

Using Enhanced Nested Function Models for Strategic Product Development

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Strategie**Innovation**

Ideen entwickeln
Ziele erreichen



Bad news first.

- This paper is not...
- ...about (technical) problem solving.
- ...presenting a new tool or algorithm.
- ...scientific.
- ...finished.

Motivation / Context

- Our approach originated from our work with management regarding strategic product development.
- The following observations were made:
 - TRIZ in Germany is mostly known as a „toolset“.
 - An integrated, algorithmic TRIZ approach is rarely used and mostly even unknown (like ARIZ).
 - The strategic importance of findings that TRIZ offers as science of development of engineering systems is not widely recognized, let alone used.

Tasks from Innovation Management

While training and working with Innovation Managers, the following questions and challenges came up:

- How to deal with complex systems?
- IM wanted to visualize entire products with each part in one Function Model (generating a „big plan“).
- How to synchronize, monitor and direct innovation activities across different departments?

TRIZ and Strategic Product Development

TRIZ supports strategic product development in the following ways:

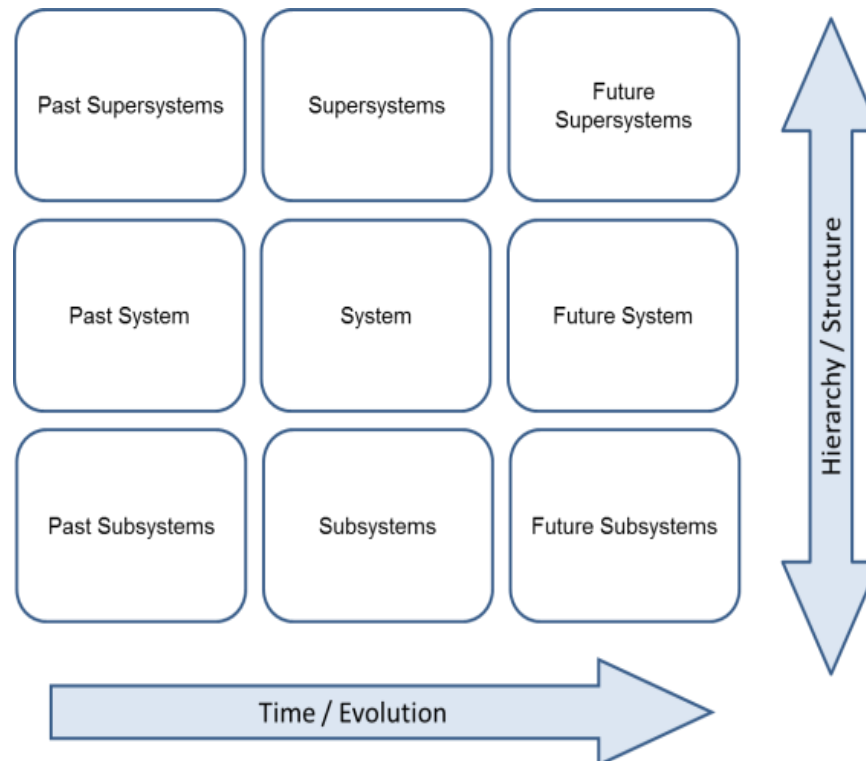
- Enabling companies to actively shape their future.
- Evaluate possible future paths for products.
- Making the innovation process planable.
- Assess the impact of future developments on investments, production lines, employees, core technologies, needed resources etc.

This paper is about...

- ...using a systemic, TRIZ-based view on complex products.
- ...integrating and coordinating existing TRIZ tools.
- ...structuring and evaluating information.
- ...supporting IM with a strategic planning tool.
- ...building a bridge from engineering to management and viceversa.

