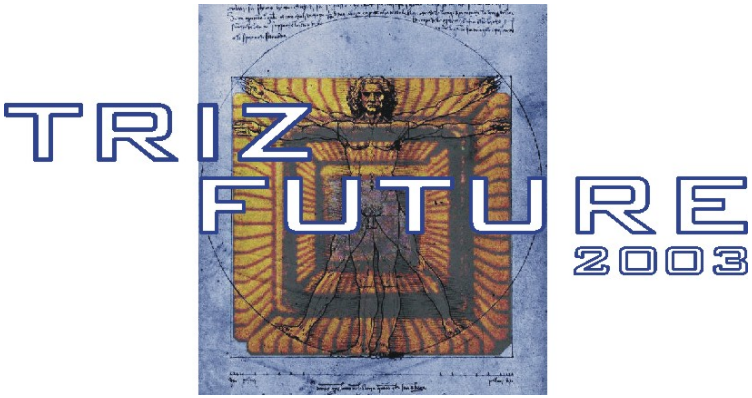

Differentiating the role of TRIZ in sustainable and disruptive innovation process

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Aachen, 12. Nov. 2003

Initial situation

- The majority of the known successful industrial applications of TRIZ are dealing with the problem solving and sustainable product development.

- From the other hand, industrial companies face significant difficulties in application of TRIZ in search for workable concepts for disruptive innovation.

- The main reason for this fact is a high variety of possible solutions combined with the lack of information about the implementation expenditures and future market response.

