

# Preface

The Lean Thinking is defined as the way to specify value, line up value creating actions in the best sequence, conduct these activities without interruption whenever someone requests them, and perform them more and more effectively. The five principles of Lean Thinking—define “value” from the customer’s perspective, identify the “value stream,” create a continuous flow, “pull” production, and seek perfection—were introduced to address the various challenges that occur within and between business units from the differences in business culture and management thought processes. Evidence of Lean Thinking implementation is found in various areas, such as services, healthcare and different industries, e.g., the automotive industry, aerospace industry, power plants, textile industry, food industry, oil and gas industry among others. Such evidence points to a number of universality and the use of the Lean Thinking tools in different contexts increasing its importance as an approach to continuous improvement.

## OBJECTIVE

The objective of the book is to give an insight into Lean Thinking as a philosophy that allows readers identifying problems/wastes in various areas, analyze them and identify activities that allow you to improve processes in many areas. As Lean Thinking is a philosophy that applies to many areas, the book will have an impact on research in the areas of Sustainable Development (environment sustainability and energy efficiency) resource management, production systems management, quality management, knowledge management, maintenance management, logistic management, healthcare, and decision support systems.

The benefits of Lean Thinking Implementation are divided in two fields. Firstly, by elimination of wastes and unnecessary resources utilization, decreasing delivery, lead and cycle times, decrease inventories, and increase the productivity. Secondly, by improving the workers satisfaction, good communication, and decision-making process. This approach has been used in many types of organizations, starting by

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being used in manufacturing companies - Lean Manufacturing, including Lean Maintenance - and later, among many others, such as in sustainable environment and energy efficient companies, as well as in healthcare organizations.

With new trends in resource management and respective energy efficiency achievement, Lean Thinking is a real added value for organizations working in this domain, mainly the ones related with energy efficiency management. Also, in the healthcare area, lean health care is a management philosophy to develop a hospital culture characterized by increased patient, and other stakeholder, satisfaction through continuous improvements, in which all employees (managers, doctors, nurses, laboratory people, technicians, office people etc.) actively participate in identifying and reducing non-added value activities (waste).

Finally, Lean concepts such as work standardization, organization and transparency are highlighted as support for implementation of solutions linked to Industry 4.0. At the same time, through the analysis of implementation cases in the industry, Lean processes' improvement capacity is highlighted from its integration with I4.0. Lean methods are seen as facilitators of I4.0, and where I4.0 is analyzed as a factor that strengthens Lean.

## **TARGET AUDIENCE**

Target users of the book are scientists working in Academia and engineers employed in companies who want to have an insight and more deep understanding of Lean Thinking and respective applications in the context of Industry 4.0, covering industry applications and services for the society, bringing added value for all the involved stakeholders.

## **THE CHALLENGES**

Topics and challenges covering *Lean Thinking in Industry 4.0 and Services for Society* are related to:

- Lean manufacturing
- Lean Thinking in healthcare
- Lean Maintenance
- Lean Six Sigma
- Lean Industry 4.0/Lean thinking in the digital era
- Lean thinking for knowledge work
- Lean thinking in support processes

- Lean thinking in services
- Methods and tools of Lean Thinking
- Industrial systems for lean implementation
- Lean improvement monitoring
- Lean Safety
- Lean Green
- Lean Sustainability

## **ORGANIZATION OF THE BOOK**

The book is organized into 11 chapters. A brief description of each of the chapters is described below:

Chapter 1 explores how Lean Manufacturing (LM) can leverage Industry 4.0 resources to achieve better industrial performance while achieving cleaner processes. The main goal of the paper is not only to clarify and extend the literature on the relationship between LM and Industry 4.0 but also to do so by simultaneously studying the impact on throughput and CO<sub>2</sub> emissions reduction. Moving away from the usual separate assessment, it is proposed a comprehensive analysis that allows evaluating how LM can establish the right conditions on the shop floor for the development of 4.0 technology-intensive environments and how these technologies can subsequently be leveraged to enhance the contribution of Lean practices to industrial performance and sustainability.