The 9 screen model as a generic product map

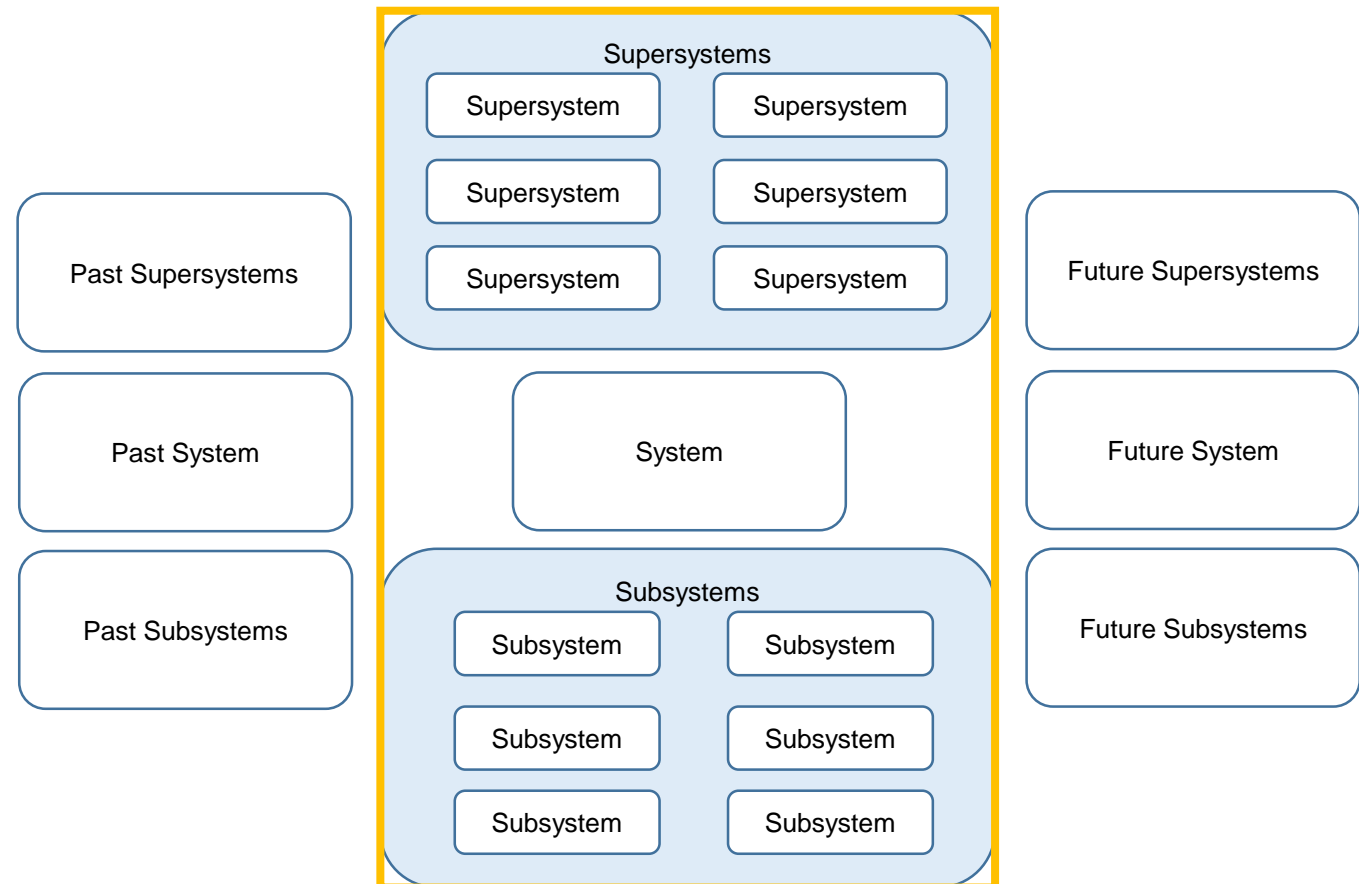
- 9 screen model (System Operator) is a universal scheme to guide thinking and structure information.
- The definition of „system“ depends on us / the project team...



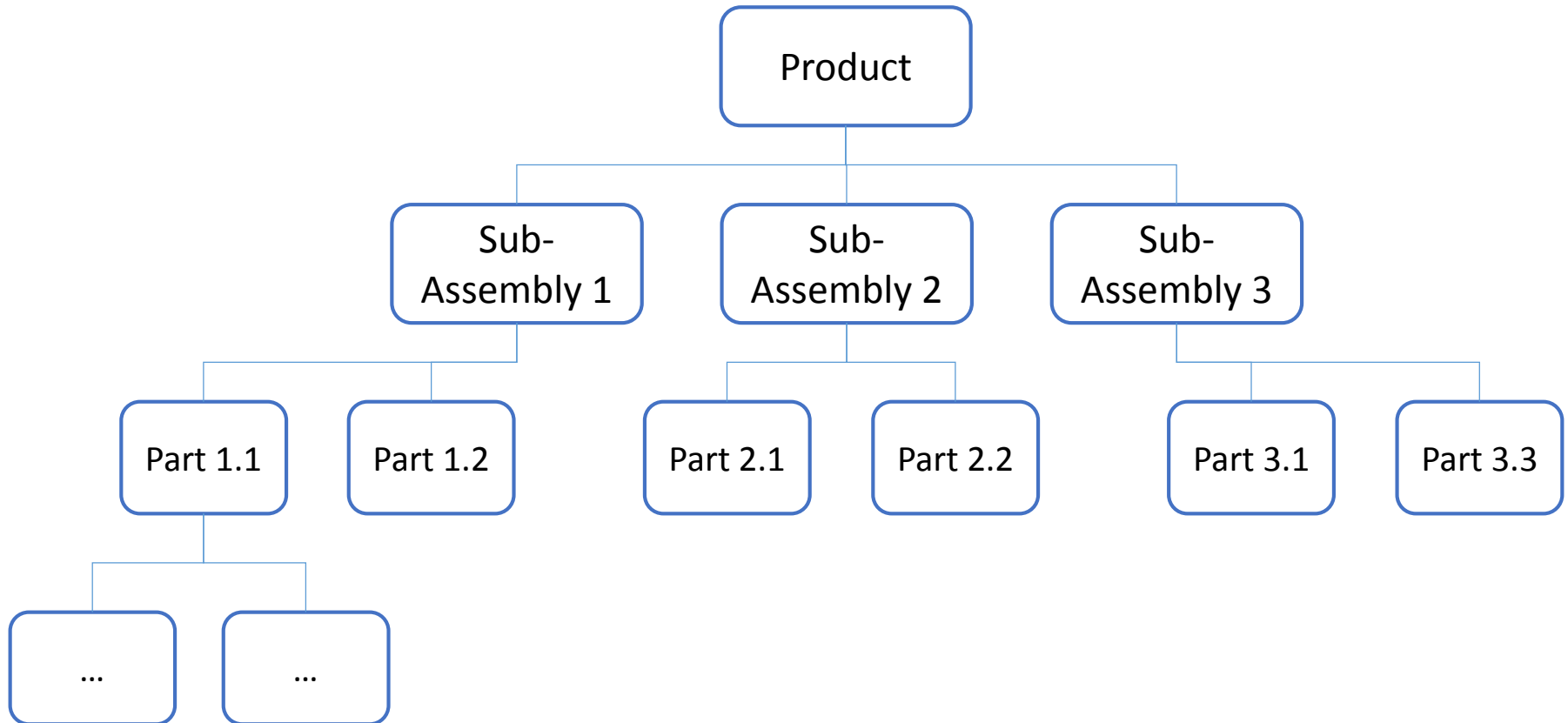
9 screen model and function models

First step:

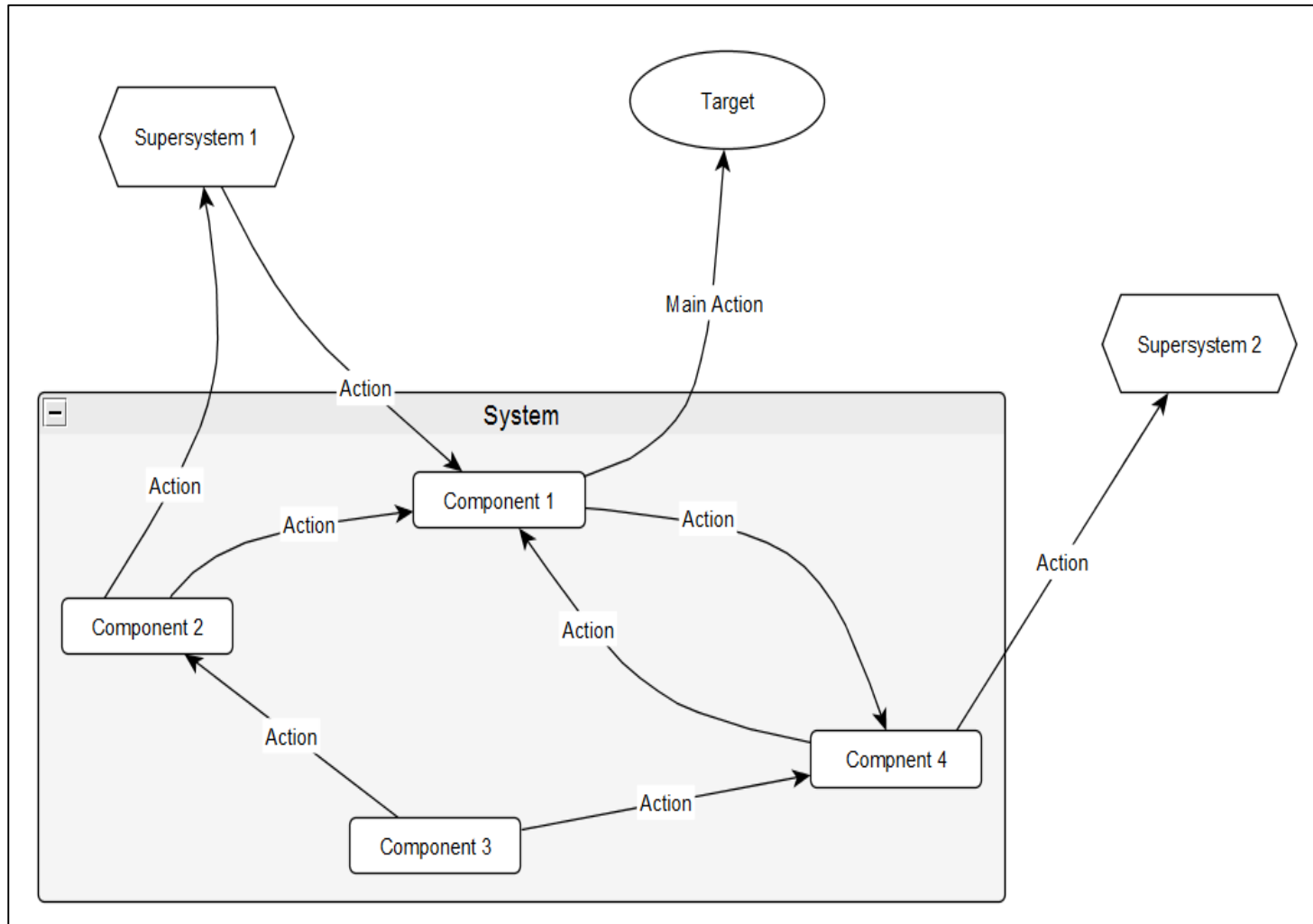
Synchronizing vertical axis of 9 screen model with function models



