

# STRATEGIC BUSINESS TRANSFORMATION: AN INDUSTRY 4.0 PERSPECTIVE

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**Abstract:** *The fourth industrial revolution (in which the industry and 4.0), initiated by the development of new information and communication technologies (ICT), is ongoing. All aspects of the change that will be brought by the industry 4.0 cannot be reliably observed, in addition, it is certain now that it will make significant changes in the way the company operates. By analysing the content of documents on technological trends and directions of the development of industry 4.0, we are forecasting their impact on company strategies in the new business environment. The paper aims to emphasize that a successful company strategy will be based on an innovative business model that is adapted to digital business industry 4.0.*

**Keywords:** *Industry 4.0, strategy, strategic transformation, business models, sustainable competitive advantage.*

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## 1. INTRODUCTION

The concept, which is called "Industry 4.0", was created in specific geopolitical circumstances, primarily as an attempt by the German government to mitigate the negative effects of the global economic (mortgage) crisis, but also to ensure the long-term growth of its own economy in new circumstances. The initial version of the concept was created in 2011 on a proposal from the German government that in 2014, with certain amendments received the current form and became the national strategy of industrial development of the German economy. Today, the term Industry 4.0 refers to the widely accepted concept of development, but with the focus on the development and vertical and horizontal integration of small and medium-sized technology-oriented organizations in the manufacturing sector.

Concept Industry 4.0 aims to provide a continuous and clear insight into all phases of production by applying Information and Communication Technologies, to vertically and horizontally import manufacturers, and to enable product monitoring and improvement throughout product lifecycle. Industry 4.0 is becoming a strategic industrial development initiative, which is largely based on the application of the Embedded software system as well as the development and application of products (and /or semi-products) with embedded semantic memory.

## **2. INDUSTRY 4.0: CONCEPTS, GOALS AND BASIC TECHNOLOGICAL DETERMINANTS**

Germany Trade and Invest (GTAI) defines Industry 4.0 as: “a paradigm shift, made possible by technological advances which constitute a reversal of conventional production process logic. Simply put, this means that industrial production machinery no longer simply “processes” the product, but that the product communicates with the machinery to tell it exactly what to do” (Sniderman et al. 2016). The concept of Industry 4.0 is based on the Digital Connecting and Networking of Cyber Physical Systems (CPS). It represents the basis, or ecosystem for connecting, via the Internet, things, people and services (using the same technologies as the Internet of Things-IoT, so it’s also often called Industrial IoT). As far as the basic principles from which the concept is developed, they can be grouped and displayed as:

- Interoperability;
- Virtualization;
- Decentralization;
- Modularity;
- Focus on service development;
- Ability to view information in real time.

In addition, to specifying the basic principles, it is necessary to emphasize that the concept of Industry 4.0 requires intensive mathematical operations and computer processing on multiple levels. Because of this, machine learning comes in the central focus, also because the adaptability of the infrastructure depends on the application of artificial intelligence (Bhandari et al., 2016). The adaptability of production and supply chain largely depends on artificial intelligence (Ai) and the way in which it is applied in certain segments.

## **3. BASICS AND THE MOST IMPORTANT OBJECTIVES OF THE CONCEPT**

According to Deloitte University Press, when it comes to the concept of Industry 4.0, very often there are also other terms such as Connected Enterprise, SMART Manufacturing, Smart Factory, Internet of Things for Manufacturing, all of which point to the very essence of the concept (Sniderman et al., 2016 ). The essence of the concept is based on the symbiosis of advanced production techniques and information technologies. What it means is processing of data and their exchange through the supply chain and operational technology.

This integrated system creates new ways of creating. This is why it is once again empha-

sized that “Industry 4.0 connects embedded system production technologies and smart production processes to pave the way to a new technological age that will radically transform industry, products, production value chains and business models” (Sniderman et al 2016).

This concept is considered in the context of this research from two aspects: the concept of industrial development of organizations, as well as the development strategy and transformation business. New technologies create a new business logic that will make the existing way of doing business ineffective. It is therefore said that new technologies are breaking down or destroying the existing state of things in relation to existing industrial technologies and the way they work.

