THE 4TH INDUSTRIAL REVOLUTION – HUMAN RESOURCES CHALENGES

Kamila Radlińska, PhD
Koszalin University of Technology, Poland

Abstract: *The article attempts to assess selected megatrends in the area of human resource management resulting from the Fourth Industrial Revolution (4IR) and Industry 4.0. New technologies and automation have been supporting production processes since the First Industrial Revolution (1IR), modifying all areas of the functioning of enterprises. However, together with 4IR and Industry 4.0, the solutions used so far almost exclusively in enterprises went beyond their walls and began to significantly affect the professional and private lives of employees, creating a framework for the concept referred to in the literature as Work 4.0, i.e. work in the realities of 4IR and Industry 4.0.*
Work in the realities of 4IR and Industry 4.0 is characterized by, among others: almost full automation of activities and robotization of workplaces, work with Big Data, in which employees are overloaded with information. 4IR technologies allow spatial and time flexibility of work, remote work and home office. All these features result in the development of non-standard employment relationships regulating the enterprise-employee relationship. However, new technologies have also resulted in the appearance of negative phenomena in the area of work. Work in the realities of 4IR and Industry 4.0 is characterized by disturbances in the work life balance, constant functioning on the so-called "stan by" and fear of missing out (FOMO).

Keywords: *industrial revolution, Industry 4.0, megatrends, work, Poland*

Introduction

The industrial revolutions that have taken place over the last 300 years have significantly affected all aspects of human activity. The first three waves of discoveries in the area of innovation concerned primarily changes in the sphere of production, while the last one also affected social life. Initially, this influence concerned the rules of operation of industrial plants, including, to a large extent, employment. New technologies gradually improved production processes, reduced production costs, mechanized and improved human work. The demand for labor decreased, both in quantitative and qualitative terms. However, only the spread of the Internet, the low cost of data processing, the mobility of devices and artificial intelligence enabled the mass production of new technologies outside production plants. New technologies in the 4IR period began to be widely used also in the personal lives of employees, which changed people's attitude to work [1]. The introduced technologies influenced the situation on the labor market, e.g. the emergence of structural unemployment, the disappearance of professions, the emergence of new forms of work. However, it was only the competency deficit revealed during the 4th industrial revolution that revealed the need to develop comprehensive measures to ensure employees the opportunity to improve their qualifications and to create a new organizational and legal framework for employee-employer relations.

Taken together, the discoveries that drive all industrial revolutions have had a direct impact on enterprises and employee. Technologies used in industry have changed the quantitative and qualitative dimension of work, reduced the labor demand and changed its structure. However, only 4IR technologies went beyond the walls of enterprises and began to be widely used in private life [1,2]. 4IR has significantly changed both the professional and private life of employees.

Work 4.0 is a term referring to work performed in the 4IR reality, the main feature of which is the deficit of competences caused by the development of advanced technologies and it is a permanent state [3]. Such an approach to the category of work is closely related to the development of a new approach to the method of improving competences related to the use of new technologies - systematic reduction of the competency deficit of employees. The concept of Work 4.0 appeared along with the 4th Industrial Revolution and is a set of activities aimed at providing systematic access to tools and methods to improve the competences and skills of employees in the field used by Industry 4.0. The subject of analysis within the Work 4.0 concept is to define systemic solutions aimed at systematic improvement of employees' competences and skills, while its subjective nature refers to the situation of employees. Because employees should systematically improve their competences in order to maintain their current position [4].

Employees found themselves in a new, previously unknown situation because technology entered their professional and private lives simultaneously, creating tensions and giving new tools used in all areas of their lives. Technology has blurred the boundaries between professional and social life. This situation further complicated the process of managing human resources and the work of human resources departments.

The aim of the article was to present selected megatrends resulting from 4IR that have an impact on employment practices. During the analysis, an attempt was made to answer the following questions: how have 4IR and Industry 4.0 changed the essence of work and employees? The conclusions were based on the results of a literature review in the field of 4IR and its impact on employee-employer relations.

The article consists of three parts. The first one reviews and characterizes the technological changes that initiated each of the observed industrial revolutions. The second describes how 4IR and Industry 4.0 influenced the situation on the labor market and its impact on human resource management departments. It outlines the definitional framework of the Work 4.0 concept. The article ends with conclusions, which constitute the third and last part of the article.

Industrial revolution - towards Industry 4.0

In the past, each new technical discovery in the way of manufacturing and distributing products quickly dramatically increased the efficiency of production processes and improved the quality of products [5], which is emphasized by the term revolution. As a result, each successively discovered technology quickly eliminated production errors, saved production time, and consequently increased the profits of enterprises. However, it was not until the Fourth Industrial Revolution that rapid social changes began.