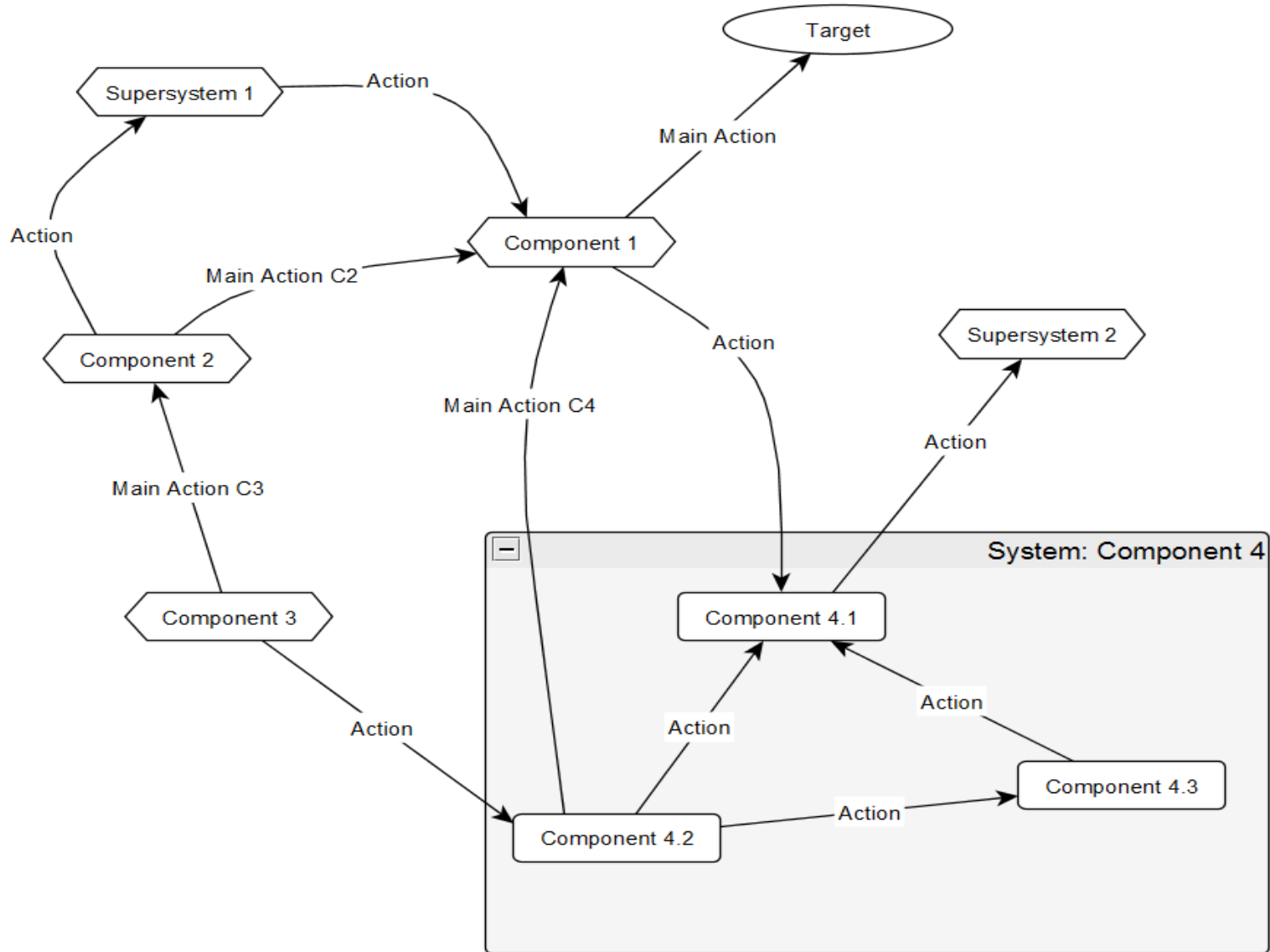
Hierarchical Product Structure



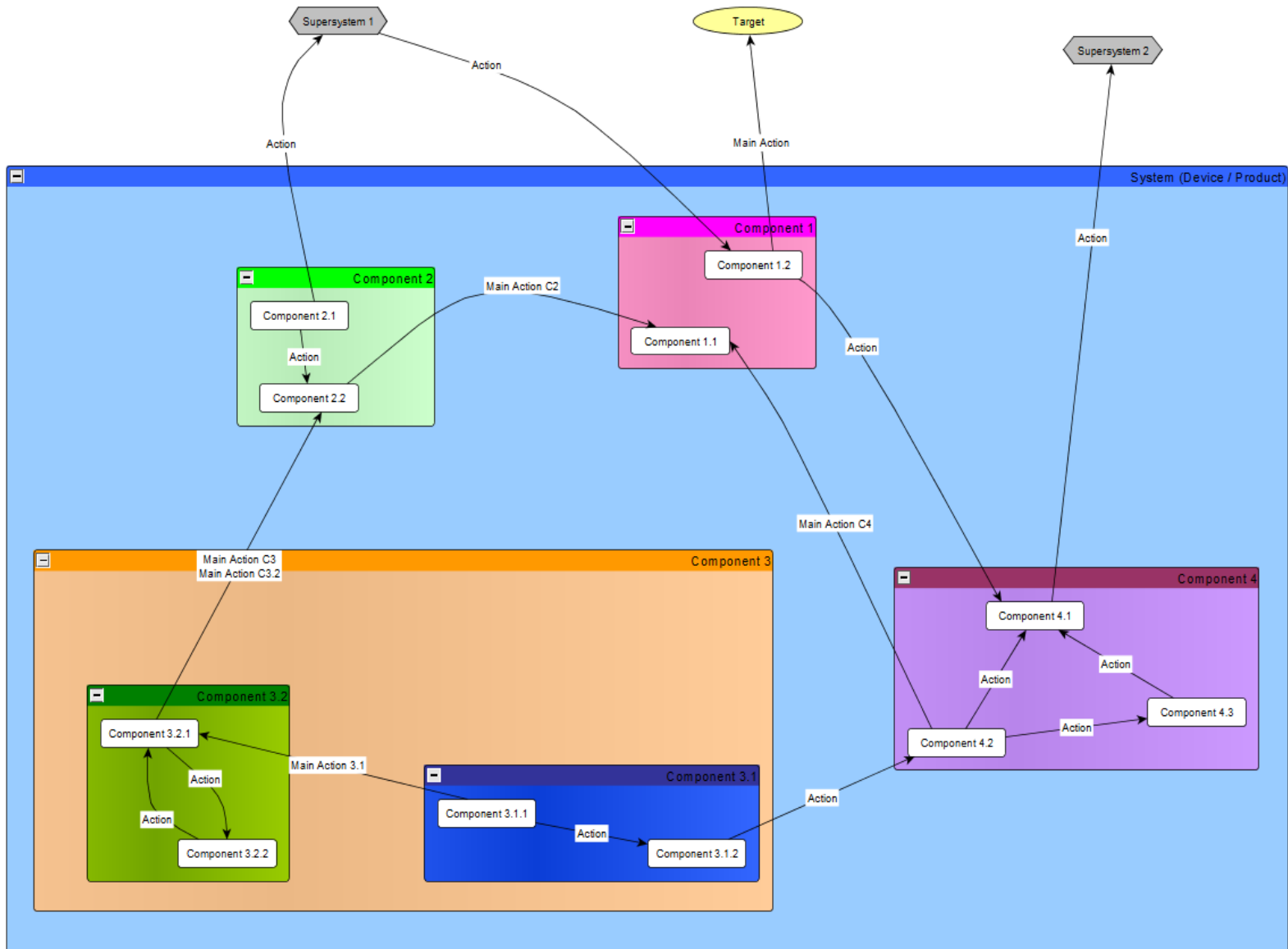
Generic Function Model Structure



