International Journal of Industrial Engineering and Management (IJIEM), Vol. 8 No 1, 2017, pp. 21-30
Available online at www.iim.ftn.uns.ac.rs/ijiem_journal.php
ISSN 2217-2661

UDK: 005.1 658.5

From Concept to the Introduction of Industry 4.0

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Received (26.11.2016.); Revised (08.02.2017.); Accepted (02.03.2017.)

Abstract

Industry 4.0 is very popular topic today because of its big influence on manufacturing. Industry 4.0 is focused on creating "smart" environment within production system. Several priority areas of action, in order to get closer to the state of Industry 4.0. are shown. There are also the most important changes, that will occur in the manufacturing operations and information technology. Some leading manufacturers of technology for Industry 4.0 are presented. Many papers explore new business concepts and strategies for adaption to new industrial revolution. This paper provides an overview of several concepts and strategies. Different strategies and concepts selected from literature are compared in order to detect the areas that are not covered.

Key words: *business concept, Industry 4.0, new business model, smart factory, smart product*

1. INTRODUCTION

Today very topical issue among the major competitors in the global industry is titled Industry 4.0. According to all indications (developing machines, computer software, robotics, etc.) global business networks will soon appear. They will unite their "smart" machines, storage systems and manufacturing facilities in the form of cyber-physical production system (CPS). Such production system will autonomously exchange information, initiate activities and independently perform control. The fourth industrial revolution is based on the concept of smart factory. Smart factories have completely new approach to the production, as shown in Figure 1. Smart products can always be identified and located. Their history, current state and future activities that are necessary to get the final look are known anytime. Well prepared database is very important because it is necessary to filter the required reports in order to receive timely and useful information. Advantages of the virtual world are used because virtual world provides the simulation of different cases. Optimization of products, processes and the entire supply chain are continuously improved. In order to successfully close the circuit shown in Figure 1. there are trusted-cloud based networks (Cloud technology).

Cloud technology provides "smart" data centres, services and applications so users (companies) can achieve lower costs and operational efficiency. The new approach allows production according to the individual customer requirements. Today many companies have moved away from mass production to mass customization production. The main goal is to have a production system that can resist any dynamic business processes. Such system must be characterized by flexibility, so it can respond to disruptions of various origins.

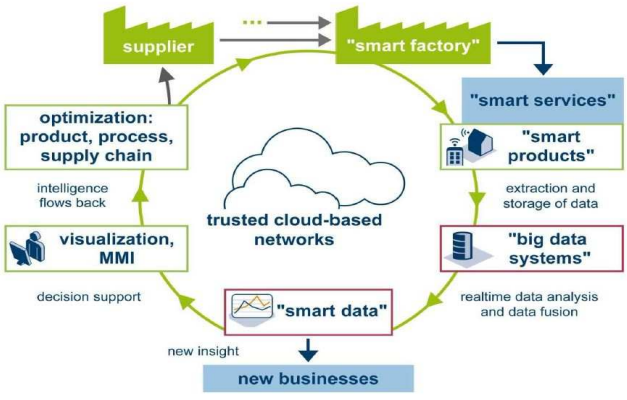

Figure 1. Concept of Smart factory [1]

Features of Industry 4.0 are horizontal, vertical and digital integration of the entire system. Key areas are standardization (so companies will easily connect to each other), the management of complex systems (it is necessary to develop and apply new models and methods), a comprehensive infrastructure (high-quality information network, Internet connection), security and privacy (data protection), work organization and design (the roles of the employees are changed, they are more involved, progress is better and there is life-long learning), legal framework (harmonization of legal frameworks) and the effective use of resources (potential savings of raw materials and energy). It is important that managers at companies understand the industry 4.0 and how it looks in reality. By finding an appropriate model, with strong support of development, a vision and path to Industry 4.0, which is specific to a plant, can be created. The idea of Industry 4.0 should be linked to specific areas of concern of certain factories. It is necessary to find areas of activities and make a step further towards the Industry 4.0. Potential problem could be the priority areas of action. The introduction and use of new technologies does not mean certain way to Industry 4.0, because it would be a very narrow approach. The system will not function properly if there is advanced technology and outdated organization. This paper presents several business models and possible strategies to improve the production systems, there are also guidelines for future research.

2. VISION OF THE FOURTH INDUSTRIAL REVOLUTION

Industry 4.0 is focused on creating intelligent products, processes and procedures. In the smart factory workers, machines and resources communicate easily. Essence of the industry vision 4.0 is in the Internet of things and Internet of services (Figure 2.), which means the ubiquitous connectivity of people, things and machines [1]. Products, transportation equipment and tools "cooperate" in order to create better each following production step. That way leads to the connectivity of virtual world and physical objects in real world.

