



Lecture
Maker Faire Vienna, 5.5.2018



Become an interdisciplinary maker through TRIZ approach

**TRIZ: Creative revealing innovative perfecting
of creators, creations and conditions**

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Maker is a crafted and interdisciplinary innovator-creator who can make his concepts-ideas for real use.

TRIZ Approach: Creative revealing innovative perfecting of creators, creations and conditions

- leads to the need to search for the latest knowledge, deepening knowledge and expanding the insight,
- leads to high efficiency of work, which encourages sparing use of time and the best use of talent,
- leads to the need to collaborate with experts from other areas of knowledge, increasing the ability to conquer challenging interdisciplinary assignments.

Maker Faire is an event to "celebrate arts, crafts, engineering, science projects and the Do-It-Yourself (DIY) mindset". Promoting equity in the creator-maker movement is the basis for success for the participation-democratization to STEM (science, technology, engineering and mathematics) but also to art and conditions (the environment).



Center of Science Aurelium, <http://aurelium.sk/>, aurelium@cvtisr.sk

Please visit the Center of Science Aurelium, (named in honor of Slovak scientist Aurel Stodola), Bojnická 3, Bratislava

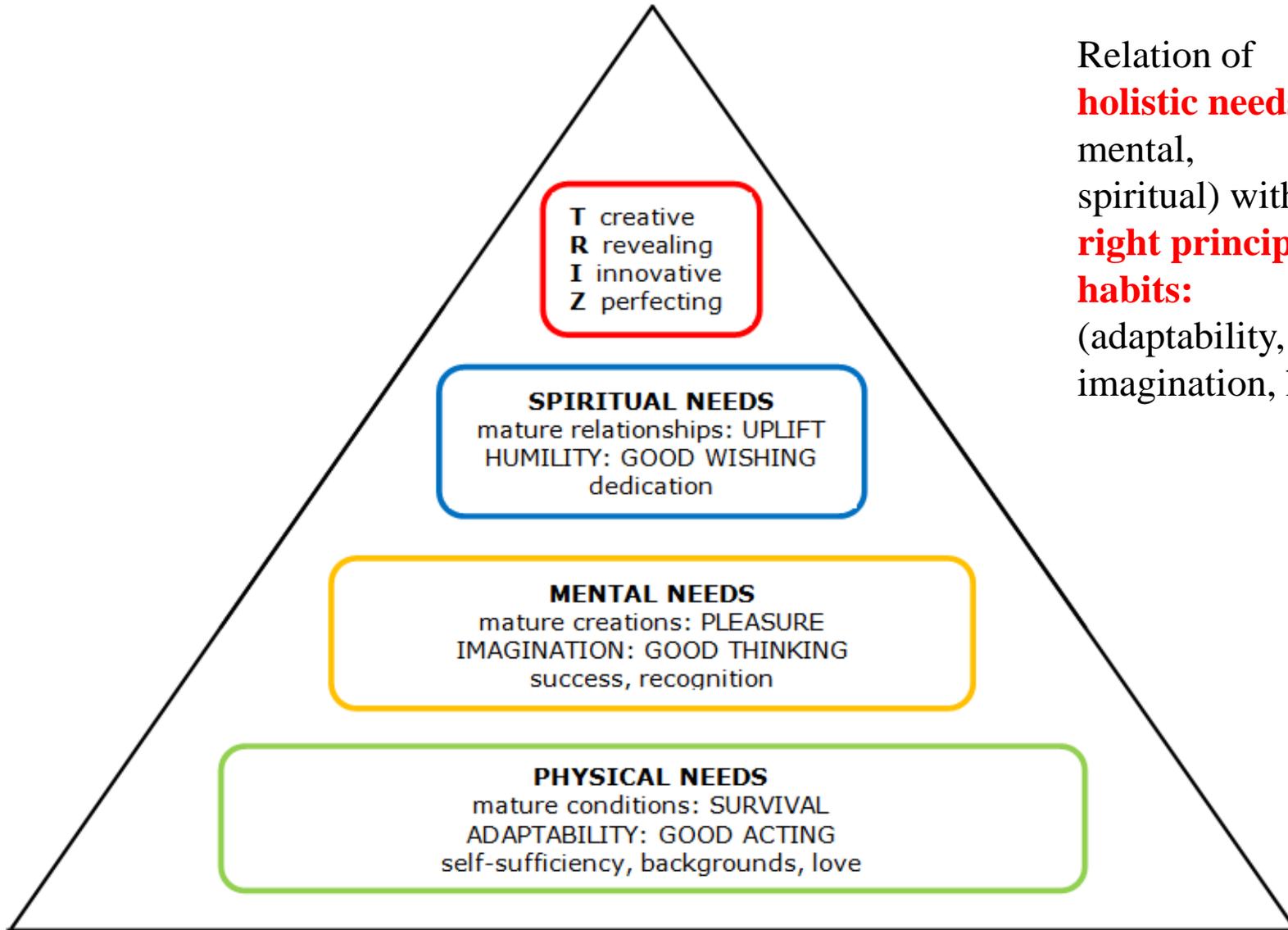


CVTI,
SOVA Digital,
Kvant,
STU Bratislava



Workplace: **ride comfort** and **driving safety** of a car

1. TRIZ approach helps to meet right needs, principles, and habits



Relation of **holistic needs:** (physical, mental, spiritual) with **right principles** and **habits:** (adaptability, imagination, humility).

1. TRIZ approach for perfecting creator , creation and conditions

The goals of mutual interaction-perfecting

- **creator (white yin):**

he can satisfy mature the proper holistic needs (physical, mental and spiritual),

- he chooses proper needs (inspirations-suggestions),
- he maintain proper principles (essence-truth),
- he has proper habits (mastery-humility)

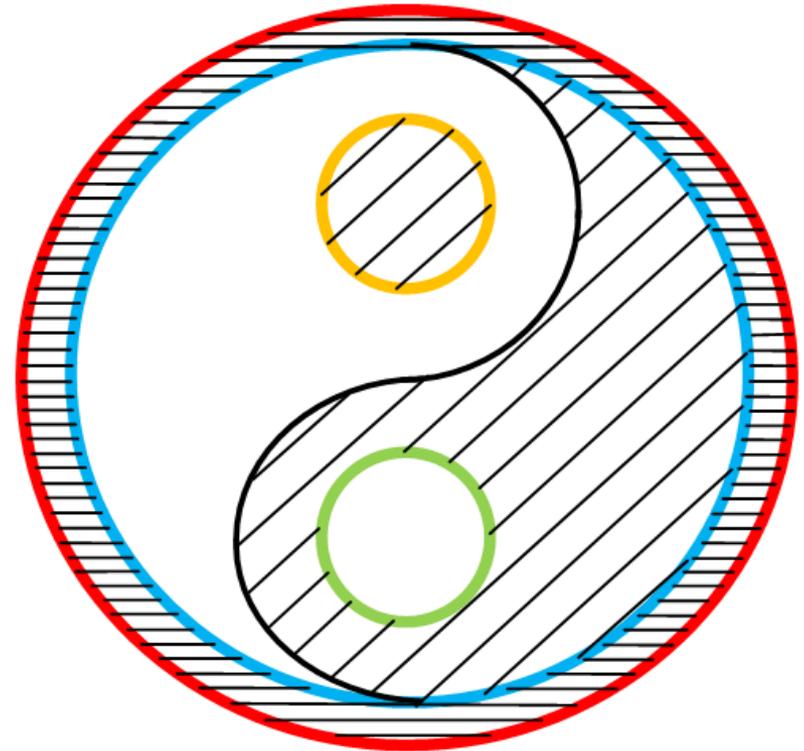
- **creation (black yan):**

via breakthrough essence it fulfills reliable and mature (saving, useful, successful) proper breakthrough mission,

- **conditions (outer circle):**

harmonization of maturity of

- creator (proper needs),
- creation (proper essence of mission)
- conditions (proper exploitation of resources).