Extended (“Nested”) Function Model Structure



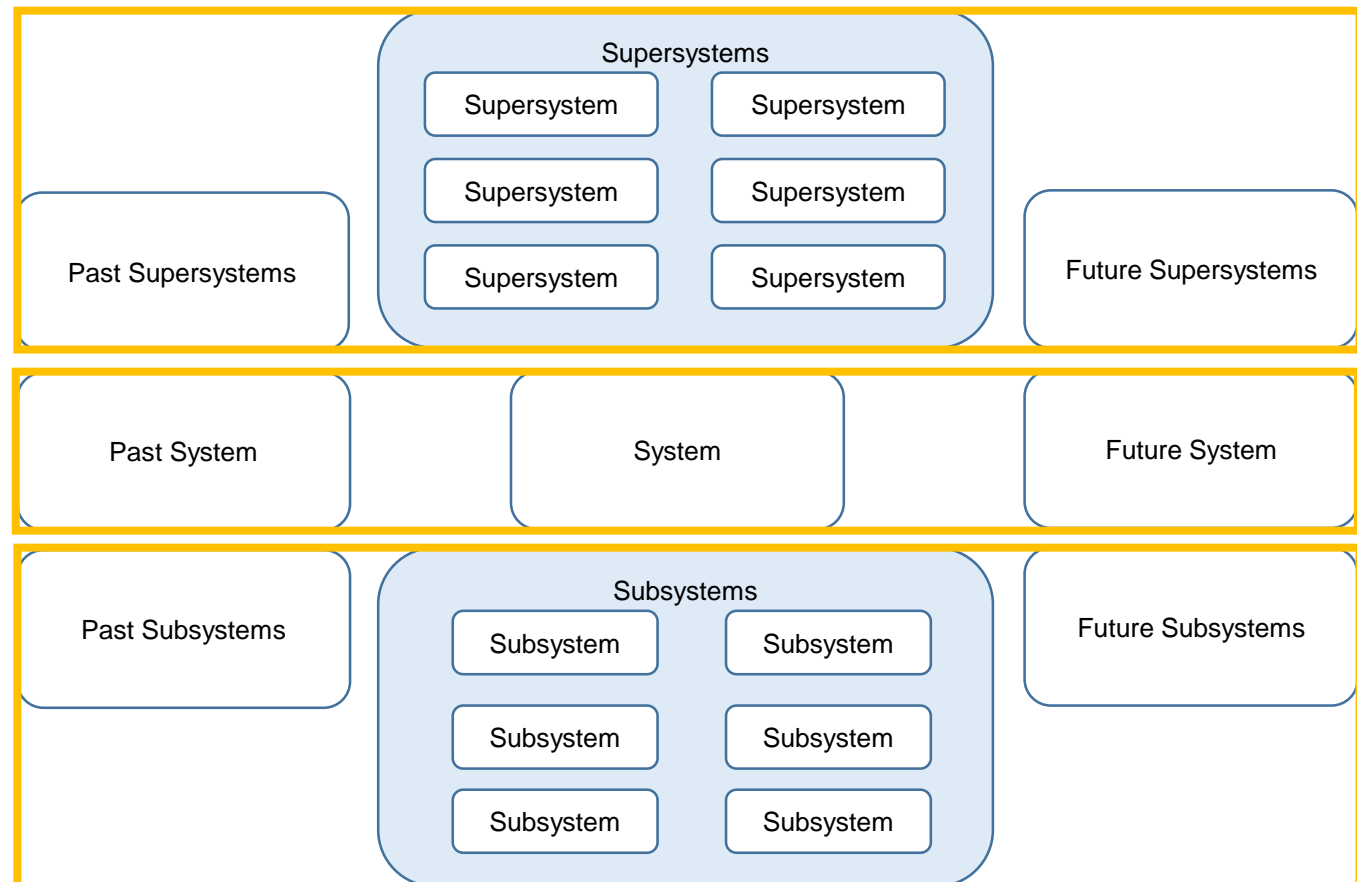
Nested Function Model for “complex” Product



