Published by the decision of the Scientific Council
of Khachatur Abovian
Armenian State Pedagogical University

Department of Philosophy and Logic
named after Academician Georg Brutian

W I S D O M

4(24), 2022

WISDOM is covered in Clarivate Analytics' Emerging Sources Citation Index service

ASPU Publication

YEREVAN – 2022

DOI: 10.24234/wisdom.v24i4.913

DIALECTICS OF SCIENTIFIC REVOLUTIONS FROM THE POINT OF VIEW OF INNOVATIONS THEORY

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Abstract: It is shown that the difficulties that appear during attempts to uncover the mechanisms of changing of scientific paradigms can be overcome by consistent application of the apparatus of dialectics and by the interpretation of science as a social institution that produces intangible assets. This interpretation demonstrates analogy between T. Kuhn's theory of changing scientific paradigms and the theory of innovation cycles, which goes back to the works of J. Schumpeter. The fact allows one to consider the production of intangible assets by the methods of institutional economics. The basic dialectical contradiction in this interpretation is the contradiction between the innovativeness of a set of ideas that form a new paradigm and ensure the systematic generation of intangible assets, and its liquidity. The liquidity of intangible assets is primarily determined by the extent to which society is ready to accept new ideas and views. The resolution of the identified contradiction is carried out through a cyclical change in resistance to innovation. The period of dominance of a certain paradigm ends when it exhausts the potential of its development, which determines the finiteness of the life cycle of any scientific paradigm, just as the life cycle of any innovation is finite.

Keywords: innovation theory, dialectics, scientific revolutions, post-non-classical science, epistemology, science of science.

Introduction

The question of the regularities that determine the nature of the development of science is one of the central questions in the modern history and philosophy of science (Ladyman, 2012; Irvine 2012).

At present, the model of scientific revolutions has become widespread; the most frequently cited work, in which the corresponding point of view is stated, is the monograph by T. Kuhn (1996).

According to T. Kuhn, the period when the development of science fully corresponds to the cumulative model is finite. This period is called the period of "normal science", when there is an accumulation of scientific results found in solving the next problems according to generally accepted patterns and methods. In each of the periods of "normal science" a certain paradigm dominates. According to T. Kuhn, the scientific revolution is a change in the dominant paradigm, expressed in a change in the interpretation of the main scientific results and achievements obtained earlier, and most importantly, in a change in the basic approaches to obtaining new scientific results, the methodological basis for the development of science.

Based on the logic of T. Kuhn, it can be argued that the transition from one paradigm to another is only indirectly connected with the own logic of the development of science, it mainly depends on what kind of resources – informational, economic and political – the supporters of a particular paradigm have. However, the mechanism that leads to a paradigm shift remains poorly understood.

As noted in (Platonova, 2017), the change of paradigms, as understood by T. Kuhn, – is rather a psycho-sociological process that is loosely connected with the existing empirical base or logical constructions, as a result of which the scientific merits of any paradigm always remain relative. T. Kuhn (1996) gives an example of chemistry and thermodynamics of the era of dominance of the phlogiston theory. He emphasizes that "these once generally accepted conceptions of nature were on the whole neither less scientific nor more subjectivist than those prevailing at the present time," and this is precisely the conclusion that any historian of science who has studied this issue in sufficient depth will come to.

Examples of this kind lead to a well-defined dilemma, which is one of the starting points in T. Kuhn's constructions. Namely, if certain obsolete concepts "If these out-ofdate beliefs are to be called myths, then myths can be produced by the same sorts of methods and held for the same sorts of reasons that now lead to scientific knowledge" (Kuhn, 1996, p. 2). On the other hand, if they are to be recognized as scientific, then it turns out that science must include "If, on the other hand, they are to be called science, then science has included bodies of belief quite incompatible with the ones we hold today" (Kuhn, 1996, p. 2).

The conclusion that T. Kuhn (1996) draws on this basis leads to a whole range of questions, the answers to most of which are still unanswered: Can scientific development be regarded as a mere increase in knowledge?

