Journal of Business, Economicsand Finance - (JBEF), ISSN: 2146 – 7943, , http://www.pressacademia.org/journals/jbef

PressAcademia

Journal of Business, Economics and Finance

Year: 2017 Volume: 6 Issue: 3

THE REFLECTIONS OF DIGITALIZATION AT ORGANIZATIONAL LEVEL: INDUSTRY 4.0 IN TURKEY

DOI: 10.17261/Pressacademia.2017.688
JBEF- V.6-ISS.3-2017(9)-p.291-300

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To cite this document
Yuksel, A.N. and E. Sener (2017). The reflections of digitalization at organizational level: industry 4.0 in Turkey. Journal of Business,Economics and Finance (JBEF), V.6, Iss.3, p.291-300.
Permemant link to this document: http://doi.org/10.17261/Pressacademia.2017.688

ABSTRACT
Purpose - Recent developments on internet and digitalization have emerged the fourth industrial revolution named as Industry 4.0. While some researches have been carried out on Industry 4.0, there has been no detailed investigation on the impacts of Industry 4.0. This paper attempts to show the effects of Industry 4.0 at organizational level.
Methodology - Qualitative method is used in this study. The data were collected through five open ended questions. Questions were asked to ten executives from diverse organizations. Answers were analyzed by researchers by applying content analysis method.
Findings- At the end of analyses, the impacts of Industry 4.0 were categorized by two extensive scopes. First includes organizational level impacts and individual level impacts, second includes positive impacts and negative impacts.
Conclusion- The present study fills a gap in the Industry 4.0 literature by the contributions of its findings. More research is required to do in this field over time depending on its increasing use at organizations.

Keywords: Digitalization, fourth industrial revolution, industry 4.0, Turkey, organizational impacts.
JEL Codes: M15, M19, O30

1. INTRODUCTION

Technological innovations have been inevitably triggering a rapid change in the world. In terms of both development and diffusion, the speed of innovation seems to have increased more than ever (Schwab, 2016: 18). Meanwhile beyond rapidity, technological innovations give rise to the emergence of entirely new industries and types of work. Also technological innovations give rise to a global shift from manufacturing economies to knowledge and service economies. The underlying assumptions about the job design that were true in the 1970s and 1980s have been no longer valid today and organizations have attempt to adapt to a rapidly changing knowledge economy (Langfred, Rockmann, 2016: 630). Many of the large organizations that have emerged worldwide for the last 15 years, have revealed the process of digitization by merging social needs with the new ideas that have built on structural innovation (Bayraktar, 2017: 10). It is clear that the subject of this work, Industry 4.0, has risen above the digital revolution, and even it moved beyond the digitalization process that has emerged. The name of the fourth industrial revolution "Industry 4.0" is comprehensive and it is a very new term. It is observed in the literature that, academic studies on this term began to increase in 2016, but for 2014 we have only seen Germany based studies. For example, in their studies, Gorecky et al. (2014: 289) stated that the development of Industry 4.0 would change tasks and demands for the labour in the organizations and demonstrate solutions for the technological assistance systems of workers, which implement the representation of a cyber physical world. Likewise a paper published on 2014 in Germany, describes that outside of the German-speaking area, the term Industry 4.0 is not common and it is used for defining a future project in the paper (Lasi et al., 2014: 239). Especially in 2016 and the subsequent years, it can be seen that the term Indusrty 4.0 have been used more commonly. However in Turkish literature, the number of academic articles is lower than the publications and reports prepared by some institutions. Among the significant studies on the concept of Industry 4.0 in Turkey, there is an article named "New Industrial Revolution Intelligent Manufacturing Systems Technology Road Map" prepared by TUBITAK in 2016. In this article, 10 technological targets of Turkey are determined for catching/passing the world level. Also in October 2015, The Aegean Region Chamber of Industry took the issue and prepared a publication namely "Industry 4.0" in order to raise awareness of a new transformation in production Technologies. In march 2016, TUSİAD prepared a report named "Industry 4.0 in Turkey As an Imperative For Global Competitiveness" to support the efforts on industrial transformation in Turkey. The aim of this paper is to define the present and future potential impacts of Industry 4.0 at organizational level, which is a new concept and which will have various implications in each area whose boundaries have not yet been identified. For this purpose, firstly the digitalization and the bringings of the digital age, the concept of Industry 4.0 and the potential impacts of Industry 4.0 will be examined. In the method section, the method of working will be examined and the findings will be tried to be explained in detail.

