

TRIZ BODY OF KNOWLEDGE

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INTRODUCTION

As the worldwide appreciation for TRIZ grows, its further development as a science is hindered by a number of factors. One of these factors concerns the somewhat fuzzy boundaries of TRIZ. Unfortunately, there are currently no TRIZ textbooks or training programs that are universally accepted by the global TRIZ community. This leads to significant differences in the interpretation of some key concepts, tools and approaches of TRIZ (and in some cases to their corruption). In addition, these discrepancies make it difficult to meet an increasingly tangible need for a globally authoritative certification of TRIZ practitioners.

To improve the situation, the International TRIZ Association (MA TRIZ), the Altshuller Institute for TRIZ Studies (AI), and the European TRIZ Association (ETRIA) have mutually agreed to define the TRIZ Body of Knowledge.

Hardly any scientific association, even the most respected and established one, is able to define with utmost certainty the boundaries of its “subject” science. Any science, TRIZ included, is an evolving entity, with its boundaries constantly being pushed forward. However, it is possible (and necessary) to identify and describe those elements of the sum total of knowledge in the given science that constitute its core and are accepted by the majority of leading experts.

Logically, a compilation of the body of knowledge of any scientific discipline should begin with the identification of its most important postulates. It should also involve the identification of this discipline’s structure. However, we realize that it will take a tremendous effort on the part of many experts to reach consensus on a set of axioms for TRIZ and its structure. It will also take a concerted collective effort to develop a comprehensive body of knowledge comprising the emerging science of TRIZ. This document represents a starting point for such a project. In preparing this document, we not only intend to lay the foundation for defining the boundaries and content of modern TRIZ, but also hope to open a discussion on these topics among the people for whom TRIZ has become a profession. We believe that such a discussion is necessary for the healthy development of TRIZ.

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Thus, the main goals of this document are the following:

1. Identify the basic concepts, components, and tools of TRIZ,
2. Foster further advancement of TRIZ by improving the understanding of its fundamentals.
3. Provide an objective basis for the certification of TRIZ specialists to minimize disputes concerning the requisite knowledge mandatory for specialist certification of one level or another.

SELECTION CRITERIA

In order to be included in the TRIZ Body of Knowledge, a TRIZ concept, component or tool must satisfy the following criteria:

- A. It has to be used by the majority of TRIZ schools in the world (not surprisingly, most of these elements of TRIZ were either authored and co-authored by or were developed in close collaboration with Genrikh Altshuller).
- B. It has to be used in the majority of non-commercial publications on TRIZ authored by TRIZ Masters
- C. It has to be used in the majority of TRIZ courses presently offered in the world

Presently, there are several new developments based on “classical” TRIZ, such as I-TRIZ, TRIZ_{plus}, TRIZ-OTSM, and some others. Although some of these developments are used by many TRIZ practitioners, they have not yet attained the status of being universally accepted and, therefore, are not included in this document.

This document contains the elements of TRIZ that are applicable mostly to technological systems. Those TRIZ elements that can be used primarily in non-technological areas (e.g., social sciences, art, pedagogy, etc.) may be the subject of some future codification effort. Altshuller’s other piece, *Theory of Creative Personality Development*, is also not included in the TRIZ Body of Knowledge.

WHAT IS TRIZ?

Premise: The evolution of successful technological systems is not random, but is governed by certain laws or prevailing trends.

Contemporary TRIZ is both a theory of technology evolution and a methodology for the effective development of new technological systems. It has two major subsystems based on the laws (prevailing trends) of technological system evolution: a set of methods for developing conceptual system designs and a set of tools for the identification and development of next-generation technologies and products.

TRIZ methods are based upon prevailing trends of system evolution (predominantly, technological systems). These trends were identified by examining statistically significant information from different areas of intellectual activities (mainly, technological innovation).

Important note: The names of some concepts and tools developed and used in TRIZ coincide with those in other approaches for enhancing engineering productivity that were developed independently of, and sometimes even before TRIZ. One example is Value Engineering Analysis (VEA), developed by Lawrence Miles and Yuri Sobolev: some of its approaches and tools are fundamentally different from those named identically in TRIZ.

