

THE ONGOING INDUSTRIAL REVOLUTION – ACHIEVEMENTS AND IMPLICATIONS

Valeriu TUDOR,
PhD., Ambassador
valeritudor34@yahoo.com

ABSTRACT

Mankind has countless proofs of industrial development, from pyramids placed in any location on earth to tunnels, statues and monuments, whose construction throughout the millennia of mankind existence on the Planet Earth still cannot be explained, under many aspects, even though suppositions are made, including ones referring to aliens.

In the following article, short reference will be made to the industrial revolutions in the second part of last millennium and the beginning of the present one.

Keywords: industrial revolution, development, economic and social life.

1. Several data and information

During the period mentioned, three industrial revolutions changed human society in its essence, by modifying the course of the economy and social life.

The first two industrial revolutions created the industrial construction, particularly of the western states, which became the main economic powers of the world, benefitting from better living conditions. Gradually, their example was followed, until a certain level, also by other countries in Europe and on the other continents. If the first countries mentioned also benefitted from the colonization wave, which provided them with cheap raw materials and labour, the second category of states, in some cases, did not hesitate to employ similar means, even if indirectly.

The third revolution in the field was the source of the invention of microchips and the emergence of computers, which increased the interconnectivity of places and persons at a distance and expanded the management of an increasingly high volume of data and information. In the new conditions, the first industrial robots were created, which had a significant contribution to the increased efficiency of different industrial

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branches, which, in its turn, implicitly led to the decrease of human labour on the assembly lines. The car industry was and remains an conclusive example; now action is taken for manufacturing unmanned vehicles. We should not forget also the military industry, including the complex installations for cosmic space flights and many other branches. These industries fully benefit of what the evolution of human intelligence offers.

However, human intelligence reaches even further. Hence, in the recent decades, **a fourth industrial revolution** occurred, opening new perspectives – radical and irreversible changes, at the level of the global economy, with new consequences and implications for the entire mankind. The progress derived therefrom targets fields such as: *artificial intelligence; robotics; nanotechnology; genetics; 3D printing...* They provide new opportunities for entrepreneurs, investors and employees, together with real challenges for mankind. A report of the Swiss bank UBS shows that the engines of this new industrial revolution are: *automation and extreme connectivity*. The key-element of this period will be the use of artificial intelligence (**AI**) by companies in order to automate professions currently fulfilled by humans. This tendency is not new; it derives from the previous revolutions, but now not only the poorly qualified, low-income individuals will be affected, but also an important part of the middle class, with medium-level qualifications and high routine level.

According to the above-mentioned report, artificial intelligence allows robots to process images and human language, to analyze high volumes of information, to make complex decisions and to behave like humans, in order to control certain processes. From here derive the main economic and social effects and even more:

- A very high discrepancy between the poorly qualified and the high qualified employees, leading to increased unemployment and economic and social inequality.
- Reduction of well-paid jobs for a low number of employees with very high qualifications and complex skills, competences that many graduates of the educational institutions do not possess.
- The highly qualified individuals have advantages and the poorly qualified have a reduced number of available jobs. Hence, the occurrence of high social tension, phenomenon which will be under expansion.

The fourth industrial revolution may seem a strong opponent, impossible to defeat, but the world has gone through such situations before, especially in the previous industrial revolutions, being able to surpass them. The World Economic Forum (WEF) estimates that, until 2020, approx. 5.1 mil. Jobs will be lost as a consequence of automation and robotisation, in the 15 economies analyzed, economies representing 65% of the world labour force of 1.85 billion persons (<https://www.weforum.org/>).

In his work, “A Short History of the Future”, Jacques Attali writes that we will live with robots we will not be able to trust. “Domestic robots will become a universal presence in the everyday life. They will be permanently connected to high

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power networks which they will be able to access wherever they will travel to. They will work as helpers with the domestic chores, as aids for the handicapped or elderly persons, as workers and members of the security forces. In particular, they will become “watchers”. Until 2050, these machines will evolve into what Attali calls “monitoring machines”, which will allow everyone to self-monitor their own observance of the imposed rules.

Hereinafter are examples of truly useful robots, as follows:

- According to the statistics of Citi and the University of Oxford, 77% of all factories in China and 57% of the jobs in the 34 OECD member countries are in danger of being automated. *Foxcom* – producer of electronic components, partner of *Apple, Google and Amazon*, occupying place 10 in the top of the largest employers in the world, reduced 60,000 jobs in favor of robots, in a Chinese company having 1.3 mil. employees. The largest employer in the world – the U.S. Department of Defense (with approx. 3.2 mil. employees) – is already using the greatest unmanned aerial vehicle fleet in the world, especially drones, in its operations in the Middle East. Massachusetts Institute of Technology established that, within a BMW factory, the teams composed of humans and robots collaborate efficiently and can be more productive than the teams composed exclusively of humans or exclusively of robots. (*Camelia Sisea, Trei angajatori din zece înlocuiesc muncitorii cu roboți. Este doar începutul, ziare.com, Sunday, 12 June 2016*).