1. TRIZ approach enables to meet requirements

Altshuller was the first in human history who revealed principles of inventing-perfecting (1946):

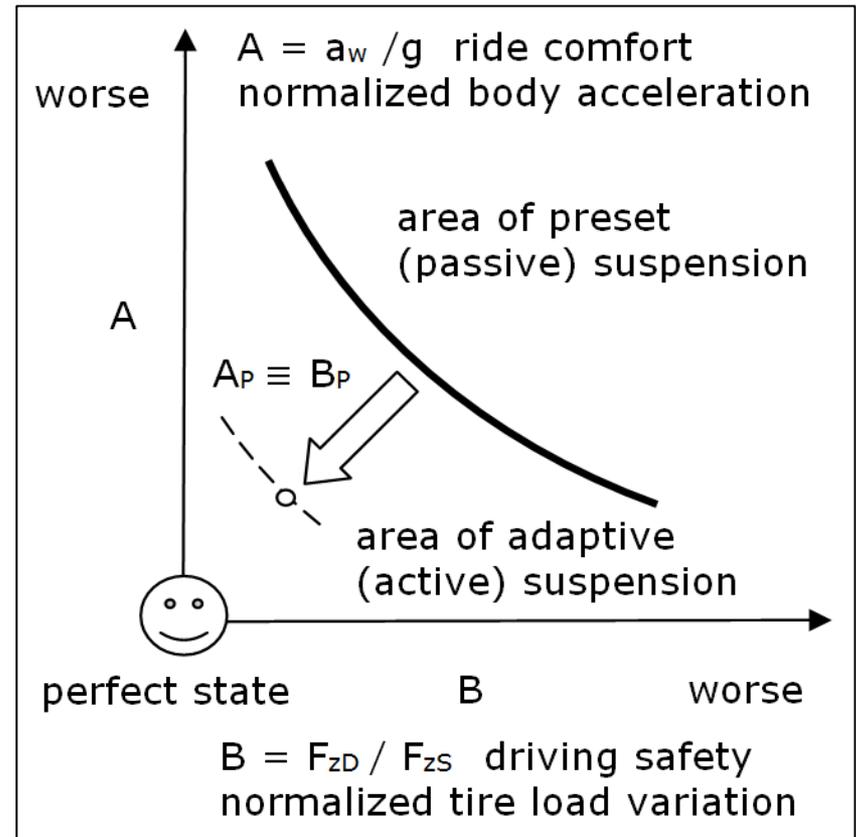
- **the principles of physical, mental and spiritual perfecting of creators** by analyzing the success stories of successful people,
- **the principles of perfecting of creations** (product: technics-work-goods, process: technology-art-service) by analyzing successful inventions,
- **the principles of perfecting of conditions** (the consistency of the maturity of the creators, creations, users, resources and amenity of environment) by the analysis of successful breakthrough changes in the history of humanity.



1. TRIZ approach enables to meet requirements

Altshuller has made surprising discoveries to build TRIZ approach dedicated to perfecting creations:

- in all successful inventions it was necessary to overcome contradictions, A, B,
it is necessary to identify contradictions,
- 99% of successful inventions use already known solution principle, the essence of fulfilling the mission
it is necessary to search for similar essence,
- new essence (discovery) of fulfilling the mission occurs only in 1% successful inventions,
it is necessary to discover a new essence,



1. TRIZ approach enables to meet requirements

Development of the creativity using the TRIZ approach

This **free book TEaching TRIZ at School** has been developed in the frame of the TETRIS project funded by the European Commission-Leonardo da Vinci Programme.

<http://www.tetris-project.org/>

The partners of the project consortium are:

AREA Science Park (Italy)

