

A FRAMEWORK FOR CATEGORIZING IMPORTANT PROJECT VARIABLES

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Abstract

While substantial research has led to theories concerning the variables that affect project success, no universal set of such variables has been acknowledged as the standard. The identification of a specific set of controllable variables is needed to minimize project failure. Much has been hypothesized about the need to match project controls and management processes to individual projects in order to increase the chance for success. However, an accepted taxonomy for facilitating this matching process does not exist. This paper surveyed existing literature on classification of project variables. After an analysis of those proposals, a simplified categorization is offered to encourage further research.

Introduction

Project management literature contains numerous conceptual frameworks for studying the complex social-technical project system. The search continues for a comprehensive list of the variables affecting projects in an effort to identify the magic formula to insure project success. Academics and practitioners seek a specific set of controllable variables so that any project's chance of failure can be minimized.

Numerous researchers have attempted to verify the estimated connection between different variables and project success through empirical studies (Murphy et al. (1974), Allen et al. (1980), Campion et al. (1993), Tippet & Peters (1995), Wozniak (1993), Lewis (2000), Lynn et al. (2000), Gemuenden & Lechler (1997)). In a study of 43 NASA projects, Bearden (2000) acknowledged the potential relationship between numerous variables and project success levels as measured by budget and schedule adherence. His individual variables were roughly categorized as technical or programmatic, but he chose not to explore the programmatic factors. Instead, he concentrated on 21 specific spacecraft technical parameters. Through extensive case studies of two NASA space flight projects, Kloman (1972) identified eleven areas which influence levels of project success. These were the environment, individuals, teamwork, role definition, stability of objectives, organization, systems capability, management systems, headquarter's role, contract types, and engineer – scientist coordination. Others have sought project professionals' opinions of critical success factors (Dugan et al. (1977), Thamhain & Wilemon (1983), Pinto & Prescott (1988), Larson &

LaFasto (1989)). From an extensive literature review the variables and their operational definitions are as varied as the projects included in the samples. Hackman and Morris (1975) concluded that, even after thousands of studies, the knowledge of why some projects are more successful than others is still inconclusive.

Framework

Based on the tremendous number of project variables believed to affect project success and the large variety of projects, several authors have attempted to classify the variables in order to create a more manageable set. Pinto and Slevin (1988) grouped the factors identified by their sample of project managers into ten categories. These categories were mission, top management support, schedule, client consultation, personnel, technical, client acceptance, communication, feedback, and trouble-shooting. Pinto and Prescott (1988) investigated the intensity of those same ten factors during various lifecycle stages. Murphy et al. (1974) deployed a 177-question survey to 646 project professionals from a variety of industries. The variables thought to affect project performance were sorted into 32 factors. Belassi and Tukel (1996) categorized their variables into those relating to the project, the project manager or team, the parent organization, and the external environment. These are not orthogonal categories. When focusing on the project, the parent organization is part of the external environment. Also, the project is composed of technical and resource considerations, which may have completely different evaluations. Larson and LaFasto's (1989) themes were goals, structure, competency, commitment, communication, standards, external support, and leadership. Nicholas (1989) chose to classify the variables affecting project success as participants, communication, and processes. This succinct taxonomy fails to provide independent categories, since processes and communication are implemented by participants. Cohen and Bailey (1997) developed a framework for project effectiveness as a function of environment, team design, processes, and psychosocial traits. This categorization fails to consider either the technical complexity or the resource adequacy that other studies indicate can affect project success. Each author pictorially depicted their categories and hypothesized the interrelationships and effects on project performance.

The existing empirical research is “clearly insufficient to completely understand the features or characteristics of effectively functioning teams.” (Larson & LaFasto, 1989, p. 19). Yet, certain themes continue to arise: teamwork, availability of necessary technology, resource adequacy, and a favorable environment. The exploratory research by Parsons et al. (2002) provided support for a classification of project variables along four independent dimensions: technical, environmental, social, and resource adequacy.

