SIX SIGMA IN PROJECT MANAGEMENT

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Competition is increasing rapidly and it is not good enough to complete the projects within time and budget, but the aim is to understand the Voice of Customers (VOC). In the last few decades, the project management concept and its techniques have established proven practices and demonstrated their worth within several organisations. But the continuing dramatic failures in projects have highlighted the disadvantages in traditional methods of project management and in particular, the ways in which projects are formulated and executed through them, leaves many opportunities for further development in the project management process.

As organisations have started paying more attention towards improving their operational management practices, Six Sigma methodology has revolutionized the world of business and evolved with growing momentum in customer satisfaction and quality. In the changing business environment, the key element needed for sustaining or building competitive advantage is the ability of an organisation to respond proactively through operational and project improvements.

In the last few years, many project management techniques (PERT, Gantt Charts, WBS, milestone chart, line of balance and computerised project management tools) have been introduced and are widely used by many organisations to manage their projects. Although they assist project managers in processing large amounts of data, they are not fully capable in certain aspects of project because of its size, its uncertain scope and the increasing complexity in the project management environment. The fundamental limitation in the project management techniques is their inability to deal with subjective judgements that are imprecise and vague (McGarland, 1985).

Project management techniques are capable of determining the project progress accurately by using various mathematical calculations and by identifying the constraints in the project by expanding them. But the basic problem in them is their inability to provide suggestions and decision making support for the project managers in performing bottleneck solving strategies (Seiler, 1990). The techniques are only capable of performing limited analysis on the information available and rely on the project manager's ability to estimate the delay or interruptions in actual situations.

The information gathered using project management tools is useful, but the evidence suggests that they are not sufficient to handle complex problems in the project efficiently. Many of the project management methods have failed in the past because these techniques were not measuring the value added by process changes. The increasing unpredictability and complexity of unforeseen events in projects means that there is a need for a system that can provide decision-making support and increase the ability of project managers by interacting with them in a way that is more cost effective and efficient.

To achieve organizational objectives, many organizations in the past like Allied Signals, GE and Motorola have successfully implemented quality methodologies like Six Sigma across all

departments within their organization and have achieved remarkable improvement in the market share, product reliability and customer satisfaction (Coronado, 2002; Harry, 2000). Six Sigma has become a buzzword in the business world, but it is difficult to ignore its importance in reducing the number of defects and its concept of continuous quality improvement within the organization. Six Sigma is an operational system that speeds up the improvements in the business system using various statistical aspects by getting the right projects conducted in the right way (Lucus, 2002). It is a powerful business strategy that has been recognized not only in the manufacturing sector but also both in the service and transactional processes. Above all, it is simple, structured and it emphasises on producing the results that impacts the project outcome, making Six Sigma stand out from other quality programs (Blakeslee, 1999). In order to achieve maximum benefits through the development of project management, one should consider the need to integrate Six Sigma with project management using the process improvement methodology which has five key stages namely, Define, Measure, Analyse, Improve and Control.

Recent research conducted by the author shows that the benefits of effectively managing projects accrue to all parties including project managers, project stakeholders, the customers and the project champions[1]. Indeed, engineering companies benefit from Six Sigma and the consequence is improvement in project performance in terms of budget, schedule and quality issues as identified by Black Belt professionals and project managers. Adoption of Six Sigma throughout the project lifecycle would also help in solving some of the issues and potential risks before they become critical. Adopting Six Sigma is the roadmap to project quality that ensures project success, customer satisfaction as well as minimizing the occurrence of repeatable problems and it provides a quick recovery for unforeseen circumstances.

Another point the author's research has concluded is that the majority of project managers have no knowledge about Six Sigma but some of those who have attended training in the past or have knowledge about its tools are becoming more aware in systematically managing projects. Some managers have stated that Six Sigma provides the structure and tools to identify and address problems. Some of the respondents iterated that they have integrated Six Sigma in new product development projects. Six Sigma has become an integral part of project control system and along with change management; it forms a crucial relationship in improving the project performance within the company. This process promotes data gathering and encourages project managers and other stakeholders to make accurate decisions.

Subsequently, application of Six Sigma methodology in project management would provide an opportunity to the project managers to take maximum benefits from their projects by developing strategies that are based on performance metrics by eliminating unwanted complexities and uncertainties. Recognizing that project management is itself a process and by adding Six Sigma methodology could bring value and are best applied within the organization. While, in most instances, it is not possible to achieve Six Sigma level of performance in new projects, but the integration of Six Sigma and project management would help to set up high quality standard and provide a mechanism to achieve the project goals.

