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Technical platform & basic design: challenge of new engineering phenomena (towards review of ontological basis of classical TRIZ).

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Abstract

Overall, the study aims to start the preliminary discussion concerning analysis and updating of the ontological foundations of TRIZ. Established in the mid-twentieth century, this theory was based on advanced for its time philosophical and methodological approaches and relevant to that time engineering practices. The main part of this basis has not lost its significance today, but it is clear that over the years the techno-sphere has got significant changes. Reflection and inclusion of them into the jurisdiction of the TRIZ methodology - a necessary condition for the development of TRIZ, maintaining its leading position in a number of substantive theories of development. From our point of view, main road of this update is to review and revise (if necessary) the basic provisions, postulates of TRIZ, called (in accordance with modern approaches of the philosophy of science) as "paradigm" or "ontology"[a].

In the main part of the study (sec1,2,3) we analyze, as an example, a fundamental concept of TRIZ - "Technical System" (TS), and its correlation with the relatively new phenomenon of modern techno-sphere - "Technical platform"/"Basic design" (TP/BD). In particular, we show that these entities have some specific characteristics of the development, not covered (described) in classical TRIZ laws for TS development (S-curves, ideatliy).

In the final part of the study we return to the discussion of the ontological problems of modern TRIZ. In addition to the full-scale application of "ontology" in works to organize, classify, and translate into computer language the existing provisions of TRIZ, we discuss the ontology analysis and progress *per se,* and the applicability of the concepts of modern science methodology to ensure this process.

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Keywords: TRIZ; TRIZ development, TRIZ 2.0, Technical system, Technical Platform, Basic Design, TRIZ ontology, Life cycle, Ideality;

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1. Structure and Life-Cycle (-s) of the technical object. Appearance of the "Technical Platform" and "Basic Design".

In classical TRIZ concept of Technical System (TS) and its life cycle defined in extremely abstract [2] [3], and at current stage this abstractness makes difficult the use of TRIZ-tools for the specific types of TS. Our research of modern engineering and manufacturing practice shows that TS may be attributed to the whole set of technical artifacts, such as:

a. Artificially implemented (reproduced) physical effect, which provides a particular function in the TS (TS is often referred to by the name of that effect, e.g. "internal combustion engine", "Nuclear Power Plant").
b. Set of supplementary physical effects, providing additional functions for the useful work of the main physical effect (for example, ignition for internal combustion engines or primary/secondary circuits for the NPP).
c. TS design – paper-drawings or CAD descriptive version of the TS, in which the functions and effects found their providers, bulk arrangement of elements performed, materials for their production defined (e.g., design-project for a nuclear power plant licensing and construction).
d. Specific, existing TS; design, embodied in the material.

Obviously, each of these entities has its "life cycle" from the point of view of the development process. Implemented in a specific TS physical effect evolves in the direction of greater manageability and efficiency; set of physical effects - into multifunctionality and reliability of the system. Are there any developments in TS design? Yes, obviously, during mass production the design is constantly the subject for improvements, primarily due to the "learning curve". Does not remain unchanged material object also. Typically, there is a process of constant improvements on large engineering structures, and most of them, besides, has a practice of full scale modernization, upgrade, update.

The question arises - which of the mentioned is *the* "Technical System" in the sense of classical TRIZ? What kind of thing - essence, substance - is the subject for development in accordance with S- carve law (see for example [2]). What do we improve? Formal response, arising from the classical TRIZ – everything, abstract S-curve law of development is applicable to any of the above mentioned levels of TS (a-d). But now it lost it's instrumental force, since does not describe the direction of improvement in the multilevel model of the TS life cycle. Real recommendations, arising from the S-curve law of development, are multidimensional, and the choice between possible directions is not regulated and is not standardized. In fact, the development of new TS is given to the misrule of "trial and error" method again, as it was before appearance of classical TRIZ.

Contemporary engineering practice solves this problem. Since non-systematic, unguided change of TS in the framework of mass production and global competition becomes ineffective, one of the answers is managing the development of the TS through the formation of a "Technical Platform" and "Basic Design"[b].

Here the citation from automobile industry research [4]: "Projectification and platform approaches have been two main transformation trends, implemented by industrial firms during 1990s. For those firms, innovation management no longer deals with introducing radically and totally new products, but rather with applying innovative features within the regular stream of products and platforms". There are some similar ideas from software engineering [5] "paradigm shift from target-specific to cross- platform applications could be foreseen in the mobile software industry. Development and marketing practices should understand this philosophy…". Development becomes a two-step process this way - first created TP/BD, and then, at its base, the designs of real products and their material embodiment are appear. TP/BD removes the part of overall uncertainty, reduces the dimensionality of the system of equations to be solved when creating a new object.

[b] Technical Platform usually used for the goods of mass production - cars, computers, etc. The scope of the term "Basic Design" - serial construction of complex engineering structures, such as nuclear power plants. Here in this paper we discuss commonalities of them, so use below abbreviation TP/BD.