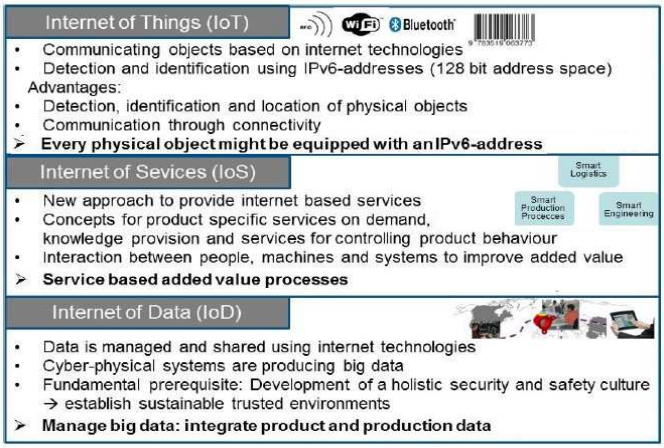

Figure 2. Internet of things, Internet of services, Internet of data [4]

Smart products have all information about them. "They know" time of their production, production conditions, where is their stock, delivery time, and other important information. They have interface with smart mobility, logistics and networks. Their interface is an essential part of new smart infrastructure that includes CPS, Figure 3. Industry 4.0 can't be observed "in isolation", it must be observed as number of areas where actions are needed to create the conditions typical for Industry 4.0. Industry 4.0 should be applied interdisciplinary (closely link different areas).

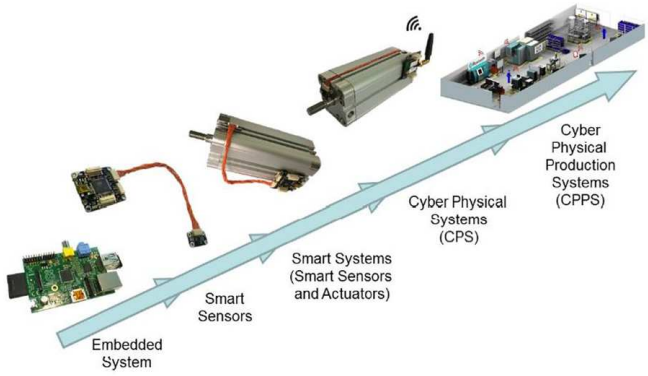

Figure 3. CPS - Cyber-Physical Systems [4]

Approaches characteristic for Industry 4.0 are horizontal integration, vertical integration and integrated digital engineering. New approaches result with new business models.

Horizontal integration refers to the integration of different information systems that are used in the phases of production planning and business processes. That systems include the exchange of materials, energy and information within the company (such as internal logistics, production, marketing) or among different companies. The aim of this integration is delivered information across the whole network (from the supplier to the customer). Presented integration is very helpful to suppliers, they are always informed on time about the state of stock, so they can better plan and organize future delivery. Today, customers should contact the manufacturer to find out current state of their products, horizontal integration will enable the customer to monitor his product (computer will present completed tasks, but precondition is "smart product" that knows everything about itself). If problem occurs, the customer can immediately intervene and decide about way of solving problem.

Vertical integration means integration of information systems at different hierarchical levels, all in order to exchange information from the bottom to the top of the hierarchy and vice versa. By linking all processes and using sensors in every step of production, manufacturers check the quality and reduce waste. Continuously exchange of information through a hierarchy allows the responsible employees preventive action when potential problem is detected. Machines are connected to a communication network and they have anytime information. Their role is to inform operator about state of process.

Full digital engineering enables the collection and exchange of product data throughout the entire chain involved in the development of products. It reduces the conversion of large number product data that have accumulated throughout its life cycle. This approach can reduce time of production for future products because there is already ready documentation for production. Previous data are used, for example documentation of product design, production planning or simulation, to create faster new documentation. Along with this, decentralized intelligence and decentralized management are very important. Decentralized intelligence is related to the Internet of things and services and smart products, Figure 2. Decentralized control is possible by using new cyber-physical systems and information and communication technology.

Table 1. Review of approaches characteristic for Industry 4.0

Paper or company / Approach for Industry 4.0	Kagermann[1]	Mourtzis [2]	Anderl [4]	Roland	Bosch [7]	McKinsey [8]	Merz [15]	May [16]	Scheer [17]	Obermaier [19]
Horizontal integration	+	+	+	+	+	+	+	-	-	-
Vertical integration	+	+	+	+	+	+	+	-	-	-
IoT, IoS, IoD Cloud computing	+	+	+	+	+	+	+	-	+	+
Cyber-Physical Systems	+	+	+	+	+	+	+	-	+	+
New business models	+	+	-	+	-	+	+	+	+	+
Flexible production	+	+	-	+	+	+	+	-	-	+
Cluster concept	-	+	-	+	+	+	-	-	-	-

For successfully applied requirements of Industry 4.0 production will be possible at affordable price. It will be very flexible production with higher productivity and less resources. Finding the preconditions for introduction of the fourth industrial revolution is a key challenge. Preconditions depend on the current state of certain manufacturing companies that aspire to progress. If their conditions significantly deviate from the vision of the fourth industrial revolution, then there will be many conditions. If they fulfil the conditions, it will be a revolution process. Those companies that have their status near the fourth industrial revolution will move into the fourth industrial revolution with few fulfilled conditions they were missing. That process is called evolution.

