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The Link of Industry 4.0 and Organizational Transformation

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Abstract: Industry 4.0 known as fourth industry revolutions is defined as a big change and transformation that will affect the life of people, organizations, societies and governments with the difference of the industry revolutions such as Industry 1.0, Industry 2.0 and Industry 3.0. Industry 4.0 is the last industry revolutions that predict to perform the production with cyber-physical systems, and it is the last industry revolutions that the knowledge society see. It is thought that human factor is gradually decreases with the industry 4.0 and human will engage in art, social etc. activity and exhibit its creativity. Therefore, it's possible to say that the big transformations and changes are waiting the people with Industry 4.0. In this context, the aim of the study is to reveal the relations between Industry 4.0 and organizational transformation by analyzing together. In accordance with this purpose, at first the Industry 4.0 is explained, following the link of organizational transformation and Industry 4.0 are examined and the examples are given. In the study, it is stated that there are needed to organizational transformation so many subjects such as economic, social, technological, politic and legal to pass Industry 4.0. Besides, it is thought that the organizations, societies, and governments which do not fulfill the transformation as organizational will not be successful to pass Industry 4.0 model.

Keywords: Industry 4.0, Fourth Industry Revolution, Organizational Transformation, Industry Revolutions

Endüstri 4.0 ve Örgütsel Dönüşüm Bağlantısı

Özet: Dördüncü sanayi devrimi olarak bilinen Endüstri 4.0 diğer (Endüstri 1.0, Endüstri 2.0 ve Endüstri 3.0) endüstri devrimlerinden farklı olarak dünyada insanların, toplumların, örgütlerin ve devletlerin yaşamını etkileyecek büyük bir değişim ve dönüşüm olarak tarif edilmektedir. Endüstri 4.0, üretimi siber-fiziksel sistemlerle gerçekleştirmeyi öngören ve bilgi toplumunun gördüğü son sanayi devrimidir. Endüstri 4.0 ile üretimde insan unsurunun rolünün giderek azalacağı ve insanın üretim dışında sanatsal, sosyal vb. başka etkinliklerle meşgul olacağı ve yaratıcılığını ortaya koyacağı düşünülmektedir. Dolayısıyla Endüstri 4.0 ile insanlığı birçok konuda büyük dönüşüm ve değişimlerin beklediğini söylemek mümkündür. Bu bağlamda çalışmanın amacı Endüstri 4.0 ile örgütsel dönüşümü birlikte inceleyerek aralarındaki bağlantıyı ortaya koymaktır. Bu amaç doğrultusunda çalışmada öncelikle Endüstri 4.0 konusu açıklanmakta sonrasında Endüstri 4.0 ve örgütsel dönüşüm bağlantısı incelenerek örnekler verilmektedir. Araştırmada Endüstri 4.0`a geçiş için ekonomik, sosyal, teknolojik, siyasal ve hukuki birçok konuda büyük bir örgütsel dönüşüme ihtiyaç duyulduğu belirtilmektedir. Ayrıca bu konularda örgütsel olarak dönüşümü gerçekleştiremeyen örgütlerin, toplumların ve devletlerin Endüstri 4.0 modeline geçişte başarılı olmalarının mümkün olmadığı düşünülmektedir.

Anahtar Kelimeler: Endüstri 4.0, Dördüncü Sanayi Devrimi, Örgütsel Dönüşüm, Endüstri Devrimleri

