

IMPACT OF TECHNOGENIC CIVILIZATION ON THE EVOLUTION OF SCIENTIFIC THINKING

IMPACTO DA CIVILIZAÇÃO TECNOGÊNICA NA EVOLUÇÃO DO PENSAMENTO CIENTÍFICO

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afirmação da autoridade do conhecimento útil com base em evidências matemáticas, lógica formal e conquistas da ciência moderna. O estudo foi realizado em 2022 usando métodos de coleta de dados qualitativos. O estudo mostra que a formação da civilização tecnogênica se deve à influência do pensamento científico e tecnológico, cujo surgimento é causado pelas exigências da realidade moderna, em que as esferas cultural e humanitária dão lugar à científica e tecnológica. O pensamento científico e tecnológico condiciona o desenvolvimento das tecnologias de informação e computação que geram o pensamento informacional. Conclui-se que a ciência é a base e o meio de sistematização da realidade natural e social. Ela causa o surgimento e o desenvolvimento da engenharia e da tecnologia. Com base nelas, forma-se o pensamento científico e tecnológico, cujo fundamento filosófico e metodológico é o

Abstract: The article considers the evolution of thinking in the context of technogenic civilization. The article aims at tracing the evolution of scientific thinking as a phenomenon of technogenic civilization from scientific and technological thinking to informational one in the context of asserting the authority of useful knowledge based on mathematical evidence, formal logic, and the achievements of modern science. The study was conducted in 2022 using qualitative data collection methods. The study shows that the formation of technogenic civilization is due to the influence of scientific and technological thinking, whose emergence is caused by the requirements of modern reality, where the cultural and humanitarian spheres give way to scientific and technological. Scientific and technological thinking conditions the development of information and computer technologies that generate informational thinking. It is concluded that science is the base and means of systematizing natural and social reality. It causes the emergence and development of engineering and technology. On their basis, scientific and technological thinking is formed, whose philosophical and methodological foundation is rationalism. The transformation of scientific and technological thinking in the process of social changes leads to the emergence of informational thinking, which is the result of the development of information and digital technologies and appears as a mode of scientific and technological thinking.

Keywords: Thinking. Scientific and technological thinking. Informational thinking. Science-centrism. Technocentrism.

Resumo: O artigo considera a evolução do pensamento no contexto da civilização tecnogênica. O objetivo do artigo é traçar a evolução do pensamento científico como um fenômeno da civilização tecnogênica do pensamento científico e tecnológico para o informativo no contexto da

racionalismo. A transformação do pensamento científico e tecnológico no processo de mudanças sociais leva ao surgimento do pensamento informacional, que é o resultado do desenvolvimento da informação e das tecnologias digitais e aparece como um modo de pensamento científico e tecnológico.

Palavras-chave: Pensamento. Pensamento científico e tecnológico. Pensamento informativo. Centrismo científico. Tecnocentrismo.

1. Introduction

At the beginning of the 21st century, the world is moving to a new knowledge-based society (often called the information society (Petrova, 2014)) and is facing grand social changes (Alekseeva et al., 2023; Trempelets et al., 2023) and economic, technical, and cultural innovations (Safronov, 2022). The content of labor changes and its productivity increases tenfold (Sekerin et al., 2022), the microelectronic revolution empowers the human mind and affects the structure of society (Otrokov et al., 2023). Today we witness the rapid development of information, communications, and intellectual technologies, which opens up new opportunities and prospects for modern science (Gasparian et al., 2022) and raises questions about the role of scientific knowledge in this new civilization (Aleksandrova et al., 2023). The ability to use the latest technologies to search, store, and use information in the scientific process (Shadrina et al., 2023), as well as the ability to transform the information received into knowledge (Shafazhinskaya et al., 2023), plays an important role in the formation of new thinking in modern society (Safronov, 2022).

Thus, modern technogenic civilization is characterized by a new way of thinking. Throughout history, it has been taking various forms from philosophical and religious to synergetic, pedagogical, and economic. In the context of rapidly developing information and computer technologies, scientific and technological thinking becomes relevant (Starostenkov, 2022). The spread and approval of scientific and technological thinking is due to its influence on the solution of practical problems (Mendes and Isabel Martins Guerreiro, 2022). Indeed, metaphysical and speculative constructs and cognition and development models are not recognized in the scientific and technological fields of activity since they have nothing to do with the practical demands of reality (Pashkurov, 2022). The criteria of practicality, pragmatism, and rationality play a decisive role in scientific and technological thinking.

