**Management of Engineering Projects: Critical Success Factors and Integrated Systems Perspective**

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**Abstract**

Engineering projects can be subject to significant complexity, which may result in a number of issues and challenges that need to be addressed throughout the project lifecycle. Traditionally projects have been viewed according to the so called ‘iron triangle’, i.e. achievement of project milestones according to schedule, cost and quality targets. While these targets are fundamentally important to the performance of engineering projects, it is possible to view projects on a systemic level in order to allow an adequate focus on all the underpinning factors that have the potential to influence the performance of projects. Consequently, a management framework has been developed that is based on an integrated systems perspective of engineering projects, where the performance of projects is a function of six contributing sub-systems that are: process, technology, resources, knowledge, culture and impact.

The sub-systems can be broadly considered as being part of three integrated levels, which are as follows: project infrastructure (resources and technology sub-systems), project organisation (process and knowledge sub-systems) and project environment (culture and impact sub-systems). This framework has been developed through building on a comprehensive literature review of the critical success factors for engineering project management. The integrated systems perspective is discussed through reporting the findings from two illustrative case studies that highlight the utility of the approach. Both case studies involved facilities development projects that were undertaken at a university in the United Kingdom and included significant technical risk.

The first project involved the refurbishment and enhancement of a large laboratory in order to accommodate a new high pressure experimental research facility. This project was carried out over a three-year timeframe and involved a close partnership between the manufacturer based in the United States and partner companies in the United Kingdom as well as the host university. The project employed systems engineering approaches[[1]](#footnote-1) as well as the failure mode and effects analysis(FMEA) technique.[[2]](#footnote-2) The second case study involved completion of a feasibility and design project for the upgrade and enhancement of a medical research laboratory that contained several pieces of advanced medical scanning equipment. This one-year project involved extensive consultation with medical practitioners in order to derive the clinical needs for the facility, which was driven through a formal requirements capture process. This approach enabled the resulting engineering and construction works to be carried out in a timely fashion.

The case studies provide managerial insights that are related to the framework but also position the approach in the context of industrial applications for engineering management.[[3]](#footnote-3) Furthermore, the case studies allow instantiations of emergent behaviour to be identified and this is positioned in regard to general systems theory. The paper concludes with a series of research implications relating to the systemic nature of projects as well as suggested areas for future research included the data and information requirements for pursuing this research agenda.

1. Philbin, SP (2009) System Safety Engineering for a High-Pressure Experimental Research Facility, *Proceedings of the 30th American Society for Engineering Management (ASEM) Annual Conference*, Springfield (MO), USA. [↑](#footnote-ref-1)
2. Philbin, SP (2010) Developing an Integrated Approach to System Safety Engineering, *Engineering Management Journal*, Vol. 22, Issue 2, pp. 56-67. [↑](#footnote-ref-2)
3. Philbin, SP, Kennedy, DA (2014) Diagnostic framework and health check tool for engineering and technology projects, *Journal of Industrial Engineering and Management*, Vol. 7, No. 5, pp. 1145-1166. [↑](#footnote-ref-3)