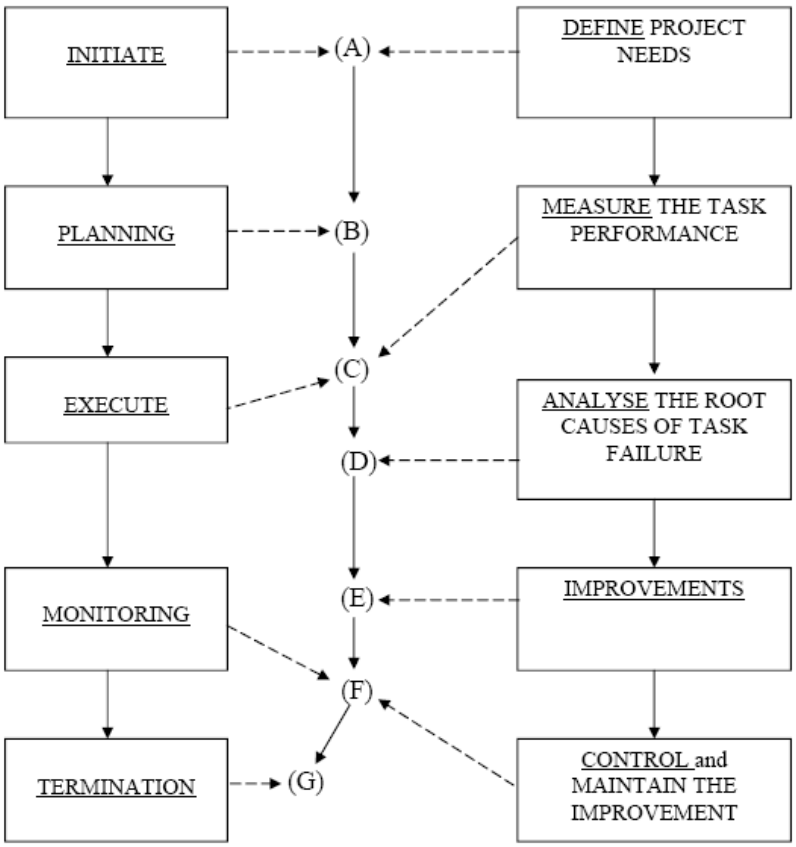
From the intangible side, Six Sigma would help in building the confidence and improve the communication among the project managers, stakeholders and customers. Many Black Belt professionals and project managers found that, "Employing Six Sigma in projects boosts stakeholders and customer confidence by clearly understanding the project objectives and its

[1] Research conducted with six managers from UK and a quantitative study employing questionnaires involving fifty managers across the world.

sub-objectives at the initial phase of the project management". In this sense, Six Sigma promotes information sharing which helps in building a friendly environment and cultivates team relationship, therefore improving project effectiveness and achievement of project success. The benefits of adopting Six Sigma in project management, as identified by the respondents were:

- Cultural changes in managing projects,
- Projects linked to bottom line benefits and customer focussed approach,
- Improvements in project tasks over long run, thereby minimizes repeated problems,
- Enables better decision making,
- Better budget, schedule and quality awareness at each phase of project management,
- Improvement in the lead time in new product developments,
- Reduction in non value added and wasteful activities for project management,
- Improvement in quality of projects and product delivery (time to market),
- Increases profit (bottom line cost savings) and better customer satisfaction,
- Development of staff skills,
- Common improvement language throughout organization,
- Better time management,
- Help to clarify project objectives and prioritisation of project tasks,
- Improved customer confidence in delivering project on time, within budget and improved quality,
- Reduction in customer complaints.

During the course of this research, the author developed an integrated model based on the principles of both Six Sigma and project management. Both methods have their own steps and phases to follow; the integrated model merges the concepts of both of them to form one single model. The proposed the integrated framework between Project Management and Six Sigma is shown below:



Phase A of the integrated framework is similar to both methodologies which involves identifying the project objectives. The purpose of this phase is to determine the nature and scope of the project. If this phase is not performed well, it is unlikely that project outcome will meet the customer demand accurately. The key process controls are needed at this phase (like data collection methods) to ensure that all the individual system, processes and platform requirements are understood and incorporated into the project as it starts. This phase includes a cohesive plan that encompasses the following areas:-

1. Developing the project charter- The project charter is an agreement between management and team about what will be accomplished from the project. It includes the background information about how the project is initiated, reason for the project and its overall expectations. A brief description of project approach, project team structure and project plan should be clearly described in this phase.
2. Capturing the voice of customer- Project managers generally reach the goal of establishing the business case for the project but fail to identify the key project parameters that are vital to meet the customer expectations. Since there are limited tools available in project management methodology to capture the voice of customer in the initiation stage, Six Sigma tools can be useful in this phase.
    a. QFD (Quality function deployment)- QFD is a structured approach that is used to define the customer needs and translate them into specific plans (design, manufacturing, development and engineering characteristics) to produce the desired project outcome. QFD approach helps to focus on the product design and its manufacturability by measuring how closely it will meet the customer specifications.
    b. Benchmarking- Precise customer requirements are not the only source of specifications for the new product development projects. These specifications can come from comparison with benchmarks based on competing against similar products or similar projects.
3. Identifying critical success factors- These are those factors that must be right to meet the project objectives. Some factors are more critical just as certain customer requirements are more important than others.
    a. Critical-to-quality tree- Another tool of Six Sigma that can be used to identify the critical success factors in project at this phase is ‘Critical to quality tree’. The purpose of this tool is to identify the key measurable characteristics of a project by converting the customer needs into measurable requirements for the project to achieve, whose specifications limits must be met in order to satisfy the customer.