The First Industrial Revolution began in the eighteenth century and was directly related to the discovery of the steam engine and the construction of railway infrastructure, its effect was the mechanization of physical human work [1]. As a result, labor productivity increased several times. In addition, steam engines and

steam locomotives made it much easier to deliver goods over longer distances and in less time. More than 100 years later, with another epoch-making discovery, another technological leap took place. The Second Industrial Revolution was associated with the use of electricity. At the beginning of the 20th century, energy-generating machines allowed us to enter the stage of automation of human activities in the production of products, to build automated production lines, as was the case with Ford Motors factories. As a result, there was a rapid acceleration of production while reducing production costs. The Third Industrial Revolution, which dates back to the 1970s, changed production thanks to computers and the automation of production processes. The invention of semiconductors, mainframe computers, freely programmable PLCs, industrial robots in the 1960s and 1970s, and the Internet in the 1990s greatly improved industrial production. The result was the construction of production lines without human intervention. The Fourth Industrial Revolution, initiated by universal access to the Internet, reduction of data processing costs, device mobility, intelligent sensors, renewable energy sources and artificial intelligence, including machine learning, has streamlined the production process and changed people's lives in the professional and private areas. The features of the Forth Revolution are digitization, work in the so-called clouds, working on large data sets Big Data [6]. The transition to cyber-physical systems and the creation of a smart factory in which unnecessary activities are not performed, where production lines are not only fully automated, but also operate based on intelligent solutions, almost completely eliminate human error, making the production process cheaper and shorter. Planning and designing new solutions in the reality of 4IR is tested virtually.

The term Industry 4.0 was first used by the German government in 2011 during the International Hannover Messe [7]. Industry 4.0 is the basis for the digital transformation of enterprises, in which every element of the supply chain takes place in an intelligent way, using computer algorithms to monitor and control machines, robots, vehicles and people. The main postulate of Industry 4.0 is to create a smart factory, i.e. a place where human activity will be integrated with the functionality of machines in order to increase production efficiency, increase labor productivity, reduce costs and improve the use of resources, including non-renewable resources.

The implementation of the idea of Industry 4.0 consists in the use of such solutions as:

- Internet of Things – IoT [8], i.e., a technology that enables automatic communication via the Internet. Communication takes place between digitally controlled machines and IT systems, omitting a human being. In particular, the Industrial Internet of Things [9], i.e., a technology dedicated to industry, which, apart from automatic communication via the Internet, collects data from various sources and sends the result to the central decision-making center (human).
- Cloud computing [10], a solution based on the use of remote tools to organize workplaces. Working in the cloud deprived the category of work of many of its classic attributes, i.e. performing work in one place and time. It eliminated the distance between the place of work, place of rest, place of life of employees. This is one of the biggest advantages of working in the cloud, because modern work is very dynamic and working in the cloud is possible 24 hours a day, 7 days a week. Such organization of work means for the enterprises a reduction of costs incurred for maintaining physical workplaces, which increases their efficiency. And finally, working in the cloud means greater security for storing, updating and processing data.
- Artificial intelligence and machine learning [11] define the relationships between machines. Industry 4.0 assumes that the production, control and analytical

processes in a smart factory take place thanks to the use of, among others, virtual assistants, sensors or robots. These technologies are being intensified to increase productivity, make better use of machine and human time, and enable real-time decision making. Thanks to transparency, automation and prediction of production, and machine learning, artificial intelligence can fully effectively transform resources into results.

The key issue is to apply all new technological solutions in all enterprises at the same time. Because the system should be integrated and understandable at all levels, starting from production, through distribution and transport, to consumption.

Sensor data recorded on production lines should be read and processed using artificial intelligence. The digital information thus prepared over the Internet should be available as a basis for employee decision-making. In the reality of 4IR, an employee should only have a set of competences that integrate technology with the real world.

Thus, the progressive automation and robotization during each of the waves of the industrial revolution had a direct impact on the systematic reduction of the need for unskilled labor and was a feature accompanying each discovery. However, only 4IR technologies, i.e., their virtuality, automation, artificial intelligence, nanotechnology, big data, have almost completely automated production and influenced the functioning of employees: their professional and private lives, in particular interpersonal relationships at work and outside. Thus, the 4th Industrial Revolution and Industry 4.0 changed not only production and work, but also changed the role of employee in the enterprise and society. Because modern technologies, artificial intelligence or calculating machines in a smart factory are as important as humans. However, its meaning has completely changed. In fact, a 4IR employee is the same team member as artificial intelligence, digital control, or industrial automation.

