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Globalization, Institutions and Socio-Economic Performance

Macro and Micro Perspectives

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The Effects of Industry 4.0 on Human Resources Management

Abstract: The opportunity of the internet in terms of eliminating the distance and the ability to instantly transfer large data influence many areas of life, and deeply affect industrial production and processes. High-tech manufacturing operations feel these changes earlier. It is inevitable for the enterprises operating with traditional technologies to be exposed to this effect in parallel with the change of environmental structure. In this study, the concept of Industry 4.0 is considered as a concept and secondly how human resources managers perceive this process from the viewpoint of human resources management of the four advanced technology companies operating in the Bursa region is investigated. An in-depth interview method was used to gather information in the study. As a result of the research, the expectation is that the Industrial 4.0 transformation of the industry will deeply affect human resources management processes due to its business environment. At each stage, it is foreseen that technology-integrated business processes will cause some of the unskilled employees to lose their jobs, while the higher qualified employees will be needed more, but it will be difficult to find these employees and keep them at work.

Keywords: Industry 4.0,Big Data, Internet of Objects, Smart Factories

Introduction

The greatest power of European economy is based on industry. Seventeen percent of the European Union GNP is of industrial origin. This industry power provides 32 million jobs. Despite this, in recent years industrialized European countries have been having difficulty competing with developing countries. The main reason for this is the aging population structure. According to the estimates of the Economic Policy Committee and the European Commission, by 2050 the population in the 24–60 age group will decline by 16 % to 48 million while the elderly population will increase to 58 million (Qina et al. 2016). Western countries, which anticipate that this change in population structure will force them to compete in the future, have attempted to redesign their industries in such a way as to require the least labor force. The most important factor behind the industry's 4th move is the incentive to stay behind.

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Industry 4.0 nomenclature belongs to Germans (ESO 2015). However, other industrial countries in the world are aware of this new wave in the industry, and every country develops a policy on its own within this area. China called its own industrial development plan "Made in China 2015" (Qina et al. 2016), which is similar to Industry 4.0 in 2015.

With this change, intelligent robots will be used more effectively in all business processes. When we look at the case from the perspective of human resource management, the change aimed at the Industry 4.0 initiative will require less manpower in production, and qualifications in the labor force will change. The human resources departments have to keep up with this transformation by renewing themselves. After all these changes, not only the enterprises but also the state policies should be updated in line with the formation of the Industry 4.0. It will be inevitable to lag behind the global economy by losing the competitive power for companies and states that cannot make this update (ESO 2015).

Overview of Industrial Revolutions

The Industrial Revolutions are seen as the basis of many innovations, modernity, and transformation in the world. The economic transformation that began in England in 1760 spread to other European countries. Prior to the Industrial Revolution, the economy was based on agriculture and animal husbandry, and tradesmen and craftsmen engaged in crafts such as weaving, blacksmithing, and handcrafted benches. With the invention of the steamer, economical structure based on economics, mechanization and serial production based on soil, agriculture, and muscle power has been passed. The amount of production and sales increased with the mechanization. The capital, which is in production, has made more production using machinery, and big companies have begun to be born. The population started to gather in the cities with new job opportunities, which resulted in a rapid population increase. The economy has recovered, and the standards of living have begun to improve (EKOIQ 2014). Below are the stages of three Industrial Revolution and production processes.

First Industrial Revolution

The First Industrial Revolution covers the period beginning in the 1760s and going through the 1830s. In this process, production has evolved from hand and muscle strength to machine use. By using coal and steam instead of wood, the power of the machines has been increased. This situation has caused mechanization and establishment of factories. Family companies and small enterprises

have left their place in large factories. The use of steam, coal, and iron as energy sources and raw materials accelerated railway development. The first Industrial Revolution was defined as the machinery of production (Siemens 2016).

The First Industrial Revolution, which began in England, spread throughout Europe and America over time. This radical change in production has also affected social construction. The average lifespan was prolonged, and the population increased. Everyday life has become practical, and quality of life has increased.

With the increase in the number of products produced with the reason of mechanization, Europe has turned to the Middle, Near, and Far East where it can offer prizes and sources of raw materials. International relations have been affected by this situation (ESO 2015).

Second Industrial Revolution

The Second Industrial Revolution covers the period 1840–1870. After the first Industrial Revolution and the mechanization of production, the foundations of the new revolution have begun to emerge. The Second Industrial Revolution started with Henry Ford's mass production band design. The Second Industrial Revolution has emerged with changes in basic raw materials and energy sources. Steam, coal, and iron, as well as steel, electricity, petroleum, and chemical materials have been used in the production process (Alçın 2016).

The development of steel production has played a major role in the development of the production network, especially the railways. The facilitation of transportation made it easy for the products to reach new markets and supply raw materials. On the other hand, other new developments such as telephone, radio, typewriter, and cheap newspaper paper have also shaped communication and transmission.

In the Second Industrial Revolution, electric technology was developed and started to be used in production lines. This has allowed us to develop the machines, increase the amount of production, and meet the concept of mass production. The main actors of the Second Industrial Revolution were England, Germany, USA, and Japan. This revolution is defined as the massification of production.

