Re-Industrialization of Europe: Industry4.0 and the Future of Work

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Abstract

The term "Industry 4.0" was first introduced in Germany in 2011. It refers to digitising industrial production. The concept outlines the vision of a smart factory, which is characterised by the complete networking of all production processes: real time control via ITC and the increased use of robots, which control themselves, are developments that should contribute to greater productivity and efficiency. The concept of Industry 4.0 is a base of re-industrialization of Europe. Industry 4.0 is shaping the digital discourse in the Czech Republic as well. The first step was the release of the National Initiative: Industry 4.0 by the Czech Ministry of Trade and Industry in 2015. We are now at the beginning of a fundamental debate that is still presenting more questions than offering answers. The aim of this paper is to discuss the issue: re-industrialization and its consequences for the world of work. If widespread predictions are correct, the digitisation of production can mean the extinction for millions of jobs. Innovations may seem grandiose, but they can also be destructive, rendering entire professions obsolete.

Keywords: Industry 4.0, re-industrialization of Europe, future of work, employment

Introduction

The term "Industry 4.0" was first introduced by the German Industry-Science Research Alliance in 2011 (Bullinger, 2013). The concept describes how the Internet of Things, Data and Services[16] will change production, logistics and work processes in the future (Kagermann, 2014). The changes brought about by networking based on the Internet of Things, Data and Services have a greater impact than for industrial production alone because they affect not only our economies, but also the world of work and social life as a whole. Industry 4.0 is more a vision than a reality, but it is already

[16] The concept Industry 4.0 involves many elements of the industrial value chain and it is based on the Internet of Thinks, Data and Services, sometimes called the Internet of Everything.

prepared to change not only industry, but also word of work. The paper is focused on two key questions, which guide this paper:
What is Industry 4.0?
What does this mean for the world of work?

What is Industry 4.0?

Industry 4.0 or the Fourth Industrial Revolution, is the current trend of automation, cybernation and data exchange in manufacturing technologies[17]. It is based on the Internet of Things, Data and Services and creates what is called a "smart factory": Within the modular structured smart factories, cyber-physical systems (hereafter "CPS") monitor physical processes, create a virtual copy of the physical world and make decentralized decisions (Herman, 2014). Cyber-physical systems communicate and cooperate with each other and with humans in real time via the Internet of Things. Services are offered and used by participants of the value chain via the Internet of Services (Platform Industrie 4.0, 2015).

In the context of the Fourth Industrial Revolution researchers and industry representatives also discus about a new organisation and steering of the entire value chain, which is increasingly becoming aligned with individual customer demands. The value chain covers the entire lifecycle of a product, from the initial idea through the task of developing and manufacturing it to successive customer delivery as well as the product's recycling. Growing digitisation brings us to the "second machine age" (Brynjolfsson, 2014). This is due to the fact that data forms the material of this Fourth Industrial Revolution.

Fourth Industrial Revolution is based on CPS. Comparison with the previous levels of industry, see table 1.

Table 1: Industrial revolutions one to four: the level of complexity

	Level of complexity	Time period
The First Industrial Revolution	mechanical production facilities using water and steam power	end of 19th century
The Second Industrial Revolution	diversified mass production using electric energy	beginning of 20th century
The Third Industrial Revolution	further automation of production through use of electronics and IT	beginning of 1970s
The Fourth Industrial Revolution	cyber-physical systems	nowadays

Source: Spath, 2013

[17] Although Industry 4.0 is currently a top priority for many companies, research institutions and universities, a generally accepted understanding of the term does not exist. As a result, discussing the topic on an academic level is difficult.

The concept Industry 4.0 is based on networking. Large amounts of data (big data) is generated as a virtual copy of the physical world. Whoever can access this limitless data treasure, will benefit, above all from flexibility and efficiency. Industry 4.0 could become a result of this ongoing digitisation in which everything along the value creation chain is networked and all of the relevant information can be independently and directly exchanged between the individual chain links. Linking people, objects and systems will lead to dynamic, real-time-optimised and self-organising, cross-company value added networks that can be optimised according to different criteria, for example cost, availability and resource consumption (Plattform Industrie 4.0, 2015).

