Chapter 67

Internet of things and industry 4.0: systematic bibliometric review

10.56238/tfisdwv1-067

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ABSTRACT
With the development and proliferation of technological standards of the Fourth Industrial Revolution in Brazil, it becomes necessary to know new methods that help in industrial processes. In this venom, this article aims to analyze and expose studies related to the aplication of the main concepts of IoT (Internet of Things) in industrial processes and business complexes. A search was carried out, with a time frame from 2014 to 2022, in bibliographic collections for theoretical references and research already carried out on the subject. The result, observed in the research conducted, identified that, although they bring greater aid to companies that adopt this technology, there are economic and technological aspects, which should be considered in relation to the implementation of IoT in the industrial and business sectors. It is concluded that The IoT presents gains for companies (such as higher productivity and productive efficiency) and their final consumers (such as quality control, lower value and safety), although it still faces challenges for implementation in several areas.

Keywords: IoT, industry 4.0, automation, technology, systematic bibliometric review.

1 INTRODUCTION

According to Reis Portilho, et al., (2021), damong the various technologies developed in the context of Industry 4.0, it is possible to highlight the concept of IoT as one of the main differentials brought to the industrial and business sectors. According to Marconato Marum, et al. (2022), the use of smart devices capable of making decisions and monitoring several important sectors forthe industry has become increasingly common, which has provided greater productivity and control of industrial processes and, at the same time, demands greater investment from companies for the implementation of such technologies in their processes products.

Despite the increase in demand for the integration of these devices in the industrial scenario, several companies continue to use old machinery and more conservative methods in their production routine, generating higher expenses with maintenance and waste of material for production. On the other hand, other companies, which in the search for pioneering in adopting a new market technology, end up

generating higher expenses when such technologies are obsolete.

In this context, this article aims to expose the main implications and challenges for the integration of this technology in the various sectors and to collect data that illustrate an ideal scenario for the correct adequacy of companies in the reality of the industrial revolution.

The methodology used in this work is of investigative origin, academic research on the subject, similar articles, bibliographic collection and blogs on the theme exposed were verified. After the studies and obtaining concise data, it can be noted that there were distinctions in relation to the hypotheses reported.

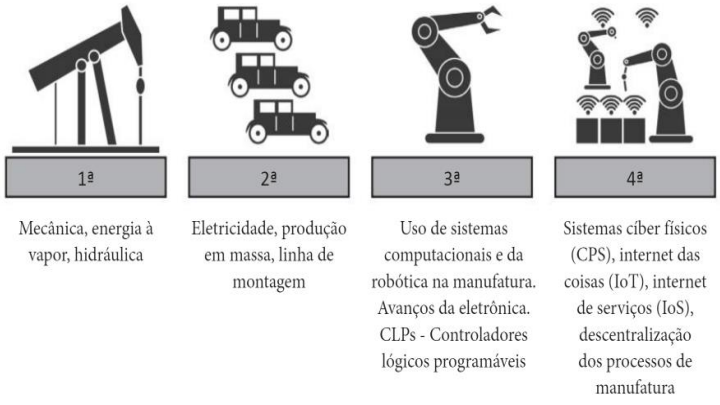
2 THEORETICAL FRAMEWORK

In this chapter, some concepts that will be used in this article will be covered, such as: Industry 4.0 and IoT: Internet of Things.

2.1 INDUSTRY 4.0

Historically, industrial revolutions have erupted and progress in various sectors and influences on the development of industry 4.0 has been seen. According to SILVA (2014), inthe eighteenth century the First Industrial Revolution in the United Kingdom emerged, the first moment when one could talk about the concept "industry", considering that there was the introduction of maquinofatura in the production processes. Already in the nineteenth century, during the period preceding the Second World Cup, there was a geographical advance of the industry, deconcentrating the great industrial pole that belonged to Europe and developing in countries such as the United States, Japan and other European countries, which was recognized as the Second Industrial Revolution. Inthis period, the use of oil as a new energy source, the creation of the combustion engine and the use of electricity in the operation of electric motors and explosion stand out. Nevertheless, the Third Industrial Revolution, or technological revolution, besides having significant changes in industrial modals, allowed the advancement and democratization of scientific knowledge, causing an event to arise in the world called globalization, which had the reduction of time and distance with the mainfactors (SILVA, 2014).

Figure 1 - The four industrial revolutions.



Source: SACOMANO, p. 28, 2018.

Currently, the Fourth Industrial Revolution is focused on connectivity between people and technology, which the association between the digital, physical, biological environment, among others, must be simultaneously linked to industrial modals. For that, the internet is used as the main tool for this assertiveness (ALALOUL, 2020).

For Schwab (2016), who first designated the term " Fourth Industrial Revolution", the connectivity between the physical and virtual environment, through the internet, will bring more flexibility and convenience to industries worldwide.

