International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2013): 6.14 | Impact Factor (2014): 5.611

Project Management as an Aid to Six Sigma

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Abstract: ***Over the years, companies have evolved various quality checks to minimise defects in productivity. There have been many good and not so good quality techniques; however one technique, which has stood out, is the Six Sigma approach. This approach has enjoyed tremendous corporate attention, the kind, which no other approach can quite claim for itself. Six Sigma, despite of far flung success and wide spread applications, has some limitations like any contemporary new improvement methodology, both in Theory and Practice as well as tools and methods available to achieve the Six Sigma performance. One short coming is that results and paybacks take too long and hampers the cash flow. One subject which can help eliminating some such weaknesses is Project Management. This paper examines Project Management with Six Sigma in brief, attempts an integration of both the methodologies and discusses what Six Sigma can learn from Project Management to make itself a stronger methodology and suggests a strengthened DMAIC checklist studded with Project Management tools.***

Keywords: DMAIC. PMBOK, Project Management, Six Sigma

1. Introduction

The globalization of world market and the reforms process undertaken has resulted in tougher competition and opening of new opportunities. Only those organizations that can produce products and services of good quality at competitive price can hope to survive and thrive in the changed economic scenario. It is evident that during last several years, the business environment has undergone a significant change. The changing complexities of business environment have long-term impact on the styles of business operations and on the performance of business corporations. Today, no business corporation can claim its survival and growth in tomorrow's volatile business environment. It is evident that several business corporations considered to be excellent at one time either could not remain so for long or were liquidated after a short period of time.

The best way to enhance our profit is either by bringing about product innovation or by improving quality and minimising the defects in existing products. Over the years, companies have evolved various quality checks to minimise defects in productivity. There have been many a good and not so good quality techniques; however one technique, which has stood out, is the Six Sigma approach.

The history of Six Sigma is a well-documented one and hence we note only briefly here. It can be traced to the American electronics giant, Motorola where a goal of improving all products - goods as well as services was established. To set a clear measure on the improvement work, the program called Six Sigma was launched in 1987, Klefsjo, Wiklund and Edgeman (2001). As a result of winning the Baldrige Award in 1988, Motorola was compelled to share its quality practices with others. The company's approach to continuous improvement was based on a comparison of process performance and product specification, and aggressive efforts to drive down defects, Folaron (2003). Motorola changed the language of quality in America by beginning to measure defects out of opportunities or parts per million (and even billion), instead of parts per hundred, Raisch, Anderson, Krogman and Krueger (2001).

Six Sigma is a quality movement, a methodology, and a measurement.. As a methodology, it is used to evaluate the capability of a process to perform defect-free, where a defect is defined as anything that results in customer dissatisfaction. Six Sigma is customer focused and has the potential to achieve exponential quality improvement through the reduction of variation in system processes, Black and Revere (2006). Six-sigma's target is to achieve less than 3.4 defects or errors per million opportunities hence the name. Higher the number of Sigma, the more consistent is the process output or smaller is the variation, Karuppusami and Gandhinathan (2006). We can sum up Six Sigma as a defect reduction effort, a variation reduction mechanism, customer satis-factor, a profit enhancing device, a loss control method, a data driven metric and ultimately a management philosophy.

Six Sigma, like any new Quality improvement methodology, has some limitations. According to Pyzdek (1999), one of the weaknesses is that, that results and paybacks take too long and hampers the cash flow. One subject which can help overcoming these weaknesses is Project Management.

2. The Project Management

Project Management is the discipline of initiating, planning, executing, controlling, and closing the work of a team to achieve specific goals and meet specific success criteria. The Project Management Body of Knowledge (PMBoK) became an accepted standard (as established by the Project Management Institute) that is still widely used in many industries around the world. The PMBoK is a well-established standard that is widely used by all professional project managers all around the world, and is the basis for certification as a Project Management professional (PMP).

