JOURNAL OF COMPLEMENTARY MEDICINE RESEARCH, 2020
VOL 11, NO. 1
10.5455/jcmr.2020.11.01.50

REVIEW ARTICLE

Open Access

Complementarity of Technological and Social Development in the Conditions of Fourth Industrial Revolution

Svetlana V. Tutunnikova[1·], Dmitriy A. Riabovol[2]

[1]Doctor of Economics, Professor, Department of Economic Theory and Economic Management Methods, V.N. Karazin Kharkiv National University (Freedom Square, Kharkiv, 61022, Ukraine).

[2]Bachelor of Economics, Department of Economic Theory and Economic Management Methods, V.N. Karazin Kharkiv National University (Freedom Square, Kharkiv, 61022, Ukraine).

ABSTRACT

This article presents the concept of interdependent technological and social development in the process of deployment of the Fourth Industrial Revolution. New breakthrough technologies, the expansion of artificial intelligence, require their merger with humanitarian knowledge. The formation of adequate forms of adaptation to completely new conditions of development is closely related to complementary interaction between the technology and social management.Ousting of a human from the material production itself, driven by the emerging digital economy, creates numerous threats and challenges in both the educational sphere and employment. Lack of proper dynamics in changing of socio-economic institutions and weak internal regulators of human behavior can lead to the set of negative consequences. It is proved in the article, that the basis of the future society will be formed through interdependent technological and humanitarian development. There is an urgent need for reformatting of the state policy in the field of social design, changing the social sphere aimed at the intellectual and spiritual development of man.

ARTICLE HISTORY

Received February 23 2020, Accepted March 17,2020 Published July 15, 2020

KEYWORDS

digital economy, artificial intelligence, machine learning, digitalization, Fourth Industrial Revolution, cloud computing, employment, education, social credit, intellectual potential.

INTRODUCTION

In today's quickly changing and rearranging conditions of development, we can see the emergence of the problem, related to determining the role and place of new technologies (such as artificial intelligence and machine learning, as well as a number of other related areas), in the context of personal development and human abilities, as well as creative and intellectual potential. These technologies quickly become (directly or indirectly) associated with technological tools and solutions, which opens new horizon for both practical and scientific research.

The technological race – the "Dot-Com Boom" of 1995-2001 – led to the formation of new rules for the game of doing business among leaders and players in the world trade and other industries. In addition, it was a start of the development of such companies, like Amazon, Ebay, Google and Priceline. Various technology applications have become not only the main instrument for doing business, but also the business itself. Moreover, to date we can say that a significant part of Dot-Com Race forecasts have already been justified (just 20 years later), and the reality has even exceeded all possible expectations of that period. We can see the appearance of completely new technologies and trends in socio-economic development.

Thus, based on the foregoing, we can conclude that the further scientific study of the development of digital economy, manifestations of new technologies (such as blockchain, artificial intelligence (hereinafter AI), machine learning, cloud computing, etc.), is an extremely relevant area of economic research. In addition, we can add that the conclusions drawn as a result of a

· **Contact** Svetlana V. Tutunnikova V.N. Karazin Kharkiv National University (Freedom Square, Kharkiv, 61022, Ukraine)
svetatutunnikova@mail.ru, dimaruabovol@gmail.com

systematic analysis and consistent study of trends in this area will be applicable in the nearest future.

The author's hypothesis is to prove the existence of multilevel and "rigid" complementarity of technological and social development in the era of the digital economy. New breakthrough technologies can serve human well-being only if they are supported by complex and balanced social measures. "Rigid" complementarity means reducing the time between the introduction of new technologies and the reaction of society to their influence.

A paired technological and humanitarian connection must precede and constantly accompany the use of new technologies. The unifying basis of technological and social is the welfare and quality of life in the society.

Methods for proving this hypothesis lie in the plane of the interdisciplinary economic, social and technological approaches, evolutionary theory. It can be noted, that noospheric theories also play a significant role (V. Vernadsky and others) in this movement. The practical materials of the development of the digital economy are becoming a real basis for the study, as well as specific technological applications and platforms.

