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Implementation of Six Sigma in Supply Chain Management in Industries

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Abstract **-** There is increasing concern about implementation failures in six sigma concept in supply chain management. The reason for many Six Sigma programmes to fail is due to an implementation model. Using a successful Six Sigma concept in an industry we have to perform strategic analysis driven by the market and the customer. It is necessary to establish a high- level, cross-functional team to drive the improvement initiative and to identify overall improvement tools. We can perform high-level process mapping and prioritize improvement opportunities. We have to develop a detailed plan for low-level improvement teams, and then to implement, document, and revise as necessary. This is important for both practitioners and academicians.

I. INTRODUCTION

Six Sigma programmes are considered as the latest management improvement tools and techniques (Watson, 2006). It is well known that Six Sigma programmes involve a host of critical decisions and many researchers have contributed to the existing literature and they have identified many critical decisions or elements of Six Sigma programs such as management involvement, improvement specialists, performance metrics, procedure, and project selection and prioritization. Six Sigma programs improve operational performance in order to enhance customer satisfaction with a company's products and services (Rajagopalan et al., 2004). Despite the immense popularity and the wide-spread adoption of Six Sigma, there is an increasing concern across industries regarding the failure of Six Sigma programmes. One reason many Six Sigma programmes fails is because an implementation model detailing the sequence of Six Sigma elements/activities is not there. The existing literature identifies many elements of Six Sigma which do enhance our understanding.

II. IMPLEMENTATION MODEL

As we know before, a model for guiding the implementation of Six Sigma programs is not available. The existing literature research related to Six Sigma and other improvement initiatives (e.g., Lean or Theory of Constraints) are utilized to isolate steps of implementation. Although suggested in different studies, these steps can connect with each other to hypothesize an implementation model. In describing a successful lean (e.g., manufacturing cells) implementation, Chakravorty and Hales (2004) found that the first step in implementing an improvement plan was to perform a customer and market driven strategic analysis. The purpose of this analysis was to direct the operational improvement effort to gain a competitive position in the market. The objective of Six Sigma programmes is to create a higher perceived value of the company's products and services in the eyes of the customer. Antony et al. (2005) indicated that linking Six Sigma to business strategy and customer needs is critical for successful implementation.

Six Sigma implementation begins not inside the business, but outside it, focused on answering the questions, 'How can we make the customer more competitive? What is critical to the customer's success?' Learning the answer to the question and then learning how to provide the solution is the only focus that we need.

In order to effectively manage bottleneck operations, Chakravorty and Atwater (2006) found that the next step in that operation is to form a cross-functional team to guide the implementation process. As Mullavey (2005) points out, in order to successfully implement Six Sigma programs, management must understand Six Sigma methodology, must provide leadership, and must guide the implementation process.

While implementing Deming's style of quality management, Hales and Chakravorty (2006) found that the step after securing management commitment and perso- nal involvement in a quality improvement initiative was to identify the tools for improvement.

Six Sigma programs have many tools for improvement, which include Histograms, Pareto Charts, Statistical Process Control (SPC), and Analysis of

Variance (ANOVA). Foster (2007) claimed that a common process for implementing improvement tools is the DMAIC methodology, which is similar to Edward Deming's ''Plan-Do- Check-Act'' problem solving. Some opine that DMAIC can be converted to DMADV which means "Define- Measure-Analyze-Design-Verify. Mast and Bisgaard (2007) considered DMAIC methodology as the scientific method in Six Sigma programmes. The next step is to understand the overall operations, and to set priorities for the project. One way to understand overall operations is by developing a process map. A process map is a graphic representation of a process, showing the sequence of tasks using a modified version of standard flowchart symbols. The map of a work process is a picture of how people do their work. Work process maps are similar to road maps in that there are many alternative routes that will accomplish the objective. In any given circumstance, one route may be better than others. By creating a process map, the various alternatives are displayed and effective planning, to improve the process, is facilitated. According to Meredith and Mantel (2003), project selection and prioritization is the process of evaluating projects, and then choosing to implement some set of them so that the objectives of the organization are achieved. The plan should include a sequence of execution activities including lower- level team improvement exercises, a training schedule, and a detailed plan of all necessary changes related to the implementation. The plan should provided a basis or implementation documentation and revisions needed to assure continuous improvement.