The article aims at tracing the evolution of scientific thinking as a phenomenon of technogenic civilization from scientific and technological thinking to informational one in the

context of asserting the authority of useful knowledge based on mathematical evidence, formal logic, and the achievements of modern science.

2. Methods and materials

The main research method was the analysis of the relevant literature on the evolution of scientific thinking in the context of technologic civilization.

Pursuing the research objective and forming the source base of the study, we selected scientific sources from the Russian Science Citation Index, Web of Science, and Scopus databases for the following keywords: “science”, “scientific thinking”, “technique”, “technology”, “technological thinking”, “information society”, and “informational thinking”.

The analysis of the source base using the methods of theoretical generalization, comparison, analysis, and synthesis allowed us to determine the evolution of scientific thinking in the context of technologic civilization.

3. Results and discussion

A representative and bearer of scientific and technological thinking understands authority as the achievements of physical and mathematical sciences that explore nature and reveal its laws and patterns. Their achievements contribute to the increase in production efficiency, the change in technical means, and the improvement of socio-economic and cultural life (Biryukov et al., 2021).

Scientific and technological thinking is characterized by methodological clarity and consistency. It does not neglect details but tries to minimize accidents and increase the reliability of both the product (device) designed and the model or project constructed. Science, engineering, and technology are a set of well-established techniques and actions that can be constantly repeated. This possibility causes a tendency to systematicity and standardization in technological thinking. Each engineer, designer, or inventor has a certain “set of rational thinking techniques that they use on an everyday basis” (Yudin, 2016, p. 20).

When analyzing the history of science and society, we revealed that scientific and technological thinking is formed through the development of technology or technical culture. According to A.V. Mironov, the development of society and technology (artificial reality) becomes a factor that determines not only social and natural processes but also changes the

personal world. The universal essence of technology and technical activity is crucial for both socio-economic development and the spiritual-mental traits of a person. After inventing technology as a way of being, a person became a hostage of technocratic discourse, changing their role in the outer world and transforming their inner world (Karabushchenko et al., 2022; Mironov, 2017).

Due to the rapid development of information technologies, it is important to realize that technology and technical knowledge have turned from a necessary means functionally subordinate to a person and their goals into a factor that determines the boundaries and possibilities of transformative and cognitive activity (Nekrasov et al., 2015), including socio-cultural activity in all its forms and manifestations.

As a result, we deal with the scientific and technological culture of thinking, which is a set of experiences and skills, methods and techniques, and theoretical principles and empirical procedures that form thinking as a discursive phenomenon and contribute to obtaining true information about some object, i.e., about nature in a broad sense. The features of this culture are as follows: a mathematical apparatus, the rigor structure of knowledge, accurate calculation, logical prerequisites, idealized objects and orientation to formalized languages (Obidina, 2017). This is the basis of technogenic civilization as a new reality (Gladilina et al., 2022).

Socio-philosophical analysis confirms that scientific and technological thinking does not contain any evaluative (positive or negative) judgments. Within its framework, we can characterize or evaluate only the effectiveness of certain innovative, search, and creative methods in terms of their ability to achieve the goal or solve the tasks (Vetoshkin et al., 2017). However, we should not absolutize the scientific and technological style of thinking and view it as the only true type ensuring science-centrism and technocentrism. In its regard, science and technology become the dominant force or the end of creative aspirations. According to E.V. Bryzgalina (2017), the surrounding reality exists not only to be explored but also to be a means of self-understanding and finding one's place in the world. Under the existing socio-cultural and scientific practice, science-centrism and technocentrism reveal the incommensurability between the opportunities provided by scientific and technological progress and the values of culture and knowledge that are vital for a person and society (Aleksandrova et al., 2023).

Indeed, the absolutization of any way of thinking leads to an inadequate analysis and understanding of reality. For example, if recognized as the only priority, the economic style of thinking results in economic centrism. In this context, everything is considered only from the perspective of benefit, profit, and wealth (Maia and Correia, 2022). Regarding this approach, it is

believed that a person should not be lost in the scientific, technological, economic, or any other reality, but remain a spiritual and cultural, rational, and creative person, i.e., the substance of culture (Piccinini, 2009).

