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Measurement System Analysis and System Thinking in Six Sigma:
How They Relate and How to Use Them

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ABSTRACT

This article investigated measurement system analysis and system thinking in Six Sigma, as well as the factors that influence these actions. If the measurement system being used to accumulate data from the process delivers dependable and accurate results, the measurement system analysis regulates it. Process improvement initiatives can be derailed by faulty measurement systems. Also, managers who have read faulty data can be misled into making wrong decisions. To collect trustworthy data, a reliable measurement system is established with this process. A method to assess an organization as a system and interpret its practices as a whole with Six Sigma is system thinking. Also, fixing a system as a whole helps to identify the real causes of issues and to know where to address them. This article addressed the contribution of these two methods to an overall success of an organization operating Six Sigma. The most current variables, concepts, and models were studied within operations and project management. By using a design-science-investigate strategy, this study approved of a valuable growth reveal for reasonable and hypothetical application. This study allowed us to generate a fitting assessment model that will fill the research void. Also, this study contributed to the engineering field with improved project success rates and team communication.

KEYWORDS

Improvement Initiatives, Measurement System Analysis, Six Sigma, System Thinking

INTRODUCTION

Since data is the driving force in today's society, it impacts everything in daily living. Data is used by organizations in millions of ways, such as collecting data in massive loads to measure and inspect. Since organizations base their decisions on measurements, they are important. Also, in any establishment, measurement systems are important. The quantification of specific characteristics is enabled by this system that relates measures. To validate a particular unit of measure, gages, software, and personnel are required. Measurement method, measurement process, measurement instruments, and reference standards are included in the system. Decisions regarding the services provided by an organization are based on measurement values. With unreliable measurements, mistakes and bad decisions are made. More accurate measurements mean fewer errors that will occur in future processes. To assure accurate data, processes have to be suitable to their application (Little, 2001; Galli, 2018c; Milner, 2016; Detert, 2000; Zelinka & Amadei, 2019).

However, measurement systems are from perfect, and there can never be a system completely free of error. There can be small errors that will be mostly insignificant and big errors that can be

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useless because they are unreliable. Process, such as a test method, personnel including operators and their skill level, equipment's gages and their calibrated system, items measured their sample plan, and environmental factors, such as temperature and humidity are different sources of variation.

A method of determining the amount variation that exists within a measurement process is measurement system analysis. The overall process variability is directly contributed by measurement process. The system's accuracy, precision, and stability are evaluated by the method that certifies the system based on its findings. Components of measurement system variation are outlined in Figure 1.

A methodology that helps to improve an organization's processes by using statistical analysis is Six Sigma by translating operational problems into statistical problems. To solve these problems and to transform the results into practical actions, statistical tools are used (Pourdehnad & Robinson, 2001; Andersen, 2014; Galli, 2018b; Loyd, 2016; Nikabadi & Hakaki, 2018). With a data-driven and greatly methodical approach, defects are eliminated. This method can be used on any organization process in any field. Also, to determine what can be defined as a Six Sigma defect, client specifications are used. Diminishing the inconsistencies in an organization processes is the target. To achieve true Six Sigma, 34 million opportunities is the maximum to be kept by organizational processes. Six Sigma is a business strategy that seeks to identify and eliminate causes of errors or defects-defined as anything that could lead to customer dissatisfaction (Azar, 2012; Antony, 2004; Al-Kadeem et al., 2017a; Galli, 2018a; Nabavi & Balochian, 2018). A very important reason why establishment of Six Sigma is significant is reducing defects.

To identify problem areas and recurring issues that affect quality expectation, employees use certain techniques. With proper training of Six Sigma, employees have the skills to identify problems that affect production or performance. In turn, this helps to identify areas for improvement and can be worked on continuously. With Six Sigma, the variations and waste that appear after improvement ideas can also be eliminated.

When the goal is to resolve a problem immediately, Six Sigma is best. Since its focus is closing in on problems in a project environment, there is no perspective of the bigger picture. Root causes are not the main focus, so the problems remain. Because of this, organizations and stakeholders are not fully satisfied because expectations of long-term solutions are not met. In order for Six Sigma to become fully satisfying, it must incorporate system analysis to get a broader perspective and develop long-term solutions.

With competition in the world continually increasing, organizations have been forced to adapt. Focusing on quality improvement and anticipating customer expectations is necessary. Furthermore,

Figure 1. Components of measurement systems