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Turkey's Industry 4.0 Adventure: Dream or Realization

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Abstract

Today's technology minimizes human errors and enables the implementation of applications that will enable the electronic devices to work flawlessly as much as possible. Both socially and technically, in each sector with all levels, the manager must make decisions based on his/her responsibility and interest. In these environments, making the right decision, unprotected or minimal damage to the risks, depends on the personal ability of the decision maker as well as the information that comes with it. The concept of Industry 4.0, which has emerged in parallel with technological developments, includes the transformation of production and service activities into modern automation systems in social areas and the use of new methods in data exchange. In this context, the internet of the objects, the internet of services and cyber-physical systems constitute the basic structures of the new formation. In this study, the use of these technologies in the areas where social sciences operate in the fields of which are the components of the technological developments that emerged as Industry 4.0 are discussed in the topics of Autonomous Robots, Big Data, Simulation, System Integration, Cyber Security, Cloud Computing, 3D Printers, Enhanced and Virtual Reality. Planning, analysis, design, coding and implementation stages of many technologies produced and implemented by Management Information Systems for social sciences with the reason of the emergence of Industry 4.0, innovation, flexibility and efficiency approach will be explained in this study. Additionally, this paper examines the effect of the industrial transformation in Turkey.

Keywords: Industry 4.0, internet of things, management information systems, information technologies

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1. Introduction

There have been many important industrial developments in the human development process and they radically changed society's life [1]. The first one is the first Industrial Revolution. The first Industrial Revolution proposed the use of steam power in industry and steam engine powered locomotives and factories [2]. With the discovery of electricity, the second Industrial Revolution took place and the production process used in the factories has become more serial at the end of the 19th century. Also, at the beginning of the 20th century, with the invention of the telephone and the telegraph,

communication ways were also revolutionized [3]. Beginning in the 1950s, the third Industrial Revolution has evolved due to the emergence of computer and information technologies [4]. Especially, in the beginning of the 1990s, with the use of personal computers and the Internet has spread the ground for the environment to start the fourth Industrial Revolution [5].

Industry 4.0 means a combination of traditional industry and information technologies. In this way, more flexible, more efficient, more efficient and better quality products can be obtained in production processes are provided [6]. The ability to control the process momentarily at every stage of production processes minimizes the error rates. This is one of the most important advantages of the Industry 4.0 philosophy [7]. The philosophy of Industry 4.0 recommends the use of technology and artificial intelligence applications with this technology, minimizing the human factor in work such as production [8]. While the advancement of digital industry and internet technology is in progress, artificial intelligence, large data and communication have demonstrated the certainty of a new digital revolution [9].

The term Industry 4.0 was created to have a short, symbolic keyword similar to Cloud Computing, which simplifies intelligent factories, smart machines and the now-commenced industrial revolution and define network-related processes from them [10]. Industry 4.0 sets the end of traditional centralized practices for production control [11], introducing new ways of creating value [12] and combining the strengths of traditional manufacturing industries with Internet technologies [13]. It is understood as a new level of organization that performs all the value chain controls of the product life cycle in satisfying personalized customer requirements [14]. Industry 4.0 works according to the principles of interoperability, virtualization, autonomous management, real time capability, service orientation and modularity [15] (Figure 1).

The Internet of Things, the key point of Industry 4.0, can be defined as the communication of physical objects connected to a wired or wireless Internet connection. In other words, the objects recognize themselves and make communication behaviors by considering the fact that they can communicate the relevant information or make relevant decisions [16]. The Internet of Things is a technological revolution that represents the future of computing and communication, and its development needs the support of some innovative technologies [17]. The key features of the Internet of Things approach are connection, objects, data, communication, intelligence, action, and ecosystem.

