

**THE REPUBLIC OF TURKEY
BAHCESEHIR UNIVERSITY**

**EFFECTS OF INDUSTRY AND ENERGY 4.0 ON
THE INDUSTRIAL FACILITIES**

Master's Thesis

OĞULCAN BAHÇECİ

ISTANBUL, 2019

**THE REPUBLIC OF TURKEY
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**SOCIAL SCIENCE
MBA PROGRAM**

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Supervisor: ASSOCIATE PROF. ATA ÖZDEMİRÇİ

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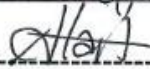
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ABSTRACT

EFFECTS OF INDUSTRY&ENERGY 4.0 ON THE INDUSTRIAL FACILITIES

Oğulcan Bahçeci

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The industry 4.0 has become the most popular revolution nowadays. It is the most important revolution. If you look at the past revolutions you will see a change in each one. In the 4th industrial one there will be a huge change for both the producers and the workers. That change is effecting the way of production and the people's working procedures. The 4.0 revolution has many *milestones* and all of these have good output. In this paper the change of the industry 4.0 and the effect of that change to the industrial facilities are covered with different point of view. The 4.0 change has differences compared with the past revolutions. At the past revolutions the human working power was transferred to the mechanical devices. But the 4.0 revolution on the other name *digitalization* brings the decision mechanism to the electronic systems. So this situation causes some different scenarios. The *entrepreneur* and future of jobs will become popular subjects because of that. The questionnaire interview style is used and question sets are asked to a couple of specially chosen people. The output of the interview and researches are commented at the conclusion.

Keywords: Industry 4.0, Energy 4.0, Change, IOT (Internet Of Things), Robotics, Speed and Flexibility

ÖZET

ENDÜSTRİ VE ENERJİ 4.0'IN ENDÜSTRİYEL TESİSLER ÜZERİNDEKİ ETKİSİ

Oğulcan Bahçeci

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Endüstri 4.0 son zamanlarda çok popüler bir konu haline gelmiştir. Bu devrim en önemli sanayi devrimi olarak nitelendiriliyor. Diğer tüm sanayi devrimlerine bakıldığında hepsinde bir değişim görülecektir. Endüstri 4.0 değişiminde hem üreticiler hem de çalışanları etkileyen büyük bir değişim söz konusu olacaktır. Bu değişim bir üretim tesisindeki tüm süreçleri ve çalışanların yapısını etkileyecek bir yapıya sahiptir. Endüstri 4.0 bir çok yapı taşlarına sahip, bu yapı taşlarının her birinin yararlı çıktıları mevcuttur. Bu tezde Endüstri 4.0 değişiminin Endüstriyel tesislerdeki etkilerinin Endüstri ve son kullanıcılar tarafından etkileri incelenmiştir. Endüstri 4.0 daha önceki devrimlerden bir çok farklılık barındırmaktadır. Daha önceki devrimlerde insan gücü ile yapılan bir takım işler makina gücü ile yapılmaya başlandı. 4.0 devrimi diğer adı ile *Dijitalizasyon* elektronik sistemlerde karar verme mekanizmasını ortaya çıkartmıştır. Bu durum bir çok senaryo ortaya çıkarttı. *Danışmanlık* ve geleceğin işleri gibi bir çok değişik konu gündeme geldi. Tezde özenle seçilmiş sektörde tecrübeli kişilere anket setindeki soruları üzerinden mülakatlar gerçekleştirilmiştir. Bu araştırmalar ve mülakat sonuçları sonuç kısmında yorumlanmıştır.

Anahtar Kelimeler: Endüstri 4.0, Değişim, Nesnelerin interneti, Robotik, Hız ve Esneklik

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ABBREVIATIONS

IOT	:	Internet of Things
AI	:	Artificial Intelligence
ROI	:	Return of Investment
PLC	:	Programmable Logic Controller
SME	:	Small and Medium Enterprise
B2B	:	Business to Business
B2C	:	Business to Consumer
CPU	:	Central Processing Unit
R&D	:	Research and Development



1. INTRODUCTION

Industry 4.0 is a word you have started to be familiar with nowadays. The Industrial revolution has started from 1.0 and now we are talking about the 4.0 revolution. Industrial 4.0 revolution is very significant and became every popular nowadays because it is not only touching the business sector, it is also about our daily life. Our life style will be effected as well. First of all, industry 4.0 makes both the data of the end users and the business sector partners very important. Industry 4.0 can be researched with two main points. One of them is the industrial facilities, the other one is the end users. This paper is essentially focused on the industrial facilities and the change of their strategies. There are use cases(application areas) and the output of the some researches which is very important for our country.

2. LITERATURE REVIEW

The Internet of Things (IOT) is defined as a new industrial revolution that will profoundly affect firms, companies, countries and the consumer habits in the world. IOT is the most important component of the industry 4.0. Companies and countries that are engaged to be included in the IOT-based supply chain, determine their strategies and their road maps in the future in order not to lag behind the world. Most of the countries are making their road maps to see their future on the revolution. Therefore, this situation results companies to change their operational strategies, especially effecting the manufacturing sectors. The Industry 4.0 brings a lot of change even in the organization and culture. In most of the developing and already developed countries, the road maps has been written for this new technology.

Most of the developed countries are seeking to increase efficiency, quality, speed, flexibility, and new measures against labour loss with this digital transformation. Developing digital road maps by creating policies and strategies based on the industry 4.0. Digital transformation brings the key words quality, speed and the flexibility. Production is now becoming more customers oriented. Instead of the traditional methods to be done by people up to now, higher level production will be provided. This will effect the supply-chain management in a positive way so that the producers can easily adapt the customer needs to the mass production. However, this also will bring more competition to the area and since the cost of the raw material will be decreased, the price of the product in the markets will be also reduced. This technology provides the manufacturers rapidly adapt to the customer's needs in a more efficient way.

¹McKinsey Global Institute 2015, P2

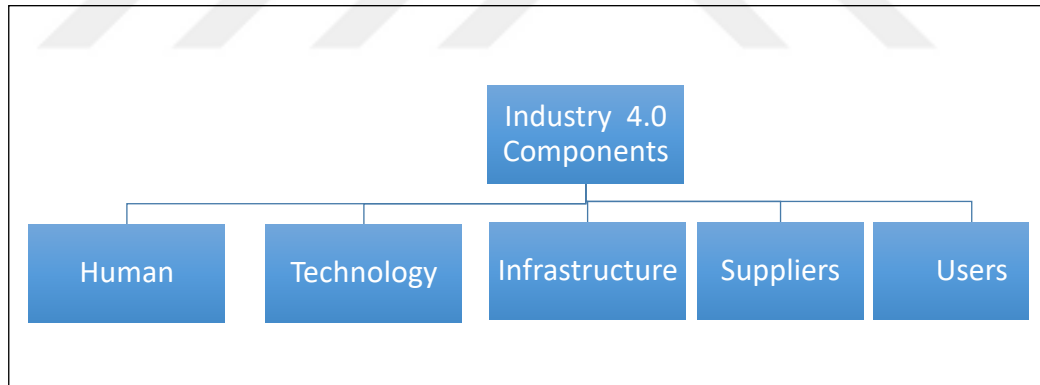
¹ McKinsey Global Institute, The Internet of Things Mapping The Value Beyond The Hype, June 2015

On the other hand, digital technologies make it possible to employ less people. This is the biggest problem for both the employers and employees. Hence this situation may cause loss of some jobs but this technology will also provide the new job lines to be introduced. Future of jobs, which is the very well known nowadays becoming very important and the additional employment opportunities provided by the growth in the economy are also emerging. For this reason, strategies and policies for the acquisition of new talent is also gaining increasing importance. In the future, the need of the human power will be decreased and the new future of jobs will be more popular. ²OECD 2018, Page 17

The digital transformation road map of the manufacturing industry, which is prepared in line with the above-mentioned vision and objectives, focuses on human, technology, infrastructure, suppliers, users consists of the following components;

The components are;

Figure 2.1: The components of industry 4.0



Source: OECD

² OECD, transformative technologies and jobs of the future, March 2018

- i. *Human:* Human is the most important component because the adaptation to that transformation should be done first. The education and the change of the procedures must be done by the humans so we need educated and adapted humans. The education system should be prepared and the qualified workforce should be developed. ³ European parliament 2015, Page3
- ii. *Technology:* New technology should be adapted to make investments. So the r and d teams, other suppliers should work with each other to make the technological infrastructure ready for the using.
- iii. *Infrastructure:* For the latest technology infrastructure is very important. Government should make investments. 4.0 revolution is related with the human' also. That's why the government should make investments to the whole Industry and the SMS'S "Data Communication Infrastructure Development should be done"
- iv. *Suppliers:* We should develop our local suppliers. The supply management is the very important application of the Industry 4.0. The Local Producers are going to talk with the local supplier's computers and make the forecast of the future so "Support of National Technology Suppliers should be done"
- v. *Users:* User is the end of that chain. Even B2B or B2C. The end user should have information about that change. Also the Industrial users should be aware of the usage of the system so "Supporting the Digital Transition of Users should be done" ⁴ McKinsey Global Institute 2015, Page 29

With the digital transformation, the changes in the manufacturing processes will directly and indirectly necessitate the transformation in the labour force. If you look at the industry change towards to the Industry 1, 2 and 3 you will see how the facilities and labour force changed. With these changes in the past years the need of human power increased and blue-collar workers demand was increased. By now with the industry 4.0 the whole system is changing. Robotics and computer technologies are taking the action

³ European parliament industry 4.0 digitalisation for productivity and growth, September 2015

⁴ McKinsey Global Institute, The Internet of Things Mapping The Value Beyond The Hype, June 2015

of the blue-collar workers. New business roles will be popular for the white-collar workers. For the manufacturing industries the all of the processes will be changed and new strategy models will be developed. This situation may cause the entrepreneurs work to the.⁵McKinsey Global Institute 2015, Page 8

The development and production of critical technologies with local resources will reduce external dependency and increase the number of domestic enterprises that produce digital technology. This situation is very important because of the local production. Local production is also depended to the external resources so that situation causes the raw material cost increase and delivery time problems. A local electronic firm is depended to the china for the embedded hardware materials. The effect of the raw material for that producer will effect to the hardware and directly to the electronic producers. Also they wait for the product, they should make perfect supply chain management for that.

By increasing these technologies we are becoming less dependent on foreign countries. The revolution of the industry 4.0 is the way to increase our local production. The role of the companies and the government is getting more important. Turkey needs to develop the digital technology products and services to the competencies of national technology suppliers. To meet the digital transformation needs and demands of the manufacturing industry in our country and even in the global markets in selected technology areas it is aimed at the formation of the world's leading national technology suppliers.