Third Industrial Revolution

In the first half of the twentieth century, industrialization and technological progress slowed down due to the two great world wars. In addition, negative economic developments such as the 1929 global crisis were experienced. The

Third Industrial Revolution began to use programmable machines, which in 1970 caused mechanical and electronic technologies to leave their place in digital technology. In this period, technologies such as computers, microelectronics, fiber optics, lasers, telecommunication, nuclear, biotechnology have influenced the direction and form of development production. With the use of computer and communication technologies in production processes, mechanical and practical products have begun to enter our lives (ESO 2015).

In the Third Industrial Revolution, renewable energy sources such as the sun and the wind have become important with the irreparable sources and environmental concerns. Thus, the need for body power begins to grow.

Now we are in a period of a new industrial revolution. It started with a period in which interrelated processes were in communication, objects connected to each other via internet gathered data and completely changed the production process, and machines started to emphasize interaction with people.

New Revolution: Industry 4.0

The concept of the Industry 4.0 can be described as an increase in the amount of digitization throughout the entire value chain, and a possible structuring of data transfer between people, objects, and systems in real time. The Fourth Industrial Period emerged when the machines used in production started to manage themselves and production processes without the need for human power. This structure, which is referred to by the concept of "the Internet of objects", extends to the self-management of the manufacturing factory.

The Fourth Industrial Revolution was first spoken at the Hannover Fair in 2011. In October 2012, the Bosch Group and former SAP CEO Henning Kagermann created a working group and presented the Fourth Industrial Revolution proposal file to the German Federal Government. The German government began preparing its own Industry 4.0 transformation roadmap in 2013. Bosch took part in the Industry 4.0 working group and played a leading role (Siemens 2016).

Industry 4.0, which was adopted at the beginning of 2011, has become a market of billions of euros from a technical term within a period of 6 years. By 2020, it is expected that only 140 billion Euros will be invested in Industry 4.0 within Europe. Furthermore, it is anticipated that 14 billion devices will interact with each other through the Internet of objects (ESO 2015).

In 2013, the "Industry 4.0 Platform" (www.plattform-i40.de) was put into practice to prevent the Industry 4.0 from being just one theory and to take action. This platform is primarily aimed at supporting the development of new

technologies, defining the basic standards for the Industry 4.0 vision, identifying new business models, and conducting community awareness activities (Siemens 2016).

Over time, the concept of Industry 4.0 has become the focus of all countries that have developed beyond Germany to design a new industrial system. With the support of the necessary legal regulations, this concept is intended to be more widespread and to create more effective opportunities for new products and processes. Industry 4.0 also presents various challenges and threats for businesses. The difficulties of this diversity can be summed up in four areas: economic, social, technical, and environmental (Hecklaua et al. 2016).

Distinctive Features of Industry 4.0

The distinguishing innovations this new era brings are as follows:

- Global interaction of storage systems and resources with machines.
- The development of unique intelligent products with location knowledge.
- The smart factories, adapting to product specifications.
- Realization of new business models.
- New social infrastructure in the workplace for the employees, business structure being sensitive to individual differences.
- Better work/life balance.
- Responding to individual consumer demands.
- Intelligent software developed for immediate response to engineering and problems.

Concepts Related to Industry 4.0

It is necessary to know its concepts in order to understand Industry 4.0. Knowing these concepts gives important clues about what might be happening today and in the future.

3D Printers

The 3D printer is a machine that transforms digital three-dimensional computer data into real objects that can be handled. All mechanical parts except engine and electronic parts are printed by 3D printers (Festo 2016).

3D printer technology addresses a wide area. The areas of usage of this technology have a range from information technologies, genetics, medicine, to industry, food, and jewelry. With 3D printers, a lot of things are produced,

including human tissues and musical instruments. These devices drastically reduce production costs.

While the creation of the design in the virtual environment is achieved through various CAD programs, the CAD is scanned with an existing object and transferred to the virtual center by scanning. Prototypes that can move with unlimited color options are produced with 3D printers.

Internet of Objects

Objects must communicate with each other through the use of the Internet as an intermediary, and their work is their own management. It is really important in terms of facilitating our daily life. Smart home technologies are examples of this. This structure, also called "Internet of Industrial Objects", makes smart factories even smarter. Thus, products with many different and complex structures can be produced in shorter time and in quality (ESO 2015).

Virtual Reality

The virtual reality is the main feature of Industry 4.0. Virtual reality is the live, direct, and indirect imagery of the real-world objects enriched by computer-generated sound, image, graphics, and GPS data (ESO 2015). The concept of virtual reality is applied in many different areas such as video games, entertainment sector, military applications, health sector, education, tourism, architecture, and sales-marketing. In the industry, the virtual environment is used at every point such as production planning, design, production, service, maintenance, testing, and quality control (Bayraktar and Kaleli 2007).

Smart Factories

Digitalization has confronted humanity with the concept of intelligent life. In the past, the everyday work carried out by muscular power can now be realized by machines and internet networks. The application of cyber-physical systems in production systems is called Smart Factory. Fifty percent of German companies are planning industrial networks, while 20 % have already transitioned to the intelligent factory of Industry 4.0 (PWC 2016).

