The Impacts of Industry 4.0 Technologies on International Trade

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Abstract

Industry 4.0 is a term initially used to define a high-technology strategy suggested by the German government in 2011 to keep its industry globally competitive, but currently commonly used to refer to the development of cyber-physical systems (CPSs) and dynamic data processes that use massive amounts of data to drive smart machines. Industry 4.0 combines the strengths of traditional industries with state of art internet technologies. It encompasses a set of technologies that enable smart products to be integrated into intertwined digital and physical processes. Although Industry 4.0 is still in its infancy, its concept is not a simple one since it envelops many technologies that are used in a variety of different contexts. While Industry 4.0 technologies are expected to alter business models substantially, many international firms still face the challenge to assess the diversity of developments brought by Industry 4.0 and their potential impacts. For that reason, these firms still cannot make a decision whether to wait too long with their Industry 4.0 implementation or to start too early. The objective of this work is to provide an overview of some Industry 4.0 technologies such as the internet of things (IoT) and big data and analytics (BDA) and their potential impacts on the international trade. This is done by examining the available works in the literature regarding this topic. As a result, it has been found that Industry 4.0 technologies have many potential positive impacts on the international trade such as a more effective optimization of the supply, production, and distribution activities around the world, reducing the transaction costs associated with international production, monitoring emerging trends and opportunities in overseas markets without the need to make substantial resource commitments in local marketing affiliates, and facilitating an ever-deeper international division of labor in the global factory. From the other hand, it is expected that many drawbacks will arise with the adoption of Industry 4.0 technologies such as greater concerns about cybersecurity and individuals' privacy.

Keywords: *Industry 4.0; internet of things; big data and analytics; international trade.*

1. Introduction

Modern industrial development has lasted for hundreds of years. The first industrial revolution started at the end of the 18th century and was represented by mechanical production factories based on water and steam power; the second industrial revolution began at the beginning of the 20th century with the symbol of mass labor production based on electrical energy; the third industrial revolution started in the 1970s with the characteristics of automatic production based on electronics and internet technology; and right now, the fourth industrial revolution, namely Industry 4.0, is ongoing, with the attributes of cyber physical systems (CPS) production, based on heterogeneous data and knowledge integration (Lukač, 2015).

Industry 4.0 is a term reputedly first used to describe a high-technology strategy proposed by the German government in 2011 to keep its industry globally competitive, thus, to develop its economy. But now, it is commonly used to refer to the development of "cyber-physical systems (CPS) and dynamic data processes that use massive amounts of data to drive smart machines" (Sirkin et al., 2015). The concept of Industry 4.0 is not a simple one. It envelops many technologies and is used in a variety of different contexts (Magruk, 2016). There are two pieces that define Industry 4.0 at its core: Internet of Things (IoT) and Big Data and Analytic (BDA). Each piece is similar in nature, but when integrated with the other, it creates capability that has never before been possible. Autonomous cars, robotic surgery, intelligent buildings, smart electric

grid, smart manufacturing, and implanted medical devices are just some of the practical examples that have already emerged (National Institute of Standards and Technology, 2013).