2. LITERATURE REVIEW

2.1. Digitalization and The Bringings of The Digital Age

In recent years, Industry 4.0 has been introduced as a populer term to describe the trend towards digitalisation and automation of the manufacturing environment (Oesterreich, Teuteberg, 2016: 121). In other words, Industry 4.0 can be defined as the increasing digitalisation and automation of the manufacturing environment from the technical point of view, as well as the creation of a digital value chain to enable the communication between products and their environment (Oesterreich, Teuteberg, 2016: 122). Therefore, before the concept of Industry 4.0, it is necessary to examine the concept of digitalization. According to Schwab, the digitalization simply refers to automation. Besides, the most visible reality of the digital age is "information products" that many new businesses produce by zero storage and transportation costs. For instance, some groundbreaking tech companies like Instagram or WhatsApp produce information products while they need low amount of capital to grow (Schwab, 2016: 18-19). According to another definition, digitalization is, instead of having a non-integrated information technology infrastructure, the process of transforming digitized resources into new revenue, growth and operational results which will add value to the company. Developing new business models, integrating information, company resources and digital technologies by new combinations to create unique customer experiences and applying technology to these resources to enable new products and services also expresses digitalization (Accenture, 2015: 12). Digital processes emerge as a result of increased networking of technical components and also in conjunction with the increase of digitalization of produced goods and services, they lead to entirely digitalized environment. This is in turn led to new technologies to arise such as simulation, digital or virtual protection and augmented reality (Lasi et al., 2014: 240).

As a result of the digital age, innovations have begun to derive from interdependencies among different technologies. Harmonization and integration of a large number of different disciplines, technologies and inventions are one of the requirements of the digital age. For example, today, the biological world and digital manufacturing technologies have mutual interaction (Schwab, 2016: 19). Uninterrupted communication can be provided among more machines and vehicles, thus it facilitates the emergence of more simulation and optimization software towards to operation and control of production systems. Due to improvements in automation and data collection (sensor) technologies, intelligent systems and tools generate and transmit more data (Banger, 2016: 147). If the developments in information technologies that have changed not only the high-tech products, but also the routine tools of our daily life are used in innovative way by industrial firms, it has the potential to completely change production processes (EKOIQ, 2014: 3). By digitalization of every stage of the production chain, ensuring machine-human-infrastructure interaction 'Smart production systems' have been developing. Thus, there has been a paradigm shift in the industry; it is seen that the industries where steam powered mechanical systems have been used for about 300 years, convert to a system in which Cyber-Physical Systems (CPS) take part (TÜBİTAK, 2016: 1).

One of the fundamental forces of Industry 4.0, CPS are the systems that connect the physical world and virtual world (cyber space) and also one of the returns of digitalization. Besides CPS contain smart machines, warehousing systems and production facilities that have been introduced digitally and have end-to-end ICT-based integration feature (Kagermann, Wahlster, Helbig, 2013: 14). By the help of virtual and augmented reality, a mediating interface can be built between user and CPS. Virtual Reality is a system that allows user to interactively explore and simulate the behaviour of a CPS-based production system. However, it needs a realistic mapping of manufacturing processes. The Augmented Reality is the other system that refers to the computer aided enhancement of human perception by use of virtual objects. Augmented Reality facilitates the directly add of needed information to the labour's field of view (Gorecky et al., 2014: 290). Other than these, according to Schwab, it is possible to classify yields of digital age as physical, digital and biological. Physical yields are already showing themselves as autonomous vehicles, 3D prints, advanced robotics and new materials (Schwab, 2016: 24-26). This incrementally growing technologies will play a key role in transition to Industry 4.0. These can also include: Watson an artificial intelligence developed by IBM, Google Glass developed by Google, Slingshot water purifier, sensor technologies, self-driving cars, nano-printing that can be sensitive while producing micro things, drones and robotic surgical systems (Schlaepfer, Koch, 2015: 5).