Focus of the presentation

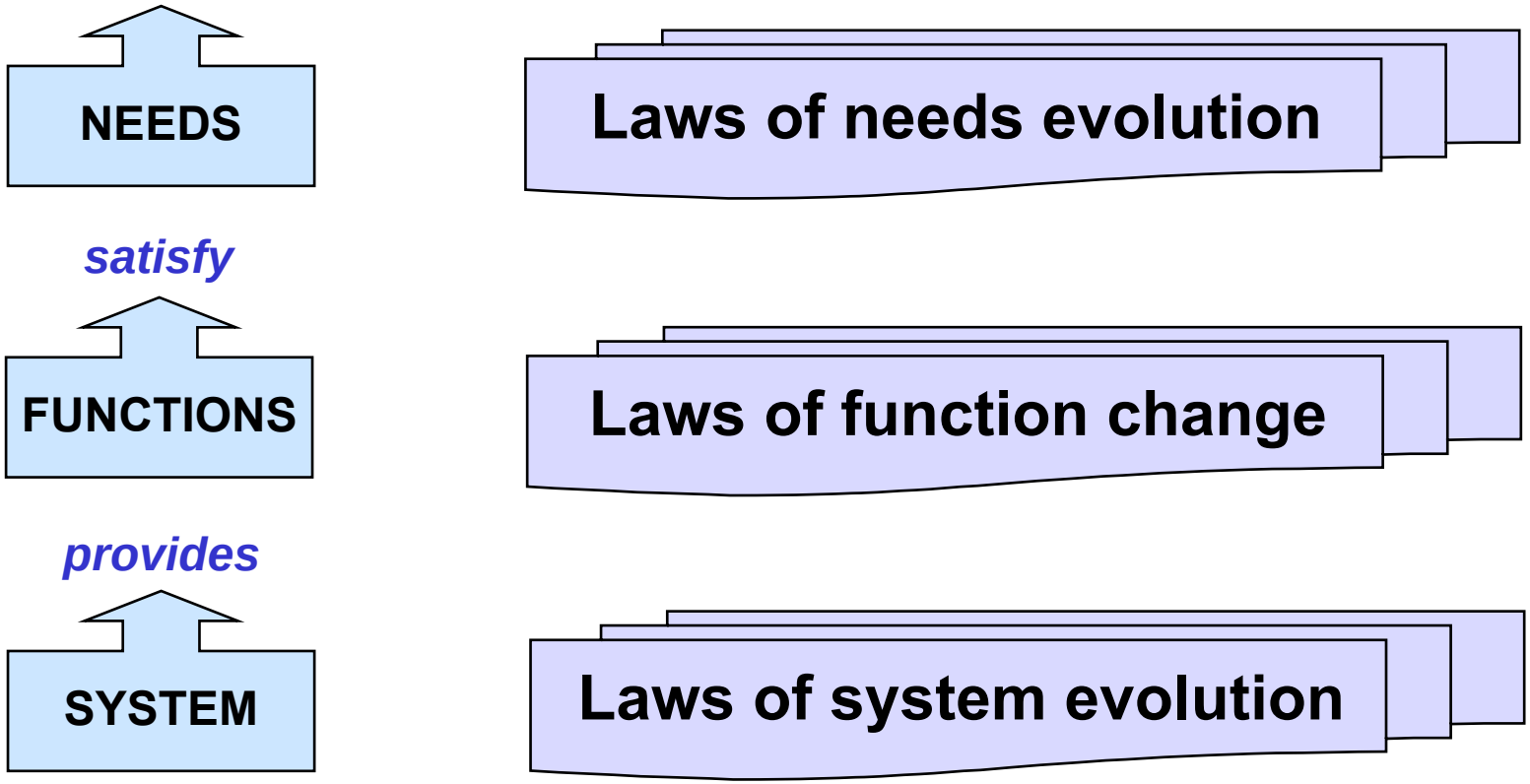
A new quantitative approach

to define the future product features

and research & development directions

with the highest success and market potential

Levels of laws of technological evolution



TRIZ as a science for forecasting system evolution [1, 2]

Definition of sustainable and disruptive evolution

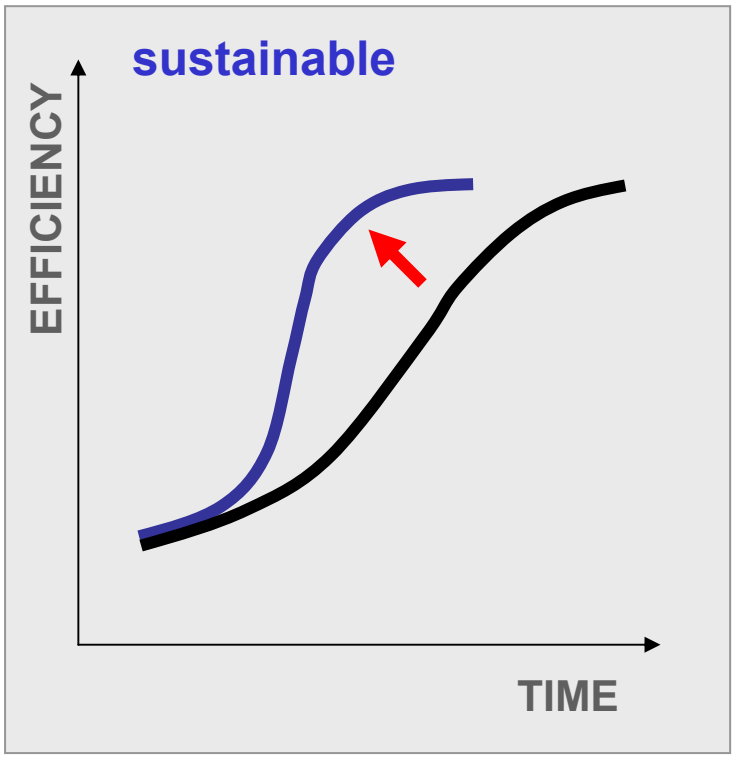
Sustainable innovation

- continuous improvement process
- problem and tasks are being solved step-by-step
- using technologies with low to medium implementation costs
- lower risk