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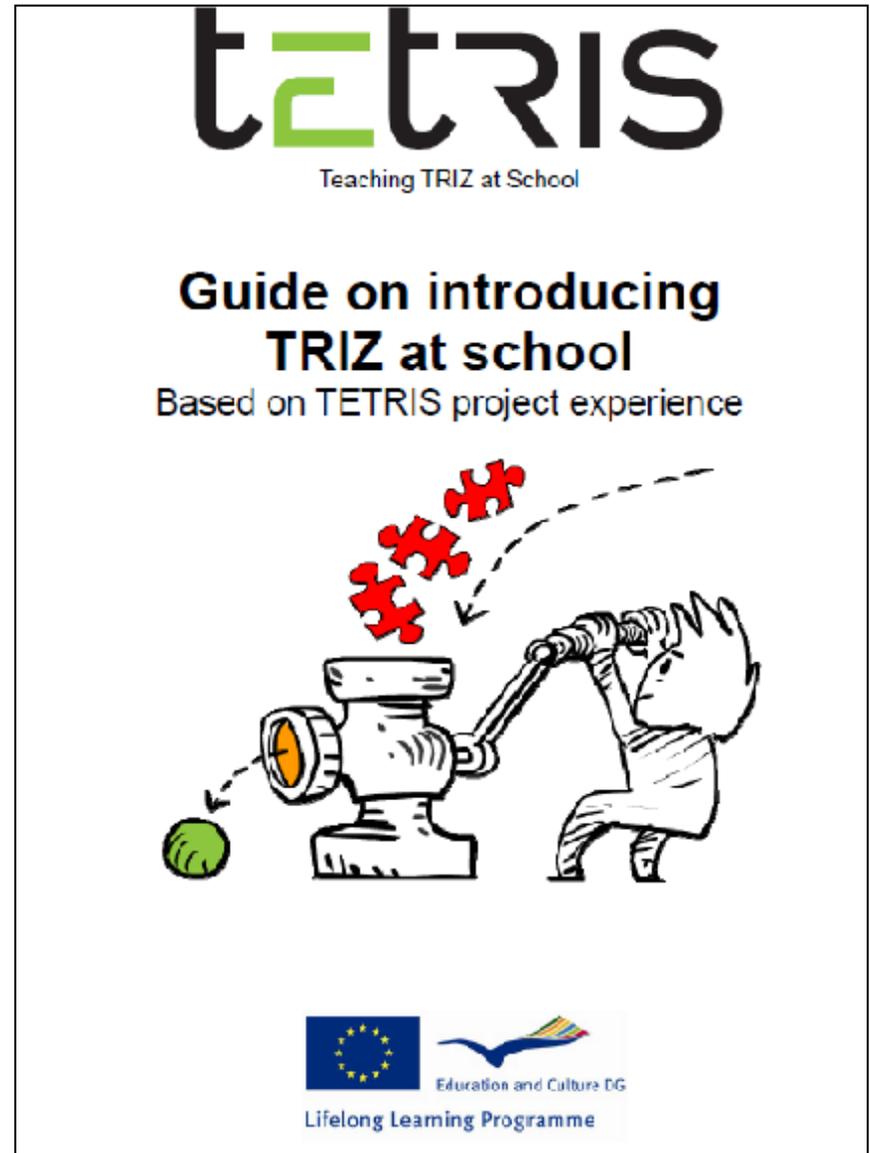
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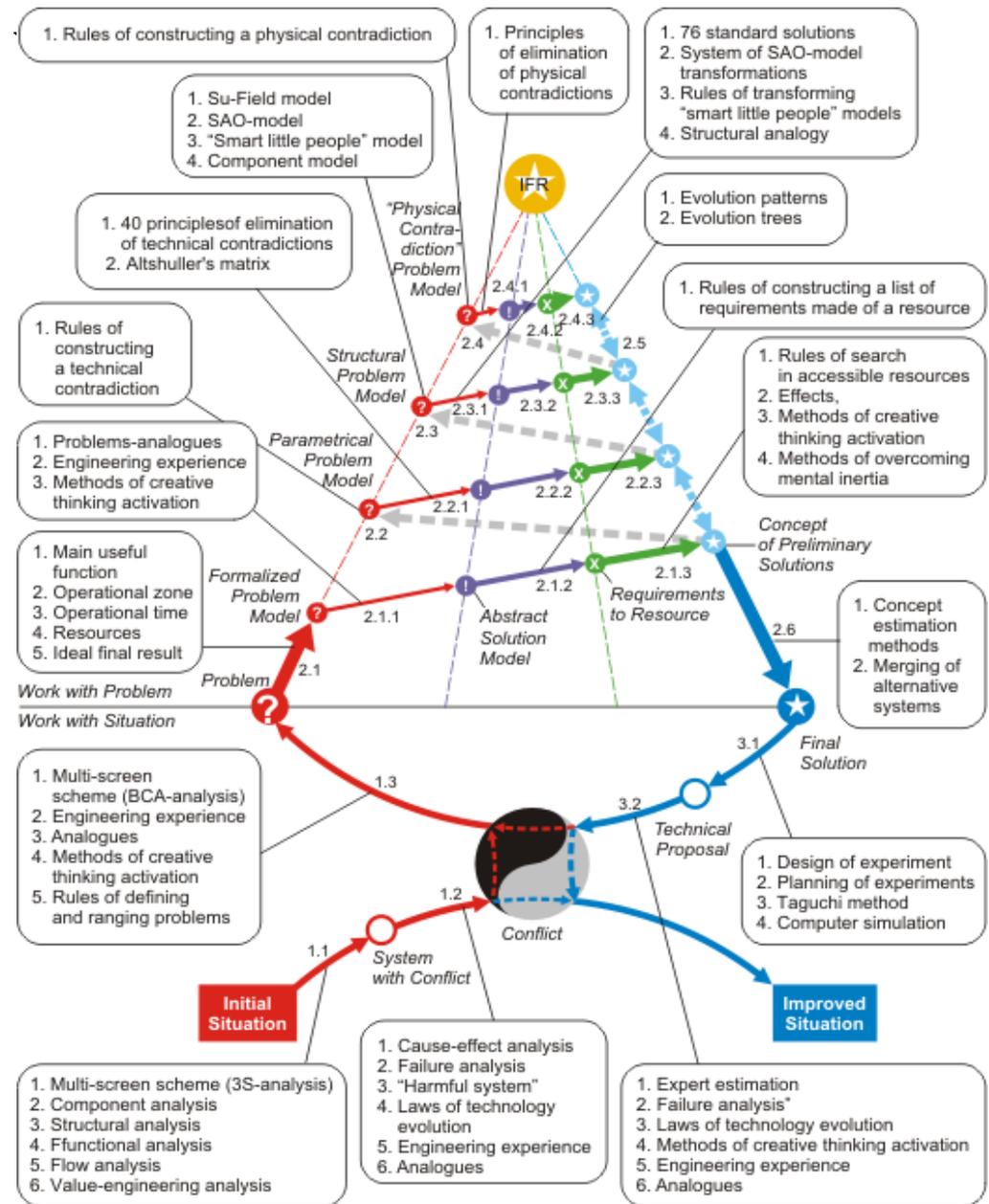
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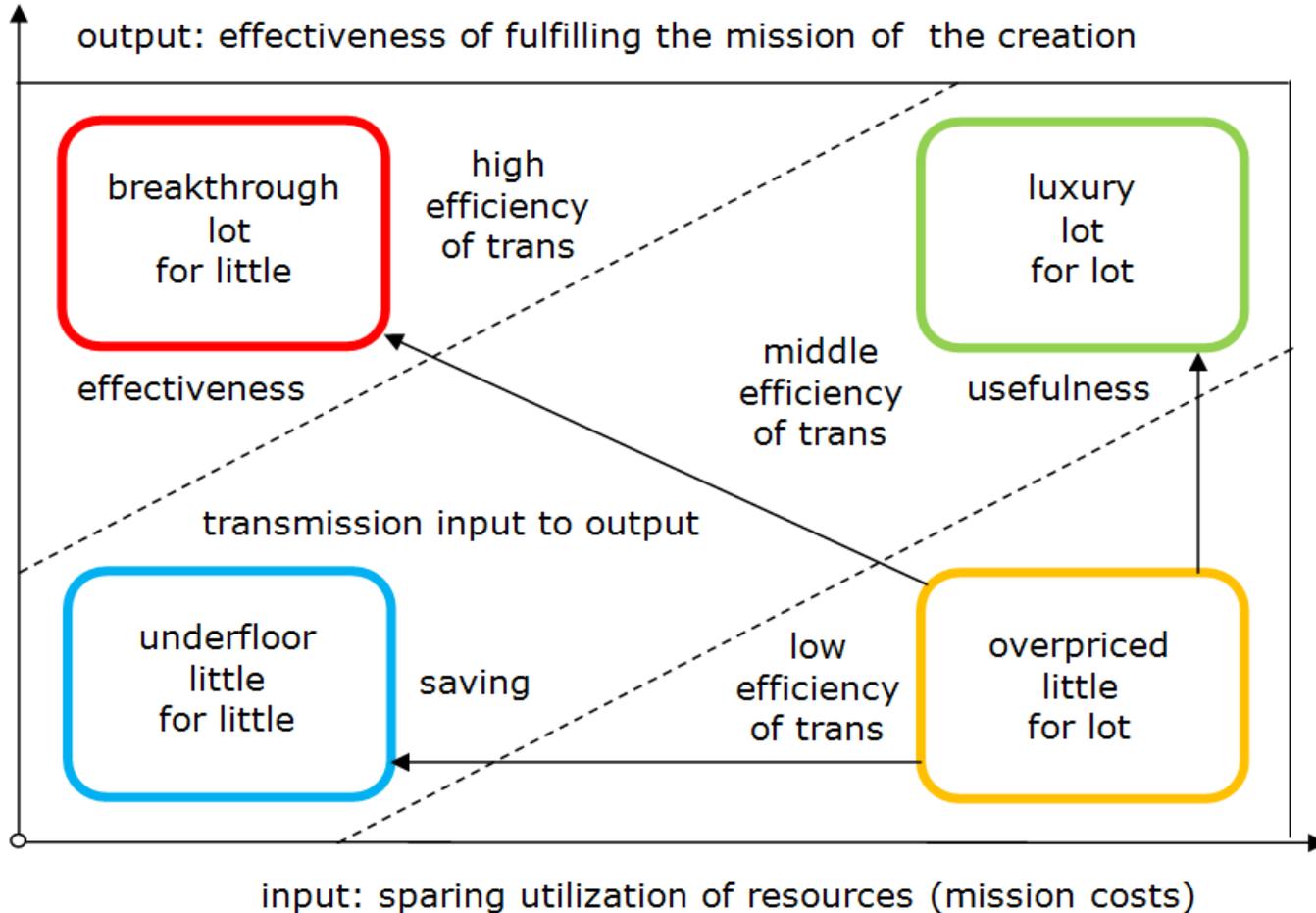
1. TRIZ: science and art

