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Performance measurement of R&D projects in a multi-project, concurrent engineering environment

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Abstract

An R&D Project can be characterized by its life cycle with three phases of evolution, viz., Project Selection Phase (Screening, Evaluation, Selection), Project Execution Phase (Technology Development, Product Development, Performance Demonstration) and Implementation Phase (Production, Marketing, Sales). The traditional approach of performance measurement deals with each of these phases in isolation. As a result, the evaluation models and performance measurement criteria are separate for each phase. Once a project is selected, all attention is focused on its completion within the stipulated time and cost, without much consideration to either the assumptions made at the time of project selection or the requirements of the implementation phase. As a result, performance measurement system for project execution phase is totally independent of other phases. In an R&D environment with high uncertainty and complexity, coupled with multiple projects competing for limited common resources, use of different models of evaluation at different phases may lead to incorrect assessment and poor overall performance. This paper addresses this important issue and suggests a framework for an Integrated Performance Index encompassing the entire lifecycle of R&D projects. The framework identifies the key factors in each phase of the project lifecycle and integrates them through a formula to derive an Integrated Performance Index that can be used to measure the overall performance of a project at any point of time during its life cycle.

Keywords: Integrated performance measurement; Multi-project environment; Concurrent engineering; Project management

1. Introduction

Performance measurement plays an important role in ensuring the project success and its subsequent usefulness to the sponsoring organization. In a controlled environment, the organizational and project performance is known to be sensitive to the metrics of measurement. Hence it is very important to devise appropriate performance measurement system to suite the project and organizational environment. The notion of performance measurement generally implies identification of certain performance metrics and criteria for their computation. Several metrics have been developed to evaluate R&D projects during the selection phase [1–2–3]. Similarly there are well developed metrics for project performance measurement during the execution phase, mostly built around PERT/CPM and the earned value system. But there is no link between the performance metrics of the project selection phase and the project execution phase. Also, there is no explicit link between the performance factors measured during the project execution phase and the factors that may determine the project performance during the implementation phase. These missing linkages may lead to poor overall performance of the project. It is essential to bridge these gaps through an integrated performance measurement system that could be used for all phases of the project life cycle. This paper addresses this important issue and proposes a framework for integrated performance measurement.

The following paragraphs explain the motivation for the proposed model, problem definition, proposed approach for integrated performance measurement, conceptual model, identification of key factors and their

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integration, and the advantages of using an Integrated Performance Index.

2. Motivation for the proposed model

The proposed model is motivated by the real-life experiences of the authors and the problems faced in dealing with the high technology aerospace R&D projects. The first author had the opportunity to work on the management system for the Integrated Guided Missile Development Programme (IGMDP) of India. The Programme is characterized by a multi-project environment comprising of five large R&D Projects involving the development of technologies and systems that would be contemporary at the time of their deployment 10 years later. Due to the lack of adequate technology base within the country and the restrictions on the flow of technology from outside, all the required technologies had to be developed within the country. The Programme adopted concurrent engineering philosophy to reduce the cycle time from design to deployment. In spite of this high complexity and large magnitude of task, the programme succeeded in the development of several critical technologies indigenously through a partnership network of R&D organisations, academic institutions, public and private sector industries and user services, using certain unique management practices. One of the important factors that contributed for the success of this Programme is the integrated way of looking at the project performance and the associated tools, techniques and methodologies evolved and used in the Programme. This experience led to the development of the proposed framework for the integrated performance measurement of R&D projects.

3. The problem of performance measurement in R&D projects

R&D managers throughout the world are continually faced with a series of decisions as to, how to select the most appropriate projects from several competing proposals, how best to evaluate a project during its execution, how best to make use of available knowledge about the project to forecast a project failure and initiate its early closure to prevent further drain of resources, etc. Due to the inherent complexity and uncertainty, R&D projects are not easily amenable for performance measurement. This situation is compounded further by the multi-project and concurrent engineering environments. Under these conditions, the approach of dealing with each phase of the project life cycle entirely independent of other phases will lead to poor overall performance. Too often, at the completion of a project, management may realise that the market no longer exists, or the technology is obsolete, or the original purpose no longer fit the current business strategy. How can we remedy this situation? This is the main problem addressed by this paper.

Fig. 1 shows the typical life cycle of an R&D project. Project proposals are initiated based on stated or perceived customer requirements. These proposals are then screened, evaluated and selected with the help of some project selection methods using certain criteria. The selected projects will then enter the Project Execution

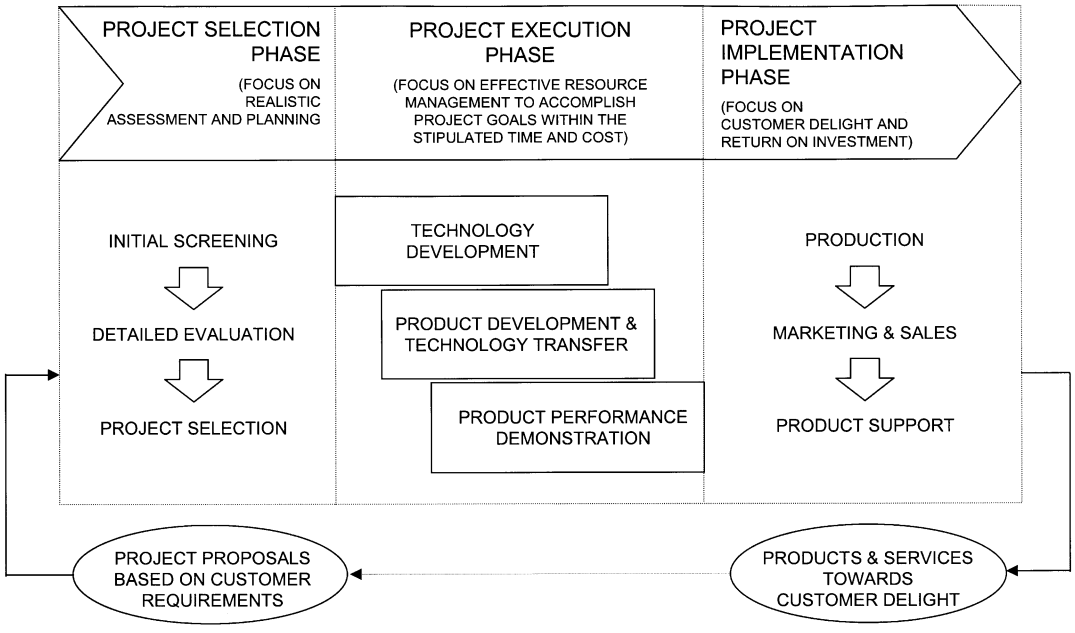

Fig. 1. Life cycle of a typical R&D project.