Digitalization process is a process of industrialization, of employees, universities and the turn of the city, new business models and business forms. This process should be taken into account in a 3 parts. One of them is the producer's side. The other one is the government's side. Last of them is the universities side. At the producer side, the producers should be aware of why to use this technology first. The maintenances engineers and the Boss should be educated. The seminars and the education should be done. The adaptation of the latest technologies to the students and making them a part of the local production is the way of the becoming a global producer.

⁵ McKinsey Global Institute, The Internet of Things Mapping The Value Beyond The Hype, June 2015

At the users side the customer or business users should be taken into account. The University and the Industry cooperation is very important.

It is predicted that 50% of existing jobs can be realized by automation technology. Especially in the manufacturing facilities the need of the human power will be decreased in the future. The blue collar workers job's will be done by the robots and these people will be evaluated in different jobs. We are in the very important part of that change. Most of the companies don't want to fire their employees so they should make new titles for them. So most of the companies are making strategies for that change. In then few years that kind of change has been seen in the bank sector in Turkey. In the 90's when you go to the bank, someone was asking to you what is your operation. Now the system has changed, and before you reach the attendant they already know who you are and are able to target you with special offers. ⁶McKinsey Global Institute 2015, Page 50

Looking to that example It's the same for the industrial change. Experts with 30 years of experience and new graduated ones will be working together and the companies should manage them in a very strict way.

⁶ McKinsey Global Institute, The Internet of Things Mapping The Value Beyond The Hype, June 2015

Table 2.1: Strategic effects of 4.0 revolution

Support	Description	Effect Potential
Supply & Demand Management	The Big Data will arrange the production according to the customers need.	%80 power
Work Force Efficiency	Robots and automated process	%50 workforce efficiency
Asset Management	Predictive maintenance	%40 managing assets effective
Stock management	Smart DATA system	%30 stock cost decrease
Go to Market Time	Reduced R&D time for prototypes	%30 go to market time decrease
After Sales Services	Remote monitoring and service	%30 maintenance cost decrease
Quality Management	The perfect production and see the error's of the productions	%20 quality cost decrease
Process & Resource Management	RFID technology remote monitored stocks	Efficiency %5 +

Source : McKinsey Global Institute

The International companies are working on these revolutions much. Country inspections also show that competence and opportunity-based, strategic approach to the identification of digital technologies to be supported. For example, the United states National Science and Technology Council issued a protocol in 2016 that set technology priorities in terms of advanced production followed by a separate strategy and action plan on artificial intelligence technologies of special importance UK has positioned artificial intelligence as one of the building blocks of the industrial strategy. ⁸US national science and technology council 2016, Page 31

⁷ McKinsey Global Institute, The Internet of Things Mapping The Value Beyond The Hype, June 2015

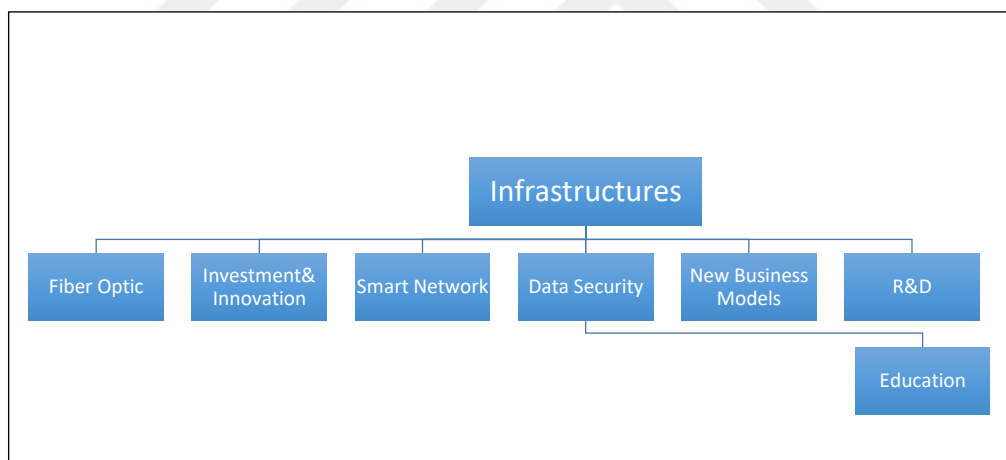
⁸ US national science and technology council, advanced manufacturing national science and technology council Washington dc, January 2016.

The South Korean government, which has put the manufacturing industry's digital transformation process on the agenda of industrial development with the concept of smart factories (which is the most important one for the 4.0 revolution), announced that in the first quarter of 2018, the manufacturing industry would increase investments in digital transformation. The South Korean Ministry of Commerce, Industry and Energy has set five priorities in this direction:

Autonomous vehicles, electronic products (both the embedded and hardware), semi-conductors and screens equipped with internet of things, bio-health and renewable energy. In these areas, it is aimed to transfer 844 million dollars of resources in 2018 and to increase the share of r and d spending in these five areas to 30% to 50% of total R&D expenditures by 2022

The strategies are supported with the following infrastructure;

Figure 2.2: The supported with the infrastructure



Source : DE Digital Federal Ministry for Economic Affairs and Energy

- i. *The fiber optic network:* Creating a gigabit fiber optic network for Germany up to 2025 is a important aim. The current data communication infrastructure and strategy including broadband, is expected to be inadequate for digital transformation needs, thus providing symmetric internet access at gigabit speeds

⁹ DE Digital Federal Ministry for Economic Affairs and Energy, Digital Strategy 2025, 2017

to homes is necessary. In addition, it is aimed to take an active role in establishing mobile internet infrastructure and standards especially with 5G perspective.

- ii. *Creating the regulatory framework to bring more investment and innovation:* Germany's Digital 2025 Strategy places the EU's digital single market policy in the perspective of the national regulatory framework. On the other hand, the strategy includes recommendations for "regulation of digital laws", "establishment of regulatory framework trial areas" where new business models and technologies will be tested, and "modernization of competition laws". In such manner, this is very important for the legal processes.
- iii. *Encouraging "smart networks" in the key commercial areas of the economy:* The strategy paper emphasizes the importance of the management digitalization basics such as energy, infrastructure, health, education through intelligent networks. The documents and the other things will be digital and it will save time and money.
- iv. *Strengthening data security and improving information-based autonomy:* The strategy acknowledges that giving is the main raw material of the digital economy security (Digital wallets and coins) and that all measures must be taken to ensure data security.
- v. *Providing new business models for SMEs:* Most of the SME's understand that digitalization is important, but at least half of them are clear strategies in this regard, and they are "digitalized" and "innovated" programs. To facilitate the digitalization of SMEs, technical and financial support should be provided.
- vi. *New technology research, development and innovation:* Strategy while US firms allocate 14% of their research budgets to commercial applications of digital technologies, US businesses report that it allocates twice as much resources as German businesses in this respect. The strategy document states that support programs focused on specific technologies will be implemented and additional tax will be introduced to encourage r and d innovation. By these milestones at the US, the end users workshops for industrialized age provided by companies, are becoming more popular.

- vii. *Initiating digital education for every stage of life:* The strategy contains vital goals in every area of education and training, from primary education and lifelong learning. These objectives include the digitalization of educational content, in addition to providing the workforce with digital skills.

Germany has taken concrete steps in many areas outlined in the strategy following the publication strategy outlined above. For example, technical and financial support has started to be provided to SMEs under the digital program. Industry 4.0 platforms has accelerated its work on standardization and reference architecture, has even begun international collaborations. Technical and financial support has started provided to SMEs under the digital program of Germany. For this purpose, enterprises that SMEs can consult can be accredited.¹⁰DE Digital Federal Ministry for Economic Affairs and Energy 2017, Page 6

To increase our share of global exports by strengthening the competitive position of our country and increase our production export with high added value, technology intensive structure development manufacturing industry needs a structural transformation.

In order for the digital transformation process to be carried out efficiently, businesses need to transform management understandings, organizational structures and business cultures in addition to the technologies they use in their production processes. This cause the operational and process based change. That should be taken in to a account in a different point of view.

Suppliers will also play a critical role in maintaining and improving the competitive position of our country with the digital technology products, services and solutions they will produce.

In order for the digital transformation process to be carried out efficiently, enterprises need to transform their management understandings, organizational structures and business cultures in their production processes. The transformation process in our operations should be primarily managed by the top management so that the organizational structure can be transformed into digital transformation. In addition, the possible resistance against change a culture of innovation should also be developed in

¹⁰ DE Digital Federal Ministry for Economic Affairs and Energy, Digital Strategy 2025, 2017

enterprises.

Businesses need technical and financial support to develop new technologies. In this context, universities need cooperation and encouragement in bringing the existing technologies to the business. In addition to businesses, the existence of an ecosystem that supports the transformation of public institutions, universities, financial institutions, as well as institutions/organizations, plays an important role in the success and sustainability of digital transformation.

Digital technology also offers important possibilities when it comes to fast delivery of products that are another important asset to product development. So the product managers are able to design and see the samples in a very fast way. This condition is has very good advantages because the markets condition and the customers needs are changing very rapidly. To catch that change, the products must be design very quickly and detailed according to the customers expectations. The 3D models and design of the products on the computers are giving advantage to that procedure. ¹¹DE Digital Federal Ministry for Economic Affairs and Energy 2017, Page 47

¹¹ DE Digital Federal Ministry for Economic Affairs and Energy, Digital Strategy 2025, 2017

3. INDUSTRY 4.0

Industry has been changing towards hundreds of years. It has started with the steam and water mechanical power (1st industry revolution), Electricity and mass production (2nd industry revolution), automation systems (3rd industry revolution), physical and digital systems connections (4th industry revolution). When you look at the history of the industry revolution you will see a huge evolution, increase of production, increase of the productivity.

The Industry 4.0 Revolution is changing the way of our procedures and business functions, Organizational process habits should be change. So in that case organizations must decide to make strategic plans for the change. They are now calculating to make investments for the new technologies. They are calculating the ROI of their facilities. But as far as know industry 4.0 is a very popular topic and there are many companies in that market. This brings the risk of the wrong decisions. The number which Companies actually don't know the exact meaning of the system is very high. Generally the owners of the companies are not technical people so in that case they may have wrong decisions. There may be some consulting companies for taking the full action of implementation of fully the technical and the operational process.¹²TUBİTAK,Yeni Sanayi devrimi Akıllı Üretim Sistemleri Teknoloji Yol Haritası, 2016 Page 2

The "Industry 4.0 " was first announced in 2013. Along with the fact that Germany is mainly based, also explains the main features of this new revolution, thus opening the doors of a new industrial world to the whole world. This announcement has became a very important culture and started to opening new windows to the industry. Industry based on the concept of 4.0; all the relevant units in industrial production communicate with each other(this is the main concept of the Industry 4.0), and all data can be accessed in real time.