Discussion

While not all variables affecting projects are controllable by either the project or its parent organization, the identification of these variables is still valuable. The key to project success is hypothesized to reside in the appropriate application of project management techniques and project controls. The tools available to a project manager do not conform to the one-size-fits-all philosophy. Project management practices need to be applied with different intensities based on the project characteristics (Webster, 2000). These characteristics may be classified into categories of variables correlating with project success. Furthermore, there is general agreement among researchers that different styles are even required at different life cycle phases within a single project (Adams & Barndt, 1988). This assertion, the benefit of matching management style to project characteristics, was supported by the empirical research of Shenhar (1998), Murphy et. al (1974), and Clift and Vandenbosch (1999). In addition, several authors hypothesized that project characteristics are critical in the determination of appropriate management style and control mechanisms (Frame (1995), Seely & Duong (2001), Baccarini (1996), Pinto & Trailer (1999), Anderson (1992)). Shenhar (1998) summarized, “a

carefully selected management style may lead to better implementation and to an increased chance of project success.” (p. 33)

By mapping this abundant number of variables into four broad categories, the project manager can concentrate on a manageable number of factors when adopting a particular leadership style and designing the appropriate control processes. Any attempt to tailor the project controls to tens of individual variables would likely lead to pandemonium. Whereas, the adoption of four umbrella categories is manageable. However, to be successful, these categories must be the best possible ones for tailoring project controls and management styles. For instance, Nicholas’s (1989) categories fail this test since dealing with different categories of participants can require varying management styles. His taxonomy, while a manageable number of categories, does not provide sufficient discrimination to map against project controls and management styles.

Conceptual Design

Exhibit 1 maps the variables identified by several authors into four broad categories designed to facilitate further research. The categories represent recurring themes in the project literature surveyed. In addition, they comprise the author’s view of a viable classification since each project attribute belongs in only one of the four themes. This taxonomy provides an appropriate separation of variables so that the project controls and management styles can be tailored to the needs of individual projects based on their status in each category. Exhibit 2 pictorially provides a hypothesized framework for further investigation of interrelationships among these factors, and their potential influence in the tailoring of project control processes.

Exhibit 1. Placement of Project Variables into Four Categories

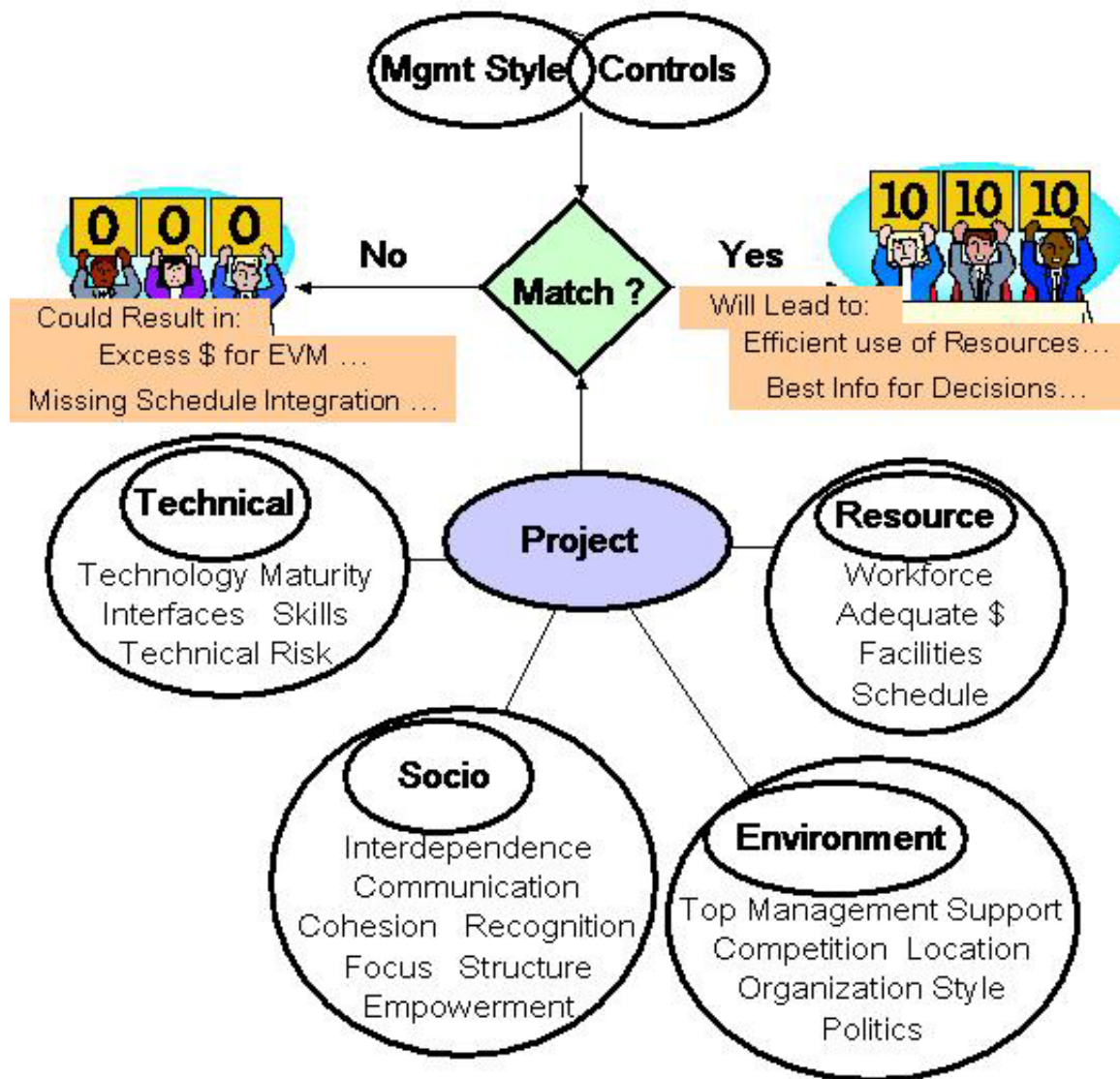
Authors	Technical	Socio	Environment	Resources
Pinto & Slevin	Personnel Ability, Technical Difficulty, Trouble-shooting	Feedback, Communication	Mission, Top Management Support, Client Consultation, Client Acceptance	Schedule
Belassi & Tukul	Project	Manager, Team	Parent Organization, External Influences	Project
Cohen & Bailey		Team, Processes, Psychosocial	Environment	
Kloman	System Capability, Individual Abilities	Organization, Teamwork, Role Definition, Engineer-Scientist Coordination	HQ Role, Environment, Stability of Objectives, Management Systems	Contract Types
Larson & LaFasto	Competency	Structure, Leaders Commitment, Communication	Goals, Standards, External Support	
Parsons, et al.	Technical Difficulty, Interfaces, Design Stability, Technical Maturity, Integration Risk	Interdependence, Communication, Cohesion, Recognition, Focus, Structure, Empowerment	Geographical Dispersion, Politics, Top Management Support	Schedule, Resources, Reserves, Facilities