Features of smart factories include:

- Being successful in managing complex production processes smoothly and quickly.
- Its products being smooth and long-lasting.
- Inside them, machines, people, and production resources are in interaction.

Cyber-Physical Systems

The cyber world is based on the physical side of the world. The boundaries of the physical world expand with the cyber world. The cyber-physical systems that the cyber and physical world come together are made up of these two elements. These two worlds communicate with each other with a designated internet address on the Internet. It is called the virtual environment which is created by the simulations of the objects in the real world. Cyber-physical systems include monitoring, control, and coordination, as well as computation and communication.

The cyber-physical systems, which aim to raise the boundaries between real and virtual worlds, and to create a wide communication network with the Internet of objects, constitute one of the forces at the core of Industry 4.0. Cyber-physical systems are intelligent systems in which ever-changing data are simultaneously linked together in a virtual cloud system. The aim of this system is to realize "intelligent monitoring" and "intelligent control". The best example of this is the Smart Factories. For example, failures occurring at any stage of production can be eliminated immediately and on the spot, and the system can operate at full capacity and without any problems. This system can also make a difference in R&D, design, and marketing processes. For example, before a factory is physically installed, all feasibility studies can be done by simulation. A significant number of manufacturers have begun using radio frequency identification (RFID) production, which can be evaluated under "Smart environments" or "Wireless sensor networks". First, Volvo Trucks used RFID systems based on information systems in the production of Toyota automobile parts (Siemens 2016) to ensure continuity in production.

Big Data

The advancement of technology, the development of the Internet, and the social media revolution have facilitated access to information. The information that is easy to access also brings the problem of useless and wrong information with it. This mass of information has been described as information garbage. Extracting real and reliable information from this area, where so much information is involved, leads us to the concept of Big Data.

Big Data, social media sharing, Internet statistics, blogs, photos, videos, logs, etc., transform all collected data from sources such as textures into meaningful and workable forms. When this converted data is correctly interpreted, it makes a great contribution to companies taking strategic decisions and managing their risks. Accurate strategic decisions are made up of accurate information. That's why it's great Big Data for Industry 4.0 (Alçin 2016).

Firms have understood how important even the slightest information is. It is known that such valuable data are everywhere. Every click we make while using the Internet is a very important data source. RFID and sensor technologies are constantly accumulating data due to their environment. All of this, financial data, medical data, when they all come together, are giant data. All the information we need is in Big Data. For example, they record every move made by an information technology company's systems and find answers to questions such as "which faults are related to each other", "how much does your problem system affect its performance". A bank can identify fraud attempts from customer actions. A social sharing site can analyze the likes and dislikes of its users and show them the best ads. A store can analyze the customers' products and offer them the best products and increase their sales. Big Data shed light on the future (Big Data 2017).

Smart Robots

The robot is described as an electro-mechanical device that performs preprogrammed tasks. The biggest use of robots is industrial production. Robot technology is called "Robotics" and "Mechatronics" in the literature. When we say "automation", robots or robotic technologies come to mind. Robots are still widely used in production. Robot technologies are important to increase the effectiveness of Industry 4.0. For example, in smart factories, robots will manage production by recognizing each other, doing business, communicating, analyzing, and adapting more quickly to changes. In the automotive sector, in a variety of production processes such as paint, assembly, welding, quality control, a large number of robots are used. With Industry 4.0, robots are aimed at achieving a totally robotic approach to production. For example, the robot responsible for the welding process may be able to provide other points of service by updating its software if necessary in the installation area. Moreover, it will do so entirely on the basis of its own observations, analyses, and predictions (Festo 2016).

Simulation

Simulation is defined as the creation of an artificial environment or imitation of the order in a timely manner for the operation of any process or system in the technical sense. Imitating processes or systems in the real world very close to reality provides great advantages in many respects from saving time from human effort to avoiding gains from economic gain (EKOIQ 2014).

After the steam, electricity, and computing forces entering the factory in the first three industrial revolutions, the simulation technology is now used in factories and provides significant benefits.

Horizontal and Vertical Integrations

The continuous stream of data provided by interconnected structures underlying Industry 4.0 is a critical point of production. In order to achieve this flow, horizontal and vertical integration must take place not only at certain points but also at every point.

"Horizontal integration" means a continuous flow between each step in the production and planning process itself, as well as between the steps of production and planning processes of different enterprises from raw material procurement to design, to production, to marketing, and to recycling.

"Vertical integration" means providing uninterrupted communication and flow of technological infrastructure used in all processes. The integration of sensors such as sensors, valves, motors, control panels, production management systems, and ERP software in the production area is covered in this scope.

With vertical and horizontal integration, Industry 4.0 is able to respond quickly to changes and problems in the production process, facilitating private and personalized production, and optimizing the global supply chain. Businesses are becoming more flexible. The changes are provided by simple interface updates (www.innovarobotik.com 2016).