Innovation and entrepreneurship are crucial for sustainable and efficient development for the better consolidation of aspects of Industry 4.0 and a recurrent economic growth. In this sense, to better understand the approaches that the technological aspects of Industry 4.0 can bring, master plans should be planned in order to contemplate all aspects of this new technological era.

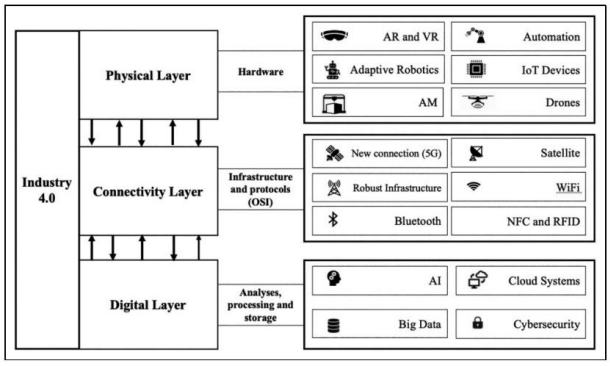
In this sense, Kruger and Steyn (2021) report that there are three very important layers that define the logic behind this new technological era. The first layer is physics. The technologies that are grouped in this pillar are related to hardware's capable of capturing measurements and variations of information from the external environment, such as temperature, pressure, humidity, sound, light etc . (KRUGER AND STEYN, p. 58, 2021).

In the second layer, you have connectivity. In this layer, computer systems are inserted, such as IoT, which, through telecommunications networks such as 4G, 5G, Bluetooth Network, Wi-Fi , etc., bring an approximation between technology and humans, so as to make their daily lives more simplified (KRUGER And STEYN, p. 58, 2021).

Finally, in the third layer is digital. The digital layer is responsible for processing data from the physical layer and compiles it, through the connectivity established by networks in general, using tools such as software, programs and etc. With this, it is possible that the technology provides data that can be used to automate business and thus obtain the best possible efficiency (KRUGER And STEYN, p. 58, 2021).

Figure 2 implies the overview of these layers in Industry 4.0 (KRUGER AND STEYN, p. 58, 2021).

Figure 2 - Industry Layers Overview 4.0



Source: KRUGER And STEYN, 2021.

2.2 IOT: INTERNET OF THINGS

The development of the Internet of Things is associated with the development of industry 4.0 and represents a strong trend towards the new industry revolution l. The term "IoT" describes a system in which the internet is connected to the physical world by the middle of sensors, this term integrates several devices with detection, identification, processing and communication aimed at connecting humans and machines. IoT's base can be considered a global network infrastructure composed of multiple devices; such as instruments, vehicles, buildings and others; incorporated through electronics, circuits, software, sensors, dependent on sensory, communication, network and information processing technologies that enable the these objects collect and exchange data. (PASINATO AND CAMPANA, 2020).

A critical requirement of IoT implies that things on the network must be connected. Thus, the Architecture of the IoT system must ensure operations so that it is possible to achieve the desired connection between the physical and virtual worlds (PASINATO AND CAMPANA, 2020).

3 CHALLENGES FOR IMPLEMENTING IOT

3.1 THE POSSIBILITIES BROUGHT BY IOT

IoT makes it possible to design applications such as smart cities, automated homes, health, energy, and many others.

3.2 CHALLENGES

The biggest challenges for the implementation of IoT, according to most research done in this field, are related to the development of "horizontal IoT platforms", systems that integrate these devices and provide free information sharing between them. Thus, the main challenges for the development of platforms of nature are those listed below (GAZIS, et al., 2015).

-Technological interoperability: with respect to devices interacting not only with people, but with other devices. In order to build an entirely functional ecosystem

considered the biggest challenge in the field of IoT today (GAZIS, et al. , 2015).

- Isemantic interoperability: the need for devices to interpret, share and perform actions correctly according to previously defined commands (GAZIS, et al. , 2015).

- **Security and privacy**: data identification, unique identification and encryption are considered major challenges in the implementation of IoT, where energy efficiency for encryption and data protection technologies are some of the parameters to be considered to overcome and this challenge (GAZIS, et al., 2015). - - **Smart devices:** circuits that work with low powers and, at the same time, devices capable of tolerating severe interactions need to be developed and, in addition, the adaptation and behavior of these devices, as well as the guarantee of trust, privacy and security for the user, as well as a good battery life, support for power surges and storage technologies are among the largest challenges in relation to IoT (GAZIS, et al., 2015).

- Resilience and reliability: ensuring the absence of interruptions in the operation of devices during industrial processes or in emergency cases (GAZIS, et tol., 2015).

