

PAPER REF: 7314

## **INTERACTION BETWEEN LEAN PHILOSOPHY AND INDUSTRY 4.0: EXPLORATORY STUDY**

**Beatrice Paiva Santos<sup>(\*)</sup>, Fernando Charrua-Santos, Tânia Miranda Lima**

C-MAST, University of Beira Interior, Covilhã, Portugal

<sup>(\*)</sup>*Email:* beatrice.santos@ubi.pt

### **ABSTRACT**

The evolution of information technologies and their introduction into production processes is transforming the industry bringing it to a new level of organizational development. Industry 4.0 or the fourth industrial revolution promises to have great impact not only on improving productivity but also on developing new products, services and business models. At the same time, the role of the Lean management philosophy in these new production scenarios will be questioned. Thus, this paper aims to intensify the discussion about how the combination of these two approaches can be the key to achieving the degree of flexibility necessary to overcome the current challenges of high variability, customization and reduction of product life cycles.

**Keywords:** lean, industry 4.0, technologies, CPS; IoT, cloud, big data.

### **INTRODUCTION**

Lean production systems have successfully challenged conventional mass-production practices, reducing non-value-added activities and delivering quality products focused on customer satisfaction. At the global level, industries have strived to become "Lean" organizations and reap the benefits associated with this philosophy. However, the constant changes in global markets and high competitiveness have led to the need to provide customized products to satisfy increasingly demanding customers. Although Lean allows achieving good results in the production of reduced batches, any adjustment in processes, cycle times or stocks increases the complexity of the processes, limiting the production to the manufacturing of products with shorter life cycles and unit batches. Thus, organizations have sought to find new management and production methodologies in order to achieve the necessary flexibility to survive in these new scenarios. The German government, as well as governments of other countries and influential organizations, believe that Industry 4.0 (Hermann, 2016) will play a relevant role in the formation and performance of these new industries. Discussed worldwide under various denominations, Industry 4.0 encompasses a set of state-of-the-art technologies linked to the Internet with the aim of making production systems more flexible and collaborative. In this approach, machines use self-optimization, self-configuration and even artificial intelligence to accomplish complex tasks in order to provide much higher cost efficiencies and better quality goods or services (Bahrin, *et al.*, 2016). Through the widespread implementation of sensors in the production environment, it will be possible to join the physical and virtual worlds, giving rise to Cyber Physical Systems (CPS). These systems connected through the Internet of Things (IoT) will interact with each other using standard Internet-based protocols and analyse data to predict faults and adapt to

changes (The Boston Consulting Group, 2015). These new industrial structures can be the key to achieving the high levels of productivity and quality desired by LP. Therefore, this work aims to explore the interaction between Lean Philosophy and Industry 4.0 and demonstrate how the implementation of both can be complementary.

## RESULTS AND CONCLUSIONS

The literature review has revealed that Industry 4.0, with its advanced integrated systems of information and communication connected online, provides organizations with significant capacity to achieve Lean objectives.

	RFID	CPS	IoT	Cloud	Big Data	Simulation	Augmented Reality	3D Printing	Horizontal/Vertical	Plug'n Produce
<i>Continuous Flow</i>	x	x	x	x	x				x	
<i>JIT</i>	x		x	x	x			x		
<i>Kanban</i>	x			x	x					
<i>Poka-Yoke</i>	x	x	x	x	x		x			
<i>Pull System</i>	x			x	x					
<i>SMED</i>	x	x	x	x	x		x			x
<i>Value Stream Mapping (VSM)</i>	x			x	x	x				

Fig. 1 - Interaction between LP tools and Industry 4.0 solutions

Figure 1 shows some crossings between Industry 4.0 solutions and LP tools to determine the importance this interaction for the future industries. Technologies such as CPS, IoT, Cloud and Big Data, for example, facilitate communication between "smart devices" offering wide possibilities for optimization and collaboration. In addition to these benefits, the combination of these two approaches brings financial benefits resulting from the reduction/elimination of redundant waste that makes up for the required investments.

## REFERENCES

- [1] Bahrin, M.; Othman, F.; Azli, N.; Talib, M. Industry 4.0: A review on industrial automation and robotic. *Journal Teknologi*, 2016, 78(6-13); pp.137-143.
- [2] Hermann, M., Pentek, T., Otto, B. Design principles for industrie 4.0 scenarios: a literature review. Washington, DC: IEEE Computer Society, 2016; pp. 3928-3937.
- [3] The Boston Consulting Group (BCG). Industry 4.0: the future of productivity and growth in manufacturing industries. Alemanha, 2015. Retrieved from: [https://www.bcgperspectives.com/content/articles/engineered\\_products\\_project\\_business\\_industry\\_40\\_future\\_productivity\\_growth\\_manufacturing\\_industries/#chapter1](https://www.bcgperspectives.com/content/articles/engineered_products_project_business_industry_40_future_productivity_growth_manufacturing_industries/#chapter1). Accessed on 03/10/2017.