Cloud Computing Systems

Along with the advances in information technology, increasing data volumes and increasing use of the internet have begun to force existing hardware systems and software. With this need, the concept of cloud computing systems has emerged. Cloud computing is the general name given to services that provide information sharing between computing devices. It has been adopted by computer theorists that the future of the Internet passes through the cloud system. There is a sense that the cloud system will be used instead of future hard disks (www.innovarobotik.com 2016).

The industry benefits from 4.0 cloud computing. Features such as large storage areas and advanced computational power make it possible to collect, analyze, and store data in production. Communication between intelligent devices has also led to a new breakthrough in the industry by working together with Big Data, the Internet of Objects, and Cloud Computing.

Compliance of Companies to Industry 4.0

Up to this point, we have been given information about the reasons for the emergence of Industry 4.0, its development, and the point it is at today. This information makes it clear that Industry 4.0 is experiencing breakthrough developments, that technology continues to progress continuously, and that companies outside of this development will be destroyed.

With Industry 4.0, the following developments will be faced.

- Production process will be digitized.
- Production processes will manage themselves.
- Products will be able to carry information and provide this information to consumers.
- The Internet of objects will dominate the entire factory, the firm, and the business world.
- Production performance will be higher.
- All data and business principles will be analyzed in digital programs and intelligent systems.
- Resources will increase, costs will decrease.

Difficulties in adapting to Industry 4.0 will be discussed below.

- Standardization
- Process/work organization
- Eligible products
- New business models
- Security/know-how applications
- Qualified workforce
- Research
- Training/professional development
- Legal infrastructure

We can foresee that companies and countries should take the following steps in order to comply with Industry 4.0.

- Strengthen the technological infrastructure.
- Informatics technologies should create training programs to strengthen innovation and entrepreneurship.
- Identify new business models.
- New technologies should be developed.
- Provide new collaborations appropriate to the digital world.

- Identify the priorities of producers.
- Increase the quality of the changing workforce.

The Impact of Industry 4.0 and Human Resources Management

In the United Kingdom, in a research study, there are three technological bases (Rhisiart et al. 2014) that have radically influenced the future of the business: artificial intelligence and robots, shaky developments on the Internet, and time and space constraints for the acquisition of skills. "At present, at least 65 % of children who go to primary school will work in jobs that do not yet exist when they have completed school education," said WEF (2016), the World Economic Forum's "Future of Jobs" report. Nine of the 18 factors that are predicted to affect business structure in the future are the roots of technology: mobile internet and cloud technology, the increase of computing power, hence the processing capacity of Big Data, new energy providers and technologies, Internet of objects, mass information exchange via internet, sharing economy, peer-peer sharing platforms, highly developed robotic and independent transportation, artificial intelligence and learning of machines, advanced production and 3D printing systems, advanced materials, biotechnology and genomics.

We actually see some of these effects in our lives. The results of one part will be reflected in your life in the next few years. These developments will affect the technological, socio-economic, geopolitical, and population structure, but will also lead to the emergence of new business categories and new professions while also removing some of them. These developments will change the set of skills needed in both old and new jobs, redefine how and where people will work, require a new management understanding and new management regulations. According to estimates, these developments in technology will lead to the disappearance of 7.1 million people in the period between 2015 and 2020; three out of which will be from the office and management business partner, and one third from other smaller business families (WEF 2016, p.13).

In the future, the ability to manufacture will come from a more critical factor than capital. The increase in the level of your ability will result in lower wages in the lower skill, higher wages in the higher skill, which will increase social tension (Schwab 2015).

Industry 4.0 will change the daily lifestyles of communities and all the habits of business life. This change will have to keep pace with states, societies, companies, and employees. Those who cannot catch up with change will face the risk of economic disappearance.

This change, which takes place over states, societies, companies, and employees, will also affect human resource management in a fundamental way. Industry 4.0 will change all steps from production to distribution, from distribution to marketing, and will incorporate radical innovations within the organization. At the center of these innovations will be human resources. Agile companies with easy-to-change adapters will pass before the competition. In order for the agile process to spread throughout the company, human resources will need to

Tab. 1: Knowledge and Skills Required for Activities in Your Future Factory. Source: Lars Gehrke et al. (2015), "Industry 4.0., A Discussion of Qualifications and Skills in the Factory of the Future", www.vdi.de.x

	Must	**Should**	**Could**
Technical Qualifications and Skills	IT knowledge and abilities, Knowledge Management, Computer programming/ coding abilities	IT knowledge and abilities, Knowledge Management, Computer programming/coding abilities	IT knowledge and abilities, Knowledge Management, Computer programming/ coding abilities
	Data and information processing and analytics	Interdisciplinary/ generic knowledge about technologies and organizations	Specialized knowledge about technologies
	Statistical knowledge	Specialized knowledge of manufacturing activities and processes	Awareness of ergonomics
	Organizational and proccessual understanding	Awareness of IT security and data protection	Understanding of legal affairs
	Ability to interact with modern interfaces (human-machine/ human-robot)		
Personal Qualifications and Skills	Self and time management	Trust in new technologies	
	Adaptability and ability to change	Mind-set for continuous improvement and lifelong learning	
	Team working abilities		
	Social skills		
	Communication skills		

redefine its mission, job definition, and responsibilities (Alayoğlu 2010). Tab. 1 summarizes the qualifications that are expected to have occupations for future employees.