The tendencies of science-centrism and technocentrism did not emerge at once and began their development in the second half of the 19th century. During this period, the spread of scientific and technological achievements contributed to the belief in the advantages of scientific and technological (rational-practical) thinking and its possible use in all spheres of human life. The further cognition of natural laws opened new opportunities for the development of science and technology. Scientific and technological discoveries and tools allowed one to better model not only the laws of nature but also the socially important functions of a person (Kulikov and Minakov, 2023). According to V.M. Rozin, the history of science and technology studies the consistent objectification of a person's technological functions. From the genetic perspective, the development of technological tools has a historical character and goes through several stages: instrumental labor, handicraft, machine production, and automated production (Rozin, 2006). Robotics, computer information systems, and digital technologies have become a reality. While developing, these tools conditioned the formation of science-centric and techno-centric tendencies and absolutized the advantages of scientific and technological thinking. However, this does not mean denying or ignoring these benefits.

An important feature of science-centrism and technocentrism is the expediency of mathematical methodology. It is the main point in the scientific and technocentric criticism of socio-humanitarian knowledge. From the socio-political perspective, technocentrism is transformed into technocratism and, consequently, into the so-called "technocratic worldview". It is characterized by the cult of science and technology and the desire to achieve unlimited power with the help of scientific and technological achievements. Scientific and technological progress becomes the meaning and goal of human development. The criticism of technocratic plans and aspirations was combined with the criticism of a utilitarian attitude to life. The result was the concept of one-dimensional man (H. Marcuse) that prioritized functional and production aspects. From the viewpoint of a technocrat, a person does not appear to be an immanent value but rather a cog of a certain technology, a part of a large mechanism, an element of the social mechanism. This implies an assessment of another person through their utility, efficiency, etc. (Nekrasov, 2019).

In our opinion, the scientific and technological era (technogenic civilization) is assessed from the educational perspective, which is characterized by abstract humanism and utopianism.

A similar assessment was given in the middle of the 20th century. Currently, it is necessary to consider scientific and technological thinking, according to which science, technique, and technology are the determining factors not only of the latest forms of socio-economic organization but also of the goals of socio-political development. New technologies reveal more opportunities for social progress and demonstrate that fighting against scientific and technological progress is a mistake and simply meaningless.

For modern society, the relentless technologization of almost all spheres of life and technocracy as a paradigm (the organizing principle of activity) has acquired a comprehensive existential character (Chashchin, 2012). To a large extent, it predetermines the development of the entire civilization. Under the influence of these trends, individual phenomena or processes reach a general social or planetary scale.

In other words, this refers to the global problems of modern civilization. Their paradigm-based absolutism lies not only in quantitative measurements but also in qualitative changes in the structure of socio-economic, political, and cultural life. Upon a never-ending flow of knowledge and information, the processes of constancy and traditionality are leveled and interrupted, and the moral values of people and communities are transformed (Knekht, 2022).

The principles of scientific and technological (rational-pragmatic) thinking are expanding and acquiring a new semantic dimension. This circumstance is due to a change in the structure and capability of scientific knowledge. This refers to strengthening the practical possibilities of scientific knowledge through its wider use in everyday life. Thus, applied or working aspects of theory become relevant. According to V.A. Emelin (2016), it relates to the development of thought experiments and simulation modeling, the operationalization of theoretical constructs, and the actualization of such theoretical components as application. Along with deductive reasoning and interpretation, the latter has become a structural factor of theoretical systems.

Like any other cognitive, intellectual, and socio-cultural phenomenon, scientific and technological thinking is transformed and improved in the process of its development. The current stage of the scientific and technological revolution is associated with the development of information and digital technologies. They initiate a new stage in the development of thinking in general and scientific and technological thinking in particular. The latter is often called informational. This is due to the fact that the scientific and technological revolution is growing into the information technology revolution. Its result is the widespread use of information and computer technologies. These include a set of innovations in microelectronics, telecommunications, and optoelectronic industry, as well as the creation of computer technology

(Medvedev and Borodulya, 2018). Over the past two decades, many technological breakthroughs have arisen around this core in the field of new materials and energy sources, medicine, and nanotechnology. Technological transformations have created a digital or electronic world utilizing industrial, educational, cultural, household, and other systems based on the mass use of electronic and digital means (Yastreb, 2015).