Digital yield of digital age is the internet of things. The connection between things and people is made possible by connected technologies and various platforms, and this resulted as internet of things (Schwab, 2016: 27). This term can be seen as internet of things and services in some papers as well. Internet of things and services, based on perpetual communication via internet that allows a continuous interaction and exchange of information not only between humans and human and machine but also between machines themselves. Further Internet of Things represents a fundamental concept in the integration of all smart devices that are parts of major smart projects (Roblek, Mesko, Krapez, 2016: 1-3). In the biological sense, especially innovations in the field of genetics, and future productions of synthetic biology will be other yields of the digital age (Schwab, 2016: 30). All these developments, along with enabling innovations that were not possible before also with the factors like Cyber-Physical Systems, internet of things and services was among the elements that triggered the fourth industrial revolution also called Industry 4.0.

2.2. Industry 4.0

Three industrial revolutions have taken place until Fourth Industrial Revolution which is known as Industry 4.0. First Industrial Revolution followed introduction of water and steam powered mechanical manufacturing facilities at the end of 18th century. First mechanical weaving loom produced in 1784 in the UK. Begin with a light industry as textile in the UK, the First Industrial Revolution penetrated to heavy industry with the consecutive technological advancements. Thus, production concept broadly shifted from manpower to machine power. Second Industrial Revolution was emerged through introduction of mass production with the help of electrical energy at the beginning of 20th century. In the same period Henry Ford's automotive mass production system also quickly improved industrialization. In the First Industrial Revolution, industrialization effected UK and Europe. With the Second Industrial Revolution, industrialization spread rapidly in countries like the US and Japan and after this affected many regions of the world. In the 1970s, until today the Third Industrial Revolution has become dominant. Through electronics and IT the further automation of production processes achieved and in 1969, first programmable controller (PLC) Modicon 084 was introduced. First Industrial Revolution, while being defined as mechanization of production, Second Industrial Revolution is serialization of production and the Third Industrial Revolution is defined as automation and digitization of production (Kagermann, Wahlster, Helbig, 2013: 13; Schlaepfer, Koch, 2015: 3; Ekonomik Forum, 2016: 17; Siemens, 2016: 5-6). In recent years, by Cyber-physical systems and dynamic data processing the end-to-end connection of value-chains have been provided, thus the Fourth Industrial Revolution has come true (TÜSİAD, 2016: 19). The main goal of Fourth Industrial Revolution, with other name Industry 4.0, is horizontal and vertical integration of cyber-physical systems into production processes and logistics (Prinz, Kreimeier, Kuhlenkötter, 2017: 160).

The reason of the widespread use of Industry 4.0 term instead of the Fourth Industrial Revolution and also the more presence of Germany based works related Industry 4.0 in the literature is because of the term Industry 4.0 is a name of a project of Germany. To continue to strengthen the development of the country in the future, Germany prepares some projects. Industry 4.0 is one of that projects (Siemens, 2016: 9). The Global Production Competitiveness Index Report which was published in 2013 by Delloite, reveals that the industrial forces of the past 60 years as Germany, US and Japan, quickly lost their production competitive advantage to emerging economies pioneered by China, India and Brazil (EKOIQ, 2014: 2). As confirming the report; the steadily competitive pressure on the manufacturing industry in Germany by Asian and South American, competitors are calling for a commitment by the industry to secure Germany as production area. And also to be able to maintain its position against low-wage countries (Prinz, Kreimeier, Kuhlenkötter, 2017: 160). In 2011, in order to strengthen the development of the country, German Ministry of Education and Research, under the name “High-Technology Strategy 2020's Future Projects”, has announced the “Industrie 4.0” project. This project firstly have been voiced in the Hannover Fair and in 2013 under the leadership of Federal German Academy of Science and Research, “Industry 4.0 Strategy Document” has been prepared. Thus a new industrial revolution was introduced under the name Industry 4.0 to all over the world (Siemens, 2016: 9). Associated with the term Industry 4.0 due to the increased research attention on the internet of things and Cyber-Physical systems, governments and industries worldwide have noticed this trend. Governments and industries have taken action to take advantage of the benefits of the new industrial revolution, governments such as the US, Germany, France, UK, China, Japan, and Singapore have implemented various plans. Industries like AT & T, Cisco, General Electric, IBM and Intel founded the “Industrial Internet Consortium” in 2014. Also other big firms like Siemens and Bosch have already invested heavily. In the meantime growing number of research centres and universities have also taken part and contributed. After all of these contributions, a question appear **“After years of efforts, what is the current status of the Fourth Industrial Revolution?”** (Liao et al., 2017: 3610). In fact, this industrial revolution is still in its early stages, fundamentally changing the way of living, working and communicating. With this revolution, new business models are emerging and the systems of production, consumption and delivery are being reformed as the built-in industries become degraded. From a social perspective, there is a serious paradigm shift in the way people express themselves, inform each other and entertain. In addition to these, governments and organizations, as well as many systems such as education, health and transportation, are being reformed (Schwab, 2016: 9-10). Looking at the industrial production framework, advanced digitalization in factories, combined use of internet technologies and future-oriented technologies in the field of "smart" objects have caused serious paradigm shifts in the field of production (Lasi et al., 2014: 239) and it is clear that the changes will continue. Therefore, it is understood that Industry 4.0 will have its effects in various forms. It is also important what are these effects in today's situation.

