

Challenges of Industry 4.0 for Companies in Emerging Economies: Some Inputs for the Research

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New technologies are revolutionizing the business world, such as the Internet of Things, cloud computing, data analytics, big data, robotics, and artificial intelligence. With their developments and “smart” applications, these technologies are named Industry 4.0.

Industry 4.0 is creating smart factories and companies endowed with higher operational efficiency and flexibility, a higher level and speed of production, better product quality, generating increased sales, cost reduction, and higher business performance (Szász et al., 2020; Duman & Akdemir, 2021). Benefits are enhanced when operational data and technological developments are combined with suppliers and customers, moving towards a smart value chain.

Technologies 4.0 and their applications offer an excellent opportunity for companies to redesign production processes, develop new business models, and innovate new products and processes (Moeuf et al., 2020; Szász et al., 2020; Somohano-Rodríguez et al., 2020). However, the development and implementation of Industry 4.0 are linked to the institutional framework of each country, understood as the rules, laws, incentives, and organizations related to business. This is especially relevant in emerging economies, where there is political instability, low institutionalization, high levels of informality, and low levels of research and innovation, among others (Vassallo et al., 2011; Pérez et al., 2019; Jiménez and Geldes, 2019; Ortiz et al., 2023).

Given this context, two focuses of analysis are proposed to develop research to facilitate Industry 4.0 in emerging economies: firstly, to understand the internal factors that lead companies to implement these new technologies, and secondly, to review how the insertion of companies in the different innovation and entrepreneurship ecosystems facilitates or hinders progress towards the massification of Industry 4.0.

At the business level, different factors that contribute to the implementation of 4.0 technologies have been reviewed, such as lack of knowledge, staff training, the need to incorporate their implementation into strategic planning, the availability of digital technologies that facilitate information and communication, as well as digital technologies that enable advanced robotics and integration, often requiring the support of external advisors (Moeuf et al., 2020; Primi & Toselli, 2020; Yu & Schweisfurth, 2020). However, beyond individual factors, it would be relevant to understand what drives companies to make the strategic decision to adopt Industry 4.0 in their future development. It is not enough to make small advances or

minor implementations to be successful in this new paradigm. Policies, programs, people, and specific resources should reflect this strategic decision in firms. It would even be interesting to understand what leads to the emergence of new technology-related enterprises in a particular ecosystem. There is also a need to develop policies aimed at promoting, adopting, and developing 4.0 technologies in companies, considering their capabilities and resources (Raj et al., 2020; Primi & Toselli, 2020; Yu & Schweisfurth, 2020).

A second focus for Industry 4.0 research is the innovation and entrepreneurship ecosystem. Companies will be more willing to transition to and adopt new 4.0 technologies to the extent that they have suppliers of technological services and products, universities and research centers validating, adopting, and developing the latest technologies to local and sectoral conditions, agents that train and educate in these technologies, public institutions promoting, facilitating, regulating, and generating the requirements for this development, and public and private institutions that enable access to financing (Benítez et al., 2020; Boisier et al., 2021).

Undoubtedly, research for developing, adopting, validating, and implementing Industry 4.0 in companies in emerging economies is a developing topic with many opportunities.

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