

## **INDUSTRIALIZATION 4.0 - THE DIGITAL REVOLUTION WHICH REDEFINES PRODUCTION**

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**ABSTRACT:** Industrialization 4.0 is the fourth industrial revolution defined by cyber-physical systems, IoT (Internet of Things), cloud and AI (Artificial Intelligence). When we talk about production companies, Industry 4.0 involves a major transformation of the entire production by unifying digital technologies and the Internet with conventional industry. Thus, the basis of production automation and interconnection of its processes is an integrated system of equipment, machines, employees, mobile devices and IT systems, all of which are able to communicate with each other both inside and outside the factory.

**KEY WORDS:** industrialization, systems, technologies, production.

### **1. INTRODUCTION**

Regardless of the manufacturing sector we are talking about, technological innovation is essential for the future of any successful business. Industry 4.0 represents the new wave in the technological evolution of production, pushing more and more companies to meet the new standards set by a constantly changing market, by transforming production units into "smart factories". This aspect involves the use of software that allows the integration of CNC (Computer Numerical Control), the use of IoT technologies, Big Data & Analytics and the interconnection of systems used in factories. Adapting the entire production cycle to the digital age of industrial technology will, without a doubt, make the distinction between businesses that want to remain relevant in the current economic context and companies that make major efforts just to survive. The digitalization of production brings manufacturers into an area of high competitiveness due to the transformation of factories into connected and self-organized units. Such production centers have an increased efficiency by manufacturing products in a shorter time and at lower costs,

which automatically determines a higher profit. [1]

The use of advanced manufacturing capabilities and IT tools throughout the production process brings 4 major advantages to the manufacturing companies:

- **TIME.** Data entry and operations planning is done automatically - the time saved can be allocated to activities that produce value to the company. In addition, employees become more productive in the context of an optimized system, and orders are delivered faster;
- **COST.** The data are accurate and presented in the right context and format - resulting in informed and well-documented decisions and, implicitly, better cost and revenue planning;
- **FLEXIBILITY.** Any change can be easily adopted due to flexible systems open to new opportunities, which allow the optimization of processes based on data analysis;
- **INTEGRATION.** The production process takes place with a low number of interruptions, due to the integration of the systems used with the factory resources (employees, machines, equipment), making possible the simultaneous development of the product and the manufacturing process. [10]

## **2. WHY WE SHOULD BE INTERESTED IN INDUSTRY 4.0**

Investing in factory digitalization systems is essential if you want your business to maintain its position in an environment with increasing competitiveness. The transition to Industrialization 4.0 makes it possible to optimize all stages of the product life cycle, by digitizing factory operations, which also means improving the position of producers on the market. Statistical data show that 24% of Romanian companies understood the relevance of digitalization and created an adequate technological infrastructure. Therefore, decision makers in such businesses have a well-developed strategic direction for digital transformation, implementing software solutions tailored to their needs. [3]

Thus, it is understandable that businesses that do not keep pace in this area, will not be able to compete with manufacturers who have decided to use software systems that reduce production costs and time, while efficiency, quality and profit are growing.

Implementing a complete production management system (MES - Manufacturing Execution System) focused on the needs of your business is one of the most important steps towards creating and setting up your own smart factory. The transition from the traditional factory to the “smart factory” involves 4 stages:

- Digitization: Provides access to real-time data. The right software solution makes it possible to digitize information and transmit it quickly to the entire production chain, whether we are talking about procedures, technical drawings, instructions, lists of materials or other data essential to your business.

- Mobility: It connects operators to factory information systems designed to manage production processes, equipping them with PCs, tablets, smartphones to be permanently online.

- Automation: Organizes production processes by interconnecting machinery, machines, equipment and devices from the factory and connecting all these resources to IT solutions outside the production units: management systems and inventory management.

- Factory computerization: It uses an information system that integrates both factory resources (machines, equipment, employees, etc.) and execution processes (production control, quality assurance, materials management, process control, equipment maintenance, interfacing with production machines). [3]

The transition to this new digital industrial reality is taking place all over the world: about a third of companies already rate their level of digitization as high, and this level is expected to increase on average from 33% to 72% in the next 5 years.

The leaders of the industrial companies digitize essential activities within their own vertical value chain and also in relation to the horizontal partners in the supply chain. In addition, they are improving their product portfolio by introducing innovative digital features and data services. Globally, companies plan to invest approximately 5% of their digital sales revenue annually in the digitization process. Based on surveys conducted among industrial sectors, 5% of digital sales revenue corresponds to a total investment of \$ 907 billion.