2.3. Current and Potential Effects of Industry 4.0

Industry 4.0 will provide greater flexibility and robustness together with the highest quality standards in engineering, planning, manufacturing, operational and logistics processes (Kagermann, Wahlster, Helbig, 2013: 20). At the same time, it will also help to improve production processes, increase productivity by lowering party size values, and fulfill individual requests and short-term demands. With Industry 4.0, the product development times will decrease and it will be possible to be transparent in the real time to make faster decisions (Basl, 2016: 4).

With the vision, set for Industry 4.0, it becomes clear which level and areas the effects will be in (Kagermann, Wahlster, Helbig, 2013: 20-21):

(i) Industry 4.0 will be characterized by a new level of socio-technical interaction between all actors and resources involved in production. "Smart Factories", an important component of this vision, will be embedded within inter-company value networks and will be characterized by end-to-end engineering.
(ii) With Industry 4.0, smart products can be assigned with a unique identity and thus always be locatable. Even while they are being made, they will know the details of their own manufacturing process.
(iii) In the future under Industry 4.0, it will be possible to combine individual customer and product specific features in the design, form, order, planning, production, operation and recycling stages of products.
(iv) The workforce will be able to get rid of having to perform routine tasks and focus on more creative, value-added activities.

The four core components of Industry 4.0 are **Cyber-Physical systems, the internet of things, the internet of services and smart factories**. Machine communications and smart products are not considered as independent parts. The machine communication is an enabler of the internet of things. Also smart products are subcomponent of the cyber-physical systems (Roblek, Mesko, Krapez, 2016: 3). Some of the studies predict that the new era factories will perform self-inspection, control and the development processes by self-acting robotic production tools which have been detecting processes by sensors instead of human senses (Alçın, 2016: 27). All these components can give an image of the fact that factories work completely without human agency. However a holistic view on the Industry 4.0 as a technology-organization-personnel triangle is a more sensible angle of view. In this context, also referred in the vision set for Industry 4.0, the term “socio-technical system” is further included in almost every future developments of industrial workforce. The socio-technical approach underlines that technological innovations are not the solely defining momentum of Industry 4.0, also the other subsystems organization and personnel are equally important (Reuter et al., 2017: 355). Gorecky et al. (2014: 289) indicate that in the future, the individual worker will undertake more responsibility and a larger operating area. Additionaly, the labour as a last at the Cyber-Physical structure, when confronted with complex problems will take the role of the creative problem solver. According to another study, there are two perspectives on the role of labour in Industry 4.0. The automation perspective gives two roles to the labour: highly qualified experts and depreciated specialists. Conversely, labor-centered perspective proposes an increase in the range of action of specialized experts and high qualified workforce with raised value (Prinz, Kreimeier, Kuhlenkötter, 2017: 160). As future users of new technical devices and systems, qualified workforce and their practical knowledge about their workplaces are crucial for Industry 4.0, in terms of the success of the design and management phases (Reuter et al., 2017: 356).