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1. INTRODUCTION

It is seen that there are many changes and developments in the world. In this context, there have been many revolutions in production and industry. These revolutions are respectively Industry 1.0, Industry 2.0 and Industry 3.0. In contrast to these revolutions, Industry 4.0 is frequently spoken in recent years. Industry 4.0 is the 4th industrial revolution. Industry 4.0 is expressed as a revolution in which cyber-physical systems are used in the production process. Industry 4.0 is the last industrial revolution that the information society can see. Industry 4.0 is a digital transformation in the production process. With Industry 4.0, it can be said that changes and transformations are waiting for many people. Especially with Industry 4.0, it is expected that the importance of human element will decrease in production process and robots will be replaced by human. These robots are described as tools that can manage the production process themselves. Therefore, it is thought that man will move away from production and engage with other activities. In this context, economic, social and technological etc. conversions are needed in many subjects. Organizational transformation can be defined as the self-preparedness and adaptation of organizations to a new process. On the other hand, organizational transformation is to adapt to rapidly changing challenges and opportunities Therefore, it is a concept and process that is increasingly important in human service organizations (Schalock et al., 2018: 53).

The aim of this study is to reveal the link between organizational 4.0 and organizational transformation. For this purpose, firstly the subject of Industry 4.0 is explained and then Industry 4.0 and organizational transformation are discussed together. In the study, data about Industry 4.0 and organizational transformation were used. Based on these studies, the relationship between Industry 4.0 and organizational transformation is examined.

2. INDUSTRY 4.0

The first industry revolution (Industry 1.0), which come to exist in the later 17 centuries has occurred with the development of steam engine, water power and mechanization (Ghobakhloo,2018: 910). With range of technological development based on England, the production system of the world turns in to atelier to factory, piecework production to mass production, the production of steam-operated machines and investment of technologies which will make mass production have been important determinants of this process (Soylu, 2017: 44) First industrial revolution has started with invention of steam engine by Thomas Newcomen in 1712 and improvement of it by James Watt. First industrial revolution has continued to 1830. The invention of steam engine has affected textile industry, shipbuilding industry and agricultural sector via railway and mechanical production with water and steam power has started (Derya, 2018: 2-3). With the shocking developments in industry area, Europe -notably economy- gain an edge over other nations in numerous field (Soylu 2017: 44).

The second industrial revolution (Industry 2.0) has realized under the guidance of Henry Ford who regularize the mass production and assembly line. A very important improvement had occurred in 19th century, the electrical technologies has used in production lines in factories for the first time. This production model which based on low cost, mass production, standard product has been accepted second industrial revolution. Second industrial revolution is to go into mass production whereby assembly line. It is a technological revolution. It is to start to mass production based on work sharing with the help of electrical energy. In 1914, Ford's T assembly line both increased production and decreased the costs. With the electrical engines and combustion engines, which progress at the same time have made industrial mass production and decentralized structure possible. The leaders of the second industrial revolution are England, Germany, Japan. Iron and steel are widely used as raw materials and heavy industry develop with second industry revolution. The next industry revolution has occurred after World War II. The programmable machines which developed in 1970 at first announced the new era. In this period first microcomputer has been developed and digital technologies has come to the fore. This period which accepted third (3th) industrial revolution (industry 3.0) has made clear computer-based production systems and micro-processor. The complex production systems have economized through more and more use of electronic information technologies. The third industry revolution is founded by developing digital technologies (Derya, 2018: 2-3, Soylu 2017: 44, Ghobakhloo, 2018: 910).

At the beginning of the 21th century, the informatics and communication technologies importantly evolved with the common use of internet and the software. In this process, new

production systems which can fictionize the production process as unmanned has come into view and the new production systems have called as Industry 4.0 (Soylu 2017: 44).

Industrial revolutions are summarized in Figure 1.