The research results where two hundred and seventy-eight companies (that produce machines and plants) were tested show their greatest challenges during the introduction of Industry 4.0 [1], Figure 4. Companies indicate standardization as a most important precondition. Standardized systems, platforms, processes, interfaces make a crucial infrastructure for easier implementation of Industry 4.0 [6].

Figure 4. Preconditions for introduction of Industry 4.0 obtained according to a survey of companies engaged in the production of machines and plants [1]

The high level of cooperation and "openness" between the companies is crucial [7]. It is necessary to create new business model and make analysis of the cost and risk of introducing new model. It is important to have a professional staff that will be able to continue research related to the Industry 4.0. Only implementation is not sufficient, further research is required.

2.1 **Eight priority areas for action**

Separation of areas of activity is one of the best approaches at the beginning. But separation only in terms of easy understanding the area of activity, while the process of implementing Industry 4.0 will gradually connect all areas. Eight priority areas for action [8], shown with Figure 5.:

1. Resources and process - Process improvement through efficient use of materials, increase the speed of value creation (for example, by reducing the cost of materials). An example of improving the cement production, where the computer system is introduced for controlling, stabilizing and optimizing the production process.
2. The use of property - Maximum use of machines that are in production. What is especially pronounced in industries that use expensive machines, every minute when machine does not produce causes loss. All machines should be maintenance preventive because it is the only way to prevent unplanned stop of machines. For example, GE offers software solutions for preventive maintenance, where collects data about the status of machine using a variety of sensors and enabling timely correction with minimal costs [9].
3. Operation - In this area of action is necessary to increase the speed of the operations by creating a working environment favourable to workers. In order to reduce waiting times and stoppages, it is necessary to reduce the complexity of tasks, break them into multiple tasks, make a prototype so workers will become more

familiar with tasks. Robots can help workers in production, they need to do difficult tasks. For example, lifting heavy plate on a laser cutting machine. Universal robots are today on the market. They work together with workers in production. There is no risk of injury because when worker is close, robot slows his actions. The company Etalex works with sheets and achieves savings in the work with the help of universal robot [10].
4. Inventories - It is necessary to reduce the excessive (and unnecessary) material procurement and production for unknown buyers. For example, Wurth company offers solutions for storage. It is box that contains camera to signal the state of the components in box [11].
5. Quality - The unstable processes in production cause poor quality products and lead to increased costs. With the help of advanced process control it is possible react on time and correct the process, in order to minimize bad products.
6. Supply and demand - only a good understanding of customer needs can lead to good quality and customer satisfaction. Advanced analysis can lead to the approximate estimate of demand by 85% on a weekly basis [8]. For example, the company Renault offers configurator for each type of car [12].
7. Time to market – Reaching the desired market with a new product, earlier than other, creates an advantage, increases profits and allows earlier response to the potential problems.
8. Service and maintenance - Today in this area is great potential, offering customers various solutions of "remote" maintenance is big advantage. The company Secomea offers software solutions which can be a safe and stable link with industrial machines and condition of machines can be determined without staying physically next to them [13].

Figure 5. Eight priority areas for action [8]

2.2 **The changes that will occur by applying Industry 4.0**

The changes are focused on the life cycle of a product, instead of focusing on the production process. On the foundations of lean production, company can build smart production. In smart production leader will make decisions according to the information, not just according to the experience. The most important changes that will occur in the manufacturing operations are shown in Figure 6.

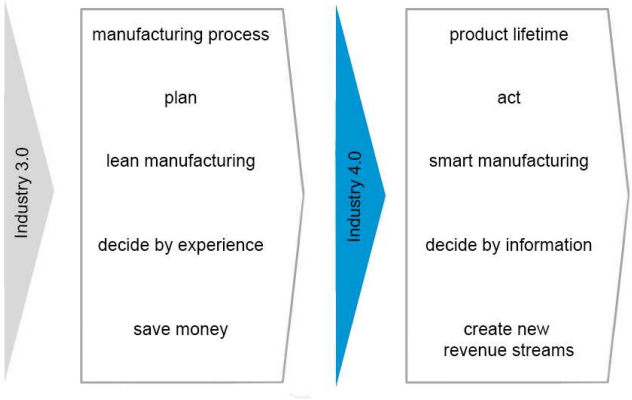

Figure 6. The most important changes in production operations [14]

The most important changes in the information technology are shown in Figure 7. The information system has previously been linked to the process, but now is linked to the product. Unique packages are changing to integrated systems that connect all the information. Simple information systems are changing to the smart platform. Instead of deciding on basis of events that have already passed, decision making is based on the information. Cooperation and communication are carried out through the infrastructure rather than through defined communication channels.

