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The internet of things and the forth industrial revolution: the problem of humanitarian expertise

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Abstract: The article analyses the modern developmental trends of information technology in the context of its humanitarian expertise. The main growth and development nodal points of modern technologies are distinguished, in particular, the global industrial networks, smart products creation, Internet of Things, the concept of smart environment. The formation effect of the Internet of Things and smart environment paradigm on the individual and society is examined.

Key words: Industrial revolution; Convergent technologies; Industrial networks; The Internet of Things; Smart environment

1. Introduction

In the late 20th century many countries, such as the USA and Japan, set an objectives of forcing the innovative development, meanwhile in scientific literature the models of scientific and innovative activity were actively developing, in terms of which the production was given great importance. Thus, in the triple helix model proposed by H. Etzkowitz and L. Leydesdorff, the industry is considered as an equal member of scientific and technological development, the generator of knowledge, moreover, only in this case the creation of knowledge-based economy as opposed to politically organized economy is possible (Leydesdorff, 2012).

Innovative focus of scientific and economic policy to a large extent determined the fundamental changes in scientific and technical programs, which currently are not limited to purely applied problems, but include the attempts of socio-cultural studies and analysis. The modern ambitious lines of breakthrough technological research are based on conceptual grounds, affecting the nature and future of man, social relations, values, ideology. Hence the situation of need of the philosophical understanding and humanitarian expertise inside technological or industrial projects arises. This is most noticeable with regard to programs that define the current state of scientific, technical and industrial development as a revolution. At least three such approaches can be distinguished: the program of NBIC-convergence (Roco, Bainbridge, 2003), a project of the fourth industrial revolution Industry 4.0. (Kranenburg, 2008) and the concept of smart environment.

2. Methodology

Methodological component of the research is based on the tradition of humanitarian expertise, developed mainly in the framework of philosophical research. This results from the fact that philosophical approach can be the basis for interdisciplinary integration of humanities related to the understanding of essence of the modern breakthrough technologies, the specificity of their interaction with the individual and social transformations, which may be caused by them. Humanitarian expertise is treated in this regard as a social technology of anticipatory response to the possible negative implications of social and technological innovations in the context of irreducible multiplicity of moral perspectives and expert examinations.

The complexity of humanitarian expertise of modern technology arises from several factors, primarily, from the disparity between the philosophical understanding of technology and practices of its implementation. At the same time, social or psychological examinations are already insufficient, as technology not only affect the human environment, but also human's body, mind, values, life world, and these changes require philosophical reflection. The specifics of the current situation is that it is insufficient to discuss these issues in philosophical debates or in the articles, as the situation itself requires practical results, the application of which should provide optimal use of technological innovations, especially if they affect the nature and essence of the person. Therefore, it can be argued that humanitarian expertise is a synthetic form that combines philosophical analysis, scientific data, anticipatory methods, ethical guidelines and practical recommendations. A distinctive feature of the proposed approach is that we propose to consider conjugated technologies i.e. the ways of interaction between man and society

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with technology, as well as the results of these interactions, and the changes caused by these interactions, as the subject of humanitarian expertise.

2.1. Convergent technologies

In 2002, M. Roko and V. Bainbridge group's report outlined the main peculiarities of the integration process of the largest modern technological developments, known as NBIC-convergence. It implies converging, synthesis of nano-, bio-, information and cognitive technologies that are critical to the scientific, economic, technological and social development of society. Formation of technology convergence was conditioned primarily by setting the goals of complex objects research and reflects fundamental feature of the present stage of development of scientific and technical knowledge, reflected in the integration of private areas, cross-disciplinary collaboration, using of complex, systemic research methods.