It the cycle of perfecting it is necessary to recognize and remove:

- the administrative contradiction: **challenge : statement of need,**
- the global-technical contradiction: **idea: discovery of principle,**
- the local-physical contradiction: **creation: breakthrough concept,**
- the production contradiction **prototype: much for little,**
- the instructive contradiction: **product: simple complexity,**
- the maturity contradiction: **goods: maturity compliance** and finally
- the holistic contradiction: **market: holistic perfecting to put all together**



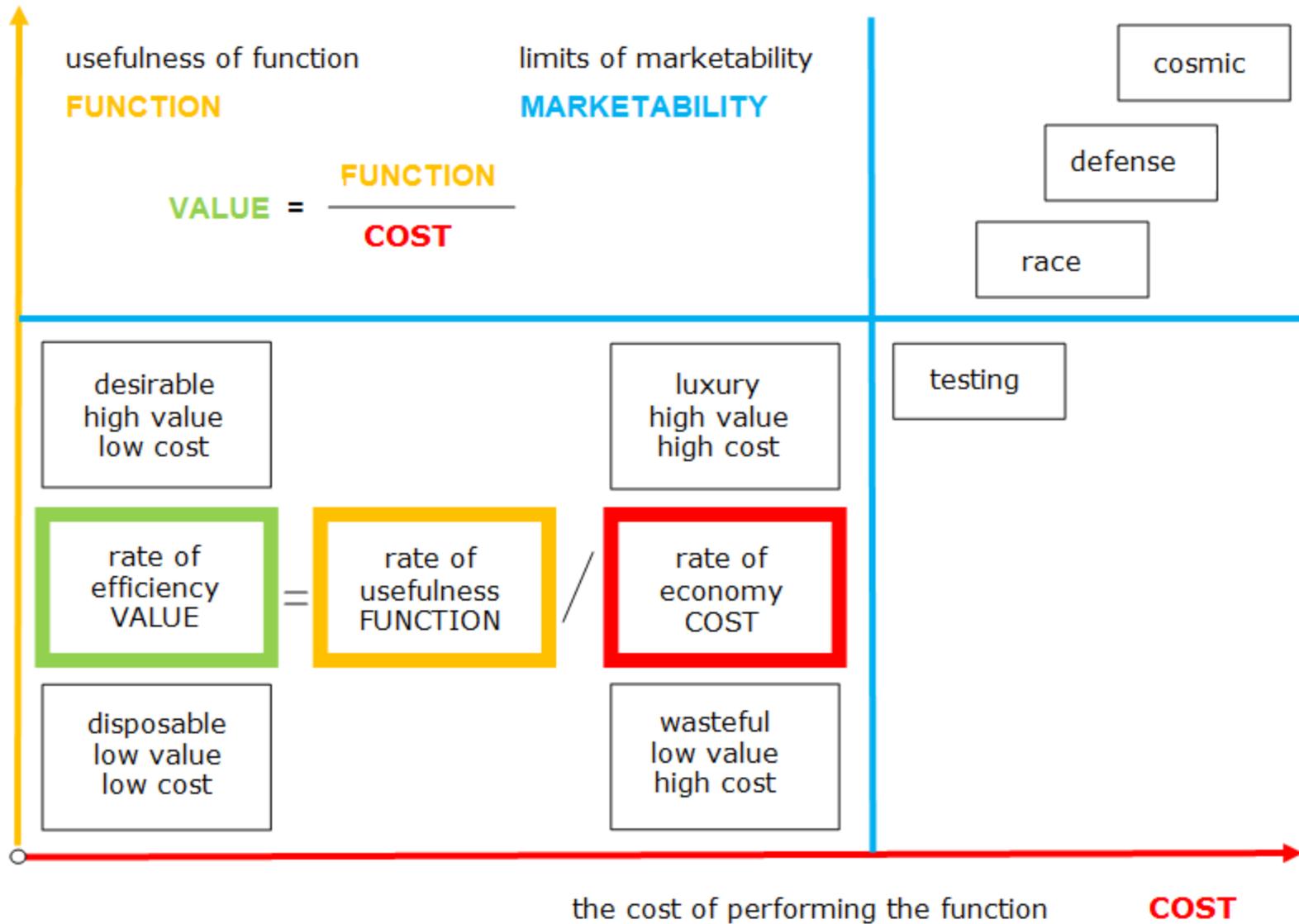
1. TRIZ approach enables to meet requirements



$$\text{efficiency of transmission} = \frac{\text{effectiveness of output}}{\text{sparing input}}$$

(value-benefits) (mission-function) (cost-consumption)

1. TRIZ approach enables to meet requirements



2. Driving force behind all processes: Ubiquitous Attraction of Perfectness

According to contemporary conceptions, the driving force behind all processes: from conceive (creation) and development (fulfillment of mission) to the extinction (re-use), is the “**Ubiquitous Attraction of Perfectness**”, (Palčák, 2017) which can be expressed in the form of the **Law of perfecting**:

efficiency of transmission = effectiveness of output / sparing input

successful creator = harmony of useful properties / sparing effort

efficient creation = harmony of purposeful properties / sparing outcomes

mature conditions = harmony of usability properties / sparing extraction

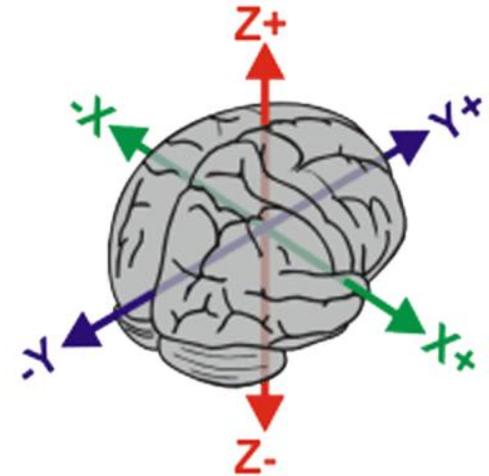
The “Ubiquitous Attraction of Perfectness” provokes:

- **curiosity and discovery**: perception, searching for and getting to know the right incentives-challenges),
- **imagination of the past, present and future**, understanding the essence and context) and
- **desire for self-fulfillment** (motivation for creatively trying to satisfy our proper physical, mental and spiritual needs).

3. Surprising results from brain research for the TRIZ approach

A great example of the impact of the **Law of Perfecting** is the **development of the brain**, which constantly strives in your consciousness to accomplish its mission as much as possible: taking the right decisions to best meet the right physical, mental, and spiritual needs, while exerting the least effort on the basis of choice, cohabitation and compliance of the right incentives-challenges:

- **inspiration** from the superconsciousness (from above),
- **challenges** from perfection (from front),
- **support** from congenial people (from left),
- **impulses** from subconsciousness (from below),
- **lessons** from experts (from right),
- **principles** from conscience (from behind),
- **decisions** in the consciousness (inside)



3. Surprising results from brain research for the TRIZ approach

The worldwide initiatives (USA, EU, Japan, China) to advance brain research have goals:

- discover y of the ways how

to improve the diagnosis, prevention and treatment of brain disorders;

- theoretical modeling of the brain and the development of brain-based artificial intelligence

to improve computers;

- integration of neuroscience with the social and behavioral sciences

to improve education , life management of a society and **creative inventive thinking**

improve education, way of life and especially to improve the imaginative creative thinking to get people to maintain the indispensability,

**Sperry, Nobel prize
1981**

Collaboration of
sentient thinking in the
right part of the brain
with
considering thinking in the
left part of the brain.