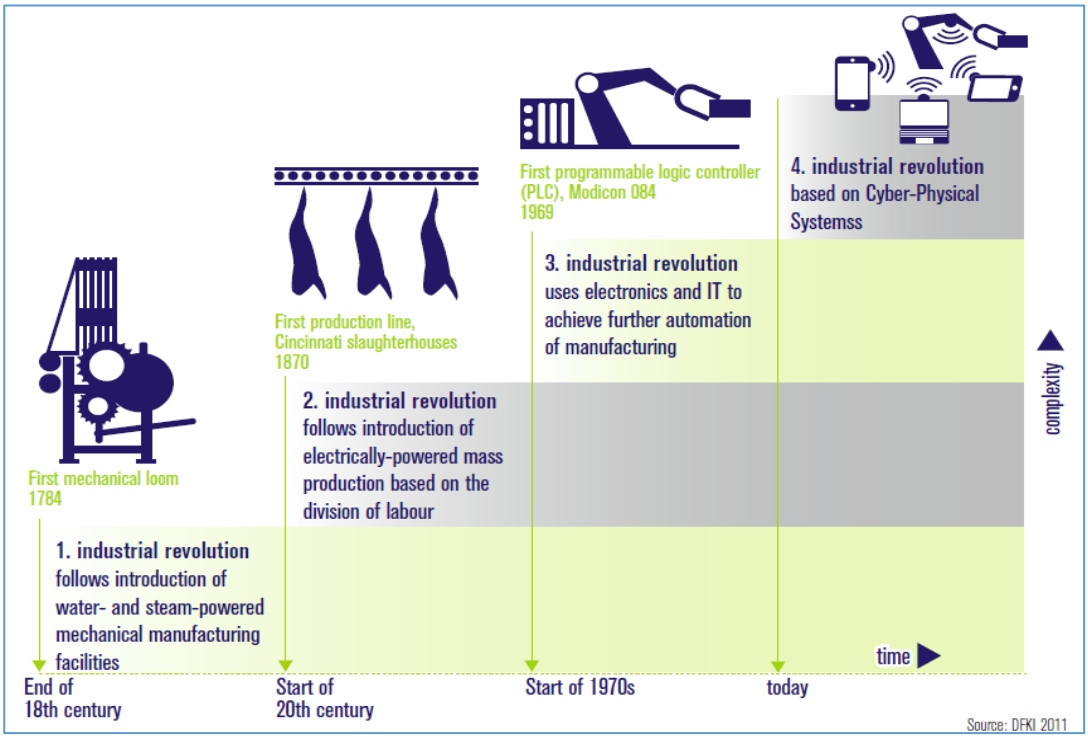


Figure 1: Industrial Revolutions
Source: National Academy of Science and Engineering, 2013: 13

Industry 4.0 is concept that emerges in production systems and it is a concept that contain IoT, big data, CPS and small object. Current production systems have been networked and digitalized and named industry 4.0, manufacturing 2.0 or internet of things (IoT) (Junior et al.,2018: 372; Blunck and Bendul;2019:260,). The transformation to the digital form of organizations is commonly known as Industry 4.0. Industry 4.0 has completely changed the working style and activities of organizations. In addition to this, the economic environment and customer needs have changed with the digitalization of organizations. There are some debates about this kind of digitalization. ‘’it is industry 4.0 or not’’. Firstly, the concept emerges in Germany in 2011 and all nations has acknowledged the concept and the revolution has named Industry 4.0 or 4th industry revolution. The data transfer which is reliable and on time and real time communication is started to be important factor to achieve industry 4.0 success. Cyber physical systems (CPS) form basic characteristic of industry 4.0. 140-billion-euro investment will make only in Europe up to 2022 to the Industry 4.0 revolution. On the other side it is foreseen that 14 billion devices will communicate with each other via internet of things (IoT) (Sony and Naik, 2018: 910; Zeng et al., 2018:1, Celik, 2018: 87).

Industry 4.0 used for three interconnected factors, a) digitalization and integration from simple technical and economic relations to complex technical and economic networks b) digitalization of product and services and c) new market models. All human and machine activities are interconnected with many communication systems in the industry 4.0. The most promising technologies are Internet of things (IoT), Internet of services (IoS) Internet of people (IoP). Thanks to these communication systems, the digitalization of industrial production can create a new digital market models (Zezulka et al., 2016:49). When all industry revolutions analyzed, we will easily understand the development process of Industry 4.0

There are 9 technologies that provide Industry 4.0 transformation. These are shown in Figure 2.