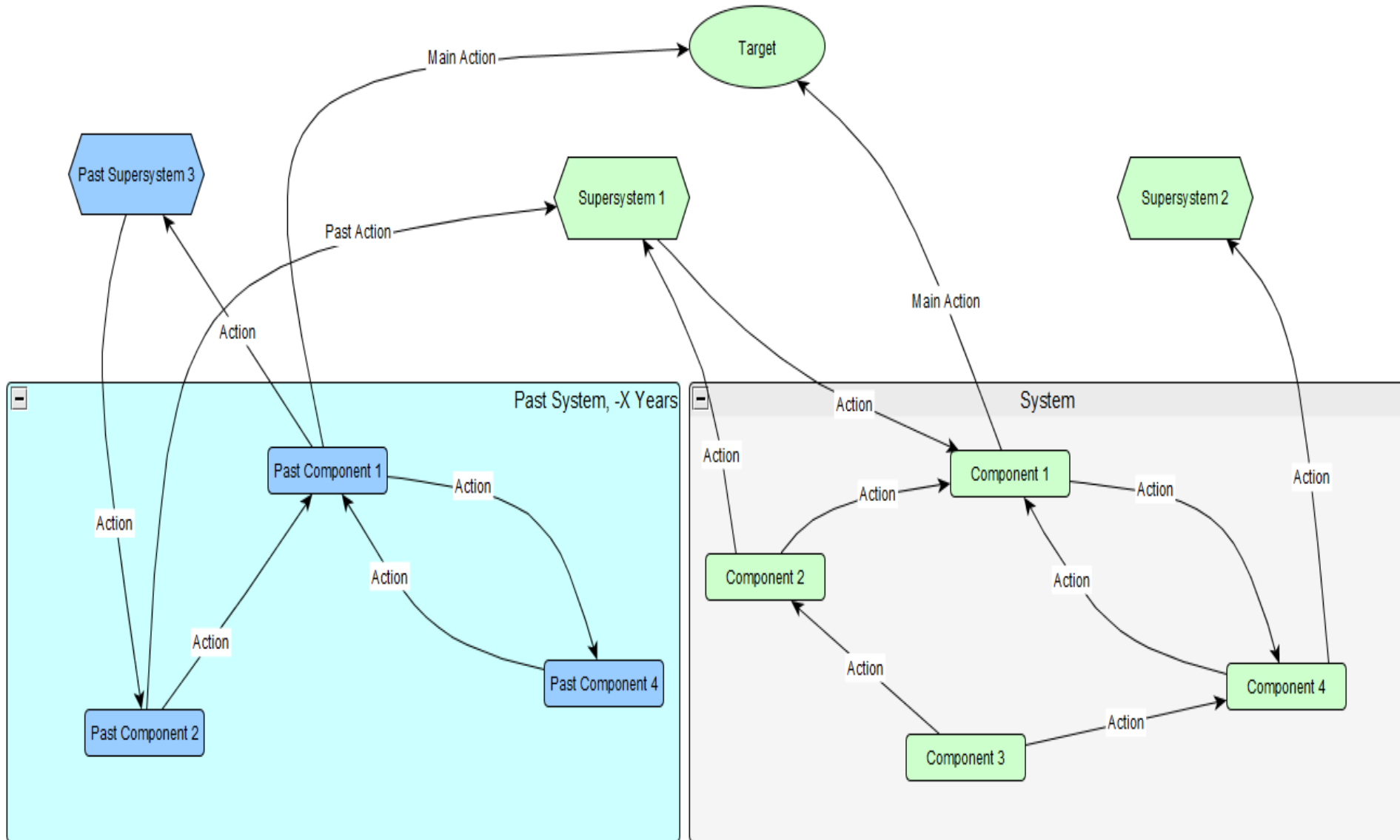
9 screen model and function models

Second step:

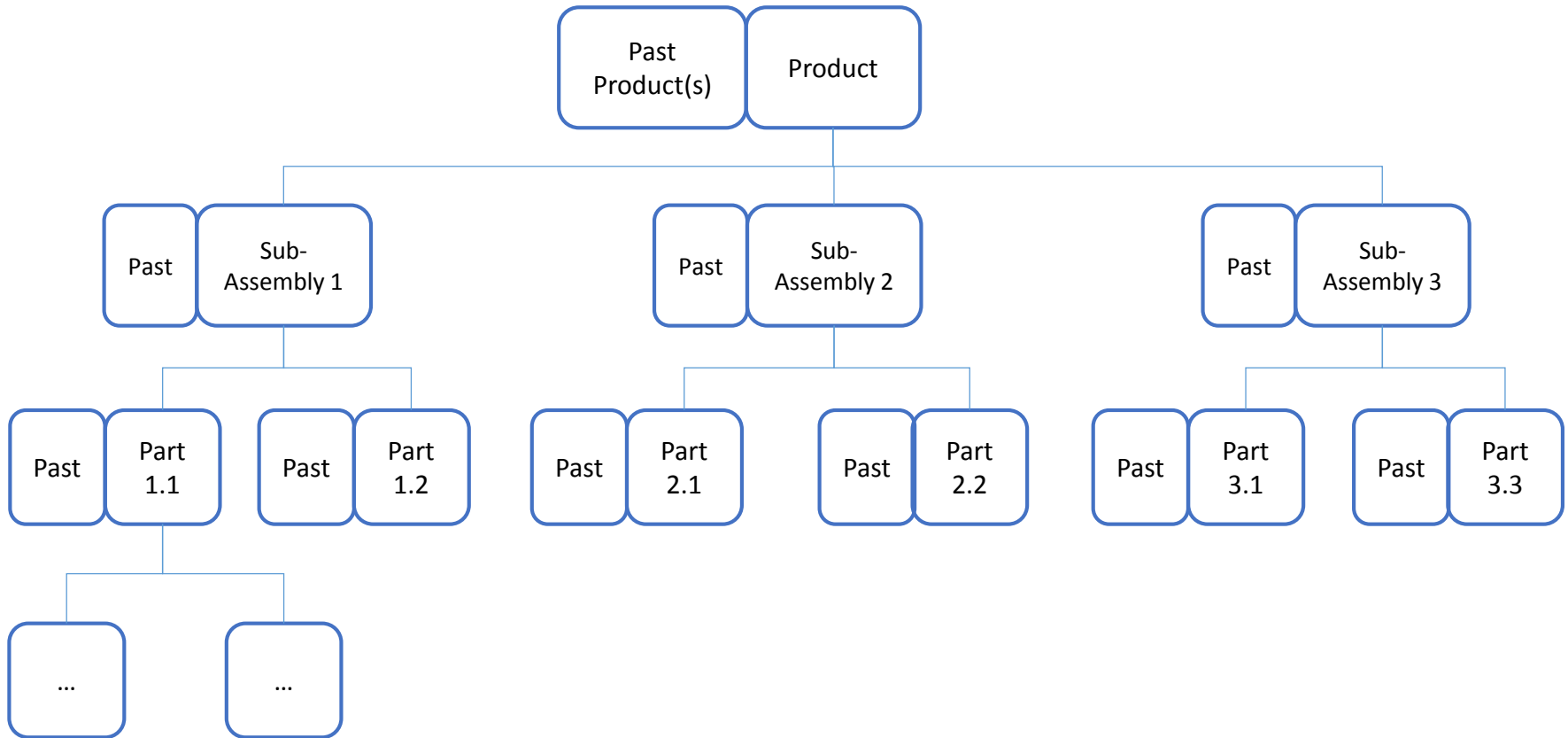
Synchronizing horizontal axis of 9 screen model with function models