**Kahneman, Nobel prize
2002**

Slow and painful thinking in
the **upper part of brain:**
neocortex (cerebral).

Quick and easy thinking of
lower part of brain :
limbic system (basal).

3. Surprising results from brain research for the TRIZ approach

For your correct selfimprovement is important apply **proper education (shaping yours skills)**, which would have had to develop your innate talents and to achieve:

- **the greatest depth of knowledge** (your own expertise) and at the same time to get
- **the widest possible knowledge** (overview of contexts) needed for co-operation.

To meet defined goals, the **TRIZ: Creative revealing of innovative perfecting of creator, creation and conditions** (Altshuller) is appropriate approach, because it allows to become an exceptional personality-leader (creator), who can:

- **understand challenges of the attractiveness of perfecting,**
- **overcome the acquired inertia of thinking,**
- **generalize and abstract, as well as get specific,**
- **come up with breakthrough ideas to perfecting oneself, creations and the environment, and make things actually work.**

3. Surprising results from brain research for the TRIZ approach

It turned out that for the success of creator in overcoming contradictions in the challenges for perfection of the present state, is necessary **holistic (physical, mental, and spiritual) maturity of perfecting, or the maturity** of:

- exceptionalness **(PQ-Perfecting Quotient)**, whole brain,
 $PQ = EQ \times IQ \times TQ \times AQ \times MQ \times RQ$

on which participate the interplay and harmony of all the right-desirable qualities, therefore maturity of:

- soulfulness **(EQ-Emotional Quotient)**, right part of brain,
- expertise **(IQ-Intelligence Quotient)**, left part of brain,
- openness **(TQ-Techexe Quotient)**, left part of brain,
- resistance **(AQ-Adversity Quotient)**, left part of brain,
- obedience **(MQ-Mission Quotient)**, right part of brain,
- consideration **(RQ-Relationship Quotient)**, right part of brain.

3. Surprising results from brain research for the TRIZ approach

More important than the high level of individual abilities-skills is their

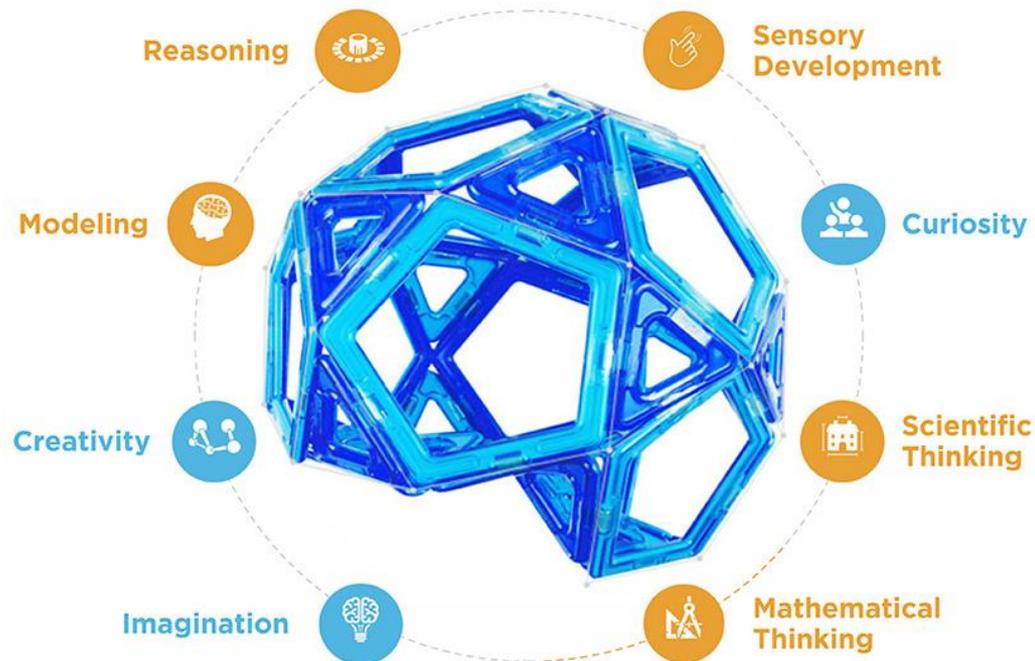
- **balance,**
- **interplay and**
- **harmony,**

because even the only lacking (zero) correct attribute-habit in the product of their values in the formula for (PQ) causes the devaluation of all others.

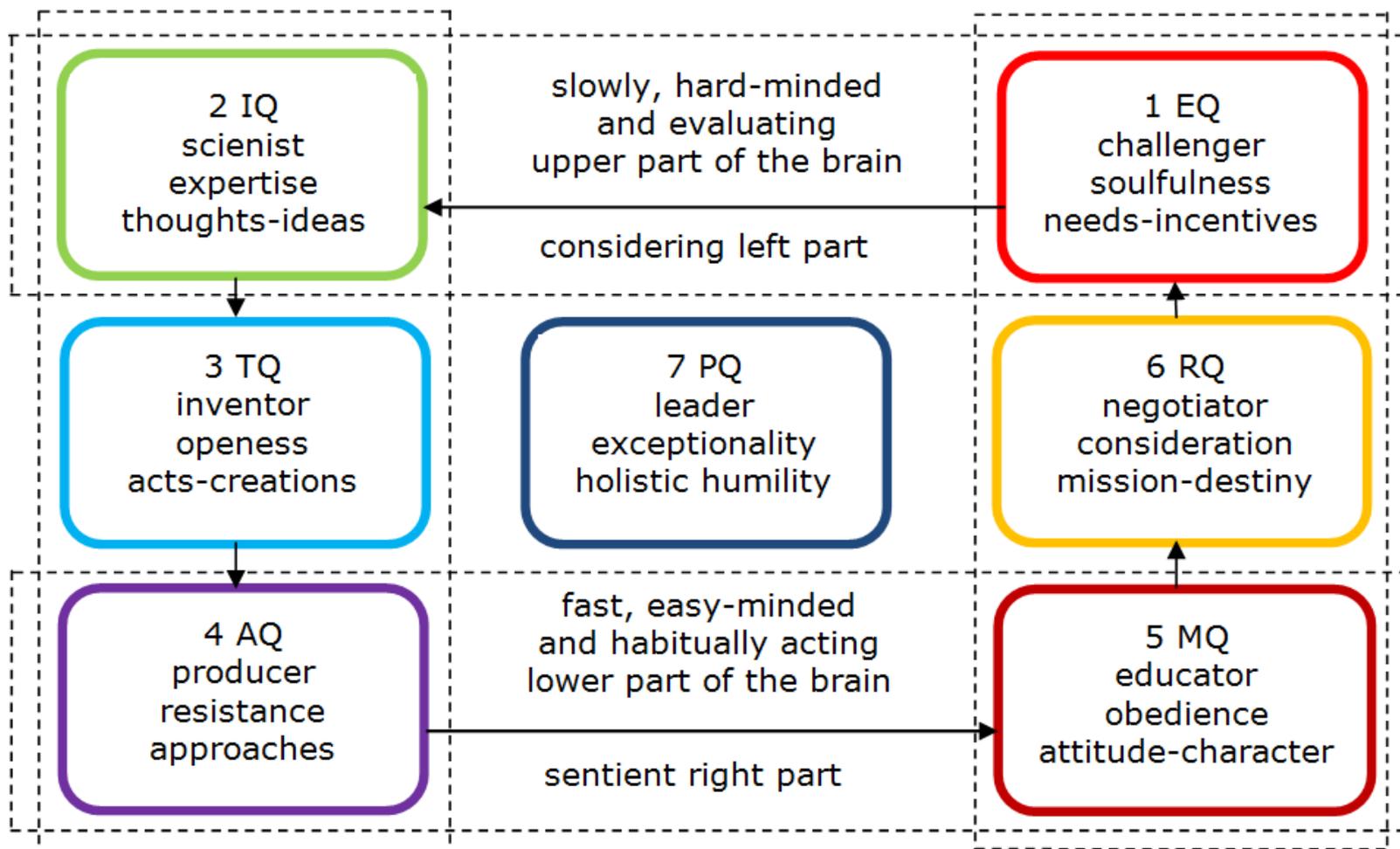
The holistic (physical, mental, and spiritual) maturity of perfecting, or the maturity of **exceptionalness**

