$$NPV = \sum_{n=1}^N \frac{C_n}{(1+r)^n}$$

Source: Khamooshi and Abdi (2017)

**FIGURE 1**  
**THE FORMULA FOR CALCULATING THE NPV**

It has been suggested that out of the NPV analysis if any project yields a negative value, then the same should not be pursued (Ballesteros-Pérez et al., 2020). As observed by Bilenko et al. (2019), undertaking a sensitivity analysis on the expected cash flows and tweaking the simulation parameters to estimate the NPV of projects are essential activities that fall under the scope of the forecasting exercise. According to the works by Fontes et al. (2020), for making appropriate financial decisions in any project “the discounted cash flow method” is one of the best techniques as it maximises the wealth of the project shareholders. As put forward by Roslon et al. (2020), once the quantitative analysis and forecasting are done with, project evaluation would have to accommodate an evaluation of the concerned qualitative factors. As stated by Magni and Marchioni (2018), the payback period for a project is the time period required to equate the cash flow surpluses to the project investment, and as a generic rule for forecasting the economic feasibility of projects, the ones with longer payback periods should be discarded in favour of the ones with smaller periods. The payback method should be exercised to assess any project’s liquidity status as opposed to the profitability question. In its technical definition, the payback period for a project could be forecasted by the following formula.

Source: Dwiputra et al. (2019)

$$\text{Payback Period} = \frac{\text{Initial payment}}{\text{Annual Cash Flow}}$$

**FIGURE 2**  
**THE FORMULA FOR THE PAYBACK PERIOD**

ARR could be defined as the mean income of any project once the necessary deductions depreciations have been accounted for. According to Karina (2017), with this technique, the concerned finance manager utilises “the net income and book value” of the project investment, as opposed to the projected cash flows. The ARR for any project can be calculated from the following expressions.

$$\text{ARR (total investments)} = \frac{\text{Average annual profits} \times 100}{\text{Initial capital invested}}$$

$$\text{ARR (average investment)} = \frac{\text{Average annual profit}}{\text{Average capital invested}} \times 100$$

Source: Karina (2017)

**FIGURE 3**  
**THE FORMULA FOR ARR CALCULATION**

As per the opinion of Batistela and Simoes (2017), IRR can be defined as the rate at which the NPV of any project is equated to zero. As put forward by Kuppens et al. (2018), while using the technique of IRR project managers need to prefer projects which have greater values for the same.

$$\sum_{t=0}^n \frac{X_t}{(1+r)^t} = 0$$

Source: Kuppens et al. (2018)

**FIGURE 4**  
**THE FORMULA FOR IRR CALCULATION**

Profitability index or PI is the ratio between the present values of expected future cash flows of a project to its actual cash outflow. It is a generic rule that projects with higher values of PI should always be favoured over the ones with lower values of the same. As inferred by Khalfi and Ourbih-Tari (2020), the “Discounted payback period” is a preferred tool for forecasting when the project life cycle is highly uncertain due to its environment. One of the critical utilities of this technique, in project evaluation, lies in the fact that the same allows for project risk adjustment by incorporating a "discount rate" (Batistela & Simoes, 2017). In many of the previous research works, “Monte Carlo simulation” was used to derive the probabilistic distribution of the project cost and duration, so that, a confidence level for the project cost and duration could be affixed to evaluate the concerned project performance (Batistela & Simoes, 2017). In the EVM methodology, certain indices are used and they are: “Scheduled Variants or SV”, and “Cost Variants or CV”. Alongside these two indices, project cost and time buffers, represented respectively by  $ACBf_t$  and  $ASBf_t$ . The expressions for cost and schedule control indices have been shown in the following image.

$$SCol_t = ASBf_t + SV$$

$$CCol_t = ACBf_{t=ES} + CV$$

Source: Marchioni and Magni (2018)

### FIGURE 5 THE EXPRESSIONS FOR “SCHEDULE CONTROL INDEX” AND “COST CONTROL INDEX”

#### Research Gap

Despite the abundance of project evaluation and forecasting methods, it has been particularly noted that, all of these methods were not integrated with the project risk management principles. This is to say that, despite the methodologies of forecasting being scientifically rigorous, the missing link between project environment uncertainties, which could not be expressed in monetary terms, the accuracy of the results could not be taken as something unchallengeable. There have been many advances in the framework of project risk management but, integration of the same with project finance forecasting techniques has not been comprehensive. Moreover, there has been a general lack of information that specifically classifies different types of commercial ventures and the corresponding forecasting methodology, so for a given project manager it is extremely painstaking to find the right body of knowledge and skills that are required to make appropriate financial decision makings.

#### Objectives of the Study

The objectives of the current study are stated as in the following:

- To examine the various techniques of project evaluation and forecasting
- To understand the significance of project evaluation and forecasting, from the perspective of project managers, for making prudent financial choices
- To provide recommendations as to the type of forecasting techniques to be followed for accuracy of the predictions.

