



The 50th CIRP Conference on Manufacturing Systems

Industry 4.0 impacts on lean production systems

Tobias Wagner^{a*}, Christoph Herrmann^a, Sebastian Thiede^a

^a*Chair of Sustainable Manufacturing & Life Cycle Engineering, Institute of Machine Tools and Production Technology (IWF), Technische Universität Braunschweig, Langer Kamp 19b, 38106 Braunschweig*

* Tobias Wagner. Tel.: +49 5341 28-6731. E-mail address: t-a.wagner@tu-braunschweig.de

Abstract

The fourth industrial revolution and its Industry 4.0 or connected industry technologies dominates the current discussion of production research. Digital developments like cyber-physical Systems are the key technologies for future and more agile production systems but a common understanding of the term Industry 4.0 is not established at this time. First generic implementation approaches present manifold technical solutions but miss an integrated consideration with existing Lean Production Systems. The actual impact of Industry 4.0 solutions is mostly not clearly specified and a method to evaluate is missing.

This paper introduces the Industry 4.0 in an environment of connectability in the Internet of Things and Services with the vision of a smart factory. The initial situation of industrial companies is characterized by Lean Production Systems and Lean Principles. For companies, Industry 4.0 offers an estimated benefit by stabilizing Lean processes with Industry 4.0 applications. To support the development process the presented Concept of an Industry 4.0 impact matrix on lean production systems gives a useable framework. The matrix considers elements of lean production systems with Industry 4.0 technologies and gives a first estimation of impact. In the described development process of a cyber-physical Just-in-Time delivery the matrix is used to find a stabilizing application for a Just-in-Time material supply process.

© 2017 The Authors. Published by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Peer-review under responsibility of the scientific committee of The 50th CIRP Conference on Manufacturing Systems

Keywords: cyber physical production system; connected industry; Industry 4.0; cyber physical system, Lean Production, technology management

1. Industry 4.0 and existing lean production systems

According to the Gartner Hype Cycle for Emerging Technologies the key technology trends over the next ten years are immersive experiences, smart machines and platform revolutions [1]. Also within scientific research the quantity of publications on IT- and communication technology has raised rapidly. The term ‘Industry 4.0’ was formed in by the National Academy of Science and Engineering (acatech) and its working group founded on the Hanover exhibition in the year 2011 [2].

Meanwhile Industry 4.0 is an international accepted area of research in the field of Internet of Things (IoT). Based on the definition of the Cluster of European Research Projects on the Internet of Things (CERP-IoT) Industry 4.0 can be defined as the industrial vision to enable “people and things to be connected Anytime, Anyplace, with Anything and Anyone, ideally using Any path/network and Any service” [3].

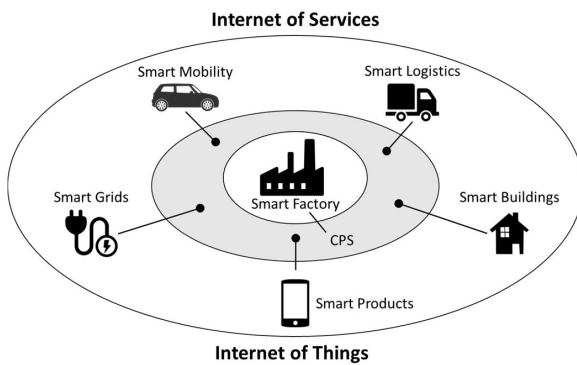


Fig. 1. Internet of Things and Services [2]

Smart factories are the central object of Industry 4.0. This concept figures out the usage of modern and further IT- and communication technologies to enable human beings, machines, products and resources to exchange information with each other. As shown in Figure 1 Industry 4.0 and its smart factories are part of a global Internet of Things and Services which is also the frame for visions with less industrial production relation like smart grids [2]. Following the vision of Industry 4.0 the industrial production will move from a physical process with IT support to an integrated cyber-physical system of production [2]. This cyber-physical systems combine the physical world with the cyber world by embedded computer controlled feedback loops [4]. From the technical perspective

this means a total integration and connection of data acquiring sensors and data based controlling actuators.

For a successful implementation of Industry 4.0 the initial situation of industrial companies should be considered in a socio-technical view. The recent decades of western industrial production were characterized by the wave of lean production and lean management [5]. From this perspective an implementation of Industry 4.0 means also an integration of new technologies into existing lean production systems and an adjustment of business processes.

Following this consideration this paper focused on industrial companies with widely integrated lean production systems. The concept behind lean production is to avoid waste of non-value adding activities but also to keep processes and equipment simple and easy to use as well as easy to maintain. The approach of implementing complex IT solutions to connect machines, human and processes creates an unsolved dilemma between lean production and Industry 4.0. Nevertheless this paper presents a conceptual framework to find lean production supporting Industry 4.0 technologies. As shown in an industrial use case Industry 4.0 can achieve potentials to increase transparency and stability of lean principle following processes.

2. Concept and principles of lean production systems

2.1. System elements of production systems

Production is defined as fabrication and assembly as well as all functions and activities directly contributing to the making of goods [6]. The term production system describes the complex interrelation of technical functions and human functions as well as technical components and human components as a socio-technical system [7]. This system oriented management approach is based on the systems theory and the theory of cybernetics [8]. The socio-technical system considers interdependent human, technical, social and organizational subsystems connected via open interactions with their environment [9].

2.2. Lean Production System

The Toyota Production System (TPS) and its synonym Lean Production was developed by Toyota Motor Corporation in the 1970s. The TPS integrates a set of methods and tools with the management philosophy to completely eliminate the seven forms of waste (Muda) and to produce profit through cost reduction [10]. The TPS defines everything that does not create value as waste including: overproduction, waiting for work,

Download English Version:

<https://daneshyari.com/en/article/5470135>

Download Persian Version:

<https://daneshyari.com/article/5470135>

[Daneshyari.com](https://daneshyari.com)