Continuing the logic of T. Kuhn (and his followers/critics, including, in particular, I. Lakatos), it should be concluded that there are no guarantees that the next paradigm will be more "perfect" than the previous one. This conclusion is very important against the background of criticism of objectivism (interpreted through the requirements of scientific rigor and accuracy of research in the positivist sense), which is very common in modern literature on the humanities (Cooke, 2000). To replace evolutionism and objectivism in the humanities in the second half of the last century came relativism and cultural analytics (Ionin, 2000; Manovich, 2016).

Moreover, T. Kuhn's conclusion makes the notion of progress deliberately ambiguous. (The fact is also reflected in the current literature (Ionin, 2000).

Thus, the creator of the theory of interprettation of cultures, Clifford Girtz (Alexander, 2008), argued that – "Research is successful if it is more insightful than the previous ones, but it does not stand on their shoulders, but runs alongside them in a race" (Girc, 1997, p. 194). Points of view of this kind are fully consistent with the ideas about the formation of post-non-classical science (Lebedev, 2013, 2014; Arshinov & Lebedev, 2007).

As noted in (Lebedev, 2013), the program of social and socio-psychological epistemology and philosophy of science was stated in the works of M. Foucault, T. Kuhn, representatives of the institutional and cognitive sociology of science (N. Collins, A. Storer, E. M. Mirsky, E. A. Mirskaya, A. N. Avdulov, A. Yurevich, M. Barber and others). The works of these authors emphasize the social nature of science and scientific knowledge (Lebedev, 2013). Specifically, we are talking about the integration of science into broader cognitive systems and contexts, about the dependence of the nature of the functioning and development of science on factors of a social nature. It is significant that the latter are understood not so much as factors of a material nature (economic, technical and technological problems and the needs of the development of society), but as socio-psychological and scientific-organizational ones (methodological stereotypes, the degree of demand for creative personalities, creative and innovative thinking in society and science and etc.).

The work (Lebedev, 2013) also emphasizes that "an important direction of modern post-nonclassical epistemology and philosophy of science was the cultural and historical analysis of the functioning and development of scientific knowledge", which was most developed in Russian-language philosophical literature at the end of the 20th century in the works of V. S. Stepina, M. K. Petrova, M. K. Mamardashvili and others.

However, it should be noted that the thesis about the formation of post-classical science faces quite definite criticism, which is given precisely from the standpoint of analyzing the change in the social role of science in modern society. Specifically, the following judgments are given in (Nikiforov, 2013).

V. S. Stepin and his followers associate the post-nonclassical stage of the development of science with the widespread use of interdisciplinary and complex research, with computerization and the use of expensive instrumentation systems (Nikiforov, 2013), but the most important thing is that "in the … process of determining research priorities, along with cognitive economic and socio-political goals are beginning to play an increasingly important role".

One of the main theses underlying the ideas about the formation of post-non-classical science in the last quarter of the 20th century is the thesis about the change in the types of scientific rationality. In (Nikiforov, 2013), the point of view of V. S. Stepin and his followers is described through the following visual diagram.

The classical type of rationality: the scientist is guided by intra-scientific values, striving to ensure that knowledge about the object under study does not depend on the means of obtaining it and the characteristics of the cognizing subject itself.

Non-classical type of rationality: the knowledge obtained depends on the means of obtaining it (to substantiate this point of view in the literature, as a rule, philosophical provisions based on the achievements of quantum mechanics are used).

Post-non-classical type of rationality: knowledge depends not only on the means of cognition, but also on the characteristics of the subject of cognition, and social values and goals are added to intra-scientific values.

According to A. L. Nikiforov (2013), this scheme describes not so much the development of science as it reflects the change in the place of science in society, specifically, its reorientation towards applied knowledge (moreover – towards achieving direct commercial results from scientific and technical activities).