- People and robots, called “cobots”, work together in the SEW-Eurodrive factory in the German land Baden-Wurtemberg. The “cobots” represent a contraction between “coworker” and “robot”). They are so new that, for the time being, they make up only a reduced percentage of the global sales in the robotics industry (under 5% from the total of 240,000 robots sold in 2015). The producers hope that these flexible robots, with an average price of 24,000 dollars, have the potential to revolutionize the production process, especially for small companies, which cover 70% of the world’s manufacturing industry. The specialists expect that the world market for cobots will increase, from 100 mil. dollars in 2015, to more than 3 billion, in 2020. BBC communicated, on May 4th, 2016, that a humanoid robot created by NASA started to “work” in a research laboratory in the Great Britain, going to be sent into space. (*„Coboții” cuceresc industria. Roboții lucrează umăr la umăr cu oamenii într-o fabrică, ziare.com, Thursday, May 5th, 2016*).

- The drone market will double in the following years, according to the estimates of the analysts within the American institute IHS Jane, who take into account the amplification of the geopolitical tensions at the global level and the tendency of the military leaders to use UAV (*unmanned aerial vehicles*) technology. In year 2016, the sales of military drones reached 6 billion dollars per year, but the amount may exceed 11 billion dollars per year, until 2025, according to the above-mentioned report of IHS Jane, quoted by CNBC. Large drone producers are the USA (3.36 billion dollars in 2016), Israel (0.15 billion dollars in 2016), China and India,

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followed by other countries. (*Marius Jianu, Războiul dronelor. Marile puteri cheltuiesc anual miliarde pe roboții de luptă, ziare.com, Monday, September 12th, 2016*).

- Business Insider agency reports that robot Hadrian X, developed by the Australian company *Fastbrick Robotics*, will be able to build a house almost by itself, working in one hour as much as a mason in two work days and it takes no lunch break. Hadrian X is an improved variant of robot Hadrian 105, which can place 225 bricks per hour. The experts estimate that, until 2025, a quarter of the jobs in the field, existing at present, will be replaced by intelligent software or by a robot. (*Camelia Sisea, Muncește într-o oră cât alții în două zile..., After Daily Mail, ziare.com, Sunday, July 31st, 2016*).

- The Romanian researchers built robotic installations meant to ensure the distribution of insecticides over the fruit trees. The robots stop the action if they pass next to a place where the tree has been removed or if they cross a water stream (canal etc.), in order to not spray there. The robots reduced the consumption of insecticides with 35-40%. (*Radio România Actualități, Thursday, September 15th, 2016*).

- The personal cook, created by the British company *Moley Robotic Kitchen* is a portable kitchen, with stove, oven, sink and tools. It will be available starting 2017, for 15,000 – 72,000 dollars.

- Life-saving drones. They are developed by *Zipline*, being equipped to deliver the blood necessary for transfusions, as well as medication, to the small villages in Rwanda, to a distance of up to 120 km. In executing this project, a Romanian specialist was also involved. The drone will soon be available in the USA, as well.

- The flying security agent, developed by the *Aptonony Company* in San Francisco, is a drone equipped to monitor certain areas.

- The equipment which gives you superpowers. It is ExoPush industrial Exoskeleton of the Parisian company *RB3D*, which can help the workers fulfill very demanding duties with less effort (it has harnesses and sensors supporting the workers' equipment). It amplifies 10 times the force of those wearing it.

- The clothes-folding robot, produced by *Foldimate*. It is apt for folding clothes twice faster than a human can do it, while ironing and freshening them. It will be available in 2018, for the price of 700 - 850 dollars. (*Camelia Sisea, Cinci roboți cu adevărat utili, care ne pot face viața mai frumoasă, ziare.com, Sunday, August 28th, 2016*).

Other examples:

- The concierge robot – provides information in subway stations in Japan (*TVRI, Wednesday, October 5th, 2016, 14:00 hours*).