The impact of Industry 4.0 on human resources management processes is explained below.

Strategic Perspective

In order for human resources to be able to contribute to business results, business units need to be strategic partners. In order to achieve this, HR specialists who can understand and interpret financial data, have a good command of the dynamics in the sector in which the company operates and to the up-to-date developments, and who contribute to important projects carried out in the company and develop applications and projects parallel to these elements will be needed.

Employment

According to the researches, employment is aimed to grow by 6 % in the 2020s. This growth will increase consumption, and the economy will be affected. The presence of equipped elements in the installation and development of intelligent devices and systems will be crucial. With digital conversion, all processes and customer expectations will change.

With the spread of robots, technological unemployment will arise. Technological developments will change the structure of the workforce in the short run and partly cause unemployment. In the long run, the labor force will increase in quantity and quality. The muscular power in the past will leave its place to the mind. Intelligence will also increase the level and quality of education. In the long run, highly qualified individuals will be employed. Robots and people will act together and be managed together in harmony (EKOIQ 2014).

It will be very difficult to find these talents. The definition of the workforce will change. Consultants, home office workers, freelancers, brand awareness professionals, and suppliers will contribute to the activities of periodic and project-based companies. These people will never be deprived of their jobs due to their talents. Objective perspective lines will present different perspectives as an eye from outside with fresh information. This will make the companies rich.

Performance Management

Depending on changing corporate structures, new generation performance measurement tools will emerge in the coming years. The concept of performance consulting will take its place in business life. From a classical performance

perspective that values seniority, it will shift to a performance management understanding that rewards young and hardworking employees. Today, employees want to work with managers who empower and inspire them, to give feedback to managers, to regularly talk about company goals, and to follow developments in this area (Alayoğlu 2010). Still, many companies continue to incorporate new performance measurement methods into their work systems. New network performance measurement methods are much more active than the old ones. To build an effective system, it is necessary to build a complex structure with components such as continuous monitoring, routine checks, performance coaching, staff development, performance reviews, and returnability infrastructure for leaders. These data must also be viewed on a digital system. Companies that provide human resources software services will have to move very fast and keep pace with change.

Reaching the Talent

Human resources will find it difficult to find human resources with the capabilities required by digital conversion and Industry 4.0. Human resource management, which focuses on closing open positions, will leave a proactive approach to talent-oriented, talent-driven proactive approach (LinkedIn 2015). Human resources will want to reach out to qualified personnel from all over the world in order to find and deploy the company's required skills, and new strategies will be developed in this direction. These employees will provide flexible working opportunities for working in the countries where they are located.

Although their competencies are high and the number of qualified staff is high, finding the right talents and positioning them will be one of the biggest challenges in the coming periods. In the coming years, it will become even harder to find people with talent, experience, and skill and to put them into the right jobs. Populations in developed countries are declining, and the baby boomer generation will begin to retire. This necessitates finding talented people from developing countries and joining them in the workforce.

With the digital era, Turkey's most beloved countries have their own abilities; countries with employees who think their skills are inadequate are Germany, Japan, USA, Romania, and Hungary (EKOIQ 2014).

There will be deficiencies in skills in fields that require technical skills such as information technology, mathematics, medicine, and engineering. In this case, companies will try to find and win people with critical skills. The only way to be successful in this competition is to set up your own talent management systems and integrate them into HR processes. Companies that set up their own

talent systems and actively use their processes have a financial performance that is over 300 % higher than their competitors and twice as much as their labor force applicants on the market (EKOIQ 2014).

Almost all employees in enterprises will be in the status of "knowledge workers" who do business with technology help. It will not be easy to find next-generation digital capabilities such as Data Scientist, Artificial Intelligence Specialist, Application Developer, Cloud Architect, or Agile Project Specialist. An important part of these abilities is very far from the concepts such as CV, LinkedIn, and Assessment. In this case, standard resource hiring and recruitment methods will not work. Companies like Facebook, Google, Microsoft, and Amazon, which are advantageous in terms of culture and activity, will gain importance in order to find these profiles and gain them to companies. In today's business world, we are experiencing serious problems in terms of the ability of digital talents to come out and be protected even if they do. The value judgments, habits, and behavior of companies cause this.

Training

Training is one of the most important elements of Industry 4.0. Recruitment of the intelligent machines and the qualified workforce that can use these machines, training of the expert staff, the formation of a structure that will perceive the cyber-physical systems, and the updating of the education system from primary school to the university parallel to these developments gains importance in time.

Data-Based Management

The most important decisions taken by institution concern employees. It is necessary to take into consideration the data and vital information that is vital for the company. HR analytics will be on the agenda of more and more companies, and governance-based management will become very important. It will be beneficial to incorporate data that will support personal comments and decisions in the HR field.

Protection of Information

Human resources have a detailed database of employees' personal information. The protection of these data is very important for both the employees and the company. In the business world, the protection of confidential information has become a critical process. Risks in human resources are the protection of the data, wrong recruitment decisions, and loss of ability in a short period of time.

