The Idea of Technology in Scientific Knowledge

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Abstract The study of technology as a phenomenon of human society, which started in the ancient world and continued at early stages of cultural and historical development, is still popular. With a large multitude of works in the context of different theoretical approaches, there's still no single opinion regarding understanding the sense of technology. This research takes into account the complex of main concepts of technology, but stick to the approach developed by modern Russian philosophers, within which technology is defined as a totality of artifacts and technical knowledge—from technical to theoretical, scientific & technical, and systemic & technical.

Keywords Technology • Philosophy of technology • Technical knowledge

1 Introduction

The idea of technology in philosophical & historical environment of humankind, which was formed in the ancient times, evolves from the ideas of technology as of something created by human hands under the influence of higher forces to classical and neoclassical concepts of technological knowledge, in which technology is viewed as a products of human civilization, a tool, technical knowledge, manifestation of a certain secret, and sense of truth. Approaches to evaluation of the functional nature of technology (naturalistic, willing, natural & scientific, rational) and historical & philosophical concepts of interpretation of technology (ancient, new European, positivist, Marxist, culture crisis, anthropological, technical determinism, ontological, spiritual, and Russian cosmism) show the diverse nature of this phenomenon. Study of the status of technology in modern society and development of technical knowledge, which led to formation of ideas of technological paradigm, is, in our opinion, one of the top-priority tasks of philosophy of technology. Philosophical analysis of technological paradigms that fix deep structural changes

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in development of human civilization in twentieth to twenty-first centuries requires viewing the issue of emergence of the very idea of technology and its transformation in historical and philosophical environment of humankind. That's why it is necessary to view evolution of knowledge on technology and to analyze classical concepts of technological knowledge which formed in the nineteenth century.

2 Theoretical Basis of the Research

While giving the main content of the research, it is necessary to view the notion of technology, taking into account existing approaches to technology and technical knowledge.

The term "techno" is of Ancient Greek origin, which means "skill". Technology (technique, technology) is skill, knowledge; methods of work and their application in a certain sphere; craft" (Dal 1999). In the Large Soviet Dictionary, technology is "totality of means of human activities, created for conduct of processes of production and servicing non-production needs of society. Technology materializes knowledge and experience accumulated by the humankind in the course of development of public production" (Large Soviet Dictionary).

In the New philosophical dictionary, *technology* (Greek and Latin techne—skill)—is a notion with the following meanings: firstly, a certain ontological entity (complex of tools, machines; artificial environment); secondly, "human's striving to power over nature" (New philosophical dictionary 2009); thirdly, it is creativity, in which human's purposes are expressed; fourthly, technical creativity; fifthly, technology is viewed as a means of preservation of humankind during transition from organic to artificial world. The sixth meaning of the word reflects the activities of a human related to the special means of transformation of nature. The seventh meaning: technology is a system of values and norms that regulate the life of a human in the civilized world.

Polysemy of this notion is related to the fact that it reflects various forms of human activity. According to V.E. Davidovich, the number of definitions of "technology" could be multiplied. However, the main fundamental attribute of technology is the principle of transformation, i.e., "technology is something that human uses to transform nature, himself, and society" (Davidovich 1997).

Friedrich Rapp states that full definition of technology would contain references to various aspects of technology, which would lead to the detailed description (Rapp 1989). He distinguished the following elements of technology: applied natural science, complex of tools and means, will to power and subjection of nature, "opening" and "ordering" of nature, realization of ideas, self-preservation of human, inevitable production of excesses, overcoming the nature's limitations, creation of artificial environment, and objectification of human activities and achievements.

Consideration of technology as an applied natural science is criticized by F. Dessauer. "Goal setting's approaching laws of nature does not lead to invention. . . ." (Ropohl 1989).

According to J. Agassi, the very division of science into fundamental and applied is not correct. ". . . fundamental research is search for certain laws of nature in view of the use of these laws" (Stepin et al. 1995). According to J. Agassi, invention is a theory, not practical activities. Natural and technical sciences could be viewed from the position of creation of new knowledge and from the position of applying this knowledge for solving specific tasks. Besides, natural sciences could be viewed as the sphere of application of mathematics. Due to this, division of sciences as to the sphere of practical application if relative, and the tern "applied science" is incorrect.

However, this approach does not allow determining the specifics of technical sciences and technical knowledge. G. Ropohl (1989) offers to solve this issue from the point of view of the systems theory, distinguishing three aspects of technology: natural aspect (science, technology ecology), individual, human aspect (anthropology, psychology, physiology, and esthetics), and social aspect (economics, sociology, political science, and historical science).

Based on the concept of functional difference, Carl Mitcham (1995) develops a typology, according to which technology is an object (tools and machines), secondly, as knowledge (skills, rules, and theories), thirdly, as a process (invention, design, creation, and use), and, fourthly, as expression of will (will, motive, need, wish).

Jacques Ellul emphasizes technical "totality" in modern world and defines technology as totality of rational methods which possess effectiveness in any sphere of human activities (Ellul 1986a, b).