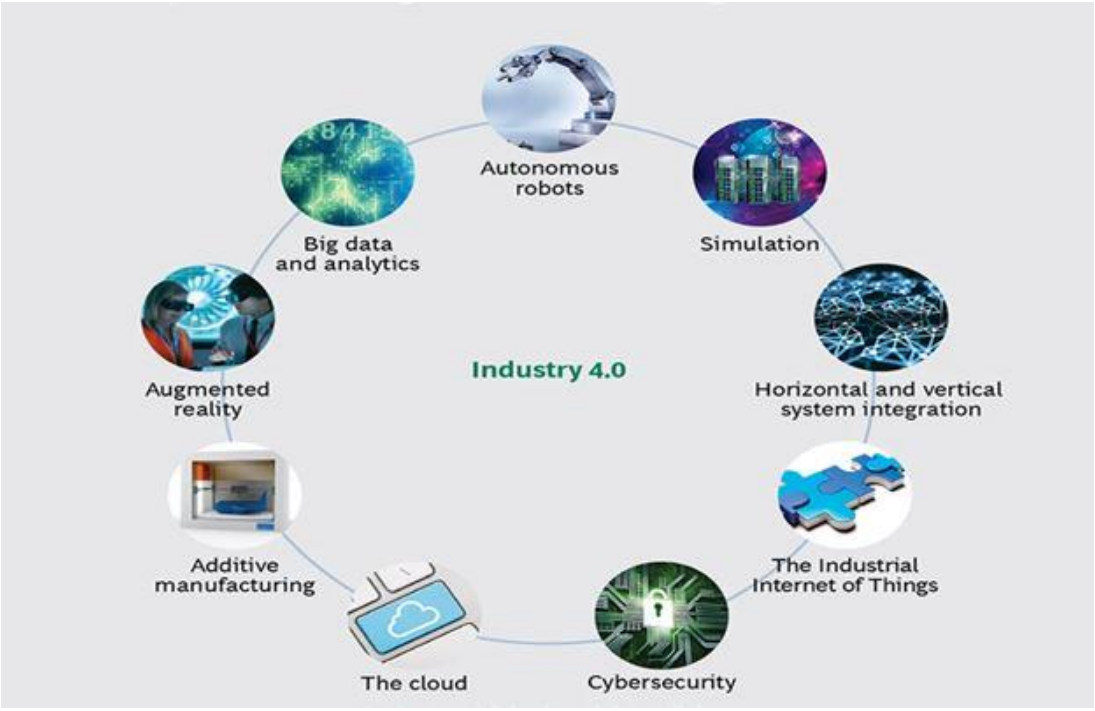


Figure 2: Industry 4.0 Technologies
Source: Gerbert et al., 2015: 1

3. ORGANIZATIONAL TRANSFORMATION

Today's organizations are constantly faced with changes. (Hugentobler,2017: 522). Organizational transformation is an increasingly important concept and a process. At first with the organizational transformation, organizations develop sustainability, effectiveness and efficiency and quickly adapt to changing opportunities and challenges (Schalock et al., 2018: 53). The list of changes that shape the modern business world are quite long. The digitalization of works and gig economy are the some of them. The technologies such as photography, video technology, eye-tracking, wearable sensors enable the collect data with the new and different ways. The digital process has transformed the organizations and this change has caused some circumstances that organizations can hardly cope with. This circumstances are emerging customer departments, cultural diversity in global market, market fluctuates, increasing customer expectations to quality product and services, using internet in core works of business. The organizational change or transformation require continuous organizational development (Sousa and Rocha, 328: 2019).

Increasing changings affect the organizations that are consistently involved in an interaction with their environment, take input and offer output, have open and dynamic systems. The change in organizations have a low acceleration up to industrial revolution. Along with industrial revolution, it has become more dynamic and accelerated. By the 1990 the transformation of organizations has progressively increased with the development of information technology. After this period, many factors such as increasing globalization and competition, importance of international and regional integrations, new technologic inventions, formation of international standards, consumer awareness, change of expectations, increasing importance of knowledge have created significant changes both managerial styles and managerial process (Kerman and Oztop,2014: 22).