ERP software, preferred by many companies, will leave their place to analytical tools that enable better measurement and decision-making on human-induced issues that run through the cloud. Technological systems will be used to evaluate employees. The storage of information on the cloud and the use of mobile technologies will bring new privacy policies and risks. In addition, the HR will need to tackle problems with information security and intellectual property rights (www.turkishtimedergi.com 2016).

Working Environments

With Industry 4.0, the Y and Z generations will feel the power. In the offices where these generations work intensively, common working areas such as corners and cafes that will support the use of the latest technology and individual work will be preferred. It will increase the number of companies that use office designs to make office work attractive. To attract large companies, young entrepreneurs and equipped young people to their companies, they are developing office designs using new systems in business environments.

In a social sense, a completely different working routine will emerge. The 9am–5pm shift is going to be a working concept that is not constrained by space, and time will be very flexible working away from the understanding of work. Companies that prefer office design to work with flexible hours will multiply (www.turkishtimedergi.com 2016).

Social Media

With social media, everything will go through a more transparent structure. Social media channels will evolve into a democratic platform where information workers can participate at all levels, from complaints or pleasures of customers to employees' side rights, working hours, or interactions with each other. The democratization of work will take the institution away from the hierarchy to a more horizontal organization. Employees can be effective in communicating with each other, producing solutions. This interaction will make people more proactive in making observations and taking responsibility for their work. This new order will be organizational and will change job descriptions from the root (Laleli 2017).

Business and Life Balance

Human resources should identify ways to improve the health and interaction of employees as well as work and life balance. Are your employees healthy? Do they have the habits and knowledge to make them energetic? Are the managers

Tab. 2: Demographic Information Related to Interviewed Operations

Company	**A**	**B**	**C**	**D**
Respondent	HR Manager	HR Manager	HR Manager	HR Manager
Position seniority/ Workplace seniority	12/12	26/19	6/20	5/28
Sector	Industry automation	Textile	Textile	Machine production/ Industry automation
Capital Structure	Foreign	Foreign	Foreign	Domestic
Age of Business	42	50	65	60
Number of Employees	1000	900	1500	1100
White Collar	200	175	300	250
Blue Collar	800	725	1200	850

helping them focus? Do they have the skills to do their jobs? Can they spare time for their friends and family? Do you have time for the hobbies? They should ask their questions.

Without discrimination, whether large or small, human resources departments in all companies need to incorporate factors such as undertaking the role of "helping people improve their performance", recreation rooms, sports programs, and job quality enhancement programs (Laleli 2017). (Lalei 2017).

Status of Businesses Prepared for Industry 4.0

This research covers four industrial operations operating in Bursa. Three of the businesses are foreign capital. Two of the interviewed firms are textiles, both operating in the field of technology. The number of employees working in the company ranges from 900 to 1500. Negotiations were held in May 2017 with interviews with managers of the human resources and managers responsible for technology, and interviews were conducted in the factory. Demographic information on the interviewed enterprises is given in Tab. 2.

The following four questions were basically directed to business managers:

1. What are the general challenges businesses are facing in the environment that Industries 4.0 brings?
2. How do you anticipate how these challenges will affect current and future business and business processes?

3. What are the core competencies that employees must have to fulfill their position in the current or future business?
4. Do you have any initiatives that you have developed as a business in this area?

The answers given by the enterprises to the questions are shown in Tab. 3.

Results

In response to the question "What are the general challenges that businesses will face in the environment created by Industries 4.0?" the work structure will become technologically more complicated, which will increase the demand for high-qualified staff, but it will be difficult to find and retain these qualities, whereas some of the low-quality staff will lose their jobs. The need for existing selection methods to be inadequate in the future and the need to organize adaptation programs to support existing employees in their adaptation to the new situation are emphases on direct human resources processes.

The answers to the question "How do you anticipate how these challenges will affect your current and future jobs and business processes?" emphasized that the role of consulting firms will become more prominent when it comes to achieving talent. Management directors seem to have agreed on the need for the public to make significant innovations in education in the new period.

The answers to the question "What are the basic competencies that employees must have to fulfill their current or future business?" show that the areas of common emphasis are information technology, communication skills, problem solving, and process skills.

In response to our question, "Do you have any initiatives to develop this field as a business?" it seems that every business is prepared for this. Programs related to Industry 4.0 are carried out centrally in foreign capital enterprises. Responsible persons have been identified and appointed in each business.

