

The Necessary Triad: A Science-Education-Social Activity

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Abstract

Recently the earth population and its natural ecosystems exist in very complex and permanently changing living conditions, being economy, social, natural or technological ones. More than that, it lives in the conditions of a high complexity, and such complexities may vary in its quality, time and space. Another feature of such life is its permanently growing speed of various transformations that is conditioned by many unseen and still unknown metabolic processes. The global communication network has made the emergency cases inseparable feature of everyday life. There are no ways out of it, and humanity has to predict the coming transformations and to adapt to them. The development of such interdisciplinary model is necessary if humanity wants to predict the coming transformations and to adapt to them. It has to be done by joint efforts of the scientists, scholars, teachers and the volunteers including the grassroots activism of concerned people. The triad of a scientific community, teachers and the teenagers is the necessary precondition for the developing necessary efforts in many directions: the revitalization of a futurology, in prediction and mitigation of the critical situations (accidents, natural disasters, and hybrid wars), and in the development of interdisciplinary researches. Gradually civilian volunteers are becoming more professional and mobile teams of civilian rescuers. Today, an individual safety has turned in a matter of each person, family or social group while the science-education-social activity triad has become a necessary precondition of survival.

Keywords

Globalization, Hybrid, Interdisciplinary Research, Metabolic Processes, Science, Teachers, Time, Triad, Volunteers, Russia

1. The Research Problem

Two years ago the UNESCO's Public Committees argued for the merging of its Committees for Natural and Social Sciences, and such merging had already happened. This decision has been absolutely right but still insufficient. What we actually need isn't their merging only but their capability to translate the results gained out by one discipline to the languages of all the rests. That is *I'm coming out in favor of an interdisciplinary approach* in the study of any natural, social and technical phenomena.

But the said above is correct in a particular moment i.e. in relation to the phenomenon in a fixed space-time dimension. Although, recently such phenomena are the developmental ones, and such developments necessarily mean a new relationship between its qualitatively different parts. It signifies that I should lay down point by point the essence of interdisciplinary approach as I understand it.

First, a reality in which we are living is a complex phenomenon (Keen, 2008). And the glue making it as a whole is the various *constructive or metabolic processes*. Besides, the very term "complex" has at least two meanings: a kind of hybrid, natural, social or technically constructed, and a certain integrated wholeness i.e. living organism of a very high complexity. In the case of the hybrid systems the leading role belongs to the designers and engineering while in the latter case when the organism uses and reworks the necessary resources and releases the wastes, an interdisciplinary approach is necessary.

Second, in the processes of construction, the leading role is playing by the craft of mutual adjustment of different structures and processes (say, in the process of designing and construction of a plane or a ship). In the living organisms we are mainly dealing with various metabolic processes that may have very different character: a one-sided transformation, domination or even mutual annihilation.

In this last case, an access to necessary resources, their packing, transportation, retail and their consumption are the processes for the maintenance of any living organism. Of course, such "living chains" may be very different that is dependent on various conditions both from the access to necessary resources and the needs of a particular organism.

Third, under the conditions of the "Internet Galaxy" both constructive and metabolic processes are highly dependent on global conditions (war or peace, access to necessary resources, their quality and use values, etc.). And under high degree of the interdependence of the all with all, these values (costs) may be highly varied.

Fourth, it is just very case stimulated the transnationals to shift some enterprises into the developing countries in order to join their financial resources with very cheap labor forces. In other words, these companies usually gained an additional profit by means of shifting the metabolic processes to the necessary resources.

Fifth, in other cases such companies act vice versa: they transport the cheap labor forces to the places of extraction of necessary resources. But in all already mentioned and other cases the information and transportation means play a key role.

Sixth, the most difficult and the least explored issue is a *global metabolism*. Until we were using the biosphere concept of the turnover of a matter and energy in it was more or less clear because it may be schematically presented as a three phases turnover: the producers—the consumers—the decomposers (i.e. the reducers; the details in: [Levchenko et al., 2017](#)).