PQ-(Perfecting Quotient), whole brain,

$$PQ = EQ \times IQ \times TQ \times AQ \times MQ \times RQ$$



4. The cycle of right needs-principles-habits for perfecting of creators



The cycle of self-perfecting of leader-creator

4. The cycle of right needs-principles-habits for perfecting of creators

The right habits for leader-creator are needed to achieve **holistic exceptional maturity of perfecting (PQ)**. They can be acquired only by everyday adherence to the following right principles-rules that stem from the virtues verified by tribes.

The goal of the first three principles-habits from cycle of self-perfection is to gain autonomy-self-sufficiency in order to offer it in cooperation.

1. The right needs-incentives (challenger)

The right challenger should have the skills in the shape of (E): profound own expertise (I) and a wide multi-layered (triple bar) overview (\equiv). The upper layer includes the ability to stimulate professionals from different areas of knowledge, within middle layer is the ability to drive them (to incite, to create creative relationships, and to make things happen) and in the lower layer is the ability to create appropriate conditions for them.

2. The right thoughts-ideas (scientist)

The scientist should have the skills in the shape of (T): the deep expertise (I) for revealing breakthrough discoveries as well as the ability to communicate (-) necessary to commit a new knowledge straightforwardly to others to be able to avail it in the real life.

4. The cycle of right needs-principles-habits for perfecting of creators

3. The right acts-creations (inventor)

The inventor should have the skills in the shape of hashtag (#) : to have the ability to apply his profound multi-level expertise (II) and broad multi-layered overview (=) for cooperation with experts from other areas (especially with the TRIZ access specialist), who will advise him to properly use internal (own) capabilities as well as external resources (known successful improvements from areas beyond his own knowledge).

While the mission of the first trinity of right principles-habits is to help us get rid of dependence on desires, things and people, and to achieve autonomy-self-sufficiency (personal independence), it means to have our own opinions, our own resources and our own goals, the following three principles-habits of perfection will lead you to an advanced cooperation and advanced coexistence.

4. The right approaches-practices (producer)

The manufacturer would have the skills in the shape of (Π) : to have the ability to apply his multiple expertise (II) to today's interdisciplinary creations as well as the ability to communicate (-) with creators, customers and suppliers.

4. The cycle of right needs-principles-habits for perfecting of creators

5. The right attitudes-character (educator)

The educator should have the skills in the shape of (Π) : to have the interdisciplinary (III) knowledge as well as a broad (-) overview to be able to lead his students to discoverability, independence and responsibility.

6. The right mission-destiny (negotiator)

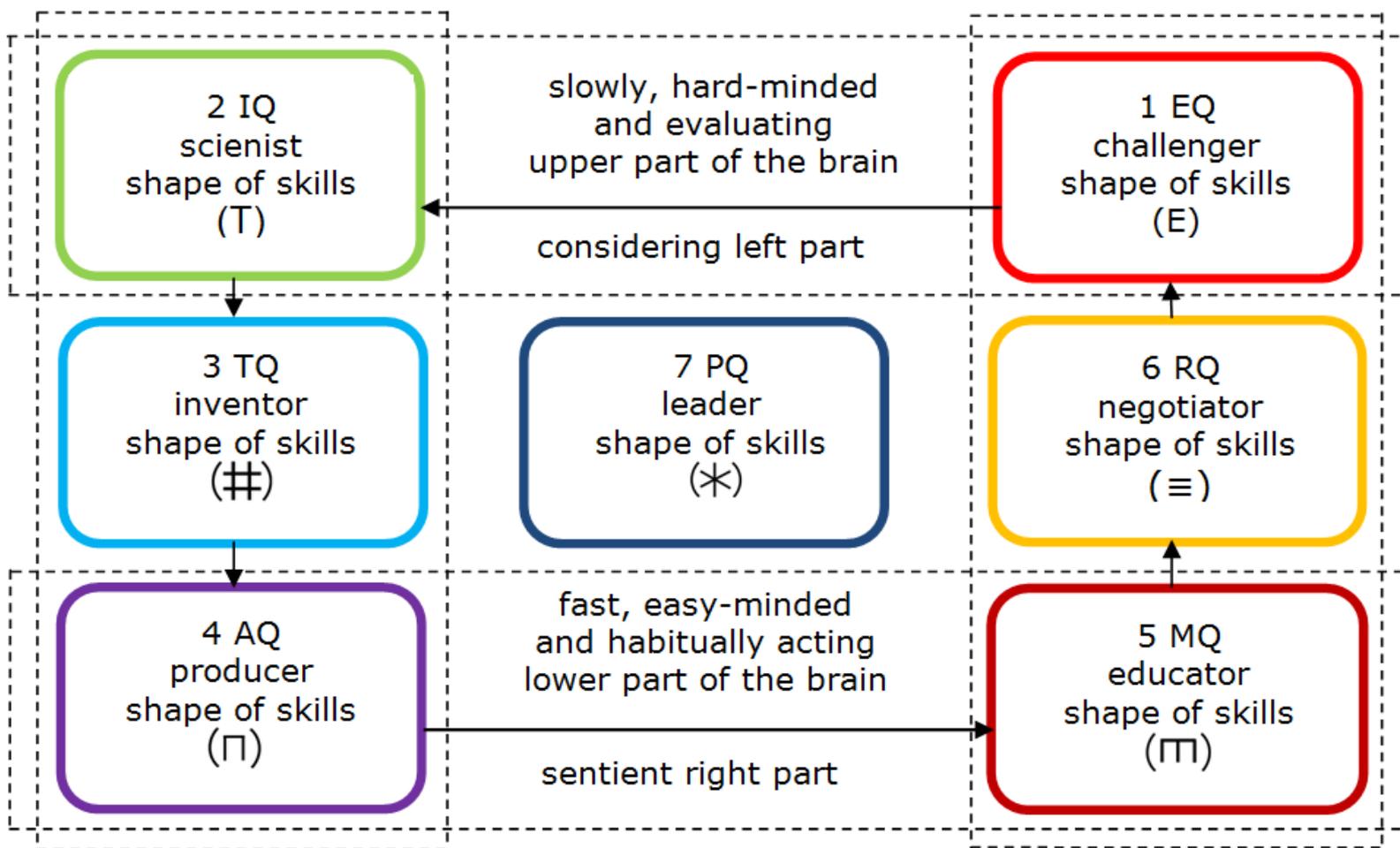
Negotiator should have the skills in the shape of triple bar (\equiv) , it means a wide multi-layered (\equiv) overview to be able to unify the attitudes of managers, experts, manufacturers and users.

We will learn a lot from teachers (the path to wisdom), the work will teach us more (the path to skill), but the most you get if you deliver (the way to understanding the connections), which takes you to the search for a holistic compliance.