In the future, the objects could communicate with each other directly and independently. They consult one another about what should happen to them next. This means that objects will become machine-readable. Thus, products will be able to express many things. Sensors and actuators will ensure that the data from scanners and computers can be distributed and processed directly. The Internet of Things and Services is the result and it promises to merge the physical and the virtual world into CPS (Wan, 2015).

The guiding theme of the future developments outlined above seems to be: "anything that can be digitised will be digitised" and accordingly, the scenario of the future developments is ambitious. Researchers and industry representatives emphasize the opportunities of the concept Industry 4.0: Real-time networking of industrial processes makes production cheaper, sustainable and efficient and digital networking allows the direct involvement of customer demands. The IT and TC sectors will be the first to see the benefits. Creators and providers of software solutions for big data analysis, networking and digitisation can most likely look forward to increases in orders. Many more industries, however, will probably be deeply impacted by Industry 4.0 developments: machine and facility engineering, electrical equipment manufacturers, the chemical industry, car makers and their suppliers, but also the logistics industry as well as agriculture.

Changes in the area of world of work

What is meant by the concept Industry 4.0 for the world of work? There is no definitive answer to this question at the moment. The estimates are uncertain and differ. Rather, most of the scenarios revolve around a more complex relationship between humans and machines (Kurz, 2014):

The **automation scenario**: systems direct humans. Monitoring and control tasks are taken over by technology. It prepares and distributes information in real time. Employees respond to the needs of cyber-physical systems and take on primarily executive tasks. The abilities of lesser skilled workers are thereby devalued.

The **hybrid scenario**: monitoring and control tasks are performed via cooperative and interactive technologies, networked objects and people. The demands on employees increase because they have to be considerably more flexible.

The **specialisation scenario**: people use systems. CPS is a tool to support decision-making. The dominant role of the qualified workers is maintained.

Digitisation and Industry 4.0 will change work in the future. Automation will enable ever smaller series production, labour will nevertheless continue to be an important part of production. The concept Industry 4.0 means, however, much more than networking of all things. The future includes intelligent data acquisition, storage and distribution by objects and people. Traditional production-line workers' and knowledge workers' tasks will amalgamate to an ever greater degree (Spath, 2013). As a result, many labour processes will be carried out more efficiently and effectively in the future. The processes will also provide a variety of new assistance systems. This means that administration processes will be further automated as well. A variety of options will open up to certain labour groups (especially the highly qualified) to design their own working life, both in terms of where and when they do their jobs as well as the nature of the activity and access to the task at hand. A polarisation of employment thus assumed to be on the horizon in which certain jobs with mid-level skill requirements and wages will be the first to be made redundant as the consequence of Industry 4.0.

Frey and Osborne forecast that half of all the jobs in the US labour market could feel the effects (Frey, 2013) . Accordingly, vocations at the lower and upper ends of the qualification spectrum that are less automatable and more experience- and interaction-based professions would gain in relevance. This is also where we can expect to see completely new fields arise (Picot, 2014). Furthermore, due to increased outsourcing, the droves of "click workers" and "cloud labourers" *who are poorly paid and less socially secure as freelancers will most likely grow.* The world of work is undergoing a major process of change. The main force of transforming it is onward march of technology. The robots are coming and if the forecasts are correct, it can mean the extinction for millions of jobs. Innovations may seem grandiose, but they can also be destructive, rendering entire professions obsolete even as they boost productivity and convenience.

If widespread predictions are correct, automation in the workplace is set to increase at an unprecedented rate. There's going to be a huge change, comparable to the industrial revolution (Acemoglu, 2014).

