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TO THE PROBLEM OF VALUE ORIENTATIONS OF SCIENCE

Summary

Based on the relation of the fundamental values "truth – the good", the analysis of some internal and external values of scientific knowledge is carried out. It is shown that the current stage of development of science reveals the changes in the functioning of these values: there occurs a definite "weakening" of the role of intrascientific values or the renunciation of them in individual situations. Along with this an increase in the role of external social and cultural values of science takes place.
Keywords: intra- and extra- scientific values, truth, system, logicality, scientific rationality, simplicity, beauty, efficiency, social practical significance

Introduction

Scientific knowledge in its dynamics is based on certain regulators – the axiological prerequisites of science, goals and values. They determine the direction of the further movement of knowledge and they must be discovered, guided by them in order to obtain scientific knowledge and foresee the consequences in the process of its implementation.

When considering the problem of value orientations of science, philosophers pay attention to its various aspects: their classification, the role of intra-scientific and extra-scientific values in cognition (T. Kuhn, H. Lacey, H. Putnam, K. Popper), the set and content of these values, based on consideration approaches (H. Lacey, T. Romanovskaya, V. Yakovlev), etc.

Aim, subject and research methods

The method of statistics is the analysis of low internal scientific and outer scientific values and the vision of transformations, changes in their role and significance in the minds of modern scientific knowledge.

To conduct a categorical analysis of the actualized problem and outline the relationship between its basic concepts, we use a number of theoretical methods of scientific research, including: analysis, synthesis, comparison, generalization.

Research results

By value, we will understand the significance of something for someone (i.e., the significance of X for S, or X is a value for S). In the case of scientific values, this relation is "immersed", respectively, in the context of science or the basic elements that constitute it – special knowledge, special activity and socio-cultural forms of its organization. If we are talking about X, then we mean, for example, such values as objectivity, truth, systemic knowledge, etc., and then it makes sense to talk about value orientations. If we focus on S, then it is more appropriate to talk about the value orientations of someone (including his methodological attitudes, advantages, tastes, accents).

The set of values X is divided into two subsets (which, in general, intersect) of intra-scientific and extra-scientific values. The first consists of those values (mainly of a cognitive nature) that function within the limits of science itself, the second embraces values that are external to science and indicate its sociocultural and socio-practical significance.

In general, the internal values of scientific knowledge are values and goals that are immanent for it, they are not characteristic of other types of cognitive and practical activities. Internal values are oriented within science and are its immediate standards, logical and methodological parameters, regulators of the correctness and legitimacy of scientific activity, criteria for assessing the acceptability and quality of its products (observations, experiments, facts, laws, theories, etc.).

The external values of science are the goals, norms and ideals of science that go beyond the boundaries of science and regulate its relationship with society, culture and their various structures.

Intra-scientific values are often justifiably called cognitive in the sense that they relate to the generation and functioning of scientific knowledge (i.e., cognitive activity), while extra-scientific values are more often related to the socio-cultural context. Among the philosophers of science who point to the role of intrascientific values in scientific knowledge, we note T. Kuhn, H. Lacey, H. Putnam, K. Popper.

In general, the set and content of internal and external values, as shown in the scientific-historical and modern methodological literature, are significantly different not only for different sciences, but also for the same science at different stages of its existence and for the development of science as a whole [Voznyuk A. V., Dubasenyuk A. A., 2011; Leysi H., 2008; Romanovskaya T. B., 2001; Yakovlev V. A., 2001]. So, for example, the value of the logical proof of scientific knowledge, its axiomatic construction has priority in mathematics, but not in history or even physics. In physics, the logical-conceptual reproducibility of phenomena, their exact quantitative description, experimental verification, and practical application come to the fore.

At the same time, values, as ideals, are the most stable formations, while knowledge, facts that do not relate to basic values can change quite actively.

As a basis for accepting theories, scientists identify possible sets of cognitive values: accuracy, logical consistency, predictive and explanatory potential, simplicity and productivity in setting research problems (T. Kuhn).

Some scientists pay attention to other values that can be attributed to cognitive ones: instrumental efficiency (H. Putnam), a high degree of falsifiability (K. Popper), the possibility of explaining through an assessment of strengths and weaknesses in historically previous theories (A. McIntyre). There are also those who believe that a set of cognitive values should not include simplicity or explanatory scale (Bastian van Fraasen), instrumental efficiency, since this is a social, not a cognitive value (E. McMullin) [Leysi H., 2008, p. 101]. The analysis of such disputes may be the subject of a separate study.

