

REVOLUTION 4.0. A NEW ECONOMY?

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Abstract

Revolution 4.0, Industry 4.0, Work 4.0, Smart Factory, CPS and the like, these are some of the most frequently used terms in the media these days. They usually refer to the current revolutionary stages of digitization and automation in technology with immense consequences to the labour market, economies and societies. Nevertheless, it is - above all - another propagandistic slogan and strategic initiative of the West that is attractive in terms of marketing. It is an analogy to the concept of so-called economy of the 1990s with popularizing optimistic visions in the spirit of another groundswell of techno-optimism and updates of the theories on capitalism transformation. It would be more appropriate to speak about another stage of the information, digital or scientific and technical revolution rather than about a revolutionary and epochal civilization change. However, technological development continues and it is important to react to such activities also from the perspective of Czech competitiveness and the nature of Czech economy. The article critically describes some aspects of the phenomenon of Industry 4.0 and warns of the dangerous techno-optimism “4.0” and the potential negative effects of Revolution 4.0.

Key words: Industry 4.0, Cyber-physical system, Innovation, The fourth Industrial Revolution, K-Waves

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Introduction

The Fourth Industrial Revolution¹ is supposed to be brought about by Průmysl 4.0,² supported by projects such as *Industria 4.0*, or *Industry 4.0*. At the Hannover Fair 2013, the *Industrie 4.0* platform was launched. Its fundamental visions occurred in Hannover 2011 in the project intended for the future that was part of *High-Tech Strategy* that related to the research platform

¹ Hereinafter referred to as “4IR”. There’s a hyperinflation of terms ending with “4.0” (industry, work, logistics, transportation, power engineering, technology, education, research, defence, ethics, culture or economy 4.0 and the entire society 4.0, etc.).

² Hereinafter referred to as i4.0. This term has become widely used, however, it is rather an abbreviation used in business and industry.

called *Smart Factory* from 2005. The German government funds the project with participation of companies such as Siemens, Volkswagen and Bosch. The core lies in intense propaganda of new technologies for industry and household automation with the aim of stimulating the demand for new technologies and accelerating the development of automation and fully automated control systems. The project is artfully larded with poetic declamations about the revolutionary nature of 4IR and it makes use of well-known phrases used by the concepts of information, knowledge, digital and network economy. Subsequently, other countries (not only European ones) join in and contribute to the creation of a phenomenon that, sometimes almost hysterically, stirs debates about the revolutionary nature of automation, digitalization and automation technologies. The Czech response to “*Challenges 4.0*” is *the National Initiative Průmysl 4.0* (its output is a text by Mařík et al., 2016) or *Alliance Society 4.0*. The impact of digitalization is not omitted by *the Draft of the Strategic Framework “Czech Republic 2030”* and a strategic document called *the Czech Republic 2030*. The paper critically outlines some aspects of the Industry 4.0 phenomenon that is compared with the bubble of so-called new economy of the 1990s and warns against the dangerous techno-optimism and potential negative impacts of the Revolution 4.0. In order to achieve this, the methods of description, comparison and qualitative analysis have been employed, making use of secondary data from specialist literature sources and results of available research on the topic.

Texts about 4IR usually swear by its revolutionary nature and its impacts especially beyond industry. Intelligent factories and smart cities, all-embracing system automation, digitalization and automation of manufacture and services, artificial intelligence, 3D prints, cyber-physical systems, the Internet of things and services, cloud calculations and others are to have immense impact not only on the economy, they are also expected to lead a social revolution. It is supposed to be an “*existential challenge*”, a paradigm and quality turnabout after which, it is said, nothing will be “*as before*”. “*The second era of machines*” (Brynjolfsson, McAfee, 2015) is to multiply not physical, but rather spiritual strength; it is supposed to enhance greatly the release of the power of human spirit and creativity. Most texts about 4IR and i4.0 are of popularizing and non-critically propagandistic or naively utopian nature, or they are industry- or technology- oriented. With the exception of, e.g. (Lasi et al., 2014), (Sommer, 2015) or (Šulc, 2016).

1 The bubble of another “new economy”

We can mention the bubble of so-called new economy (i.e. also of so-called new economics) of the 1990s, when expectations weren't met and the bubble burst. Could 4IR, by any chance,

be its analogy? Or an attempt to respond to problems and decrease of the share the West has in global economy? Do we actually see a fundamental reversal in technology development or a shift from quantity to quality at the beginning of the 2010s? Or such favourable conditions were not needed in the 2010s? And there wasn't any project (or even an effective catchword that would be easy to remember) summing up the possibilities of technologies, directions of their development that would be the epitome of the optimistic vision of the West. The 4IR concept is intended particularly to the general public, media and politicians, as it is crucial to re-establish confidence and demonstrate that particularly Western Europe isn't "*a tired empire*" and it's not committing suicide.