This state of affairs is due to obvious factors. As soon as the achievements of science began to be used on a mass scale, as soon as its professionalization was completed, science as a social institution began to increasingly fall under the power of capital, primarily large capital. Hence, there is now a steady desire to convert science into a direct source of profit, and this point of view is being put into practice at the level of political decisions. As A. L. Nikiforov (2013) shows, in modern conditions, scientific knowledge becomes a commodity, and a scientist becomes a hired worker producing this commodity. However, this thesis of A. L. Nikiforov needs to be clarified: in modern conditions, the results of scientific activity become a commodity of wide (almost mass) demand; industrial espionage and the resale of technological secrets are by no means an invention of the 20th century.

Nevertheless, the A. L. Nikiforov's statements are quite convincing. The emphasis in scientific activity throughout the 20th century is clearly shifting from the "High comedy of science," in the words of Maximilian Voloshin, to the "social values and goals" that supporters of the post-nonclassical science thesis talk about.

Based on such considerations, the cited work (Nikiforov, 2013) states that "there is no post-nonclassical science, but there is a growth in applied research with its own extra-scientific goals and values, with its own standards and norms".

Obviously, both the arguments of the supporters of the thesis about the formation of post-non-classical science and the arguments of its critics, at least, have the right to exist. More precisely, there is a quite definite contradiction, which is of a fundamental nature, in the sense that it expresses the inconsistency of the very foundation of science, the dialectical nature of its development.

The purpose of this work is to build a dialectical model for the development of science as a social institution.

Methodology: Dialectics as the Basis for Building a Model for the Development of Science

Attempts to apply dialectics to the interpretation of the nature of the current stage of the development of science are known, one example is the work cited above (Girc, 1997). In the final paragraph of this article, it is stated that "...the most adequate and universal among all paradigms of scientific knowledge is the concept that we call positive-dialectical epistemology".

The approach of (Girc, 1997) to a certain extent corresponds to the ideas of classical dialectics: the structure and dynamics of scientific knowledge is woven from contradictions (understood in the spirit of dialectics), and this circumstance is fundamental. In cited report it is also stated that science and scientific knowledge are not just complex, but dialectical systems, i.e. systems characterized by opposite properties. The fundamental inconsistency of science and its development is expressed, in particular, in the existence of concepts that absolutize certain of its facets.

As rightly noted in (Girc, 1997), empiricism absolutizes the importance of the empirical level of knowledge in science and the data of observation and experiment as the basis and criterion for the truth of scientific knowledge, while theoretism, on the contrary, exaggerates the relative independence of theoretical knowledge in relation to the experimental data of and its role in scientific knowledge.

Similarly, irrationalism exaggerates the role of intuition and the personal dimension of scientific knowledge and cognition, while pragmatism deliberately exaggerates the dependence of scientific knowledge on practical activity and underestimates the ideological significance of scientific knowledge (Girc, 1997). There are a number of other oppositions: internalism – externalism; essentialism – instrumentalism; methodologism – constructivism; naturalism – culturalism; objectivism – humanitarianism; positivism – transcendentalism; individualism – sociology. All of them reflect the objective contradictions inherent in any reflection of what is, both at the level of philosophy and at the level of specific sciences.

However, positive-dialectical epistemology, as follows from the text (Girc, 1997), only states the existence of contradictions, while the consistent application of dialectics provides for their resolution in the spirit of the law of unity and struggle of opposites. We are talking about the application of Hegel's triad "thesis - antithesis – synthesis" to those contradictions that were listed in the final paragraph of (Girc, 1997).

Dialectical Model of Science as a Social Institution

Continuing the logic of V. S. Stepin and his followers, as well as taking into account the criticism of the thesis about the formation of post-non-classical science (Nikiforov, 2013), one can conclude that the development of science (as a social institution) should be considered, first of all, from the standpoint of both institutional economics and applied philosophy.

This approach gives possibility for solving at least one fundamental contradiction that characterizes science as a social institution - the contradiction between science as a means of making a profit and as a self-sufficient civilizational value associated with the generation of new knowledge. We emphasize that namely this contradiction de facto was discussed in cited above report (Nikiforov, 2013).

