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DEMAND - TREND MATRIX: QUICK ROADMAPPING FUTURE INNOVATIONS

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Abstract

In general, there are two alternative strategic approaches being used today to innovatively improve existing products/ technologies and generate ideas for new products and technologies: market pull and technology push. The first approach is to use the results of market studies (voice of the customer) to generate new ideas and concepts that would meet the identified customer and market demands. However, the shortcoming of such approach is that new ideas are generated randomly and chaotically; or in case if classical tools of TRIZ are used, we obtain a number of ideas which are not ordered accordingly the market demands or we can miss some important evolution steps.

In modern TRIZ, the second approach (technology push) is implemented in form of "Evolutionary Potential Assessment and Product/Technology Forecast" and involves the of resources available within a selected product/technology for further evolution according to the TRIZ Trends and Lines of Technology Evolution.

The most widespread use of this approach is to build an "Evolutionary Radar Plot" of a selected product or its part and then further evolve the product along the undeveloped lines of evolution. The shortcoming of this approach is that the results obtained do not correlate with market demands and requirements and only use the inner potential of the existing product/technology.

Keywords: market requirements, TRIZ, Trends and Lines of Technology Evolution

1. Demand-Trend Matrix

A **Demand-Trend Matrix (DTM)** is a rather simple tool which brings together technology push and market pull approaches. A principal idea behind DTM is to organize a new ideas generation process in a systematic way by establishing mapping between market requirements and demands (including revealed market trends) and the TRIZ Trends and Lines of Technology Evolution (Fig. 1), also known as "Trends of Engineering Systems Evolution" under abbreviation TESE [1]. Each Trend includes one or more specific lines of evolution.

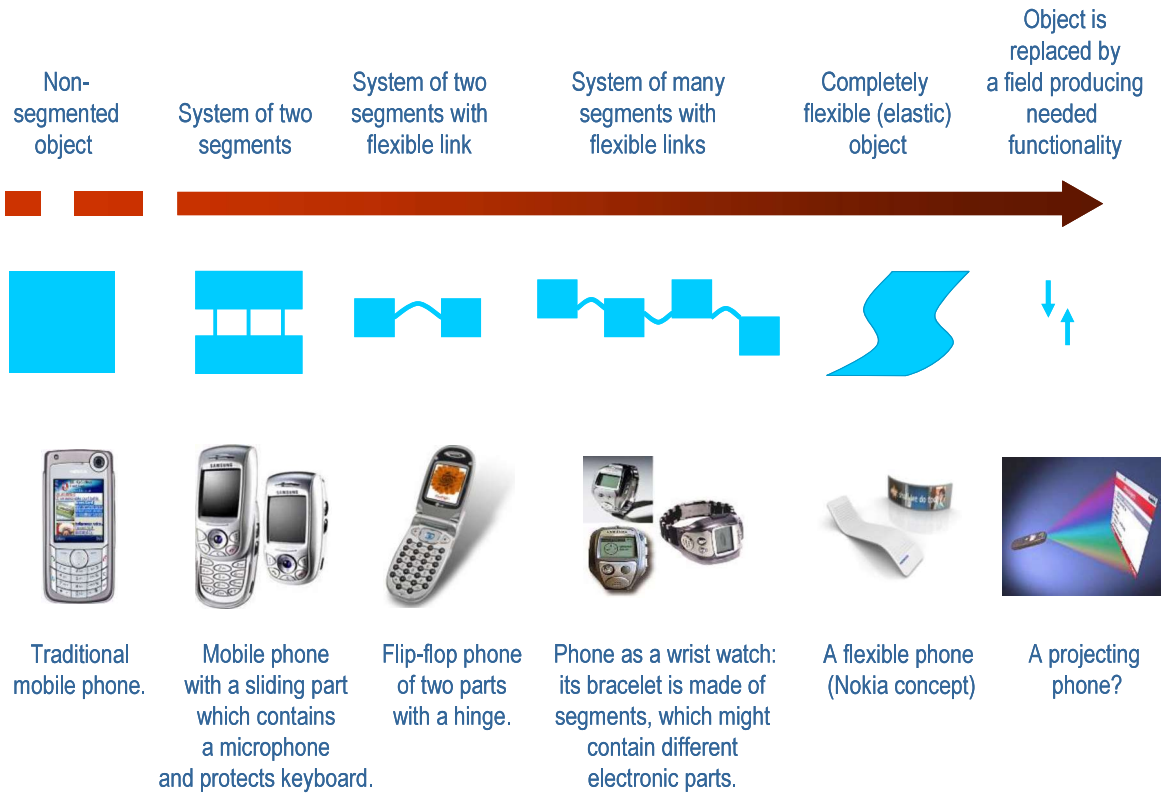

Fig. 1: Example of the TRIZ Line of Evolution of increasing physical system dynamics