The Fraunhofer Institute published a study of “Industry 4.0” in 2013. As a result of the study, there are three future-relevant themes were identified: **Complexity, capacity for innovation and flexibility**. In particular, the complexity will emerge rapidly in the future due to the diversity of technologies used and the increasing individualization and personalization of products and services (Rennung, Luminosu, Draghici, 2016: 373). Apart from these, the fact that production equipments are equipped with machines and robots with high automation, they can easily adapt to the slightest changes and have working capacities compatible with the labour are expected effects in the future. It is also expected that with the sustainability of resource saving of production systems, increase in productivity and decrease in costs (Can, Kıymaz, 2016: 110-111). In a workshop, the main benefits of fields caused by Industry 4.0 were presented as follows (Jager et al., 2016: 118):

(i) Digital individualization (Additional benefits to product options can be created and offered digitally)
(ii) Flexibility (Rapid responses to demands can be provided by a production system that can be easily adapted)
(iii) Demand orientation (Products and services can be produced according to usage area)
(iv) Sustainability (The production schedule can be planned for cost and utilization optimization)
(v) Consistent process orientation (Customer will have better connections with business processes)
(vi) Automated knowledge and learning

(vii) Productivity optimization (Economic production and with real-time transformation, small production units can be assembly together)

As well as the effects and benefits of Industry 4.0 mentioned, have been realized in some industries and countries; it is understood that the effects are still unknown in some of the countries. Therefore, this study will also determine the level of awareness of the effects of Industry 4.0 in Turkey.

3. DATA AND METHODOLOGY

3.1.Research Model

This study was carried out by sharing opinions and experiences of experts working in different sectors operating in Turkey in order to demonstrate what the current situation is and its effects are at the organizational level of Industry 4.0, which is thought to cause effects not yet fully foreseeable. Study in this direction, is a phenomenology research from among qualitative research design methods. In phenomenology research, the data source of the research is the one having experienced the phenomenon of research and those who can explain this phenomenon. *The main purpose of phenomenology as a research pattern, to reduce individual experiences of a phenomenon to a universal description. So it is an effort to understand the true nature of the object* (Creswell, 2013: 77). The aim of this study is to understand the effects of the Industry 4.0 which is a new phenomenon in Turkey and world wide at the organizational level.

3.2.Working Group

In order to capture an analytical view in the study, the opinions of the experts of the field were taken, the organizations expected to have a relatively high level of digitalization were selected (criterion sampling) and also their works and web sites were examined. As a result of the investigation, the managers of related organizations of the information processing, information technology, research and development and human resources departments have been determined. Although the main method of collecting data is interview in phenomenology research, the data collection tool of the study was sent electronically due to the thought of it is a convenient method of digitalization. When the time constraints of the participants of the study group are taken into account, it is seen that the use of this technique has been appropriate. The study was conducted with a working group of 13 people determined by criteria sampling and 10 persons composed of employees of banking, education, technology, electronics and furniture sectors operating in Turkey. In addition to 10 persons, in order to provide support to analytical side of the study 3 academic members engaged in academic studies related to the subject are also included in the study (Table 1).

Table 1: Features of The Working Group

Participant*	Job	Gender	Workspace/Workig Unit	Sector
P1	Inspector	Male	Inspection Board	Banking
P2	Human Resources Training and Development Chief	Male	Human Resources Directorate	Furniture
P3	Director of Educational Technologies	Male	Information Technologies	Education
P4	Technical Product Manager	Male	Research and Development, Product Development	Technology
P5	Head of Department	Male	Faculty of Economics and Administrative Sciences	University
P6	Head of Department	Male	Faculty of Economics and Administrative Sciences	University
P7	Head of Department, Dean	Male	Faculty of Economics and Administrative Sciences	University
P8	Project Manager	Female	Information Technologies	Banking
P9	Production Consultant	Male	Electronic Manufacturing Factory	Electronics
P10	Section Manager	Male	Automation and Project Development Department	White goods
P11	Chief Executive Chairman	Female	Executive Board	Machine
P12	Assist. General Manager for Technical Affairs	Male	Management	Machine
P13	Data Manager	Female	Information Processing	Food

* The code given to them is used instead of the names of participants and their businesses.

Participants in the working group are largely the employees participating in the administrative decision-making processes in their organizations. This feature is due to the deliberate selection of the participants appropriate to the nature of the study. Thus, it is assumed that the participants can provide clear and accurate information about the digitalization processes of organization. Along with this, an important part of the participants is male. Although this feature is not specified on purpose, it may be the subject of a separate work.