The goal of exploiting the business opportunities that disruptive technology creates, which basically make up the core of the Industry 4.0 organization, is increasingly focused on the strategic level (McKinsey&Company,2016, p.2):

- Achieving the full new perspective of strategic, but also operational effectiveness;
- Conducting transformation of existing ones and creating completely new business models;
- Creating and continually improving the platform for the digital transformation of its own business with the construction of new business ecosystems with the tendency of adopting and applying new technologies as well as the global strategic initiative of high-tech development.

Taking into account all of the above, as well as by consulting the relevant literature in the above area, it is necessary to give a sublimated overview of the basic objectives of the unconceived concept as shown in Fig. 1.



**Fig. 1:** Sublimated view of the most important objectives of the concept Industry 4.0. (Sniderman, B., Mahto, M. &Cotteleer, M., 2016).

### 3.1. *More significant technologies that make up the core of the concept*

Considering that the core of the Industry 4.0 concept is composed of several advanced ICT technologies that largely initiate and enable the successful transformation of the existing business models, a brief overview of the aforementioned technologies is given. We cite shortened explanations of certain terms.

**Cyber Physical Systems (CPS)** represent an evolutionary new stage in product development in the sense that these systems represent a unique entity consisting of a physical device or system and a built-in or embedded system. CPS basically represents a product enriched and complemented by a layer of electronics with software and a sensor system that collects product data, its current state and the mode of exploitation. The system sends the collected data to the central hub where they are processed, and in form of information, present to different stakeholders.

**Manufacturing Executin Systems (MES)** is in practice a third-level system that connects business applications (software, usually ERP classifications) with real-time control and monitoring of production and production operations (Wilson, 2015). The advantages of the MES system are: lower production gaps, increased productivity, higher efficiency, complete integration. A complete business system works almost without interruption, as a single entity.

**BigData** is an analytical model for processing large amounts of data, of different formats, that is rapidly changing. Today, most of the production and maintenance of industrial products is based on analyses made on a sample that roughly represents 1% of the total production of a given industrial product. The use of the BigData model is based on the premise that in 99% of the remaining data generated by devices and products there is a hidden value that would increase the value of the product itself by discovery, collecting, grouping, aggregation and use those data. The value would increase, both in terms of technical product improvement, product quality, enhancement and in terms of framing products for one of the accompanying services, that could be offered to current customers by turning them into users. BigData transmits the focus of business focus, from product manufacturing to value delivery. (Johansson et al. 2016). One of the essential technical and operational requirements that are being set up within BigData analytics is to provide structured data so that different users of systems with different roles can make a meaningful use.

**Digital twin.** Almost all industrial products today start their lives as digital (they are designed and manufactured by some CAD /CAM system) and only after the production phase they become physical products (Heppelmann, 2015). The idea of a digital twin is based on the automatic collection of data from the physical environment and their overlap with data from the digital world, in order to keep the product in motion throughout its lifecycle. The digital twin opens new opportunities for lifelong product management, such as those for further product development, its preventive maintenance, the provision of product-related services, and optimum product exploitation in terms of achieving maximum economic and technical benefits while meeting the requirements of sustainable development. The digital twin is based on (Mukkamala, 2016):

- A mathematical model (virtualization model for a particular product, the model on which the virtual avatar is based);
- Physical model (equations and relations describing the physical object that were

- used in product design));
- Data and analytics (statistical models and data analytics used to monitor product exploitation and manage product maintenance and improvements); Real data coming from the device.

Digital twins allow shorter time to arrive at important information - BigData technologies can aggregate and process data from different digital twin copies and get more reliable reports, which suggests that trends are more quickly noticed.