H. Lacey, analyzing the works of his predecessors, refers to cognitive values empirical adequacy, explanatory and unifying ability, the ability to accumulate opportunities (includes predictive ability, internal consistency, the source of interpretive ability and the ability to solve problems), simplicity [Leysi H., 2008, p. 106–110]. In addition to the above cognitive values, he notes those "that have historically proven themselves in other systems, actually functioning as criteria for selecting a theory, and, according to the scientist, the following are paramount: certainty, provability (as in mathematical proof), consistently materialistic metaphysical basis, popularity, compliance with "common sense", consensus on understanding the "reasonableness" of reasoning, usefulness of theory in the Baconian sense" [Leysi H., 2008, p. 111].

Based on the above review, we can conclude that there is no single clearly defined list of intra-scientific and extra-scientific values. These values may historically unfold and be re-identified, previously accepted values may be revised.

As a basis for bringing a sequence of value orientations, values on which scientific knowledge can be based, so that the resulting knowledge is scientific, we propose to put the subject area of the functioning of these values. From here, in our opinion, the considered values function for their significance (manifest themselves as a guideline that carries a “certain weight” for obtaining scientific knowledge) in modern science, in particular in natural science knowledge, in the following sequence: objective truth, scientific rationality, consistency, consistency, simplicity, beauty. Along with these internal values, such external values as efficiency, social and practical significance, and responsibility for the consequences also play a significant role today.

At all stages of the development of science, objective truth has been a significant intrascientific value. Science, the process of scientific knowledge from the beginning of its isolation, is focused on obtaining objectively true knowledge, such that is generally valid, independent of the individual and humanity.

Truth is the ideal of scientific knowledge. It provides, on the one hand, a reflexive-constructive development of criteria for the perfection and improvement of knowledge, and on the other hand, an assignment to a system of values in which the ideal of this perfection is determined contextually, through links with other value categories. Objective truth as a universal value of science has retained a relatively stable content for a long time within, mainly, natural science knowledge.

At the post-non-classical stage of the development of science, transformations take place in the interpretation of scientific truth: a departure from the traditional correspondent concept, the transition "... from truth as a cast from an object to truth as a way of interacting with an object ..." [Chernikova I. V., 2004, p. 94], when in certain situations of natural science knowledge (when substantiating highly abstract theoretical constructions), the coherent conception of truth becomes more adequate.

The coherent approach to the understanding of truth is widely used in mathematics, logic, theoretical natural science, where the most important sign of accepting a theoretical system is consistency. A demonstration of the coherent approach is the so-called "theoretical verification" by M. Bunge [Bunge M., 2003, p. 276–278], which takes place when justifying highly abstract theoretical systems under construction.

Another important intrinsic value of science, which has methodological significance for it, is scientific rationality. M. Savostyanova, revealing the principles of the axiological analysis of science, argues that "one or another type of scientific rationality is an independent value in science and has methodological significance ... Not a single fact will be recognized outside the accepted type of rationality. And, conversely, in its context, even a poorly verified or confirmed fact acquires the appearance of truth" [Savost'yanova M. V., 2009, p. 181]. We are also obligated to consider scientific rationality as an intrascientific value by the fact that the scientific community shares the relevant norms in its activities.

Scientific rationality presupposes a specific set of justification methods; a system of categories that serve as coordinates of thinking in a particular area; specific rules concerning the general nature of the objects under consideration, the clarity and accuracy with which they must be described, the severity of judgments, the breadth of data, etc.; certain examples of successful activity in this area. What methodological rules we elevate to the rank of canons of scientific rationality depends on our understanding of the specifics of scientific knowledge. Among them, in particular, include the possibility of empirical verification, experimental confirmation, criticality, meaningfulness, simplicity, etc.

Scientific rationality is a specific kind of rationality that is characteristic of science. V. Stepin distinguishes three types of scientific rationality: classical, non-classical and post-non-classical, which interact with each other, and the appearance of each new type does not cancel the previous one, but only limits it, outlines its scope [Stepin V. S., 2012].

It is extremely important to emphasize the special significance of the post-nonclassical type of scientific rationality in the development of modern society. After all, contrary to the thoughts of extreme anti-scientists who see science as an evil demon capable of destroying civilization, the way out of today's ecological and sociocultural situation, obviously, is not to abandon scientific and technological development, but to give it a humanistic dimension. It, in turn, raises the problem of a new type of scientific rationality, which explicitly includes humanistic guidelines and values.

Scientific rationality at the present stage of development of science is a heterogeneous complex with rather complex interactions between its various historical types. In particular, there is an increase in the degree of freedom of activity (above all, the activity of a theoretician), a kind of redistribution of priorities as value components in the system of norms of scientific rationality. In scientific knowledge, there is a process of liberalization of the criteria of scientific rationality, which manifests itself in the form of certain “refusals” from traditional, more “hard” cognitive norms [Ratnikov V. S., 2004].