Concerning Industry 4.0, a large number of articles and books are written, conferences are given and TV programs are made in the last 5 years. Almost all institutions in Turkey, state institutions, private companies at all levels, NGOs are interested in this
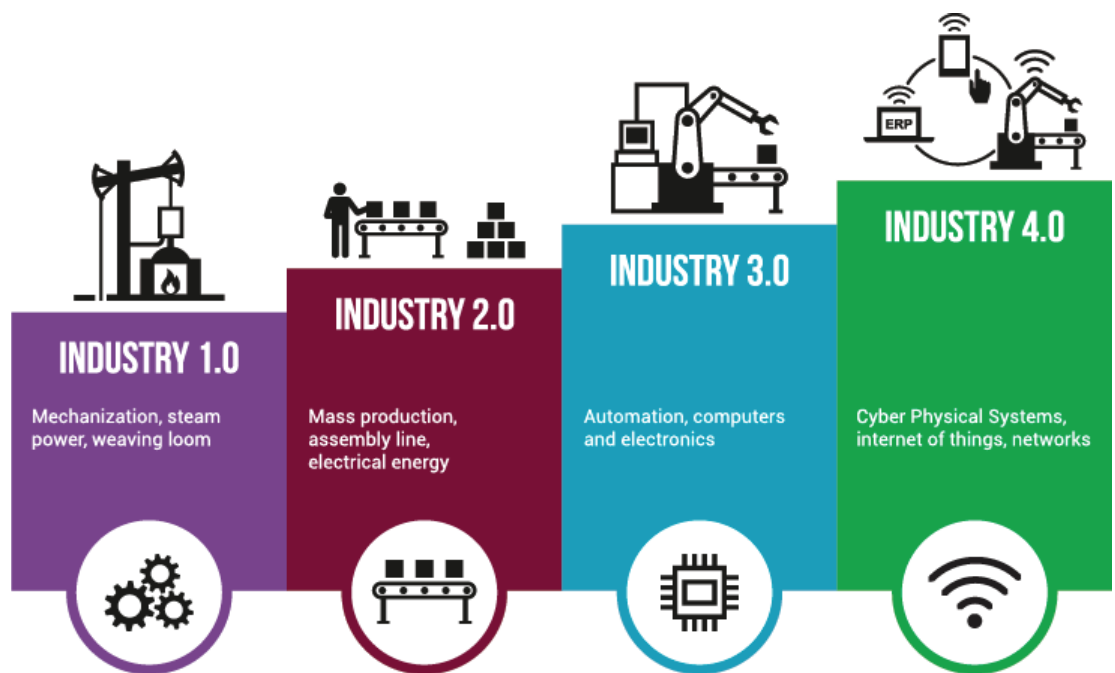
Figure 1: The development of Industrial Developments [19].

issue. Due to the sensitivity of the political power to Industry 4.0, a number of institutions are compulsorily concerned with this issue. Many institutions are obliged to deal with this issue with the request of the state administration.

This study will reveal the process on Turkey's digital conversion. What is the process of transformation? What vision does the state and private sector do with their work? In which areas and to what extent are these studies carried on? What are the deficiencies? The current handicaps of the Industry 4.0 adventure will be tried to be revealed whether the subjects discussed reflect the reality. Like many countries, how the components of Industry 4.0 will be integrated in Turkey is a major topic of curiosity. Some predictions about the future will also be shared in this study.

2. Industrial 4.0 Applications in Social Sciences: Management Information System View

There is a decision making process in the face of many problems in social and professional life. In business life, when the management is sub, middle and upper, it is important to have some tools or methods to support them, such as reports and forecasts, in decisions of managers in these departments.

Expert units that provide this support use their methods according to the management information system (MIS) philosophy. The main task of the MIS experts is to solve the

problems by effective, efficient and effective methods based on technology. Developing Industry 4.0 production philosophy is in complete harmony with the MIS science.

A MIS specialist has the skills to master industry-related issues such as system integration, big data analysis, artificial intelligence, business intelligence, database management, data and text mining, in the process of solving any problems encountered. For this reason, the MIS experts are working towards creating in-depth and forward-looking solutions to the problem, rather than the rapid elimination of problems.

Many Industry 4.0 implementations have been made for social sciences. Social media tools have brought about a profound change in social relations. Application software for smartphones and these phones can be integrated with the Internet of Things (Internet of Things), which is synonymous with Industry 4.0. For example, a smart watch attached to the arm can measure your blood pressure at certain intervals and then send these results to your personal doctor. Your mobile phone distinguishes the words you use in your social life or dislike them according to your criteria and can send you different content ads. This process is recorded as an application installed on your mobile phone using your phone's microphone to record your speech and then divide these conversations into words and evaluate them according to a certain systematic and match them with the advertisements related to the internet.