The following thesis is the basis for this work. Science – is among other things, a social institution that creates intangible assets that can be converted into tangible or financial assets in one way or another. (Formulation option: the main role of science as a social institution has been and is in the generation of intangible assets.) In this regard, it is appropriate to emphasize that economic thought has long operated with such categories as "human capital" (Zhang & Xiaojun, 2021; Bosi et al., 2021), "social capital" (Millon Cornett et al., 2021; Alfano, Ercolano, 2021; Bäker et al., 2021), etc.; notions about intangible assets are by no means unusual.

The above statement de-facto is a broad interpretation of the well-known Marxist thesis, which treats science as a productive force. The need for a broad interpretation of this thesis is determined, among other things, by the fact that the conversion of science (as well as pseudoscience) into financial assets in modern conditions is far from necessarily associated with material production (or even with the creation of information technologies).

Thus, the concept of global warming, created on the basis of scientific tools, ensured the formation of well-defined markets that are only indirectly related to material production. Even more illustrative in this respect is the formation of a market for "organic" or "ecological" food products, the inflated cost of which is determined solely by the introduction of ecological discourse into the mass consciousness. There is no need to emphasize that the formation of this discourse was almost entirely based on the use of scientific (and/or pseudoscientific) tools (with appropriate PR support, of course).

Finally, there is the concept of "intellectual property", which formalizes the existence of intangible assets legally.

For the concept we are developing, it is essential that, speaking about the creation of intangible assets, one should take into account the existence of assets that de facto become the property of a corporation and the state (more broadly, humanity), and assets that de facto remain in personal use.

Partially, the ownership of such assets is formalized institutionally (legislation in the field of intellectual property rights, patent legislation, etc.). Along with this, there are intangible assets created as a result of scientific (or pseudoscientific) activities, the "liquidity" of which is associated with the existence of well-defined formal (and, more importantly, informal) institutions.

Examples of such assets are the personal (real or imaginary) authority of a particular scientist, the nature of his scientific connections that determine the opportunities for promoting specific ideas, etc.

Thus, it can be argued that the possibility of ensuring self-realization, self-affirmation, etc. can also be considered as a kind of intangible assets. Self-respect and freedom – even if only internal - have always been one of the highest values for a person worthy of that name.

It follows from this that the Marxist thesis of science as a productive force really needs to be revised, taking into account the consideration of intangible assets, which, of course, does not imply a rejection of dialectics as such. Science, under certain conditions, can indeed become a "productive force", but this does not exclude the fact that it itself produces only intangible assets.

In order for these assets to be further converted into material ones, additional efforts are required. In accordance with J. Schumpeter's ideas, only a complex chain of activities leads to the actual creation of an innovation (Swedberg, 1995; Tülüce & Yurtkur, 2015). Recall that J. Schumpeter understood innovation as an invention that has already reached the stage of commercialization).

From the definition proposed above, it follows that other basic provisions of the J. Schumpeter's concept are also applicable to science. Indeed, as soon as we are talking about the production of certain assets (whether tangible or intangible), then at least the question of using the ideas of the theory of innovation is legitimate.

In other words, science can and should be considered as a tool for generating innovations, but this tool in itself is also an innovation and, therefore, obeys the relevant laws.

From this point of view, the periods of scientific revolutions that T. Kuhn speaks of and his sequences fully correlate with J. Schumpeter's ideas about the life cycles of innovations. What T. Kuhn calls a new paradigm is innovation (innovation of a higher order), which creates an opportunity to generate other innovations.

This point of view allows us to remove all the difficulties that are inherent in attempts to explain the change in scientific paradigms, which were mentioned above. If a scientific paradigm is an innovation (albeit of a higher order), then it must obey the same laws as any other innovation. In particular, its development potential and life cycle are finite.