The next important intra-scientific value is axiomaticity, more precisely, the systemic nature of knowledge and the axiomatic way of its organization. The fact is that the axiomatic method is historically the first proper theoretical method of constructing knowledge, which gradually becomes in science the ideal of knowledge organization and the ideal of its conceptual perfection.

Unlike ordinary or spontaneous-empirical knowledge, scientific knowledge, as is well known, is characterized by a special organization and systematic character. All objects, phenomena of the world, facts, key concepts and terms, laws, hypotheses, models, properties, etc., the range of which is considered by a certain area of scientific knowledge, it seeks to reduce to one degree or another of integrity. Each new result in science is based on the previous one, each new statement is tried to be deduced from other true or proven ones. Such starting points in mathematics are axioms, and in the natural sciences – fundamental (empirically justified) laws. The ideal of such a systematization is the axiomatic method of organizing knowledge in mathematics and the hypothetical-deductive method in the natural sciences.

The axiomatization of science is closely connected with the processes of mathematization, since this principle underlies the construction of mathematics itself. In the period of classical natural science, a characteristic feature of the mathematization of physics was, first of all, that mathematics among theoretical physicists carried an instrumental function.

During the formation and development of non-classical physics, mathematical forms begin to "actively manifest themselves" in the form of mathematical hypotheses. An example of the successful implementation of this method was the change by W. Heisenberg and M. Born of the form of the canonical Hamilton-Jacobi equations, which consisted in replacing numbers with matrices. In a similar way, J. Maxwell obtained the equations of the electromagnetic field, E. Schrödinger – quantum mechanical equations, and P. Dirac – the relativistic equation of the electron.

In modern physical theories, the mathematical apparatus is an inseparable part of them, mathematical studies receive physical realization, without them it is impossible to formulate a theory. In modern physics, mathematical forms, along with the conceptual one (formulation of empirical material is carried out with the help of certain forms of thinking, concepts, statements, hypotheses, etc.), have instrumental and codification functions [Ratnikov V. S., 1995, p. 83].

Science, throughout the history of its development, in addition to striving for the clarity of the knowledge system, inherent in the desire for its logical rigor. Within the framework of scientific activity, not just new knowledge is valuable, but rationally substantiated knowledge, which includes the requirement to satisfy the laws of logic. Obtaining logically controlled knowledge is a value that regulates scientific activity.

However, the real movement of scientific knowledge often requires violations of strict logic. They stimulate the accelerated development of scientific thought, the emergence of ideas that create fundamentally new approaches. Here we can recall the paradox in describing the radiation of a completely black body, which forced M. Planck to introduce radiation quanta, as well as the paradox of N. Bohr's theory of the atom and his postulates. But these violations are perceived by the scientists themselves as those that need to be eliminated. And this means the existence as an intra-scientific absolute of the requirement of the logical validity of science.

The need for logical control, the requirement for clarity of judgments, clarity of definitions, the rigor of a logical conclusion – all this does not always contribute to the success of obtaining new knowledge. To gain new knowledge, a "logical jump" is needed, which is carried out by intuition. And only then the tradition prescribes to justify this jump logically, to give the new knowledge legitimacy, the status of scientificity. Science spends a lot of effort on this, passes new knowledge through logical "filters" and looks for ways to bring it into a logical system.

Among a number of internal values that scientists are guided by in the process of cognition, they distinguish such aesthetic attitudes as simplicity and beauty.

By simplicity, some understand harmony, elegance and other aesthetic qualities. For others, behind this definition is: thrift; economy of wording; efficiency in explanation, prediction, etc.; deployment of the "simplest" mathematical equations available; conceptual clarity, "clarity and distinctness" (R. Descartes), understandability; an idealization that provides a reference level and a departure from which can be easily explained; the presence of relevant analogies with other theories (N. Campbell) and formalizability. Simplicity also implies coherence (E. McMullin), conformity, homogeneity (W. Newton-Smith), epistemological conservatism (B. Ellis), or rejection of ad hoc characteristics [Leysi H., 2008, p. 109–110].

In Western philosophy of science, the interest in simplicity has been inspired by efforts to rationally reconstruct the procedure for choosing between empirically equivalent theories that claim to theoretically explain the same area of empirical evidence. Since it is impossible to choose between these theories, if one remains within the empirical criterion, non-empirical considerations are included as a choice. One of them is the criterion of comparative simplicity.

