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SMART BUSINESSES AND INFORMATION TECHNOLOGY IN TURKEY

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Abstract

In parallel to the rapid developments in the world, the 4th Industrial Revolution started for the businesses and the fact that this revolution led the business to a big evolution was faced. At this point, businesses started to be adapted to these new applications and the era of digital transformation. The most fundamental factor in identifying a business as a smart business is to use information technologies in the most efficient and adaptable way to business resources. In the digital age, the use of new technologies offered by the industrial revolution for businesses that are trying to provide effectiveness and efficiency by using production capabilities such as quality, speed, cost and flexibility is important in terms of providing competitive advantage of businesses. In this study will be discussed in the scope of Industry 4.0 in Turkey.

Keywords: Information Technologies, Industry 4.0, Turkey

1. INTRODUCTION

The world has become a global village with the spread of communication and transportation and the expansion of information and technology in First Industrial Revolution, before starting in the UK, France and then spread all over the world that J.Watt's invented a new type of steam engine in 1781 and triggered by the French Revolution in 1789 (Karahan, 2010: 234-235). The Second Industrial Revolution, which began in the middle of 19th century (1850-1970). There was a major transformation in the business structure with the workforce were classified according to their expertise in the Second Industrial Revolution. Also, Henry Ford used assembly line production technology in businesses, this technique was reflected in other sectors and productivity increased (Bulut and Akçacı, 2017: 52). In parallel with these developments, programmable machines were developed and started to be used in business in the Third Industrial Revolution with the concept of programmable logic controllers that started after World War II, and computers, information technologies, electronics, automation systems were widely used in production in 1970 and later (Şekkeli and Bakan, 2018: 19). The end-point for businesses in today's digital age is the Fourth Industrial Revolution, referred to as Industry 4.0 (Schwab, 2018). The Industry 4.0, which symbolizes the beginning of the Fourth Industrial Revolution, was first introduced at the Hannover Fair in Germany in 2011 (Yıldız, 2018: 547). Emerging technologies that have mobilized the

Fourth Industrial Revolution have evolved from the knowledge and systems of previous industrial revolutions, especially based on the digital possibilities of the Third Industrial Revolution (Schwab, 2018: 24). It is seen that Industry 4.0 concept is based on 4 basic technological developments as 3D printers and production systems, internet of things, augmented reality and use of robot technologies in every field (Bulut and Akçacı, 2017: 70). Nowadays, with the impact of developing technology and globalization, businesses have been under the influence of Industry 4.0 (Kablan, 2018: 1562) and these applications have become inevitable in terms of competitiveness of businesses. Therefore this study will be examined smart business in Turkey within the framework of Industry 4.0.

2. Information Technologies and Industry 4.0

Information technologies are applications required for an enterprise to gather and use the information it needs to realize its mission (Akyel and Bal, 2010: 45). Information technology started to be used effectively in businesses with the transition period to the information society which started with the Third Industrial Revolution which was called as the 3rd Wave by Toffler (1980). In the late 1980s, concepts such as knowledge economy, information age, network economy, information society became an important issue for businesses and knowledge as well as production resources such as labor, capital and natural resources, became the most important source of businesses (Lazarevic and Lukic, 2015: 259). For this reason, information became more important than traditional production sources and has been used as a strategic tool for businesses (Yıldız, 2008: 216). In this period, information technology considered as management support systems, management information systems, decision support systems, office automation systems, artificial intelligence systems, electronic data processing systems, internet and intranet (Karahan, 2010). While information technologies correspond to a long-term trend towards the expansion of information and information-based systems and values, in recent years, together with the digitalization of information by computers (Lazarevic and Lukic, 2015: 259), and the basic concepts of Industry 4.0 as big data, augmented reality, additive production (3D printers), cloud computing, cyber security, intelligent robots, sensors, horizontal and vertical software integration, Internet of Things have become important for an businesses to be considered a smart businesses (Fırat and Fırat, 2017). Industry 4.0 defined, its simplest form, as connecting people and objects to each other at any location, anytime, anywhere (Wagner et al., 2017: 126). Industry 4.0 includes services that management of the value chain in the life cycle of products and production systems, continuously increasing individualized customer requests, product development and production order starting from the idea stage, distribution and recycling of a product to the ultimate consumer (Pamuk and Soysal, 2018: 4). In this respect, Industry 4.0 plans to cooperate with each other directly or indirectly related to the production department of the businesses, and foresees that the software of digital data and information technologies work together (Şener and Elevli, 2017: 26). This concept refers to the integration of production processes based on technologies and devices that communicate with each other throughout the businesses' value chain. It refers to a structure that can be taken autonomous decisions based on self-organizing mechanisms where computer-guided systems, which are defined as smart factories or businesses of the future, follow physical processes, form a physical virtual copy (Soylu, 2018: 45). According to Kagermann et al. (2015), Industry 4.0 is moving production automation to a new level by using customized and flexible mass production technologies. It is a concept used to express the ways in which the means of production will work independently through information technologies and how these technologies will be coordinated with people to produce customer-oriented products. The distinguishing elements of Industry 4.0 are divided into 3 as speed, width and system effect. In this period, all technological