Function Model of Past and Present System



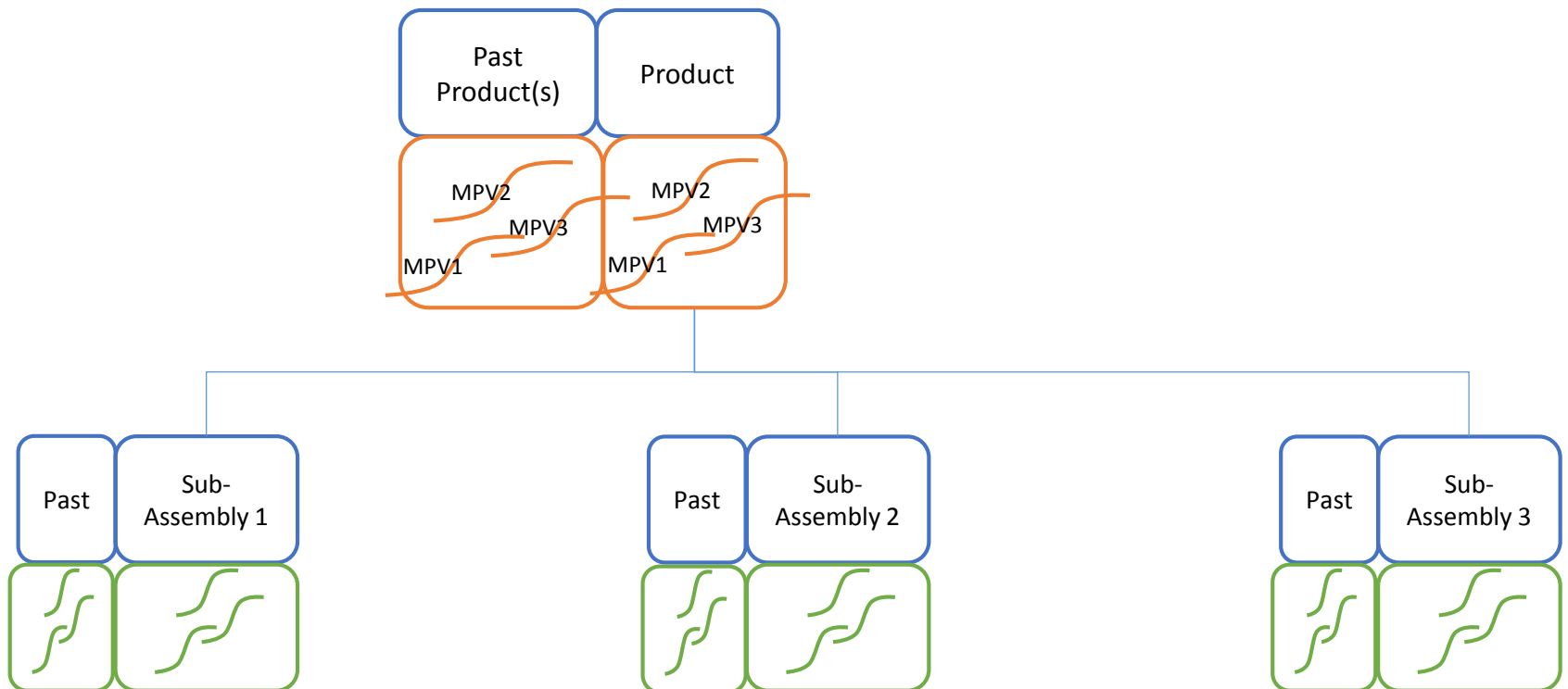
Hierarchical Product Structure



Integrating MPV

Third step:

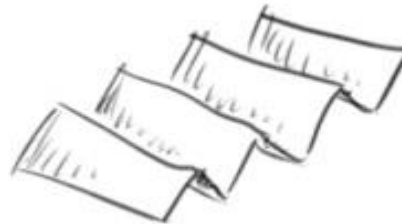
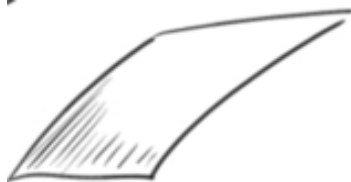
Identify MPV-Sets for components on all levels, as well as their development over time



