Six Sigma Project Management: Insights from Research and Practice

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Abstract

Estimates for Six Sigma project failure rates vary widely, from around 30% up to 80% of all projects. The gurus who provided the basis for quality management theory, such as Deming, Juran, Crosby, Imai and others gave detailed prescriptions for successful quality improvement programmes. However, they provided little in the way of addressing the critical requirements of individual improvement projects (for an exception, see Juran & Gryna, 1988, chapter 22).
In contrast, the literature on project management concerns itself almost exclusively with the critical factors for project success. This presentation asks how quality projects such as those carried out using Lean and Six Sigma approaches can be improved by applying insights from project management research.

Introduction

Project management has been an important occupation for thousands of years, since our ancestors first conceived of large scale projects such as the building of the Pyramids of Egypt and the Great Wall of China. Throughout history, projects have been undertaken with varying degrees of success, and afforded us a body of knowledge of what constitutes 'good' project management. This body of knowledge has been compiled by the Project Management Institute as the Project Management Body of Knowledge (PMBOK®) (PMI, 1996).

Six Sigma, in contrast, has existed only since the 1980's with its roots tracing back to Shewhart's 'Plan-Do-Check-Act cycle' (Shewhart, 1939) and Juran's 'Universal Sequence for Breakthrough Improvement' (Juran, 1964). Many prescriptions have been made for effective deployment of Six Sigma improvement teams, but little empirical data has been collected and reported in the academic literature.

This paper aims to help address this deficiency by identifying project success factors reported in the project management literature and exploring how they might be applied and assessed in the context of Six Sigma and Lean process improvement projects. This is important because of the high project failure rates that have been reported (eg. 50-70% - Hammer & Champy, 1993).

Definitions

The definitions of 'traditional project management' and 'Six Sigma project management' will be illustrated through a listing of some of the differences. It should be noted that not all Six Sigma programmes are deployed in exactly the same way therefore the descriptions used here may not ring true to all practitioners.

	Traditional project management	Six Sigma project management
Project scope	Small through to very large, may span multiple functions, processes, locations, technologies, etc.	Typically focussed on a single process, product or service.
Project timeline	May take years	Commonly 3-9 months
Project budget	Large budgets sufficient to cover the cost of a predetermined solution	Usually little or no budget
Project human resources	Teams made up of project professionals such as project managers, business analysts, designers, testers, change managers, and people with in-depth technical knowledge of the solution(s).	Small teams made up of people with in-depth practical knowledge of the process, product or service. They tend to have limited or no prior project experience, with the exception of the project leader/coach.
Project goals	Deliver a predefined solution to specification, on time and within budget.	Solve a defined problem. Additional goals may include deliver cultural change, develop project team skills, and enhance management information.
Typical solutions	Construct and execute a new structure, strategy, system or programme.	Improve a process using simple improvements at the areas of greatest impact.
Body of knowledge	Project Management Body of Knowledge (PMBOK) (PMI, 1996)	Six Sigma Body of Knowledge (ASQ, 2004)

Project success factors

A selection of success factors addressed in the project management literature is presented below, using a modified version of Belassi and Tukel's (1996) categories.

Project Manager / Leader	**Project Team**
Ability to deal with the 'authority-gap' by	Careful recruitment and selection
motivating and recognising team members	Induction and training prior to project
Problem-solving ability	for all project team members
Results orientation	Superordinate goals
Energy and initiative	Team rules and procedures
Self-confidence	Physical proximity
Perspective	Low interdependence of tasks
Communication	Organic coordination
Negotiating ability	
Style adapted to different project phases	**Project**
	Availability of resources
Environment	Urgency
Top management support	A project vision
Mature project management environment	Clear objectives and scope
	Communication throughout the project

Table 1. A selection of success factors

1. Project leader/manager related success factors

In the late 1960's, Hodgetts, a doctoral student at Oklahoma, was interested in a dilemma faced by project managers. While they direct the work of their project team members, these team members are usually made available to them by a functional manager in the business. Therefore the project manager him/herself lacks the authority to mete out rewards and promotions to those who demonstrate their worthiness in the project. Hodgetts interviewed a number of project managers regarding their experiences of the authority gap and discovered several techniques used to overcome it. He was more surprised, however, to find that the experience of the authority gap and the techniques used to combat it vary by project size. Managers of very large projects used formal agreements to gain full control and authority over their project resources for the duration of the project. In contrast, small projects, which are most relevant to process improvement projects of interest in this paper, required a greater range of techniques. Successful managers of smaller projects tended to be more human relations oriented, giving team members credit for good work and letting them know the importance of the role they play on the project. This suggests that for effective Lean and Six Sigma projects, the leaders need to be equipped with a range of effective motivational techniques and the ability to remain observant of each team member's contributions.

More recently, the Project Management Institute commissioned authors Turner and Müller to undertake a review of the literature relating to the leadership styles of project managers as a factor in project success. Their review, published in 2005, found little had been done to examine leadership styles and capabilities. An exception was the prior work of one of the authors

(Turner, 1999) which resulted in the identification of seven traits of effective project managers:

- Problem-solving ability
- Results orientation
- Energy and initiative
- Self-confidence
- Perspective
- Communication
- Negotiating ability

The authors were particularly surprised because the general management literature is replete with studies correlating managers' leadership styles with business success. In one of the few project leadership studies, Keegan and den Hartog (2004) tested Bass' (1990) model of transactional and transformational leadership in a project management context. They hypothesised that transformational leaders would be more effective, but found no significant link.