Indeed, the initial potential inherent in one or another scientific idea of a fundamental nature is quickly exhausted. An example here is the history of the development of quantum chemistry.

As is known, the properties of an individual molecule of any substance can be (at least theoretically) predicted by solving the Schrödinger equation for a system containing the corresponding number of atomic nuclei and electrons. The problem is that a problem of this kind, both in classical mechanics and in quantum mechanics, is exactly solved only for a system containing two bodies (the "two-body problem"). In particular, exact solutions for the Schrödinger equation can only be obtained for the hydrogen atom (a nucleus and one electron). The three-body problem is already solved only by approximate methods (in particular, exact solutions can no longer be obtained even for a helium atom, which includes a nucleus and two electrons).

Quantum chemistry was created as a means of overcoming such difficulties; in its framework, already in the first half of the 20th century, many important and necessary results were obtained, which can be regarded as fundamental. In particular, the method of linear combination of atomic orbitals was developed, a model of hybrid orbitals was created, which successfully described the symmetrical nature of the valence bonds of the carbon atom, etc.

Calculation methods were continuously improved. At present, quantum chemistry has reached the level of implementation of software products that are easy to use and of great practical importance. However, already in the 1980s, monographs on quantum chemistry often argued that many textbooks in this discipline are increasingly reminiscent of programming textbooks. At present, a significant number of papers on quantum chemistry are also published annually, there are also specialized journals, but there is no reason to expect breakthroughs here: even the most significant of the papers published in recent decades cannot be compared (in terms of fundamentality) with those that were made in the first half of the twentieth century.

This situation can be viewed as a particular manifestation of a general pattern. When a basic fundamental idea appears (for example, such a tool as the Schrödinger equation appears at the disposal of researchers, capable of describing atoms and molecules), then the first works will most often be of a fundamental nature, which is confirmed by the entire history of science. The subsequent results obviously cannot be so impressive – everything that could be done quickly and efficiently has already been done. Researchers working in this particular field move to the level of less and less significant problems, while their number tends to grow – success always attracts followers.

For clarity, the generation of a new fundamental idea can be compared with the finding a gold deposit: at the first stages, mining is fast and efficient, but as it is exhausted, it becomes more and more costly.

A more correct wording is as follows. The driving force behind the development of science is the generation of meanings (in the philosophical meaning of this term), i.e. some ideas that can give new field for generation a variety of important projects.

At the same time, one must understand that any scientific discipline that has acquired a complete (canonical) form, formed a certain subject field, its own methodology and tools, is an already completed "project", in other words, a set of already used ideas.

The fact highlights a very definite contradiction. Namely, if science is a social institution that generates intangible assets, then the question of their liquidity inevitably arises, which leads to basic contradictions that determine the uneven nature of its development.

Obviously, the liquidity of an intangible asset depends not only on its own characteristics. For clarity, let us consider the simplest example. A modern astrologer or homeopath can make quite a lot of money from the reputation he has in the relevant circles (this is his most important intangible asset), but his activity certainly could not be successful (financially, of course) if society as a whole had a truly scientific outlook - they would simply start laughing at the providers of such services.

This example shows that the liquidity of an intangible asset depends on how it is perceived by society. A fundamental scientific idea may not be accepted, not even because it is too complex; the history of science demonstrates many examples when the quite interesting scientific publications went unnoticed.

Circumstances of this kind lead to a fundamental dialectical contradiction between innovativeness and liquidity of everything that is characterized by the word "generation of ideas". If an idea is overly innovative, society will not accept it - it will simply be beyond the perception of the majority. If the idea is accepted by the majority (the intangible asset becomes liquid), then the potential for its development begins to be exhausted very quickly. Moreover, the level of innovativeness of an idea easily perceived by society cannot be significant (with rare exceptions).

Namely this contradiction is the basic root of the alternation of scientific revolutions. Completed projects (what T. Kuhn calls "normal" science) can exist for quite a long time, or rather they dominate until their potential is exhausted. Until that time, fundamentally new ideas have practically no chance of being accepted by society, which de facto often does not need new projects and new design. The time for new ideas comes only when the life cycle of the previous ones ends.