Considering the changes in technology over the past three hundred years, these changes have caused an organizational transformation. Nowadays it has seen that contemporary organizations use information technologies solving many problems. In increasing number of studies interested in change

management have revealed that the complex change process can solve with the help of information technology. Most of manager have revealed that new technology cannot increase efficiency alone. In order to achieve this, organizational structure and process changes should be realized with technologic development (Iraz and Simsek; 1999: 48-49).

Table 1: The Supporter of Organizational Transformation and Their Effects on Organizational Transformations

Supporter	**Definition**	**Effect on Organizational Transformation**
Values	-improving the life of individual -improving the life of family -community development	-determining organizational culture -provide evaluation of outputs -providing a conceptual basis for the implementation of transformation strategies
Critical thinking ability	-analyses -syntheses -system -adaptation	-provide a conceptional basis for the implementation of organizational transformation
Innovation	-triggers creativity -encourages flexibility	-promote the culture of learning -supports knowledge production and creativity -creates internal environments that encourage growth and development and support individuals -construct social networks that build organizational capacity and improves the effectiveness, efficiency and sustainability of the organization

Source: Schalock et al.,2018: 67

4. INDUSTRY 4.0 AND ORGANIZATIONAL TRANSFORMATION

The concept of Industry 4.0 or 'Industrie 4.0' in German firstly presented Hannover fair in 2011. German and many European governments focused to Industry 4.0 in a short time. The Industry 4.0 concept has generally presented physical system applications related to computer networks in industrial production systems. Technological innovations and changes have affected the short time performance and longtime sustainability of organizations (Ghobakhloo, 2018: 910-911).

The works transforms from real physical environment to virtual platform with new information and communication technologies. New information and communication technologies will underlie the works that will make future. The Industry 4.0 sight involves comprehensive digitalization process which starts with consumer's order to production process (Wilkessman and Wilkesmann, 2018: 239). The Industry 4.0 concept have a great importance for many organizations, research centers and universities. Academic experts defend that the Industry 4.0 will not understand separately and manufacturing organizations face various difficulties in understanding this concept. Gilchrist (2016), Liao (2017) and Santos (2017) have explained the concept with technological trends and design principles (Ghobakhloo, 2018: 911). Industry 4.0 known as organizations' digitally transformation-, with the simplest definition is the internet of machines, people and things. It has utterly changed the activities of organizations. Industry 4.0 is a collective term which includes contemporary automation systems, data exchange and production technologies. Industry 4.0 which is the fourth stage of industrialization not only concern with smart and online machines and

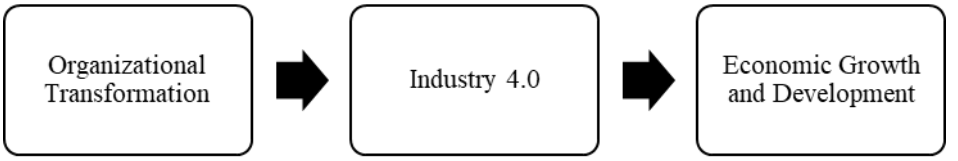
systems it also concerns Nano Technology, genealogy, renewable energy, health and social science (Ozsoylu,2017: 45-46). It is proven that Industry 4.0 gain favor to the organizations at the level of operational and value chain. Industry 4.0 has importantly adopted by the German organizations such as Volkswagen, Daimler, BMW. Besides China government has focused product development process called 'Made in China'. USA, France, England, Japan and Singapore governments has begun to similar initiatives. (Bag et al., 2018: 1).