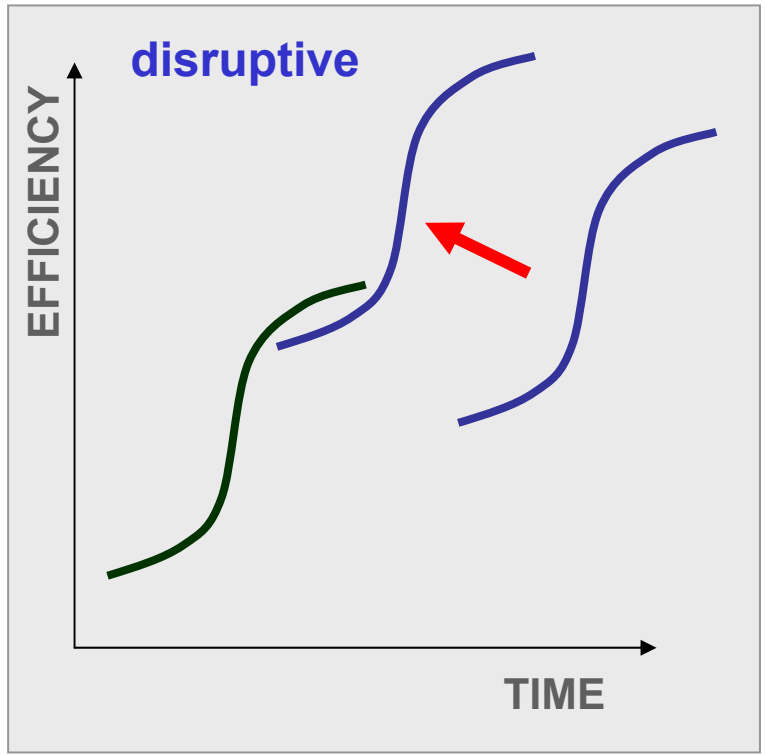
Disruptive innovation

- significant shift to a new technology
- higher future potential of created systems
- breakthrough solutions with medium to high implementation costs
- higher risk

Sustainable and disruptive innovation in terms of the S-curve analysis

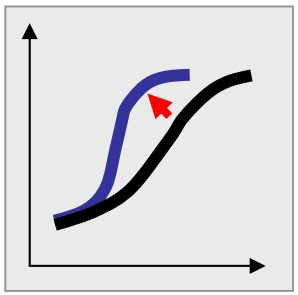


Shortening evolution cycles to reach the highly profitable stage of maturity

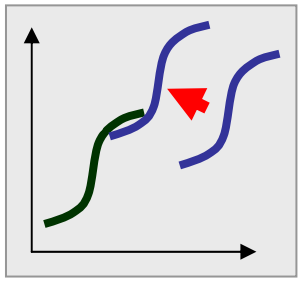


Transition to a new technology without efficiency losses

Some difficulties in application of the S-curve analysis in the innovation process



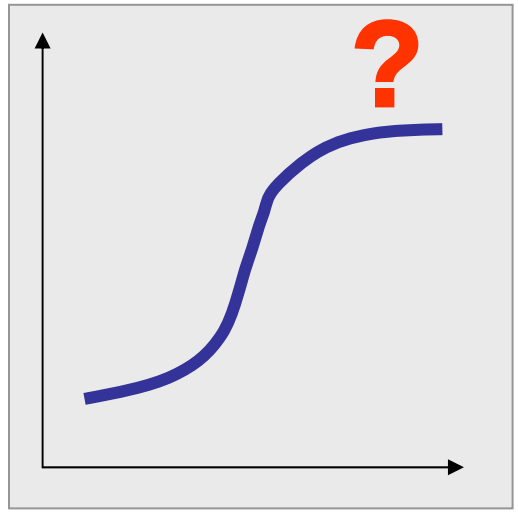
1. How to measure or calculate the level of system maturity ?
2. How to measure the increase of the system efficiency by sustainable innovation ?



3. How to quantify the system growth potential by disruptive innovation ?
4. How to quantify the innovation progress in general ?

Choice of the innovation strategy

What is the right innovation strategy in the end-phase of a system evolution along the S-curve:



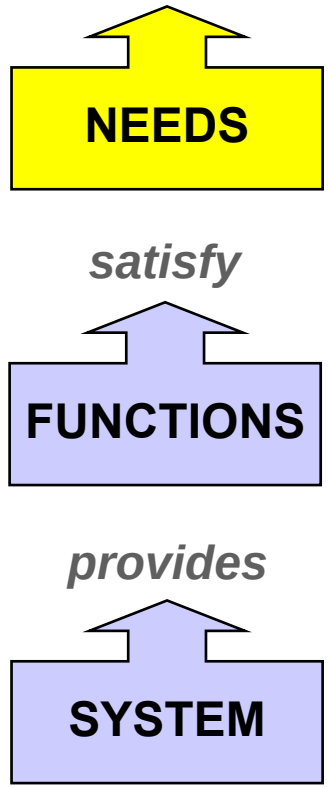
- **continuous sustainable improvement ?**
- **disruptive substitution by a new system ?**
- **transition to a super-system including both sustainable and disruptive elements ?**

How to obtain the quantifiable criteria for decision making?