Chapter 2 reports how the lean management approach requires the direct support of both sustainability and industry 4.0 concepts in order to develop the respective principles and tools. On the other hand, UNDP's Sustainable Development Goals have a very important place when it is aimed to support sustainable industrialization, strengthen innovation, and ensure operational excellence. It is presented the way how to find answers to "How Industry 4.0 and Sustainable Development Goals can enhance Lean practices?" by performing content analysis in various databases in the existing literature.

Chapter 3 presents a study that aims to understand how the concept of Industry 4.0 has impacted the Portuguese business fabric, focusing on the purchasing area. The transformation in the processes led to discover new forms of digital technologies in the products processes to generate competitiveness in the market. New business models are a driving force for evolution and progress in the digital era. These models are based on the pillars of Industry 4.0, bringing sustainability to the industry, reducing waste, and forecasting more accurately the market.

Chapter 4 investigates the impact of applying Lean Thinking techniques to eliminate operations that do not bring business value in an organization. For this

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purpose, the authors decided to use the methodology of increasing the efficiency of business processes to identify the current process and indicate its optimization potential. The applied process optimization methods, focusing on the elimination of waste, are one of the main principles of Lean Thinking.

Chapter 5 throws light of new or different factors the disputable view which has presume that, at any point in future, the global automobile industry can reach a maturity level and would naturally resettle in the key developing countries where the auto market is expected to grow fast-paced and wages are significantly bottommost. The authors analysed that the gateway facing by a developing country is trying to create domestic automobile industry which have arisen due to recent developments: a wave faced due to technological and structural innovation; pressure caused by pandemic.

Chapter 6 presents a result of the work carried out in a company responsible for designing and projecting automated material handling and storage systems. The main goal is to present the developed solutions to reduce wastes in the internal logistics department.

Chapter 7 addresses a proposal for the reduction of the machine changeover time in practical terms, on the example of a forming machine in the production process of a trunk shelf, based on the use of the SMED method. The stages of development and the foundations of the Lean Management concept and description of the SMED methodology are presented. A forming machine was selected, in the manufacturing process of a trunk shelf, and respective identification and measurement of changeover times, in the real model, were performed.

Chapter 8 proposes the advantages of modelling an application destined for automotive using Automotive Standard Architecture (AUTOSAR). This standard is structured in layers making the software application independent from the microcontroller unit (MCU) specifications. By structuring an application in this way, it reduces the time and the cost of developing new ones for a different microcontroller or for creating new applications with a similar purpose for the same microcontroller. The main goal consists of presenting a primitive implementation for an electric automatic gearbox that can be developed, in a more detailed way, when new features are required.

Chapter 9 presents a general overview, focussing on exploring and identifying the best suit Industry 4.0 technologies which can enhance lean and green paradigms in industry through which a clear pathway can be created for smooth transfer of technology within a system. Also, discusses about enhancement of lean tools by application of Industry 4.0 technologies and have developed a relationship matrix between Industrial 4.0 technologies and lean practices.

Chapter 10 presents and analyses how healthcare practitioners are also keen to benefit from Lean being well aware of the potential contributions that lean operations would bring in their field. This work is devoted to provide a guideline for healthcare

practitioners to apply statistical quality control tools within a correspondence to four main components of lean thinking: problem detection, process redesign, process reliability & sustainability and continuous improvement. By this means, practitioners will be able to start their own journey in the world of lean healthcare systems through substantial statistical tools as well as systems thinking.

Chapter 11 highlights the benefits of using Lean Maintenance, showing and discussing obtained results from studying industrial companies and concluding about used tools and level of this concept implementation in their activity. For obtaining the base results for this work, surveys were used for research carried out in enterprises. Some questionnaires were sent to companies, in Poland, for being possible to acquire some data from their experience and results by using Lean Maintenance.

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