Technology, being a significant factor of formation of the very human, establishment and development of human society, expresses the generalized difference of human from animal. A human, while creating "second nature" live in artificial environment, created by him with the help of technology—and, thus, creates himself. This position is substantiated by P.K. Engelmeyer, who treated technology as real creativity (Engelmeyer 2007).

Karl Jaspers saw the sense of technology in human's achieving domination over nature. "Technology is totality of human's actions aimed at domination over nature; their aim is to give the life such a form that would allow it to take the load of need away and acquire a desired form of environment" (Jaspers 1994a, b).

Martin Heidegger, refusing from the simple instrumental understanding of the sense of technology, prefers treating this essence as a "type of opening something secret", one of the means of finding the secret of being (Heidegger 1993a, b).

N.M. Al-Ahni assign to expansive interpretation of the notion of technology the definitions offered by Ernst Bloch and Hans Zaksee. According to the former, technical creativity, as all human creativity on the whole, should be viewed as conduct of "yet-to-be" ("new"), so it is based on "latency" of substance, its openness in the sense of "inexhaustibility" of its sources. According to the latter, technology is a bypass to the goal (Al-Ahni 2004). N.M. Al-Ahni states that apart from

expansive treatment of technology, there is too narrow interpretation of this notion—e.g., the following definitions of the notion: technology as production of excessive, activities aimed for benefit, as applied science, as a means to find something, and as a system of artificial bodies of society (E. Kapp's concept of technology as projection of human organs).

At that, there is a whole range of "intermediary" definitions of the motion. They include the following: technology as creation (invention and design) and use of tools in the widest sense of the word (Al-Ahni 2004).

Technology attracted the thinkers' attention, but the idea of technology was born in the ancient times, which was an initial point of its transformation in the history of development of philosophical thought.

The idea of technology, formulated in the ancient times, reflected no only human artifacts but the divine entity.

On the whole, the main thesis of the Aristotle's concept consists in neutrality of technology as to other spheres of human's existence. Technology (in ancient times—art, handicraft) is viewed as a small part of creative activities' application, related to creation of labor tools and artifacts.

Certain efforts to describe technical systems transformed in the seventeenth to eighteenth centuries into the system of engineering education, into technology as a complex of knowledge on machines. Engineering turned technology into a practical field for the research.

In the Modern Age, the increased role of technology in human's life was mentioned by F. Bacon and R. Descartes. The Bacon's setting of division of the world for "subject" and "object" predetermined development of the European philosophy and science until now, being a source of anthropogenic civilization (Bacon 1978).

The deep transformation in the philosophical thought of the seventeenth century was possible due to the R. Descartes's philosophical system. "Descartes taught people to think so that they could create technology" (Descartes 1989).

The rationalistic methodology was specified in positivist and Marxist concepts of the nineteenth century.

In positivism, which states the primate of scientific (natural) rationality over the abstract (metaphysical), technology is an object of consideration of such thinkers of A. Comte, E. Littre, and H. Taine.

Marxist concept views rationality as a human's capability not only to develop ideas on the ideal object (ideal, model, theory) but to embody in the forms of practical activities. Technology is the system of artificial bodies of a public human, the main part of production forces of the society, and their element. At that, in the system of social relations, technology is a neutral element; but it is very active in nature's transformation, as it stimulates scientific & technical progress.

F. Dessauer (1881–1963) stuck to another position in the discussion on the problems of the philosophy of technology. In his works "Philosophie der Technik" and "Befreiung der Technik" he founds on the Kant's concept of the transcendent. Dessauer states that transfer through the limits of experience is possible in the

practical sphere (Dessauer 1927). Analysis of the act of technical creativity, performed by Dessauer, led to the idea of the "fourth kingdom", in which solutions to technical problems exist (Dessauer 1952).

In the nineteenth to twentieth centuries, the concepts in which technology is treated pessimistically, formed. Changes in the content of the notion of technology were predetermined by industrialization, expansion of the global market, deepening division of labor, development of transport and communications, demand for military technology, and large influence of technology on such social interests as unemployment and estrangement. In the works of O. Spengler, technology is one of the leading factors that stimulate human's subjection to the state machine in the conditions of destructive influence of technical civilization on nature. The age of technology is characterized by rationalization of human's activities (Spengler 1998). According to O. Spengler, while there are technical pathfinders of a high level, civilization exists (Spengler 1998).

José Ortega y Gasset views technology as an inseparable feature of modern civilization. In his work "Meditation on the technique", Ortega y Gasset creates periodization of technical evolution, the basic principle of which is the relations between human and technology. He distinguishes three stages in technical evolution: technology of randomness, technology of skill, and technology of human-technology (Ortega y Gasset 2000). Ortega y Gasset emphasizes on negative consequences of scientific and technical progress and its threat. "Let us not speak of technology as of a unique positive phenomenon, as of unique, unchanged, and sustainable human reality. It is now wise: the more the technology is blinded by this idea, the larger the chances are for full decline and death for modern technique" (Ortega y Gasset 2000).