The Problem of the Existence of Objective Regularities in the Development of Science

The issues discussed in the preceding sections are obviously connected with the problem of the existence of objective laws governing the development of science. Indeed, if the emergence of a revolutionary scientific idea is due only to the personal characteristics of the author (mainly his talent and accumulated store of knowledge), then one cannot speak of the existence of objective patterns. The birth of a genius, and even more so the acquisition of a certain body of knowledge by him, can only be considered as a random process.

However, the phenomenon of science as a social institution can also be viewed from the point of view of the modernized theory of the noosphere by V. I. Vernadsky, reflected, in particular, in (Suleimenov et al., 2018; Bakirov et al., 2021). The proposed interpretation of the noosphere can be briefly explained as follows. Consider two people entering into a dialogue. It is customary to say that in this case two individuals exchange information, but this is nothing more than an approximation, and a rather rough one at that. In reality, there is an exchange of signals between neurons that enter the brain of the interlocutors, i.e. interpersonal communication leads to the emergence of a common neural network. Continuing this reasoning, we come to the interpretation of the noosphere as a global neural network.

Further, the exchange of signals localized within the brain of an individual gives rise to such entities as the mind, consciousness and intellect of a person. Similarly, the exchange of signals between neurons of the global neural network generates non-trivial information entities of a transpersonal nature, or rather, a transpersonal level of information processing. The appearance of such entities is due to the fact that the "information capabilities" of neural networks depend non-linearly on the number of neurons - otherwise it would not make sense to create neural networks from an increasing number of elements, as is the case in practice (Shazeer et al., 2017).

At the level of correct mathematical models, this conclusion was substantiated in (Suleimenov, et al., 2022), and in (Suleimenov et al., 2016; Suleimenov et al., 2021), specific examples were presented that illustrate it at a qualitative level. In particular, it was shown in (Suleimenov et al., 2016) that the voting council, under certain conditions, is converted into a neural network, and in this case, the decision is made not by the totality of those who participate in the voting, but by the transpersonal information system formed by them.

Information objects that are formed at the transpersonal level of information processing may have a different nature. One example is any of the natural languages. This is an information object that is by no means localized in the memory of individual people; it exists and develops only through interpersonal communication. Umberto Eco (1968) expressed this metaphorically: "it is not we who speak the language, it is the language that speaks us" (p. 180).

Similarly, science, considered as a system of knowledge, is also a transpersonal information object. Additional arguments in favor of such a judgment are as follows. In accordance with the results of works (Suleimenov et al., 2020; Vitulyova et al., 2020), the human intellect, first of all, should be interpreted as an information processing system. It is obvious that if we consider science, understood as a system of knowledge, from this point of view, then it is impossible not to notice that the processing of information here is carried out precisely by collective efforts. Moreover, the neural network theory of the noosphere, embodied in the works (Suleimenov et al., 2018; Bakirov et al., 2021), makes it possible to reveal the essence and mechanisms of the emergence of the collective unconscious (it is appropriate to emphasize that the conclusion about its existence in the works of both Jung himself and his followers (Gullatz, 2010; Iurato, 2015) was made on purely empirical basis and until recently had no consistent theoretical justification). The neural network theory of the noosphere allows us to assert that, along with the collective unconscious, there is also a collective conscious, in whose area lies the phenomenon of science, understood as a system of knowledge.

Consequently, the generation of new ideas that underlie scientific revolutions can and should also be viewed through the prism of processes occurring in the collective conscious (interpreted as a structural element of the noosphere). Such processes have not been sufficiently studied, to put it mildly, but the very existence of a certain organized environment in which they occur allows us to assert that there is a basis for attempts to uncover the objective laws of "collective thinking".