Quantifiable approach for decision making

Basic steps:

1. Focusing on the evolution of user needs and not on system or its functions *(user = customer, consumer, client)*
2. Determining system value by the current satisfaction level of all user needs
3. Calculating the potential of sustainable or disruptive innovation by the expected growth of the system value



Identifying desired user needs

User needs are captured and formulated in specific form:

a) **they are independent from any known technical solution**

b) **they are measurable (e.g. in minutes, grams, %% etc.) to allow a reliable quantitative statement**

Examples of user needs for bureau telephone:

- Minimize time needed for dialing and connection
- Miss no incoming calls
- Reduce space required for the telephone casing
- Increase the display visibility
- Reduce weight of the handset …

Definition of the System Value

As a system (product, process or service) is created for performing functions and satisfying user needs

the System Value V_S can be expressed as a sum of satisfaction level for each need S_j

multiplied by its weight or potential P_j

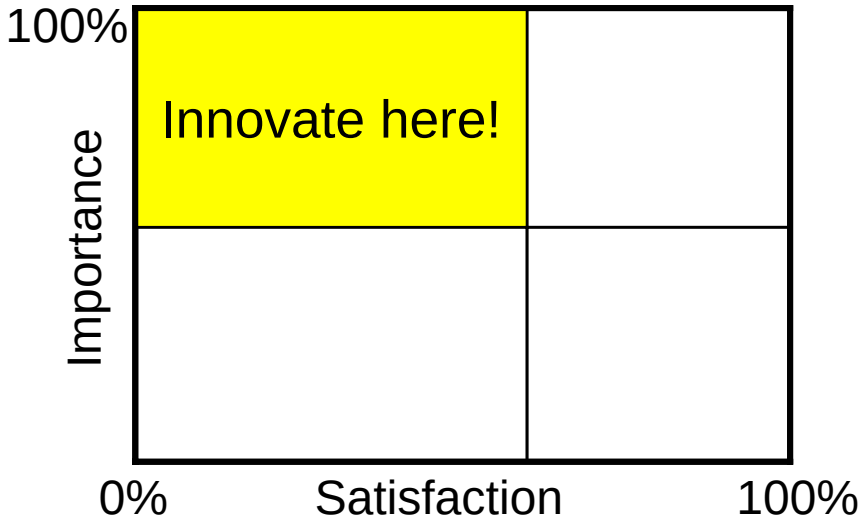
(with *n* as a total number of needs: *n* = 80…200)

System Value: $$V_S = \sum_{j=1}^{n} P_j \cdot S_j$$

Focusing innovation efforts

The potential of needs helps to structure the innovation activities and to focus them on tasks

i.e. needs
with high level of Importance I_j
and low level of Satisfaction S_j



Need potential can be exactly calculated as $P_j = F(I_j, S_j)$:

$$P_j = F(I_j, S_j) = (4P_{0.5} - P_{1.0}) \cdot I_j + (P_{1.0} - 1) \cdot I_j \cdot S_j + (1 + P_{1.0} - 4P_{0.5}) \cdot I_j^2$$

The more simplified formula P=I+(I-S) was first proposed by A. Ulwick [3,4]

Formulating innovation tasks

User need	Market potential	Importance	Satisfaction Company À	Satisfaction Competitor A	Satisfaction Competitors B	Comments
Miss no incoming calls	9,8	4,9	1,2	2,1	1,8	To-do, high priority
Minimise time needed for dialing and connection	7,7	4,1	1,4	2,5	3,1	To-do, high priority
Increase the voice quality of connection	6,4	4,8	4,2	3,4	4,0	To-do
Hands-free telephoning	5,0	3,7	3,3	3,8	3,9	To-do
Reduce space required for the telephone casing	4,2	4,1	4,7	3,7	4,9	no action
Increase the display visibility	2,9	3,2	3,9	4,7	2,8	no action
Reduce weight of the handset	0,1	1,9	4,8	4,3	4,8	no action