At present stage the growth points of both technical and scientific knowledge are focused in the field of convergence of nano-, bio-, information and cognitive technologies. The specificity of objects of scientific knowledge, distribution and translation of basic and applied knowledge in the designated by NBIC program areas changes. They include, in fact, one research area – cognitive. The program's creators indicate its role in the structure of convergent studies, arguing that if the representatives of the cognitive sciences manage to invent, then nanotechnologists will manage to build, biotechnologists will manage to realize, and experts in the field of information technology will manage to monitor and control (Roco and Bainbridge, 2003). Thus, a basic, fundamental level of scientific knowledge is associated with cognitive research, priority of which is conditioned by the study of important issues related to the understanding of brain activity, cognitive processes, behaviour, communication, etc. Nanotechnologies, based on the idea of the world's unity at a nano-scale, appeared to be classical applied knowledge, enabling to use understanding of nature for creating artificial objects. Biotechnologists represent modern, non-classical practical knowledge, as far as become the condition and the basis for fundamental research in their field, integrate not only the functions of devices and tools, but also of management, monitoring, modelling. Information technology becomes a universal tool for fundamental and applied research; moreover, they become meta-technologies used at all cognitive levels and stages. Later, social technologies are added to NBIC structure, making a project of NBIC-convergence as it is.

The purpose of scientific and technological development is also changed, being already understood not as the conquest of nature or stimulation of demand. The NBIC-convergence program declares improving quality of life, physical, intellectual and social potential as the main task of science and technology. There are different interpretations of this idea, from creating favourable ecological environment, transition to a knowledge society, to the reconstruction of individual, or even the creation of a "post-beings" (Bensaude-Vincent, 2008). As well the difference between European and American NBIC programs, which have different understanding of strategic objectives of convergent technologies development, shall be taken into account. In the USA, the founders and leaders of convergent technologies see their development path in transformation of individual and strengthening his capabilities, the rhetoric in this area is relying upon the terms "reconstruction of man" and "post human". European view is expressed with the expression "convergent technologies for the European knowledge society". This program is based on the idea of social constructivism, the joint action of technology and society to improve the quality of human life, highlighting that social values have priority over technology.

Despite the differences, all the concepts of converging technologies coincide in understanding the revolutionary significance of these processes for the process of scientific and technological development, human and social evolution. One of the most noticeable demonstrations of NBIC-convergence was the intensification of discussions relating to the boundaries of permissible impact of technology on the worldview, the body and the person's lifestyle. Development of converging technologies can serve as a basis for the practical implementation of Trans humanistic ideas of human transformation (Nesterov, 2013), which will undoubtedly require serious ethical analysis.

2.2. Industry 4.0: industrial networks and the Internet of Things

Modern periodization's are based on the traditional recognition of introduction of industrial production in the 19th century, conveyor invention and automation as the first, second and third industrial revolution, respectively. There is a debate about the expediency of detachment of manufacturing automation in a separate stage. Thus, the American economist J. Rifkin doesn't treat it as a separate revolution, considering the development of computerized management systems as a preparation to modern, third industrial revolution, which, in his opinion, is based on the convergence of new communications and energy (Rifkin, 2012). The main difference of the companies of 21st century is in replacement of predominantly hierarchically organized areas of industrial management and interaction with horizontal ones that provide the possibility of collaborative action. In the field of industrial communication strict, subordination-based ways of managing slow down the dynamics of the business development, therefore the organizational style becomes dispersed, horizontal, and network-based. Moreover, in a number of

important contemporary areas such as global logistics, information technology, only this one can yield. Another important feature is replacing of exhaustible energy sources with new types of sub allocated energy resources and technologies. Traditional manufactures using oil, gas, coal, are becoming more expensive and lose their competitiveness. Allocated resources, such as energy of solar, wind, geothermal underground water sources, biomass, etc. become prominent.

The European approach, presented, primarily in Germany, is based on the traditional distinguishing of three industrial revolutions in history, and considers the present stage as a fourth, known as Industry 4.0. The concept of the fourth industrial revolution is based on the fact that automation of production, being carried out actively in the 20th century, had a local nature. Management systems have been developed for each area, and often for each enterprise separately and have generally been incompatible with each other. In the 2000s, in the wake of introduction of new business management programs many systems have provided the opportunity to interact, but at the level of the direct manufacturing the automated networks were still local. The advent of the fourth industrial revolution is associated with the development of global industrial networks, to which all the production processes of a wide variety of enterprises will be connected.