According to the publication by Statista (Digital Economy Compass 2019), investments in the development of the sphere of AI for 2018 amounted to about $12 billion, while the figure for 2025 is assumed to be more than $200 billion [1, p. 77]. Moreover, such major Chinese companies as Baidu, Alibaba Group and Tencent, have already actively joined the development of new technological solutions, mainly in the field of AI applications, such as "machine learning" [1, p. 72]. We should highlight, that China is already approaching the United States by the criterion of the number of patents issued throughout the year [1, p. 76]. We can already see many real examples of practical usage of these applications even in our daily life (smartphone apps and various online services).

The development of AI technologies and machine learning, along with other advanced applications, have several scenarios for further development – to become a real "helper" for human (already proven tools, such as the Google Assistant, Amazon Echo, etc.), or a source of destruction of the usual way of life. A good example is the talk of two active (also in this particular sphere of technological development) figures for today – Jack Ma, the founder of the Alibaba Group (total capitalization as of Nov. 2019 is $470 billion), and Elon Musk (founder of SpaceX, Tesla, Solar City and other innovative companies), during the 2019 World Artificial Intelligence Conference i n Shanghai.

Elon Musk: "I think generally, people underestimate the capability of AI. They sort of think like, it's a smart human. But it's, it's really much – it's going to be much more than that. It'll be much smarter than the smartest human".

Jack Ma: "So I never in my life, and especially the last two years where people talk about AI say human beings would be controlled by machines. I never think about that. I think it's impossible. Right? It's impossible, because human beings, they are different. Machines are invented by human beings".

As we can see, these are two opposite points of view on the role of new technologies in the development of civilization.

It cannot be missed that the current stage in development of the digital economy is accompanied not only by positive changes, but also by an increase in inequality, which can lead to the appearance of whole armies of unemployed, who were taxi drivers (they will be replaced by automatically driven cars), postmen (solutions in the sphere of delivery by drones, etc.), and even journalists (content will be generated based on the user's individual preferences) "just yesterday".

The accumulation of negative consequences and growth of uncertainty and fragmentation of society in the context of rapid technological progress indicates a close complementarity (which has not yet taken shape) between the technological and social components of development.

Stimulated by the global development of technology, evolution of artificial intelligence (against the background of close relationships between the main trends of the time) has already brought civilization to the threshold of the so-called technological singularity, regardless of the desire of a particular person. In fact, this concept theoretically means such an acceleration of development that it will be practically impossible to get a stable or at least realistic idea of its internal processes and individual aspects [2]. As one of the indicators that shows the possible realism of the aforementioned concept in the future, we can give an example that, according to the already mentioned publication Statista Digital Economy Compass, in the year 2018 the world created more than 33 zettabytes of information (33 billion gigabytes). For comparison, this is 375 million times more than the entire Internet in 1997 (88 terabytes). It is worth noting that, according to forecasts and current growth rates, in 2030 will be created approximately 612 zettabytes, which is 18 times more than during the previous year [1].

Cognitive, information and communication technologies have already demonstrated the ability to penetrate any technological process, as digitalization is gradually becoming an integrated technological platform. These technologies are the

result of "embedding" knowledge into technological processes.

If the content of these processes, – regarding the features of technological changes, environmental interactions, etc., – is quite predictable, then from the standpoint of the future society, the development of socio-economic qualities of the person himself is not so simple.

Different-speed changes in technological and social characteristics lead to the accumulation of contradictions (sometimes insoluble), the collapse of society and growth of inequality and fragmentation in personal development.

It is this that actualizes the problem of the search for "controllability" of technological improvement, its interdependent complementary development along with the social sphere, the complex inner world of man. Humanity of the 21st century must learn to use the achievements of technological progress to improve the quality of life, and as a result, minimize possible negative impact. The set of problems of the future society dictates the need for a transition to a new stage of social structure.

As a part of this study, it is also worth highlighting the main areas pursued by "smart money" and "unicorn hunters" – investors who seek, in the same way as industry researchers, to correctly compare current trends and make an investment in a successful company at the early stage of its development.

It is worth to pay attention to such an active investor as SoftBank Group (Japan). Led by one of the richest entrepreneurs in Japan, Masayoshi Son (with personal wealth of more than $20 billion), a corporation is an investor in numerous successful technology companies.

For example Uber is providing access to a mobile application for a wide range of car owners who express a desire to work as a taxi service, but do not want to stand in line for a license (this application has quite seriously changed the industry several years ago). Despite belonging to such a relatively elderly area as transporting people within a certain city, the company has nothing to do with traditional players.