2. The Internet of Things (IoT)

The real and virtual worlds are growing closer and closer together, thanks to the IoT. The IoT can be defined as the network of physical devices, items embedded with electronics, software, sensors, actuators, and connectivity which enables these things to connect and exchange data (Wortmann & Flüchter, 2015). One indication of the importance of IoT is that the number of IoT devices worldwide is increasing exponentially (Vermesan et al., 2011), and it is expected to reach up to 125 billion in 2030. At its core, innovation in the IoT is characterized by the combination of physical and digital components to create new products and enable novel business models. As a result, the primary thing-based physical functions of a thing can be enhanced with additional IT-based digital services, which can be accessed not only on a local basis but at a global level. For instance, the primary thing-based function of a light bulb is to supply light in a specific location. If the light bulb is improved with IoT technology, it may also recognize human presence and serve as a low-cost security system, which in the case of a snooping activates a flashing light mode and sends a warning to the owner's smartphone. In a similar way, the primary thing-based function of a bin is to provide storage capacity. But when the bin is enhanced with IoT technology it may additionally measure and monitor its own weight, thus, detect levels of low stock and provide an automatic refilling service. And while the primary thing-based function of a tractor may be to tow other farm equipment, a connection of the tractor to the IoT could ease IT-based predictive maintenance and optimization services (Fleisch et al., 2014). The IoT has important potential impacts on international trade since it is expected that it will bring substantial changes in the management of geographically scattered value chains such as products will be given unique identifiers across the world, there will no longer be a need to coordinate and synchronize product and information flows, substantial benefits in production and distribution efficiency, decreasing the transaction costs that come with international production, and facilitating an ever-deeper international division of labour in the global factory (Strange & Zucchella 2017). However, implementing IoT should rise even greater concern about cybersecurity among executives. IoT poses not only the normal risks associated with the increased use of data but also the vastly greater risks of systemic breaches. As organizations connect to millions of embedded sensors and communications devices, each is a potential entry point for malicious hackers, and the same interoperability that creates operational efficiency and effectiveness also exposes more of a company's units to cyber-risks" (Strang & Zucchella 2017).

3. Big Data and Analytics

For many years, firms made business decisions based on data from a limited range of traditional sources such as production records, internal accounts, and market research reports. But, with the arrival of Big Data and Analytics, firms had to adopt the new trend in order to be able to survive at the market place (Blazquez & Domenech, 2018). Big Data and Analytics can be described as a collection of data from traditional and digital sources inside and outside your company that represents a source for ongoing discovery and analysis. Sources include sensor-generated data from smart products, data from search engines and social media sites (e.g., Google, Facebook, and Twitter), This, together with the improvements in computing power and lower data storage costs, has led to the growth of big data and analytics (Strange, & Zucchella 2017). By using Big Data and Analytics, firms will be able to monitor emerging trends and opportunities in overseas markets without the need to make substantial resource commitments in local marketing affiliates. They will be also able to optimize more effectively their supply, production, and distribution activities around the world (Strange & Zucchella 2017). However, this will not come for free since Individuals' privacy will be under threat. When data becomes so valuable, firms will do their best to get it. Facebook knows what we like, Google knows what we browse, Twitter

knows what is on our mind. To top it all, our telecom service providers know where we are, and who we are connecting with. Collectively, it is an incredible amount of information and can be more than what our closest friends or family would know about us (Shukla, 2015).

4. Other Implications of Industry 4.0 Technologies

The Industry 4.0 technologies have many other implications on nature of competition and corporate strategies in many industries. These implications include the replacement of lower-skilled labour with automation at a higher rate, which in turn, will an increase the demand for higher-skilled labor (e.g., software specialists, mechatronics engineers, and data analysts). An improved machine-to-machine and machine-to human interaction will facilitate greater product customization. Distribution will be affected by unmanned logistic drones, at least once the considerable safety issues have been solved. Labour productivity should increase, and labour costs should decrease, in the medium-term. Firms will base their production location decisions less on production costs and more on proximity to customers. Digital platforms for the distribution of products (e.g., Amazon, Alibaba, and EBay) should also make it easier for small firms to enter global markets (Strange & Zucchella 2017).

4. Conclusion

It is expected that the Industry 4.0 technologies will have many potential positive impacts on the international trade such as a more effective optimization of the supply, production, and distribution activities around the world, reducing the transaction costs associated with international production, monitoring emerging trends and opportunities in overseas markets without the need to make substantial resource commitments in local marketing affiliates, and facilitating an ever-deeper international division of labor in the global factory. From the other hand, it is expected that many drawbacks will arise with the adoption of Industry 4.0 technologies such as greater concerns about cybersecurity and individuals' privacy.

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