

# Chapter 21

## The Six Sigma Strategy: Tools and Techniques

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### ABSTRACT

*This chapter studies Critical Success Tools and Techniques (T&Ts) of Six Sigma (SS) strategy reported by researchers and practitioners. The main objectives of this research are to describe the current situation of SS and collaborate in the understanding of its successful implementation. This study was carried out through an extended literature review. Moreover, two periods of time were analyzed in order to emphasize on the evolution of SS. Such analysis relied on odds-ratio and hypothesis testing for proportions to study the most important T&Ts reported in almost two hundred of successful works related to SS projects. Afterwards, such T&Ts were identified and described. From this perspective, this chapter can be a useful guideline for training in companies, since it highlights the T&Ts most frequently used in successful projects, which have managed to improve the processes, reduce costs, and increase customer satisfaction in companies.*

### INTRODUCTION

Improving quality has become an important business strategy for many organizations including manufacturers, distributors, transportation companies, financial services organizations, health care providers, and governmental agencies. Quality is a competitive tool that can result in considerable advantage to organizations that effectively employ its basics principles (Montgomery & Woodall, 2008). Thus, since high quality levels and reduced cost are competitive advantages for companies, they become important factors in the long-term success of such firms. On the field of process improvement, one internationally accepted methodology is SS, which has been adopted by several companies to reduce variation of their

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processes and products and like Kwak and Anbari (2006) mentioned, SS is a project-driven management approach to improve the products, services, and processes of companies by continually reducing defects in the organization.

Pioneers in SS application, are companies like Motorola and General Electric (GE), which reached financial gain and recognition of the quality of their products, surprisingly in the decade of the 80's and early 90's respectively. Following this, many other worldwide companies have implemented SS, some with great success, others with medium and sometimes without obtaining expected outcomes or even to failure, which results in dissatisfaction, distrust and disappointment among investors and workers toward the methodology.

SS is a business process that allows companies to drastically improve their bottom line by designing and monitoring everyday business activities in ways that minimize waste and resources while increasing customer satisfaction (Harry & Schroeder 1999). Similarly, Montgomery and Woodall (2008) defined SS as a disciplined, project-oriented, statistically based approach to reduce variability, remove defects, and eliminate waste from products, processes, and transactions. Also, Pavel and Sarbu (2014) stated that while many other control methods have come and gone, SS remains as the most popular method currently in use. Finally Goh (2010) also pointed out that SS as a quality improvement framework has enjoyed an unprecedented long period of popularity.

The goal of SS is to increase profits by eliminating variability, defects and waste that undermine customer loyalty. Then, SS is a rigorous and systematic methodology that utilizes information and statistical analysis to measure and reduce variation, improving an organization's operational performance, by identifying and preventing root causes of defects in manufacturing and service-related processes in order to exceed expectations of all stakeholders to accomplish effectiveness. Lately, works on SS have become particularly common in a great variety of sectors such as higher education institutions; see for example, Pavel and Sarbu (2014), Zhao (2011), and Isa and Usmen (2015).

Since SS has become a salient improvement strategy several works have been written addressing it. Most of them mention successful SS projects; however, Goh (2010) addresses the methodology differently. He describes six triumphs and six tragedies of SS listed in Table 1.

SS began officially at Motorola on January 15, 1987, when the CEO Bob Galvin launched a long-term quality program named *The Six Sigma Quality Program*, which was an aggressive corporate strategy to improve company performance through quality. However, was Bill Smith, a veteran engineer at Motorola and Mikel Harry a Ph.D. from Arizona State University, which developed a four stage problem solving approach: Measure, Analysis, Improve, and Control (MAIC). After implementing SS, in 1988, Motorola was among the first recipients of the Malcom Baldrige national quality award; then, companies like Al-

*Table 1. Triumphs and tragedies of Six Sigma*

Triumphs	Tragedies
<ol style="list-style-type: none"> <li>1. Use of a common, realistic metric for quality assessment and improvement</li> <li>2. Clear assignment of roles and responsibilities in performance improvement efforts</li> <li>3. Logical alignment of statistical tools</li> <li>4. Recognition of the time effects on processes</li> <li>5. Unprecedented synergy with modern information</li> <li>6. Capabilities to grow for larger roles for business competitiveness</li> </ol>	<ol style="list-style-type: none"> <li>1. The belief that SS (as typical black belts know it) is universally applicable</li> <li>2. Obsession with personal attainments</li> <li>3. The idea that professional statisticians are no longer needed</li> <li>4. Irresponsible hype of SS</li> <li>5. A bigoted "in data we trust" mentality</li> <li>6. Ignorance or neglect of what is important beyond DMAIC</li> </ol>

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