Basic TRIZ Concepts, Components, and Tools

1. Foundational concepts

- 1.1. Dialectics as a philosophical foundation of TRIZ [1]
- 1.2. Directional evolution of technological systems [2]
- 1.3. Technological system [3].
- 1.4. Functions [4].
- 1.5. Ideal technological system [5].
- 1.6. Substance, field, sufield [6]. Substance-field resources [7].
- 1.7. Reflectivity principle [8].
- 1.8. Ideal substance [9].
- 1.9. Ideal final result (IFR) [10]
- 1.10. Inventive situation. Inventive problem [11].
- 1.11. Levels of inventions [5].
- 1.12. Contradictions: administrative, engineering, and physical [12].
- 1.13. System operator. Multi-screen scheme of talented thinking [13].

2. Trends (laws) and sub-trends (lines) of technological system evolution [14]

- 2.1. Trend of increasing degree of ideality [14]
 - 2.1.1. Mechanisms of increasing the ideality of technological systems [15]
- 2.2. Trend of non-uniform evolution of sub-systems [14].
- 2.3. Trend of completeness of system parts [14].
 - 2.3.1. Sub-trend of elimination of human involvement [16].
- 2.4. Trend of “energy conductivity” of systems [13].
- 2.5. Trend of harmonization of rhythms [13].
 - 2.5.1. Sub-trends of chronokinematics [17]
- 2.6. Trend of transition to super-systems [14]
 - 2.6.1. Sub-trend of transition from mono- to bi- and poly-systems [18]
 - 2.6.2. Sub-trend of increasing structurization of voids [19].
 - 2.6.3. Mechanisms of convolution (trimming) of technological systems. Coefficient of convolution [20]
 - 2.6.4. Sub-trend of deployment — convolution [21]
 - 2.6.5. Trimming of technological systems [22].
 - 2.6.6. Integration of alternative systems [22].
- 2.7. Trend of increasing dynamism [23]
 - 2.7.1. Lines of increasing dynamism [24]
- 2.8. Trend of increasing substance-field interactions [25].
 - 2.8.1. Lines of evolution of sufields [26]
- 2.9. Trend of transition from macro- micro-levels [27].
- 2.10. Trend of matching — mismatching (coordination - noncoordination) [21].
- 2.11. The general pattern of engineering systems evolution [28].

3. Algorithm for Inventive Problems Solving (ARIZ)

- 3.1. ARIZ — a program for inventive problem solving by identifying and resolving contradictions [29].
- 3.2. Main line for solving ARIZ problems and ARIZ logic [30].
- 3.3. Structure and basic notions of ARIZ-85C [31]
 - 3.3.1. Problems-analogs [32]

4. Substance-Field Analysis

- 4.1. Basic concepts and rules [6].
- 4.2. Standards for inventive problem solving [32]
- 4.3. Structure of the system of standards. System of 76 standards [33].
 - 4.3.1. Standards for system modification [33]
 - 4.3.2. Standards for system measuring and detection [33]
 - 4.3.3. Standards for application of the standards [33]

5. Techniques for resolving contradictions

- 5.1. Techniques for resolving engineering contradictions (inventive principles)
 - 5.1.1. 40 main inventive principles [34].
 - 5.1.2. 10 additional inventive principles [35].
 - 5.1.3. Duality “principle-anti-principle” [36].
 - 5.1.4. The Contradiction Matrix [37].
 - 5.1.5. Typical diagrams of engineering contradictions [38].
- 5.2. Techniques for resolving physical contradictions
 - 5.2.1. Separation principles [39].
 - 5.2.2. Using the separation principles at macro- and micro-levels [40].

6. Scientific effects

- 6.1. The concept of database of effects [41].
- 6.2. Physical effects [42].
- 6.3. Chemical effects [43].
- 6.4. Geometrical effects [44].

7. System analysis methods

- 7.1. Methods to search and formulate inventive problems [45].
 - 7.2. Flow analysis [45].
 - 7.3. Trimming (Ideal Functional Modeling) [45].
 - 7.4. Cause-effect Analysis. Formulation of key problems [45].
 - 7.5. Component-and-structural analysis [45].
 - 7.6. Diagnostic analysis [45].
 - 7.7. Evolutionary analysis [45].
 - 7.8. Function analysis [45].
 - 7.9. Integration of alternative systems [45].
 - 7.10. Failure-anticipation analysis [46].
 - 7.11. Super-effect identification (system improvement without solving problems [47].
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