K. Popper, analyzing the concept of epistemological simplicity, identifies it with the degree of falsification and concludes that "simple statements should be valued above less simple ones, because they tell us more, because their empirical content is greater and because they are better verifiable" [Popper K., 1983, p. 188]. Thus, simplicity is one of the methodological principles of cognitive activity. Simple theories are easier to test, and this is its (simplicity) value for science.

Beauty is another value guide in choosing a scientific theory as a scientific one. The beauty of a scientific theory is closely related to simplicity. A simple theory (from the point of view of its expression), but a meaningful theory that covers objects and phenomena widely, can be considered beautiful.

According to one of the definitions, which goes back to antiquity, beauty is a measure of harmony, truth, consonance of the Cosmos, it is "the correct coordination of parts with each other and with the whole" [Geyzenberg V., 1987, p. 269]. Mathematics better than other sciences falls under this understanding. W. Heisenberg noted that "in this case, the parts are the properties of integers, the laws of geometric constructions, and the whole is obviously the underlying system of mathematical axioms, covering arithmetic and geometry and ensuring their unity with its consistency" [Geyzenberg V., 1987, p. 269].

One of the traditional criteria of beauty is the ratio of chaos and order, when an object devoid of internal organization is not considered beautiful. Aesthetic pleasure comes from the discovery of a pattern that is hidden in an imaginary chaos.

Beauty in science arises when three conditions are combined: the objective correctness of the decision, its unexpectedness and economy. From the point of view of epistemology, it involves saving forces and identifying the shortest path to the goal. Beauty in scientific research involves reducing the complex to the simple without losing content. W. Heisenberg believed that such a reduction is achieved in the process of scientific activity by the discovery of a general principle that facilitates the understanding of phenomena and is perceived as a manifestation of beauty. For modern theoretical physics, the unification of four types of interactions into one final theory would be, on the one hand, a victory, and on the other, it would be beautiful.

Outstanding physicists and mathematicians of the twentieth century. often expressed the idea of the operation of the principle of simplicity in science, since the scientist, like the artist, strives for harmony, beauty and order. Thus, beauty serves as an important condition for the search for truth, and epistemology has an aesthetic dimension.

Intrinsic values are weighty, but not the only regulators that determine scientific knowledge. Together with them, a system of extra-scientific values operates, which affirms the ideas of utility, practical, applied component, and the necessity of science for society.

Being a part of culture, science depends not only on scientific traditions and values proper, but also on the norms and attitudes of the entire human culture. The ideas of the determinism of science by other forms of cultural creativity were expressed as early as the beginning of the 20th century, for example, by O. Spengler. His idea of cultural determination of scientific knowledge is recognized and developed both in philosophy and in science itself. The outstanding physicist E. Schrödinger spoke like O. Spengler: "there is a tendency to forget that all natural sciences are connected with a universal culture and that scientific discoveries, even those that seem at the moment the most advanced and accessible to the understanding of a select few, are still meaningless outside their cultural context" [Prigozhin I. R., Stengers I., 1986, p. 61].

In recent decades, thanks to the formation of post-non-classical science, science is recognized as a form of cultural creativity that cannot exist outside of cultural value norms and attitudes. The own internal development of science demonstrates the possibility of its approach to that vital world, which was once opposed by the idealized world of science. Therefore, today, to a certain extent, it is difficult to abandon such socio-cultural factors, external values of science as efficiency, social and practical significance, responsibility for the consequences, etc.

Efficiency characterizes science in terms of its effectiveness, as a producer of new scientific knowledge and its introduction into science and practice.

The cognitive activity of human society is aimed at obtaining information related to the objects of the material world, and transforming it into an ideal education – scientific knowledge. In an ideal form, information becomes publicly available, suitable for distribution in time and space.

For self-managed systems, it is important to accumulate information that contributes to their most efficient functioning and development. The greatest value is the information that contributes to the generation of new information. From these positions, science can be considered as a specialized subsystem as part of the most highly developed system on Earth – human society, which generates the most highly valuable information – scientific knowledge.

The process of producing new knowledge consists of at least two main operations: obtaining new information about the object of study and its theoretical (logical) processing. The value of the acquired knowledge depends on the results of these operations. The contribution of the acquired knowledge to science is all the more significant, the greater the degree of its novelty and the higher its theoretical level (information capacity).