4 METHODOLOGICAL PROCEDURE

This study was based on a bibliographical investigative analysis, exposing the main topics, opportunities and challenges related to Industry 4.0 and IoT and how they are related to anthropological daily life, in order to facilitate literary understanding by the reader.

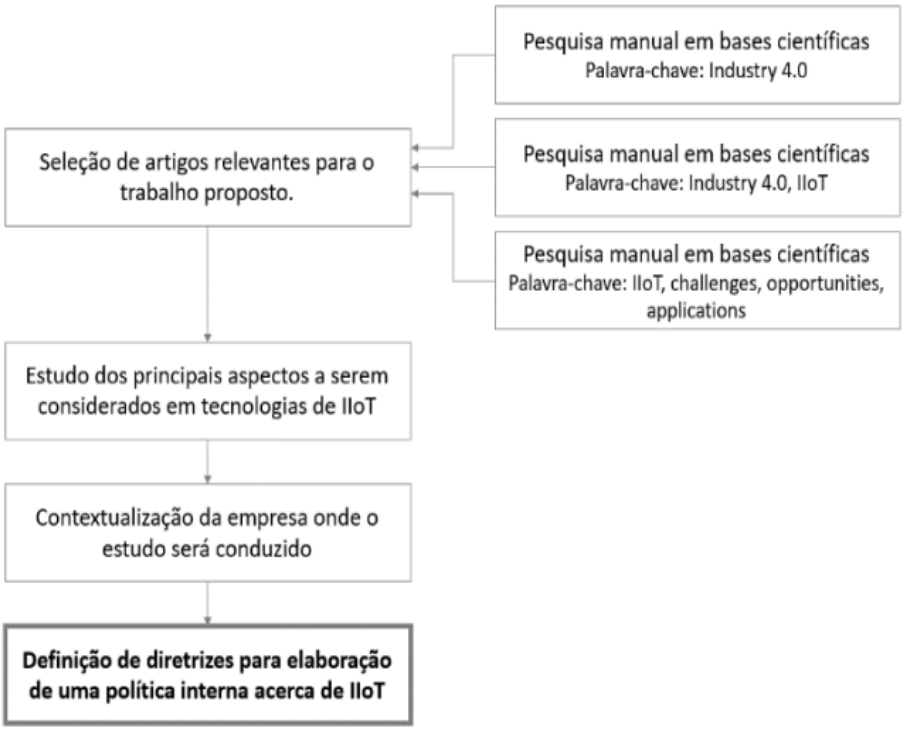
In the elaborate stage of the work, a wide search was done in Google Scholar, searching for other articles similar to the theme exposed, blogs and bibliographic collections, as well as other sources of research.

With the capture of the most precise content, it will be possible a more objective mixture of the work, facilitating the reading and addressing in a succinct and direct way to the reader the main aspects of the relationship Industry and IoT.

With regard to the "Internet of Things", IoT is a very broad concept and has very specific concepts that must be exalted, as well as its reproduction worldwide. Given this, this work was done a thorough search in the main academic ties specialized in disseminating the precise analyses of the Approach of IoT in the industrial space.

Figure 3 highlights the main selections from the literature on IIoT (PASINATO; CAMPANA, 2020)

Figure 3 - Literature selection and process of definition of guidelines on IioT



Source: PASINATO E CAMPANA, 2020

5 FINAL RESULTS AND CONSIDERATIONS

According to the proposal of this work to raise points and aspects about the implementation of the virtual world to the industrial environment, through academic studies and data collected through the cited works, it is observed that several studies focused on this new resource were found. Thus, generating important data for the development and completion of this work.

Based on the studies done in this article, seeking to better understand the application of IoT in the midst of industry 4.0 processes, it can be noted that there are numerous aspects that will imply the result of this implementation.

Resuming the theme and articles covered, it is seen that there are already several benefits in the implementation of IoT in various areas of the industry, thus offering greater opportunity to use this method to obtain improvements, solutions and industrial evolution.

Through the data present in the articles used as a basis, it was observed that there are still some challenges to be overcome when talking about the introduction of the virtual world in the industrial environment, such as the development of employees in relation to the use of virtual means to complement their work and the communication and interaction of devices with each other, for extracting accurate results in the merge of the various data obtained. It can also be observed the need for a study on the improvements and changes that IoT would bring to such areas and activities, such as in the area of production or maintenance.

Despite the challenges, there have also been several positive aspects, which help a lot in industrial development. Bringing improvements such as higher productivity, better results in production control, greater and more accurate obtaining of important data, greater quality control, better economic performance, better performance of its employees and etc. Improving the productivity of the industry, the resourcefulness of various processes, being able to obtain the reduction of costs and optimization of procedures.

Thus, IoT is a great investment for the industrial environment, although there are several obstacles and lack of information that hinder the evolution and use of this resource.

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