But already in the 1920s the Russian physicist [A.L. Chizhevsky \(1924\)](#) empirically showed an impact of the solar electro-magnetic radiation on a behavior of human masses. We are now living in a qualitatively new global milieu which I've called *the socio-bio-technical sphere* (hereafter the global SBT-system) that is impossible to depict and to study in the above scheme of the biosphere turnover. Therefore, the backers of the techno-sphere concept are absolutely wrong.

Seven, an entirely new situation has emerged, and it signifies that an interdisciplinary of the global SBT-system is needed, and a team of various scientists together with the practitioners and the experienced people should develop the new concept of the global SBT-turnover.

Eight, it is not an easy task because for several reasons. First of all, there is no the Big Data about the key components concerning what particular new substances are produced by an integrated human activity and about their further circulation in a global turnover. For example, there is no data related to an overall sum of the greenhouse emission.

Ninth, what is a feedback impact of the poisoned air on global ecosystems? After then, is the only one this kind of feedback exerts impact on these ecosystems important, and if it so in what particular degree?

Tenth, what particular impact this feedback exerts and is this impact dispersing uniformly or by many other ways? And so on and so forth. In sum, a global turnover concept of its socio-bio-technical system is urgently needed.

2. An Importance of the Study of Metabolic Transformations

The metabolic transformations are one of key features of any living process. Every moment these organisms find or gain necessary resources for their existence and *reworking them* into inner resources for their further existence. The triad of the search of the resources, their consumption and decomposition is relevant here. These reworking processes are the necessary elements of any metabolic process.

It's indicative that V. Vernadsky suggested that a process of direct transformation of solar energy rays directly into a nutrition processes as the plants did every moment is possible in a future. Vernadsky called this phenomenon as an autotrophy of humanity ([Vernadsky, 1980: pp. 228-245](#)). A man, continued Vernadsky, is a social species, that is the heterotrophic one. The further the more

he will consume a limited resources accumulated in the run of many thousand years. The use of solar and wind turbine is also limited. Humanity by his growing consumption has transformed the equilibrium of the biosphere. A man has changed a character of many chemical reactions and has introduced many new ones. Therefore, a chemical synthesis of food would be radically changed the life of the global SBT-system and radically reduced the wastes production and their negative impact on the nature and humanity.

I'd like to underlie that these ideas has been produced by Vernadsky in the 1920s. He argued that already in those times humanity were guided by the ideas and concepts that had been no more fit to current reality. These warnings had been made the century ago! Actually, they meant that *even one hundred years ago a radical turn of global metabolic processes had already happened*. But humanity needed two world wars, many civil wars and ethno-confessional conflicts, and turn toward a consumer society mode of existence in order to realize that this mode of life and existence is leading to more (hybrid) wars and natural and technological disasters!

In the same years Vernadsky argued that if a direct i.e. *chemical mode of food production* will be opened, tested and organized it will radically change the life of global humanity (Ibid., pp. 240-241). But the great scientist underscored that this question isn't a "chemical" but social one. It follows that the studies of the metabolic processes are at least an interdisciplinary process but the social ones in their essence. The more wide generalization made by Vernadsky sounds that an earth life is a planetary (cosmic) phenomenon. That is, referring to A. Chizhevsky and many others one may state that the metabolic processes are planetary (cosmic) phenomena as well.

As to a social metabolism, it is Janus-like. On the one hand, it's tightly connected with the natural (geo-chemical) processes because such metabolism is a part and parcel of struggle for living resources, geopolitical domination and a particular mode of living. On the other hand, it's *the social metabolism as such*. It represents an exchange of the news, knowledges, crafts, of the social and status positions and so on and so forth (Yanitsky, 2013). But the social metabolism is dependent on a degree of development of various technologies. On the one hand, the social metabolism depends on a character of human relationships, say, friendly, neutral or adversarial. On the other hand, it depends on social technologies, and first of all of the mass-media and social networks (Arsenault & Castells, 2008).