III. METHODOLOGY

a) Data analysis

The primary form of data analysis is the reflection by the researcher on his own experience. The researcher identifies patterns and common themes by analyzing the experiences of themselves and other participants. Content analysis works well for identifying possible root causes and prioritizing alternative solutions. In this study, we collect ideas on how Six Sigma is implemented. Three general guidelines are applicable to content analysis. First, two judges are used for performing the analysis so that the consistency of results could be estimated. Second, the categories of interest must be applicable to the research objectives. In this study, we collect data specifically on the implementation and use of Six Sigma. Third, the units of analysis must be appropriate for representing the topic under examination.

To examine the flow of information through the system; we employ process mapping. Each activity in a business process is shown on a two-dimensional scale. The processes are then connected with arrows showing the direction of service flows. Average waiting times and processing times are estimated for each stage of the process. These maps help to identify where services had breakdowns or long wait times are processed through redundant or unnecessary activities.

At the end of each day, researches review the information and data for the current day. They spend several hours brainstorming ideas and reflecting on what has happened during the day's events with several of the management. They group the ideas using content analysis and map the order processes which would be addressed the next day. The ideas with the greatest potential for success and most support from the team responsible for changes or from other company executives are prioritized for implementation. Results of the ideas implemented during the current day are reviewed for performance. Those provide improvements are noted, as well as our preliminary insights into why they work. Other areas in the order process that could benefit from the same solutions are identified for implementation on the following day. In the beginning of the day, the team choses the next problems to attack based on consensus. The planned solutions are implemented during the first shift operations of the company. During this period, the researcher focuses solely on assisting with the implementation efforts and documenting the process. These processes occur on an iterative basis throughout the study.

b) Form cross-functional improvement team

With approval from the CBO, a cross-functional team is formed, consisting of managers, engineers, and consultants. This team is called the ''Management System of Operational Change'' (MSOC). While leadership skills are considered, eight members of MSOC are primarily chosen for their technical skills. This includes participants from the customer service organization (non- access), the circuit fulfillment group (access), and the application development team.

MSOC is responsible for developing a charter for all the improvement initiatives, a timeline for carrying out the implementation, and a budget to support the changes. MSOC is also responsible for analyzing the existing process, planning the change with active participation from all departments, implementing the change in process, establishing performance matrices, and following up the effects on performance. MSOC begins with analysis by interviewing personnel (customers, engineers, and technicians) from different departments in existing process and by examining customer complaint reports, cost reports, etc. MSOC's

initial assessment is that the deteriorating performance is due to variation in the process and/or many wasteful activities at each stage of the existing process. The company is determined to find a long-term solution that would improve their operations and satisfy their customers. The main objectives are to improve customer service by eliminating waste from the existing process. improvement ideas, such as Lean and Theory of Constraints principles which are included to enrich the training programmes. To reinforce understanding among managers, engineers, and associates in the application of DMAIC methodology, we have to develop examples of DMAIC applications, and supervise many sessions where the managers and the workers work on the methodology to reduce variation or waste from the process.

c) Develop detailed implementation plan

Using the implementation priority, a detailed implementation plan consisting of major activities is developed. First, each department is designated to setup a lower level improvement team from the department. After meeting and discussing with the supervisor, a team (6–8 engineers and associates) of shop workers (and/or process owners) is established to carry out the implementation. The entire company is to be divided into a number say as 30 teams (varies with the industry-strength). Second, once teams are identified, the next step is to select supervisors or champions for managing the teams during implementation. MSOC spends inordinate amounts of time selecting supervisors and champions. MSOC should believe that the success of the implementation is dependent on the champions and their ability to manage the teams. While technical skills of champions are required, their human skills are more important for this role. They come with varying levels of experience (5–25 years), professional qualifications. Following many days of deliberations, MSOC selects 10 champions or supervisors to manage 30 teams (average three teams per champion). After establishing communication protocol with MSOC, the champions or supervisors are responsible for implementing Six Sigma programmes with the teams. Third, teams are formed to become completely familiar with the department and its operations. Each team is responsible for obtaining the latest department functional flow drawings, the department's scope or boundaries (where it begins and where it ends), and information flow throughout the department. These teams would work through the process and observe information flow and the use of various sub-systems and tools. Fourth, once a ''good'' understanding of a department and its operations are developed, we need to verbalize the possible problem statement. Typically, the first time a problem statement is written there is no clear agreement among the team members. Fifth, a room is secured for meeting, invitations are sent to management to attend the event, and suggestion boxes are set up near the department. A room is secured close to the target department in order that engineers and associates meet frequently and openly discuss ways for improvement of the process. Sixth, as we know people learn differently (some learn better with text and others learn better with visuals), the training is delivered by MSOC in an interactive manner using presentation of slides with audio and video enhancements.