The Industry 4.0 is improving the data's importance. A data was a insignificant thing in

¹² TUBİTAK,Yeni Sanayi devrimi Akıllı Üretim Sistemleri Teknoloji Yol Haritası, 2016

the past. But now every machine in the industry has a measurement of data. These data's are becoming meaningful and they are now talking with each other. Also some of the scientist says that there will be junk irrelevant data's in the future. So data's are becoming by together and compressed. In the future there will be a huge data on the world but the meaningfully processed ones will become more important, the other ones will be a irrelevant. So this situation may cause some new type of jobs in the future.

¹³McKinsey Global Institute 2017, Page 4

That real time data flow and intelligent data is connecting physical world to the digital world. This technology gives the ability physical to digital. The sensors are taking data's and the software's are processing them. At the end high performance processing and artificial intelligence technologies allows us to use the meaningfully data's easily.

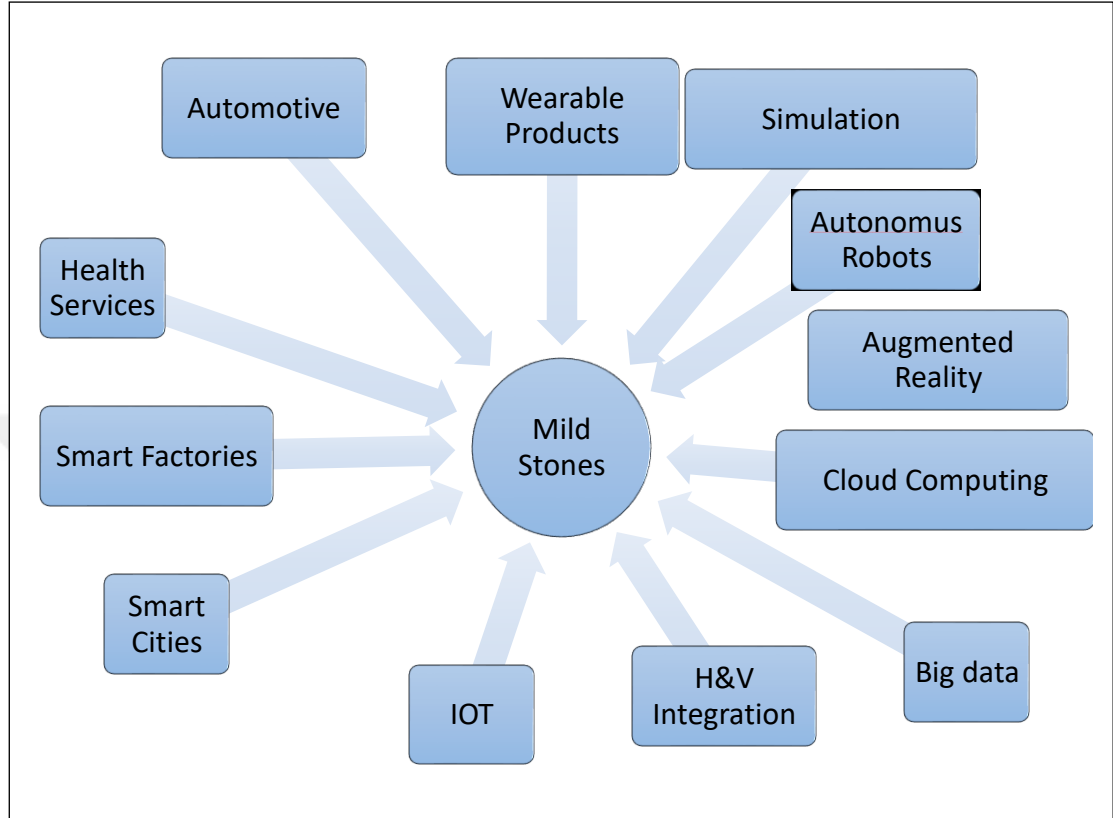
¹⁴TUBİTAK,Yeni Sanayi devrimi Akıllı Üretim Sistemleri Teknoloji Yol Haritası, 2016 Page3

¹³ McKinsey Global Institute, Technology Jobs and Future of Work, February 2017

¹⁴ TUBİTAK,Yeni Sanayi devrimi Akıllı Üretim Sistemleri Teknoloji Yol Haritası, 2016

There are few milestones stones of the Industry 4.0 . These are below;

Figure 3.1: The milestones stones of industry 4.0



Source : The Boston Consultant Group

- i. *IOT*: The internet of things: IOT is the biggest important point of the 4.0 revolution. Because it is the infrastructure of the collecting data. Analysts estimate that by 2020 20 billion devices will connect to the internet. It is meant to be intelligent units capable of communicating interconnected over the internet. With this connection new areas of use and over the internet, measuring and / or controlling an object with a unique ID. So this will be a also good market for some companies individually.

IOT applications are both on the B2B and B2C level. Which means it will effect our daily life as well. The application examples are below;

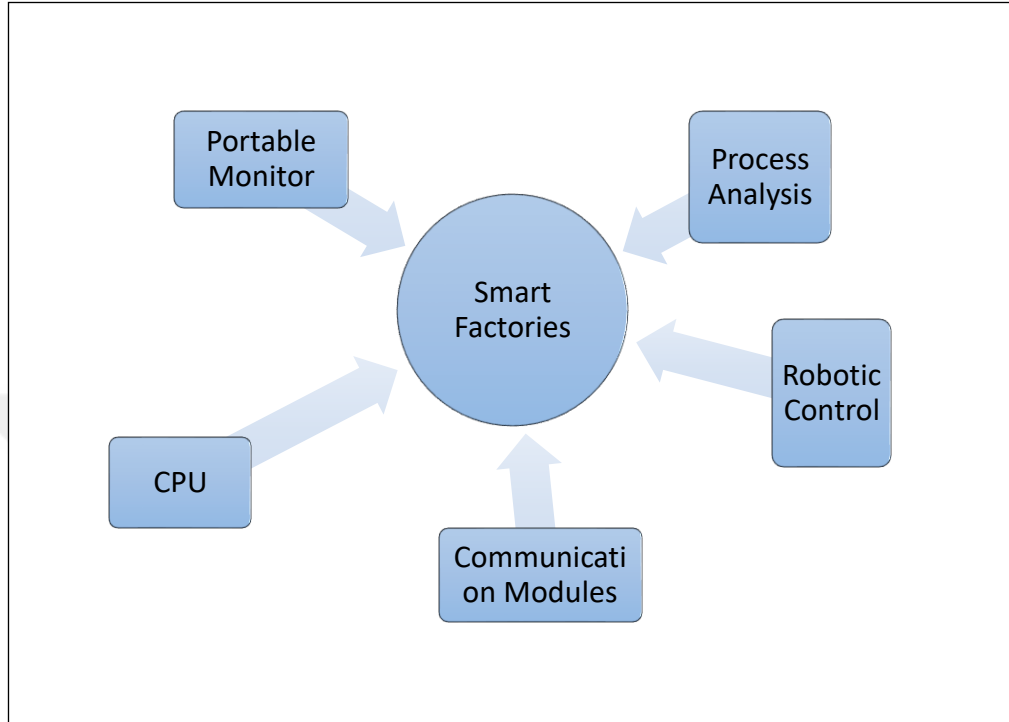
¹⁵ The Boston Consultant Group &Tusiad, Türkiye'nin Sanayide Dijital Dönüşüm Yetkinliği, December 2017

- ii. *Building and Home Automation:* Monitoring and control of smart buildings and smart homes, from increasing security to reducing energy and maintenance costs. IOT products and systems for intelligent in the sector include field applications. Connecting home devices to the Internet. All of the devices and security is connected to the internet and you can control it anywhere you want. You can control your lights and these can be smart. Smart locks (Electronic locks instead of mechanical locks) can be done. With Intelligent thermostats the energy efficiency will be at a very high level.
- iii. *Smart Cities:* Smart Cities became the trend topic, even the operators and technology companies are making investment to that system. Reduce cost and resource consumption with IOT products for outdoor lighting, surveillance, long-range wireless connectivity. IOT products and systems for smart cities already in use in the sector include; ¹⁶The Boston Consultant Group, Page63
- iv. *Smart Factories and Manufacturing:* At the industrial side most important output of 4.0 revolution is the smart factories. Moving smart factories and industry 4.0 projects to the next level with software and hardware is huge important. All of the systems at 4.0 revolutions become together and makes the factories digital transformed.

¹⁶ The Boston Consultant Group & Tusiad, Türkiye'nin Sanayide Dijital Dönüşüm Yetkinliği, December 2017

IOT products and systems for intelligent factories currently used in the industry include;

Figure 3.2: Smart factories



Source : The Boston Consultant Group

- v. *Health Service*: IOT product systems currently used in health and fitness industries include; Hospital facilities, security entrance control, remote monitoring, ambulance telemetry
- vi. *Automotive*: IOT products systems currently used for modern automobiles include; Charging station, cable replacement, predictive maintenance, motor management, information and entertainment
- vii. *Wearable Products*: Which is the end user's side of view. Keep track of how much calories you spend following your daily activity, from bracelets to bands that measure your ECG, and many different products are quickly accessible today.

¹⁷ The Boston Consultant Group & Tusiad, Türkiye'nin Sanayide Dijital Dönüşüm Yetkinliği, December 2017

- viii. *Simulation:* At the engineering side, 3D simulations of products materials and production processes are already in use. In the future, simulations will be used more extensively in factory operations. Virtual models, created from real-time data, virtual reality of the physical world will be created with machines, products. So this will effect the product go to market time and the testing procedures will be more less. That situation causes the less mistakes and the more customer oriented products.
- ix. *Autonomous Robots:* One of the first words that comes to mind when we say "automation" is robots or robotic technology. "Autonomous Robots" can be defined as robotic systems with certain intelligence rather than robots with automatic work function. The robots, which are expected to reduce human mistakes the most, are still widely used in production. Robotics promises to increase the impact of Industry 4.0. For example, in intelligent factories, robots will be able to manage production by recognizing each other, doing business, communicating, analysing, adapting more quickly to changes. That technology is also related with the advanced supply chain management.
- x. *Augmented Reality:* In its simplest form, it is an advanced form of video games we play on computers. Augmented reality (AR) is a live direct or indirect view of a new perception environment created by the computer, such as audio, video, graphics, or GPS data, created by the combination of sensory input and animated elements combined into a physical, real-world environment.
- xi. *Cloud Computing:* With Cloud Computing, users are able to do the applications they want on the internet via computers in the service provider rather than keeping them in the on-site computer or data centre. Thus, more economical, flexible and agile data management is achieved. Providing comprehensive IT services without the need for large infrastructure investments, cloud computing helps to focus their business areas by entrusting all IT services to the management of service providers. On the other hand, industry 4.0 also benefits from cloud computing. The wide range of storage spaces inherent in this application, such as advanced computing power, offer a great opportunity to collect, analyse and store data, which is a

very important asset in industrial production.

