Status of Six Sigma and Other Quality Initiatives in Foundries Across the Globe: A Critical Examination

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ABSTRACT

Foundries are actively involved to reduce the scrap rejection and rework during the manufacturing process of the components and improving their sigma level. In 2014, global casting production in foundries are increased to more than 105 million metric tons, an increase of 2.3%, according to this year’s MODERN CASTING Census of World Casting Production. This all papers discuss various tools and techniques used in various phases of DMAIC like ANOVA, process map, the cause effect matrix diagram, statistical methods, SQC, design of experiments (DoE) and Taguchi methods Fuzzy Analytic Hierarchy Process (FAHP) Total Productive Maintenance (TPM) which used by various foundries of world to enhance their manufacturing performance. Defect reduction is therefore chosen as the Critical-to-Quality (CTQ) factor, for world class quality in foundry products. Analysis is carried out using various software like Minitab, SPSS, and SPC for Excel etc. Study shows Six Sigma is a well-structured methodology to achieve expected goal which is need of the day in globally competitive era.

KEYWORDS

DMAIC, Foundries, Foundry Casting, Quality, Six Sigma

1. INTRODUCTION

Modernization, globalization, and quick access to information in era of information technology, products and services have changed the way of our customers’ needs and mode of conduct of business. Old business models no longer work. Today’s competitive environment leaves no scope for error & defects. We must enhance customers’ satisfaction and persistently look for new methods to exceed their fast varying demands. To compete in such an environment, companies need to accept an efficient technique that can assess and take a diagnostic approach to meet customer needs and for more delight to customer.

For total operational excellence to satisfy customer changing need is one of the most significant key requirements of any business in today’s globally competitive environment with sustained growth of business. All foundry industries are not the exception to this. For global competitiveness, Indian industries are trying many improvement measures like SQC, Quality Circle, TQM, Lean TPM, Manufacturing, etc. Most of the measures being tried by them are efficient of producing the desired results but worry remain with their implementation and longer time span to realize the benefits (Desai et al., 2011).
In today's globally competitive market, industries are trying many improvement strategies such as Toyota Production System, Single Minute Exchange of Dies (SMED), Poka-yoke, Lean manufacturing, etc. In spite of capable of producing required results, these techniques lack in their implementation and result after long time. In this globalization, each industry needs a new breakthrough strategy and that is well provided by Six Sigma (Desai, 2008).

The requirement is for a breakthrough strategy, which can have multidirectional benefits in shorter duration and that is need of the day and that comes through overall operational distinction. Six Sigma is proven breakthrough strategy, for increasing productivity and quality in Indian and global foundries.

Six Sigma is a business-driven, multi-faceted approach for reducing the defects and improving the process capability (Kumar and Khanduja, 2013) Improvement program for reducing variation, which emphasizes on continuous and breakthrough improvements (Anderson et al., 2006).

Six Sigma is business performance improvement strategy that aims to reduce the number of mistakes/defects – to as low as 3.4 occasions per million opportunities (Antony, 2002).

Six Sigma is quality improvement program with a goal of reducing the number of defects to as low as 3.4 parts per million opportunities or 0.0003 percent (Chakrabarty and Tan, 2007).

A business strategy used to improve business profitability, to improve the effectiveness and efficiency of all operations to meet or exceed customer needs and expectations (Kwak and Anbari, 2006).

From a statistical viewpoint, six sigma is a metric of process measurement represented by the Greek letter $\sigma$ that represents the amount of variation with a normal data distribution. Fundamentally, Six Sigma quality level relates to 3.4 defects per million opportunities (DPMO). The effort of Six Sigma is not on counting the defects in processes, but counting the number of opportunities within a process that could result in defects so that causes of quality problems can be reduced before they are converted into defects (Antony, 2006).

Six sigma stream line process, improves process flows, reduces total defects, improves communication, reduces process cycle times, improves knowledge, higher altitudes of customer and employee satisfaction, increases productivity, decreases work-in-progress (WIP), decreases inventory, improves capacity and output, increases quality and reliability, decreases unit costs, increases price flexibility, better designs, decreases time to marketplace, faster delivery time and increases ability to convert improvements, innovations and inventions into hard money (Coronado and Antony, 2002).

In short, six sigma is a best approach for an enterprise to become more effective and efficient for quality improvements (Banuelos et al., 2005).

2. CONCEPT OF SIX SIGMA

Six Sigma is a quality improvement program that aims to reduce the number of defects to as low as 3.4 parts per million. It uses the normal distribution and strong association between product nonconformities, or defects, and product yield, reliability, cycle time, inventory, schedule, etc. (Tadikamala, 1994) Six Sigma highlights an intelligent combination of the wisdom of an organization with proven statistical tools to improve both the efficiency and effectiveness of the business when it comes to meeting customer needs. The ultimate goal is creation of economic wealth for the customer and provider equally. This does, not indicate that six sigma substitutes existing and ongoing quality initiatives in an organization, rather that senior management focuses on those processes recognized as critical-to-quality (CTQ) in the eyes of customers. All critical systems are then the subject of intense scrutiny and improvement efforts, using the most powerful soft and hard skills in the organization. (Smith, 1993).

A term sigma quality level is used as an indicator of a process goodness. Lower Sigma quality level means greater possibility of defective products, while, higher Sigma quality level means smaller possibility of defective products within process (Smith, 1993; Breyfogle et al., 2001).
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