## METHODOLOGY

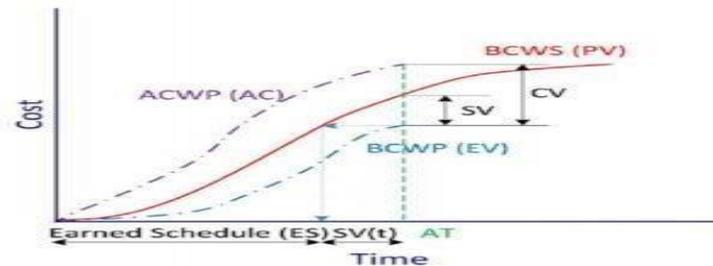
This project evaluation methodology implements the “Monte Carlo Simulation” to get the statistical distribution of all the plausible outcomes of any project. Through this method, the statistical distribution of project cost and time at any percentages of completion is obtained. For each outcome of the “Monte Carlo Simulation”, a triad which is denoted by the percentage of completion, time and cost at that completion level is obtained which describes the status of the project. If the actual values fall within the confidence level, the concerned project is considered to be well under control and if not, the concerned managers would have to take corrective actions to account for the monetary loss (Fontes et al., 2020). It has already been mentioned that EVM (“Earned Value Management”) could be used for forecasting any project’s CEAC “Cost Estimate at Completion”. Although there have been several techniques to calculate the value of CEAC, a very popular one is the “Index-Based or Regression-Based techniques” (Rosłon et al., 2020). The regression-based forecasting technique is about setting either a linear or a non-linear relationship between a “predictor” and “response variables”. The mathematical relationship between project cost and time can be formulated once appropriate information regarding the nature and complexity of the tasks are available. In fitting the S curve, it is quite common to use a non-linear regression analysis. In such a methodology, it is assumed that the project data points follow a Gaussian distribution (Rosłon et al., 2020).

## RESULTS & DISCUSSION

For evaluating large projects' financial feasibility, the application of the NPV technique is extremely helpful as this provides a piece of very good knowledge about the venture’s profitability, along with incorporating the various risk considerations (Dwiputra et al., 2019). The DPP method is also a good fit for evaluating small scale projects if the project environment is more stable in nature, showing this technique’s popularity among the project managers and financial evaluators alike. Capital budgeting is a critical project evaluation and management tool and the concerned managers need to be aware of the various techniques like the NPV, IRR, PI, and so on but which of these should be particularly applied to any given project depends exclusively on the nature of the same (Lee et al., 2009). As per the literature review, various project performance parameters should be carefully analysed for having a proper insight into the economic feasibility and profit of the same. In this regard, the major criteria of project performance and evaluation have been found as in the following:

“Cost variance”= (“Earned Value”)- (“Actual Cost”) “Scheduled variance”= (“Earned Value”)- (“Planned Value”) “Cost Performance Index”= (“Earned Value”) / (“Actual Cost”) “Scheduled Performance Index”= (“Earned Value”) / (“Planned Value”)

These parameters for a given project have been shown graphically in the given diagram:



Source: Tugan and Sinayuc (2018)

**FIGURE 6**  
**EVM PARAMETERS**

Through the literature review, forecasting of any project's performance was recommended so that appropriate financial decision could be taken. There have been three major methodologies: "Index-based methods", "Regression-based methods", and "Heuristic-based methods". As observed by Leu and Lin (2008), the "regression technique" for project performance estimation is much superior to the other choices, but for this to work a sufficient and reliable set of project data has to be available. In recent times, the implementation of the EVM framework for evaluation and forecasting purposes has been refined with the introduction of "Gompertz Growth Model", which enables non-linear regression analysis and curve fitting (Tugan & Sinayuc, 2018). It has also been observed that in recent times, the application of hybrid algorithms has been extremely popular for their accurate forecasting results (Lee & Arditi, 2006).

## CONCLUSION & RECOMMENDATIONS

By leaning onto the recent developments in forecasting technologies, it can be argued that projects should implement an "AI powered decision support system". This study showed that by using random forest the forecasting of these projects' costs was much accurate as compared to the use of any other techniques like neural network or SVM (Meharie & Shaik, 2020). As a matter of fact, it has been well established in the domain of project management and forecasting that financial decision making should not be done based on statistical error margins but only on the reliability of the warning signals, as generated by any forecasting techniques. In the current work, the concept, necessity, and the various aspects of different types of forecasting techniques, relevant for making wise financial decisions as part of project evaluation have been described. The knowledge and technical skills of a project manager in having a comprehensive understanding of the application of relevant project evaluation and forecasting techniques is irreplaceable, more so now than ever as ramifications of the Covid-19 pandemic continue to impact projects. Rahman et al. (2021) explored leverage effects on the financial performance of different industrial firms in Bahrain and recommended capital restructuring as value addition.

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