Human resources management and work in the realities of 4IR

According to [12] during the 4IR, the most susceptible to being replaced by systems and technologies are mainly professions involving the performance of simple administrative tasks, and in the case of production positions - positions of people performing simple activities in the production process. On the other hand, the positions and professions least susceptible to redundancies are project managers, operational managers, engineers or doctors, as well as members of management boards of enterprises, but also specialist positions, i.e. mechatronics, automation, IT. The need to program and maintain complex workplaces, lines and systems will generate new workplaces. It is also important for the labor market, including employment practices, that the market will demand new skills to replace the existing ones. Examples of new generation professions are computer scientist (combination of computer science and automation), cyberbiologist or cyberphysicist [13]. Therefore, the future form of work will be determined by automation and robotization, which on the one hand will cause the disappearance of some traditional professions, and on the other hand will increase the demand for specialists in the field of operation, maintenance and service of implemented technological solutions and those dealing with the design of new solutions, adapting them to the changing customers' needs and their further development [14].

These changes in the area of work make it necessary to change the approach to the perception of knowledge, skills and competences of employees. The traditional skills of employees in the realities of the 4IR will be replaced by machines. In their place, there is a need to equip employees with new expected skills, in which the ability to

systematically adapt to new technologies seems to be the most important [15], as well as the convergence of certain specializations.

The Forth Industrial Revolution requires a revision of human resource management methods, as it is associated with the emergence of work in enterprises that requires qualifications, competences, and attitudes other than before [16, 17]. The effectiveness of human resources management in the conditions of 4IR requires, on the one hand, the use of economic calculation in terms of labor costs, in which work is treated as capital, not a resource. On the other hand, formulating an employment policy adapted to the realities of 4IR [1]. The Fourth Industrial Revolution began the search for new areas of recruitment and training, including improving the qualifications and competences of employees, motivating by building team cohesion and activities building the image of enterprises. The new employment policy framework requires in this area to take into account new technologies, automation and intelligent robotics as well as general trends related to the style of work and life of employees, i.e. increased mobility of employees, working in conditions of a shrinking workforce, generational diversity in enterprises.

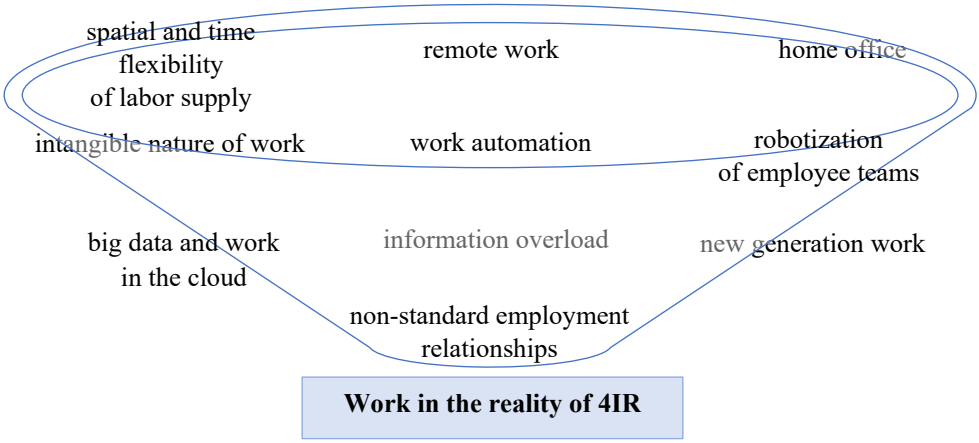
4IR creates a new definitional framework for the category of work, establishes new forms and ways of performing it, the essence and manner of performing it definitely differs from the traditional approach to the category of work, from the beginning of the industrial revolution. Work in the realities of the 4IR changes the role of employee in the enterprise. This means the integration of the employee, intelligent machines, systems and the introduction of changes in production processes aimed at increasing production efficiency and implementing the possibility of flexible changes in the assortment. Employees, machines and IT systems automatically exchange information during production within the various systems operating in the enterprises [18], and this requires new skills qualifications and attitudes. The goverment must also be involved in the process of equipping employees with the attributes necessary to perform work in 4IR realities. Because working in the realities of 4IR and Industry 4.0 requires adaptation of laws and regulations (new labor low), techniques to arouse commitment, awareness and cooperation of employees (new education system), activities for dialogue with social dialogue institutions (new employment policy and new market institutions [19].

