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Digital Transformation of Lean Production: Systematic Approach for the Determination of Digitally Pervasive Value Chains

Authors : Peter Burggräf, Matthias Dannapfel, Hanno Voet, Patrick-Benjamin Bök, Jérôme Uelpenich, Julian Hoppe

Abstract : The increasing digitalization of value chains can help companies to handle rising complexity in their processes and thereby reduce the steadily increasing planning and control effort in order to raise performance limits. Due to technological advances, companies face the challenge of smart value chains for the purpose of improvements in productivity, handling the increasing time and cost pressure and the need of individualized production. Therefore, companies need to ensure quick and flexible decisions to create self-optimizing processes and, consequently, to make their production more efficient. Lean production, as the most commonly used paradigm for complexity reduction, reaches its limits when it comes to variant flexible production and constantly changing market and environmental conditions. To lift performance limits, which are inbuilt in current value chains, new methods and tools must be applied. Digitalization provides the potential to derive these new methods and tools. However, companies lack the experience to harmonize different digital technologies. There is no practicable framework, which instructs the transformation of current value chains into digital pervasive value chains. Current research shows that a connection between lean production and digitalization exists. This link is based on factors such as people, technology and organization. In this paper, the introduced method for the determination of digitally pervasive value chains takes the factors people, technology and organization into account and extends existing approaches by a new dimension. It is the first systematic approach for the digital transformation of lean production and consists of four steps: The first step of ‘target definition’ describes the target situation and defines the depth of the analysis with regards to the inspection area and the level of detail. The second step of ‘analysis of the value chain’ verifies the lean-ability of processes and lies in a special focus on the integration capacity of digital technologies in order to raise the limits of lean production. Furthermore, the ‘digital evaluation process’ ensures the usefulness of digital adaptions regarding their practicability and their integrability into the existing production system. Finally, the method defines actions to be performed based on the evaluation process and in accordance with the target situation. As a result, the validation and optimization of the proposed method in a German company from the electronics industry shows that the digital transformation of current value chains based on lean production achieves a raise of their inbuilt performance limits.

Keywords : digitalization, digital transformation, Industrie 4.0, lean production, value chain
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