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Challenges of Transforming Production Enterprises in the Transition to the 4th Industrial Revolution

János, Simon

Abstract: *The purpose of this paper is to study new forms of innovation and link them with characteristics of high-tech companies that set benchmarks for the 4th Industrial Revolution. As industry is in the phase of strong program diversification, knowing characteristics of the 4th Industrial Revolution and its global trends can serve as a decision-making tool in business decisions of a company that is just adapting to the new situation. High-tech companies are investing above and beyond in R&D, boosting innovative activity that is vital to the company's competitiveness and growth. It is important to know the business environment of high-tech companies, where a strong interdependence between the R&D and marketing functions in the company is crucial in terms of finding comprehensive development solutions and introducing new products and services to the market.*

Index Terms: *Industry 4.0, SMLC - Smart Manufacturing Leadership Coalition, IoT*

1. INTRODUCTION

According to World Economic Forum analyzes, there are several reasons why today's changes in production development are not only a continuation of the third revolution, but also of a new, fourth revolution, or of Industry 4.0 [2-3]:

- **Speed** - The changes that are happening in the industry today are as fast as they have never been in history, and are exponential in comparison with previous revolutions that can be said to have taken place linearly over time. This is the result of a fast download information from around the world, the deep connection of the whole world in the changes and the availability of new technologies.
- **Width and Depth** - Based on the digital revolution and the integration of different technological solutions, changes are happening in all walks of life, leading us to unpredictable changes not only in the

industry, but also in the economics, social arrangements, and they touch each individual.

- **Systemic Impact** - All these changes require the adaptation of the entire system, including government, corporate governance, industry and society.

As one of the most industrialized countries in Europe, Germany is a leader in setting the stage for the fourth industrial revolution. Its government has already labeled industrial change as an industrial revolution and declared these changes as crucial to the continued development of industry in the country. In 2012, the Working Group presented to the German Government the starting points and proposals for the implementation of this strategic initiative, the main objective of which is to create smart products, manufacturing processes and smart factories [1]. Industry 4.0 outside Europe is not well-liked, but a similar initiative has been launched in North America, called SMLC - Smart Manufacturing Leadership Coalition, whose main goals are to establish collaboration between companies already active in the field of smart processes, thereby increasing global competitiveness [4-7].

The Internet of Things has already launched the fourth industrial revolution by introducing data capture sensors, industrial mobile devices, and data processing software. Industry 4.0 represents a three-point advance in manufacturing [9]:

- Digitization of production, introduction of management information system, and production planning;
- Production automation, systems for capturing data from production lines, and for operating machinery;
- Automatic data exchange - by linking production sites to a complete supply chain -

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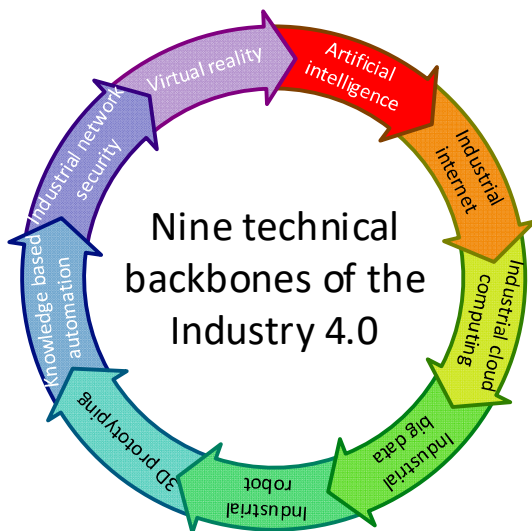


Figure 1: Technical backbones of industry 4.0.

As shown in Figure 1, today's production is based on the so-called 9-tier process control system, which is usually managed through a central information system [14]. Production efficiency in so established system can be very accurately measured using the OEE (Overall Equipment Effectiveness) criterion. The average OEE in the industry is between 60-70% and the best industrial companies have it around 85%. In the future, this structure will be replaced by a branched cyber-physical architecture of ruler systems.

The main features of Industry 4.0 according to [13] are:

- Multitasking - cyber-physical systems (workpieces-assembly sites-finished products) enable communication and communication to workers and processes in a smart factory.
- Visualization and virtual reality - A virtual copy of a smart factory is established by capturing data from real-time processes and a factory simulation model.
- Decentralization - the ability of cyber-physical systems to make their own decisions and produce locally, thanks to new technologies such as 3D printing.
- Real-time data processing - the ability to collect, analyze, and process real-time data.
- Service orientation.
- Modularity - the flexibility of deploying a smart factory to the changing process requirements, the ability to replace and expand individual modules.

Even before 2020, the fourth industrial revolution brought to us advanced robots, autonomous transportation, artificial intelligence, advanced

materials, advanced biotechnology, and more [14][12].

Smart manufacturing of the future will be organized much differently than the traditional one, the main differences are shown in Table 1. The concept of production organization according to the principles of Industry 4.0 has great potential for the industry, especially in terms of bringing production to customer needs. In smart factories, it will be possible to produce the product at the customer's request in a profitable way, even if the customer orders a single piece, especially at the expense of better connectivity of information throughout the value chain.