- Robots “employed” to work in hospitals. In two hospitals in Belgium, in 2016, it was considered the “employment” as receptionist, of robot Pepper, programmed to understand human emotions. Until now, it was “employed” in shopping centers, banks and train stations. It is produced by *Sofibank* company,

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together with *Aldebaran*. In Japan, they sent batches of 1,000 pcs., at the price of 1,850 dol. per piece. For Belgium, it will cost 34,000 dol. per piece. (*Business 24, Wednesday, June 15th, 2016*).

- *Symmer 3D* Company in Timișoara executed the first 3D bio–printer in Eastern Europe. This bio–printer will have an essential role in the organ transplant in Romania, as well as in changing the way of treating persons with cancer. The 3D printer is going to build structures populated with stem cells, in the first stage, with the goal of obtaining nose, ear, blood vessels, and later to create more complex organs, such as the heart, according to the declarations made by Calin Brandabur, Chief Technical Officer within *Symmer 3D*. (*Constantin Pescaru, Made in Romania. Imprimanta 3D care printează organe..., ziare.com, Tuesday, October 11th, 2016*).

- Artificial intelligence is at the basis of new research identifying the substances which can prolong a person’s life, shows *știridinlume.ro*. *GeroScope* is the artificial intelligence performing simulations with hundreds of compounds, being able to identify the geroprotectors, essential substances for a longer life. The project is led by scientists from the Physics and Technology Institute in Moscow, in cooperation with *Insilco Medicine Inc*. Until now, samples have been collected from persons with ages between 15-30 years old and over 60 years old (*George Stanciu, Playtech.ro, Wednesday, December 7th, 2016*).

- *Toyota* launched a robot apt to trigger a series of strong maternal reactions in the Japanese women, meant to encourage them to procreate. Since 2017, the Japanese women will be able to exercise their passing towards motherhood with the help of *Kirobo Mini*, a little robot looking like a helpless baby. It has the role of waking the maternal instinct of the Nippon women and guide them towards having children. (In Japan there is a huge demographic crisis; the number of births halved in the 20th century, reaching around 1 million children). The price of the little robot – 392 dollars. (*Tehnologie cu față umană: Cum au ajuns roboții să stimuleze natalitatea, ziare.com, Tuesday, October 4th, 2016*).

- *Avatar Mind Company*, according to the portal Quartz, presented the little robot *iPal* – for the function of babysitter: it answers elementary questions, sings, dances or plays games which do not require high mobility. Jiping Wang, founder of *Avatar Mind*, claims that the little robot can keep a 3-8 years old child busy for a few hours. “*iPal* is happy when the child is happy and encourages him/her if he/she is sad”, states the company in the presentation of the babysitter robot. (*Business 24*).

- *Microsoft* researchers developed a word-recognition technology, which allows for a conversation to be written, as indicated by *The Verge*. The leader of the research team, Xuedong Huang, states: “We reached the level of a human. This is a historical achievement”. The margin of error of the transcription of words is 5.9%, *Microsoft* considering this is “almost equal” to that of humans transcribing conversations. (*Reușită istorică pentru Microsoft: Oamenii egalați de o nouă tehnologie, Florin Necula, Editor ziare.com, Wednesday, October 19th, 2016*).

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- In Yinchuan, the capital of Ningxin province in Northern China, your own face may serve as a bank card. On buses, the fare is paid by means of a facial recognition *software*, which allows the accessing of the passengers' bank accounts on the basis of scanning their faces, according to a CNN report. In another project, solar energy-supplied trash cans are tested, which function as a sort of compactors, allowing them to store five times more trash. The trash cans emit a signal when they are full, notifying the cleaning service employees that they can unload them. (*Oraşul viitorului: Oamenii îşi folosesc propriile chipuri în loc de carduri şi funcţionarii sunt înlocuiţi de holograme*, Camelia Sisea, *ziare.com*, Saturday, October 22nd, 2016).

- *Reebok* will open in 2017, in Wixom, Michigan, USA, a production unit for sport shoes soles, using the 3D printers, according to different reports. It will manufacture around 300 pairs of sport shoes, for the price of 185 dol. per pair. They were inspired by the technology used for manufacturing car tires.

- *Adidas* announced the opening of a factory in Ansbachm, which will be almost fully operated by robots, as well as a similar investment, where production will start in 2017, in the USA. (*Reebok va produce din nou încălţăminte în SUA*, Marius Jianu, *ziare.com*, Monday, October 24th, 2016).

- In the USU, *Google* and *Tesla* are testing self-driving vehicles.

In Singapore, they passed from self-driving taxis to self-driving buses, according to TechCrunch. The first two buses can serve 80 passengers each. (*Ţara care va testa autobuze care se conduc singure. Sunt electrice şi capabile să transporte 80 de persoane*, *ziare.com*, Monday, October 24th, 2016). It is worth mentioning that already groups of hackers started attack operations on the self-driving vehicles, in order to make them inoperable.