MSOC is aware that in the past, many improvement initiatives had failed, not because the programmes were flawed, but because the company did not identify improvement champions and failed to communicate with the shop floor employees. In other words, there was no general agreement on what to do, which program to use, no adequate training, no communication of what was to be done, no development of trust between workers and managers, and no visual support of top management. The MSOC resolved these critical problems to prepare the company for the changes. For example, MSOC knew that the workers did not trust the management's commitment and were not interested in participating and giving their honest responses (or suggestions) to improve the process. Over four/five weeks, MSOC holds a series of formal and informal meetings with workers from different departments. During the last week of the meetings, MSOC provides a week-long training session on process excel- lence through Six Sigma. By the time they must have completed their training programme, MSOC and workers meet several times. Upper managers are involved at every stage and exhibit visual commitment to the effort. Managers answer associate's questions openly and honestly and solicit suggestions to improve the process. After several weeks, MSOC and the workers freely exchange ideas and work with greater cohesiveness.

d) Implement, document, and revise

While implementing, MSOC must have encountered major findings that put impact on the implementation of Six Sigma and its DMAIC methodology. First, when the problem is easy and clearly identified, DMAIC proceeds in a sequential and rational manner—beginning with phase one and ending with phase four. Although the amount of time spent in each stage varies, MSOC experiences the succession from one stage to another smoothly. After each iteration of DMAIC, MSOC documented the process, interacted to reflect on why the solution works and tries to identify other areas where the solution might apply.

On reflection, the researcher believes that when the problem is clearly identified, MSOC and the departments feel that everyone behaves in a predictable and rational manner and the company's resources (money and personnel) are not wasted.

Second, when a problem is difficult and not clearly identified early in the process, DMAIC proceeds in a cyclic and reflective manner. In other words, the problem definition (Define Stage) may not be complete until Analyze Stage. This process appears counterintuitive and irrational to participants and observers in the process. To stabilize the process, we recommend initially delaying deliberation on problems which are not fully identified, in favour of addressing those for which the problem is easier to recognize. During the daily review sessions, a revision is proposed to the DMAIC training program. First four steps are: Strategic Analysis; Form High-Level Cross-Functional Team; Establish Improvement Tools; and Perform high-Level Process Mapping and Prioritization of Improvement Opportunities. These steps are considered strategic decisions, implying a top down approach, where management is primarily involved in decision making. Last two steps are: Detailed Plan and Form Low-Level Improvement Teams; and Implementation, Documentation, and Revision. These steps are considered tactical decisions implying bottom up approach where engineers or technicians are primarily involved in decision making.

IV. CONCLUSION

There are several important points worth discussing about the implementation model. We have to perform Strategic Analysis, which needs to be market/customer driven. Using a successful Six Sigma program in an industry we have to implement model which consists of six steps. The second step is to establish a high-level, cross-functional team to drive the improvement initiative. The third step is to identify the overall improvement tools. The fourth step is to perform high-level process mapping and to prioritize improvement opportunities. These four steps are considered strategic decisions implying a top down approach where management is primarily involved in decision making. The fifth and sixth steps are to develop a detailed plan and form low-level improvement teams and to implement, document, and revise as needed. These steps are considered tactical decisions, implying a bottom up approach where engineers or technicians are primarily involved in decision making.

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