elements are developing at a great speed and new technologies develop help to develop new technologies. The development of new technologies not only improves the production structures of the businesses but also enables them to benefit from the economies of scope as well as changing the society and even the living conditions of the individuals in the society. With the effect of the system, developing technologies cause a change in the structure of countries by providing a complete transformation of the system (Özsoylu, 2017: 46).

The first tools of the Industry 4.0 are cyber-physical systems. Cyber-physical systems refers to the new generation of engineering systems that require tight integration of computing, communication and control technologies to achieve stability, performance, reliability, robustness and efficiency when many applications are working with physical systems (Kim and Kumar, 2012: 1287). These systems are new generation systems with integrated, computational and physical properties that can interact with people and many new methods. The use of these systems is a key factor for businesses to interact with the physical world through computation, communication and control and to guide future technological developments thanks to their ability to expand their capabilities (Baheti and Gill, 2011: 161). Cyber-physical systems, expressed by the higher availability and affordability of sensors, data acquisition systems and computer networks, force businesses to use high technologies and move towards implementation with the competitive nature of today's industry. The increasing use of sensors and networked machines has also made it necessary to use continuous high volume data generation known as big data (Lee et al., 2015: 19).

One of the basic components of Industry 4.0 is the concept of Internet of Things (IoT). The Internet of Things consists of a series of intelligent and connected sensors that collect data and process and convert these data according to the needs of businesses. This data is transmitted to other devices or individuals to accomplish the objectives of the system or its users. The Internet of Things is derived from new contextual data sources that reflect events in a wider environment, allowing many data to be combined with intelligent analytics. The internet of Things, the new form of human machine collaboration, represents the new way to increase efficiency and effectiveness in businesses. The creation of intelligent interactive things with the use of Internet of Things allows for the creation of new channels to deliver new value to meet the needs of the community (Schwab, 2018: 138). By means of the use of these systems, it means the formation of a network structure where addressable things form among themselves, where machines can communicate with each other without the need for data entry manually (Aktaş et al., 2016: 43).

Another concept in which Industry 4.0 is often used is the concept of augmented reality. Augmented reality is a field of study involving the combination of real-world and computer-generated data (Somyürek, 2014: 66). Augmented reality is a variation of virtual environments or virtual reality (Azuma, 1997: 355). Systems using augmented reality record real and virtual objects by combining real and virtual objects in a real environment, and operate in interactive, three-dimensional and real-time (Van Krevelen and Poelman, 2007: 2). In recent years, the production of wearable technologies are examples of augmented reality (Erbaş and Demirer, 2014: 9). On the other hand, the terms 3D printing and additive manufacturing constitute another element of Industry 4.0. These terms refer to the process of creating a physical object with continuous addition to the production layers (Schwab, 2018: 195). Three-dimensional printing technology, using a printer computer-aided design programs designed with the help of any data without the need for any additional people, tools or machines without the need to send three-dimensional data to the machine as a result of the addition of three-dimensional physical parts as a result of the addition of materials is a technique (Yılmaz et al., 2014: 35). Because of its flexibility, low cost and time

savings, this technology is especially used in prototype production (Çallı and Taşkın, 2015), making adaptive production more applicable. Besides, production using 3D printing technology is criticized for reasons such as being slow compared to traditional series production, not having the same quality and standards in each product, and having difficulty in producing complex structures (Yılmaz et al., 2014: 36).