In order to provide the opinions of the students on different subjects on a university campus, the performing of mobile surveys and then systematically sending these survey results to the managers and assisting the decision-makers in this direction can be shown as one of these applications. The location of any other location or any trainer you want to go from a point within the university.

The application of the recipe to you in the form of oral and printed material can be specified as another Industry 4.0 application example. Small objects such as RFID and iBeacon are used in Industry 4.0 applications. When you come to a library, it lets you scan the book you're looking for. The presentation of the program to your mobile phone with the signals sent from small devices called iBeacon is an example designed according to the concepts of Industry 4.0 and Internet of Things. The kiosk in the university campuses can be charged to smart cards and the weekly meal order can be determined from this platform. Nowadays, with the help of Drone who are in a very popular position, blood or organ transport from one hospital to another hospital can be carried out and plays an active role in emergency interventions. With the technologies like AR and VR, the lessons can be transferred to the students in a very realistic way without the need for any real objects. There are many examples of Industry 4.0 applications used in social sciences.

It should be noted that the MIS vision does not only address Industry 4.0 by the use of technology in production processes and adopts it as an understanding that can be used throughout life. The logic here is that the technology takes place at every stage of life, but with Industry 4.0, technology minimizes or eliminates human mistakes and makes things more efficient and efficient.

For example, the evaluation of food quality in a company by employees is not very significant when evaluated by occasional surveys. However, with a tablet to be installed at the entrance of the cafeteria, food quality and hygiene issues can be evaluated. Attractive designs with simple questions will increase the number of data entries and evaluations.

The administrator will be able to see the data instantly on his/her screen or phone. The solution of the problems can be very fast when the instant graphs appear. Sensors that can be placed on different locations on a campus, and can be determined instantly when the garbage is not emptied. It may be possible to determine that employees in certain regions do not perform their duties adequately.

MIS is a science that tries to find problems in hardware and software in order to get benefits with the help of technology in many subjects during the intensive activities of all kinds of institutions and organizations. In this context, MIS uses all components of Industry 4.0 to find solutions to problems.

3. Industry 4.0 and Turkey

Turkey has logistic advantages due to its geographical location. In addition, its flexible and cost-effective production makes it one of the competitive countries in the global value chain [18]. Production statistics indicate that in Turkey, the technology is often used in medium or low levels in the economy, low value-added products are produced and this affects economic growth negatively [21]. Research and Development investments and activities in order to respond to Turkey's economy is highly valued in the industry 4.0. The fourth industrial revolution can only develop based on the establishment of the infrastructure of machinery and information technology and the training of qualified workforce that can bring these two technologies together. For each of these qualifications and qualifications, organizations in which Research & Development and innovative production activities are supported should be established.

Turkey's economy has to grow by an annual average of 8.5% in order to take place in the world's top 10 economies in 2023 [22]. Turkey, in order to become a global and regional powers, knowledge of new production technologies will be integrated into

industrial systems, technology and skilled labor must close the gap [18]. As industry 4.0 increases pressure on classical relations of production; countries that use simple and low-cost technologies in production, such as Turkey, are threatened. To overcome this problem, Turkey's industrial problems must be understood in an integrated, focusing on innovation and information technology research and development should be developed.