Selection of the most valuable user needs in to-do list

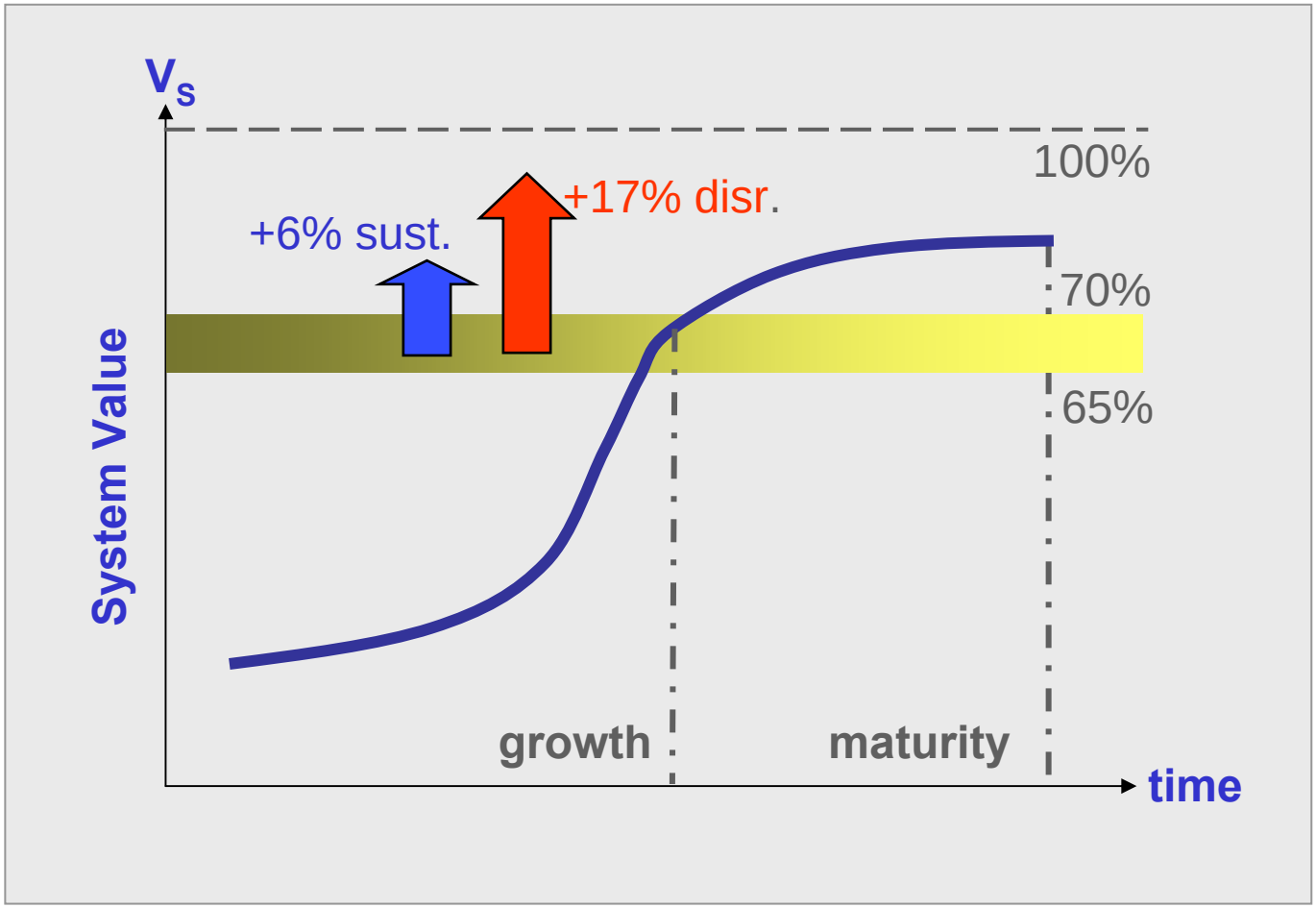
Quantifying innovation progress

Innovation progress can be expressed as an increase of the total system value.