- xii. *Big Data:* Today, with the increasing use of the Internet and the acceleration of technological developments, a lot of data is obtained every day. About 2.5 trillion (10¹⁸) bytes per day. Big Data web servers logs, internet statistics, search records from GSM operators, blogs, social media publications (these were formerly known as garbage information), RFID tags and information from sensors (IOT).
- xiii. *Horizontal and Vertical Integration:* With Industry 4.0, companies, departments, functions and capabilities will become much more compatible. Horizontal integration is also the synchronous operation of the companies 'companies' correspondence in the supply chain. Both integrations are technically done in the cloud.

In the past, the business model's are just for selling the product. After that selling it may be continue with the service agreements. First lets cover that change thorough the B2C. In recent years we were buying music CD's, after that we started to download. And now we are buying cloud services per mount, and we have the right to listen it. In the Industry the change process is the same. Service has been become popular. The manufacturers are working on the new business models to give different services to their customers. Now companies are renting devices and making service agreements instead of buying the devices. The service agreement includes the full maintenance and insurance. The industry is becoming more elastic and agile. So in that case they can easily add or change the device easily. Or they may need that in a short period of time. First they rent the base model. Than the company may according to their needs offer a new modules.

Thus, the organization has less afford to ignore the force of the reject to buy. Compared with the first case now it seems more clever, to buy the service. And also after buying the service there will be a choice of reshape the product.

While Industry 4.0 has been growing at the business also it effects to our life as well. By that technology we are becoming more mobile. We can access all of the data and the process from the internet. All of the software's and machines are now talking with each other. All of these things are part of the production life cycle.

This change also effects to the customers. Customers are becoming a part of the production. When you offer a specific car now, you can see the process online as well. You can see where is it and when it is going to be come. So very good synchronized data flow is available with the industry 4.0 ¹⁸The Boston Consultant Group, Page22

3.1 USE CASES OF INDUSTRY 4.0

As covered before the best application are of the 4.0 revolution is the automotive industry because of the large development side and complex production. As an example Ford Motor Company, has built up a joint manufacturing laboratory testing automotive components and prototypes. With joint manufacturing, prototyping is faster, more flexible and more cost-effective. Typical development for parts has dropped to 3-5 hours in a few days, allowing designers and engineers to quickly test and fix more ideas. While the creation of a prototype for the most complex engine piece, the intake manifold, required a period of four months and \$ 500,000. With joint manufacturing, Ford motor company is now able to produce the same parts in just four days at a cost of only \$ 3,000. Ford motor company plans to expand its joint manufacturing practice from r and d to produce parts that can be used directly in vehicles. That investment has brought them a very good advantage. They have done a very huge saving and became more flexible and customer oriented. ¹⁹Ford Motor Company 2016

Toyota company has started to Supporting automation with intelligent systems (Advanced robots, collaborative robots, etc.) They are now on the way of remote and real time tracking and monitoring of production factors, providing instant feedback. Making automatic and real-time quality control, increasing the effectiveness of root cause analysis. At the production shortening the stopping time of machines with predictive maintenance that can be detected without the occurrence of malfunctions²⁰MEMEX - Measuring Manufacturing Excellence 2014, Page 3

¹⁸ The Boston Consultant Group &Tusiad, Türkiye'nin Sanayide Dijital Dönüşüm Yetkinliği, December 2017

¹⁹ Ford Motor Company 2016

²⁰ MEMEX - Measuring Manufacturing Excellence, "The Internet of Everything"26 September 2014.

For example, Toyota has been able to solve problems in the production process in real-time using rockwell's software to reduce quality problems in production, using large-scale advanced analytical methods that have been produced for many years. This means that the software offers false production and real-time tracking and correction to minimize the cost of the product. Real-time analytics allow for reduced machine downtime and increased production quantities and quality.



4. INDUSTRY 4.0 CHANGE

4.1 DEFINITION OF THE CHANGE

Industry 4.0 brings a huge change with the organizations and the workers. The procedures are changing. Data which you can't see and take in your hand(Which the previous generation people are surprised) is becoming very important. So in that situation, there should be some plans for that change.²¹ Springer Company 2018, Page18

4.2 WHAT IS CHANGING

The way of the procedures, supplier's orientation, workers etc. If you look at to the industry 4.0 the total way of the procedure is changing. The Raw material's supply chain, the operations between the production and sales. These changes can take huge time but some of the companies are taking entrepreneurs for making them fast. 4.0 change is different from the previous ones. This time the human thinking style is in the game. The previous ones are focused on the mechanical powered production processes. But 4.0 is focused on the decision-making mechanism so that brings a plus difficulty to convince the people.

4.3 WHAT IS DIGITAL CHANGE

Digital change in other words Digitalization is the making the processes and the all of the systems digital in a company. Measure and analyse is the most important thing for digitalization. Measuring the system efficiency controlling the producing by the collected DATA and supply management is the biggest things for the digitalization.

4.4 WHY ARE COMPANIES CHANGING

Companies should change because the competition is getting more day by day. At the previous 20 years when you go to the Bank they were asking you what do you want. They don't know who are you? What is your need? So they don't have a thing to offer you. But now they say to you we have a special offer for you. Because they know who you are? What is your need? What are your habits? So that data mining brings a huge advantage to sellers. In that kind of system is it possible not to change? It is not.

²¹ Springer Company Book, Alp Üstündağ, Industry 4.0:Managing the digital transformation,2018

4.5 HOW CAN IT BE CHANGED?

The change of that adapted system is not easy for the companies. So they get entrepreneur supports. The change should be divided to the following;

4.5.1 Operational

The first thing to change is operation. Because the production procedures are changed, the operations should be renewed. As an example now the digital Bank stores are opening. The digital ones has computers and robots inside. So the total operation of that store has changed. Someone must redesign the scenario.

4.5.2 Customer

The customer side is very important. The customers are divided in to two. At the industry side the operator (The user of the system) is a customer, or end users are customers. The customer's habits are changing also think about the way we listen the music, we were using CD's. Now they are on the cloud. At the industry side rent is preferred instead of buying them because we can add or cancel the contract. It has become more flexible.

4.5.3 Product

Products are the most effected output of that system. Think about the way we buy cars 20 years later. We go to the store, look and buy. But now we are designing the products. Specialised products are very popular and became more day by day in the future.

5. EFFECT OF THE INDUSTRY 4.0 ON DIFFERENT SECTORS

5.1 AUTOMOTIVE SECTOR

Automotive sector is the very good application area of the 4.0 revolution. A automobile production facility has many of substations inside. These substation may be considered as a separate factories. Automotive have different type of components. The chassis part should be produced and painted. The assembly part should connect the components etc. So the all procedures should be connected with each other and at the same rhythm. At the unit production cost management there should be the data taken from the each machines electric consumption. There are hundreds of machines. The predictive maintenance of the system can be done by the data's taken from the machines. For the supply chain management it is the best application area. There are hundreds of components so the software can guess the future orders and manage the raw material ready for the production. So at the automotive sector the 4.0 revolution will effect to the highest rate. Most application of the 4.0 is applied to the automotive sector and very useful outputs are done.

5.2 SURGERY

At the surgery sector the 4.0 revolution has effected with the blockchain and the software side. The big data and the software revolutions are effecting to the prediction of the risks. Also at the software side some of the manuel procedures are done by the automated software. Like the test cases and the other automatic decisions. So this will bring the decreased cost of the productions and less mistakes.

5.3 PRODUCTION SECTOR

Most of the production sectors are the best application areas for the 4.0 revolution. The unit cost calculation the supply management and the predictive maintenance are the best use cases for the production sector. The decreased cost and the more efficient factories are the outputs of the 4.0 revolution.

6. FUTURE OF JOBS

Future of Jobs is the trend topic for nowadays children. Especially the Z generations are growing different from us. Think about the Job interview of 15 years past. What was important on those days. University degree, Age, experience etc. But now it is becoming more complicated. New type of the job lines are getting important and some of the Universities are opening new faculties for that jobs(also that respond is a adapting to the change). At the following table the must, necessary and the maybe qualifications are shown. Data process analysis, statistic knowledge, understanding of institutional processes and processes, ability to adapt the change is the most important ones. Data process and cloud computing etc are the new lines. So the X and Y generations should adapt to these. But strategic knowledge and the adapting change is also takes an important point because now the technology becomes in a different point in the future it will be in a totally different way. So adapting to the change and acting strategically are very useful for the carrier plan.²²OECD 2018, page 5

²² OECD, transformative technologies and jobs of the future, March 2018

Table 6.1: Quality skills of employees of the future factories

Must	Necessary	Maybe
Information technologies knowledge's	Knowledge management	Computer programming
Data process analysis	Knowledge of manufacturing activities and processes	Expert knowledge of technology
Statistic knowledge	Information technology security and awareness about the protection of data	Awareness of ergonomic
Understanding of institutional processes	Trust to new technologies	Predisposition to legal affairs
The ability to interact with modern interfaces	Predisposition to continuous development and lifelong learning	
Self management/time management		
Ability to adapt change		

Source : McKinsey Global Institute 2017

As shown in the table the qualifications are changing for the employees. The ability to adapt the change and strategical knowledge is getting more important.

²³McKinsey Global Institute, Technology Jobs and Future of Work, February 2017

So these changes causes the new Job Lines. The some examples of the future of jobs are below;

- i. *Artificial Intelligence Engineer:* One of the issues talked about most today with the development of technology is artificial intelligence. It basically aims to teach human behaviour and thinking to machines and to think about machines independently and take action. This action brings many people who will work in the field of technology. Artificial intelligence will be much more spoken than it is now, and perhaps artificial intelligence training will be one of the most popular professions of the future.
- ii. *3D modelling Engineer:* 3D printers are one of the most remarkable technologies of recent years. The initiatives established in this field promise significant changes especially in the fields of textile, health and food. 3D production engineering will make production in the future free from mass production and personalize.
- iii. *Data Analyst:* Raw Data is not important unless it's processed. So in the future the importance of the data will be more . Data analysts, which are very important nowadays, continue to gain importance especially with their studies on big data and developing technologies. In the future, technologies such as internet of things and big data are expected to increase the need for these experts.
- iv. *Private Privacy Expert:* Culture has spread all over the world with social media. We all enjoy sharing on the social media where we are, what we eat, what we eat, and we even enjoy looking at what other people have done. It seems that if technology continues to progress at the same speed; Our detailed information, such as our knowledge, marital status, status with banks, registration record, will begin to be easily reached. At the moment we will like to see the culture of exhibitionism in the future will lead to big problems. We will be consulting personal privacy consultants.
- v. *Digital Marketing Specialist:* Normal marketing strategies and applications like hardcopy materials are became unfashioned nowadays. The social media and video marketing is the future of the marketing. You can measure the efficiency

and adapt to the change of the sector rapidly with the digital marketing. So the Digital Marketing Specialist is the important part of the Future of Jobs.