Conclusion and Evaluation

This study focuses on the theoretical background, the field research, and the working environment that Industry 4.0 will emerge in industrial enterprises and the possible effects of this environment on the human resources processes. Although the development of industry and technology in a country is realized by the innovation capability and performance of the enterprises, the fact that it can be achieved by the ecosystem approach requires a very wide participation including the public sector. It is unthinkable for the public to be indifferent to

Tab. 3: Responses of Business Managers to Interview Questions

Question	Answer
What are the general challenges businesses are facing in the environment that Industries 4.0 brings?	**A. Company.** The rise of technology will lead to a decrease in the number of blue collar workers. Employment will shift to a staff that is competent and skilled. Those who cannot use the technology will be the problem of adaptation of the X generation, and those staff who cannot renew themselves will be exported from their workplaces. It will be difficult to resume the exported talent and adapt to the companies. Managing the workforce centrally increases costs. The cost of a staff member working in Istanbul at my company is 1.5 times higher than Bursa. With digitization, the built-in labor force will cost less. It is important for companies to conduct cost-benefit analyses. **B. Company**. I think we will have the problem of retaining the qualified workforce to find a qualified workforce. For this reason, our company has diversified its motivation tools. We have actively involved our diversity team in the HR processes to manage diversity. In this way, I think that we can reach many human resources and make a difference. **C. Company**. The competencies of human power in the existing structure will not be enough. The development and exchange programs need to be prepared and implemented on the blue and white sides. Global human resources will be needed. We have the risk of losing employees who are working hard with digitization. I think this could harm the economy of the country. It will be difficult to find highly qualified employees. The selection methods available will not suffice. **D. Company.** Employment will vary. While the highly skilled workforce will have a 5 %–10 % increase in employment, the collar workforce will be in the same blue reduction. In this case it will cause unemployment. Orientation programs will need to be prepared for the adaptation of the new workforce to the company. Diversification of motivational actions and new proposal and reward systems will have to be put into effect. Implementation of a structured training development process is required. The consolidation of your abilities and the retention of these abilities will become an essential necessity. It is necessary for the public administration to determine some laws and policies to pass the Industry 4.0 process. It should support this through training and incentive processes. Otherwise, it is not possible to capture the Industry 4.0. We cannot go beyond a system that we learn from global companies.
How do you anticipate how these challenges will affect current and future business and business processes?	**A. Company.** The state needs to change its policies. A successful path cannot be pursued if the state policy does not own the Industry 4.0. Education is something that needs improvement at the beginning. There is a need for reform from primary education. **B. Company.** Regrettably, the current education system (including vocational high schools) is not enough to train qualified labor force. It is very difficult for us to get rid of assemblage and labor-intensive work if there is no education reform starting from the vocational high school.

(*continued on next page*)

Tab. 3: (continued)

Question	Answer
	C. Company. Managing human resources processes will be very difficult. With digitization, it will be difficult to manage people and technology together. It will be difficult to keep the talent in the company. Standard practices will bring difficulties to employees. They will ask for flexibility during their stay. The state's rules and harmonization process will force companies. Concurrently companies will be forced. **D. Company.** The expected qualification from the workers will change with Industry 4.0. The jobs that are simple, self-repetitive standard tasks will be replaced with a structure that can decide in complex situations, take visualization and action, and attach importance to preventive care. It will be difficult to find and manage talent. Consultants and supplier companies will be serious players.
What are the core competencies that employees must have to fulfill their position in the current or future business?	**A. Company.** Information technologies; technical skills; communication skills **B. Company.** Technological skills; problem-solving competencies; process skills; analytical skills. **C. Company.** Technical skills; innovation; change; technological capabilities; strong communication skill. **D. Company**. Cognitive flexibility; problem-solving; creativity; coordination; emotional intelligence; to think right and to decide; service centrality; compromise; people management.
Do you have any initiatives that you have developed as a business in this area?	**A. Company.** Our company has accepted the "technology for life" approach. Currently, we run more than 50 projects. In a project in our factory in Germany, people live and learn how to work in high-tech equipment and how products interact with each other. The machines are told which product to produce next. More than one product can be produced on the same line. With the RFID (radio frequency identification system) system, the status of the products can be monitored at any time. Technicians can see the instruction manuals in their glasses and use their hands freely. In case of any malfunction, the robots give the knowledge of the service. The aim of this project is to optimize production transport networks by bringing together information technology and production automation through the internet. A similar model is applied to our Bursa plant. A person in charge of Industry 4.0 has been assigned. This person is collecting data and improving the process. Then the project will be spread to all our companies in Turkey. It is imperative that we all have this change ready. **B. Company.** We have just started outsourcing work on digitization. So what we will do in this area will be planned in the coming period and roadmap will be drawn. The very active use of HR analytics now is important. This process, which is carried out globally, is also about to settle in Turkey. Many data will be used to improve processes. This year's motto "digitization" is that we are all excited to keep up with this shift.

Tab. 3: (continued)

Question	Answer
	C. Company. We divided the IT department into two and turned it into a unit working with Industry 4.0. Pilot applications in production have already begun. **D. Company.** We want our company to become a factory of future technology. We want to adapt our current conditions to the future with energy, efficient production lines with high flexibility, an optimized workflow of information and materials, efficient energy network for building and production processes, and a practical and integrated training factory. We want to optimize logistics and material flow, optimize inventories, produce without bottlenecks, and incorporate suppliers into the production process. We want to monitor and restore corrective measures with production cameras, sensors, RFIDs, and barcodes, to minimize energy consumption. We are working on an Industry 4.0 team for this and a computer engineer responsible for operations.

this issue, as industrial production affects both the economy and employment. Germany and China are the most striking examples of this.

