

## Chapter 19

# Using Lean–Sigma for the Integration of Two Products during a Ramp–Up Event

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### ABSTRACT

*Keeping up the quality level in a manufacturing environment has become an issue when trying to start the production of a new product which is in a ramp-up stage into a running production line ramp-down model. If production of the old model is ended too fast will make shortages in the customer supply, and will have excessive inventory numbers of the newer product. Trying the re-design in a production line to keep building the old model while incorporating the newer tends to create an undesirable impact on quality and productivity. Nowadays, continuous improvement methodologies like Lean and Six Sigma are used to solve this challenge. While Lean Manufacturing tends to be efficient for quick fixes, Six Sigma works better when there is plenty of time to conduct deeper statistical analysis. This chapter describes a combination of Lean Manufacturing speed with the Six Sigma analysis' power. Combined to maintain the quality and productivity of a production process during such conditions.*

### INTRODUCTION

It is increasingly evident that the era of mass production is being replaced by the era of market niches. Such changes and challenges were addressed by the EU “Manufuture strategy” underlines this vision in the proposal for the 7th framework ([www.manufuture.org](http://www.manufuture.org)), which states that the next generation factories will be described as adaptive, transformable, high performing and intelligent (El Maraghy & Wiendahl,

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2009). Actual markets are making the selling window to shrink to a less than a year for industries such as the telecommunications and high tech. Therefore the product lifecycle not only has been shrunk but, as result of the dynamics of markets, a mutation of the product life cycle is now faced, and is accompanied with an increasing divergence to the life cycles of the associated processes and equipment. Observing the lifecycle, today a product volume climbs much faster to a first peak, then go down to retake volume sales to reach a second peak (this after promotion activities) and finally a sudden reduction of the produced volume, which occurs mainly because the announcement of a new product intelligent (El Maraghy & Wiendahl, 2009). Such changes and behavior are opposite to the traditional product lifecycle behavior, where a steady volume increases after the release of the product, a long and stable phase follows and to conclude with a final ramp-down. Under these conditions and for meet their financial goals, business and organizations have to deal with external and internal forces and put pressure to overlap the ramp down and ramp-up products; and to cut not only the new product's development time (time-to-market), but to adjust the production system to shorten the time for reach a full production volume (time-to-volume) (Terwiesch et al, 2001). According to Terwiesch et al (2001) the ramp-up stage is characterized by a stress from two contradictory factors: low production capacity, and high demand. In general, the poor capacity and low production rates can be attributed to process variables such as machines break down, time consuming setups, product reworking, among others, caused by a poor understanding of the production process and the slow learning process. In other hand, high demands are present mostly because the product is fresh to the market, an innovative product or the first of its type and the customers are forward to pay for the newness.

## **Ramp-Up Period**

Terwiesch et al (2001) have defined ramp-up as the period between the end of product development and full capacity production. In other words is the process of bringing a production system up to its required operational characteristics after it has been designed and build and before it is taken into full operation (Doltsinis et al, 2013). The focus during the ramp-up is on achieving a specific production volume and to maximize the potential profit and is measured in terms of production volume over time and the desired product quality objectives. Nevertheless, the ramp-up process is not well understood and is faced by trial and error rather than an overall systematic strategy, resulting in delays and costly repetitions achieving less than optimal decisions (Kersten et al 2007). Literature shows that in practice the current approaches for ramp-up time reduction there is the need to understand the production system's behavior, for then support a decision making that delivers an efficient shortening time in the system. (Fjällström et al, 2009; Haller & Thoma, 2003; Terwiesch et al, 2001) Industrial sectors as the high tech (Salah et al, 2010) and the automotive faces this problematic yearly or even sooner (von Cube & Schmitt, 2014). For example, for the Automotive manufacturers it is critical to master ramp-up projects in less time and with less money while manufacturing more complex products in more complex processes and still assure on-time start of production. As product life cycle decreases at the same time the amount of sold cars per month, then considering a production of 25.000 cars per month and return on sales of 7%, the risks in delaying as well as reducing product life cycle by one month imply a loss or turnover of 44€ million in the European market (von Cube and Schmitt, 2014). However, according to Basse et al (2014). A broad range of scientists characterizes the ramp-up as one of the most complex processes in a manufacturing company, arising from the interdisciplinarity of the decision makers and their sub-optimal and partially contradictory targets and the interdependencies between the various elements which describe and shape

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