7. DATA& METHOD, RESEARCH METHODOLOGY

The questionnaires' type of research methodology is applied on that paper. The set of questions below are prepared and interviews were done with these peoples. All of the questions have significant aim. These are open-ended questions. The notes were taken during the interview. The interviewers were chosen very specially. All of them has a experience with the engineering sector which touches to the 4.0 revolution. I have chosen them with the different point of view. Some of them has seen the application, sold the system, from the software side of view. So this is very important to see the issue with the different point of views. The main aim of the question set is to get the information of the what are the applications of the 4.0, the Turkey's situation and the future effects. I would like to thanks to all of them for supporting my paper with 45 minutes of their interview.

7.1 INTERVIEWS

You may review the interview question's and the answers at the appendix part.

7.2 OUTPUTS OF THE INTERVIEWS

Questionnaire type of research methodology was used on that paper. The set of questions below were prepared and interviews were done with these people. These people were chosen carefully from the sector. The aim is to see the different point of view. So during the interviews the taken notes are shown for each question at the previous section. The interviewees have the approximately same vision of 4.0 industry. During the interview the specific questions below were asked and open ended answers taken as notes. By the collected notes the outputs were commented below as common ideas.

Industry 4.0 has a huge application area and the topic is becoming very popular. Data is becoming more important. Most of the sector are getting ready to use this technology. At the application areas; the data's are taken from the electrical system and energy analysis, systems in the form of interpretation. At the software side Energy and IOT Platform provides licenses, reports, KPI follow-up screens and post paid rules, quick accessibility and alarm management of all facilities. This gives a very effective advantage to the user. It is integrated in all systems and measurement devices, collecting energy, automation and ERP applications in a single platform and providing operational efficiency. This allows machines to communicate with the each other. In that case the separated processes became together for one aim. So the supply chain and the automated smart manufacturing can be done by the communication of the devices at the same network.

The most important application area is automobile sector because it has-sub productions. On the other hand the surgery, biomedical, end-user sides are getting important. In Turkey the companies are starting to change but the infrastructure is missing. We need to improve both the companies and in the long term also the education system. Even to the companies and at the long term to the education system. On the other hand the government should support the SME's and the industrial facilities. Many developing countries are making the necessary investments but Turkey is likely going to remain a step behind them. At the end-user side, the technology is

growing very fast but people are slower to adapt it, because of the security. At the industrial side the adaptation will be more faster. The big companies are going to make the investments for the 4.0 and their cost of productions will decrease. The smaller ones (most of them) are not going to make the investment. So their cost of production will be higher compared with bigger companies. That situation is going to be a disadvantage for the smaller companies. The competition between them is going to be tougher. If we look at to the sector view. When we look at this by sector, the most important application is for the production sector, specifically the automotive sector. However, in the software sector block chain and automated testing will be very popular and give advantages to the companies. So the surgery and the software sectors will be effected in a very positive way from the industry 4.0. The technology is very new, so the entrepreneurship will become very popular for the adapting the technology and the change of procedures. Artificial intelligence is going to be the future technology. The smart software will do the automatic procedures and all other things.

Most of the digital technologies have become popular. Some are not yet ready for application but these are becoming popular. But many are now at a point where their greater reliability and lower cost are starting to make sense for industrial applications. With Industry 4.0 the cost of production will be reduced. However, companies have resistance to make the investments. Big data is the future with the IOT applications. As an example, new ways were created to capture more data from sensors in African gold mines. New data showed some unsuspected fluctuations in oxygen levels during leaching, a key process. This can help to optimize the process. Advanced analytics is very important. Stronger analysis can dramatically improve r and d procedures. Human-machine interfaces have lots of advantages in the logistic sector. Logistics companies developed a picking technology using augmented reality. In that sector also the block chain is very important for developing software. Digital-to-physical transfer is the famous topics which allows to design the 3d prototype models. Local Motors builds cars almost entirely through 3-D printing, with a design crowdsourced from an online community.

Industry 4.0 enables the special and custom production for the industrial facilities. By doing this first they should be unique and special. So each factory is different like each person. Their size can be changed by the location and the importance of their production. Specialized IOT and industry 4.0 solutions should be applied to each factory. If the technology is new and the integration is special, the workers may have

some difficulties. First in Turkey we should give importance to the educational issues. With the industry 4.0 you can shape, expand, adapt the needs of your company according to the change. Suppose that it allows you to be more flexible and agile, you became more customer oriented and closer to the market. All the production and the backlog are done by the smart software's. So the customer's need and the production planning, supply management is done with perfect synchronization. The cost of production is reduced and efficiency is increased.

Questioner type of research methodology was used in that paper. Approximately 1 hours of interviews were done with 7 people from the energy sector. The question's were asked for the following outputs;

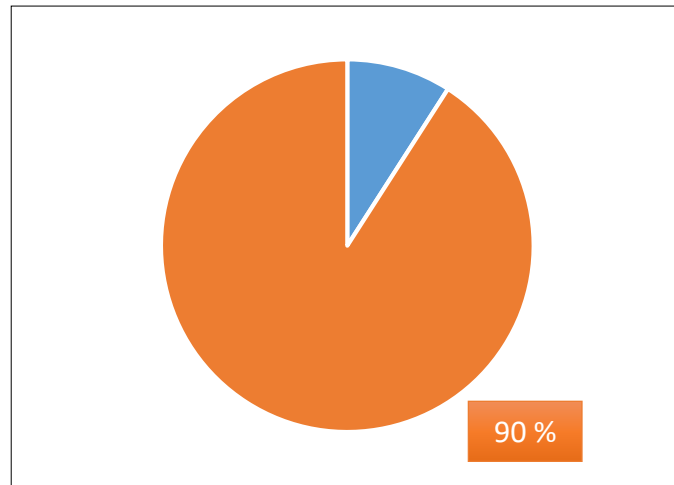
- i. Get the general information about Industry 4.0
- ii. Effects of Industry 4.0 on different sectors
- iii. Cost of that revolution for Turkey
- iv. See the end users side also
- v. Cover the developing countries situation
- vi. Cover the small company's situation
- vii. Competition
- viii. Future of jobs
- ix. Artificial Intelligence

According to the Interviews common outputs are below;

- i. Importance of Industry 4.0

According to all common interview outputs, the industry 4.0 revolution is getting more important and the popularity of that topic is increasing. Most of the interviewees agreed that Industry 4.0 is very important and at the future we are going to be talking about that revolution which is happening now.

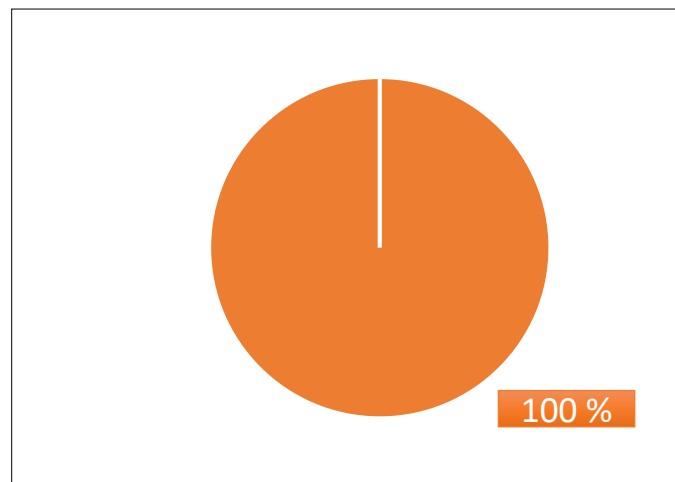
Figure 7.1 Importance of Industry 4.0



ii. Application areas of the Industry 4.0

According to all common interview outputs, the application areas of industry 4.0 is increasing with IOT. The number of the devices which connected to the internet will increase the industry 4.0 applications. The applications will be very popular and there will be huge added values for that.

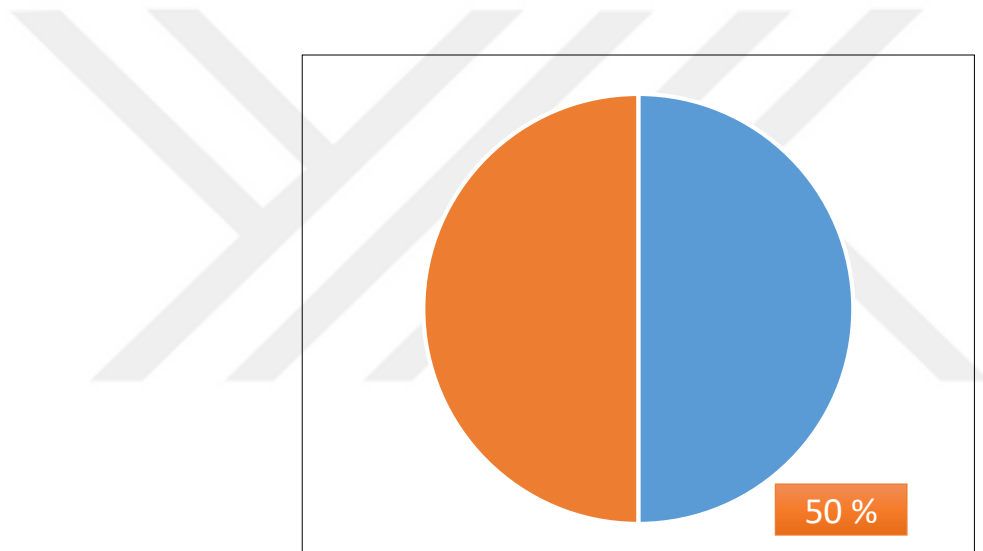
Figure 7.2 Importance of Industry 4.0



iii. Situation of Turkey

Turkey is at very important areas for the industrial facilities. The big companies are making investment to Turkey but there should be government supported infrastructure issues to be done. According to all common interview outputs, the output is at the middle. Half of the interviewees think that there will be government and international companies support so applications will increase. Half of them think that Turkey is not ready. The infrastructure, education and people should have time for that adaptation.

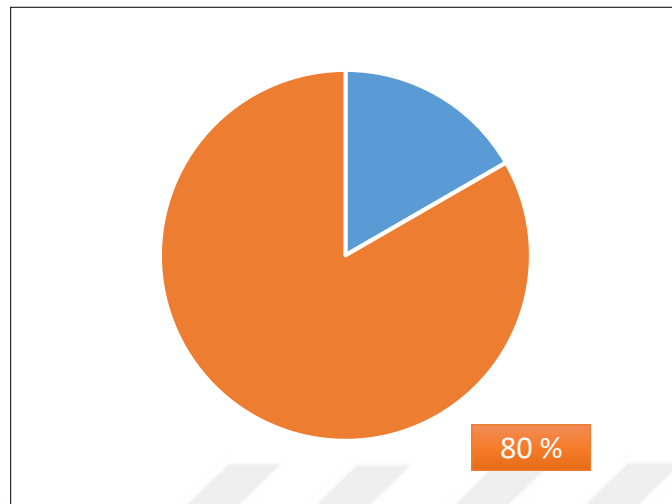
Figure 7.3 Situation of Turkey



iv. Bigger are threat for the smaller companies.