2.1 The Project Management Body of Knowledge (PMBOK)

The Project Management Body of Knowledge (PMBOK) is a collection of processes and knowledge areas generally accepted as best practice within the Project Management discipline, PMI (2016). The PMBOK Guide is process-based, meaning it describes work as being accomplished by processes. This approach is consistent with other management standards such as ISO 9000 and the Software Engineering Institute's CMMI. Processes overlap and interact throughout a project or its various phases. Processes are described in terms of:

- Inputs (documents, plans, designs, etc.)
- Tools and Techniques (mechanisms applied to inputs)
- Outputs (documents, products, etc.)

As an internationally recognized standard (IEEE Std 1490-2003) provides the fundamentals of Project Management, irrespective of the type of project be it construction, software, engineering, automotive etc.

PMI Standard: A Guide to the Project Management Body of Knowledge - Description

The subset of the Project Management Body of Knowledge that is generally accepted is identified and described in this guide. Generally accepted means that the knowledge and practices described are applicable to most projects, most of the time, and that there is widespread consensus about their value and usefulness. It does not mean that the knowledge and practices should be applied uniformly to all projects without considering whether they are appropriate.

ISO 10006:2003, Quality management systems - Guidelines for quality management in projects, is an international standard developed by the International Organization for Standardization. ISO 10006:2003 gives guidance on the application of quality management in projects. It is applicable to projects of varying complexity, small or large, of short or long duration, in different environments, and irrespective of the kind of product or process involved. This can necessitate some tailoring of the guidance to suit a particular project. ISO 10006:2003 is not a guide to "Project Management" itself. Guidance on quality in Project Management processes is discussed in this International Standard. Guidance on quality in a project's product-related processes, and on the "process approach", is covered in ISO 9004. A new "Project Management - Guide to Project Management" ISO 21500 was in preparation (2008). Since ISO 10006:2003 is a guidance document, it is not intended to be used for certification/registration purposes, ISO (2016).

PMBOK Guide recognizes 44 processes that fall into five basic process groups and nine knowledge areas that are typical of almost all projects. The basic concepts are applicable to projects, programs and operations. The five basic process groups are, Wikipedia (2009):

1) Initiating
2) Planning
3) Executing
4) Monitoring and Controlling
5) Closing

The nine knowledge areas are:

1) Project Integration Management
2) Project Scope Management
3) Project Time Management
4) Project Cost Management
5) Project Quality Management
6) Project Human Resource Management
7) Project Communications Management
8) Project Risk Management
9) Project Procurement Management

Each of the nine knowledge areas contains the processes that need to be accomplished within its discipline in order to achieve an effective Project Management program. Each of these processes also falls into one of the five basic process groups, creating a matrix structure such that every process can be related to one knowledge area and one process group.

The PMBOK Guide is meant to offer a general guide to manage most projects most of the time. A specialized standard was developed as an extension to the PMBOK Guide to suit special industries.

Much of PMBOK is unique to Project Management e.g. critical path and work breakdown structure (WBS). Some areas overlap with other management disciplines. General management also includes planning, organizing, staffing, executing and controlling the operations of an organization. Financial forecasting, organizational behavior and planning techniques are also similar.

3. Similarities and Dissimilarities

Interest in Six Sigma is growing rapidly within the professional Project Management community, and the most common question coming from that group is something like how does Six Sigma relate to the Project Management Body of Knowledge (PMBoK)? Six Sigma and PMBoK do have connections, similarities and distinctions.

At a basic level, many of the methodologies advocated by PMBoK and Six Sigma have a great deal in common. Both seek to establish a sound plan; identify and communicate with stakeholders; conduct regular reviews; and manage schedule, cost, and resources. Both disciplines seek to reduce failures, prevent defects; control costs and schedules, and manage risk. As specific connections are explored, it is useful to identify and comment on several different perspectives from which this topic can be considered.

Both sets of practices bring value and are best applied in conjunction with one another. We compare both the methodologies and the see the similarities and dissimilarities in the following Table 1.