So-called new economy and global information society were once immensely popular terms that became much less popular after the bubble burst at the end of the 1990s. The Internet bubble refers to the period of the boom of Internet companies which lacked a good business model and bankrupted soon after they were founded, while they managed to attract vast investments (approx. 1995-2001 with a peak around 2000). At the beginning of 2001, prices of almost all shares of technological online companies dropped dramatically and the bubble burst.

What's going to happen to Bubble 4.0? 4IR seems to be no epoch-making change, let alone a revolution, but rather a contemporary stage of the digital global and local transformation at the most. New possibilities of production will probably end up being restricted to a group of companies from the developed world. After all, it is especially developed countries that are predicted to benefit from 4IR (growth of their competitiveness, creation of new manufacturing capacities, termination as well as creation of jobs) and serious threats to other countries that are expected to be the main bearers of the costs and threats.

2 4IR as another stage of information revolution

"... in connection with the 4th Industrial Revolution we may hear people speak of cyber-physical-social revolution that causes ... interaction ... between cyber-virtual systems of the physical world and social systems" (Mařík et al., 2016, s. 15). The core of *Průmysl 4.0* is to lie in *"profound evidence-based industrial integration ... based on information and cybernetic technologies"* (ibid., p. 17). However, more realistic opinions suggest that 4IR is another stage of informatization and digitalization, or a kind of another mix of economy, or – more broadly – knowledge, digital and network society, rather than a revolution.

We can mention chaos in dating and terminology concerning technological, industrial and other similar revolutions. There are certain periodizations of history, for instance according

to the predominant activities of classifying the society as pre-industrial (agriculture), industrial (industry) and post-industrial (services) with references to R. C. F. Aron, D. Bell or A. Toffler. Toffler's scheme of "three civilization waves" is similar: agricultural society of the "first wave", industrial society of the "second wave" and super-industrial (or information) society of the "third wave".³ Knowledge economy refers to systems based on using knowledge or products with advanced technologies with the view of creating values, products or services. This economy is driven by ideas and innovations. Another frequently used term is "learning society" or "knowledge society" (P. F. Drucker) with characteristic features such as knowledge, know-how and education. The knowledge society is expected to bring about a historic turnabout – after agriculture, industry and services it is now becoming the dominating mode of knowledge production. Historic pillars of the knowledge society are theories of the information society (manufacturing facilitation and dissemination of new findings via information and communication technologies) and concepts of the post-industrial (or super-industrial) society with references to Bell, Masuda, Toffler, Galbraith, etc.

4IR is often defined within the meaning of the current digitalization trends and the related manufacturing automation. Is 4IR another digital revolution (the first one was originally expected to be the third industrial revolution),⁴ or just another stage? D. Tapscott has been promoting slogans of digital economy since the 1990s. Digital economy is a concept that refers to a revolutionary way of source allocation that makes use of information and communication technologies. It is supposed to be a process that concerns the entire society, linked with the information society. However, such a concept of digital economy was presented in the context of so-called New Economy of the 1990s, when other terms used were *Internet Economy* or *Web Economy*. Digitalization is considered to be one of the pivotal trends, including the topicality of labour saving technologies (with, e.g., U.S. companies returning from Asia)⁵ or the World

³ With references to various theories on capitalism transformation. Modern and postmodern capitalism is often referred to as the post-industrial society (D. Bell), technotronic society (Z. K. Brzezinski) or information society (the Tofflers), but it also uses terms such as network society (M. Castells, J. Rifkin), digital society (D. Tapscott) or knowledge society (P. F. Drucker). The above stated are also linked with contemporary "Capitalism 4.0" or vision of "New Economy" of the 1990s.

⁴ There are also broader considerations concerning civilization revolutions that claim we are to witness the onset of digital revolution (after the neolithic and industrial revolutions). That revolution is not expected to change the current world, but rather create an absolutely new, virtual, one.

⁵ Significant impacts of 4IR, particularly within the meaning of complex automation of manufacturing that is difficult in terms of labour, smart factory, Internet, 3D print, etc., should also include the shortening of manufacturing and supply chains in terms of their organizational structure and geography. That is related with a further drop in demand for labour (especially low-cost labour, which may seriously affect especially Asia), a further drop in the share of labour cost and growth of the importance of transportation costs. Manufacture localization is expected to become more important, while manufacturing is expected to move closer to consumers and, on the global scale, it is predicted that manufacturing will return from developing and newly industrialized countries back to developed countries.