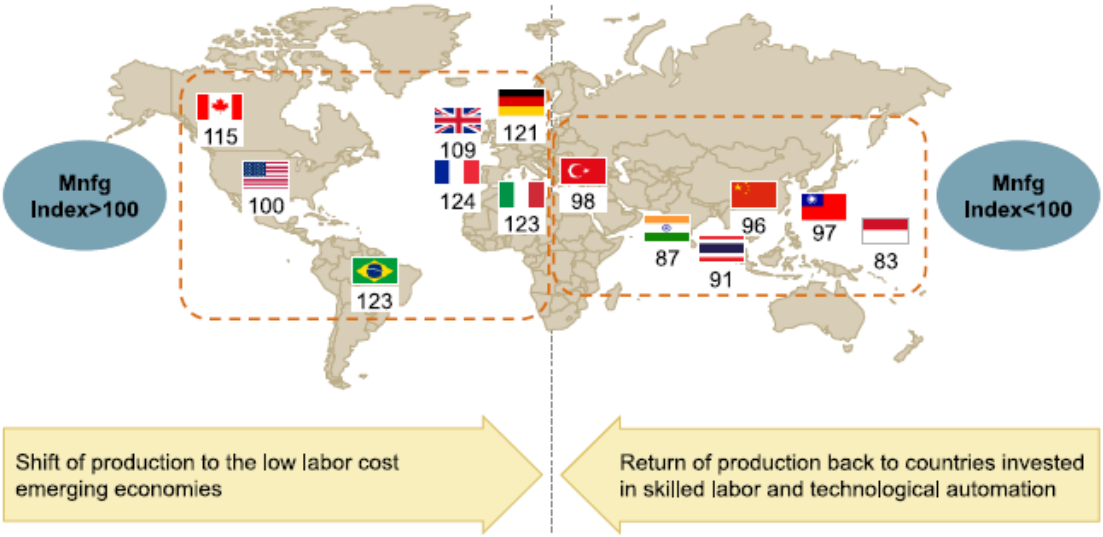
Cloud computing concept, another application that has entered into business life with the latest industrial revolution, is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. Cloud computing is a fundamental change in the invention, development, deployment, scaling, updating, maintenance and pricing of information technology services (Marston et al., 2011: 176). Cloud computing service is a model that is created by users' access to various information services such as calculation, storage and update, where information is stored and which servers are running on them and how they are configured, regardless of location, and access to this information over the internet (Seyrek, 2011: 702). In order to respond to the changing demands of the customers, it is possible to increase the efficiency and efficiency of the enterprise, extend the life of the product, reduce production costs, allow the most efficient use of business resources, create temporary and reconfigurable cyber-physical production lines, a networked production model benefiting from on-demand access is defined as cloud-based production in terms of enterprises (Yıldız, 2018: 550). Google AppEngine and Microsoft Azure platforms, Amazon Elastic Computer Cloud application, web-based e-mail services are widely used cloud computing samples by businesses (Kavzoğlu and Şahin, 2012).

The last concept that Industry 4.0 brings to businesses life is the concept of smart factories. Smart factories are the factory system that vertically integrates hierarchical subsystems to transform the traditional factory into a flexible and reconfigurable production system (Wang et al., 2016: 3). These factories are often referred to as dark factories because the human factor is completely out of the system, except in extraordinary circumstances in smart factories (Ünlü and Atik, 2018: 438). Smart Factory is a manufacturing solution that provides such flexible and adaptive production processes that will solve problems arising on a production facility with dynamic and rapidly changing boundary conditions in a world of increasing complexity. This special solution could on the one hand be related to automation, understood as a combination of software, hardware and/or mechanics, which should lead to optimization of manufacturing resulting in reduction of unnecessary labour and waste of resource. On the other hand, it could be seen in a perspective of collaboration between different industrial and nonindustrial partners, where the smartness comes from forming a dynamic organization (Radziwon et al., 2014: 1187).

3. Industry 4.0 Indicators In Turkey

Turkey is located in a strategic geographical region that provides logistic advantages. The Turkish economy has grown very fast in the past two year. Flexible and low-cost production is available at a relatively low labor cost in Turkey. This situation has enhanced competitive position versus global competitors. According to the Boston Consulting Group Global Production Cost Index (Table 1), scores 98 vs. the U.S. benchmark score of 100 and Germany of 121. In other words, direct manufacturing costs in Turkey are 23 percent lower than those in Germany and 2 percent lower than the U.S., which creates a competitive edge for Turkey to obtain share from the global value chain and build an export platform (Bulut and Akçacı, 2017: 60).