- Robots end up controlling the music industry, which they transform more than we could imagine: from the Internet *streaming* services, discovering new talents and promoting them, until composing musical pieces (*ziare.com*, Sunday, December 4th, 2016).

2. Implications/consequences in different fields

- It is important to rethink the meaning of the idea of work, in order to determine the environments and the places where work should be performed, in the conditions of the new technologies.

- Adaptation to the new technologies is a challenge, both for the employees and for the employers, in the public, as well as in the private environment. The newly built working environments must keep up with technology, which will be used to answer the employees' needs, as well as the market dynamics.

- How to build organizations and work places, since little has changed in the last 150 years, for instance: structured hierarchy, suffocation by bureaucracy, control and rules, resistance to salary policy. The organizations must become flexible and must

continually adapt, in order to be able to survive. Due to technology, there is a chance for achieving this.

- The rule of organizations reinventing themselves and innovating any sector or industry: a low degree of hierarchy and a high degree of autonomy, simplified bureaucracy and a high level of the employees' involvement in the decisional process. Even though not perfect, these organizational design models (“*holocracy*”, “*wirerarchy*”, work freedom-centered organizations or organizations working distributive and independent of a certain location, of a headquarters) caused the current status of the working environments. Without being perfect, the above-mentioned models have one thing in common: the maximization of the technological level in the work environments, taking advantage of the manner in which it can help the organizations innovate and perform (information circuit, communication, employee education and development, productivity etc.).

- The work space is redefined, it is no longer a strict working schedule. The organizations must abandon the perception that efficiency and performance are strictly connected to the rules of the physical office, which presupposes fixed working times, daily commute etc. The new working environments, largely depending on collaborative technologies and digital instruments, meant to support the employers, require, however, a high degree of digital literacy among the population. The integration of digital literacy in the school curricula must become an essential part of the learning process, which, for the time being, is little perceptible, except in few countries and areas of the world.

- At the same time, it is also necessary that the governmental policies are more receptive to the new working manners with the new technologies, regulations being necessary for persons working remote (lower taxes, different taxes etc.). Even more so, as the new technologies provide opportunities to help solve the problem of unemployment for disadvantaged groups – persons with disabilities, elderly or ethnically discriminated. Reward measures could even be established for the employers promoting such social solutions. (*Revoluția tehnologică la locul de muncă, ziare.com, Tuesday, May 3rd, 2016*).

- Essentially, the measures at the national / governmental level should target, as priorities:

1. The thorough reform of education because almost two thirds of the children now starting the educational process will occupy positions which do not currently exist. Therefore, it is necessary to train them in applied mathematics, programming, argumentation and communication, from ages of 11 – 12 years old, study of foreign languages, as well the development of teamwork abilities, directly and/or remote.

2. Cooperation between the private environment and the public sector, in order to modify the fiscal regulations and to adopt flexible laws, of a nature to reduce the loss of jobs.

3. Adoption by the emerging economies, including Romania, of a new development model, compatible with the new technology, because the old model followed by the developed countries is no longer sustainable. These states are now dependent on services (banking, tourism etc.) or military industries a.s.o. The European structural funds should be used to reduce the impact of robotization, by training the staff and the adequate economic and technical basis. (*Cum ne pregătim de revoluție? Piața muncii și a patra revoluție industrială, ziare.com, Friday, April 29th, 2016*).

3. The social status of robots/cobots

As the media informs, on May 31st, 2016, in the European Parliament, a motion was submitted, which puts into a new light the domestic and industrial robots in Europe and in the world. According to the motion, the robots would have rights and duties; according to their new status of “*electronic persons*”, as specified in the respective motion draft. The ongoing industrial revolution asks the European elected representatives to evaluate the robots’ role in society, including their taxation system. Apart from the role held by robots in factories and plants, the number of these “*electronic persons*” is increasing in other fields, as well, as indicated above in this article, personal care and health etc. being specified, situation which feeds the masses’ fear of unemployment, social inequality and alienations.

In the motion it is also shown that the high level of intelligence, depth and autonomy of the robots imposes the rethinking of the entire legal system: from taxation to legal liability. (*Emanciparea rasei electro. Roboții din Europa ar putea fi considerați persoane electronice, cu drepturi și îndatoriri, Marius Jianu, ziare.com, Thursday, June 23rd, 2016*).

Note: For this moment, there is no available data on the adoption/rejection of the respective motion.