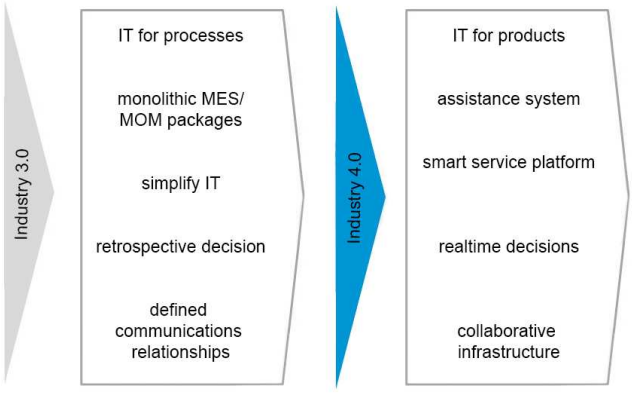

Figure 7. The most important changes in the information technology [14]

3. ANALYSIS OF NEW BUSINESS MODELS

New innovative business models are being developed along with the fourth industrial revolution. Various authors have concepts of innovation and strategic maps

at the beginning of creating business models. In the first prediction phase a common vision is created. Customers, employees, managers and business partners participate in the preparation of vision. During the creation process it is important to understand customer needs and define specific objectives. Guidelines are produced in the second phase in care of identifying internal and external factors that affect the fulfilment of the objectives. When concrete business model is created, starts third phase. In the third phase transformation is prepared so new model could be applied. Multiple models are preferred because evaluation will show the best variant, Figure 8.

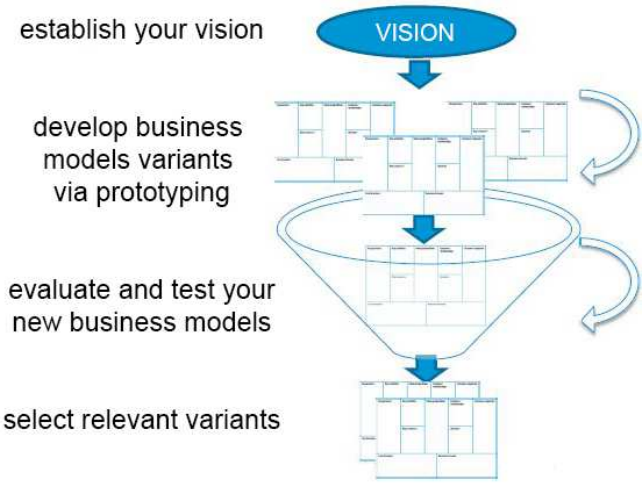

Figure 8. Evaluation of business models [14]

Below are presented several strategies for implementation of Industry 4.0.
The procedure for introduction of Industry 4.0, according to the author Merz [15], occurs at three levels:

1. Strategic level – Two steps are at strategic level. First step refers to the five paradigms of Industry 4.0, and second step on the 3C model, Figure 9. New paradigms are explained in the second chapter. Model 3C is a central component of a strategy. Competitive role of companies in relation to the Industry 4.0 opens the question of whether the enterprise is pioneer, imitator or subcontractor, or it has its own market niche.

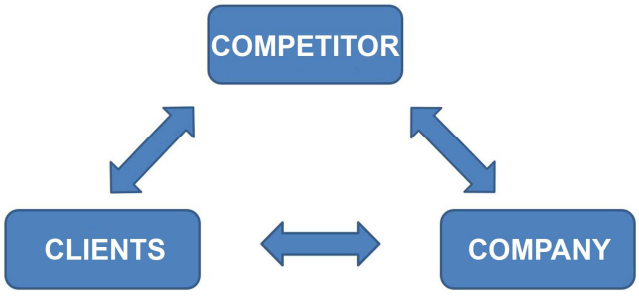

Figure 9. New Paradigms Industry 4.0 and 3C model [15]

Very important point in Model 3C is connection with customers, shown in Table 2., where are presented examples of possible design for each connection with customer. Focus is on areas of product quality, functionality, price, delivery, development time and flexibility. Production has changed from mass production to mass customization. Mass customization is a strategy that is focused on personalized products especially trough flexible processes.

Table 2. Connection with customers in 3C model [15]

connection with customers	examples of possible design
product quality	• acceptable quality (in combination with an affordable price) • best quality (in combination with the price according to value)
product functionality	• unique function • new functions • improved functions
product price	• high price (for snobs) • low price • price according to value
product delivery	• exact delivery
optimization of product delivery	• delivery time (the next day) • delivery less than 3 weeks
arrival on the market (product development time)	• product developement time less than 1 month • product developement time more than half year
individual product	• standard product • variations of production • individual production (Mass Customization)
hybrid products	• combination od product service
flexibility to change quantities	• Possible small quantity orders • Possible large quantities

2. Tactical level - is the positioning of the company with its strategy of Industry 4.0 according to the technology that is applied but needs adaptation, shown on Figure 10.