At least, Uber does not own a fleet, and only provides computer solutions for its commercial performance and efficient functioning. With more than 10 billion trips, the company has already faced a direct need to involve AI and machine learning in the process, with the goal to ensure the efficiency of transportation (with the help of vast historical database) [3].

Didi Chuxing is largely an analogue of the previous company in China, with more than 300 million users. The company is one of the leaders in the so-called "sharing economy", as well as the aforementioned Uber and Airbnb (that is providing rental services from private individuals, with the help of innovative software solutions, available in more than 190 countries). As a part of the newest initiative, Didi plans to launch up to 30 robotaxi (autonomous vehicles) in the Jiading District in Shanghai as early as 2020. It is mentioned, that at first the driver will still be present in the car [4].

Grab is a Malaysian company, which for the most part does not own physical assets, and by analogy with the previous two large players, provides its unique software solution in the sphere of delivery, taxi and other areas, diversifying its activities.

In addition, SoftBank has a number of investments in other projects (mostly in the sphere of Internet applications), that are relevant for the current stage of the digital economy development, and the total size of its investment fund is estimated to be more than $100 billion [5]. Thus, it is possible to distinguish a much realized tendency to active growth of investment activity in the field of AI applications and related areas, resulting in (among other things) the rapid growth of capitalization of the companies from this sector, – sometimes for the most part unreasonably. To illustrate this thesis, it is worth citing the news of September 2019 that shocked many investors (in particular, the SoftBank), about a decrease in capitalization of the startup WeWork (USA) within a period of only 6 weeks, from more than $47 billion to $10-15 billion, since the promises to investors were overestimated [6].

The aforementioned innovations, generated by the latest technologies, in addition to improving the quality of services offered and reducing transaction costs, have a significant impact on the dynamics of employment.

According to the report by McKinsey Global Institute, "Jobs Lost, Jobs Gained: Workforce Transitions in a Time of Automation" (from December, 2017), till the year 2030 approximately 400-800 million workers will be forced to change the scope of their activities and to gain new demanded skills [7, p. 21]. Even now, 60% of jobs have at least 30% capability of automation. We should note, that such areas as management, application of unique knowledge and decisions at work, unpredictable and non-monotonous physical operations, are subject to automation by an average of 20%, while the rest (which accounts for more than $2.7 billion of wages), has this indicator at the level of 64-81% [7, p. 37].

According to some projections, only the threat posed by the possibility of fully autonomous driving vehicles invention in the near future, may affect between 2.1 and 3.7 million workers in the US [8]. It is important to note, that the routine unskilled labor is going to be supplanted in the first place. For

example, the company Foxconn (Hon Hai Precision Industry Co., Ltd.), which is the largest company in Taiwan, replaced more than 60 thousand workers in its factories with Foxbots in 2016 [9]. Moreover, the company already announced (back in 2015) its desire to replace at least 30% of its employees with automatic systems by 2020 [10].

The examples, mentioned above, demonstrate the global challenge that the digital economy brings to our lives. The answer lies in the ability of the state to reformat its social policy and to strengthen social regulation.

The need for a more balanced development of technological progress and the social sphere is indicated by the cardinal changes that await the education system. We can already ascertain that the breakdown of traditional educational systems is happening all over the world. Short training programs for quick learning of new skills are becoming more and more popular.

However, we can see that a huge army of students and an extensive network of higher education institutions remain mainly unchanged. According to the remarks of the American sociologist R. Collins in his monograph "The middle class without work", the phenomenon named "inflation of diplomas" is actively growing right now. Over the next ten years, the AI will replace 46% of workers only in Japan (and in the US – 30%), and then 80% of the population of the "golden billion" will be left without work [11, p. 4].

The education system turned out to be inactive, with too low reaction rate (compared to the requirements of the modern technological revolution), which creates the need for a transition to some new forms. By the way, we should not forget that this situation affects millions of people around the world. The global education market in 2017, according to Taylor & Francis Group, was more than $4.4 trillion. From 2000 to 2014, the number of students in the world doubled and amounted to 207 million people [11, p. 4].

If we will not take active efforts to adapt the education system, this can lead to enormous social costs, a breakdown in the lifestyle (and maybe fate) of a huge number of young people. We consider it important to pay attention to the development of social indicators of the most relevant processes of "pressure" of modern technologies on existing social institutions, the need for institutional changes. Even more complex is the question of personal income that in conditions of precarious employment fall into the risk zone.