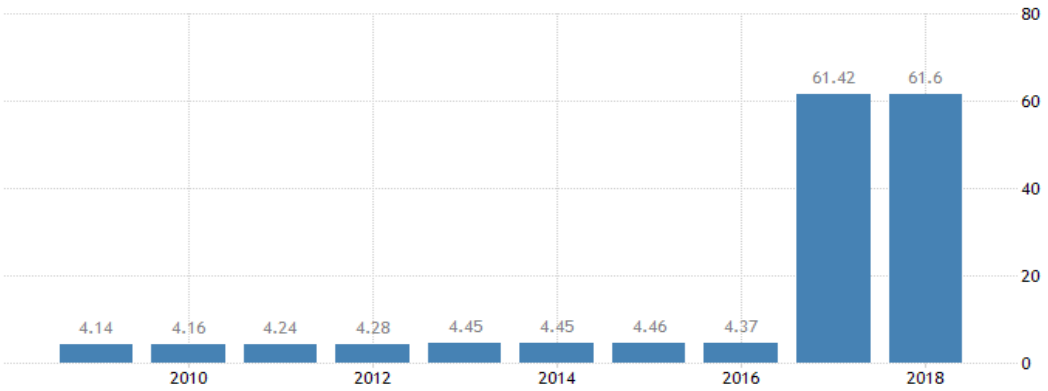
Table 1. Turkey's Position in the Global Value Chain



Source: https://tusiad.org.

In this respect, the Turkish goals must be to ensure and enhance the sustainability of our competitive advantage with Industry 4.0, but, beyond this, to create a Turkish industry with greater added value that receives a larger share of the world's production value chain (TÜSİAD (Turkish Industry and Business Association) Report, 2016: 10). Another Industry 4.0 is Global Competitiveness Report published by the World Economic Forum. Global Competitiveness Report assesses 140 economies. The report is made up of 98 variables, from a combination of data from international organizations as well as from the World Economic Forum's Executive Opinion Survey. The variables are organized into twelve pillars with the most important including: institutions; infrastructure; ICT adoption; macroeconomic stability; health; skills; product market; labour market; financial system; market size; business dynamism; and innovation capability. The GCI varies between 1 and 100, higher average score means higher degree of competitiveness. With the 2018 edition, the World Economic Forum introduced a new methodology, aiming to integrate the notion of the 4th Industrial Revolution into the definition of competitiveness. It emphasizes the role of human capital, innovation, resilience and agility, as not only drivers but also defining features of economic success in the 4th Industrial Revolution (www. tradingeconomics.com). According the this report (see below Table 2), Turkey scored 61.60 points out of 100 in the 2018. Competitiveness Index in Turkey averaged 13.83 Points from 2007 until 2018, reaching an all time high of 61.60 Points in 2018 and a recordlow of 4.13 Points in 2007.

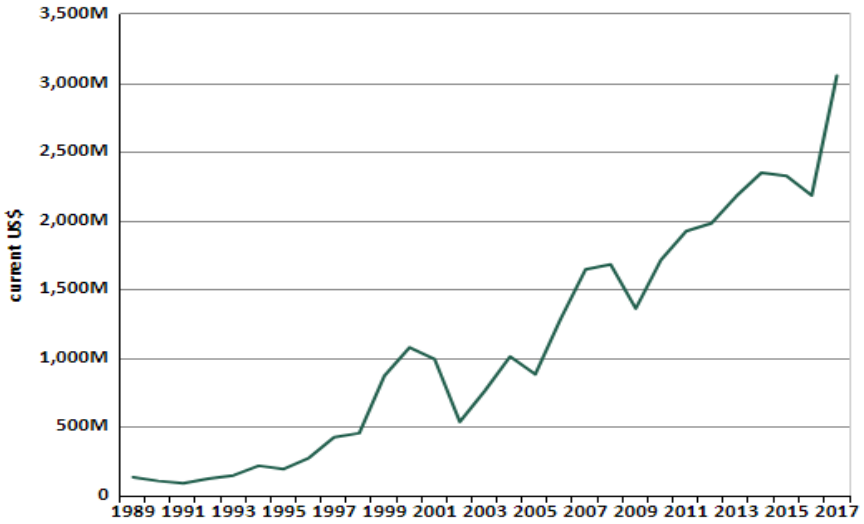
Table 2. Turkey Competitiveness Index



Source: https://tradingeconomics.com.

Another important indicator in the scope of Industry 4.0 is that countries can export high technologies products. High-technology exports are products with high R&D intensity, such as in aerospace, computers, pharmaceuticals, scientific instruments, and electrical machinery. In this context, innovative technologies became determinant factors for added value increase with the knowledge based society transformation (TÜSİAD Report, 2016: 6). In 2017, high-technology exports for Turkey was 3,052 million US dollars. High-technology exports of Turkey increased from 454 million US dollars in 1998 to 3,052 million US dollars in 2017 growing at an average annual rate of 14.32 % (https://knoema.com). Also, another analysis from OECD shows that composition and diversity of Turkey's exported goods suggests that the country's sectoral specialisation has reached a threshold which foreshadows additional sophistication and market share and GDP per capita gains in the future (OECD, 2018: 21).