The Internet history obviously demonstrates the social and economic transformations that communication networks are able to produce. Nowadays a number of projects of global industrial networks are being launched, to which the advent of fourth industrial revolution is connected. Integration of manufacturing and smart technologies must come to a level that would allow the manufactured products to interact with any necessary object in the global network. The actors of this network are smart products that manage to control their own production in independent and decentralized way using sensors and communication systems. The product is given the functions of the source of information, changes in its environment, control over the process of its manufacturing, and network-based interaction with other elements of production. It is no longer the implementation of the paradigm of human-machine communication, stated in an era of automation, but the construction of medium of machine-machine interaction, linking technical facilities in the same way as the Internet nowadays unite people. This will allow even the largest industries to increase the flexibility and efficiency of the work which was previously an advantage of small companies or that ones that not involved in manufacturing management.

Industrial networks, currently successfully implemented at the level of separate countries, such as Germany and Japan, are not oriented on creation of a more global network similar to the Internet. Rather, the local structures will associate with each other by means of successfully existing World Wide Web. This implies a number of significant changes in the Internet, which is right now not simply a network banding people together. In the middle of the 2000s the number of devices using it exceeded not only the number of people using the global web, but also the population of the planet. Detectors, sensors, robots, gadgets have become similar participants of the information exchange.

This phenomenon is reflected in the concept of the Internet of Things, which was developed in the late 90s at Massachusetts Institute of Technology, but only last few years has reached a maturity stage and became a technology that could have significant impact on technique and society. Its implementation implies two main directions, namely, the organization of a new type of industry in which the products with sensors can manage their manufacturing, and integration of technical objects, surrounding the person into the global network, establishment a common information environment for them.

The forecasts of leading companies, developing foresights for this sphere, such as Cisco, Ericsson, Google, and others, indicate that a total of 15 – 60 billion devices connected to the Internet are expected by 2015 according to different estimates (Drozdov and Zolotarev, 2012). These figures represent the minimum possible values, as currently the problem of providing micro devices with power is not solved. Its solution is a determinant objective of the fourth industrial revolution. Development of technologies enabling micro- and nano-devices to receive energy from the environment by themselves to meet their needs is a turn that will fundamentally change the manufacturing, the use of products as well as technical and technological, communication living environment. The new machines will not only get the ability to communicate with people and artefacts, but also self-support of the existence, autotrophy, a higher degree of independence from the man.

Internet of the 2000s was influenced by people's needs, the main its newly acquired feature were social networks. The current changes of global network are of more drastic nature, they affect the fundamental principles and technology of hardware and software. In order to provide the interaction of billions of devices, the protocols of user registration, data transfer and storage are changed. For the Internet of Things the human being and device are equal actors. It can be argued that the current priority of network development is not an association of people, but an integration of technical environment in global communication. The most amazing fact concerning the Internet of Things is the invisibility of its formation for the majority of people, who virtually live in network every day, but do not realize that the number of user-machines in it exceed the number of people. Rob van Kranenburg notes that the most profound technologies are those that are not visible; they weave themselves into the fabric of everyday life until they are indistinguishable from it (Kranenburg, 2008).

Thus, the smart objects require minimal control both at the manufacturing stage and in operation; providing them with a network machine-machine interaction and introduction of universal standards for information processes in the Internet are the bases of the fourth industrial revolution. As a result, computer interaction environment is developed around the modern human. The devices around us become more functional and independent, and their connection into a network will undoubtedly lead to qualitative changes in the techno sphere, one of which may be the creation of an intellectual environment of human existence, which is intensively discussed in modern computer sciences.

2.3. From the paradigm of artificial intelligence to the concept of a smart environment

One of the innovative brainstorms of the 20th century was artificial intelligence development program, proposed in the 50s. Its weak version, which implements the task of developing devices capable of performing a number of the human intellectual operations, in fact, is the basis of cognitive and information revolution of the end of the century. The strong version, as the concept of creating of thinking machines, has been extremely productive for philosophy, not only setting interesting problems, but also opening a new approach to the traditional philosophical questions, such as the problem of consciousness. The third direction in artificial intelligence, known as Ambient Intelligence, which is based on the task of creating self-government, capable of autonomous existence environment, is currently emerging.