We think, that the conception of unconditional basic income, promoted by some parties (mostly large companies, but also entrepreneurs and politicians), is highly controversial [12].

The idea itself is not fundamentally new, but the concept of unconditional basic income (hereinafter UBI) takes on some new shades in the modern technological conditions. Some countries are already introducing the basic principles of this concept – e.g., Finland (although in some especially poor countries, unconditional basic income is equal to the minimum subsistence level, which does not provide a decent life). Despite the fact that the UBI concept is implemented with great national characteristics, it can be a good product of "balancing" the impact of technological progress on social sphere.

In 2018 all of the residents received a check for $1,600 directly from the government. However, it is worth considering, that in 2018 Alaskans received just about $1 billion in total, whereas the minimum estimated amount of the program offered by some politicians, is more than $3 trillion per year, which represents about 75% of all current US federal spending [13; 14, p. 6]. Moreover, in our opinion this approach as a whole cannot be called an exhaustive within the framework of the problems of the social consequences of the Fourth Industrial Revolution, since such can only be temporary actions that only partially eliminate inequality.

Continuing to assess the impact of AI technologies and machine learning (alongside with other related areas) on the global dynamics of employment, it is worth paying attention to the following. We are talking about new forms of employment, the flexibility of the labor market, the emergence of its new segments.

Nowadays, in response to the growing digitalization of the interaction between employee and employer, many companies are transferring their employees to the "remote work". However, in our opinion, this is not a serious problem, because an increasing number of skilled workers around the world thus gain access to their workplace, – even without the need to make an expensive move and start life in a new place.

Moreover, virtual and augmented reality technologies already claim to be a powerful learning tool. Devices like Oculus Rift and Microsoft HoloLens (two of the most famous leaders in this industry), are already a highly effective innovative solutions that can improve the productivity of workers for such big companies as Lockheed Martin and Boeing [15, 16] . In case of the first mentioned company, a solution from Microsoft – HoloLens, mixed reality glasses, – allows to get rid of more than 1,500-page instructions that are needed to build the new Orion spacecraft. In the case of Boeing, such a technology allows, for example, to obtain more information about specific problems for employees, working on the installation of electrical systems into the new aircraft

(consisting of many kilometers of wiring), in real-time. Such additional "virtual" layer overlays the image of the real world.

We should pay attention to the potential of collaboration between AI and humans on especially complex and important tasks – such as, for example, the process of identifying diseases at an early stage. A 2018 study showed that a specialized diagnostic system aimed at recognizing suspicious areas (that are often invisible to humans) in photographs is able to find a disease with an accuracy of 99% – a result, that is inaccessible even to highly qualified doctors [17].

In the context of this and other examples, concerning the medical sphere (that is becoming increasingly important for the life expectancy and quality of life), it is worth thinking more not about a complete replacement of the human by AI technologies, but about their productive cooperation, – the full redistribution of repeated operations, and only partial of the complex ones. In our opinion, such an approach is the most adequate, and can lead to a significant increase in labor productivity. In addition, it will continue the trend of decreasing number of working hours per year and increasing free time, while maintaining employment levels and reducing social tension.

As a result, contrary to the popular belief, AI technologies will make working tasks and the workplace not robotic and "soulless", but rather, vice versa. For example, in the near future, chatbots will be able to answer at least 80% of the requests of customers and users, because a considerable part of the questions are more or less standard and the answer can be programmed in advance [18].

It should be noted, that the problem of such a "cultural shift" in modern conditions is becoming more and more discussed. For example, John Gikopoulos (a global leader in artificial intelligence and automation from Infosys Technologies Limited), said "we often focus on the key technical skills", regarding that workers tend to perform only repetitive and not creative functions [19]. However, the modern complex world, which has accumulated a totality of problems and contradictions, determines the need for a transition to a new stage of social structure. We think, that awakened by man, the space of the digital economy with modern breakthrough technologies, need strong humanitarian support, – a comprehensive control of the human mind.

RESULT

Qualitative changes in technologies demonstrate the ability of technological innovations to penetrate into any economic process, while digitalization is becoming an integrated technological platform, significantly changing not only the face of the economy, but also the human life. Information and cognitive technologies serve as a channel for "embedding" knowledge in technological processes by processing large amounts of data, or by imitating human intelligence.

