Systemic Concept of Science as a Tool for Resolving Certain Science Problems

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Abstract–**Due to scientific progress the questions about the goal, the real object and the limits of science are being asked again. New values related with science appear too and enter into relations with the old values of science such as truth, good and beauty, causing confusion about what is important about science at all. The paper presents a view of science which tends to eliminate these problems and tensions. The view suggests treating science as a system – a system of knowledge and human actions, and investigating it using general system theory notions and categories. It is supposed to help us to determine the right relations between different values of science and to understand that science is not an isolated thing, but a totality which is not just a sum of its parts. The concept can be seen as a tool for dealing with certain problems within science and managing science.**

Index terms–**Science, system, integrity, utility, truth.**

I. Introduction

Carefully observing the world one can easily notice that in the face of techno-scientific progress and as the answer for new social needs, various new branches of science are constantly being formed. They appear so suddenly, their development is so dynamic and their results so surprising or even shocking that the basic questions like: *What science is supposed to serve for? In what manner? And within what limits?* are brought out again. In fact, these questions are questions which methodology of science describes as questions about determinants of nature of science. The determinants are: the object, the method and the goal [1]. If, considering new circumstances in which science is now, we are asking questions about its determinants again, it seems there is a time to revise and re-define the determinants. Moreover, it is necessary to revise values related with science too, since different people expect different things from science. The problem with values is a problem of tension between different, sometimes opposite or contradictory values we associate with science. It seems that the biggest tension occurs between values such as truth – since ever related with science and utility – a new value which is expected from science nowadays. Determining the right relation between these values and revising the determinants of nature of science are one of the most important tasks of philosophers of science nowadays. But the solution we will get depends first on how we understand science at all.

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II. Problems about Science

There is a group of scientists and philosophers, like Evandro Agazzi, Mario Bunge, Fernando Broncano or Javier Echeverría, who believe that many problems we are dealing with in science nowadays could be solved and science could be well-managed if we consider it as a system. That is to say, if we start to understand science in the categories of Ludwig von Bertalanffy's general system theory. Especially the issue of knowledge management using this point of view is widely accepted and promoted by various researchers and teachers [2]. Before we go into details about this idea, let us first underline what kind of problems, according to the authors, this idea could deal with when it comes to science. Though problems being mentioned are many, let us briefly recall just the basic ones. The author of the idea of system in general he proposed to treat science as a system and found various problems which could be seen by his successors mentioned above too.

He claimed, for instance, that nowadays the specialization of scientists has gone so far that each scientist is highly focused on his own (narrow) area only, without being actually aware of what his colleagues from other areas of science do and what their results are [3]. We could simply call it a lack of communication between specialists from different domains due to high specialization. It is too obvious to analyze what danger for the development of science this problem brings. Moreover, lack of communication or low communication between various branches of science is related with another problem – cooperation in between science [4]. Though we could think that scientific cooperation is doing pretty well, we need to consider that it is so mostly between branches which are close one to another. What about branches which are not? When there is no communication and no cooperation or their level is low, the integrity of science is in danger and that is another issue mentioned. As a result of above, it happens sometimes that the results obtained by one group of researchers are (unintentionally) doubled by the other group, discovering exactly the same regularities, principles etc., causing problems like waste of energy and resources – the unnecessary and unwanted thing in science [4]. As we can see, though the list could be much longer, there are many problems observed within science. According to systemic view thinkers this could be changed it if we follow systemic way. How does it look like?

III. The System of Science and its Characteristics

Having as a base the theory of Bertalanffy (perhaps yet

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not new but widely accepted in various grounds), the authors such as Evandro Agazzi and the others claim that science is a system, precisely "a system of knowledge and human action" [5]. And system, according to Bertalanffy himself, is a "group of elements in interaction" [6]. Analogically to what Bertalanffy said about system in general, treating science as a system requires understanding description of this system. Two things are necessary here: to determine what elements form the system and to determine what relations between them exist. The authors reserve though that they do not want to investigate just the elements of science themselves, but mostly they want to investigate the relations between these elements. It is also necessary to determine certain characteristics of the system of science.