The representatives of the German robotics sector (VDMA), which includes companies, such as *Siemens* or *Kuka*, claim that the proposal is too complicated and it comes much too early.

Instead of conclusion

Astro-physicist Stephen Hawking declared, at the inauguration of a center exclusively dedicated to artificial intelligence (AI) research, within the University of Cambridge, as reported by *The Guardian*, that AI can be either the best or the worst thing ever to happen to humanity. He warned how dangerous the invention of a super-intelligent robot is, a robot endowed with its own will, which could destroy mankind. The difference will be made by the manner in which humans will use this technology. “The potential benefits of creating intelligence are huge. We cannot predict what we

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might achieve when our own minds are amplified by AI. Perhaps with the tools of this new technological revolution, we will be able to undo some of the damage done to the natural world by the last one – industrialization. And surely we will aim to finally eradicate disease and poverty”, concluded the scientist. (*Stephen Hawking : Inteligența artificială poate fi cel mai bun sau cel mai rău lucru care s-a întâmplat omenirii, Constantin Pescaru, ziare.com, Thursday, October 20th, 2016*).

In his turn, American futurologist Alvin Toffler, who published, in 1970, “Future Shock” and, recently, “*Creating a New Civilization*”, stated that science and technology will develop at such a rapid pace that most people will not be able to “digest” this information flow and will be tempted to “disconnect”. (*InfoBrasov.net, No. 4630/Date: 2016-12-21; Homo Ecologicus, Apr. 2, 2016*).

The day predicted by Albert Einstein: “I fear the day that technology will surpass out human interaction. The world will have a generation of idiots”. (*no-mobile phobia*).

As can be seen, the perspectives are multiple, from progress to unwanted implications.

References

- „Coboții” cuceresc industria. Roboții lucrează umăr la umăr cu oamenii într-o fabrică, ziare.com, Thursday, May 5th, 2016
- Camelia Sisea, Cinci roboți cu adevărat utili, care ne pot face viața mai frumoasă, ziare.com, Sunday, August 28th, 2016
- Camelia Sisea, Muncește într-o oră cât alții în două zile..., After Daily Mail, ziare.com, Sunday, July 31st, 2016
- Camelia Sisea, Orașul viitorului: Oamenii își folosesc propriile chipuri în loc de carduri și funcționarii sunt înlocuiți de holograme, ziare.com, Saturday, October 22nd, 2016
- Camelia Sisea, Trei angajatori din zece înlocuiesc muncitorii cu roboți. Este doar începutul, ziare.com, Sunday, 12 June 2016
- Constantin Pescaru, Made in Romania. Imprimanta 3D care prindează organe..., ziare.com, Tuesday, October 11th, 2016
- Constantin Pescaru, Stephen Hawking : Inteligența artificială poate fi cel mai bun sau cel mai rău lucru care s-a întâmplat omenirii, ziare.com, Thursday, October 20th, 2016
- Cum ne pregătim de revoluție? Piața muncii și a patra revoluție industrială, ziare.com, Friday, April 29th, 2016

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- Florin Necula, Reușită istorică pentru Microsoft: Oamenii egalați de o nouă tehnologie, Editor ziare.com, Wednesday, October 19th, 2016
- Klaus Schwab, World Economic Forum (Ed.), The Global Competitiveness Report 2016-2017, World Economic Forum Publishing, Geneva, 2016 available at http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf
- Marius Jianu, Emanciparea rasei electro. Roboții din Europa ar putea fi considerați persoane electronice, cu drepturi și îndatoriri, ziare.com, Thursday, June 23rd, 2016
- Marius Jianu, Reebok va produce din nou încălțăminte în SUA, ziare.com, Monday, October 24th, 2016
- Revoluția tehnologică la locul de muncă, ziare.com, Tuesday, May 3rd, 2016
- Tehnologie cu față umană: Cum au ajuns roboții să stimuleze natalitatea, ziare.com, Tuesday, October 4th, 2016
- Tehnologie cu față umană: Cum au ajuns roboții să stimuleze natalitatea, ziare.com, Tuesday, October 4th, 2016
- Țara care va testa autobuze care se conduc singure. Sunt electrice și capabile să transporte 80 de persoane, ziare.com, Monday, October 24th, 2016
- InfoBrasov.net, No. 4630/Date: 2016-12-21; Homo Ecologicus, Apr. 2, 2016
- Business 24, Wednesday, June 15th, 2016
- Radio România Actualități, Thursday, September 15th, 2016
- George Stanciu, Playtech.ro, Wednesday, December 7th, 2016
- George Stanciu, Playtech.ro, Wednesday, December 7th, 2016
- <https://www.weforum.org/>