According to all common interview outputs, bigger companies are going to make industry 4.0 investment and their cost are going to decrease. So the smaller companies are going to have cost problems compared with the bigger companies. Most of the interviewees agreed that big companies are going to be a threat for smaller companies.

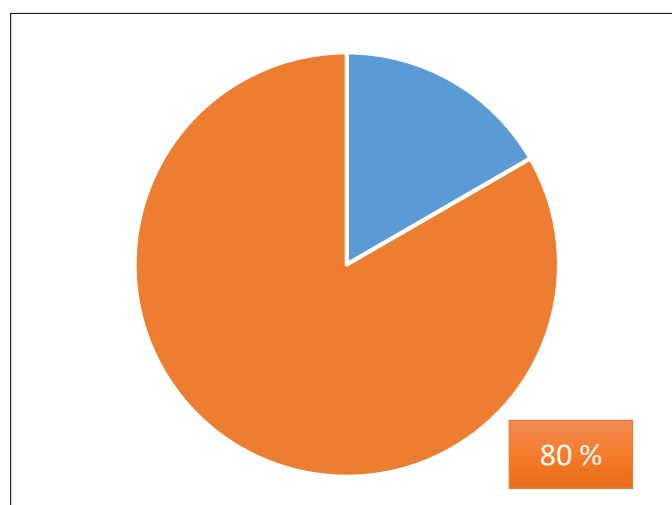
Figure 7.4 Bigger Companies are threat for smaller companies



v. Competition

According to all common interview outputs, industry 4.0 revolution will bring the competition. Because bigger companies will decrease their cost and price of their products, customers will be able to buy their products. Most of the interviewees agreed that productions are going to be specific at the future. There won't be integrated facilities anymore and OEM productions will be very popular.

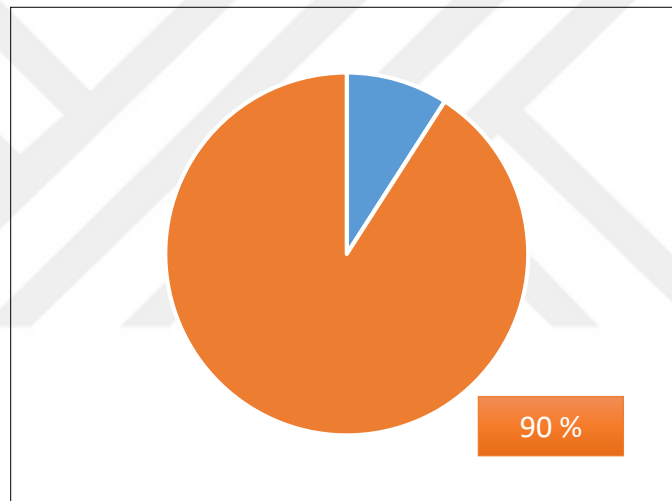
Figure 7.5 Competition



vi. Consultancy

According to all common interview outputs, suppose that industry 4.0 is a new topic companies want to know details and why to get these investments. So someone should make the project, analysis and put the advantages/dis advantages presentation to bosses. They should convince them to buy. This situation causes the entrepreneurship very important. Most of the interviewees agreed that consultancy is going to be very important.

Figure 7.6 Consultancy



8. CONCLUSION&DISCUSSION

In this paper industry 4.0 is covered with the different points of views. The “customers” side and the “Industrial users” side of the industrial revolution is the biggest change nowadays. The 4.0 revolution has brought change of the working style of the people so this revolution is different from the previous ones. That change makes new jobs like entrepreneur and the future of jobs. The procedures and the production ways are changing. The X and Y generations are trying to catch the change. The Z generation is entering after the processes have already begun changing. Some jobs are getting to die, but some new jobs are getting more important.

A question set was prepared and interviews done specially chosen of people from the electronic sector. The aim of choosing different type of people is to see the picture from different points of views. Who makes the application of the 4.0 will give the technical side view. The sales representative can see the force of the selling the system. The test engineer can see the work done to implement the system and after sales work force. The software side of view can see the issue from the other side, which touches to the end users. The marketing manager point of view covers the both of them, which is the most difficult one. Because marketing is a very multidisciplinary process. A marketing people must cover the issue with different point of views. They should think like a customer to see the customer’s needs. They should think like a r and d engineers to see the difficulties and the process. They should look at the boss view to see the added value of the system. They must look at the aftersales point to see the problems before and take preventions before.

Before making investment decisions, it is necessary to develop strategy, roadmap and technology investment. In order to direct the investments according to the target, companies should identify their digital strategies and shape the digital transformation roadmap in the industry. It should prioritize investments that are easily accessible through technologies, which can be implemented quickly and have the highest impact on profit.

According to the output of the interviews the following segmentation is done;

Table 8.1: The output segmentation of the interviews

	Rating/10	Comment
Industry 4.0 is becoming important and necessary for companies	9/10	According to all common interview outputs, the industry 4.0 revolution is getting more important and the popularity of that topic is increasing. It is at the top level necessary for the companies.
The application areas of the industry 4.0 are increasing	10/10	According to all common interview outputs the Industry 4.0 The application areas of the industry 4.0 is increasing with the IOT. The number of the devices is connected to the Internet will increase the industry 4.0 applications.
The situation for Turkey	5/10	Turkey is a very important areas for the industrial facilities. The big companies are making investment to Turkey but there should be government supported infrastructure issues to be done. So their common view is Turkey is not ready for the industry 4.0 revolution.
The bigger companies are threat for the smaller companies	8/10	According to all common interview outputs, the bigger companies are going to apply the industry 4.0 investment and their cost are going to decrease. So the smaller companies are going to have cost problems compared with the bigger companies.
Competition is getting more tough rapidly	8/10	According to all common interview outputs, the industry 4.0 revolution brings the competition. Because the bigger companies will decrease their cost and the price of their products.
Consultancy getting more important	9/10	According to all common interview outputs, suppose that industry 4.0 is a new topic the companies want to know details and why to get these investments. So someone should make the project, analysis and put the advantages/dis advantages presentation to the boss. They should convince them to buy. This situation causes the entrepreneurship very important.

Relevant public institutions should primarily establish programs to support companies in their digital transformation journey. In this respect, the public should encourage companies to take the guidance and consultancy services needed in the transformation journey through various acceleration programs to accelerate digital transformation in industry. With the industry 4.0 up to 10 percent saving can be achieved by detecting situation before and take the action. Normally without the IOT application 600 hours of operational efficiency is used for taking and processing the data. By automating the process that is attempted to be handled manually and by telephone in the multi-branch stores, that work force is minimized. Energy consumption profile of the buildings are taken according to hourly changing energy unit prices in the dynamic electricity market and contribute to the ability of planning the use of electricity in cheap hours with demand side management. So a dangerous situation can be foreseen and preventative action can be taken.

Before making investment decisions, it is necessary to develop strategy, roadmap and governance competencies and to take technology investment decisions in line with the determined strategy. In order to direct the investments according to the target, companies should identify their digital strategies and shape the digital transformation roadmap in the industry. This caused entrepreneurship to become more important. It should prioritize investments that are easily accessible through technologies, which can be implemented quickly and have the highest impact on profit. The cost, profit and return of investment analysis become more important and the time of taking action is less now. The additional profit created should lead to an innovation cycle within the company by directing them to the financing of new investments and ensure the continuity of investments. In this respect, the government should encourage companies to take the guidance and consultancy services needed in the transformation.

According to the all of the interview's outputs and the literature review; the common idea is industry 4.0 is the biggest revolution and it will bring a huge change. In our country the infrastructure is not ready yet. It is a very useful technology but for the smaller companies it is not efficient. The big companies are going to make their investments and reduce their costs. The completion will be at the very high level in the future. There will be some new type of the jobs in the future and the data's importance will get more important. At the Europe and USA side the especially the big companies are going to change but the developing countries has some time to get that technology.

At the end users side these technologies are going to more slower compared with the industrial side. Because at the future we are going to have some security problems so this may be a negative effect to the end user side. At the Industrial side these security problems will cause some new type of jobs which are cyber security specialists. In the future the number of the products connected to the internet will be very high. All of the machines and the products will be connected to the internet so this will cause security problems. A hacker case scenario will be very different from nowadays. All of the production can be lost with the one security opening.

As a result of industry 4.0 more productive and strict system processes should be reached. That situation will cause the companies to make and design new strategies. The link between design principles and technologies are very important for new technological look. That is the output of the framework for industry 4.0 is proposed by concerning fundamental links between smart products and smart production units. Industrial companies future directions indicate that smart production, control and monitoring of the smart IOT devices will change from human labour centred production to fully automated way. In this respect, transformation of industry 4.0 requires strategic work force, making new and right organizational structure. The main major implementation areas in manufacturing will be real time supply chain management optimization, human robot collaboration, smart energy consumption, digital performance management and predictive maintenance. Supply chain management and the predictive maintenance are the most important areas of the 4.0 industry. Industry 4.0 is the most important revolution. It is effecting many things in companies. So that situation has caused the entrepreneur and the process managements to be important. Developing countries are getting ready for that change but they are not ready. Even for Turkey the technical infrastructure is not enough.

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APPENDICES



Appendix 1 Interview questions

Name, Surname:

Job/Title/Company:

Interview Time/ Place:

Questions;

- 1. Could you please inform about the industry 4.0 ?**
- 2. What do you think about effects of the industry 4.0 to other sectors?(please give examples)**
- 3. What do you think about the cost for our country and what is missing?**
- 4. What do you think about the human power? Are we ready?**
- 5. What do you think about the end users?**
- 6. What do you think about the situation developing countries?**
- 7. What do you think about the small companies? Are the big ones thereat them?**
- 8. What do you think about the competition? In which sector it is going to be big?**
- 9. Which of them is going to be more important? People, raw material, entrepreneur?**
- 10. What do you think about the future of the artificial intelligence?**
- 11. Is the technology going to make a totalitarian government?**

Appendix 2 Interviews

Interview 1

Name, Surname: Tumay Solak

Job/Title/Company: Electrical Engineer/Risk Management Specialist/ Sabancı Holding EnerjiSA

Interview Time/ Place: 15/09/2018/İstanbul

Questions;

1. Could you please inform about the industry 4.0 ?

I am working as a Risk mang. specialist at EnerjiSA. So industry 4.0 is important for me. We are not using that technology yet. In my opinion it will have a benefit for me at the future. As an example I am making risk calculations, it will be a benefit for me that system says the calculations forecasts from big data. Also the machine learning and data mining systems will give positive effect for energy.