This position is supported by Karl Jaspers—he considers that consequences of the age of technology "will not leave anything of what a human obtained in the sphere of labor, life, thinking, and symbols in a thousand years" (Jaspers 1994a, b). According to Jaspers, technology is peculiar for reason and power. Besides, technology is a "skill, which methods are external as to the goal. This is capability to do and possess—not to create and allow growing" (Jaspers 1994a, b). The idea of technology—i.e., its true sense and purpose—consists in liberation from the nature's domination. However, modern technology, having appeared due to natural science, spirit of invention, and labor organization, may lead human to complete estrangement from nature.

The need for philosophical reflection on the basis of technology was expressed also in anthropological concept and concept of technical (technological) determinism.

According to the anthropological concept, technology is a natural continuation of human's bodies and his capability to think. In the E. Kapp's philosophy of technology, work tool and weapon are viewed as various forms of continuation (projection) of human organs. It was Kapp who provided its systemic and detailed development in his work "Grundlinien einer Philosophie der Technik" (Kapp 2004).

The concept of technological determinism origins from recognition of technology as objective reality with high dynamics and own reuglarities that can change not only social relations but human's nature. Considering technique as a general benefit, representatives of the optimistic determinism (A. Toffler, D. Bell, Z. Brzesinsky, and H. Kahn) are sure that technology and new techniques will be a basis for progress in future (Toffler 2004; Bell 1986).

Representatives of the pessimistic direction of technological determinism J. Ellul and D. Meadows view technology as the power of evil. Technology is something "given" without any definitions: there's no need in sense or value, it imposes itself by just existing (Ellul 1986a, b).

The idea of technology within technological determinism is more or less opened in the theories of industrial society and post-industrial society, society of consumption, and technotronic and technocratic societies.

The idea of technology is viewed in other historical & philosophical concepts: spiritual (belonging to the divine creativity—F. Dessauer, N. Berdyaev, V. Solovyev), Russian cosmism (V.I. Vernadsky, K.E. Tsiolkovsky, A.L. Chizhevsky).

The sense of modern technology will remain secret for a long time even when various engines are invented, electronic machinery is developed, and nuclear technology is used.

3 Methods and Objects of the Research

Theoretical and methodological basis of the research consists of the studies of foreign and Russian scholars. The research uses dialectical method which allows determining general regularities on technology and tracking transformation of the idea of technology in historical context.

Methodological basis of the research is systemic approach, which directs the research at revealing the integrity of the object, determination of various types of connections of a complex object, and bringing them into single theoretical picture.

Consideration of the global problems, caused by development of technology and technologization of life, caused the necessity to use the methods of structural & functional approach.

The tools for determining specifics of the selected object include comparative & historical and comparative & competitive methods.

4 Results of the Research

The idea of technology in philosophical & historical environment of humankind, which was formed in the ancient times, evolves from the ideas of technology as of something created by human hands under the influence of higher forces to classical

and neoclassical concepts of technological knowledge, in which technology is viewed as a products of human civilization, a tool, technical knowledge, manifestation of a certain secret, and sense of truth. Approaches to evaluation of the functional nature of technology (naturalistic, willing, natural, and rational) and historical & philosophical concepts of interpretation of technology (ancient, New European, positivist, Marxist, culture crisis, anthropological, technical determinism, ontological, spiritual, and Russian cosmism) shows many-sidedness of this phenomenon. The study analyzes regularities of transformation of the idea of technology in historical and philosophical environment of humankind; approaches and concepts of interpretation of technology are determined.

Thus, technology is inseparable part of modern civilization. Study of technology stimulates development of such concepts with the help of which a human and society can ensure their safe existence.

5 Conclusion

The following conclusions are made.

Firstly, there are a lot of definitions of technology, analysis of which showed that the term "technology" is used in a narrow and wide sense of the word. In a narrow sense, technology is instrumental means used by a human in specific spheres of their activities (there are set phrases: technology of art, dance, thinking, verse, letter, technology of musical instruments play). Also, technology is viewed as totality of artifacts (items created artificially by a human) for conduct of transformational activities. These are objects with internal nature and logic of action. In a wide sense, technology is analyzes as a product of human civilization, technical knowledge, and part of social dynamics.

Secondly, the following approaches to evaluation of the functional nature of technology could be determined: naturalistic (a human has to compensate the lack of his organs, as compared to animals); willing—according to which a human realizes his will to power at all levels through technology; naturalistic & scientific (technology—applied science); rational (technology—consciously regulated activities of a human).

Thirdly, there are the following historical & philosophical concepts of interpreting technology: ancient (Plato, Aristotle), New European (F. Bacon, R. Descartes), positivist (A. Comte), Marxist (K. Marx), culture crisis (O. Spengler, K. Jaspers, José Ortega y Gasset), anthropological (E. Kapp), technical determinism (optimistic determinism—E. Toffler, D. Bell, S. Brzesinsky, and pessimistic determinism—J. Ellul, D. Meadows), ontological (M. Heidegger), spiritual (belonging to divine creativity—F. Dessauer, N. Berdyaev, V. Solovyev), Russian cosmism (V.I. Vernadsky, K.E. Tsiolkovsky, A.L. Chizhevsky).

In our opinion, technology is a complex system in which the following elements are interconnected: production complexes of machines, information technologies, and technologies in economic, managerial, informational, and public systems.

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