Despite the fact that modern science continues to claim the role of the main supplier of knowledge about the world, blind faith in science is a thing of the past. The socio-practical significance comes to the leading positions. This is due to the growth of the technological application of science, which manifested itself in a qualitatively new stage in the development of science and technology, as well as their interaction with society and is expressed in the formation of technoscience. In it, the leading roles are played not by fundamental ones (they are more often a possible consequence here), but by applied research, which is predetermined by the social order. The traditional understanding that science generates scientific knowledge that finds technological application has become a thing of the past. Today, "the very activity of obtaining knowledge is "embedded" in the processes of creating and improving certain technologies" [Yudin B. G., 2006, p. 590]. The goal of scientific activity is not to obtain true knowledge, but to obtain an effect that can be embodied in a technology that is in demand.

Science, having rejected any philosophical claims, also becomes a kind of business that forms the worldview and value orientations of its participants. The social order, which is well paid, today is a significant factor in the choice of objects of knowledge and directions for the movement of research activities. And in post-non-classical science, which depends on other socio-cultural institutions, social order, the needs, goals and values of society, this is precisely the situation that takes place. As noted by V. Kizima, "the era of gain gives rise to a corresponding worldview of a person, and with it a public attitude, leading, in the end, to a well-defined cultural-historical paradigm. Today it is completely determined and has already embraced the spiritual sphere. This is ... nomadic heroism with its arche – money, for which everything is exchanged, just as with Heraclitus everything is exchanged for fire" [Kizima V. V., 2005, p. 189]. The modern financier J. Atalli draws attention to the same situation in his work "The Horizon Line". The foregoing, in fact, is a value orientation of modern society, which is directly related to both science and the scientist.

Science and technology evoke many different often conflicting associations in society today. On the one hand, they provide us with comfort, make life safe and secure, on the other hand, undesirable consequences appear: environmental pollution, climate change, social conflicts. Obviously, humanity must bear responsibility for the consequences caused. One of the reasons for these consequences is the constant expansion of the possibilities of mankind through science and technology, the belief in the certainty of their progressiveness and the elimination of criticism of their successful development.

The issue of undesirable side effects of science and technology was not previously in the focus of scientific and public discussions. According to Ar. Grunwald, there are two reasons for this: "firstly, these negative and undesirable consequences of the manufacture or use of new technology were initially considered negligible compared to the advantages and achievements" [Grunvald Ar., 2011, p. 116]. Because of the existence of the idea that the environment around us, beyond its scale, is so much larger than emissions that nothing threatens it, and its resources necessary for humanity are unlimited. "Secondly, it was tacitly assumed that all the negative consequences of scientific and technological progress could be solved with the help of it itself, i.e. mainly on the basis of natural science and technical knowledge, and future equipment and technology will be able to eliminate all these negative consequences better than the old ones. Thus, the solution of these problems can be moved from the present to the future" [Grunvald Ar., 2011, p. 116]. Over the past decades, these arguments have been discredited by the current state of the biosphere, and today there should be a completely different understanding of the relationship between science, technology and society.

It is obvious that society should influence scientific and technological development. But how accessible is it to public control? Indeed, from the point of view of technological determinism, it occurs according to its own laws. Behind the foreseen goal-oriented intentions of the participants in the formation of technology, an "invisible hand" is hidden – economic pressure on technology through market mechanisms, the foreseen emergence of technology from the application of uncontrolled development of natural science, etc.

The sovereignty of science and the freedom of scientific research are increasingly associated with social responsibility. Attempts to relieve oneself of such responsibility, explaining it by epistemological or methodological reasons that determine the logic of the development of science, the logic of a particular study, are unethical. To be in an exclusively cognitivist position in relation to science is becoming increasingly incorrect.

Conclusions

Real science is inseparable from its social context. Scientific institutions are often strongly dependent on politics, economics, and ideology and turn out to be tools in the hands of the latter, means through which their interests are introduced into science.

Within the framework of classical ideas about the values and goals of science in general and the scientist in particular, the priority belonged to the knowledge of truth. Her accomplishments are considered a boon to humanity. Today, in the post-non-classical period, this position is preserved only in individual cases, but I would like to believe that it is preserved. However, other reasons also appear: it is necessary for a career; this is required by the social order; the scientist performs the work area as a member of the group; his earnings depend on it, etc.

Nevertheless, whatever changes the values of science and the values of the individual scientist experience, it is impossible to imagine the existence of the modern world without science. As shown by the analysis of the value orientations of scientific knowledge, at the present stage, there is a certain "relaxation" of requirements ("reassessment" of intra-scientific values) or the rejection of some of them in certain situations.

At the post-non-classical stage of the development of science, transformations take place in the interpretation of scientific truth: in certain situations of natural science knowledge, there is often a departure from the classical correspondent concept and an appeal to the coherent concept of truth. In scientific knowledge, there is a process of liberalization of the criteria of scientific rationality, the influence of the aesthetic values of simplicity and beauty. There is also an increase in the role of socio-cultural values.

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