3.3.Data Collection Tool

In accordance with the purpose of the study, the basic research question, which is answered by the authorities of different sectors and departments, has been prepared and sent to the participants as follows:

> *"What is your opinion about the current impact of the high technology's use characterised by internet of things and services and named as Industry 4.0 on organizations? And also what do you think about the potential impact of Industry 4.0 on organizations, institutions and firms? And why?"*

In addition to this question, a form consisting of questions about the position of the participants, the unit they work in, the sector and whether they already have knowledge of Industry 4.0 and how they evaluate their organization's current level of digitalization have been prepared. Data collected by the form that has totally 5 questions.

3.4.Data Analysis

Forms that participants thought sincerely answered, were evaluated by researchers based on qualitative data analysis evaluation process. All the responding and received back forms were collected in a single text and content analysis was conducted. Some of the answers in a total of 8 pages of answer text are presented in the findings section under the categories which are based on the nature of the research question. From time to time the participants' expressions were included to enrich the findings section.

4. FINDINGS

Among the questions on the returning forms, the Industry 4.0 and digitalization related three questions were evaluated in this section, and the answers were presented in separate titles.

4.1. "Do you have any previous knowledge about the industry 4.0? If so, where did you get this information?"

Information sources of Industry 4.0 are shown in Table 2.

Table 2: Information Sources of Industry 4.0

Participant	Information Sources of Industry 4.0
P1	Academic Development Process
P2	«Industry 4.0 Platform» information documents
P3	Sectoral meetings
P4	Educational background and widespread IOT applications
P5	Scientific studies
P6	Foreign press, foreign literature, web and social media
P7	Academic meetings
P8	Social media and sectoral events
P9	Online and printed documents: Book, brochure, web
P10	Web with international fair and company visits
P11	Technology development zones
P12	Travel abroad and Industry 4.0 programs
P13	Panels

As seen in table, it is understood that all participants are aware of Industry 4.0, usually by the social media and web. On the other hand, some participants were informed through works of their firms about Industry 4.0. Some of the answers of the participants to this question are as follows:

"*Yes, I have. I have been in a catch –up work about the topic through the site of the Industry 4.0 platform and the education information documents*" (P2)

"*I had knowledge and opinion about Industry 4.0 from the media and various sectoral events.*" (P8)

"*Yes. I participated to the last Industry 4.0 programs of the OAIB with Germany and Poland.*" (P12)

4.2. "How do you evaluate your organization's current level of digitization?"

The perceptions or opinions of participants in the research group on the level of digitalization of their organizations are shown in Table 3.

Table 3: The Level of Digitalization

Participant	The Level of Digitalization
P1	Leader in Mobile Banking
P2	Systematic Digitalization (Industry 4.0 Office Team in the R&D Center)
P3	Digitalization in Financial and Recording Processes
P4	Market Leader in Digitalization
P5	Intermediate "Costly" Digitalization
P6	Software and Hardware Increasing the Efficiency of Student, Library and Personnel Information Systems
P7	Distance Education System, Smart Boards, e-classes Electronic Information Management System, e-signature system
P8	Data Mining, Business Intelligence and Virtualization, Process Automation, Cyber Security
P9	Smart Factory
P10	Automation 3.0
P11	Medium
P12	Good
P13	Digital Integration of Production and Sales Department Software Department

The level of existing digitalization in the institutions was asked to the participants, and it has been seen that in general, digitalization has been completed or investments for digitalization and technology have been continued. In general, it is understood that the institutions have not yet reached the level of Industry 4.0. However for the current level of digitalization of the organization, it has seen only in one of the answers as level of "Smart Factories" which is one of the core components of Industry 4.0. Some answers to this question as well as the "Smart Factory" answer were given below:

"*As competition and technology continue to grow together, our investments on digitalization and technological investment continues at the fastest pace. In our established R & D center, an Industry 4.0 office team was organized and our field investments gained speed in the name of systematic digitalization*" (P2).

"*Since we are one of the developers of Industry 4.0, we are giving lots of importance to the level of digitization. Today we are one of the market leaders*" (P4).