#### **4. STRATEGIC TRANSFORMATION OF THE CONCEPT OF NEW INDUSTRIAL PRODUCTION**

The transformational impact of ICT we can see on the creation of so far non-existent habits and consumer needs and on the creation of entirely new market segments which creates a special need to change the strategic paradigm of the organization to adequately respond to modern business challenges (Ilić, Marković & Ivannikov, 2017. pp. 57-70). According to the President of the German Academy of Sciences Professor Henning Kagermann, the main goal of Industry 4.0 as a concept is to achieve the strategic advantage of “mass customization”, ie through a higher degree of production of products tailored to the individual needs of customers, but at the cost of mass production (Kagermann, 2015).

The above concept is based primarily on the collection of data obtained from the production machines, but also the product itself, which serve as the basis for creating additional value delivered to the customer or client. For the purposes of “mass customization” it is necessary to change the production process, so production information is no longer only present on machine tools, but on internal transporters that transport parts during production and who knows what next operation and which machine should be implemented.

The idea is that all production lines are plug and play type and that the equipment is composed of standard building blocks at the level of the device itself. Industry 4.0 implies the virtualization of production machines in order to optimize the process over virtual copies of machines from the real world. Furthermore, Industry 4.0 must meet the digital continuity condition that must exist between design, production and digital model, preferably on a single platform, because only in this way can all product data be available to all interested parties and be used within separate technical and technological systems that must cooperate with each other (Szigeti, 2015).

The influence of this concept on the transformation of the product itself is radical and “it”, according to which the product within the concept of Insure 4.0 differs in relation to the traditional way of production is the fact that the product itself is also a container with information. Semantic memory is added to each product during production and constantly updating with new information that can be used as a service log of an individual product. The information collected in this way can later be used for maintenance, checking of the load and harmonization of working and exploitation characteristics as well as for predictive maintenance in order to reduce periods when the product is not in function.

The concept of product with memory is critical to the success of the Industry 4.0 strategy (Mantle, 2014). Thanks to this concept, it is possible to monitor the product throughout the production plant during its formation, but also later throughout its lifetime by collecting

a critical amount of data necessary for the implementation of various analyses necessary for constant improvement of the product, but also for making optimal strategic and operational decisions.

A sublimed view of the potential transformational impact that the Industry 4.0 concept can have on modifying existing and creating new products is that in the following figure 2:

Product impact	Potential IT/OT applications
<b>Making already existing products smarter</b>	Add sensors and connectivity to improve product performance or safety; enable connections to mobile applications to improve the user experience; add advanced materials to existing products to improve performance
<b>Offering the data generated from smart technologies as a product or service</b>	Offer access to data and metadata generated through existing business operations; build and sell a platform on which to manage data from connected products/enterprises; develop tailored data bundles for individual end users
<b>Developing completely new products and services</b>	Develop cost-effective mass customization; enable new and hybrid product innovations through advanced manufacturing technologies; create new service formats and business models

**Fig. 2:** Potential transformational impact of the Industry 4.0 concept on modifying existing and creating new products (Sniderman, B., Mahto, M. &Cotteleer, M., 2016).

All of the above mentioned drastically influences to the delivery of higher value to consumers, through the development of a smart manufacturing process and smart products which, with the creation and implementation of a new business model, will represent the backbone of achieving a sustainable competitive advantage in the coming years.

## 5. STRATEGIC TRANSFORMATION AND A NEW BUSINESS MODEL

According to the group of authors (Stefanovic, Milosevic, 2012), the strategy is one of the pattern or models by which the business model is transformed. The business model is a combination of functional strategies from which the operational processes of realization are further developed.

For most of the business transformation of business models and redesign of business processes ICT has initiated transformation. This particularly applies to technologies that form the core of the Industry 4.0 concept, and in particular one technology platform that can be called “ubiquity computing”. In this sense ubiquity is a feature of the larger system that represents the capability that all minor system ie nodes can communicate each other smoothly and in real time without any restrictions, ie processing data and information in any nodes of a system according to needs. This practically means that all products, manufacturers, service users, subcontractors, workers and semi-products, and even the materials from which the products are made already have an embedded communication capability and that it is continuously taking place. At the level of production facilities and factories, this was possible until now, but it was limited to remote control and control of the correctness of machines and processes.

