International Journal of Enhanced Research in Management & Computer Applications
ISSN: 2319-7471, Vol. 8 Issue 12, December-2019, Impact Factor: 5.945

Fourth Industrial Revolution

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ABSTRACT

The fourth industrial revolution, which comes with smart manufacturing and smart production systems, is used together with technology and digitalization. Intelligent production, efficiency through digitalization, reveals new business models. The fact that the machines communicate with each other is based on advanced Technologies such as Internet of Things (IoT) and cloud computing. With the increase in automation, companies need to have intelligent monitoring and control technologies to manage and optimize value chain networks in real time. Consequently, machines that can communicate with each other through the development of intelligent production, self-managing production systems and processes, form new production facilities. Since digital transformation is essential for Industry 4.0 technologies, producers should therefore plan how to develop their digital organization by looking for the best digital use. Data management and cyber security should also be taken into consideration. In this study, we discuss how smart manufacturing and smart production systems play role within Industry 4.0.

Keywords: Industry 4.0 revolution, smart manufacturing, smart production systems, Internet of Things

1. INTRODUCTION

The concept of Industry 4.0 is expected to constitute an important place in our country's aimto be among the first 10 economies in 2023. Due to globalization production lines over the past two decades, many sectors will be structured in countries with low labor costs. As the information and communication technologies improve, reducing production costs become important. The development and dissemination of new automation technologies have gained momentum (Marapoulos, 2003; Chryssolouris et al., 2009). As a result of these gains, the increase in the overall productivity is expected. The increased productivity in various sectors will cause increased competitiveness at the national level. Print industry is an example of such sector (see Figure 1). For these reasons, the developed countries have begun to rapidly develop the practices required by the new industrial revolution. The major producers have begun to see efficiency gains through integrating these new technologies into their production lines.

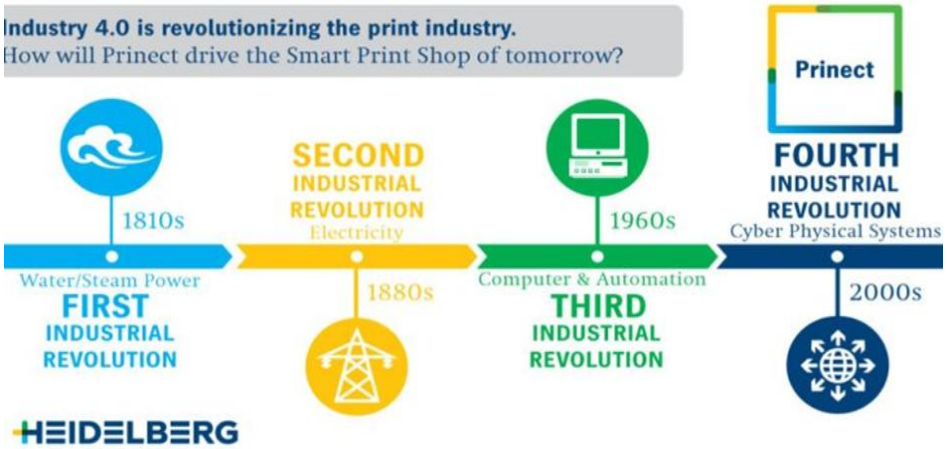

Figure 1: Print industy revolution.

Kaynak: Mark Bohan, Next Level: Industry 4.0 Explained https://news.heidelbergusa.com/2016/08/industry4explained/

The perspective on industrial automation is also known as the 4th Industrial Revolution. The central feature is the integration of the virtual computer world through the formation of "cyber physical systems" (CPS) with the physical world. Production systems and technological components based on CPS must be able to configure, edit and optimize themselves autonomously against external demands (Lee &Seshia, 2011). In other words, this concept is a new process-innovation form, also called "advanced automation use" (Lee & Seppelt, 2009). In this way, a level of automation at the level of industrial production that has not yet been heard in the earlier stages of industrial development has become available (Forschungsunion & Achatech, 2013).

2. COMPONENTS OF INDUSTRIAL 4.0 TECHNOLOGY

Figure 2: Example Technologies of the 4th Industrial Revolution (i-Scoop, 2018).

Kaynak: https://www.i-scoop.eu/manufacturing-industry/

The components of the industry 4.0 technology include the following (Bohan, 2016).

System Integration: While the systems exhibit automated operations within their own domain, it is not always easy to communicate with other systems. In order to have successful communication among multiple systems, we would need standards and open architecture to provide support for various operations such as information transfer between the business and the customer. This means that we need use common languages for data exchange such as JDF for job information, PDF for content, and so on.

Big data and analytics: As we can now much more easily collect enormous amount of data, we need to decide on ways in which how to analyze such big data which is a challenging task. The purpose of big data analyis is to find trends and eventually be able to make intelligent and automated decisions. Through the data analysis, we can not only predict production related issues in the future but also take actions to prevent undesirable outcomes.