Phase B of the integrated framework is taken from project management process that involves deciding on how work should be conducted to improve/eliminate the constraint or meet the project objective. This phase not only involves the use of techniques like PERT/CPM for project scheduling but involves a much wider scope of a project. It begins by setting the project goals, identifying bottlenecks in the project tasks, cost estimating/budgeting, risk management, resource usage estimating and the milestones to be covered to ensure that project is completed successfully. The basic consideration in project planning is the work breakdown structure that divides the overall project into work packages (elements) and identifies the project subsystems interfaces to be managed. This phase becomes the tracking system to ensure that all tools, communications and work packages are bought together as a total system to execute the project adequately. One of the Six Sigma tools that can be use at this phase to focus the critical inputs is Failure Mode Effect Analysis (FMEA). The purpose of FMEA is to establish project

priorities and draws attention on the interrelationship between inputs and outputs, therefore helps project team to avoid spending time collecting data on non critical aspects of the project.

Phase C of the integrated framework is the combination of the execution stage of project management discipline and the measure stage of Six Sigma methodology. In the execution stage, the project management team directs the performance of the planned activities and tasks interfaces that exist within the project. Deliverables are produced as outcomes from the processes and work performance information about the completion status of the deliverables is collected as a part of this phase. Measurements of the deliverables will help the project manager to visualise the things that are hard to see. The goal of “measure” is to activate the mode of data management which include both data collection as well as organization of the data for the purpose of observation. This step uses a variety of statistical tools like Histogram, scatter plot, quality control graph (depending upon the need) to read the current situation of the CTQ (critical to quality) and project parameters. The focus here is to establish the relationship between the target and control limits applied by customer specifications overlaid onto that target. In case of human interaction within the process, a gauge repeatability and reproducibility study is conducted on the project task to determine the variation among other factors such as environment and equipment.

Phase D of the integrated framework follows the spirit of Six Sigma methodology to determine the performance of project processes aiming to achieve the project goals. It is followed by an analysis in finding the root causes of a problem if the performance of the tasks lags behind or not within the control limits defined by the customer. To meet or exceed the customer expectations, data from the previous phase (C) must be evaluated in this phase. Cause and effect diagram or Five Whys are powerful means to organize the brainstorm of ideas to identify the root causes that causes the problem. Once all the critical failure factors have been identified and organized in the previous steps, regression analysis or hypothesis testing can be used to test the correlation between the factors to separate out the irrelevant characteristics. It is necessary to conduct situation appraisal at this phase in order to increase the communication between stakeholders and address issues that are not directly process-related or were not previously addressed. The importance of this phase in the integrated model is that it has to find solutions to the problem without further damaging the project outcome, a solution that will later be improved. Using various tools at this phase takes advantage of Six Sigma sequencing by enabling the project to flow smoothly from phase C to phase E.

Phase E of the integrated framework applies Six Sigma strategies using various technical and statistical techniques like Brainstorming, Design of experiments and Kaizen to eliminate root causes in the failure tasks to achieve better project performance. The purpose of this phase is to utilize current capacity and incur maximum benefits from the task outcome without creating additional expenditure in the project. The solutions derived from phase D are prioritised and then implemented in pilot runs to see if the improvement results match with the customer or project requirements. Once all the improvements alternatives are pilot tested, evaluated for failure resistance and their impact on CTQs (critical to quality) have been justified, the ideas are then simulated in the final effort to implement the best solution.

Phase F of the integrated framework is the combination of monitoring stage of project management discipline and controlling stage of Six Sigma methodology. This phase is designed to ensure that the improvement/changes made in the previous phases are supported by the entire project without any delay in project duration, cost overruns and quality issues. The purpose of this phase is to continually monitor the project variables and measure the project

activities (after improvement) to ensure that it stays within specified control limits. One of the Six Sigma tools that can be used at this phase to monitor the process performance and provide feedback on solution performance is SPC (Statistical Process Control). It helps to audit the improvements and assures that the modifications made in the project activities will be properly sustained to run the project to a successful end.

Phase G of the integrated framework is taken from last stage of project management discipline where project is terminated through the project charter. It includes the successes during the project, lessons learned and analysis of the gains from the project outcome. The review should be presented to management to determine how well the project output integrated with missions, strategies, customer requirements and objectives of the organization.

Overall, the integrated framework is made by combining management aspects of project management and engineering aspects of Six Sigma. Specifically, for the companies that use only project management within their system, Six Sigma provides the prospective of targeting the customer needs and performance measures during the stages of project execution and monitoring using various technical and statistical tools. The methodology of project management could benefit from the data and techniques of Six Sigma in decision making process that promotes more scientific approach to factors that are critical to quality and for the customers.

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