In DTM (Fig. 2), each customer requirement or market demand is identified with a specific subsystem (part) of a system (product) which we want to improve, and then each TRIZ Line of Evolution is applied to this part to see if a solution can be proposed on the basis of this TRIZ Line that would meet the corresponding customer/market demand.

Thus, by evaluating opportunities in each cell of the matrix, the entire space of couples "*customer requirement/market demand* vs. *TRIZ line of technology evolution*" is explored. After completing DTM, each cell might include either a single idea, or several ideas, or remain empty if no ideas were proposed.

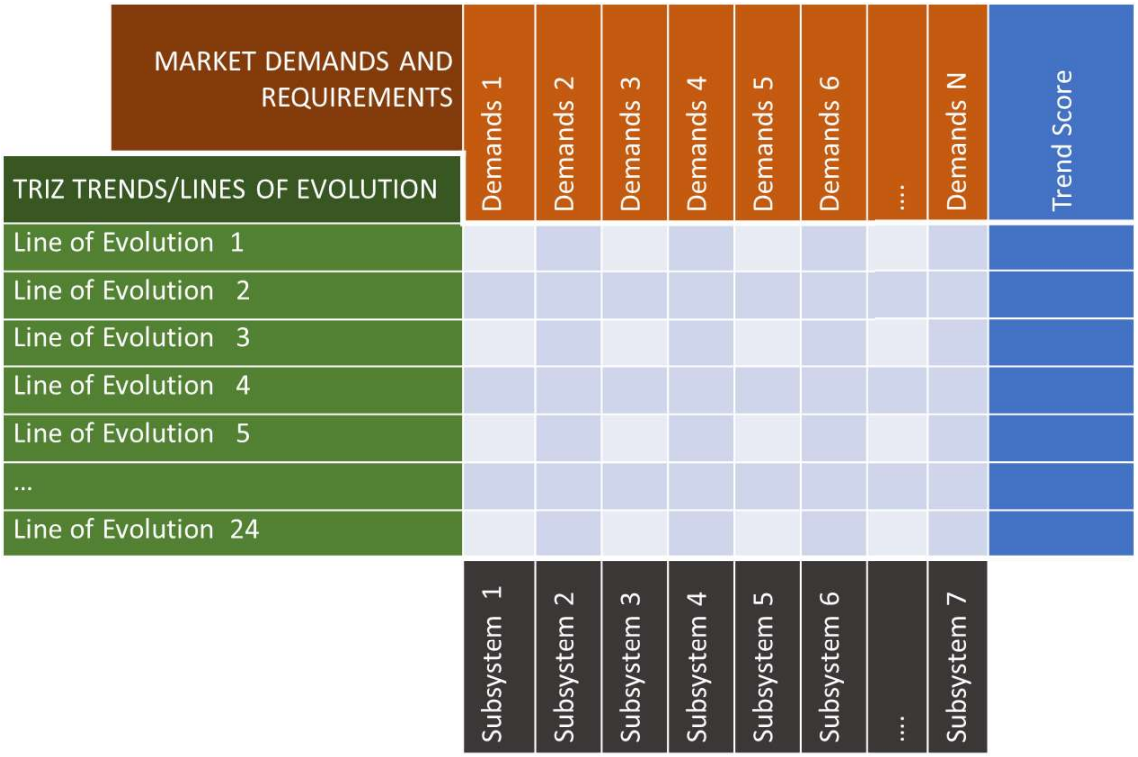

Fig. 2: Demand-Trend Matrix (DTM)

If there are one or more ideas in a cell, then the cell is marked with "+". In case if there are no ideas, or the trend is inapplicable, with "-". This gives a possibility to assign a score to each trend at the stage of evaluation, after the entire DTM Is completed. Finally, a total score against each customer/market demand and TRIZ evolution trend can be calculated.