Table 1: Comparison of Project Management and Six Sigma

Concepts	Project Management	Six Sigma
Origin	First published by the PMI as a in the Project Management profession today and has become the global standard for the industry. white paper in 1987, the PMBOK Guide was an attempt to document and standardize accepted Project Management information and practices. The first edition was published in 1996, followed by a second in 2000, and a third in 2004. The guide is one of the essential tools.	The quality evolution in Japan and Motorola. Using Six Sigma, management can measure the baseline performance of their processes and determine the root causes of variations so they can improve their processes to meet and exceed the desired performance levels. Six Sigma allows managers to take their projects to new levels of discipline and comprehensive commitment.
Theory	Project Management is based on a theory of project consists of Transformation, Flow and Value generation and on a theory of management, consisting of Planning, organizing and Controlling, Koskela and Howell (2002).	Six Sigma as a defect reduction effort, a variation reduction mechanism, customer satis-factor, a profit enhancing device, a loss control method, a data driven metric and ultimately a management philosophy..
Process	Process groups typically include: Initiating, Planning, Executing, Monitoring and Closing.	Six Sigma can be applied to operational management issues, or it can directly support strategic management development and implementation. It follows SIPOC and DMAIC.
Goals	The goals of Project Management is based on the triple constraints model of time, cost and scope,	Reduce scrap, rework and defects; Reduce variation, improve processes and process capabilities. This can be done much better if Project Management's goals of time, cost and scope are also applied.
Approach	Professional Project Management attempts to achieve these goals by encouraging best practices on a project by project basis, often through the mechanism of a project office that promulgates policy, provides templates and advice, promotes appropriate use of tools such as critical path method, and performs periodic project reviews.	Six Sigma provides a structured data-driven methodology with tools and techniques that companies can use to measure their performance both before and after Six Sigma Blackbelt projects. It can perform better with the use of Project Management approach.
Methodologies	Project Management methodologies consist of four to five process groups, and a control system. Regardless of the method or terminology, Project Management uses the same fundamental processes.	Six Sigma is more oriented toward solutions of problems at their root and prevention of their recurrence rather than attempting to control potential causes of failure on a project-by-project basis.
Tools	Analytical tools, Industrial Engineering tools including operations research, PERT/CPM , Gantt charts etc.	Advanced statistical and analytical tools. Six Sigma's set of tools are more broadly applicable than those commonly applied within typical Project Management. When done correctly, Six Sigma becomes a way toward organization and cultural development, but it is more than a set of tools.
Primary effects	It helps Reduce lead and cycle times. It averts cost and time overruns through strict control and monitoring.	Six Sigma has a solid control phase (DMAIC: Define-Measure-Analyze-Improve-Control) that makes specific measurements, identifies specific problems, and provides specific solutions that can be measured thereby improves profit.
Secondary effects	Reduces inventory, increases productivity and customer satisfaction	Six Sigma is a robust continuous improvement strategy and process that includes cultural methodologies such as Total Quality Management (TQM), process control strategies such as Statistical Process Control (SPC), and other important statistical tools thereby Achieves business goals and improves financial performance
Criticism	Project Management is concerned primarily with effectiveness not efficiency.	Results and payback take too long and hamper the cash flow.

With so many similarities, we can say both the methodologies are similar.

3.1 PMBoK processes and Six Sigma DMAIC

PMBoK Initiating Process - This PMBoK process group relates most directly to "Define" in Six Sigma. This first phase or process includes preparation of a project charter and assignment of a project manager. Six Sigma's emphasis on predicting and managing "capability" together with tools such as defect containment scorecards promotes understanding and managing the economic consequences of escaped defects.

PMBoK Planning Process – this process comprises of all three phases of define, measure and analysis .The Six Sigma thought process and toolset have many intersections with this process group. The PMBoK areas most closely related and the most prevalent Six Sigma connections to each may be summarized as follows:

Project Plan Development, Scope Planning, Scope Definition - "Requirements failures" are one of the most common problems encountered in project planning. Six Sigma's define brings a rich toolset to address these issues, including Kano classification, needs/context distinction, KJ analysis, and other language processing tools that help to reveal latent and unstated requirements – sound planning begins with a clear understanding of the voice of the customer.