2. What do you think about effects of industry 4.0 to the other sectors?(please give examples)

In my opinion we should look at this question with the macro view. Industry 4.0 have important milestones and it will effect to different kind of sectors. As an example at the service sector it will have a benefit at software side, like big data. It will effect to the supply chain, marketing, production, r and d sides. As an example at the automotive sector, the design procedures will be developed in a positive way. With the augmented reality the design project will be more efficient and customer oriented products will become more popular. At the production side the robotics and IOT will make the production more efficient.

3. What do you think about the cost for our country and what is missing?

In my opinion, our country is not ready for the industry 4.0 revolution. There are road maps for that revolution from the industry ministry but we should have make infrastructure. First of all we should educate our workers and make them to use these tools efficient. At the Europe and United States they are ready for to skip 3.0 to 4.0. industry. But in my opinion we are not ready for that revolution yet.

4. What do you think about the human power? Are we ready?

First of all not only for industry 4.0 revolution, our workers education level is not enough. If we don't give the education, how can they use the devices. How can we get the efficiency from that system? In our country the boss buys the system and the worker have the resistance not to use it. Because the change is the most difficult thing for human. We should make road maps for that. In that roadmap the following issues should be covered; What should be done for old workers? What should be done for fresh graduated?

5. What do you think about the end users?

In my opinion we are not going to use these technologies in our daily life. There are many use case scenarios for these technologies like the Arçelik Sesli Asistan, Siri etc. Bu these technologies will bring some problems for the special data security of people so people don't want to use these technologies much.

6. What do you think about the situation developing countries?

For the developing countries the situations will not be fast. First they want to use and implement these technologies to their systems but the break even point will not be very closer. So they will not be using these technologies very much.

7. What do you think about the small companies? Are the big ones thereat them?

In my opinion the big companies will be a big threat for the smaller ones. Because they have the budget for the investment. Also the smaller companies at the production sector has less products and fields so they don't have to make these investments. The break even point is not efficient for them. The bigger ones costs will be decreased and efficiency will improve so they will become a threat for the smaller companies.

8. What do you think about the competition? In which sector it is going to be big?

At the service sector, competition will be increased. Also at the telecom and surgery sectors will be effected. The companies will have more reliable data's for the risk management. At the energy sector the big data will be a very important point.

9. Which of them is going to be more important? People, raw material, entrepreneur?

In my opinion the entrepreneur will be more important first, because people are not familiar to that technology. Before the investment first they want to know and get the information about the system. Also industry 4.0 revolution brings the more efficient workers so the people's working field will be changed in the future. Future of the jobs are very important.

10. What do you think about the future of the artificial intelligence?

In my opinion the artificial intelligence won't be more than siri and alexa. Because it is developed with the current movement. But human mind is always changing because we have emotions. We will see in the future.



Interview 2

Name, Surname: Kayhan Ayhan

Job/Title/Company: Electrical Engineer/Solution Architect /ABB Electronic

Interview Time/ Place: 20/09/2018/ İstanbul

Questions;

1. Could you please inform about the industry 4.0?

Industry 4.0 will effect to the production sector first. I think the production process will be very fast and the productivity will be increased. All the process will be developed to the automation systems. The classical methods will be old fashion and the whole process will be changed.

2. What do you think about effects of industry 4.0 to the other sectors?(please give examples)

I divide the effects of industry 4.0 in to two sectors. Financial and the production. At the financial side the process will be very efficient and developed. Blockchain technology will be very popular at that side related with the software. We will be talking about the digital moneys in the future more than today. At the production sector everything will be automatically done by the robotics so human power will be evaluated with different procedure. The simulation algorithms and IOT will effect to the sector in an effective way.

3. What do you think about the cost for our country and what is missing?

Turkey is not ready to that operation. In that condition it is very hard to implement that technology and change management. You can buy these software and hardware but infrastructure is not ready. First of all we must educate our people before buying these technologies. Also in my opinion these technologies have too much cost.

4. What do you think about the human power? Are we ready?

We are not ready to that operation. First of all we should educate our workers. We must make the fresh graduate students aware of that situation. There should be Industry & University corporations.

5. What do you think about the end users?

The end users will get ready to that technology very fast. The z generations are still ready. 50+ people will have a resistance to that change.

6. What do you think about the situation developing countries?

In my opinion they are not ready. Turkey as a developing country will have force for that change.

7. What do you think about the small companies? Are the big ones thereat them?

The big companies will enter to these technological change and they will succeed. The smaller ones are not going to use. But there is a fact that every service and product has a piece of cake from the market. The market size is the same. The change is the big companies cost. In that way the big companies profit will be greater.

8. What do you think about the competition? In which sector it is going to be big?

The competition will be more than today. In my opinion the Software sector will be developed and because of the big data and the cyber security new job will be developed.

9. Which of them is going to be more important? People, raw material, entrepreneur?

These technologies are very new. X generation boss's are buying these software and hardware. They want to see something preventative. They want to see the cost and the advantages. So this situation causes entrepreneur need. Entrepreneur's are going to be more popular.

10. What do you think about the future of the artificial intelligence?

It will be developed, with the automation systems and the robotics the robots are going to make their own decisions. These algorithms will be very good in the future.

Interview 3

Name, Surname: Cihangir Zülfikar

Job/Title/Company: Electrical Engineer/Digital Generation Payment Systems Product Owner/Deniz Bank

Interview Time/ Place: 22/09/2018 / İstanbul

Questions;

1. Could you please inform about the industry 4.0?

I think industry 4.0 has a huge background . It touches to huge number of sectors. In my sector as a digital payment system manager, It will change procedures of the operations. At the production sector the procedures of the producing a product will be changed. At the 3rd industry, the automated systems were used. Engineers design the product and the automation systems will be a plus for the production (They are controlled with the human). But 4rd generation revolution brings a plus, which is the artificial intelligence. In the future Engineers only designs the product and the system (Software's and artificial intelligence) will manage the production process. In bank sector the blockchain technology will be very popular. The virtual money and the digital payment systems will change the habits of the people in a different way.

2. What do you think about effects of the industry 4.0 to the other sectors?(please give examples)

Lets give some examples for the production sector. The production's were done by human power. Then it will be done by the robotics. In those days especially at the automotive sector the production process times were very long. Robot systems brought a plus to that process. All the production and planning process will be done by artificial intelligence and robots. So the productivity will be very high. On the other hand the service sector will be also effected. At the process side most of the work will be done by the software. Some of the jobs will die, some of the new jobs will be popular.

3. What do you think about the cost for our country and what is missing?

In our country we have hard work to do. We should make investment to the Universities. Some of the jobs are becoming to die, some of new jobs becoming popular. As an example at the 2000's mechanical engineering was very popular because the production companies need them. But now the software and electronic engineering became very popular. Also there are new job lines. Like Data engineer. So we should synchronise our Universities first. Make Investments to SME's.

4. What do you think about the human power? Are we ready?

We are not ready. We should first make investments to the SME'S and the Universities. We are attending to the conference(Most of them are global) at the Europe and USA they have plans and road maps. We have some road maps and plans but first of all Turkey missed the 2nd and 3rd revolution at the past. 3rd generation of the industrial devices are now recently using in the Turkey, so we are going from past to the other countries. How can we get rid of it is, we should start from the high schools and University.

5. What do you think about the end users?

I am looking at the end user side. At the Turkey they have a habit to use bank cards. Even they don't touch the real money they are using them. But in the future the digitalization will be very popular. I think that at the payment systems habits will be changed. The digital wallets and online payments will be very popular. So the blockchain technology will change the payment systems in a different way.

6. What do you think about the situation developing countries?

Developing countries like Turkey should make investments to catch the technology. But the situation is not good for them now. They should work hard and make their plans very carefully.

7. What do you think about the small companies? Are the big ones thereat them?

In my opinion it can be changed according to the sector. In production sector answer is yes. Because the bigger ones have more budgets to buy these technologies and they can make investment. Their cost will be reduced. So they make more profit and became more competitive. On the other hand at the service sector situation can be changed. Because their investment costs are less then to the production sector they can easily

make software investments.

8. What do you think about the competition? In which sector it is going to be big?

I think at the digital side the competition will get more. People only think about the production sector but at the service sector the software revolutions will be more faster. The calculations and the risk of the companies will be done by the intelligent software. Some of the workers will lost their job(Especially test engineers) because the software will make the tests faster and cheaper.

9. Which of them is going to be more important? People, raw material, entrepreneur?

I say % 50 to that question. Raw material is very important. Increasing the capacity of the production brings the raw material crisis. But these technologies are very new. So the people are first want to get information and see the way to use it. This situation will cause the popularity of entrepreneurship.

10. What do you think about the future of the artificial intelligence?

At the 90s when you go to the bank branch they will ask you “ what do you want credit or cash money?” But now when you enter, they know who you are and they are asking “We have a special order for you”. This is the change of the data mining and the artificial intelligence. The banks are getting the characteristics of the users and making the best for them. Now we have virtual assistants. In the future these technologies will develop and become more popular.

Interview 4

Name, Surname: Derya Iren

Job/Title/Company: Business Management/Digitalization & Industry 4.0 Marketing Manager/Siemens Turkey

Interview Time/ Place: 22/03/2018 / Istanbul

Questions;

1. Could you please inform about the industry 4.0?

We can say that industry 4.0 as a digitalization. This is the biggest change of recent years. This will effect even in the end user/business sector. We are concentrating to the business especially to the production sector. There are few application solutions and use cases of the industry 4.0. The IOT, big data and the blockchain technologies will be a very popular in the nearest future.

2. What do you think about effects of industry 4.0 to the other sectors?(please give examples)

Industry 4.0 will change the procedures and decrease the costs. The factories productions will be more efficient. The robots will make the production according to the software outputs. At the digital side we are going to be effected as end user also.

3. What do you think about the cost for our country and what is missing?

Our country is a good market for the big companies I am at the middle. We have investments and seminars for the users but we will see if these are enough or not.

4. What do you think about the human power? Are we ready?

We have a different situation here. We have the strict operations working now. As an example, we have experts at the factories who are 20+ years working with the traditional way and have y or z generations new graduated. Now there will be a chaos. Because the new generations are excited to the new technology and the older ones are making resistance. So we should first educate the old workers and motivate the fresh graduates.

5. What do you think about the end users?

As you know that we divide that technologies in to two. Some of the companies focus on the end user's like Samsung/Schneider. Some of them focus on the business sector like general electric, siemens. Siemens is at the field and supporting the digital change of the companies. Some of the companies are getting the data of end users. We are going to be talking about the sensors using at the football and tennis matches. The ball entered to the football tower or not? What is the productivity of the footballer? The garage door and our refrigerators, air conditioners will be act automatically according to us. They will learn our habits. What is the mistake done the backend for the tennis? These are going to the talk in the future at the end user side.