These investments will focus mainly on the development of digital technologies such as sensors or connection devices, software and applications such as processing systems. Moreover, companies invest in employee training and in implementing the necessary organizational change. More than half of these companies (55%) consider that they will amortize these expenses within two years. These are the results of the global study PwC Industry 4.0: Building the digital enterprise in which more than 2,000 companies from nine industrial sectors in 26 countries were surveyed.

During this transition, the managers of the analyzed companies estimate a reduction in costs on average of 3.6% per year and additional annual revenues on average of 2.9%. In absolute terms, this corresponds to a reduction in costs of \$ 421 billion and a simultaneous increase in revenues of \$ 493 billion. [6]

At the end of this transformation process, successful industrial companies will become truly digital enterprises, with physical products

at their core, complemented by digital interfaces and innovative data services. These digital businesses will work with customers and suppliers in digital industrial ecosystems. [3]

### **3. LACK OF EXPERTISE A BARRIER TO INDUSTRY 4.0**

The problems identified by the companies analyzed in the implementation of Industry 4.0 are rather those related to the lack of a culture, visions or internal training in the digital field, as well as the lack of specialists, than those related to the acquisition of the necessary technology. For example, approximately 40% of companies surveyed rely on the expertise of data analysis employees, but do not have dedicated departments for these tasks. Developing sound expertise in data analysis and digitization within your company is a wise decision. The individual experts who collect and evaluate the data are not enough to successfully implement the strategies associated with Industry 4.0. To be able to use them as a basis in the making process. of decisions, companies need databases, algorithms and recommendations that can be implemented, professionally prepared.

Digitization has an impact both horizontally and vertically on the value chain. This means that, on the one hand, companies need to better integrate and digitize their vertical data flow, from product development and procurement to transportation processing and logistics. And on the other hand, it involves a horizontal collaboration with key suppliers, customers and other partners in the value chain, for example using product identification and monitoring solutions. For companies, these aspects involve the creation of complex digital solutions. [10]

In addition, companies are developing new products and services with digital features that cover the entire product life cycle and therefore facilitate closer contact with end consumers. Companies also invest in digital services and create complete solutions tailored to their customers' ecosystem, often in collaboration with value chain partners.

The goals of digitization vary from country to country. Although companies are advancing

globally in the process of implementing Industry 4.0, the study reveals certain regional features at the target level: companies in Japan and Germany are implementing digitalization primarily to increase the efficiency and quality of their products. In the US, the trend is to develop new business models with the help of digital offerings and services and to deliver these products and services digitally as quickly as possible. [2]

Manufacturing companies in China are focusing on ways to deal with international competitors by reducing costs.

The Smart Factory as a key feature: secure, connected and flexible manufacturing. Smart factories are a key component of Industry 4.0. They are designed to be highly efficient, secure and cost-effective, with the help of advanced robotics, big data processing, cloud computing, strong cybersecurity, smart sensors and other advanced features.

With this approach, companies can optimize their production for mass customization, while making the workplace safer and less reliant on actual human labor and saving costs. [9]

In smart factories, robots do much of the actual work that is required to produce products. Many of the machines that operate in smart factories run on artificial intelligence and carry out high-level activities. In some situations, they can even make decisions and learn from experience.

Additionally, since smart factories typically are equipped with various sensors, machines can actually inform operators when they are likely to break down or they are experiencing any kind of problems. [7]

Knowing this information ahead of time allows mechanics, engineers, and operators to repair and/or replace problematic machines before they cause substantial issues. It is estimated that smart sensors can help businesses to reduce downtime and save up to 40% on maintenance costs. Because smart factories offer so many benefits to companies, they are becoming more and more popular. Many businesses are making the switch to smart factories.

In fact, it is estimated that smart factories will deliver over \$500 billion in value by the year 2022. The move towards smart factories is so strong that roughly 76% of manufacturers

either have a smart factory initiative that is ongoing, or are working on defining one. It is also estimated that smart factories will increase overall manufacturing productivity by a factor of 7 by 2022. [4]

#### **4. FUTURE TRENDS: INDUSTRY 5.0 OR SOCIETY 5.0**

Industry 5.0 makes a great change of perspective; the core of Society 5.0 focuses on people as fundamental axis of the production sector. Both production and marketing fields agree that beyond the focus of Industry 5.0 is the Society 5.0.