The aim of this research is to clarify the state of opinion, expectation, and preparedness about how the Industrial Industry transformation in the industry will affect the processes of human resources. The information we receive from business managers shows that every business is prepared for the new business environment that this process will bring, and that they have developed initiatives and measures. The common opinion of business managers is that some of the low-qualified employees will lose their jobs, so some people in this group will lose their jobs, while Industry 4.0 will affect employees based on expected skills and skill profiles, resulting in higher demand for high-qualified employees.

The most important condition of sustainable competitive power is investing in technology. Staying behind the global economy will make competition almost impossible. The country, the companies, the machines, and the employees have to increase their capabilities in line with Industry 4.0.

Industry 4.0 will change the daily lifestyles of communities and all the habits of business life. This change will have to keep pace with states, societies, companies, and employees. Those who cannot catch up with change will face the risk of economic disappearance.

The research was carried out in the Bursa region and only on four enterprises. It is not possible to generalize the results obtained in this direction. However, it can be said that three of the interviewed companies are multinational corporations and the results are considerable in terms of human resources when considering the number of people they work with. A research that will cover

different geographical regions and larger numbers of businesses will undoubtedly reveal the expectations in this area more reliably.

References

Alayoğlu, Nihat: "İKY'de Yeni Dönem Yetenek Yönetimi". *Ticaret ve Turizm Eğitim Fakültesi Dergisi 1*. 2010, pp. 1–97.

Alçın, Sinan: "Üretim İçin Yeni Bir İzlek Sanayi 4.0". *Journal of Life Economics* 8. 2016, pp. 19–30.

Bayraktar, Erkan / Kaleli, Fatih: *Sanal Gerçeklik Uygulama Alanları*. Akademik Bilişim, 31 Ocak-2 Şubat: Afyon. 2007.

Big Data, retrieved 24.05.2017, from http://devveri.com/big-data.

EKOIQ: "Endüstri 4.0 Akıllı Yeni Dünya". *EKOIQ*, Değişim Özel Eki. 2014.

ESO: "Sanayi 4.0". İzmir: Ege Sanayi Odası. 2015.

Festo. *Endüstri 4.0 Sunumu*, retrieved 24.05.2017, from http://www.tiad.org/assets/admin/js/plugins/kcfinder/upload/files/Festo_FikretKemalAkyuz.pdf. 2016.

Gehrke, Lars / Kühn, Arno / Rule David / Moore, Paul / Bellmann, Cristoph/ Siemes, Sebastian/Dawood, Dania/ Singh, Lakshmi/ Kulik, Julie / Standley, Matthew: *A Discussion of Qualifications and Skills in the Factory of the Future: A German and American Perspective*, retrieved 10.2017, from http://www.vdi.eu/fileadmin/vdi_de/redakteur/karriere_bilder/VDI-ASME__2015__White_Paper_final.pdf. 2015.

Hecklaua, Fabian / Galeitzkea, Mila / Flachsa, Sebastian / Kohlb, Holger: "Holistic Approach for Human Resource Management in Industry 4.0". *Procedia CIRP* (54). 2016, pp. 1-6.

Laleli, Şule: *Mobil Yakalılar*, retrieved 27.06.2018, from http://www.fortuneturkey.com/mobil-yakalilar-42504. 2017.

LinkedIn: *2015 Yetenek Trendleri*, retrieved 24.05.2017, from https://business.linkedin.com/content/dam/business/talent-solutions/global/en_us/c/pdfs/2015-T%C3%BCrkiye-Yetenek-Trendleri.pdf. 2015.

Qina, Jian/ Liu, Ying / Grosvenora, Roger: "A Categorical Framework of Manufacturing for Industry 4.0 and Beyond". *Procedia CIRP* (52). 2016, pp. 173–178.

PWC: *Industry 4.0: Building the Digital Enterprise*, retrieved 27.06.2018, fromhttps://www.pwc.com/gx/en/industries/industries-4.0/landing-page/industry-4.0-building-your-digital-enterprise-april-2016.pdf. 2016.

Rhisiart, Martin/ Glover, Peter / Beck, Helen: *The Future of Work Jobs and Skills in 2030*, retrieved 23.05.2017, from www.ukces.org.uk/thefutureofwork. 2014.

Schwab, Klaus: *The Fourth Industrial Revolution What It Means and How to Respond*, retrieved 23.05.2017, from https://www.foreignaffairs.com: https://www.foreignaffairs.com/articles/2015-12-12/fourthindustrialrevolution. 2015.

Siemens: *Endüstri 4.0 Yolunda*, retrieved 24.05.2017, from http://cdn.endustri40.com/file/ab05aaa7695b45c5a6477b6fc06f3645/End%C3%BCstri_4.0_Yolunda.pdf. 2016.

WEF: *The Future of Jobs*. World Economic Forum. Geneva, 2016.

www.innovarobotik.com: *Yatay, dikey entegrasyon*, retrieved 05.24.2017, from https://www.innovarobotik.com/yatay-dikey-entegrasyon. 2016.

www.turkishtimedergi.com: *2017'de İK'ya Yön Verecek Trenler*, retrieved 05.24.2017, from http://www.turkishtimedergi.com/insan-kaynaklari/2017de-ikya-yon-verecek-3-trend/. 2016.