Project Time and Cost Management – Project Management tools for time and cost management are the tools which can e helpful in six sigma executing its projects.

Six Sigma tools also help to prevent "expectations failures" caused by poor estimates and inadequate exploration of prioritization and feature selection issues. Six Sigma brings tools such as analytical hierarchy process, conjoint analysis and concept selection scorecards that promote fact-based conversations between the project team and the customer.

PMBoK Execution Process – This is equivalent to improve phase of Six Sigma. Six Sigma can complement product project execution primarily in the areas of risk management and in optimization through application of tools such as design of experiments, which can be used to find "what's best" solutions. Six Sigma tools such as Monte Carlo simulation (if not already being used) can find application within the context of professional Project Management.

PMBoK Controlling Process - Six Sigma complements Controlling in two primary ways. First, as it solves problems at root cause, it tends to prevent problems from reoccurring. Second, in the final step of the DMAIC improvement process (Control), controls and responses to special cause variation are institutionalized so that reaction to control issues is both rapid and sound. However, Project Management tools of control are much superior and help Six Sigma completing the projects earlier within the budgets and time.

With this discussion we can integrate both the methodologies. Presented here is an integrated model with an in built table if comparison in Fig.1

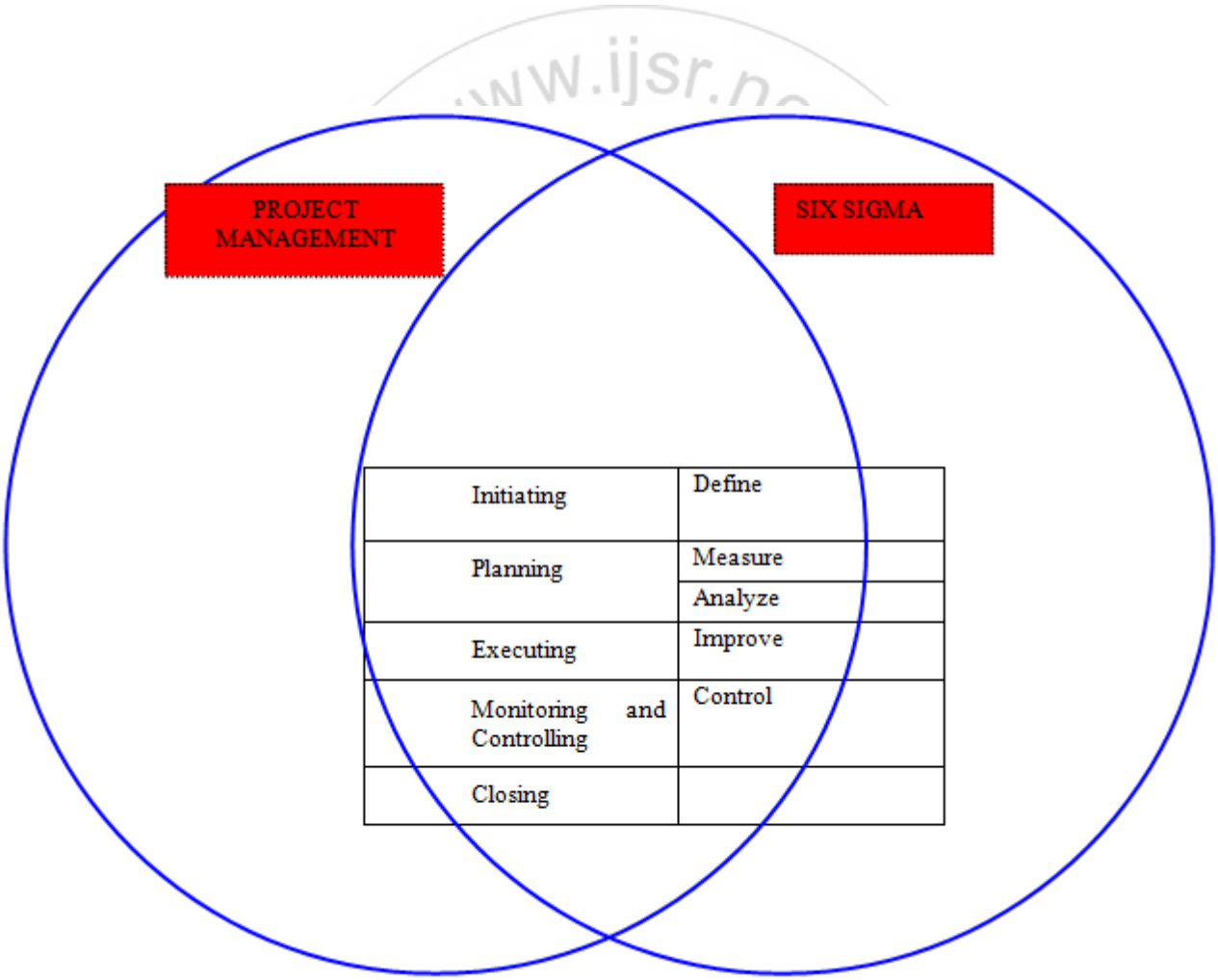

Figure 1: Integration model for Project Management and Six Sigma

4. Project Management a Complement

In the course of complex projects, all relevant processes have first to be determined and their interactions have to be analyzed. The process maps offer an analytic framework in order to show the interactions of processes. Identification of improvement areas Project Management offers an objective-oriented approach for the identification of projects, which promise a high financial success. Thus, it makes sense to apply these two different approaches simultaneously: the search for the most profitable projects carried by the (black belts) and the continuous and systematic determination of improvement potentials The continuous matching of the improvement areas detected with both approaches supports the project definition and helps to optimize project objectives. In keeping with this, particular dates for the