The paradigm of the fourth industrial revolution implies a new approach to the information classification and management that treats the buildings, automobiles, consumer goods, and people as the information spaces. One of the main ideas of smart environments concept is turning the data that people usually perceive as background noise or does not perceive at all into the information. In most cases the man cannot monitor and analyse the excursions of temperature, humidity, audio noise, wind, electromagnetic fields, and many other sources. The smart environment can use them to address variety of tasks, from maintaining desired conditions in the room to the prediction of climate change. Unlike devices the modern man used to deal with, that computer technologies withdraw into the shadows, becoming invisible, dissolve in the medium. They will not require permanent human monitoring and control. This, in turn, states a number of problems, primarily related to the reliability of technologies, security and preparedness of the people to interact with them.

Since its inception, the idea of artificial intelligence developed in parallel with its artistic perception, a keynote of which was the fear of machine riot, a rebellion of smart devices against their creator. History has shown that behind such alarmism more significant challenges that require in-depth examination may be lost from view. The main danger of smart environment concept is considered to be the creation of environment of total control over the man, exercised by his own phones, pads, air conditioners, and even irons.

For the successful implementation of smart environment program in addition to hardware and software the following two conditions should be fulfilled, namely a person's readiness to living in a smart environment, and the development of robust technologies to protect personal information (Sinitsyn and Nikiforov, 2013). The introduction of smartphones tabs and application development for them have shown that a great many of people are now ready to live in an open environment. The Internet of 90s was a medium of anonymity that was considered a primary objective. Now, when it became clear that any action on the network, whether posting pictures or sending a message is perpetuated, reasonable openness, the existence on own behalf, honesty and commitment to the posted content is becoming the best way to behave.

R. van Kranenburg describes two utopias, showing options for the man and smart environment coexistence. The first he calls a City of Control, already described by J. F. Orwell and F. Zamyatin. The alternative may be a City of Trust. The difference between them is rather in access to multiply surveillance devices than in presence or absence of them. The City of Control requires that the competence to use the data from cameras and other devices is vested to the police, security services and state, which explain the limited access of ordinary people as being in interests of their safety, but in reality, create a world of total control. The second approach envisages the possibility for all residents to use the data. For example, the car could request information from the cameras for laying the route to avoid traffic jams, the baby carriage could scan if it is safe round the corner before turning, and so on, that is to say, the city is built more on trust than control (Kranenburg, 2008).

3. Findings

A converse, an apparatus for creating life-support environment for a new-born baby, is becoming an image of modernity; it symbolizes the ontological unity of man with techno environment (Alekseeva et al., 2013). Since long ago man has been virtually unable to live in the natural world, not adapted by technologies for his needs. The feature of our time is that the techno sphere becomes a kind of a new ecosystem with its processes of self-regulation and derivative laws.

Technicalization problems of human life world, which raised fears in the 20th century, nowadays become a reality, but philosophy faces quite different challenges. It is not enough to reveal human one-dimensionality in the world of technology, or to talk about the loss of a unity with nature. The contraposition of man and machine reach back to past of technology discourses, the reality of our

existence acquires hybrid character. The philosophy of technology becomes the study of border between human and artificial inside and beyond, of techno evolution and coevolution of man, technology, nature and society. Humanitarian expertise of technical and technological changes is required, as well as forecasting of possible scenarios and, above all, elaboration of paradigm and strategy of scientific and technical, social and value-based development.

4. Conclusions

Based on the previous analysis we may draw a number of conclusions. Development of converging technologies results in transformation of the structure of scientific knowledge towards its trans disciplinarily, development of the phenomenon of convergent thinking as a new style of scientific knowledge that goes beyond narrow-subject paradigms, integrates basic, applied, anthropological and social aspects. Introduction of convergent technologies, global industrial networks and the creation of a smart environment will inevitably result in the need for social transformations and require higher level of society's readiness to innovations, which is possible subject to close complex examination of the technology on the one hand and transformations in the educational paradigm on the other, as a man must be ready for changes, determined by technological development, and constructive compatibility with technologies.

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