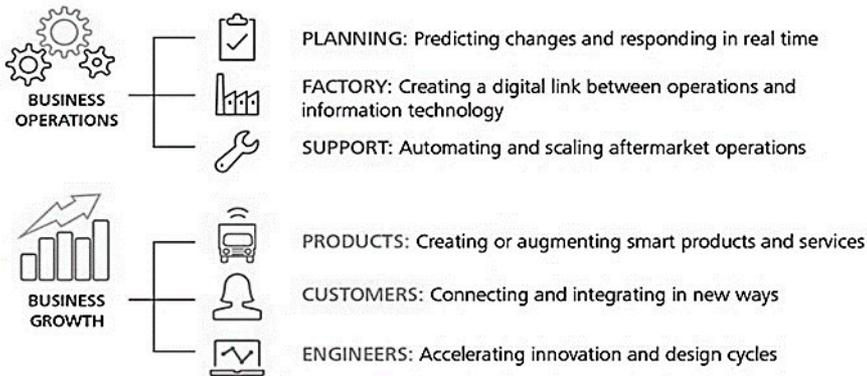
Today, thanks to the built-in communication layer and logic, the products themselves

can communicate both with machines that produce them and with a central data pool with which all other stakeholders are also connected. Since all nodes communicate with unique hub, which is also a product data repository, it is possible to use the data in new ways and even share it with the end-users of the product, thereby building brand confidence, enhancing product quality with the tendency of achieving a sustainable competitive advantage.

The mentioned technologies on which the Industry 4.0 concept are currently being realized, in future will have an even greater impact as an accelerator of changes in the business environment, primarily in the following segments:

- Reducing the time required for Return on Investment (ROI);
- Create more values in as short a time interval as possible;
- Moving from a producer to the paradigm of a service provider that delivers a new value to its users (the user buys a solution rather than a product);
- Transformation and shift of focus from products and physical systems to creating new services based on products that we have been offering on the market by the specific moment (Xu, 2015).

From a strategic point of view, the transformational impact of the above concept Industry 4.0 can be viewed through the prism of business operations and through the prism of business growth, as shown in Figure 3.

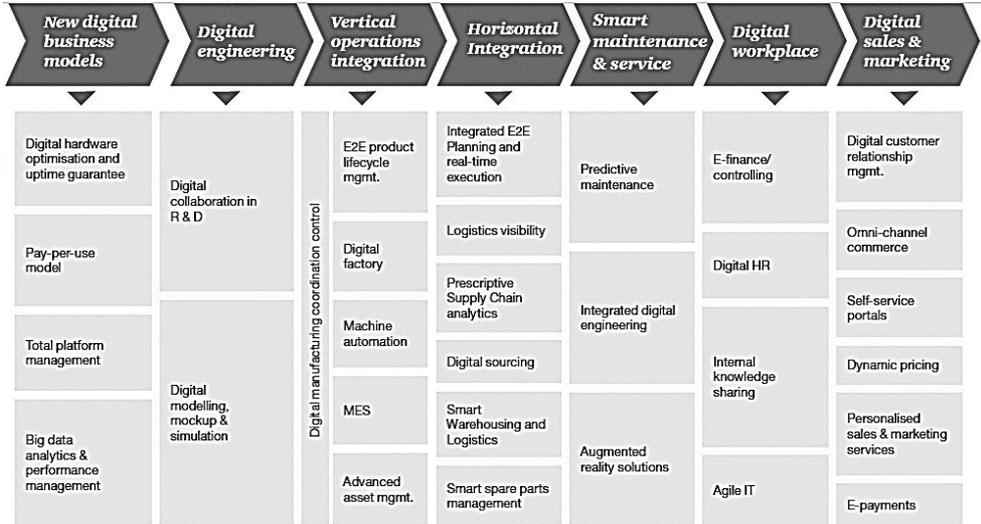


**Fig. 3:** Industry 4.0 transformation plays (Sniderman, B., Mahto M. & Cotteleer, M., 2016).

Observed from the strategic aspect of the concept Industry 4.0 initiates technological and organizational changes, but also initiates a transformation of the way to generate profits. For example, in the early stages of the implementation of the concept, the largest part of the profit in the manufacturing sector is generated from hardware-based production dominated by physical products, while after a reserved period after the implementation of the concept, and especially by introducing appropriate technologies, an ever-increasing profit is generated on software-based products ie services that were originally based on physical products. The introduction of the aforementioned ICT technologies in the production, but also in the total business of organizations, are also transforming processes in manufacturing value chains (Porter, Heppelmann, 2015, pp.5-6).