The most important distinguishing factors of Industry 4.0 can collect under the three title. The first one is velocity. **Velocity**; the new era's technologic developments progress at a great pace. Every day we witness a new technological development and new technologies pave the way for new ones. **Wideness and depth**; the developments of new era have developed on digital revolution. However, development with this speed not only lead to change on production structure but also lead to change business world, society, organizations and living conditions of individuals. **System effect**; new era has changed the system of organizations, sectors, and countries and include the integrated transformation of system. These three factors will be determinative and incompatible organizations and countries will incur losses. There are some obstacles in the transition process of firms and countries from traditional manufacturing to industry 4.0 manufacturing. The countries which do not have informatic infrastructure do not possible to reach to Industry 4.0. The factors of Industry 4.0 are internet of things (IoT), cyber physical systems (CPS) and IPv6 and cloud informatics systems. CPS is a core concept of industry 4.0 and it enables the monitoring the physical process in factory in a virtual environment with digital clone of factory and it adds value to the computing, communication, control and coordination process. Internet of Things (IoT) enhance the communication not only humans but also machines. (Paravizo et al.2018:438-439; Ozsoylu,2017: 46).

Organizations have an alteration and transformation with Industry 4.0. The organization structures and management process which inherit from past retain organizations from productivity and competition. This demoded organization structures cause unable to respond to the market needs at a sufficient speed. Now the informatic technologies on production and managerial process has become important. As a result of technological developments, many organizations have undergone the transformation at organizational structure with adaptation process to present conditions. Organizational transformation can be defined a significant increase in organizational performance with the behavior modification of personnel of organization (Simsek and Iraz: 1999: 37-42). Nowadays all functions of organizations have been exposed to big changes in many areas with the industrial revolutions and changes. The customer needs and economic environment has changed with the wave of organizational digitalization (Sony and Naik,2018: 1). The emerging developments has changed the technologic, economic and politic conditions and as the result of this, the organizational structure and management mentality has changed as well. The change has a low momentum until the industrial revolution, along with the industrial revolution it gathers momentum and increased with the effect of information technologies in 1990. The changings which increase day by day has influenced the organizations which are open and dynamic systems that provide outputs to their surroundings and take input from their surroundings. In this process of change with industrial revolutions organizations should be sensitive to their environments and take the precautions, have investment and they also transform their environments to the non-threating form. The process of rapid change, organizations that failure to meet the need of change and remain stable can cause to the 'entropy'. In this context, organizations should plan, practice the change, and survive in the rapid change process in environment and they should keep pace with this change that comes with industrial revolutions.

According to the literature, the link of Industry 4.0 and organizational transformation can be shown as in Figure 3.

Figure 3: Link of Industry 4.0 and Organizational Transformation



Source: Own- Prepared from the literature

According to this model, organizational transformation is required for many issues before passing the Industry 4.0 model. Thus, industry 4.0 process is successful and this situation positively affects economic growth and development.

CONCLUSION

Industry 4.0 is a process that involves many changes and innovations. It is thought that Industry 4.0 will change many things in the world, especially production, life and culture of people. With Industry 4.0, it is expected that people will focus on their creativity by getting out of the production process and thus human life will take a different dimension. At the same time, it is certain that these changes will also affect the life of the organization. In this context, organizations need to adapt themselves to Industry 4.0. Therefore, it is inevitable for organizations to make changes and transformations on many issues.

In this study, the connection between Industry 4.0 and organizational transformation is examined. Research shows that there is a very close relationship between Industry 4.0 and organizational transformation. In order for organizations (state, enterprise, etc.) to pass to Industry 4.0, they must undertake a major organizational transformation in many aspects of economic, social, technological, political and legal issues. In addition, with Industry 4.0, organizations need to be digitized in every issue. It is not possible for the organizations to be successful in this process unless to pass to the Industry 4.0 model. This study was carried out theoretically. In subsequent studies, it is recommended to examine the subject in detail by using a combination of qualitative and quantitative methods. As a result, it is thought that this study will contribute to Industry 4.0 and organizational transformation which is rarely included in the literature.

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