Table 1. Main features of traditional and smart production

| <i>Traditional production</i> | <i>Smart production</i> |
|---|--|
| A rigid information system based on individual applications that are poorly interconnected with centralized data processing. | Flexible information system based on cloud data, mobility, and unlimited data connectivity and interchangeability. |
| Strict hierarchical system of communication, both within users and externally with customers. | An open method of communication, supported by social networking, established both among internal users and externally, with customers. |
| Limited access to information through an established hierarchy and predefined rules. | Open access to information - the so-called 360° concept of access to information. |
| Production with more manual jobs, resulting in lower productivity and lower product quality. | Production with more automated jobs, resulting in higher productivity and higher product quality. |
| Business and Administrative Complex Business - The flow of information is therefore slow and under close scrutiny. | Open business with directly connected users and customers where real-time data exchange takes place. |
| Rigidly positioned machines in the production process and, therefore, less flexible processes, with higher costs and greater environmental impacts. | Flexibly positioned machines in the production process - so they are ready for change, there is less waste, resources are better utilized, and production costs are lower. |
| Longer times to market due to strict hierarchy and rules, inflexible manufacturing process, and business model. | Shorter time to market due to real-time information sharing, flexible manufacturing processes, and business model. |

2. INDUSTRY 4.0 IN SERBIA

We also started talking about Industry 4.0 in Serbia, as Smart Factories is one of the priority areas of the Smart Specialization Strategy (SPS) adopted by the Serbian government in 2015 and implemented in the current Horizon 2020 financial perspective.

Executives are struggling to develop effective strategies in today's rapidly changing markets. Leaders say they have difficulties understanding all new opportunities that technology brings, and, in some cases, they lack a strategic vision. They continue to focus on using advanced technologies to protect their positions, but they do not always dare to make bold investments to drive a cardinal change. Many top executives see the results of their technology investments, but others find it difficult to move forward. Challenges include focusing too much on short-term results and an incomplete understanding of Industry 4.0 technologies.

The breadth of the skills possession gap is more obvious to leaders, as is the awakening of awareness that current education systems will not be able to meet the challenge. Nearly twice as many leaders said their organizations would seek to train existing employees rather than seek out new ones [12].

With these findings as context, it has been found that some leaders are making better progress than others in facing challenges in society, strategy, technology and talent [10][11]:

- **Social Optimists** - Certain leaders stand out for their ability to do well if they do good things. This type of leaders believe that social initiatives are essential to their business, and their optimism about creating social impact influences their view in several ways. They are more likely to say that their workforce is ready for digital transformation and they are far more willing to train their workers. Companies with leaders who identify as social optimists are also growing more than those who have not successfully found a balance between doing good and making a profit.
- **Data-Driven Decision Makers** - Some senior executives overcome challenges by embracing data-centered methodological approaches to strategic decision making. These are people willing to capitalize on the capabilities of Industry 4.0, and their organizations already enjoy the economic benefits of embracing Industry 4.0. In the past year, nearly half of such organizations achieved annual revenue growth of 5% or

more, while only a quarter of other organizations achieved such results.

- **Leaders Making Cardinal Change** - This type of leader understands that investing in disruptive innovation sets their organizations apart from competitors. They have confidence, which gives them an edge when facing the unknowns of Industry 4.0, as more secure organizations will be better prepared to implement disruptive technologies. Organizations of these leaders typically have more defined decision-making processes and are more likely to make data-driven decisions with the help of different stakeholder groups.
- **Talent Hunters** - These executives prepare employees for digital transformation. These leaders are more likely than others to invest in employee retraining for the future of work. As they do so, talent hunters are also committed to social impact and see the early results of their progressive efforts - and 64 percent have already generated new revenue streams for their organizations through social initiatives [15-16].

As we think and forecast, leadership traits will define the future stability of organizations. Those who embody the qualities of successful leaders in senior and senior management positions, not only advance all positions below them and grow faster than their competitors, but are also visionaries in the ways in which they lead their companies into the future [9].

3. CONCLUSION

We are at the turn of the new Industrial Revolution, the fourth in a row called Industry 4.0 in Germany. The new industrial age connects the virtual digital to the real world at every step of our lives through the established exchange of real-time data via the so-called "Internet of Things". The changes that Industry 4.0 brings are a strategic opportunity for most companies to improve their competitive position in the market with an innovative product. Otherwise, the changes pose a threat to companies that will not adapt their products, along with business and manufacturing processes, to market demands.

Innovation and the management of the innovation process are key to ensuring the long-term competitiveness of enterprises, in particular for high-tech companies in the electrical manufacturing industry, such as Serbian industry. The business environment of the company has significantly expanded over the past 10 years, diversifying the program, reducing the risk posed by the high dependence on the universal engine or niche market for vacuum cleaners. Despite its mature industry, customers expect from Serbian

industry to innovate in this organization, which will ensure a long-term strategic advantage over competitors. The companies are entering new markets with innovative solutions that replace old technologies as substitutes.

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