Implications for Practice

The development of an accepted complexity framework for project classification will allow project managers, during the initial phases of their projects, to easily determine the most significant areas of risk. In this way, the project can tailor project controls and project management processes to the level required for maximum benefit. Processes to be optimized include schedule development and maintenance, earned value management, configuration control, data management, cost-benefit analyses, and levels of critical communication. While the framework for project complexity classification remains constant, individual projects would be ranked on their complexity level in each of the four theme areas. On one end of the spectrum, a project may be extremely complex in technical, socio, environment, and resource-constrained. At the other extreme, a project may be easy to accomplish technically, have sufficient

resources, a supportive environment, and an excellent project team. Assuming three levels of complexity within each theme, a project could receive one of 81 possible classifications. Different control techniques (configuration control, requirements flowdown, etc.) are optimal for projects with low, medium, or high technical complexity. Another set of project controls (critical path analysis, earned value management, etc.) should also be tailored for the level of complexity in the resource theme area. The optimization of communications (type and quantity) varies according to the project's level of socio and environmental complexity. Project control techniques can be very expensive to implement; therefore, it is in the best interest of a project manager to employ only the level of controls necessary to maximize the chance of success. It is a critical balancing act to optimize controls in order to provide the best information for decision-making.

Exhibit 2. Categories Affecting Project Success



Conclusion

This paper is designed to propose a framework for future research into the benefits of tailoring project controls and management techniques to the various clusters of projects as defined by the possible combinations of the four umbrella categories. For instance, a project distinguished by scarce resources may need to utilize weekly resource management reporting. Those categorized as high technical risk require a robust risk management plan. Projects with volatile environments may need processes to maintain

frequent contact and assessment of that change agent. Further research into optimizing project controls for the management of different project categories is warranted. While not all variables fall within the project's control, the judicial application of appropriate controls can mitigate potential adverse affects.

About the Author

Vickie Parsons is currently a PhD candidate in Engineering Management at Old Dominion University (ODU). She holds an MPA from ODU with an

emphasis in information sciences and a BS in mathematics from Virginia Polytechnic Institute. She has extensive experience managing project controls, systems engineering, and individual projects for NASA. As part of NASA's Independent Program Assessment Office, she currently performs reviews of NASA projects and programs with respect to management, technical, schedule, and cost processes. Her research interests include project management, project metrics, and team dynamics.

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