Turkey is both machine manufacturers and machine importer. Although imported machines are usually computer-controlled / intelligent machines, manufacturers cannot benefit from the capabilities of these devices because they are not qualified labor force. The machines we produce as a result of this process cannot go beyond the means of cheap production suitable for mass production of the second industrial age which cannot be controlled by computer [23]. Additionally, Turkish information technology usage rates are shown in Figure 2 and Figure 3.
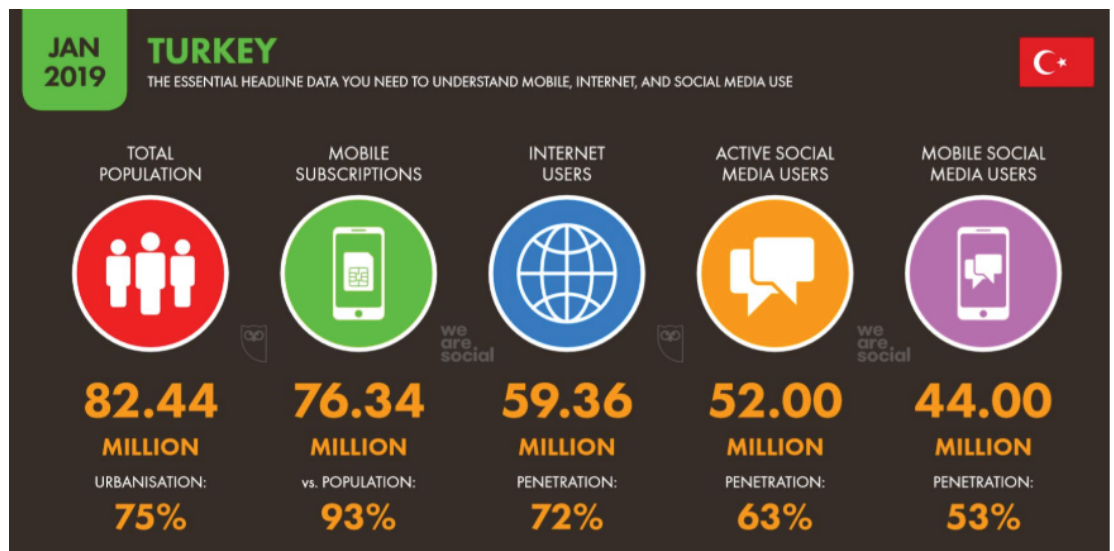

Figure 2: Statistics of information technology usage in Turkey [20].

Turkey's chances of being integrated into the light of these figures innovations in industry and 4.0, but can only be possible with the planned action of all stakeholders and partners [24]. Otherwise, in the event of loss of competitive advantage in the global cost of the common axis, Turkey's economy will suffer serious problems. Turkey is facing in cooperation with the government and industry organizations to adapt to the industrial transformation wave, increasing the awareness needs to be created without delay the strategic vision and roadmap [18]. Following this stage, according to Turkey's economic infrastructure and the ability to target sectors should be identified and encouraged to offer global market products and support programs should be applied to this sector. The global economic multinational companies that are part of the
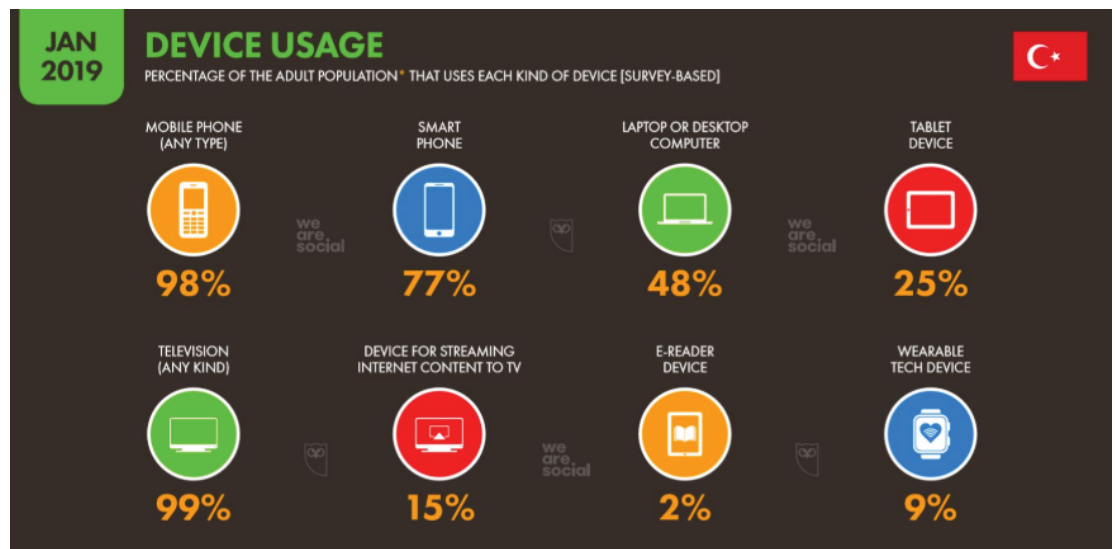
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Figure 3: Statistics of technological device usage in Turkey [20].

system should be encouraged to share their experiences and increase their activities in Turkey. Additionally, Research & Development activities should be focused on in order to reveal the qualified labor market and to follow the technological innovations.