More precisely, already at this stage of research, it can be argued that science as a system of knowledge is a kind of collective reflection: through this phenomenon, the noosphere as a systemic integrity comprehends and reflects itself (and the universe as a whole) also at the systemic - transpersonal - level. Accordingly, the question of the existence of objective laws of the development of science, in essence, comes down to the question of the existence of objective laws of thought. This philosophical problem becomes of practical importance in connection with developments in the field of artificial intelligence systems (Gabrielyan et al., 2022; Suleimenov et al., 2019), but its discussion is beyond the scope of this work.

Further, from the point of view of the neural network theory of the noosphere, the existence of objective laws of the development of science does not at all contradict the randomness of the appearance of one or another set of ideas, which becomes the basis of a new scientific paradigm (as well as the randomness of the birth of a genius). As science develops, the collective conscious comes to a point where resistance to innovation falls (according to the mechanisms) discussed in the previous sections. As a result, the generation of a wide range of very different ideas begins, the vast majority of which remain unclaimed. As an example, we can cite the situation that has historically developed in the field of computer technology, more precisely, its algorithmic basis.

The modern "digital world" is built on binary logic. However, as noted, in particular, in (Ivan'ko & Gasovich, 2016), ternary logic has many advantages over binary logic. Moreover, these advantages were realized in the "Setun" computer created in the USSR in 1959 and its subsequent modifications (Kalimoldayev et al., 2018). This example, among other things, demonstrates the rather complex and contradictory nature of the interaction between science as a system of knowledge and science as a social institution acting as a link with society. From a large number of ideas generated by science as a system of knowledge, a selection is made of those that turn out to be complementary to the processes taking place in society as a whole. Considering that the number of different ideas capable of becoming the basis of a new scientific paradigm was and remains very significant, it can be argued that the objective nature of the patterns of formation of scientific revolutions is manifested at least at this stage - at the stage of assimilation of scientific ideas by society.

However, it must be emphasized that the existence of objective laws of the development of science does not mean that its future is predetermined. The thinking of an individual person obviously obeys objective laws, arising at least from the features of the physiological structure of the brain, but this does not predetermine the direction of mental activity. Similarly, the existence of objective laws to which the collective conscious is subject does not predetermine the vector of development of science. Moreover, it is this factor that makes the establishment of objective laws of the development of science even more relevant. In particular, as shown in (Kalimoldayev et al., 2018) the further development of artificial intelligence systems can go in fundamentally different ways. The choice similar to the choice between binary and ternary logic has not yet been made.

One of the vectors for the development of artificial intelligence systems (Kalimoldayev et al., 2018) implies strengthening of the sovereignty of the individual, but there is also a pessimistic scenario - the degradation of the intelligence of the majority of the world's population.

The establishment of objective laws for the development of science, therefore, can be considered, among other things, as a search for a tool that allows, at a minimum, to exclude the most negative scenarios, i.e. the elaboration of the problems raised in the field of applied philosophy is indeed of urgent practical interest.

Conclusion

Thus, the interpretation of science as a social institution capable of generating intangible assets makes it possible to identify the basic dialectical contradiction between innovativeness and liquidity of the set of ideas that can form a new paradigm. It is this contradiction that gives rise to a change in scientific paradigms: the paradigm, which has high degree of liquidity, suppresses all the others, but this leads to the exhaustion of its development potential, which creates conditions for the development of another paradigm.

This interpretation allows, among other things, to interpret the nature of scientific revolutions with the help of analogy with the theory of innovation cycles, going back to J. Schumpeter's ideas.

Additionally, the report shows that the random appearance of a particular idea (or a person capable of generating such ideas) does not contradict the thesis about the existence of objective regularities that reflect the change of scientific paradigms through the mechanism of scientific revolutions. This is due to the fact that science as a system of knowledge can be viewed as a transpersonal information object. A consistent substantiation of the existence of such objects and their relative independence is given within the framework of the neural network theory of the noosphere.

Acknowledgement

This research has been funded by the Science Committee of the Ministry of Education and Science of the Republic of Kazakhstan (Grant № AP14870416).

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