6. What do you think about the situation developing countries?

The situation is hard for the developing countries. The companies are getting support from the government. But compared with the developed countries they are coming from back.

7. What do you think about the small companies? Are the big ones thereat them?

I am equal to them. There can be more productive ones. May be smaller ones some times be more efficient.

8. What do you think about the competition? In which sector it is going to be big?

The competition will be very high level. The production sector will grow and the costs will be reduces.

9. Which of them is going to be more important? People, raw material, entrepreneur?

The change will have Operational, customer, product and working side. So the operational and customer side will be very important. I think that change will bring a huge market for the entrepreneur. Because that companies are very new to these things they must get entrepreneurship supports.

10. What do you think about the future of the artificial intelligence?

Artificial intelligence will be the future of the job. Even for the end user or the business the most of the thing s will be done by the software the production sector the production will be done by the software.

Interview 5

Name, Surname: Cihan Özdemir

Job/Title/Company: Electrical technician/Industry Sales Specialist/Entes Electronic

Interview Time/ Place: 24/09/2018 / Istanbul

Questions;

1. Could you please inform about the industry 4.0?

I am at the industrial side of the sales department. I'm looking to the industry 4.0 for the production side. Industry 4.0 is less human power, more productivity and decreased costs for me. Industry 4.0 will effect huge number of the procedures at the industrial facilities. It starts from the raw material to the end of the production. It is going to be the most popular thing in the future.

2. What do you think about effects of industry 4.0 to the other sectors?(please give examples)

Look at the normal production's point of view. Normally for a production line. First we need a customer demand. Lets say "Product A" with the number of "X". A sales person gets the order. Then the production department plans the production. Supply chain department coordinates the materials. At the end the production will be finish and the test etc procedures will be done. So lets look at the same scenario with the industry 4.0 point of view. The demand of the product is calculated by the artificial intelligence. The raw material order are done by the software automatically. The production is done by the robots. The smart production lines gets the products with the RFID technology and at the dark stores the products are stored. Also the customers get the all information of the all process. This is the factory of the Industry 4.0.

3. What do you think about the cost for our country and what is missing?

In Turkey there should be a huge investments first of all. Because the technological infrastructure is very low. So the government should make the investments. Turkey is a good market for the global companies. In my opinion If we evaluate that opportunity in a very strategically we will be in a very good position.

4. What do you think about the human power? Are we ready?

In Turkey first of all we should make investment to our human. The managers are not enough to be the leader. The corporative companies look like a corporative but they are not. First of all the procedures and the rules must be clarified. Then it will bring the rest of them. I believe that Turkey will be in a very good position for the productivity and lead the some developing countries. Industry 4.0 revolution will bring us in a very good position.

5. What do you think about the end users?

Personally I am very excited to the new technologies. So at the end user side the home automation and smart cities will bring a very good perspective. Also the IOT will bring a very good solutions to the smart automobiles in the future. All of our cars will be smart and connected to the internet in the future.

6. What do you think about the situation developing countries?

The developing countries are at the 2nd and mostly at the 3rd revolution. So it will take some time to get rid of it for them. Turkey is different in my opinion. The other developing ones will have a resistance to enter to that technology. I am very curious about the china. We will see the situation for them.

7. What do you think about the small companies? Are the big ones thereat them?

I am equal to them. But I think that some of the smaller ones will have a good change. Because think that the big ones get the risk and make the investment of the industry 4.0. We will see that is it going to be reach to the break even in a logical time or not.

8. What do you think about the competition? In which sector it is going to be big?

In the automotive sector the competition will be very huge level. The all procedure and smart developing technologies can be used in that sector. So this will bring a big competition. Also the Bank sector will develop a lot. They will get and make the data mining of the customers information's in a very good way.

9. Which of them is going to be more important? People, raw material, entrepreneur?

Raw material is going to be very important. The raw material is the most important thing for the production. You can make the production even by your side without

technology.

10. What do you think about the future of the artificial intelligence?

Artificial intelligence is the future. Lets give an example. You are a factory and producing A product. By producing that product you need some raw materials. You suddenly get a huge number of the order and the some of you chemical raw material suppliers don't give the product supply to you because of the some chemical supplier problems of themselves. The software of the future will get the statistics of that you are going to get that order first. Then it will be contacted with your chemical suppliers own supplier with the information that my client has got the X number of order ad I calculated that you don't have enough material. You can buy the missing ones for that supplier also i make the bargain for you. This is the future. Engineers and designers will be designing the solutions the rest will be the artificial intelligence.

Interview 6

Name, Surname: Ata Yıldırım

Job/Title/Company: Mechanical Engineer/ Thermal System Engineer/ Ford Otosan

Interview Time/ Place: 26/09/2018 / Istanbul

Questions;

1. Could you please inform about the Industry 4.0 ?

Industry 4.0 is the digitalization, which we are going to be talking a lot in the future. Most of the people thinks that it is only related with the business. Also it has a end user side. We are going to see the smart cities, smart factories, smart cars and robotics applications.

2. What do you think about effects of industry 4.0 to the other sectors?(please give examples)

As I am working at the automotive sector I would like to give example from the production side. In my opinion automotive sector is the biggest use area of the Industry 4.0 because the production process are very strict and compatible for the application. In that sector the production cost will be reduced with the industry 4.0 revolution. The robotic processes will be very popular. Customizable cars will be at the shops. The personal designs and the application of that situation will be very productive .The customers demands will be very soon gotten and the applied to the data bases. With the IOT and the cloud systems the customers may see the process of their cars. At the design and the test stages the most of the work will be switched to the software's instead of the human power.

3. What do you think about the cost for our country and what is missing?

In my opinion at the first stages we are not going to adapt it. Because of the economical situations the companies don't want to make investments first. But when these systems became popular at the Europe and the International countries we are going to use it.

4. What do you think about the human power? Are we ready?

We are not ready. we should have severe change for that. We should start from the schools. Industry 4.0 revolutions will need a software background of humans. It is very hard for the 30 + person to learn the software logic. So we should start from the primary school to give the software programming background to the children.

5. What do you think about the end users?

The end users are the ones who effected that situation in a good way. In the future there won't be blue collar workers. People are going to have much time for their personal issues. Their comfort zone will be bigger. Their home, car and the all other personal things will be more intelligent. Their working hours and jobs will be more flexible.

6. What do you think about the situation developing countries?

I think that there will be a development at the software side. The countries who make investment to the software technologies will be win. Like India and china. Because the 4.0 is the combination of the dancing of hardware and software.

7. What do you think about the small companies? Are the big ones thereat them?

The big companies will make the investment and at the first stage the smaller ones will wait. The big companies investment cost will be high at the first. This situation will case the non compatibility with the smaller. But after a time the return of investment will bring the decrease of the cost so at that time the flexible and the faster cheaper production will be a plus for them. This causes the smaller ones to get the 4.0 revolution so it will get on the stable condition. While to get that time the bigger ones get the market.

8. What do you think about the competition? In which sector it is going to be big?

Production, Bank, Insurance, Software sectors will grow

9. Which of them is going to be more important? People, raw material, entrepreneur?

The raw material will be cheaper because the cost of the productions will be decreased. This is a new technology so the investors want to take entrepreneurship. I think that the true data will be very important in the future.

10. What do you think about the future of the artificial intelligence?

I am afraid of it. We are going to see many security and intelligent use cases in the future. This is a good technology but it will bring some risks. Because of that the cyber security jobs will be very popular. Because the artificial intelligence has the ability to access large range of data. At the automobile sector you know that tesla has problems with the autonomy vehicles. We are going to see in the future.



Interview 7

Name, Surname: Tamer Yiğit

Job/Title/Company: Electrical Engineer/Industry 4.0 Consultant Manager/ICC electronics

Interview Time/ Place: 15/09/2018/İstanbul

Questions;

1. Could you please inform about the Industry 4.0?

Industry 4.0 is the output of the data in my opinion. It became very popular nowadays every related people says something but they are not sure what is it. 4.0 revolution is very important for the world. It is the revolution which the decisions are given human to machines. The revolution has become to the digitalisation. Most of the biggest companies entered to market and became popular with the seminars. Everybody is considered to get data from the field but they don't know what to do next time. The important thing is the control the production process with the AI by the data processed by the system. This is the industry 4.0 for me.

2. What do you think about effects of industry 4.0 to the other sectors?(please give examples)

Industry 4.0 revolution's biggest application is the automotive sector because automotive production has sub production areas inside the system. An automotive producer in Turkey we have applied a project. We have put sensors to the engines and get the vibration data of these products. Normally it is not possible to monitor these engines manually but these sensors are getting and processing the data with the real time. In those years 4.0 revolution was not popular yet. Also we have applied a monitoring software to that area. That producer said the management that we get the 4.0 revolution. In that year they got to the point of the monitoring all of the devices energy consumption and predictive maintenance as well. They can easily get the unit product production cost and maintenance costs. The maintenance managers can see the ROI of their investments and show to the management. The next level of that process is the production efficiency.

3. What do you think about the cost for our country and what is missing?

In Turkey the problem is the Boss mentality based companies. If you full get to the 4.0 production. The all of the systems control should be done by the machine. The production efficiency, the production time, which products will be processed tomorrow, the supply chain management. All of these are done without human. So the machine can stop the production of a product because of the forecast says that it will not be needed maybe. So these kind of scenarios are very dangerous for the managers. Machines don't have feelings and they are not emotional. So the boss can look that issue in a different way. As you know the change is the difficult thing for a human. Maybe Y and Z generations get more easily but X generations get very hard to rid of that revolution.

4. What do you think about the human power? Are we ready?

In my opinion we are ready but only thing is the X generations should understand and accept that revolution.

5. What do you think about the end users?

Personally I divide the 4.0 to 2.iIndustrial and end users. End users side is a different. In my opinion it wont be a huge revolution like the industrial side.

6. What do you think about the situation developing countries?

The developing countries are going to enter to this revolution and make the investments first so the costs are going to be less and the competition will be more.

7. What do you think about the small companies? Are the big ones thereat them?

The big companies will make the investment for the industry 4.0. This will bring them the advantage of the decreased cost. So the smaller ones will continue with the traditional methods. Because the ROI for them is very long. So the bigger companies will have a advantage and the smaller ones will get more smaller. Also in my opinion, the integrated facilities will die. Niche production processes will be more popular.

8. What do you think about the competition? In which sector it is going to be big?

With the 4.0 the costs will be reduce and the competition will be more. The companies will race with each other and the customizable production's are going to be more popular.

9. Which of them is going to be more important? People, raw material, entrepreneur?

Entrepreneur is the future of Job. 4.0 is a very new technology most of the companies want to enter to that system so they should get information first.

10. What do you think about the future of the artificial intelligence?

AI is the future in my opinion most of the companies are making investments to the technology so some of the jobs done by humans will be done by the AI in the future. We will see what will happen.