Besides, the social metabolism as such is represented by a tough struggle between the people who wants to defend their privacy and the individual, group and state hackers who strive for this privacy destruction with the aim to manipulate the people of various social ranks (Bauman, 2001; Friedwald & Pohoryles, 2013). These works analyze a potential impact and its side-effects of the emerging computer technologies and their relationships with basic individuals' and dominating society values. As the above authors argued, "the technology influ-

ences people's understanding of privacy, and people's understanding of privacy is a key factor in defining the direction of 'further' technological development" (Friedwald & Pohoryles, 2013: p. 1). But at the same time, an all-embracing and all-penetrating character on modern networks is a real danger for individuals and the whole global society. In any case, the new type of conflict has emerged: between the comfort of using modern gadgets and a treat to a people's privacy and safety.

Finally, an entirely new realm of an interdisciplinary analysis has emerged. I mean the relationships between a society and the nanotechnologies, biotechnologies and cognitive sciences (Asher, 2002). This issue deserves a special analysis. So I'd like to mention here the only one clearly seen distinction: the people who concerned about their privacy in traditional sense of the term (my house is my fortress) and those who make their private life a maximally accessible to all. It's not an anomaly, but it is the wish to escape from a feeling of the loneliness and total exclusion from social life. I call this realm as conflictual field between two men: the social and the technologically-engaged ones. Are they tending to merge as well? Or one of them will take over?

3. Metabolic Transformations Require an Interdisciplinary Approach

This absolutely obvious true is often missed both in the scientific concepts and empirical researches. It's well understandable because such concepts are much easier to construct and to carry out the empirical i.e. field researches. But in this very case we are fixing a certain and one-sided feature of the object in question and aren't capable to understand its complex structure and possible lines of development.

After the Chernobyl disaster and its long-term after-effects many European scientists began to develop various concepts of a risk society. The leading figure in this realm was the German sociologists U. Beck (1992, 1999) but even that outstanding theorist and researcher never draw attention of his readers to the phenomenon of metabolism and to a necessity of the interdisciplinary studies. The threats, risks, after-effects and some other notions represent a carrying framework of his concepts and projects. I understand his wish to give an all-embracing concept of that world-size disaster, but why Beck never interested by a multisided structure of the above after-effects I cannot understand. To my mind, such global phenomenon as the Chernobyl disaster is full of short-term and long-term metabolic transformations spreading in nonlinear space-time rhythms had been obvious and gave to many Russian and foreign researchers the impulse for continue their studies in interdisciplinary manner.

On the other hand, such critical events (Yanitsky, 2014) gave another impulse for the feedback research that is to the studies of long chains of after-effects and the processes of adaptation to new living conditions. It's well understandable that in a critical situation is rather difficult to study the effects of mutual trans-

formations, destructions and other after-effects. But the processes of adaptation to new state of matters take usually a long time in which the researcher could carry out his studies. Nevertheless, I'd like to mention that the information gained by the insiders situated in the epicenter of the critical event is the most valuable. Anyhow, be it a "normal" or critical situation the knowledge received by the insides in situ is the most valuable.

4. How the "Triad" Is Shaping?

First and the most important is mutual understanding between the participants of the triad. This triad has two decisive measures: the horizontal and vertical. The horizontal one means the understanding between the natural, social and technical sciences as well as between the theorists, researchers and practitioners. Actually, it's a rather difficult task because since the Enlightenment times the all above communities developed separately. And their "separatism" has been fixed institutionally.

We meet the same difficulty in the processes of resolving the following task, namely between the theorists, researchers and practitioners. The matter is that the all them belong to different social institutions (business, scientific, executive and many others) and accordingly financed from different sources. Besides, these institutions are directed and regulated by different codes (directives, instructions, protocols, etc.) and are used different languages. More than that, their mode of thinking (reflection) is different.

The vertical measure of the above triad consists in contradictions between the projects, plans and decision-making on the one side and those who will realize (implement) these plans and decisions. A historical experience of our country gave a lot of evidences of a permanently existed gap between the former and the latter. There is nothing to surprise because of the time gap always existed between the ideas, decisions and the processes of their realization. And the time pressure created by the shift toward the ICR is growing every moment. This is so typical situation that *the developers have to act according to circumstances*.

I'm already hearing the objections and accusations that it will lead to total distraction of existing institutional system. Never, But let's look at the existing situation calmly.

Firstly, the compression of all abovementioned institutional systems generated by a work of modern information systems is an obvious fact.