objective definition. It can enormously bring down the project time and there by improve the cash flows.

Tools of Project Management that can be added to the core DMAIC to strengthen the repertoire of a Blackbelt is given in Table 2.

Table 2: Project Management tools that can be added DMAIC

Define	Measure	Analyze	Improve	Control
Gantt charts/ bar chart	PERT/CPM	Work breakdown structure	Resource balancing/ leveling	EMV
Timeline	Project dimensions	Project requirement documents		Earned value analysis
IPO	Traceability matrix	WBS directory	Deliverable deployment	Gates
SIPOC	Task list	Calendar view		
In frame and out of frame	Network diagram	Critical chain Analysis	Schedule acceleration techniques	Project dashboards
Communications strategy matrix	Resource histograms	Cost breakdown structure		
Collaboration strategy matrix				
Milestone chart				

5. Professional Project Management as an Aid to Six Sigma

Application of professional Project Management is not synonymous with application of Six Sigma. Both disciplines do share many common goals and intent. Both seek to reduce failures, prevent defects, control costs and schedules, and manage risk. Generally speaking, professional Project Management attempts to achieve these goals by encouraging sound practices on a project-by-project basis, often through the mechanism of a project office that promulgates policy, provides templates and advice, promotes appropriate use of tools such as critical path method, and perhaps performs periodic project reviews. Six Sigma is more typically oriented toward solution of problems at root cause and prevention of their recurrence, as opposed to attempting to control potential causes of failure on a project-by-project basis. Six Sigma's set of tools are more broadly applicable, than those commonly applied within the discipline of professional Project Management. Recognizing that Project Management is itself a process, Six Sigma is potentially applicable to its improvement, Gack (2008).

In the end, it is clear that professional Project Management complements and extends Six Sigma. Both disciplines make important contributions to successful business outcomes. With the incorporation of Project Management tools in DMAIC, the repertoire of a Blackbelt is strengthened, and now the Quality programmes will have reduced project time and improved cash flows.

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