HR departments must adapt their strategies to new conditions and trends in labor markets on a global scale. According to the analysis of the World Economic Forum, World Employment Confederation [20, 21] employment strategies in 4IR enterprises must consider:

➢ spatial and time flexibility of labor supply	Work in 4IR realities has been freed from time frames and physical space and is provided anywhere and anytime.
➢ remote work as a way of doing work	Work in the reality of 4IR uses digital technologies, thanks to which it can be shared between many employees employed to perform specific specialized tasks or projects.
➢ home office	Work in the reality of 4IR is increasingly characterized by homocentrism, moving the office and working from home.
➢ intangible nature of work (servitization)	Work in the realities of 4IR is still a systematic development of intangible work, work in the service sector.
➢ work automation	Work in the reality of 4IR is the rapid development of work automation, artificial intelligence and machine learning, which improve the work of the employee and limit his participation in the production process, assigning him other control roles. This phenomenon is global, as it affects an increasing number of professions and workplaces.
➢ robotization of employee teams	Praca w zespołach, w których członkami zespołów są cyfrowi pracownicy (roboty), w której praca robotów traktowana jest jak praca pozostałych członków zespołu, doceniana przez zarządzających i współpracowników, co ukazuje nowy, nieznany dotąd wymiar pracy i rezultat 4IR.
➢ big data and work in the cloud	Work in 4IR realities requires the creation and use of big data and the use of "work in the cloud", which changes the set of qualifications and competencies required by the labor market.
➢ information overload	Work in the reality of 4IR requires concentration and working on information overload. An employee spends an average of 25% of his or her time responding to emails, with only 1 in 7 emails being work-related and productivity-enhancing.
➢ NextGen Work – new generation work	Work in the reality of 4IR means developing an alternative work model, especially preferred by representatives of the Y generation.
➢ developing non-standard employment relationships	Work in the reality of 4IR blurs the border between the employee and the employer, creates conditions for the emergence of new forms of employment contracts.

Taking into account the above trends, a set of characteristics of work performed in 4IR realieties was developed, which is synthetically presented in Figure 1.

Figure 1. Features of work in 4IR conditions



Source: own elaboration based on [20, 21].

The specificity of work performed in the 4IR reality requires the adaptation of tools used by HR departments in enterprises. The rapidly changing environment, primarily technological, requires great flexibility and openness to changes in the area of recruitment, training, remuneration, motivation and dismissals.

Already at the recruitment stage, the level of knowledge of technologies and IT solutions, the ability to operate a digital process and its virtualization are checked. Because the form of work in 4IR is determined by automation and robotization. In the reality of 4IR, access to modern devices and technologies is common both in enterprises and outside them. Therefore, employees' competences related to the use of new technologies, especially young people, are not a problem. The problem of big data and their correct analysis can be solved by artificial intelligence. This does not mean, however, that human work is unimportant, on the contrary. However, recognizing the essence of work in the reality of 4IR requires a deep and quick change in assigning a new role to employees in the production process, new for enterprises and employees.

Working in the reality of 4IR and Industry 4.0 also requires taking into account some negative aspects, e.g. work-life balance, continuous action on the so-called stand by, fear of missing out (FOMO). The problem of work-life balance refers to a situation in which professional activity is maintained for a long time and systematically increased at the expense of time, energy, and personal life satisfaction. Mobile devices and smartphones allow continuous access to the Internet, thanks to which employees are connected to work even when they are at home, they can be called to work on demand [22]. In addition, open access to the Internet on mobile devices means that employees in the conditions of the 4IR live under the compulsion to be up to date, with the fear that they will miss something, they live under pressure that they will miss the information they should know. The FOMO phenomenon appeared along with 4IR and Industry 4.0 [23]. Other important negative consequences of working in the reality of 4IR and industry 4.0 is the fact that employees in the reality of 4IR live with a sense of stress and professional burnout, professional satisfaction, the threat of social

inequalities, excessive control, working in isolation, weakening the sense of community in the workplace [19].

Conclusions

4IR and Industry 4.0 have changed the way work and the employees are perceived and have influenced employment practices in the enterprises. The working environment has changed thanks to technological solutions. As a result of the use of digital technologies, the procedures of paper confirmations and real signatures have been or will be eliminated, and the work will be fully digitized. Along with this, the physical presence of a person at work will become redundant - the place and time of work will become unprecedentedly important. The system of remote work and home office will develop. Employees will meet in virtual reality, working on a par with robots and algorithms, but performing mainly control functions in them. A proper understanding of the role of a employee is therefore crucial, because management systems and, above all, employees are responsible for the use of technology in 4IR.

HR departments have so far focused their employment practices efforts on adapting employment practices to the conditions prevailing in the economy and the labor market. Social problems, generational differences, population migrations are just some of the problems that HR departments in enterprises around the world have been struggling with for years. As a result of 4IR, HR departments face new challenges resulting from rapid technological change. Changes in the approach to the process of recruiting and matching employees to work, training and motivating them, rewarding and firing. Currently, employees' competences are identified with their knowledge, experience and attitude. 4IR technologies provide knowledge, leaving decisions to man. Employees in 4IR conditions must be able to use technology in the decision-making process. A good understanding of the trends resulting from 4IR is crucial for the future of employees. Meeting the requirements of the 4IR economy and Industry 4.0 is related to the possession of new skills by the management staff, the most important of which is the ability to adapt to new (today undiscovered) technologies.

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