As a result of these changes and transformations, a person entered the world of information and network, whose functional field, as noted in (Brey and Soraker, 2009), or the functional environment of any other public entity is based on the unity of three components: a) communications; b) social agreement and organization; c) the potential for innovative development. Due to the system of information communications, global society is viewed as a consolidated phenomenon of the social order. The formation of global society is associated with the current information revolution. The functional basis of the global information society is laid by information networks which serve as a system-forming substance or matrix of the information society. Networking is the defining organizational form of modern civilization. Information networks actively influence all aspects of public life, including social, economic, political, and cultural transformations.

The current information revolution is characterized by the use of knowledge and information to generate experiences and devices that process information and communicate, as well as possible directions of their use. Over the past decades, technological innovations have been progressing, from learning on the go to mastering technology through its creation, restructuring telecommunications networks, and seeking and finding new spheres of application. The spread of new technologies increases their power as technology is adopted and reshaped by its users (Lukashevich, 2006).

This circumstance is conditioned by the essence of technology. According to M. McLuhan, all technologies are extensions of the human body and its organs. For example, one's attire or house becomes an extension of the external organs of a person; a wheel, car, or plane is a continuation of the motor (moving) human system. Mechanical technologies act like the organs of the human body. Information technologies are revolutionary and serve as an extension of the human nervous system. However, McLuhan did not foresee that they could replace higher mental functions, creating new forms of thinking, memory, and attention and even new needs (Emelin and Tkhostov, 2010). In other words, information and computer technologies have expanded the foundations of human life.

New information technologies are not just tools that need to be used but also a factor influencing the formation of thinking in general and information thinking as an integral part of scientific and technological thinking in particular. Informational thinking emphasizes the relationship between the real and the imaginary (virtual), as well as experiences and concepts (thoughts). According to V.A. Lektorskii, information technologies allow one to fabricate knowledge about reality rather than the reality itself. Therefore, it is possible to create a virtual self-living in the virtual space (Lektorskii, 2010). Today virtual life has become common. To be means to be online.

The possibilities of information technologies are fully implemented in the knowledge society. Its educational institutions are aimed at the formation of a new and active way of thinking. However, the opportunities provided by information technologies for intensifying education and training contain certain risks and threats. According to the well-known representative of the philosophy of education P. Lisman, the reason is that the quantitative possibilities of obtaining knowledge via the Internet are inversely proportional to what we really know. In Lisman's opinion, easy access to information sabotages the process of cognition. Without elaboration and meaningful assimilation, most information will remain superficial (Sukharev and Spasennikov, 2020). In this context, information, computer, and communications technologies actualize mental activity. The latter should overcome the gap between the old knowledge and the new understanding of reality created by information technologies. Each transition is a process of rethinking within the framework of the socio-cultural, economic, political, and scientific paradigm in which this process is carried out. The result of this rethinking is a new way of thinking that can be called informational.

The constant development and increasing complexity of information technologies more and more connect them with intellectual and spiritual activity, which pushes the limits of the material universe. Information technologies become a means of thinking and searching for the foundations of being and its modes (information, computer, and digital technologies) in the context of technogenic civilization (Epstein, 2016).

In the context of informational thinking, a new cultural and intellectual environment arises, whose center is not a teacher, guru, or leader, but rather the Internet. Its emergence changes the laws of intellectual creativity, cognition, and thinking. Being the main resource of informational thinking, the Internet has revolutionized the relationship between the objective and informational worlds, opening new opportunities for the rapid formation of a new spiritual reality. On this basis, powerful electronic information carriers are created that can be replaced by

quantum ones in the future. The forms of intellectual creativity and cognition are also transforming. In the new intellectual environment, the main way of cognition and communication is informational thinking.

4. Conclusion

Science is the basis and means of systematizing natural and social reality. Its activity has led to the emergence and development of engineering and technology. On their basis, scientific and technological thinking is formed, which takes its rightful place among legal, economic, political, etc. The philosophical and methodological basis of scientific and technological thinking is rationalism.

In the modern information society, the essence of information is changing. Science cannot exist without technology; therefore, the emergence of a new way of thinking is a natural process like the influence of information technologies on its formation.

Thus, the transformation of scientific and technological thinking during the scientific and technological revolution leads to the emergence of informational thinking. It is the result of developing information and digital technologies and acts as a mode of scientific and technological thinking. Modern information and digital technologies create new intentions and feelings, as well as a new cognitive and intellectual reality.

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