7. The right holistic perfecting (leader-exceptional personality)

An leader should have a skills in the shape of star (\star) : to have the ability to see everything in a broad context, that is to be challenger, scientist, inventor, producer, educator and negotiator in one person, who is able to be a driving force for society as a whole. to his breakthrough ideas, achieved results and experiences.

4. The cycle of right needs-principles-habits for perfecting of creators



The cycle of shaping skills of leader-creator

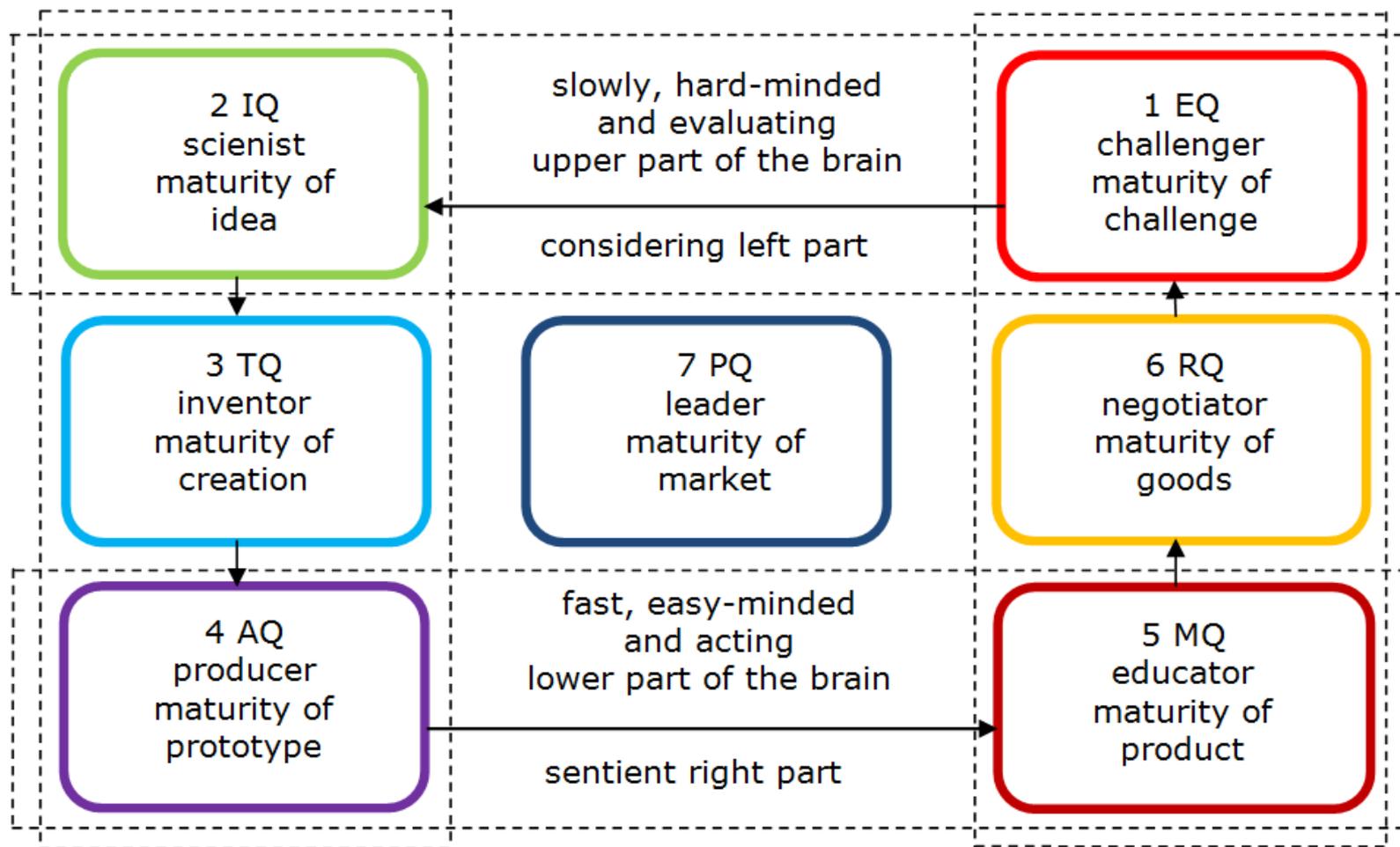
4. The cycle of right needs-principles-habits for perfecting of creators

A mature leader-creator-personality (PQ-Perfection Quotient) is able to recognize and overcome the contradictions and by perfecting themselves, creations and conditions. With his groundbreaking ideas (EQ), knowledge (IQ), ideas (TQ), experience (AQ), dedication (MQ) and personal example (RQ), it is the driving force for maturity of the market because he is able:

- **anticipate, forecast and determine** where development will go (EQ), challenge,
- **understand and convey** the latest discoveries (IQ), idea
- **search and design** successful innovations from interdisciplinary patents (TQ), creation,
- **use effective procedures** and overcome emerging barriers (AQ), prototype,
- **encourage** discovery, independence and responsibility (MQ), product,
- **to consolidate and harmonize** opinion diversity (RQ), goods,



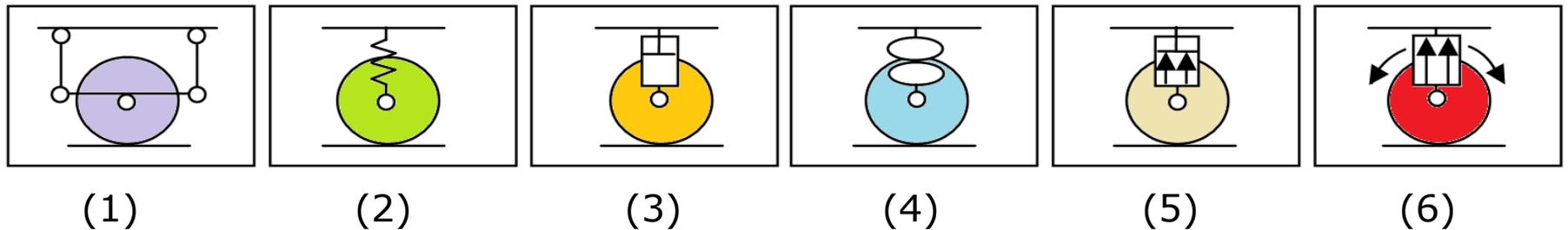
5. The cycle of the right properties of the creations



The cycle of shaping skills of leader-creator

5. Mission of the Master on the TRIZ approach

The **Master on the TRIZ approach** has the mission to guide the car expert how to intentionally search for initiatives in successful patents from all areas of knowledge and warns that the removal of local contradiction has to be to take advantage of local resources (drive and braking torque) which enable to achieve **desirable high value at low cost**.

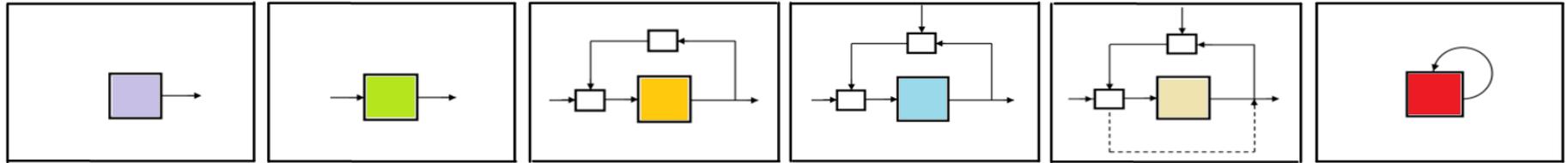


The transition from preset (passive) features of a mechanical suspension (1), (2) to a hydraulic suspension with self-adaptable change of a magneto rheological fluid properties, (3) to a hydro-pneumatic suspension (4), to the adaptable (active) suspension with electronic management of features (5), toward the recent removal of unwanted movements of the car body (vertical heave, yaw, roll and pitch) for desirable ride comfort by quick control of the drive and braking torque acting on the wheel motors using LEAF system: (Leading Environmental Affordable Family car) and ensuring necessary wheel load for driving safety simultaneously (6).