Table 3. Turkey High-Technology Exports



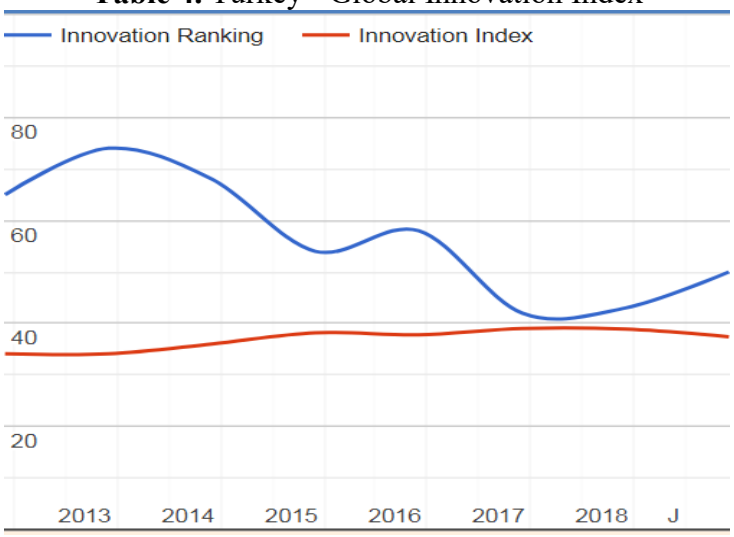
Source: https://knoema.com.

93% of the total exports of Turkey's economy consists of the manufacturing industry. The share of high-tech product group in exports is 3% (Genç, 2018: 241). According to Turkey Statistical Institute (TUIK)'s data, the share of manufacturing industry products in total exports is 92.4%. The

share of high- technology products in Turkish manufacturing industry exports was 3.3% and the share of medium-high technology products is 35.2%. The share of medium-low-technology products is 26.6% and the share of low-technology products in total export manufacturing industry is 34.9% (www.tuik.gov.tr). According to the World Bank data from International Monetary Fund's Direction of Trade database in 2017, Turkey is fairly low rate compared to other European and Central Asia (www.data.worldbank.org). Therefore it is necessary to increase of high-tech export in Turkey.

Research and development investments play an important role in the process of Industry 4.0. Turkey's central government spent 10.7 billion Turkish liras ($2.93 billion) to support research and development (R&D) activities in 201 Turkey's central government spent 10.7 billion Turkish liras ($2.93 billion) to support research and development (R&D) activities in 2017 (www.aa.com.tr). Research and development expenditure (% of GDP) in Turkey was reported at 0.882 % in 2015 according to World Bank data. Turkey is fairly low rate compared to other European and Central Asia (www.data.worldbank.org). Turkey must increase in the number of innovative firms will provide opportunities for entrepreneurs, beside will provide new employment areas (Tarı ve Alabaş, 2016: 14).

Table 4. Turkey - Global Innovation Index



Source: www.globalinnovationindex.org.

Global Innovation Index examines these innovation activities of countries on a multi-dimensional background. 128 countries have been examined in the 2018 annual report, which is aimed at the countries' long term growths, incentivization of their production activities and their improvements from business point of view. Turkey was placed 50nd among 128 countries in the general ranking (www.wipo.int).

Furthermore, Turkey's manufacturing industry is dominated by Small and Medium Enterprises, SMEs will be much more difficult to adapt to the Industry 4.0 process than it will be for large corporations. In this vein, Digital Transformation Platform in Industry established under the leadership of Turkey Ministry of Science, Industry and Technology, the platform brings together TOBB (Union of Chambers and Commodity Exchanges of Turkey), TİM (Turkish Exporters' Assembly), TÜSİAD (Turkish Industry and Business Association), MÜSİAD (Independent

Industrialists and Businessmen Association), YASED (International Investors Association), and TTGV (Technology Development Foundation of Turkey) at the end of 2016 (Özlü, 2017: 34-35).

4. RESULTS

In the recent years, Industry 4.0 have considered as the major paradigm shift and attracted the attention of both academia and industry (Dilberoğlu et al., 2017: 552). Turkey's adaptation process to Industry 4.0 of general evaluation, Turkey is decelerating of investments in capital-intensive systems as cheap labor costs, holding off the widespread use of new manufacturing technologies aim to limited qualified workforce and ecosystems, speeding employee turnover with the shift of workforce from industry to service sector and delaying of the formation of an qualified workforce (Öztürk, 2017: 17377). In the light of these developments, agriculture, health, education, the environment, energy, and transportation sector need to be updated and reshaped in the digital transformation in Turkey (Özlü, 2017: 37-38).

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