Chapter 6
Lean Manufacturing and Industry 4.0/5.0:
Applied Research in the Portuguese Cork Industry

Joao P. C. Fernandes Thomaz
https://orcid.org/0000-0002-8007-8558
Institute of Management and Administration of Santarém, Portugal

Helena I. N. Bispo
Institute of Management and Administration of Santarém, Portugal

ABSTRACT

Over the years, organizations have had to adapt to constant changes in their surroundings. To this end, they began to adopt methodologies such as lean manufacturing and Industry 4.0. Their implementation has increased the competitiveness of organizations. Sustainability is getting much attention, leading to the advent of Industry 5.0, which, unlike Industry 4.0, takes sustainable production into account. Forestry sectors are significant for the Portuguese economy, especially cork. This study examines a company in the cork sector to determine how automation and monetization of new resources could increase efficiency, quality, and safety. A qualitative approach was applied in the study through literature review and participant observation actions to analyze and propose improvements. The study fulfilled the purposes defined, identifying options to improve the production process and increase customer satisfaction and worker safety.

INTRODUCTION

The current market is constantly evolving, open to universal competition, and recognized for new technologies and knowledge. Given this fact, administrators are encouraged to optimize all processes in their company, eliminating or reducing waste (Jastia & Kodali, 2015). Several philosophies have emerged

DOI: 10.4018/978-1-7998-9715-6.ch006

to accomplish this, including lean manufacturing (LM) or operational optimization, based on Toyota's success; Industry 4.0 (I 4.0), from the internet of things (IoT); big data, 3D printing; cloud computing; artificial intelligence (AI); and cyber-physical systems (Liker, 2004).

Actually, the fifth industrial revolution (I 5.0) is characterized by human-robot cooperation in everyday life and bioeconomy. I 5.0 will increase productivity and operability, reduce workplace accidents, and shorten production processes in a sustainable and environmentally friendly way. It will create jobs, most of them in programming, artificial intelligence, maintenance, training, reuse, and the design of new robots (Demir, Döven, & Sezen, 2019; Nahavandi, 2019).

The present study highlights the interaction between LM and I 4.0/5.0 through a case study in a company in the agroforestry sector, specifically in an industrial cork unit (ICorkU). The forestry and agroforestry sectors are very significant for the Portuguese economy, in which cork exploitation plays a fundamental role. Portugal is the world's largest cork producer and exporter. The Portuguese cork industry is an example of profitable production, with the advantage that the raw material comes from a traditional, environmentally sustainable cultivation system that is well-adapted to the local climate conditions, exemplifying a circular economy (APCOR, 2020).

BACKGROUND

Lean Manufacturing (LM)

According to Drew, McCallum, and Roggenhofer (2004, p.15), lean manufacturing is

a combination of principles, practices, tools, and techniques designed to address the causes of poor operational performance. It is a systematic approach to eliminating losses along a company's value chain to bring current performance closer to customer needs.

The LM production was featured in the book "The machine that changed the world" by Womack et. al. (1990), where they contrasted the difference between the Toyota Production System (TPS) and other automotive companies and concluded that this system made Toyota the most competent organization worldwide in its sector. Figure 1 represents a simplified Toyota Production System (TPS) where there is independence between the concepts, components, people, and practices that apply to the industry and commerce and services.