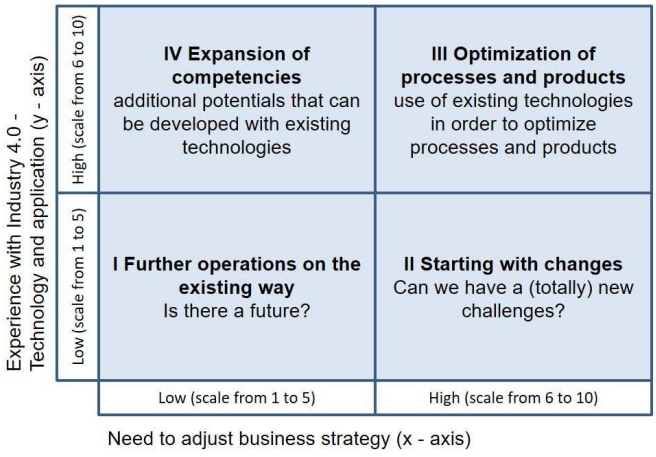

Figure 10. Positioning of the company according to its strategy of Industry 4.0 [15]

3. Operational level - This level leads to an overall introduction and implementation of Industry 4.0, shown in Figure 11. There are shown 5 levels for implementation of Industry 4.0 and need for define goals.

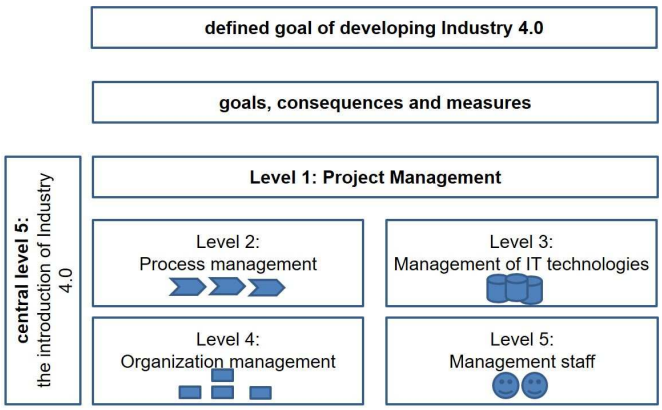

Figure 11. The levels of execution and implementation of the Industry 4.0 [15]

May [16] has created reference Model 4.0 for achieving operational excellence. Model 4.0 describes concrete steps to achieve the objective and is shown in Figure 12. Capable and related management of the company, long-term planning, work to achieve the goals, management that is oriented towards the values and iterative - PDCA cycle (Plan, Do, Check, Act) are base of model. Iterative part refers to the scientific approach to improvement. Plan - means make a hypothesis, Do - means execution of experiments, Check – is related to the evaluation and verification of results and Act - means improve the experiment, in order to repeat the experiment [16].

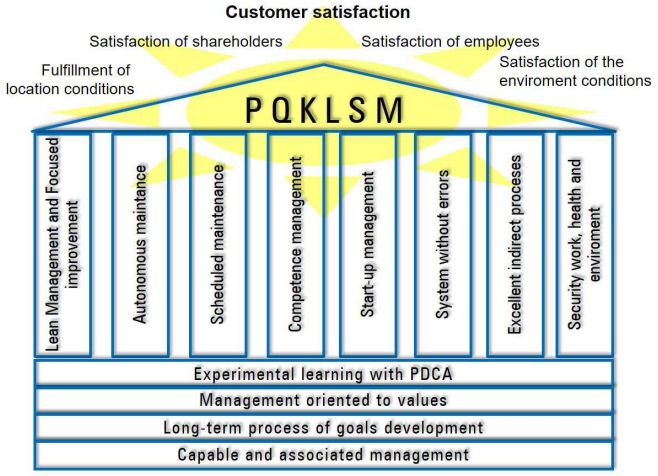

Figure 12. Reference Model 4.0 for achieving operational excellence (OPEX) [16]

Below are seven steps to introduce Reference Model 4.0 for achieving operational excellence:
1. Understanding the current situation - analysis of maturity models, analysis of values stream, analysis of development of order process, analysis of the structure of eight types of losses.
2. Basis of operational excellence - vision, mission, system goals, development of models, an increase of top management.
3. Responsibility and rules for communication - establishment of the control circuit and definition of roles and responsibilities.
4. Process planning and implementation - development plan of introduction, adoption of detailed planning for the next 9 months.
5. The commitment of all employees - the inclusion of all employees in the process of achieving operational excellence.
6. The use of methods and tools - increasing skill of workers according to the detailed plan.
7. A complete application of models - the continuous further development of the system and controlling of process.

Scheer [17] looks at major changes that will happen to the Industry 4.0 through Y-model. Graphical symbols within the Y-model show the operational drivers of Industry 4.0 and relevant technology are displayed in boxes outside the Y-model, Figure 13.