Simulation and virtualization: Through the simulation and virtualization we can assess different scenarios of the system. As a result of assessment processs, optimized solutions such as minimizing cost, increasing productivity, and so on can be developed and tested just in time for market. In many cases, the system reaching the market ahead of others takes the majority of the market share especially if the system is reliable and cost-effective in its operations.

Internet of Things (IoT): Internet of Things (IoT) allows connectivity of multiple physical devices through Internet to serve various purposes such as data collection for monitoring systems in order to make autonomous intelligent decisions. This functionality is added value for the manufactured products. IoT Technologies work hand in hand with various other computing systems such as cloud computing and edge computing.

Cloud computing: The cloud computing is mostly used for systems which cannot handle excessive computation or storage of data. The companies gather their data in the cloud and run extensive computations and analyze their data in a short period of time. The cloud solutions are beneficial for most companies if they need to see the trends of their business very quickly and make decisions accordingly. The industry is expected to continue utilizing the cloud solutions.

Cyber security: The cyber security is becoming increasingly more important as we encounter increased connectivity among existing systems through IoT and cloud technologies. The information exchanged must remain secure against disruption from various security attacks. The data integrity must be maintained. One of the challenges of the cybersecurity is that security risks constantly evolves over time. As a result of this, many companies have increased their spending to guard against cybersecurity attacks over the recent years.

Autonomous Robots: Autonomous robot as the name refers executes tasks autonomously. The use of such robots has increased recently in manufacturing systems for example in the areas of inventory control. Robots can be cost effective use, help increase productivity, quality, and safety in the manufacturing plants.

Augmented reality: In augmented reality (AR), the view of real-world objects are augmented with information coming from the computer. AR technologies can potentially transform the training of the factory workers or 3D views of the factory equipment. In recent years, we expect to see IoT playing a role in AR based applications.

Additive manufacturing: Additive manufacturing (AM) refers to technologies that build 3D objects such as rapid prototyping, direct digital manufacturing, layered manufacturing, and additive fabrication. AM becomes essential for production of single or small parts. This technology allows performance increase while reducing the cost from both supplier and consumer perspectives.

Cyber physical systems (CPS): Cyber physical systems consist of networks where smart machines, storage systems and operational resources communicate with each other. Industrial automation systems describe the computerized production structures that enable the physical production processes to be controlled via the monitor. The cyber part of the system consists of computer software that obtains data from the physical processes and adapt it to the production process (Thramboulidis, 2015: 92). Cyber physical systems are the basis for increasing production flexibility, which leads to shortening of marketing time. These production units can be flexibly integrated into existing production processes. In addition, R & D can create significant differences in design and marketing processes. For example, a factory can be set up by simulation prior to its physical installation and all necessary feasibility studies can be done through this simulation. In short, Cyber-Physical Systems, and consequently Industry 4.0, provides solutions that we cannot even imagine today, improving resource utilization and increasing productivity (Ghafory, 2017).

3D Printing: New technologies allow for the immediate production of a replacement part. Through industry 4.0 capabilities, the cost of a product produced exclusively for the customer while costing the same as the cost of mass production. Additionally, in all stages of the supply chain, the customer is able to instantly see what the case is in demand, or even to change the wishes of the product at any stage (Scheer, 2017).

Production Automation: Automation means that the work is done by the machinery instead of through manpower. Production speed and quantity in the companies that are produced with manpower are much lower than those working with automation systems. The percentage of work sharing between manpower and machine determines the level of automation. If manpower is used intensively in automation systems. It is called half automation if the machine power is used intensively, it is called full automation. Another factor that attracts attention in automation systems is that many jobs that cannot be done with manpower can be done with machines. In addition, there is no need to pay high fees for automation systems that also reduce labor costs. This leads to savings (Proente, 2018).

3. SMART MANUFACTURING

The factory of the future or intelligent manufacturing is becoming popular in the manufacturing industry; this includes the use of advanced technologies, the use of IoT and the application of analytical data to ensure that manufacturing is more productive and responsive. For instance, IoT devices can give warnings for expiration dates and machine maintenance to improve overall supply chain performance and efficiency. IoT solutions are extensively used in the food processing industry for the continuous monitoring of factory climatic conditions and for the detection of allergens. It can also manage inventory in a warehouse and distribution centers with automated inventory flow and control mechanism to reduce non-stock situations (Musiad, 2017).

While smart manufacturing systems make the entry secure in networked production, as the number of interconnected workplaces increases, the use of cloud models increases. In smart factories, automation processes enable devices and machines to communicate with each other to regulate their production processes. People only play a supporting role in the production process. The smart product is continuously informed about the current order, material and production data with the help of integrated sensors such as RFID or Bluetooth. The networked system communicates with individual smart products and monitors work steps (Intralogistics, 2015).