The above mentioned new business model and full vertical and horizontal operational value chains basically represent a holistic approach to the organization that connects, business model, processes and ICT.

Based on the impact of the Industry 4.0 concept and the greater use of ICT, there is a transformation of business models and value chains as shown in Figure 4.



**Fig. 4:** New business model & full vertical and horizontal operational value chains (PWC, 2016a, page 29).

In addition, it is necessary to further emphasize that the results of the research conducted by Reinhard Geissbauer with associates and the patronage of the PWC unambiguously indicate that the “Platform Model” is the service within which services, data, information and products can be exchanged and accessible in a predefined way. In addition, products and their digital twins communicate with users via the platform, represent the most reliable business model (Baur, Wee, 2015, p.4). Also, the results of this research indicate that the organization that has adopted and owns the Platforma model de facto owns both, the buyer and /or the user (Geissbauer, Vedsø, Schrauf, 2016, p.9).

The main problem of developing their own platform for most companies is high development costs and necessary competencies. It is precisely the cost of developing your own platform and the lack of competencies that condition industrial companies to choose to adapt to already existing platforms dominated by Google, Amazon, Apple and Microsoft. The basic barriers that need to be overcome in the above, but also in different versions of business models based on Industry 4.0, relating to:

- The level of data quality that is obtained from the sensor,
- On privacy and data security,
- Data collection and processing costs (PWC, 2016, p.5).

From the point of view of the change of the business model brought about by the concept of industry 4.0, it should be emphasized that the concept has a particularly great importance on the value chains. By looking into the business model, it becomes clear that the

integrated value chain does not imply a single manufacturer, but a much larger composite cooperative entity that we can describe as a “virtual company”. This common business entity that is presented to the buyer /user as a manufacturer, and which in reality can represent a number of independent or partially dependent legal entities and business entities, practically compresses the business environment at the single point of the communication buyer /user - manufacturer /service provider.

Changes regarding the possibilities of insight through the entire value chains will inevitably lead to the transformation of the relationship between the producer and the cooperative, especially thanks to the option of simultaneous insight into orders, which is an excellent platform for proactive adaptation to the new needs (Horus, 2015). The existence of a virtual organization that is presented as a production entity is a completely new business model that is increasingly encountered in business practice and is initiated by the concept of Industry 4.0.

## 6. CONCLUSION

„Those who are the last to go through the application of the concept Industry 4.0 and through the digitization of all business processes will be the first to die, that is, they will be the first to disappear from the business scene” (Zuhlke, 2016). This conclusion points to an unequivocal conclusion that can be drawn from the analysis carried out in the paper, which refers to the necessity of applying the concept called Industry 4.0. The concept positively influences the improvement of production efficiency, positively influences the raising of the level of adjustment of production and products, but also initiates the strategic transformation of organizations. This concept also positively influences the creation and implementation of new business models based on a higher degree of horizontal and vertical integration.

The conclusion of the world’s largest global survey, conducted by PWC in 2016 on the Industry 4.0 concept, is: at the end of the transformation process, successful industrial companies will become true digital enterprises, with physical products at the core, augmented by digital interfaces and data-based innovative services. These digital enterprises will work together with customers and suppliers in industrial ecosystem” (PWS, 2016a, p.4).

A significant number of authors and studies in the above area also suggest that organizations that do not adopt the concept or organizations that do not strategically transform and create or adopt new business models will not be able to reach the desired level of sustainable competitive advantage in the new (digital) economy.

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