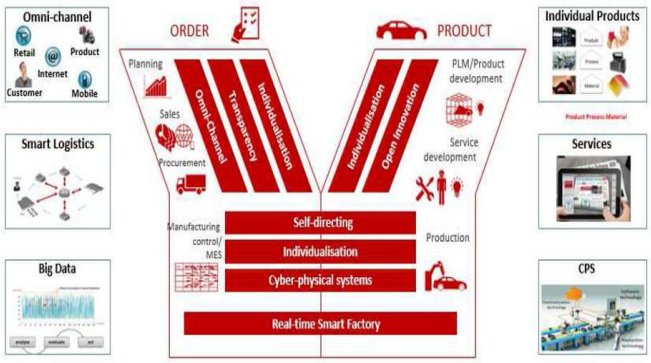

Figure 13. Y-model for Industry 4.0 [17]

There are three starting points: the smart factory, product and logistics. Top left part of Y-model shows business processes and right part shows processes required to produce the desired product. CPS system and RIFD technology are support for smart factory. Product lifecycle management has important role, monitoring of products during the lifetime, as well as maintenance of the product. BOO (Eng. Build, Own, Operate) concept represents the transition from manufacturer to complete provider. The manufacturer knows best product and analysing data collected during the lifecycle of their products, they know how to optimize the operation of the product according specific conditions. New business strategies, shown on Figure 14., are already implemented in practice.

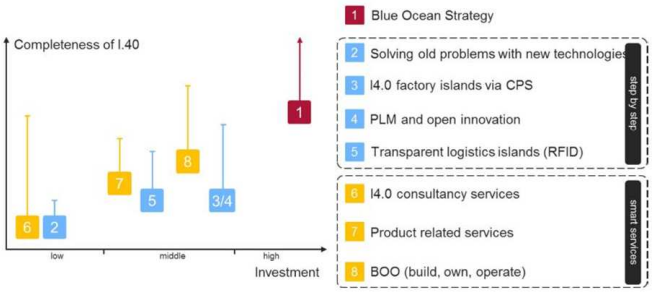

Figure 14. Strategy implementation [17]

X-axis is required deposit (low, medium and high), depending on the degree of complexity and effort that is

required to invest inside given time. Y-axis is realized scope of strategy. Vertical lines show the starting point and potential strategies. Blue Ocean Strategy is based on the creation of a new unknown market space. Companies should not focus on the competition, but to create new market space, because there will be opportunities for growth and earnings [18]. This strategy is in Figure 14. as number one because it is characterized by high capital and high level of implementation of Industry 4.0. The second part refers to the concepts called Step by Step. That is characteristic of German companies. Strategy number two refers to the step where problems are solved by using new technologies (3D scanners, boxes with sensors and cameras, RIFD technology, etc.). Strategy number three refers to the workstations represented with "islands" that are connected by Internet network. RIFD technology controls material. This strategy enables real-time manufacturing. Strategy number four is characterized with lifecycle management where data collection and analysis are most important. This leads to a complete flexibility in product design and opens the door to new business models. The fifth strategy involves a complete reorganization of the supply chain and involvement of customers and suppliers in production process. The third part is called smart services. It includes consulting services (number six), all services related to the product (number seven) and concept of BOO (number eight).

According to the author Obermaier [19] business model can be described with two basic elements, how to create value for the customer and how to create profits for the company. Innovations are very important for company. For customer service and maintenance is very important and that part brings more profit for company. An example is the company General Electric, which sells its products and offers for them service and maintenance. The business and operational models today and earlier are shown in Figure 15.

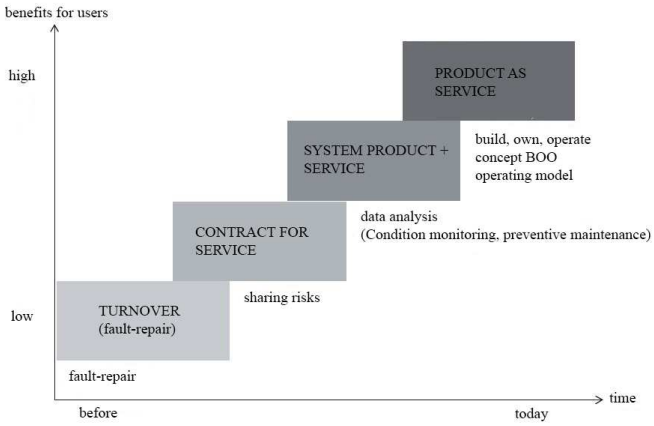

Figure 15. Business and operating models [19]

3.1 **Comparison of business models**

All these models have very similar foundations of Industry 4.0, as shown in the Table 1. The authors have different views on the new business models. Table 3. shows the differences and similarities between models in individual areas that are important for the company. Differences between models occur because each of them deals with specific areas, author Merz [15] affects most areas. She looks at three levels: strategic, tactical and operational. Models of other authors can be incorporated at certain level. For example, at the operational level [15] can be included Model 4.0 [16] to achieve operational excellence.