N	Innovation Concept	Total Value
A	Current system	57,6%
B	Best-in-class competitive product	62,1%
C	Sustainable innovation concept «Max. Value + Min. Costs »	67,6%
D	Disruptive innovation concept «Max. Value»	87,3%

Choice of innovation strategies based on the expected value growth

Matching system maturity and system value



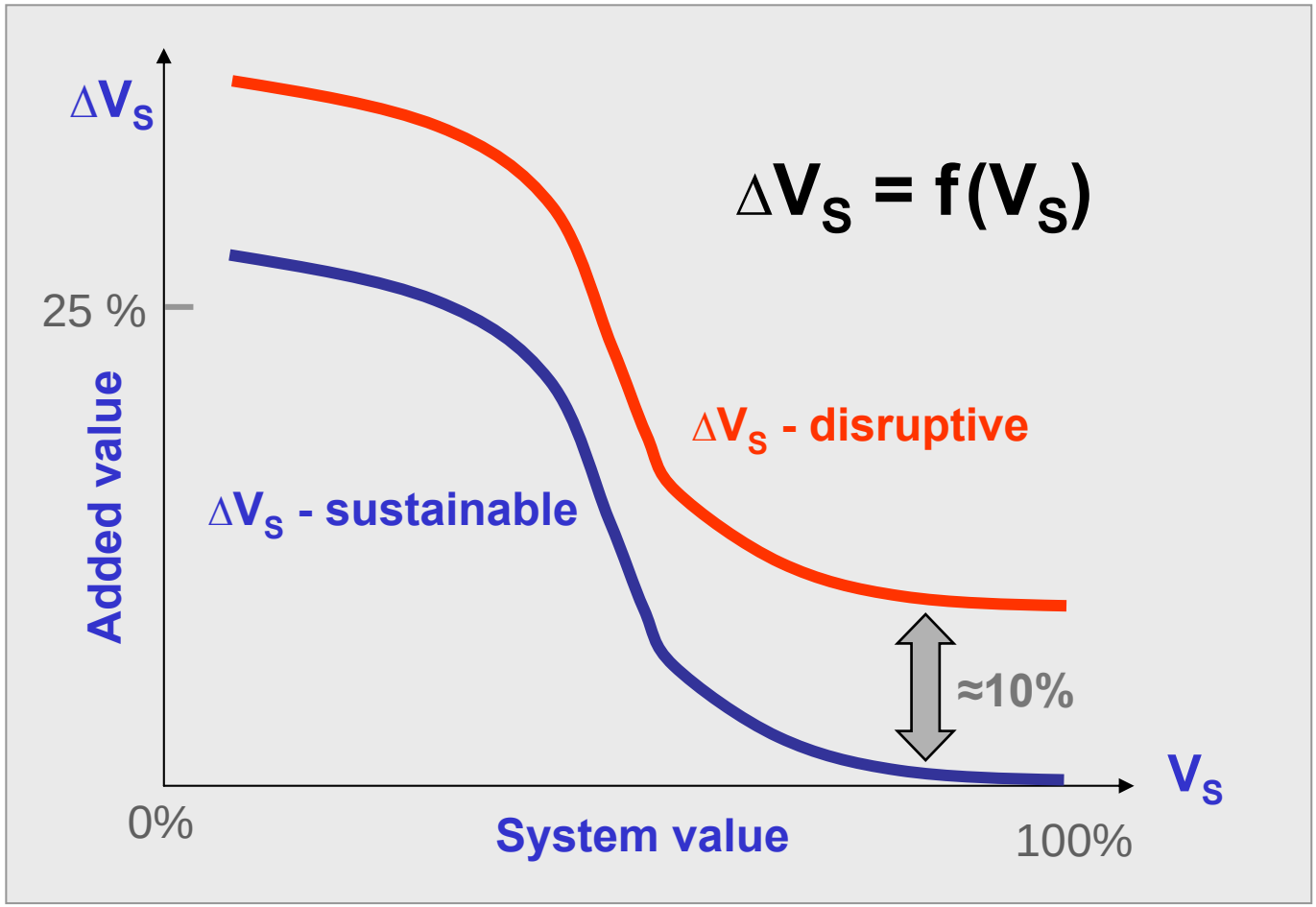
Predicting innovation success

What increase of the System Value ΔV_S is crucial for the innovation success?

