

Chapter 25

Lean and Six Sigma Innovation and Design

Rick Edgeman
Utah State University, USA

ABSTRACT

Enterprises are always seeking best and next-best practices and sources of competitive advantage. Two consistently successful means of delivering these have been Lean Enterprise Methods that are often associated with the Toyota Production System, and Six Sigma approaches to product, process, service, and system innovation and design that have contributed significantly to, especially, enterprise financial performance. The integration of these approaches, commonly referred to as Lean Six Sigma, is highlighted in this chapter with some emphasis dedicated to the use of Lean, Six Sigma, and Lean Six Sigma to enhance not only enterprise financial performance but also social and environmental performance and impacts.

INTRODUCTION

Six Sigma Innovation and Design theory, strategy and supporting methods have evolved along two primary pathways – one focused on significant innovation of existing products, services, processes or systems, and a second focused on design of new products, services, products or systems. A third, more recently emerged path is referred to as LSS or *Lean Six Sigma* (Pepper & Spedding, 2010). LSS integrates and leverages the sizeable commonalities, synergies and strengths of Six Sigma and Lean Enterprise theory and methods while ameliorating their weaknesses and distinctions. In particular, LSS wedges key lean methodologies and perspectives such as value stream mapping, kaizen (continuous improvement), and waste identification and minimization together with equally key Six Sigma concepts and tools such as its focused approaches to innovation and design – DMAIC and DMADV.

Six Sigma in the late 1970s at Motorola Corporation, but it is GE with which Six Sigma is most familiarly associated. Its use has proliferated due in large to its acknowledged contribution of multiple billions of dollars to the economic performance of many enterprises. Six Sigma delivers either desirable and reliable new designs or significant improvements in existing products, processes, systems of key

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importance to customers or – more generally – to relevant enterprise stakeholders. This is accomplished by identifying and subsequently exacting change in key measurable and internally controllable levers of change that drive outputs highly relevant to those stakeholders. Such outputs are referred to as critical-to-quality (CTQ) characteristics and directly reflect preferences of customers of the product, process or systems that is being addressed. It is because we cannot directly control these CTQs that we must instead identify and control levers of change. Doing so begins with a clear and elaborated definition and understanding of customer and other relevant stakeholder needs, desires, and expectations – the so-called voice of the customer (VOC).

Lean Enterprise theory and approaches are often associated with Toyota Corporation and the familiar *Toyota Production System* (TPS) credited to late Toyota executive Taiichi Ohno and his mentor, Shigeo Shingo (Schmenner, 2015). Lean Enterprise methods are also associated with Kaizen (continuous improvement) philosophy and methods popularized by Masaki Imai (Antony, 2015). The arc of Lean Enterprise projects and enterprises is one typically aimed at waste reduction leading to improved efficiency, increased reliability, enhanced design, and better resource utilization so that such projects tend to be internally-focused, with derivative value for the customer.

Both Six Sigma and Lean Enterprise emphasize near relentless pursuit of perfection. Lean Enterprise methods do so via continuous incremental improvement cycles with an eye toward all enterprise processes and activities. In contrast, Six Sigma projects are typically discrete in nature and target breakthrough improvement in strategically important processes, products or systems. As such, the union of Lean Enterprise with Six Sigma is both internally and customer focused, taking simultaneous aim at both cost savings and value creation.

Six Sigma Innovation, Design for Six Sigma, Lean Enterprise and – more specifically – their integration that resulting in Lean Six Sigma are discussed. Although each of these has been historically emphasized financial objectives, in principle they be used to singly or jointly address any number of objectives, including financial, social, or ecological performance, or anything contributing to organizational resilience and robustness (Edgeman, 2013). Also discussed are distinctions between the COPIS approach to business process conception prior to process implementation and execution via SIPOC (Edgeman, 2011a); commonly used supporting tools and techniques such as the Kano Needs Model and Quality Function Deployment or QFD (Tan & Shen, 2010); and concept generation and selection (Girotra, Terwiesch and Ulrich, 2010).

BACKGROUND

Of many competing Six Sigma and Lean Six Sigma definitions, the following, adapted from Klefsjö, Bergquist and Edgeman (2006), is herein employed:

Lean Six Sigma provides highly structured innovation, design, and lean enterprise strategies and methods for acquiring, assessing, and activating customer, competitor, and enterprise intelligence in order to deliver superior product, process, system, or enterprise performance that benefits all relevant stakeholders through best and next best practices and sources of sustainable competitive advantage.

Six Sigma is not unique in this quest for exceptional performance and competitive advantage. Rather, it is the combination of Six Sigma's strategic focus, structured approaches, breakthrough performance

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