The fourth industrial revolution includes smart industry, smart manufacturing, smart factory, smart grid, smart buildings, smart services, smart workplace, smart mobility, smart cities, smart supply chain and so on (i-Scoop, 2018).

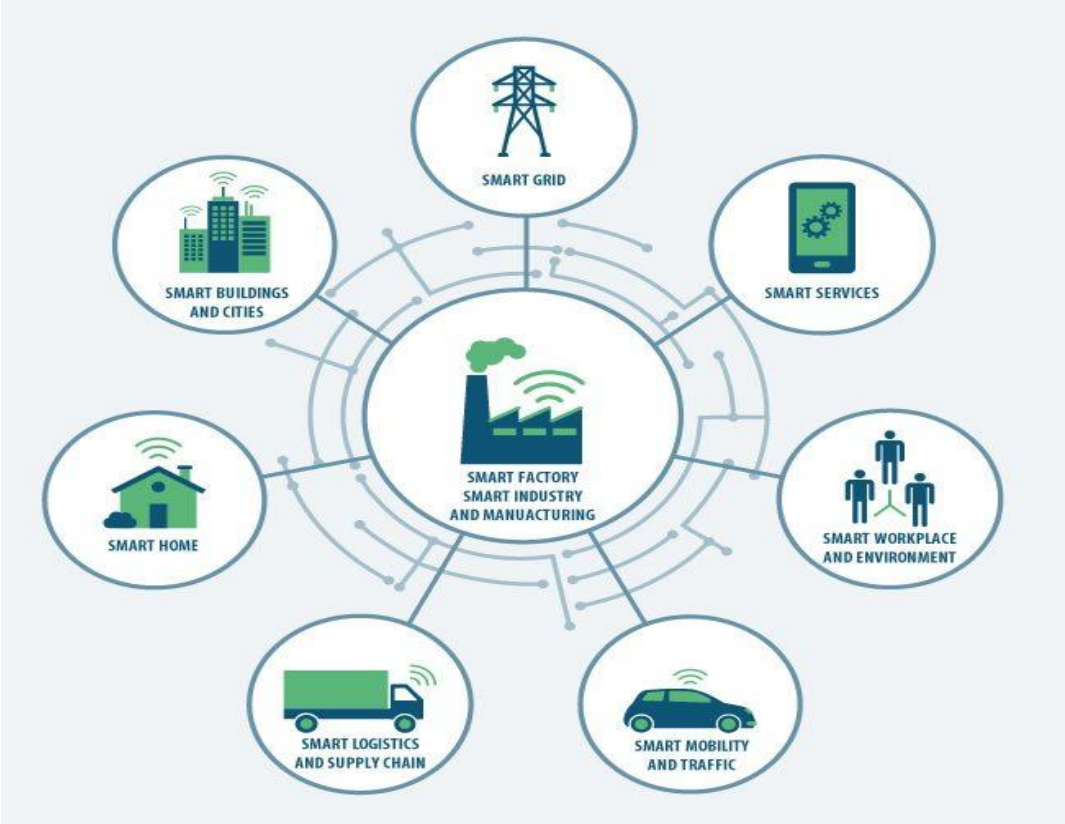

Figure 3: Smart industry and smart manufacturing (i-Scoop, 2018).

Kaynak: https://www.i-scoop.eu/manufacturing-industry/

Industrial markets and smart factories are considered part of Industrial IoT. We need to make sure the human aspect in smart IoT is not overlooked since these technologies are here to serve consumers. Smart industry can be considered a synonym of industry 4.0.

CONCLUSIONS

The goal of Industry 4.0 technologies is to create new opportunities for business models, software process improvements, and the use of sustainable resources for various sectors. Smart industry, smart factory or smart production are essentially part of Industry 4.0. The manufacturers can achieve their goals of high quality and efficiency while keeping the overall cost minimized through the smart production and automated technologies. In smart production, everything is connected with the help of sensors and RFID chips in order to increase the overall production level even over the boundaries of individual firms. In this production environment, the product itself is an active part of the production process (Siemens Vault, 2018).

The rapid development of Internet of Things (IoT) Technologies will lead to the fusion of real and virtual worlds. The value of connecting information systems that are placed in Industry 4.0 production processes between themselves and therefore with the Internet is increasing each day. Integration is yet another essential component of the overall process.

Vertical integration takes place within the enterprise; this type of integration means that the smart factory is flexible and reconfigurable. Such a smart factory can have the ability to make small batch products customized to be productive and

profitable (Banger, 2016). Companies should also take Industry 4.0 into account as they consider their future direction, the second way of capturing potential.

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