In Society 5.0, the products or services offered will be customized to the customer needs. The intention is to reach a fusion between technological development and human beings, with the main objective of people and machines complimenting their activities, and not people being replaced by machines. The use of robots is a fundamental change for collaboration of repetitive, danger, and unsafe tasks. Furthermore, the humans work will be intellectual production, which means it will be necessary to be qualified to be proactive in this society model.

This new approach of man-machine interaction is expected to increase production and offer greater satisfaction to both the worker and the final customer, with customized products. Again, is important to emphasize that Industry 5.0 goes beyond just a production process, and looks for a Society 5.0, thought and made for people and robots integrated.

One of the great contradictions with previous generations is the model focused on people. The automation of processes, the introduction of robots and the evolution of technology allow people to develop new skills in the production process.

In this disruptive approach, in order to achieve an intelligent society education need to change from its traditional form, new tools, software and hardware are needed and must be integrated with robots, and high technological training of people for Society 5.0. A huge difference between Industry 4.0 and Society 5.0 is Industry 4.0 has robotics and other technological pillars as the center of the

industrial revolution, while in Society 5.0 technology, complements or collaborates with human's work. It is important to stand out that technological advances achieved in Industry 4.0, increase the efficiency and productivity of Society 5.0 by adding the focus on the productive process to creativity and craftsmanship of humans.

A different vision is expected, another relevant aspect in this new society is the environment as a priority and the circular economy. Also, it is important to mention that the personalization of products and services is done according to the real market requirement, in order to avoid oversupply and unsalable inventories, which happens in Industry 4.0; the main idea is to produce what the population really requires, leading to a minimum over costs and waste due to overproduction. This also reduces the CO2 emissions and the environmental impact. [5]

The vision is a society where intelligent industries, autonomous cars, intelligent cities, etc. are integrated, besides the actions against climate change is: minimize all negative issues in business world and management systems. A more supportive society, with greater cooperation between people, communities and countries, greater trust among people, minimum corruption in public management, a more equitable resources distribution can be an ideal thought; regarding to markets, the basis of the production process would be greater trust and credibility between clients and companies.

The Society 5.0 is expected to be more inclusive and environmentally friendly; and also to have a better individuality management and a simultaneous integration with the environment and the society. The general expectation is a more sustainable world where environmental, social, and economic impact issues are related and integrated. [8]

#### **5. CONCLUSION**

When we refer to digital transformations and the transformative role of digitization, we also refer to the changes they generate. Therefore, we need to analyze the technological trends that cause changes and sometimes even ruptures (disruptive effects) in various fields. There are technology companies responsible

for disruptive effects in established, mature industries, where the competitive position of some big players seemed intangible. For example, nowadays, startups or small but extremely innovative companies come up with very interesting and useful solutions in these industries dominated by economic giants.

The evolution of technology, with the changes generated over the last decades, has produced a strong disruptive effect, felt by us in any field or specific activity of our lives. Therefore, technology has had a transformative, complex, cumulative and disruptive impact at the same time. In the years after the dot.com bubble, the model of digital transformation has undergone a fantastic evolution: the Internet, with an essential role, in some areas becoming the main medium through which disruptive innovations have spread. Through the global Internet, platform-type business models have emerged that have profoundly redefined human interaction, how organizations do business and monetize social interaction, or trade various types of value.

We can say that, thanks to the Internet and emerging digital platforms, our lives have taken on new dimensions. Thus, digital platforms have redefined power relations, leading at least perceptually to participatory democracy, where every opinion or option expressed in social media has an exponential potential for spread and impact.

One of the effects that digital transformation has, therefore, is the exponential effect. For example, the ability of an artificial intelligence system to learn will be exponentially greater than that of a human being. These systems will increase the ability to make decisions, to become autonomous and to better understand contexts, at a fast pace, impossible for us humans to achieve. Predictability has become a watchword and a proposed value not only in the economic environment, but also in the social one.

Currently, we find a refocus on business or social models based on data, information and knowledge. Data has become a source of competitive advantage in almost any area of interest, representing both a reservoir that feeds smart systems and the starting point for future experiences.

Increasingly, our experiences are being augmented by technology. Mixed, virtual and augmented reality redefine entertainment, learning or shopping experiences, and even professional experiences in certain fields. All this data generated from our online or offline experiences determines future new experiences. This raises a key question: will technology expand our horizons of knowledge or narrow it, on the one hand, because of previous experiences and, on the other hand, because of the limited options we have at our disposal to make decisions.

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