To apply the Demand-Trend Matrix properly, knowledge of the TRIZ trends of evolution is expected. Alternatively, this knowledge can be provided by an experienced facilitator (TRIZ expert) while a team generates ideas by using specific patterns of evolution as thinking triggers. In such cases, the team members are not required to be familiar with TRIZ. At this moment we use 24 lines of evolution.

It might take a long time to explore all possible combinations, thus we recommend breaking the process with DTM to a number of phases. Each phase might concentrate on a certain subsystem or a specific demand.

2. Completing Demand-Trend Matrix

The process of completing DTM is as follows:

1) Identifying specific customer/ market requirements and demands with respect to a selected product and completing the upper horizontal list in DTM.
2) Identifying important subsystems in the product selected and listing them in the bottom list.
3) A list of TRIZ Trends of Technology Evolution is fixed and remains the same for any product.
4) Each cell is checked against possible ideas. In fact, it is a step at which ideas are gener-

ated. If there are more ideas than one, all ideas are recorded in a cell. The ideas generation process might be somewhat time-consuming process since we need to generate ideas for each cell. However, this process can be limited to only those market demands which we consider as most important.

5) A total score for each TRIZ trend of technology evolution is identified. It consists of a number of cells which are not empty and belong to the selected TRIZ trend of technology evolution.
6) All ideas in each cell are evaluated and decisions are made on further implementation of the most potential solution candidates.

In case if there are no ideas available with respect to some demand after completing the matrix, or new ideas contradict to other demands, then the TRIZ principles of separating conflicting demands and the databases of effects can be used to generate ideas based on the identified contradiction. The resulting matrix also structures the contradiction space and provides a possibility to "uncouple" contradicting requirements. In addition, the ideas generated can be evaluated and structured according to the importance of the demands and requirements to define short-term and long-term product/technology innovations.

3. Case: A Hose Pump Evolution (fragment)

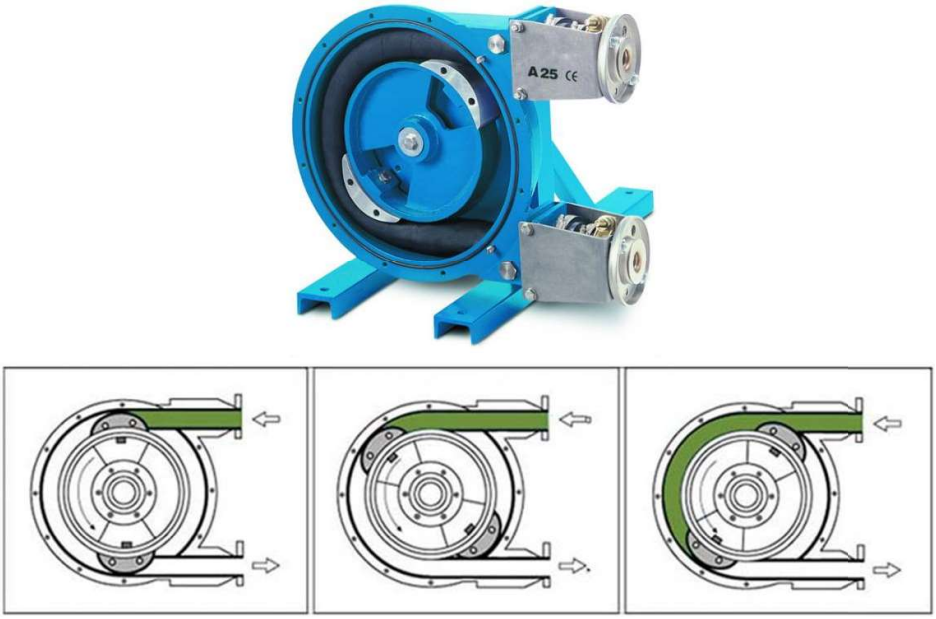

Fig.3 A hose (peristaltic) pump

A typical hose (peristaltic) pump consists of the following subsystems of upper level according to TRIZ Function Analysis:

- Hose
- Shoe
- Connection
- Drive
- Housing
- Rotor

The Demand-Trend Matrix presented below establishes mapping between market demands for a hose (peristaltic) pump and the TRIZ trends of technology Evolution (only a fragment is presented):

CUSTOMER/ MARKET DEMANDS AND REQUIREMENTS TRIZ TRENDS/LINES OF EVOLUTION	- Lifetime - High chemical resistance - Abrasive resistance - Suction capability - Discharge pressure - Capacity - Hygienical - Easy to install - Low hysteresis - Ability of failure detection	- Lower friction - Lower volume pressed to the hose - Better compression control - Mechanical strength - Retractability - Chemical resistance	Demands N	Trend Score
Trend 1	...	...	...	...
SEGMENTATION OF SURFACE	• Introduce profile to inner and/or outer surfaces of the hose; • make the inner surface rough and softer	• Cover shoe with lubricant • Feed lubricant continuously	...	...
STRUCTURE TRANSPARENCY	• Introduce cavities - lowers hysteresis; • local quality cavity prevents fatigue; • introduce cavities with gel; • introduce spiral; • use foamed rubber; • use foamed elastomeric compound; • use gel-filled foamed elastomeric compound.	• Make shoe perforated • Push gas flow through pores in metal • Replace metal shoe with high-pressure gas flow	...	...
Trend 4	...	...	...	...
...	...	...	...	...
	Hose	Shoe	...	

Fig. 3: Example of Demand-Trend Matrix (DTM) application

As we can see, application of the TRIZ trend "Structure Transparency" to a subsystem "Hose" of the hose pump resulted in generation of seven ideas how to modify the hose while application of the TRIZ Trend "Segmentation of Surface". In turn, application of these two trends to a subsystem "Shoe" resulted in two and three ideas of further evolution of the subsystem "Shoe" of the hose pump. Each idea can be checked to see if it satisfies one or another market requirement listed in DTM. If not, the idea should be deleted.

Furthermore, after DTM has been completed, evolution of each subsystem can be visualized with the help of Evolutionary Radar Plots, introduced in [2] where each radar plot depicts both initial state of a subsystem evolution and final state of evolution after completion of DTM (Fig. 4).

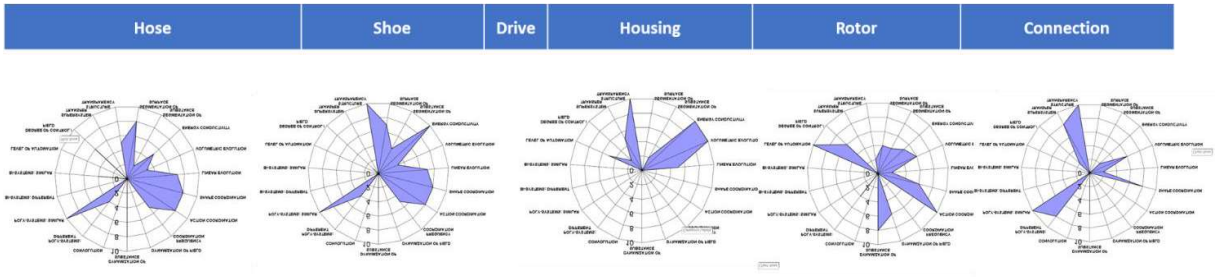

Fig. 4: Collection of Evolutionary Radar Plots indicating ideas for future development of each specific subsystem

4. Benefits of the Demand-Trend Matrix

Summarizing, the use of DTM provides the following:

- Integration of market-based and technology-based methods for forecasting and developing new ideas and concepts for future products and technologies.
- Direct application of the TRIZ Trends and Lines of Technology Evolution to fulfill market demands.
- Providing more opportunities for idea generation by creating and exploring the entire space of demands related to the TRIZ Trends of Technology Evolution.
- Enabling quick scan of future opportunities by application of the TRIZ Trends of Technology Evolution.
- Reducing probability of missing important evolution step.
- Providing information for identifying demand-related contradictions.
- Helping better identify and structure short-term and long-term product/technology innovations.

Since 2008, DTM has been applied within a number of projects by ICG T&C partners and customers on product innovation. In each project, a list of new patentable ideas were produced both for short- and long-term innovative improvements. Currently we are considering how to integrate DTM and Innovative Technology Roadmapping [3].

References

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