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## Business model innovation through Industry 4.0: A review

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### Abstract

The following article presents a brief literature review conducted to extend our knowledge about how Industry 4.0 affects business models and to identify business model innovations derived in consequence. Based on the results, a set of features, issues and requirements have been identified and three different approaches has been suggested to make firms getting closer to the industry 4.0 phenomenon such as service orientation, networked ecosystems and customer orientation. Furthermore, the impacts on the creation, delivery, and capture of value through the reconfiguration of Business Models due to embracing the Industry 4.0 are depicted. As a result, four different ways to innovate the business models based on different degrees of innovation are proposed to embrace the digitalization. Those paths goes from optimizing internal and external processes or improving customer relationship to creating new value networks or smart products and services through disruptive business models.

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*Keywords:* Business Model; Business Model Innovation; digitalization; digital transformation; Industry 4.0.

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### 1. Introduction

The increasing fusion of Industrial Production and Information and Communication Technologies (ICT) has brought the so-called Industry 4.0 into the manufacturing world [1]. This phenomenon is making possible to connect information, objects and people due to the convergence of the physical and the virtual (cyberspace) worlds in the

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form of Cyber-Physical Systems (CPS). Therefore, it is enabling the transformation of factories into smart environments [2, 3].

According to some authors [4], this phenomenon considered the Fourth Industrial Revolution, will be the most powerful driver of innovation over the next few decades triggering the next wave of innovation. Thus, the main features related to the Industry 4.0 such as real-time capability, interoperability and the horizontal and vertical integration of production systems through ICT systems, are regarded to be the response to current challenges that companies must face to stay competitive in terms of globalization and intensification of competitiveness, the volatility of market demands, shortened innovation and product life-cycles and the increasing complexity around products and processes[5, 6].

By this way, the business world's rapid digitalization is breaking down the traditional barriers of the industry, and many academics and practitioners are emphasizing the need to rethink the existing Business Models [7]. However, the recent researches are mainly focused on the technological development and less in the new business models that are emerging through the integration of those technological innovations.

Nevertheless, this new industrial paradigm is transforming the current ways of value creation, since it involves changes in the technical and production developments, which in turn has brought extensive organizational consequences and opportunities [5, 6] providing more cooperative environments, improved customer relationships or new product and services offers. Consequently, new and adapted business models are needed [3].

Finally, the discussion and initiatives that promote the digital transformation of factories are increasing between researchers, industries and policy makers around the world. Germany was the first referring to the digitalization of the industry publicly as "Industrie 4.0" in 2011. Then, the term was expanded to the Anglo-Saxon world as "Industry 4.0", while other countries has been introducing other expressions to describe the phenomenon. Thus, Unites States focuses on "Smart Manufacturing" as Japan and Korea do too. General Electrics popularized the "Industrial Internet" concept. Finally, other commonly related words found in the literature are "intelligent manufacturing", "advanced manufacturing", "Integrated Industry", "Smart Industry" and "Smart Factory" [2, 8].

Hence, in response to the increasing interest of the topic and the need of a deepen understanding of its impact in Business Model Innovation, the aim of this paper is to present a brief literature review conducted to address the following goals: To have a clear vision of how Industry 4.0 impacts on business models and to identify business model innovations that are derived in consequence.

## 2. Research Methodology

The literature survey was conducted in articles indexed in Web of Science, Engineering Village, Scopus and Business Source Premier Databases, as they are the referents in our field, for the purpose of carrying out a critical analysis of collected data and the exposition of some conclusions and future research opportunities.

The method of analysis used is the one proposed by Becheikh [9]. In order to do this, the steps related to the establishment of the inclusion criteria and the strategy for the selection of potential studies are particularly important. In our case, the criteria used are the following: 1) The content must show the impact of Industry 4.0 from a managerial approach and not be focused in concrete technological implementations into specific cases, 2) the research must illustrate Business Model Innovations from the Industry 4.0 approach and 3) the papers must reveal how the adoption of the Industry 4.0 affects the Business Models components.

On the one hand, the time period of the literature review was defined between 2011 and the present, since the term "Industry 4.0" became publicly known in 2011. Furthermore, only conference papers and journal articles related to business and management were taking into account to avoid a too technical approach.

On the other hand, to select the keywords within the search, the synonym terms mentioned above were taken into account. The keywords included in the title, abstract and/or full text were combined using the Boolean operators "AND" and "OR" in the following form: "Business Model" AND "Industry 4.0" OR "Industrie 4.0" OR "Smart Manufacturing" OR "Advanced Manufacturing" OR "Integrated Industry" OR "Smart Industry" OR "Smart Factory" OR "Industrial Internet" OR "Fourth Industrial Revolution" OR "Intelligent Manufacturing".

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