Secondly, the time distance between a particular idea (plan or project) and its practical realization is compressed to the days, hours or even minutes. Under conditions of current international tension our security is measured by the flying time of a space rocket.

And thirdly and the most important, our entire world is becoming more and more integrated by a numerous metabolic processes. It signifies that our world is rapidly moving from the hybrid phase of complexity towards the phase of nearly total integration. That is to the phase in which socio-bio-technical systems will

dominate. It means that such highly-integrated systems are needed in the highly-integrated institutional structures.

How to resolve that three very complicated issues? The key principle here I see in a kind of a parallel movement: to refine the methods of prediction, construction and the after-effects of making the hybrid things and the development of a kind of highly-integrated systems as the living organisms and natural ecosystems.

Looking at this issue more widely I'd say that the human history is full of examples of the so-called universal people. Leonardo di ser Piero da Vinchi (1452-1519) is the classical example. Russian history gives a lot of such examples: M. Lomonosov, D. Mendeleev, V. Vernadsky, P. Kapirza, F. Shtil'mark, A. Yablokov and many others. My brother-in-law Vl. Lichtenshtadt and my uncle O. Schmidt had also been universal persons. My own life-story has been also a kind of combination of a painter, architect and city planner, designer, environmentalist and finally the sociologist. The Noble laureate academician Piotr Kapitza when he had been discharged by J. Stalin constructed at his summer-house a workshop to construct the devices in which he had been needed, said that sometimes the experimenters is much more important than a theorist.

But nowadays, we are urgently needed not only in the particular universal persons but in the complex highly-integrated system of quick process from a design to an end-product. Two criteria are dominated: a minimum time and energy expenses and for the whole process and its maximum integrity.

Let me note that even in the 1925 the outstanding Russian theorist and practitioner A. Bogdanov wrote that "we are approaching to the universally-generalizing methodology of the current research... Such approach should embrace all possible real and future issues to be resolved." And further, "we obviously see a necessity of the development of universally-general methods of organization of our life...An energetic approach put the limit for the splitting up of organizational experience...The energy transformation gave us an all-embracing methodological viewpoint developed by the physical-chemical sciences. The biological sciences are stand firmly on this road. The social sciences are lag behind in their development due to a very complex character of the objects they studied and some uncertain public and ideological reasons, nevertheless they are moving in the same direction because of their rapprochement with the biological sciences" (Bogdanov, 1925: p. 4, 9, 10).¹

5. Why the Teenagers Are Interested in Public Participation?

I've been often asked the question: Why do the teenagers and the youth have been interested in a participation of the adult volunteers and other people in a protection of their urban and country environments? I see the following reasons of their activity.

¹To my mind, this and other works of A. Bogdanov had been the foundation of a systemic approach in relation to the conditions of building a socialist society in Russia. These works had been written nearly fifty years before the works of J. Forrester, the USA.

Firstly, the young and adults consider a particular area as their own irrespectively of its actual belonging because they spent a lot of time here playing, speaking, communicating and so on and so forth. In any way, they see this yard as their own habitat.

Secondly, as concerns to the young, it has been a reciprocal interest to learn something new, to make by their own hands, to observe how the trees they planted are growing, etc. To bubble or to lounge about is one matter but to make something useful is quite another.

Thirdly, in the countryside especially in the remote provinces of Russia the teachers are only the persons who can supply the schoolchildren with a useful knowledges and crafts, and such process may be interesting to them. This conclusion has been made on the study of a set of the schoolchildren conferences on various forms of the teenagers' participation in a protection of their small settlements and ecosystems around (see: Children's..., 1998).

Fourthly, the above interest is sharply growing when it was going about not a kind of regular work (cleaning a particular territory, planting the trees, etc.) but if it has actually been something entirely new, for example an idea and the project to transform a certain town in a kind of an "eco-polis" i.e. the project of the town based on ecological principles. In our case it has been such project to be realized in the town of Pushchino, one of the centers of a bio-chemical research near the Moscow megacity.