Economic Forum Meeting in Davos 2016. Digitalization is expected to make revolutionary changes primarily in industry that is anticipated to be based on communication. However, texts on 4IR usually claim that the changes won't only concern digitalization as such, but they are going to be much more extensive (Kagermann et al., 2013), (Mařík et al., 2016), while accentuating the speed of such changes. (Schwab, 2017) presents 4IR as fundamentally different from the three previous revolutions. 4IR is to take place on the background of technological breakthrough in many spheres that are to be linked with fundamental impact on the entire economy as well as with "*Society 4.0*". The first revolution is claimed to have taken place in the 18th and 19th century in Europe and U.S. It was a transition from agrarian and rural societies to industrial and urban societies. The major role was played by the development of the steam engine with applications to the textile industry and railroad transport. The second revolution occurred in 1870-1914. It was a period of growth of the contemporary industrial branches and expansion of new ones such as steel, oil or electricity production together with using electric power for mass production. The technological progress gave us the telephone, bulb, phonograph or combustion engine. The third revolution is considered to have started at around 1980 and persists until these days. It is supposed to be a digital revolution using analogue electronic and mechanic devices. The progress is demonstrated in personal computers, the Internet and information and communication technologies. 4IR follows from the digital revolution and starts taking place on the background of breakthrough in many fields where the key role is played by robotics, artificial intelligence, nanotechnology, biotechnology, the Internet of Things, 3D print or autonomous vehicles.

The World Economic Forum explains the industrial revolutions using the following scheme: first revolution (1784) – steam, water, machine production of devices; second revolution (1870) – labour division, electricity, mass production; third revolution (1969) – electronics, information technologies, automated manufacturing and fourth revolution (?) – cyber-physical systems. Popularizing texts operate with the following industry sequence: 1.0 (steam engines), 2.0 (conveyor-belt production and electrification), 3.0 (information technologies and electronics) and 4.0 (intelligent networking). The end of Industrial Revolution 1.0 is most typically claimed to be the end of the 18th century, of 2.0 it is the 19th century, with 3.0 it is the beginning of the 1970s (also referred to as the "*period of digitalization and automation*"), while the industrial revolution 4.0 is the present (2011 or 2013 to be more precise, also referred to as the "*period of smart factories of the future*"). (Šulc, 2016) sees 4IR as the "*digital age*" arguing that it started at the turn of the 1980s/1990s, while we are still at

its initial phase now. He refers to the first three industrial revolutions as the “*first age of machines*” and to the fourth one as the “*second age of machines*”.

However, the innovation logics of long K-waves (Sirůček, 2016) points to the following sequence: the first industrial revolution (with its core approx. 1760-1830), the second industrial (also referred to as technical and scientific) revolution (with its core approx. 1873-WWI), the third (also referred to as the scientific and technical in a narrower sense) revolution approx. from WWII until today with various stages (including information revolution and the like, however, including the digital stage or maybe even “*stage 4.0*”). The industrial revolutions (or technological revolutions, sometimes also even scientific and technical revolution in a broader sense) that can be identified have been three so far. The first industrial revolution set off with the application of the steam engine in the textile industry (approx. 1770-1815) and subsequently in railroad and water transportation and so on (approx. 1830-70, so-called “*railroad age*”). That age started off in England with gradual diffusion in other countries. Then there was the second (so-called technical and scientific) revolution with the application of electricity, combustion engine, “*great*” chemistry, telegraph etc., approx. 1873-approx. the beginning of the WWII. Then there was the third (so-called scientific and technical) revolution started by the WWII with the first “*atomic*” stage on the background of nuclear energy, electronics, synthetic chemistry and astronautics (approx. 1940s-1970s). Another stage is the “*information*” stage that is linked with microelectronics, telecommunications, later the Internet or biotechnologies (approx. from the 1970s-80s). And Industry 4.0, or to be precise 4IR, (approx. from 2010) could represent another stage, the “*digital*” stage. What corresponds with the outlined Revolution 4.0 is the conception and sequence of innovative long K-waves (see Dobrylovský & Sirůček, 2016). The impatiently awaited and celebrated inception of new, particularly information and communication technologies in the 1990s didn’t occur and the bubble of so-called New Economy burst. What interfered was the “*Great Recession*” at the end of 2000s which worked as a “*detergent*” preparing finally the “*historic ground*” for their complete application?

