

## Chapter 10

# A Practical Approach to Manufacturing Execution Systems at Bosch AvP: Scope, Structure, and Implementation

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### ABSTRACT

*With Industry 4.0 related initiatives, a brand new array of opportunities has emerged for organizations to face the ordeals that come with managing ever-growing manufacturing needs. The exponential increase in the complexity of supply chain management has put a real strain on manufacturing operations. In order to succeed, organizations must turn to solutions such as manufacturing execution systems (MES) in order to stay competitive. In this research chapter, we discuss the impact of MES in organizations, whilst describing the process for going from a theoretical concept to a hands-on system which runs the shop floor operations.*

## **ORGANIZATION BACKGROUND**

Bosch Termotecnologia SA (referred to as AvP) is located in Aveiro, Portugal and is the leading competence center for water heating development in the Bosch Group. Part of its Thermotechnology division, it is also one of the most important manufacturers of gas water heaters, wall-hang boilers and heat pumps.

In Portugal, the Bosch Group owns three different plants which belong to different Business Units with a combined sales revenue of 1.1 Million Euros in 2016. The Bosch Group has a very firm belief on Research & Development (R&D). That is reflected in the investment in R&D for Bosch Portugal: 100 Million Euros in 2016 (Bosch, 2017).

Bosch is known as being a very strong advocate for Industry 4.0. In fact, the Bosch Group has become a leading example by showcasing the usefulness of Industry 4.0 technologies (GTAI, 2016). Actually, the Bosch Group has quite an interesting role: on one hand, it uses Industry 4.0 technology as a basis for managing its manufacturing needs, and, on the other hand, it also provides commercial solutions in this area through Bosch Rexroth and Bosch Software Innovations, just to name a couple of examples. Manufacturing Execution Systems (MES) constitute the backbone for most Industry 4.0 innovations, as we will see in the upcoming sections.

## **SETTING THE STAGE**

Manufacturing today is very different from what it once was. Henry Ford once said that people could have their cars in any color of their choosing, as long as that color was black (Ford, H., & Crowther, S., 1922). – a quote which perfectly resumes the mindset of the 1920s. Then, Henry Ford was a pioneer of industrial management, having successfully implemented the assembly line concept, with a somewhat paradoxical aversion to change. After years of Model T production, he would eventually come around and release the Model A. However, his inertia would cost him the position of leading player of the industry: Ford would then be outrun by Chevrolet and Plymouth (Geldermann, 2017).

This small lesson from history only comes to show that there is only one thing that matters, when it comes to manufacturing: being competitive, i.e., staying ahead of competition – this was exactly what Henry Ford failed to do when it came to the Model A.

However, this is easier said than done, as managing a company is a tremendous challenge. For instance, one of the main problems which organizations struggle with is handling the complexity of their infrastructure. Henry Ford was well aware of this, since he knew that producing two car models would significantly increase the complexity of his organization. In fact, he was so concerned with this that he ended up owning the ore mines, railways and boats that supplied the Ford plant (Geldermann, 2017), all this aiming at keeping the supply chain under control without having to rely on external suppliers.

The ordeals that Henry Ford was facing in the first half of the 20th century to stay competitive are still valid today. Unfortunately, the magnitude of the challenge has increased exponentially: not only do we have to manufacture thousands of different references, but also having to keep track of ever more complex supply chains, in order to comply with the industry's norms and with the customer's demands, safety and satisfaction.

The need to handle this increase of complexity in the industrial scope was one of the main driving forces that led to the development and implementation of Industrial Information Systems such as MES: globalization and the general increase of competitiveness have made productivity (both monitoring and

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