"*I can not say it is exactly Industry 4.0. But the developments lead us there. Nevertheless, I think that our digital technology is above the average in Turkey. I can sign documents from out of office, distance education systems, smart boards, e-classrooms, electronic information management system (ebys), to shift of permission and assignment applicants from paper to digital media, e-signature... These can be given as examples of digitization level*" (P7).

"*Successful. In the level of Smart Factory*" (P9).

The answer of a participant who is actively involved in Industry 4.0 projects is below as exactly the same as it. Because of the opinion that it may reflect realistic facts about factories in Turkey at the moment:

"*At some point, application of Ind. 4.0, although the increased digitalization, there is more to do and more businesses to apply. Firstly the development of infrastructure and detailed automation projects must be carried out. … White Goods simultaneously applying similar processes to its 6 factories and at the same time in some conditions it is progressing by raising the level of automation to 3.0. But in the next 5 years we will progress step by step on our roadmap for systematic working of this processes*" (P10).

4.3. "What is your opinion about the current impact of the high technology's use characterised by internet of things and services and named as Industry 4.0 on the organizations? And also what do you think about the potential impact of Industry 4.0 on organizations, institutions and firms? And why?"

Each participant gave different answers to this basic research question. Especially, the answers given to this question were subjected to content analysis. The answers were categorized according to the relation between them in two broad categories. The first category is organizational and individual effects of Industry 4.0, and the second category is positive and negative effects. The findings are shown in Table 4 and Table 5.

Table 4: Organizational and Individual Effects of Industry 4.0

Organizational Effects	Individual Effects
Pressure of job and efficiency	Increased pressure on personnel
Faster and better works	Reduced workload on personnel
More work done with less workforce	Provided social benefits to personnel
Internal processes and automations of organization are faster, more accurate and more secure	Increased need for qualified labour
Increasing organizational efficiency and reducing costs	Human relationships leave their place to electronic environment
Provide convenience to the symmetric information flow between stakeholders	Transformation of superior-subordinate relationships from human dimension to digital dimension
Acceleration of organizational processes	
Zero error and minimum loss	
Increasing effectiveness, facilitating control	
Place independent work system	

Table 5: Positive and Negative Effects of Industry 4.0

Positive Effects	Negative Effects
Real-time traceability of production performance	Disappear of businesses that can not catch Industry 4.0
Increased labor quality	Decreased employment of the workforce with operational capability
Ability to manage factories and businesses remotely	Limited effects on countries where public services are not at a certain level
Increased client experience	Difficulties of data storage
The emergence of new technology giants	Disappear of businesses that can not manage the data
Digitalization of all devices and networking between them	Disadvantages in terms of employment
Finding solutions to quality, standard and aesthetic options of products	Weakening of handwriting ability
Provide faster, more efficient and personalized products	

As seen in Table 4 and Table 5, it is understood that there has been an awareness about Industry 4.0 and digitalization issues in Turkey. It has been seen that there are similarities between the opinions of the participants and current and possible effects of Industry 4.0 which has been already available in the literature. Most highlighted topics of the impacts of Industry 4.0 have been quality, flexibility, efficiency and speed, and it has been seen that these views of participants correspond to previous researchs. Indeed, Kagerman et al. (2013: 20) noted that Industry 4.0, together with higher quality standards, will provide much more flexibility and durability in engineering, planning, production, operations and logistics processes. At the same time, with Industry 4.0, product development times will decrease and real time access will be possible to make faster decisions (Basl, 2016).

In parallel with this identified effect, one of the participants' answers is as follows: "*At the companies that we define as Smart Factory and also that production performance can be real time monitored through the sensor and wireless IT Technologies, so the business and productivity pressure on the labour will increase. The impact of this on the organizational structure needs to be investigated first*" (P9). Regarding the potential impact of Industry 4.0 on the labour, Gorecky et al. (2014: 289), argue that in the future, individual labour will take more responsibility and will have a wider management domain; moreover, as a final step in a cyber physical structure, the role of finding creative solutions to complex problems will be on the labour.

Parallel to this view, the answers of some of the participants are as follows:

"*School Operations: The development of digital data collection techniques, the convenience of data processing on collected data, fastening school processes will become possible, making processes more efficient will become possible, so the need for qualified workforce will be increased...*" (P3).