Table 3. Differences in approaches for new business models

	Merz [15]	May [16]	Scheer [17]	Obermaier [19]
company	important is the size and financing strategy, 3C model	-	Y-model as support	way to create profit is important
employees	payment methods, bonuses, education	training, advanced education methods, analysis of competences	-	-
customer	connection through the quality, price, functionality	-	customer involvement in the production process	way - how to create value for the customer is important
competitors / market	question of whether the enterprise is pioneer, imitator or subcontractor, or it has its own market niche	-	orientation to new or unfamiliar markets, and not to competitors	cooperation with competitors because it results with benefit for all stakeholders
technology	observes additional potentials with existing technology and optimization	planned maintenance, an optimal working conditions, control	use of new technology (especially 3D scanning, printing, boxes with cameras)	can support innovation
product	adapted to the customer, possible change of design	data collection, elimination of errors in quality	PLM, product development, flexibility in production, individual product	the most important is product innovation
services	a combination of product-service, hybridity products	-	development of services and the concept BOO	service innovation is important as the product innovation
target of development	defined objective at the operational level	define goals for certain "pillars"	step by step mode	-
management	with projects, processes, IT, organization, resources	related and oriented towards value	-	-
maintenance	-	check lists, plans, analysis, optimization	concept BOO	through concept BOO
logistics	input, output	-	enables changes during the production	-

There are different strategies but company needs to choose strategies according to the investment opportunities [17]. Regardless of the selected implementation strategy, still remains important to connect with customers [15]. Author Obermaier [19] puts an emphasis on product innovation, but also on the process innovation. Concept BOO which refers to those who want to move from the manufacturer to complete provider is presented as characteristic of Industry 4.0 [17,19]. Important to emphasize is that models complement each other, neither one of them included completely all areas. What remains unexplored in these models is the measurability in the areas, in order to faithfully display the results of progress in each area separately, and a summary. Measurability is possible through the collection of data by areas, it requires good software, but also patient and prudent analysis of the data collected.

Tables 4. and 5. show the strengths and weaknesses of those models from customer and company perspective.

It is evident that there are risks for some areas of activity. First is necessary to determine current state, then set own goals and determine strategies according to goals.

Table 4. Strengths and weaknesses of models from customer perspective

MODEL	CHARACTERISTICS	CUSTOMER PERSPECTIVE	
		STRENGTH	WEAKNESS
3C model [15]	company with a competitive role, connection with customers, financing strategy	connection with customers through quality, functionality, low cost, delivery reliability, individual products, hybridity (product-services) and flexibility	possibility to realize new products with existing technologies, possibility to achieve a well-optimized processes and products
Model 4.0 [16]	company management forms the basis of the model and carries the "pillars" to achieve the desired objective, PDCA cycle, competence management, Makigami [20]	efforts in achieving the system without errors, which affects the quality of the product and that is important to the customer	issue of sustainability of the system without error
Y model [17]	three starting points: smart factory, product and logistics, PLM, concept BOO and attractiveness of unknown new market space	individual products, changes are possible until product is not on the work station, focus is on service	price of individual product
Business and operating models [19]	creating customer value and creating value for company, innovations and services	product is monitored throughout the life cycle, maintaince and servicing, spare parts	risk of the products that will require frequent intervention

Table 5. Strengths and weaknesses of models from company perspective

MODEL	CHARACTERISTICS	COMPANY PERSPECTIVE	
		STRENGTH	WEAKNESS
3C model [15]	company with a competitive role, connection with customers, financing strategy	use of new paradigm brings benefits to companies (such as savings [8]), a well-placed infrastructure and high level of overall implementation of Industry 4.0, education for employees	determining state of the company compared to companies that have characteristics of Industry 4.0, furthermore is necessary to find way toward Industry 4.0
Model 4.0 [16]	company management forms the basis of the model and carries the "pillars" to achieve the desired objective, PDCA cycle, competence management, Makigami [20]	continuous improvement and development, much focus on the maintenance and analysis systems, training and education of employees, system without errors, safety work, health and environment	good understanding of the current state, making the applicable guidelines, risk evaluation, collection and proper analysis of data
Y model [17]	three starting points: smart factory, product and logistics, PLM, concept BOO and attractiveness of unknown new market space	use of CPS system, RIFD technology and other new technologies, monitoring life cycle of product, its maintenance, product data analysis and profit from servicing parts, step by step strategy	Blue ocean strategy requires a focus on the new market space and not on the competition, which brings certain risks
Business and operating models [19]	creating customer value and creating value for company, innovations and services	create profit with help of BOO concept, data collection for the purpose of analysis, in order to obtain useful information for preventive maintenance	risks of frequent interventions that can lead to unplanned costs

4. INTRODUCTION OF INDUSTRY 4.0

Germany is a country with deep industry roots and is already a leading country in improvement of connection system, which makes the technological basis for Industry 4.0. Germany leads a dual strategy for the future, continues to enhance its position as the country with developed industry thanks to its innovative concepts and applications of smart factory and Industry 4.0 but also wants to be a leading manufacturer of technology for companies that are introducing Industry 4.0. German company Fraunhofer is engaged in development of new applications and business models for the Industry 4.0 [21].