The inclusion of digital technologies in production processes accelerates and increases production power. Growth of economies, change in import-export balances, formation of different business areas will lead to significant changes in the current system. Intelligent manufacturing processes, intelligent products and remote interoperable systems will provide a high level of flexibility in production processes. It will also allow customers to be integrated into the system and will be able to produce products that can be customized at low costs in line with customer requirements.

Figure 4 shows the amount of industrial robots available and estimated by businesses worldwide.

Figure 4 shows that the number of industrial robots installed in the world-wide enterprises in 2008 increased by 76.6% in the last 8 years and reached 1.8 million. In the next 4 years, it is estimated that approximately 3 million industrial robots will be established in factories around the world. These figures provide information on the use of Industry 4.0 components.

Research conducted by BCG with companies in the UK, Germany, and France found that companies would need qualifications such as data science (49%), software development (48%), and programming (46%) in the future; shows that the need for machine operations and muscle-powered jobs will decrease [26]. It is also known that China companies, which are economically developing fast, can provide the fastest integration in the world for digitalization. With this wave of industrialization, new professions
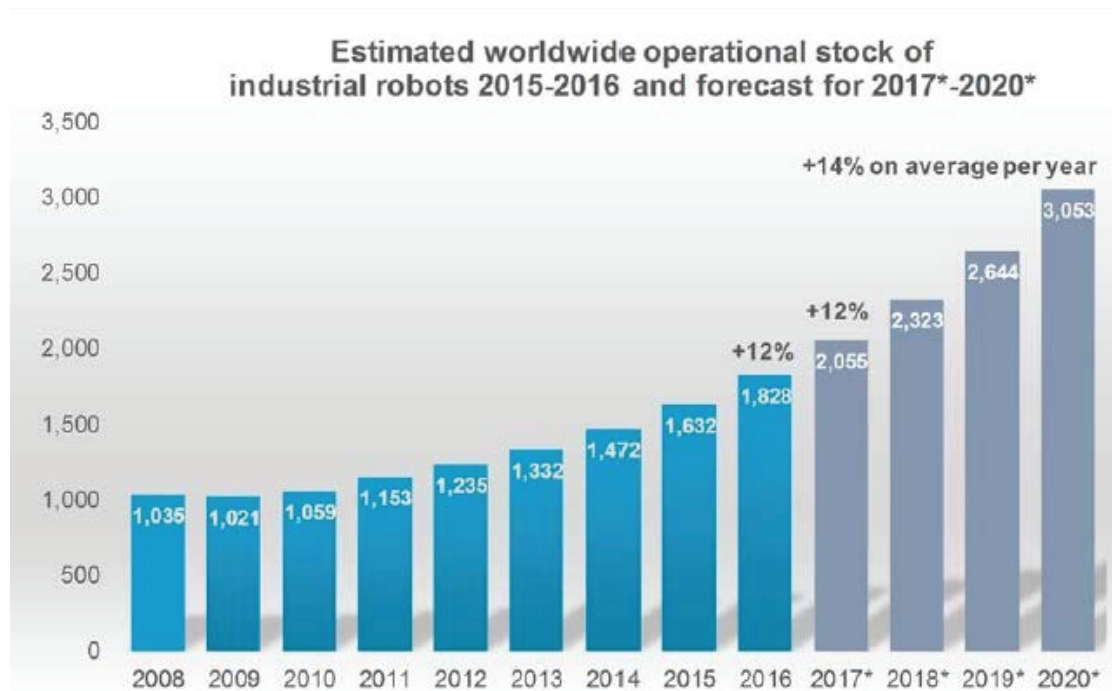
Figure 4: Amount of Industrial Robots Available and Estimated in Worldwide Enterprises (Thousand) [25].

such as industrial data scientist, robot coordinator, data security expertise, 3D printer engineering, data analyst will emerge and gain importance.