Fifthly and is a very important principle. The schoolchildren have participated not only in elementary operations (cleaning, planting) but have been gradually involved in all aspects and deeds connected with the designing and realization of the "eco-city" project (for example see details in the collection of essays called the "Eco-polis" is a model of a future city, 2013). The presentation on that Conference have embraced more than the hundred themes ranging from an ecology of plants, animals and social ecology as such till a very problematic issues such as a psychology of a stress and the SMS-mania. I consider such gathering as a very important preparation process to a mastering of the "Science—Teaching—Social Activity" triad. It's rather important that by means of such gatherings an integrated interest of children to explore their macro and micro worlds and to participate in their transformation or protection is maintaining their interest and ability to become not the passive observers but the rescuers and volunteers.

Another facet of such collaboration is of a no less important. In our times when the gap between the young and the elderly is rapidly growing it's very important their collaboration in doing such interdisciplinary projects on equal grounds. To work together is the best mean for mutual understanding of the people of various ages². My long-term study of Russian nature protection movement showed how young persons from a remote Russia gradually became

²My own life confirms this statement because my "big family" had been very diverse: the scientists and scholars, doctors, military persons, volunteers, public figures, Polar researchers and many others. Their role in the shaping of my professional biography and adherence to the interdisciplinary approach cannot be overestimated.

the leaders of various divisions of this movement, and some of them are now become the participants of a global environmental movement remaining at the same time the leaders of local environmental initiatives³.

6. A Research, Teaching and Civil Activism Potential of the Volunteers

As my previous investigations showed, the process of integration of natural, social and technical sciences isn't socially constructed but it is the process resembling real processes of integration of the natural, social and technical ecosystems and the involvement in their study both the scientists, scholars and volunteers.

For the theoretical purposes I'd divide the processes of their mutual rapprochement in some phases. The first one is an impact of the one on the other that resulted in well-known various side-effects of such one-sided contacts. *The impact is here a keyword.*

The second, the hybrid one is much more complicated. The hybridization of the things, mainly the instruments of production, and of some processes (like in a steam-engine) is based on the crafts and knowledge until now. The craft mode of production isn't equal to an industrial one. It should take into account both the craft and various knowledges. Therefore, *a combination of a manual and industrial production is a keyword here.*

The third one is an integration of the previous two with the knowledge about the various metabolic processes. It's neither an impact nor a hybrid because it is an integral i.e. systemic whole. But once again: any systemic (integral) knowledge has to be a result of an interdisciplinary study plus the methods of converting it into social action! That is *an action (activity) is a keyword here.*

Our world is organized in such way that all above steps, i.e. the studies, construction (hybridization or making something integrated) and a social acceptance or resistance are deeply institutionalized. It means that in-between of the above steps there are a lot of an intermedia links which are slow down not only the processes of production and consumption but our response to the risks and threats from the outside.

There are two ways out of such deadlock situation. The former is maximally to compress our response to the challenges from the outside and inside. And the latter is to learn to work interdisciplinary and to make the results of such integrated research easy accessible and well-understandable to the volunteers and to other concerned people. The matter is that the volunteers have to be able to think and work interdisciplinary as well.

I've tested this idea empirically and it is appeared, that it has already been realized in the Russian sciences and environmental movement (Yanitsky, 2005).

³The life story of Russian volunteer Evgenyi Simonov is the best example. He passed the way from the member of the Russian students' nature protection movement (so-called the Druzhina movement), and he is now one of the leading civil experts estimating the "One Belt—the One Road" transboundary project developed by the China's developers and their alliance. Recently E. Simonov is actually the global volunteer. But in contrast to Greta Tunberg he is well-experienced person because he had already participated in many global environmental projects as an expert or the critic.

But, of course, that project has been based on a few cases. In order to introduce such integrated approach in a social practice it will need the radical transformations in a set of institutional systems and first of all in a secondary school and the higher education.