It's OWL is an alliance of 180 companies, universities, research institutions and organizations who are working together in the field of intelligent technical systems and come from Germany. They work on 46 research projects which are worth about one hundred thousand euros. It is important to emphasize that they have strong support of the government, which has its own strategy and goals. They stimulate clusters to improve its industrial strength and innovations. That is reason why the German government allocates a certain amount of money to finance research projects. An example of a cluster is company It's OWL with companies Beckhoff, Harting, KEB, Lenze, Phoenix Contact, Wago and Weidmuller. They hold 75% of the global market for electronic connectors. As vendors they have set standards in the field of industrial automation, what helps all other manufacturing companies that use their components, such as companies that produce machinery, plant, equipment manufacturing, etc. [22].

The Bosch Group is a leading supplier of technical equipment. The company is in one of its segments focused on the development of technology and software with the aim of linking their own production bases. Bosch Rexroth (part of the Bosch Group) is engaged in the production of equipment and solutions for the smart factory. Bosch Packaging Technology is working on the production of intelligent software for smart factories engaged in the production of medicines and food. Software that is designed by Bosch Software Innovations optimizes whole process of equipment maintenance. Industry 4.0 will change the entire value creation chain, even across borders. Bosch believes that the Industry 4.0 will bring a positive change in the entire value creation chain. Customer will be able to adapt product to his needs and desires. These various products will bring higher profits to companies, but also emergence of new markets and changes in existing markets [23].

Festo is also a leading supplier of technology for automated processes. Festo together with partners from the scientific field and industry is working on solutions to connect the latest communication technologies with conventional industrial production processes. New manufacturing processes have to be very flexible and constantly have to adjust to new production conditions. Festo develops microsystems, highly accurate technology in order to achieve a fully connected all systems. Equally works on solutions that will enable the joint work of robots and humans [24].

SAP is a leading company in the sale of software to companies of all sizes and from various industrial areas. Companies face with pressures and changes in the market and product life cycle and time for testing of

products are getting shorter. The products are more complex and adapted to the customer. Manufacturers insert sensors and microchips in tools, machines, vehicles, buildings, and even raw materials, to make them "smart". All of them will be able to provide a lot of useful data to the manufacturer. SAP's concept related with Industry 4.0 covers four areas: sustainable innovation, production that can respond quickly to change, excellence of operations and service product [25].
The mentioned companies are only part of the companies that are suppliers for equipment which is necessary for the introduction of Industry 4.0. It is clear that companies are working on compiling different clusters, so they will be able to achieve their goals much easier.

5. CONCLUSION

New trends are affecting changes in business models. Own business model is part of the chosen business strategy. This paper presents some of the business strategies, related with Industry 4.0, that company can choose as its own strategy, in relation to its objectives and capabilities. There are many examples of companies that are producers of equipment necessary for Industry 4.0, they are leaders in this field which rapidly progresses. Figure 16. shows the traditional industries and move toward Industry 4.0. It is clearly visible progress of German Industry and also profitability and the expected return of investment.

Figure 16. Industry 4.0 will lead to higher profitability and productivity [6]

The new industrial revolution will create conditions where the industry is sustainable, where employees are qualified and are progressing in their education, so they are able to support the optimization in all segments of the industry. Future research will be directed towards new strategies and business models, which are adapted to the specific conditions.

- Aim is to find parameters that affect the way toward Industry 4.0. and its intensity impact.

- Those parameters that have greatest influence will be especially discussed. Such parameters are important because it is possible to find ways how to influence on their value. Management of key parameters can bring faster movement toward Industry 4.0.

- Measurement of parameters is important to prove a progress.

- Very important area for future research, that is not emphasized in the models mentioned in the work, and it is relevant today, is environmental protection and energy saving. This area will also be included for further research.

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Od koncepta do uvođa u industriju 4.0

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Primljen (26.11.2016.); Recenziran (08.02.2017.); Prihvaćen (02.03.2017.)

Apstrakt

Industrija 4.0 je veoma popularna tema danas zbog velikog uticaja na proizvodnju. Industrija 4.0 je usmerena na stvaranje "pametnog" okruženja unutar proizvodnog sistema. Nekoliko prioritetnih oblasti delovanja je prikazano kako bi se približilo trenutno stanje industrije 4.0. Tu su najznačajnije promene koje utiču na proizvodne operacije i informacione tehnologije. Neki od vodećih proizvođača tehnologija za industriju 4.0 su predstavljeni. Mnogi naučni radovi istražuju nove poslovne koncepte i strategije adaptacije na novu industrijsku revoluciju. Ovaj rad daje pregled nekoliko koncepata i strategija. Različite strategije i koncepti su izabrani iz literature sa ciljem otkrivanja područja koja nisu obuhvaćena.

Ključne reči: *poslovni koncept, industrija 4.0, novi poslovni model, pametna fabrika, pametan proizvod*