"…*In the future it will be possible to produce by working 1000 people less on any production line and there will be experts operating, analyzing remotely from the firm. However non-measured businesses and the factories can not keep abreast with their devices, disappear off the face of the earth at the shortest notice as we are sure*…" (P10).

One of the most comprehensive answers to this question is the following: "***Jobs that require qualified [able to use robots and automation machines] human power will be the subject****. Repeatable jobs or very high value-added jobs that can burden cost of prototype production will be done by machines. The work done by ordinary workers and ordinary technicians will decrease. Because, organizations which work in this way will be expensive in terms of unit costs due to high labor cost or low number of production and unable to compete. These organizations will use more* ***automated machines day by day and try to reduce unit costs****. Therefore, we will see* ***more complex machines*** *in businesses and* ***qualified people (technicians, even engineers) who can use them****, but fewer ordinary technicians and workers. There will be lots of unemployed people.* (P12).

Some jobs with mastership skills will also become more expensive as skill-based businesses decrease. Businesses will try to avoid processes requiring mastership skills and head towards processes requiring machine. Thus, this negative feedback loop will lead to mastership skill becoming a less competitive production method day by day (P12).

Some technology developing countries have been unable to produce low-priced products based upon expensive labor costs. Now they can sell owing high technology infrastructure and also the ease of use and accessibility promised to user. So countries using low-level technology will have no chance of competing with them. In other word, because they know that they can not compete with the price, they will make users technology addicts and compete with technology. Those who can not produce technology will lag behind (P12). *In summary, today's Turkey will remain in a difficult position if it remains stable in this position. Because, yes we have a crowded young population but their connections with technology are limited by the smartphones in their hands. I do not see a young technician who uses robots in our country. Both our country and we, industrialists still compete with prices. We are using technology, do not produce it. We have to buy technology from producers. I am pessimistic for the future*" (P12). If the issues cited by the participant are mentioned together (the bold fonts in the answer), participant is referring to the qualified employees as future users of new technological devices and systems (Reuter vd., 2017: 356), also to the espectation on sustainability of resource saving of production systems with increase in productivity and reduce in costs as well (Can, Kıymaz, 2016: 110-111). It is seen that the most important issue the participant refer to is by the "*we will see* ***more complex machines*** *in businesses…*" sentence is complexity (Rennung, Luminosu, Draghici, 2016: 373) which is known as one of the themes of Industry 4.0 and will especially emerge with the variety of technologies used.

5. CONCLUSION

As a result of this study which has been carried out in order to reveal the current table of the Industry 4.0 processes in Turkey, it is seen that in Turkey, although a complete transition has not yet been made to the Fourth Industrial Revolution, the Industry 4.0 awareness has occurred. It is observed that, the infrastructure has started to improve; that some sectors and firms have been getting informed and receiving information with regard to Industry 4.0 with meetings and international visits. This is also evidenced by the inclusion of vision documents as well as the adoption of government policy as the date on which the research was carried out. The Ministry of Science, Industry and Technology in Turkey has completed preparations for the production reform package aimed at increasing industrial production in 2017 of April. Along with this production reform package, digital conversion will be widespread in production and the transition to the 4th industrial revolution will be achieved. It is thought that the announcements and studies made by the Ministry of Science, Industry and Technology especially in 2017 are considered to be an increasing factor of awareness of Industry 4.0.

It appears that most of the participants' views on the current and possible impacts of Industry 4.0 overlap with previous researches. However, since Industry 4.0 technologies are not actively used in enterprises, it is thought that the realistic dimensions of their effects may not be detected. This study will make an important contribution to the literature since there is not a previous study on the organizational effects of Industry 4.0 in Turkey. This study provides a source for future studies. It is suggested that in future studies, taking the different functions of the businesses into account, the digitalization levels and the effects on the diversified functions can be examined. Also the question of why some sectors outside the information and technology sector are mostly left behind by digitalization proposed as a new research subject. It is clear that Turkey should capture the Fourth Industrial Revolution and should not lag behind the developments. For this reason, it is proposed to increase the number of academic studies that deal with Industry 4.0, and in the direction of the identified deficiencies, completion and development studies should be taken. Meanwhile to identify new effects that will emerge in the future and to take preventive measures if necessary, it is clear that this work should be repeated at times when factories are being equipped with more cyber physical systems.

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