Turkey also put forward under the leadership of Siemens Industry 4.0 and firmly applied in productivity, quality, and industrial production is emphasized in particular the need to start from the further professionalization of the necessity to raise the digitalization [22]. It is stated that growth and development can be possible with efficient and efficient use of technologies. Especially business processes using the Internet of Things (IoT) should be managed correctly so that improvements can be made. In smart modular buildings, Industry 4.0 monitors physical processes with cyber-physical systems, aiming at communicating objects with one another and making decentralized decisions. Virtual 3D development, digital planning and monitoring, systematic identification of customer needs through error-free production processes, new business processes, and above all, allows production processes to be more efficient. With Industry 4.0, Siemens estimates that the time to put new products on the market can be reduced by 25-50 percent, engineering costs can be reduced by up to 30 percent and energy savings of up to 70 percent can be achieved [22].

In Turkey, Izmir, Gaziantep, Mersin, Konya and Kayseri in the provinces 'smart factory model' projects are not yet known, although noted that the full output completed. There are 200 automation company in Turkey. Since many of them are still importing required equipments, there is no significant impact on the country's industry in

automation production which will be the basis of digitalization [27]. It should be known that institutions can successfully implement the principles of Industry 4.0 and require a long-term transformation effort with an approach that takes into account all human, technology and process elements.

"Turkey's Global Competitiveness as a Necessity for Industry 4.0" report prepared by BCG and TUSIAD in 2016 [26], the industry 77% of companies stated that they have information about the digital transformation of the research conducted in 2017, this ratio increased to 90%. In the report, 95% of the companies stated that they showed an interest in digital transformation in industry. The increase in the level of knowledge and awareness recorded in a year on digital transformation in industry is promising for Turkey. However, although companies have high levels of awareness, only 61% of respondents think that their companies are ready for this transformation.

It is observed that, the majority of industrial companies in Turkey, use enterprise resource planning software and production management systems. This shows that companies attach importance to process automation.

As is known, applications such as Big Data Analysis, Horizontal / Vertical Integration and Cloud should be built on automation systems. The fact that these systems are already used in companies shows that there is a significant potential.

4. Conclusion

In the field of social sciences, Industry 4.0 suggestions and applications provide solutions to many different problems, and the results show that different types of problems can be found in this field. the production process in Turkey, manufacturing activity in the case of integration with Industry 4.0, effectiveness and will bring about a process that is dominated by the concept of productivity. In the foreseeable future, the semantic structure, the reasoning and the fact that it can make decisions in this direction and leave it completely from human motive, is the philosophy that constitutes the focal point of Industry 5.0. The factories, which are provided with the Internet of Things within Industry 4.0, and the production system from which the human element is scarce, and which are completely unmanned working integrated to all production processes, will work according to the philosophy of Industry 5.0. With the philosophy of Industry 5.0, the aim is to make the world more livable, to use all the solutions developed for the benefit of human life and to shape the society with this consciousness.

Great importance should be given to IT education in Turkey. To educate programmers and to accelerate the research of the o are must for digitalization. In Turkey, the

biggest challenge faced by the technology manufacturer companies is low level of awareness about digital transformation in industry. Subsequent to this, lack of financing, qualified manpower and insufficient demand are seen as important handicaps for digital transformation.

The uncertainty of return on the investment costs and investment in Turkey is seen as a major problem in the digital conversion. Later, the lack of qualified workers is an important problem. Companies need to have a more competent workforce in order to effectively manage the new production systems around digital technologies. For this reason, it is very important to establish long-term training programs in order to gain additional competences that create value for the current workforce. Increasing demand for specialized labor force in different disciplines along with transformation will create new employment opportunities for qualified workforce. Such training programs must be established and disseminated urgently.

Within the framework of industrial transformation in Turkey in general, Robotics and Automation, Big Data and Analysis and Artificial Intelligence and Intelligent Systems should focus on issues. In this context, in order to determine what companies will do and how to do it, it is necessary to determine the digital transformation roadmap. Although this roadmap is one of the issues discussed in the last two years, it is still not in the way of a clearly defined strategy.

However, in addition to all these, companies which are prone to some technological transformation have the ability to make necessary transformations within their own structures. Especially in data security, robotic and IoT issues, there are important applications. These developments are not sufficient and companies need to take more steps in order to make efficient and efficient production using the Industry 4.0 components.

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