These technological changes lead to some serious shifts in socio-economic relations. However, these changes are not always adequate and positive. The reasons for the discrepancy are the lag of humanitarian knowledge from technological knowledge, and the slowing down of a person's adaptive capabilities to changes in the world around him, and various technological transformations.

We believe that the future of society, its prosperity, will largely depend on establishing complementarity between the spheres of development, combining of the technological and humanitarian knowledge, and establishing comprehensive control of the human mind over the conditions of its existence.

At least in the medium term, the joint productive cooperation of a human with technology comes to the fore; not the crowding out and independent existence of each of them, but complementing and strengthening the potential of each other.

REFERENCES

1. Digital Economy Compass 2019. Statista. URL: https://cdn.statcdn.com/download/pdf/DigitalEconomyCompass2019.pdf
2. Pandya J. The Troubling Trajectory Of Technological Singularity URL: https://www.forbes.com/sites/cognitiveworld/2019/02/10/the-troubling-trajectory-of-technological-singularity/#6b821d976711
3. Form S-1 Registration Statement. Uber Technologies, Inc. URL: https://www.sec.gov/Archives/edgar/data/1543151/000119312519120759/d647752ds1a.htm#toc647752_11
4. Kharpal A. Chinese ride-hailing giant Didi plans to launch a robotaxi service in Shanghai. URL: https://www.cnbc.com/2019/08/30/china-uber-didi-plans-to-launch-a-robo-taxi-service-in-shanghai.html
5. Ghosh S., Leskin P. SoftBank, WeWork's biggest backer, is the most powerful investor in tech right now. Here's the running list of all the Japanese giant's major investments. URL: https://www.businessinsider.com/running-list-softbank-investments-2017-7
6. Flegerman S. WeWork is postponing its IPO. URL: https://edition.cnn.com/2019/09/30/tech/wework-ipo-postponed/index.html
7. Jobs Lost, Jobs Gained: Workforce Transitions in a Time of Automation. McKinsey &

Company. URL: https://www.mckinsey.com/~/media/mckinsey/featured%20insights/Future%20of%20Organizations/What%20the%20future%20of%20work%20will%20mean%20for%20jobs%20skills%20and%20wages/MGI-Jobs-Lost-Jobs-Gained-Report-December-6-2017.ashx
8. Jajoo G. Job Automation and Unemployment. URL: https://towardsdatascience.com/job-automation-and-unemployment-a7cedfc1b517
9. Wakefield J. Foxconn replaces '60,000 factory workers with robots'. URL: https://www.bbc.com/news/technology-36376966
10. Huifeng H. Foxconn's Foxbot army close to hitting the Chinese market, on track to meet 30 per cent automation target. URL: https://www.scmp.com/tech/innovation/article/1829834/foxconns-foxbot-army-close-hitting-chinese-market-track-meet-30-cent
11. Шпак Ю. Дипломированная бедность, Аргументы и факты – 5, 2019, с. 4
12. Bokat-Lindell S. Should the Government Give Everyone $1,000 a Month? URL: https://www.nytimes.com/2019/09/12/opinion/yang-universal-basic-income.html
13. Zak A. $1,600 PFD checks hit bank accounts. URL: https://www.adn.com/alaska-news/2018/10/03/get-ready-alaska-1600-pfd-checks-are-set-to-hit-bank-accounts-on-thursday/
14. Hoynes H., Rothstein J. Universal Basic Income in the US and Advanced Countries. URL: https://www.nber.org/papers/w25538.pdf
15. Winick E. NASA is using HoloLens AR headsets to build its new spacecraft faster. URL: https://www.technologyreview.com/s/612247/nasa-is-using-hololens-ar-headsets-to-build-its-new-spacecraft-faster/
16. Boeing Tests Augmented Reality in the Factory. Boeing. URL: https://www.boeing.com/features/2018/01/augmented-reality-01-18.page
17. Artificial Intelligence–Based Breast Cancer Nodal Metastasis Detection. Arch Pathol Lab Med, Vol 143, July 2019. URL: https://www.archivesofpathology.org/doi/pdf/10.5858/arpa.2018-0147-OA
18. How AI Drives Customer Experience. Inside BIGDATA. URL: https://insidebigdata.com/2018/11/18/ai-drives-customer-experience/
19. Ismail N. Artificial intelligence will lead to a 'positive shift in the work people do'. URL: https://www.information-age.com/ai-positive-shift-work-123475179/