7. The Steps of the Shaping of an Interdisciplinary Volunteers' Team

Basing on my forty year experience of the studies of the relationships between the scientists, teachers and civil activists both in Russia and abroad I think that it's a schematic presentation of the process based on my personal experience. An ideal example is the process of the organization of the "Doctors without Borders" team but it's an exceptional case. To my mind, the necessary steps are as follows:

1) The choosing the issue for such work because the shaping of the volunteers' team is highly dependent on the character of an emergency case and local conditions;

2) An understanding of the degree of its complexity, mobility and urgency plus an estimation of local people potential for the resistance to a given critical situation. It's necessary to take into account such characteristics of the situation as its phase (the beginning, after-effects, etc.), type, and scale. Such information may be gained either from the authorities or from the insiders;

3) A selection of a personal membership of the volunteers' team that conditioned by many variables: the type and scale of the critical situation, the degree of destruction, the activity (resistance) of the state rescuers, local authorities and affected people, by the type of the affected human settlement and its usual mode of living, etc.;

4) An estimation of the will and ability of local authorities to collaborate with the volunteers' team. We encounter here with widely-spread so-called "demonstrative practice" of these authorities who till the last moment stated that the "All under their control", i.e. they are waiting the command from the above;

5) The case of nomad people who lives by a hunting and fishing deserves a special attention because their camp is so rare that the state rescuers cannot be everywhere. The only way out is the making the volunteers from these people in situ.

Until now, I draw the readers' attention to the conditions in which the state rescuers and the volunteers belongs to quite different institutions, of the state and civil society ones. But the modern conditions as a compression of the time, the possibilities offered by the global information network and the navigation systems as well as by a growing number of the retired state rescuers allow me to state that the difference between the state rescuers and civil society volunteers begins gradually effaced. Two changes should be taken into account. The former is a growing number of all kinds of the emergency cases while the latter is a rising concern on everyday safety of the ordinary people. As a result, *the emergency cases are becoming an inseparable feature of everyday life*. What changes I

foresee in the shaping of an interdisciplinary volunteers' team?

6) The institutionalized division of social, natural and technical sciences should be decidedly to overcome because it's no more fits to an integrated character of human life and his environment;

7) It means that the volunteers' activity is becoming highly integrated as well. In turn it means that the volunteers should simultaneously be a researchers and teachers;

8) In doing that, we have to select the activists which are both well-educated and experienced people;

9) In turn, it signifies that the children have to learn what the safety is, and how it should be reached. It simultaneously means that the realm of the volunteers' activity is expanded;

10) Our studies showed that the interdisciplinary teams are easy to compile if its members have a common attitude toward an interdisciplinary approach and work;

11) It should be recognized that such teams are easier and faster shaping by the representatives of natural sciences because they have a common "energetic" foundation;

12) My personal observations showed that the sociologist who came from the environmental, urban and other technical sciences are perceive the principles of the interdisciplinary approach much more easier than the alumni of the sociological departments. The best example of how the scientist and teacher turned into a civil activist is in (Yanitsky, 2005).

8. Conclusion

Recently the earth population is living in permanently changing living conditions, being economy, social, natural or technological ones. More than that, it lives in the conditions of a high complexity, and such complexities may vary in its quality, time and space.

Another feature of such life is its permanently growing speed of various transformations that is conditioned by many unseen and still unknown metabolic processes. There are no ways out of such permanently risky processes except the development of a model of that diverse and highly integrated process.

In other words, the development of such interdisciplinary model is necessary if humanity wants to predict the coming transformations and to adapt to them.

In order to escape to become a total appendage of the "smart machines", humanity has to define the limits of their interference into a private and social life. Any technological innovations have to be the instruments for various kinds of social activity only, no more. It means that people have to decide which functions might be given to a machine, and which aren't. To replace information wars by the wars conducted by the artificial intellects is a bad idea.

In all times the instruments of production had often been converted into arms but it is a wrong idea. The new instruments of production and arms of defense

have to serve human safety and wellbeing only.

Unfortunately, until now the huge arsenal of the instruments constructed for the information exchange is used for the maintenance of peace and the security is very rare. In this realm of social activity the militants are far ahead in comparison with the civilians. One shouldn't forget that privacy is one of the basic human rights guaranteed by the constitution of the RF.

Gradually civilian volunteers are becoming more professional and mobile teams of civilian rescuers. Today, an individual safety has turned in a matter of each person, family or social group while the science-education-social activity triad has become a necessary precondition of survival. It's a new form of the creative education combined with researches and social practice.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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