Added value ΔV_S	Expected innovation success *
$\Delta V_S < 3\%$	not sufficient for successful innovation
$\Delta V_S = 3\%...6\%$	incremental innovation, risk of poor investment
$\Delta V_S = 6\%...10\%$	sustainable innovation with notable success
$\Delta V_S > 17\%$	disruptive (breakthrough) innovation

* corresponds the current system value of 65…70%

Modeling innovation progress



Added value required for notable sustainable innovation is a function of the system value V_S i.e. system maturity $\Delta V_S = f(V_S)$

Calculating innovation progress

Added value can be calculated analytically

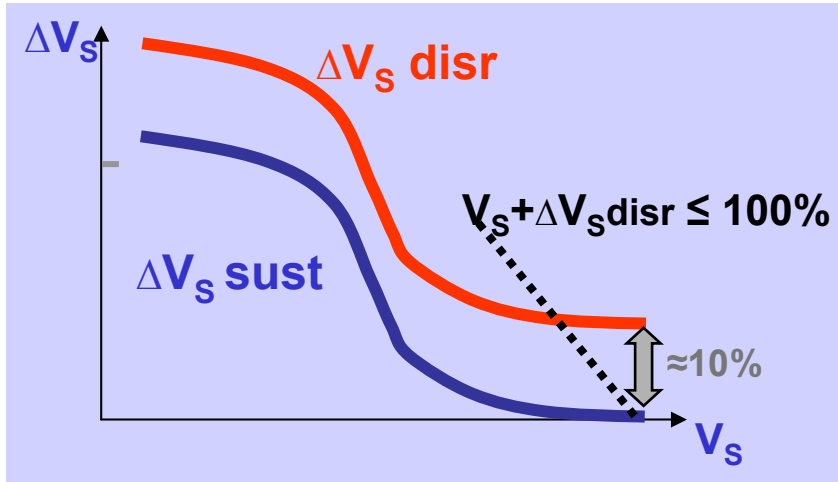
$$\Delta V_S = f(V_S) = \Delta V_0 + a \cdot V_S^2 + b \cdot V_S^3$$

Additional increase in system value needed for disruptive innovation can be expressed with empirical formula:

$$\Delta V_{S\ disr} = \Delta V_{S\ sust} + D, \quad D \approx 10\%$$

The opportunity for disruptive value growth within a system are restricted mathematically with the border condition: $V_S + \Delta V_{S\ disr} \leq 100\%$

For $V_S \geq 89\%$ **no disruptive innovation progress is possible as practically almost all user needs are satisfied.**



Role of TRIZ in sustainable and disruptive innovation

1. Sustainable innovation progress continues theoretically up to system value V_S=100%
2. Disruptive innovation is possible up to the definite degree of system maturity
3. Disruptive innovation is connected with a dramatic increase of the system value V_S. It can be reached:
   - through using new technologies and substitution of old systems or sub-systems by new ones *(systems with the level of maturity of V_S < 85%)*
   - through adding and satisfying principally new user needs *(systems with the high level of maturity, V_S > 85%)*
   - New technologies or solutions, which don't meet new or additional user needs, don't deliver disruptive innovation

Perspectives of TRIZ development

As disruptive innovation of the mature systems can be achieved through satisfying of principally new user needs the future TRIZ development should be focused on:

- identification of true user needs
- evolution of existing needs
- prediction of new needs

This, in turn, allows to define what functions and systems will be required to meet these new needs.

This knowledge also makes it possible to discover radically new directions of technical system evolution.

Conclusions

1. **Sustainable and disruptive innovation progress can be measured by the increase of the total satisfaction value of all needs delivered by a system i.e. product, process or service.**
2. **Focusing TRIZ potential on the tasks i.e. user needs with lowest satisfaction and highest importance allows to achieve maximum of innovation progress with minimum costs.**
3. **Quantified prediction of innovation success allows to select the optimal sustainable or disruptive innovation strategy in terms of added value, costs and risk.**
4. **Choice between sustainable or disruptive innovation strategies depends on the maturity of the system and thus on the satisfaction value of all needs delivered by a system.**