While Turner and Müller noted that of the many lists of project success factors mentioned in the literature, very few explicitly referred to the skills of the project manager, they also noted that most of the lists were developed by surveying project managers. While it is possible that the project manager does not influence project success, the authors preferred to conclude that the project managers simply had failed to identify their own leadership characteristics as project success factors.

An alternative view of the project manager's contribution to project success uses a contingency perspective. Frame (1987), Turner (1999) and Weinkauf and Hoegl (2002) suggested that project success depends upon project managers adopting different behaviours at different stages in the project. This is consistent with Hackman and Wageman's (2005) model for effectively coaching a team through a team task. They propose that:
1. Motivational coaching is most effective at the beginning of the project;
2. Consultative coaching is most effective at the midpoint; and
3. Educational coaching is most effective when the performance activities have been completed. (Hackman & Wageman, 2005, p278).
Weinkauf and Hoegl collected data from the team members as well as team leaders from 39 teams in a large scale project. They found that project managers engage in conceptual activities early in the project such as setting goals, determining the best approach for the project, and planning resources.

Later in the project, they become less concerned with directing and controlling, and more with giving feedback, rewarding team members, and granting autonomy. However, there was a lot of variation between project teams, and many activities such as securing information flow that were carried out continuously throughout the project.

2. Project team related success factors

The right team members, carefully selected and properly trained, are critical to the success of projects (Pinto & Slevin, 1988). Atkins and Gilbert (2003) argued that providing adequate induction and training to project team members could have prevented project failures in the case studies they examined. Furthermore, Weinkauf and Hoegl (2002) concluded after observing 39 project teams that training in preparation for complex projects is preferable to learning on the job. In the practice of Six Sigma process improvement, it is common for the project leader only to be trained to green belt or black belt level. The above findings, assuming applicability to Lean and Six Sigma projects, suggest that all project team members should undergo training prior to commencing project work.

Pinto, Pinto and Prescott (1993) verified an additional three team factors in their survey of team members from a number of hospital-based project teams. They found that cross functional teams in particular benefited from superordinate goals – that is, goals that are urgent and relevant to all and require the various groups or functions to cooperate in order to attain those goals. Superordinate goals increased the level of cooperation within the teams. Team rules and procedures also enhanced cooperation and led to greater goal achievement. Finally, they found that the physical proximity of the team was important. Team members who are located in the same office area experience more frequent and conducive interactions which led to better achievement of the project goals. Pinto et al's findings are particularly relevant to lean and six sigma teams with representatives of multiple functions. Clear goals that require cooperation, team rules and procedures, and co-location of the team members are all recommended to enhance project team success.

While the goals, rules and location of the team are generally established at the beginning of a project, much still depends on the way work is allocated and coordinated during the project. Andres and Zmud, (2002) looked at the case of software development projects, which require team members to jointly develop a complex output. They found productivity within the team was much higher when the tasks were broken down into largely independent pieces of work. In many cases, including software design, it is unavoidable that the work of the various team members overlaps. Particularly to the extent that their work is interdependent, project teams were found to be more productive when the coordination of the project was organic rather than mechanistic. Organic coordination is characterised by use of informal rather than hierarchical communication channels, cooperative decision-making and decentralised autonomy.

These results suggest that process improvement project teams would also benefit from early formal training, goals that transcend the individual or functional group interests of the project team members, team rules and procedures, a project 'home base' where the entire team can be located

together during the project, project tasks that each team member can perform as independently as possible, autonomy, informal communication channels, and cooperative decision-making.

3. Success factors related to the project

Belassi and Tukel (1996) surveyed project managers across a number of industries in regard to a set of success factors derived from the literature. Of those related to the project characteristics, the availability of resources was ranked highest in importance. Another characteristic from the literature that was not borne out by their study was the urgency of the project.

Christenson and Walker (2004) argued that an inspiring vision of what the project is to achieve will substantially influence the success of the project. They observed how effective a motivating vision could be in their case study of an information technology project, and noted other cases where the lack of a vision was identified as a root cause of project failure. They suggest that the project vision should be formulated by the project sponsor together with a stakeholder reference group and the appointed project leader. It needs to be easily understood, motivational and inspiring, credible, and point to stretch goals.

Following from the project vision, it is critical that the objectives and scope of the project are clear (Clarke, 1999). A few key objectives help to orient the team towards the desired outcome, enable progress and ultimate success to be measured, and make it possible to communicate to stakeholders what the project aims to achieve. Effective communication in turn, is also critical to the success of the change management effort (Clarke, 1999).

4. Factors in the external environment

Top management support is prominent as a success factor in the quality literature, and the project management research findings are no different. Support from top management assists by affecting the levels of many other factors, including the availability of resources, the team's clarity regarding management's desired outcomes from the project, and by influencing others throughout the organisational hierarchy to support the project (Belassi & Tukel, 1996). These findings reiterate the need for the process improvement project manager and team to garner support from a high level sponsor if the project is to be a success.

Along with support for the project, it is important that the organisation has mature processes selecting and prioritising projects and for supporting project teams. Cooke-Davies (2002) reported on a large empirical study showing that sustained success in project delivery requires organisational programme management capability in aligning projects to business objectives, rigorously measuring project performance, and learning from experience on projects. Furthermore, individual projects are more likely to be completed within time and budget if the organisation has good risk management capability, change

control processes, and operations management committed to delivering project benefits.

Conclusion

In this paper, a selection of project success factors is presented from a brief overview of the project management literature. The success factors discussed are summarised in table 1. The findings of project managers and project management researchers offer some suggestions for improved practice of process improvement initiatives using techniques such as Six Sigma and Lean. Further research is needed to verify the applicability of the project management success factors to the process improvement context.

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