This is **the breakthrough innovative perfecting** of suspension system .

5. TRIZ approach to perfecting on the inventors (creators).

The raise of **the degree of control over a system** results from transition from non-controllable system to the control over deviances, then to the system with feedback, to adaptive system, to self-educational and self-organizational system, and, finally, to self-evolving and self-reproducing system.



The development of management: 1. random, 2. controlled, 3. evaluated regulation, 4. adaptable, 5. anticipated, 6. independent (selfcontrol).



Human without Machine, 2. Human and Tool, 3. Human and powered Tool 4. Human and semi-automated Machine 5. Human and automated Machine 6. Fully automated Machine without Human.

6. Global Innovation Index (GII) 2016 (patents, research, publications)

TOP 5 COUNTRIES

Number of patents per capita

1. Republic of Korea,
2. Japan,
3. Singapore,
4. United States of America,
5. Hong Kong (China).

TOP 5 COUNTRIES

Global Innovation Index

1. Switzerland,
2. Sweden,
3. United Kingdom,
4. United States of America,
5. Finland.



TOP 5 CLASSES

Number of registrations and growth rate 2014-15

Recording and
communication
equipment
387 ↗ +141.9%



Clocks and
watches
324 ↗ +17.8%



Means of
transport
264 ↗ +10.9%



Packages and
containers
249 ↗ +3.8%

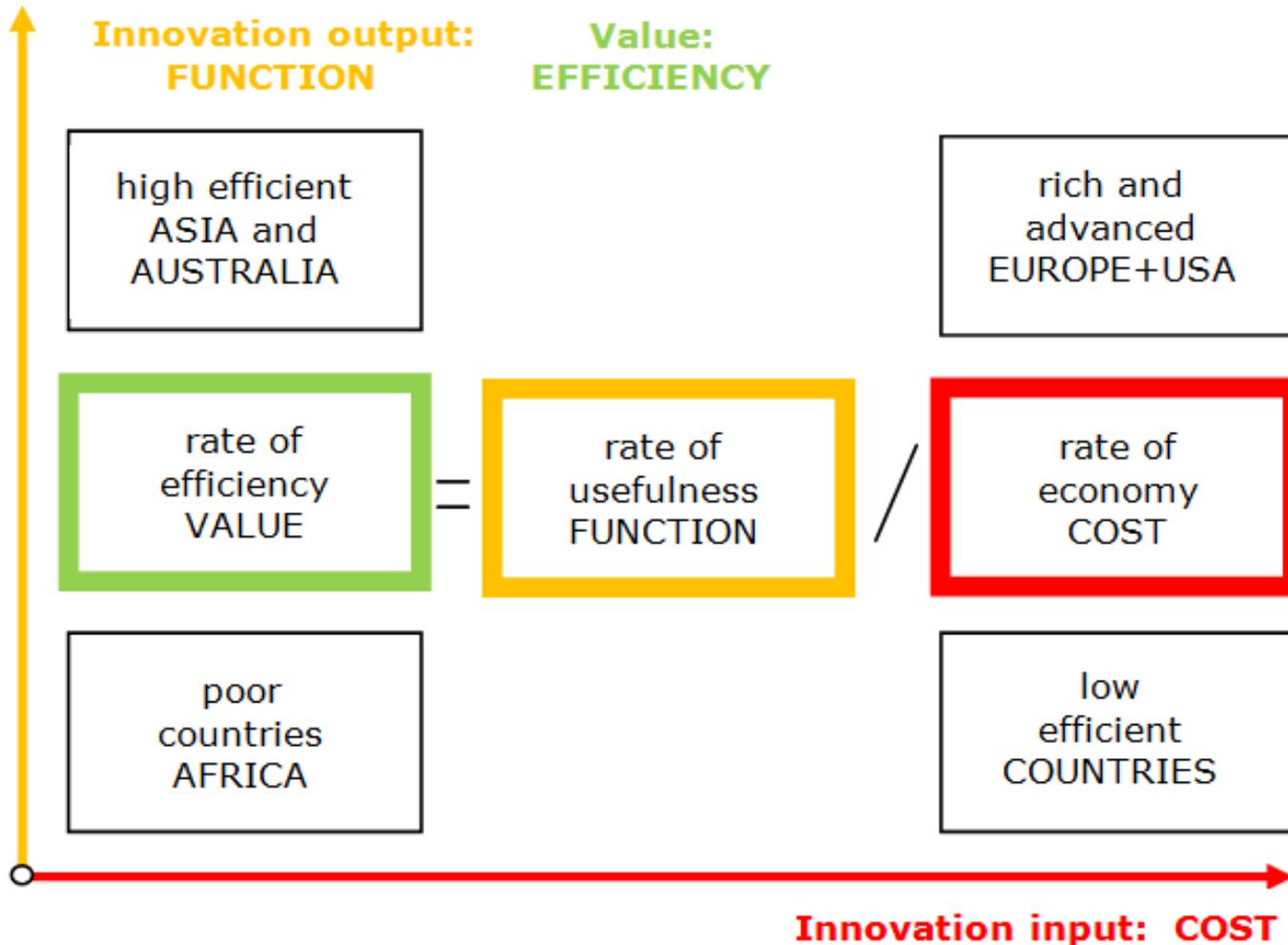


Furnishing
249 ↗ +7.3%



The efficiency of countries according to GII

6. Global Innovation Index (GII) 2016 (patents, research, publications)



The efficiency of countries according to **Law of evolution**-perfectioning

7. TRIZ approach for interdisciplinary maker

Product development is vital to the achievement of business success.

In the quest to satisfy increasingly sophisticated market needs, cuttingedge product development must rely heavily on **the contribution of many disciplines**.

Interdisciplinary maker should be familiar on activities comprising **the product development process**, including product planning, customer needs analysis, concept development and testing, financial analysis of products, design for manufacturing, intellectual property, and project management.

TRIZ tools are suitable for innovation as well, integrating economic, social, and environmental responsibility in the management of innovation and leading to sustainability of resources.



Altshuller developed science and art: TRIZ approach

T creative
R revealing
I innovative
Z perfection

- creators,
- creations,
- conditions

8. Conclusions: the way to breakthrough perfection

Our collective understanding of the world is becoming more comprehensive, complex and complete. This means that to carry out their work successfully, engineers have to take into consideration that a **efficient way how to stay informed of new and emerging technologies, is cooperation.**

Each successful innovation arises with respect for laws of perfecting, even if innovators working without the knowledge of TRIZ approach are unaware of it. **When using the TRIZ approach, the advantage is that the creator achieves his goal more efficiently, with less effort, in less time and making the most efficient use of the resources available under the given conditions.**

- in the past, the richest were owners of natural resources,
- now the richest are owners of information-information: intellectual property,
- in the future, the richest will be owners of advanced relationships.

The feedback between innovators, innovations and infrastructure is the mechanism responsible for the evolution of our civilization in **the desired direction satisfying our higher needs toward correct relations-values for humble and satisfied coexistence.**



Actual activities

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Become an interdisciplinary maker through TRIZ approach