And so the thinkers such as Agazzi claim that the system of science, just like any other system, is set in a certain background – the background which affects the system, and which is affected by the system, so both change [7]. Science, however, is a specific system – a system of human actions, so it is not set in one particular background, but in various backgrounds: biological, social, political, religious, economic, etc. For the same reason (meaning because of the human factor and social character) science is an open system – a system that enters into relations with its background, it is to say in relations with different systems [8]. Moreover, it can react on potential external threats and adapt itself to new circumstances (it is an adaptive system). Besides, the system of science is able to change itself and/or change its background intentionally. On the other hand, the background can change the system of science through certain actions called impacts. Impacts cause certain reactions in the system of science – the reactions which serve to keep the system alive. One of the most significant among all exterior impacts are so-called "pressures" – impacts that can cause the damage of the system [9]. There is also a wide range of very particular features of system of science which are called "emergent features" and are characteristic for the system of science only [10]. Describing them could be a question for a separate article.

Science, being a system, as we all know, can be characterized by two relevant variables: creation of new knowledge and dissemination of knowledge with purpose to deepen our understanding of the world and support human action. Another variable is making predictions which are then used/applied by technology producing certain things [11]. As it is not so difficult to realize, there is a whole host of variables. However, it would be really hard to find them all. That is why the thinkers suggest making so-called "conceptual analysis", that is to say "to condense the wide range of variables to a few synthetic variables" [12]. The thing which needs to be done first then is to specify if certain parameter is an "entrance" or an "exit" of the system of science. Agazzi, for instance, in the same paragraph talks about 3 classes of entrances: demands, enhancement and obstacles.

What is important, each "entrance" always creates a new "exit". This means then that scientific knowledge has its influence in its background causing its change, and changes in the background necessarily cause the formation of new "entrances" in the system of science (and each of the entrances belongs to one of the classes mentioned above). The model of the system of science, according to the authors, is a dynamic system model and only this kind of model is able to explain the complexity of the structure and functions of science. It is impossible to explain science through its interior structure's analysis which is in fact just purely theoretic explanation showing interior relations. It is impossible because the system of science is based on feedback actions, thanks to which the system enters into relationships with its background and thanks to which it stimulates itself [13]. Thus, the system of science is always an active system, and its activity takes various forms. Obviously we cannot deny that to understand the system of science it is important and necessary to investigate its internal relations too. For full understanding it is not sufficient though. Interactions between the system and the background are too visible and too important for the system and its functioning to be omitted in the explanation.

IV. Conclusion

Treating science in categories described above, according to systemic view supporters, protects us from thinking as if science was something closed and isolated from the rest of the world, something which functions on his own rules only. The mistake of thinking this way could be seen, as thinkers like Agazzi and the others claim, in the thought of structuralists, analytical philosophers or neopragmatists. Systemic concept of science, on the other hand, allows us to see that science for sure is a certain totality, but not isolated, totality which should not be understood only as a sum of its parts either. It should be understood in relation to its goal, because the goal is the thing which determines science as such. And the goal of the science is to obtain strict, objective and reliable knowledge and to satisfy the needs of the society. Furthermore, it is extremely important that the system of science is a human system – it is made by people, through people and for people. This means that it is necessary to keep this system alive and keep it working well because this system keeps humanity alive. Since there is always a human factor that needs to be taken into account anytime we talk about science, there will always be a question of responsibility related with the process of making science and obtaining its goals since responsibility is always related with any human action. And here the keynote for systemic concept of science lies – the system of science is also a system of human actions, therefore it is always related with responsibility. But there is another thing related with human action – a value. Whenever there is a human action, values appear too [14]. And the question of values is one of the most problematic questions when it comes to science [15]. Systemic concept is supposed to deal with it. Let us have a quick view at the issue

According to thinkers like Agazzi, the systemic concept allows us to see that the real problem about values and science is not that we have to find the right order to put the values related with science (such as truth, good, beauty, freedom, progress, utility, etc.) on the value scale. We should rather "find the right place for these values through active optimization of their reciprocal complex relations" [16]. Systemic thinking about science not only makes us realize that but also helps us to obtain this optimization. In

simpler words, the systemic concept of science tends to investigate and optimize relationships between various values related with science to make them as helpful for obtaining the goal of science as possible.

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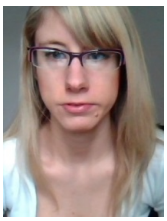

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