One issue that will loom ever larger as the incidence of automation increases, is income and social inequality. Automation is fundamentally the

substitution of capital for labour. The problem is that the people who already have the capital are the ones who will benefit most, because they are the ones who will invest in the new automation. In other words, the rich will get richer and the rest will suffer. The Internationale Labour Organization (hereafter: "ILO") needs to respond to the future of the work ongoing changes in order to be able to advance its mandate for social justice. Therefore, the ILO has launched a four - year initiative at fostering discussion on the future of work named The Future of Work Centenary Initiative (ILO, 2016):

In 2016 all ILO members States were invited to undertake national "future of work" dialogues structured around four "centenary conversations":

Work and society

Decent jobs for all

The organization of work and production

The governance of work

In 2017 a High Level Global Commission on the Future of Work will be established. Its purpose will be to examine the output from the national dialogues and other input it may consider necessary. The Commission will publish a report and recommendations in the course of 2018.

In the first half of 2019, all member States will be invited to organize events to mark the ILO's centenary and to discuss the Commission's report. The culmination of the "Future of Work" initiative will be the 2019 International Labour Conference, with the possible adoption of a Centenary Declaration.

The Czech National Initiative of the Industry 4.0

The Ministry of Industry and Trade of the Czech Republic, released the National Initiative 4.0 Industry (MPO, 2015) in September 2015, which follows the concept of German Industry 4.0. Czech initiative is a challenge to launch a debate on the possible impacts of the introduction of the 4.0 Industry in Czech economic environment. The aim of this initiative is to encourage the creation of a suitable economic environment in which the Czech industry will respond to the challenges of new industry trends. It is expected that many jobs will disappear and new ones will emerge in the future on the Czech labor market. An important element will therefore be the creation of lifelong learning.

Technological progress is driven by research and development (hereafter R & D). Paul Romer's model for endogenous growth provides theoretical explanation: the greater the proportion of an economy's labour force involved in research sectors, the stronger that economy's growth. Since its inception, many innovation analyses and innovation-policy approaches have been following this principle all over the world. The formula is then:

more is better. That means one can invest as much as possible in research and development and supposedly sit back and watch the positive effects on production and the blossoming market (Romer, 1994). Importance and position of R & D is in the Czech Republic slightly below the EU average: the share of expenditure on R & D was 2% of GDP over the period 2012-2014 in the Czech Republic, the average expenditure on R & D in the EU was 2.5% of GDP. But in the developed European countries (Sweden, Great Britain, Denmark), these expenses amounted to 3% of GDP. The share of employees in R & D per 1,000 employees was 13 employees in the Czech Republic, in developed European countries amounted to 20 employees per 1,000 in the years 2012-2014 (CSU, 2015).

Conclusion

In the future, companies will network their equipment, storage systems, resources, employees, supplier and partner companies and their customers via cyber-physical systems. There is enormous potential behind Industry 4.0: individual customer demands can be taken into account and even one-off, tailored production may become profitable; production will become faster and more flexible; this reduces the resource usage and improves productivity. Employee productivity may also greatly improve. Flexible work options could allow for better work-life balance in terms of both time and location. A variety of options will open up to certain labour groups (especially the highly qualified) to design their own working life, in terms of where and when they do their jobs.

The result of Industry 4.0 will be in the future, that many labour processes will be carried out more efficiently and effectively by cyber-physical systems . The processes will also provide a variety of new assistance systems. This means that administration processes will be further automated as well. A polarisation of employment thus assumed that certain employees will be made redundant as the consequence of Industry 4.0.

One issue that will loom ever larger as the incidence of automation increases, is income and social inequality. Automation is fundamentally the substitution of capital for labour. The problem is that the people who already have the capital are the ones who will benefit most, because they are the ones who will invest in the new automation. In other words, the rich will get richer.

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Czech industry will respond to the challenges of new industry trends. It is expected that many jobs will disappear and new ones will emerge in the future on the Czech labor market.

But Industry 4.0 still has to prove its benefit to society. Only when the developments within and around Industry 4.0 result in social added value, when new technologies, regulations, services and organisations establish themselves in the society and when these social practices prove to be "better for people", will we have recognised and put the potential for Industry 4.0 to work.

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