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# Investigating current smart production innovations in the machine building industry on sustainability aspects

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## Abstract

Driven by the rising demand for individualized high-tech products the machine building industry continuously introduces a wide variety of smart innovations. Manufacturing companies face growing production requirements which can only be only handled by intelligent systems. During the last decades the trend in manufacturing has shifted from the classic mass production to complex individualized products which have to be produced to compete with the costs of mass products. Smart Production Systems are characterized by its flexibility, resource efficiency, ergonomic design and the ability to integrate customer and business partner into the value creation process. This research study investigates current smart production innovations and trends in the machine building industry. The sustainability aspects and the potential of various smart innovations are outlined.

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## 1. Introduction

Networking of all kinds of equipment and machinery on the basis of cyber-physical systems are on the rise. In the field of manufacturing the increasing level of computerization is used to face the growing production requirements. Smart Production Systems are characterized by its flexibility, resource efficiency, ergonomic design and the ability to integrate customer and business partner into the value creation process.

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For many decades in the twentieth century manufacturing was driven by the rising demand for standardized products. After the invention of the mechanical loom in 1784 the concept of the electrically driven conveyor belt which was first used in 1870 is seen as the second industrial revolution. Henry Ford's conveyor-belt assembly line which was used for car manufacturing at the Ford factory in Michigan in the early twentieth century is a popular example for the improvements of the second industrial revolution. With the mass production of relatively small numbers of products many companies had been successful for many decades. Volkswagen as one of the leading global car manufacturer had only three different types of cars in its portfolio until the beginning of the 1960's.

In the last few decades the trend has been shifted from the classic mass production to individualized, customer-driven, high-tech products. Currently Volkswagen offers over 30 different car models, each with hundreds of individual selectable options. Complex processes on every hierarchy level, high numbers of product varieties and short product life cycles require a solid knowledge and permanent interactions with customers, suppliers and all kind of stakeholders. Under the perspective of globalization and rising competitive pressure an effective use of resources is indispensable. To cover all requirements, the effective use of IT systems and the available data is essential to secure an enterprises market position. The connection and communication between software components and mechanical and electrical parts via wired or wireless data infrastructure like the internet are called cyber-physical systems or short CPS. Through the technology of CPS, it is possible to monitor and steer production systems in a very effective way to facilitate a cyber-physical production system or CPPS. The current technological literature speaks in regards to that form of intelligent or smart productions systems or the smart factory. A pioneering role takes the German government with a high-tech strategy project that speaks about the fourth industrial revolution.

## 2. Smart Production Systems

The origin of the term "Industrie 4.0" comes from the German ministry for education and research who started a project related to computerized manufacturing of the future in the year 2011 [1]. "Industrie 4.0 is based on a concept that is as striking as it is fascinating: Cyber-Physical Systems (a fusion of the physical and the virtual worlds) CPS, the Internet of Things and the Internet of Services, will collectively have a disruptive impact on every aspect of manufacturing companies. The fourth industrial revolution allows companies to take specific actions before it happens. Manufacturers can begin now to define their target manufacturing model and then plan a transformation roadmap. Despite the significant hype around the topic, nobody knows what the exact consequences are for manufacturing operations or when will these happen, although there's a clear notion that the later-movers will most likely be forced out of the market" [2].

### 2.1. Attitude of machine building companies towards Industrie 4.0

In a survey among 12 randomly collected, globally acting machine building companies the author investigated the attitude towards Industrie 4.0 in October 2016. In the first part of the survey the participants were asked for their knowledge regarding Industrie 4.0. As Figure 1 shows most of the company representatives have followed up with Industrie 4.0 intensively or at least in part. It can be assumed that the contact persons have a very good understanding of the topic in the survey. The interviews were held personally with companies from Germany (6), Italy (2), Switzerland (2), Spain (1) and Japan (1).

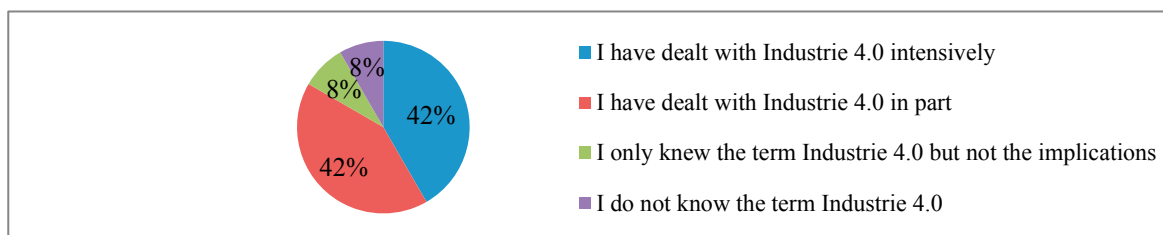


Figure 1: Knowledge about the topic Industrie 4.0

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