We may add that many refer to the fourth, so-called information, revolution not as to a stage, but rather a revolution of its own, with the beginnings dating back either to the 1960s or 1980s. Alternative concepts operate with the first industrial revolution divided into its first stage (approx. 1770-1870) and second stage (last third of the 19th century-WWII), the second industrial (scientific and technical) revolution divided into the first “*atomic*” stage (1940s-1970s) and second “*information*” stage (from the 1970s). Could 4IR actually represent the third stage in this concept?

3 Dangerous techno-optimism 4.0

Most visions concerning new technologies underestimate fatally the risks and threats and in the spirit of excessive techno-optimism they merrily sketch out only wonderful future. They expect information and digital technologies to change lives of all people and shift them toward greater sharing and cooperation, restriction of the desire for power and ownership, toward greater empathy and responsibility. They expect markets to transform into “*new cooperative space*”, while people should share goods and information without any control from above, communication and empathy will be boosted. Markets will turn into an “*ecosystem*”, the “*age of empathy*” is on the horizon, technologies enhance creativity that goes hand in hand with mature and responsible behaviour, establishing interpersonal relationships that are not based on control and ownership, but rather on support and collaboration. Ownership is expected to be replaced by the access to databases, services and sharing. The boundaries between the real world and the online world will disappear. There will be an end to the global economic crisis linked to oil. Building a new infrastructure will create millions of job opportunities and thousands of entrepreneurial ones. Energy democratization will contribute to the society’s shift from the authoritarian structure to collaborative ones (with the use of (Rifkin, 2000, 2011) who, however, refers to the predicted changes as to the third industrial revolution, not a fourth one).

By contrast, the texts focus on risks, unless we catch the 4IR trends in time (Mařík et al., 2016). The problems with safety, manipulation, monitoring, restriction to the choice of lifestyle or dependency and actual dictate of new technologies are usually only mentioned at a general level. By splitting the society into digitally demented (Spitzer, 2014), lonely, dehumanised and chipped individuals who communicate through networks, touch each other from a distance and live with robots. They succumb to the destructive illusion of comfort, they devote their time to projects and new and new applications and they are inculcated with the right to “*enjoy themselves*” to death. At the same time, they are continuously monitored, thoroughly controlled and monstrously manipulated. They have no privacy and their automated slavery is intensified by smart households and devices as well as intelligent cities for stupid people. An obsession, at times even hysteric, with everything digital needs to be mitigated, which also applies to education.

Trends of the shift to the knowledge society, enhanced by informatization and cybernetization will be reflected more significantly in labour markets with a lot of serious impacts (Méda, 2016). What will actually people do when the work will be done by robots and machines will even learn empathy and creativity and start living their own spiritual life? The use of artificial intelligence is actually expected to result in an absolute drop of labour needed in all spheres and most of the people who currently work will become redundant. What will we make out of all the people? Programmers, operators, digital specialists, creativists, scientists and enthusiastic volunteers? *The Draft of the Strategic Framework “Czech Republic 2030”* expects that in 2015-30 approximately 700 thousand jobs will cease to exist due to the isolated

influence of digitalization, while only approx. 300 thousand new jobs will be created. The future of labour, especially in Germany, is conceived in, e.g., *Green Paper Work 4.0*. Optimists remark that during all the previous industrial revolutions more new jobs were created than actually cancelled. They strongly believe this will also be the case of the future. They have a naive dream of an automatic commencement of participation and expansion of this room for economic democracy, new “*era of networks*” or of the importance of shared economy and the unavoidable trend of “*society uberization*”. They expect the occurrence of new extensive networks when people will be consumers and users at the same time, there will be no difference between an employer and an employee and ownership will become totally marginalized.

On the other hand, new technological situation may enhance localization and decentralization. There are also still more and more predictions heralding “*the end of the golden age of globalization and world trade*” and terms such as deglobalization or desintegration have become common now. However, the truth is that new technologies provide a hope for renationalization of economies (by, for instance, shortening the manufacturing and supply chains).

Conclusion

4IR is, above all, a political and marketing, project, another strategic media and academic bubble, while no civilizations changes are likely to take place. The impacts of the other stage of digitalization and automation of particularly industrial production are exaggerated and overstated. Despite that, trends such as *Průmysl 4.0* are important. It is also an important topic for economists and politicians. Especially with respect to the nature of our economy, with high degree of dependence on processing industry, in the sense of a cheap extended production line of Germany and an assembly hall. The national initiative *Průmysl 4.0* may thus be seen as a set of measures how to respond to the German project and not to lose our competitiveness (see Nečadová, 2016). We should just remain sober and realistic and throttle back, let’s not exaggerate or fantasize about an “*epoch-making age*” or a ground-breaking “*revolution of thinking*”.

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