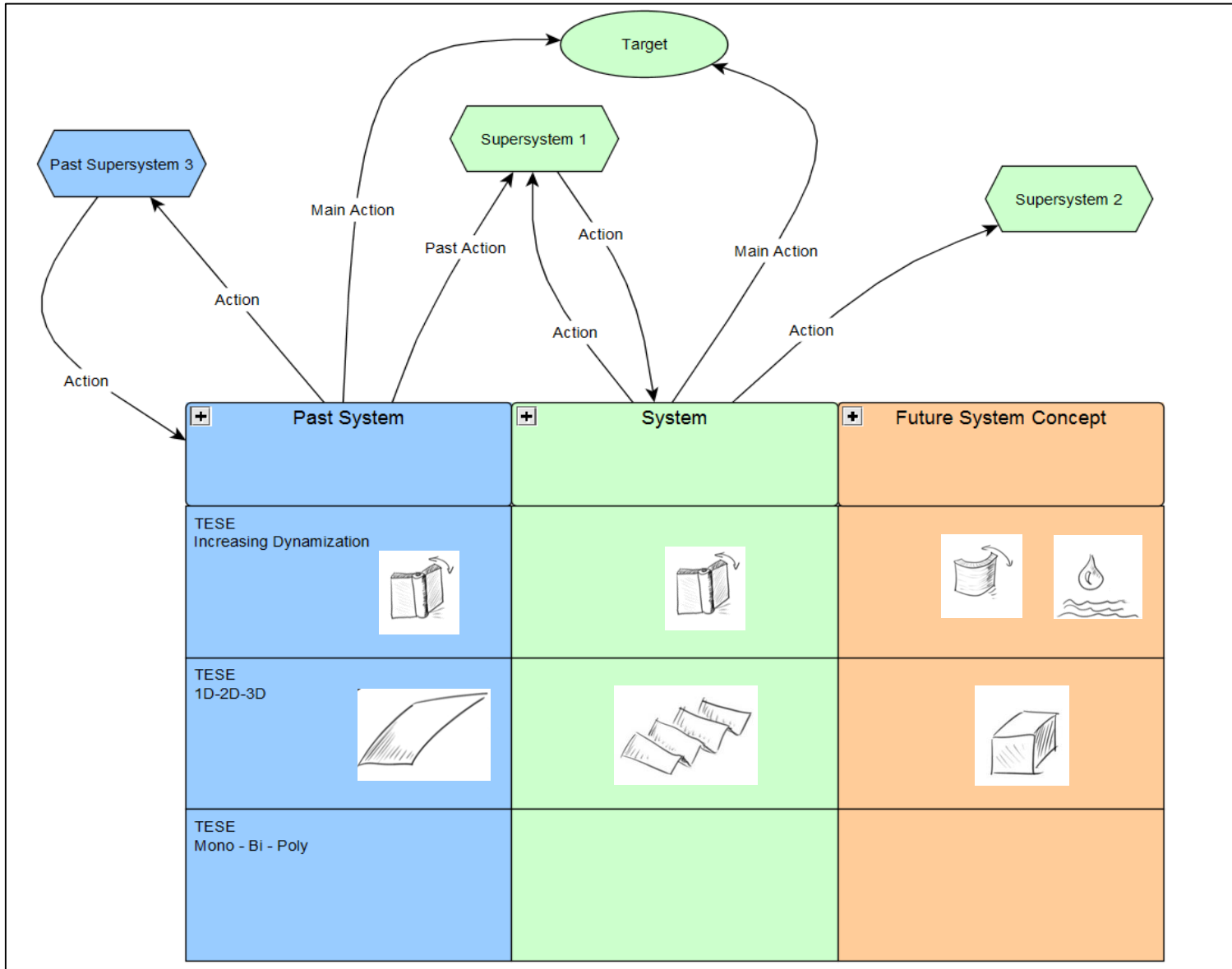
Integrating MPV

Fourth step:

Identify TESE-Sets for each component, supported by past function models.



Identification of TESE Mechanisms

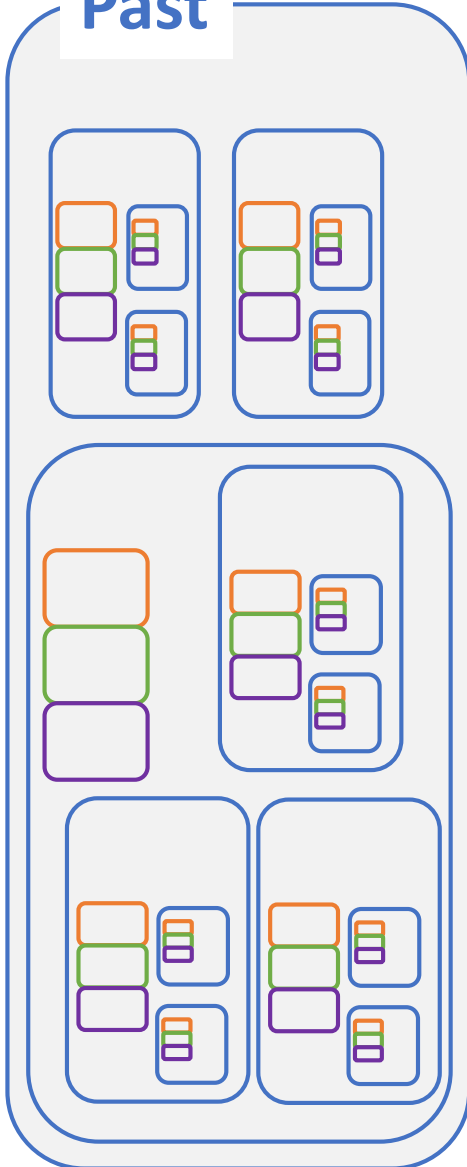


„Completing“ the Map

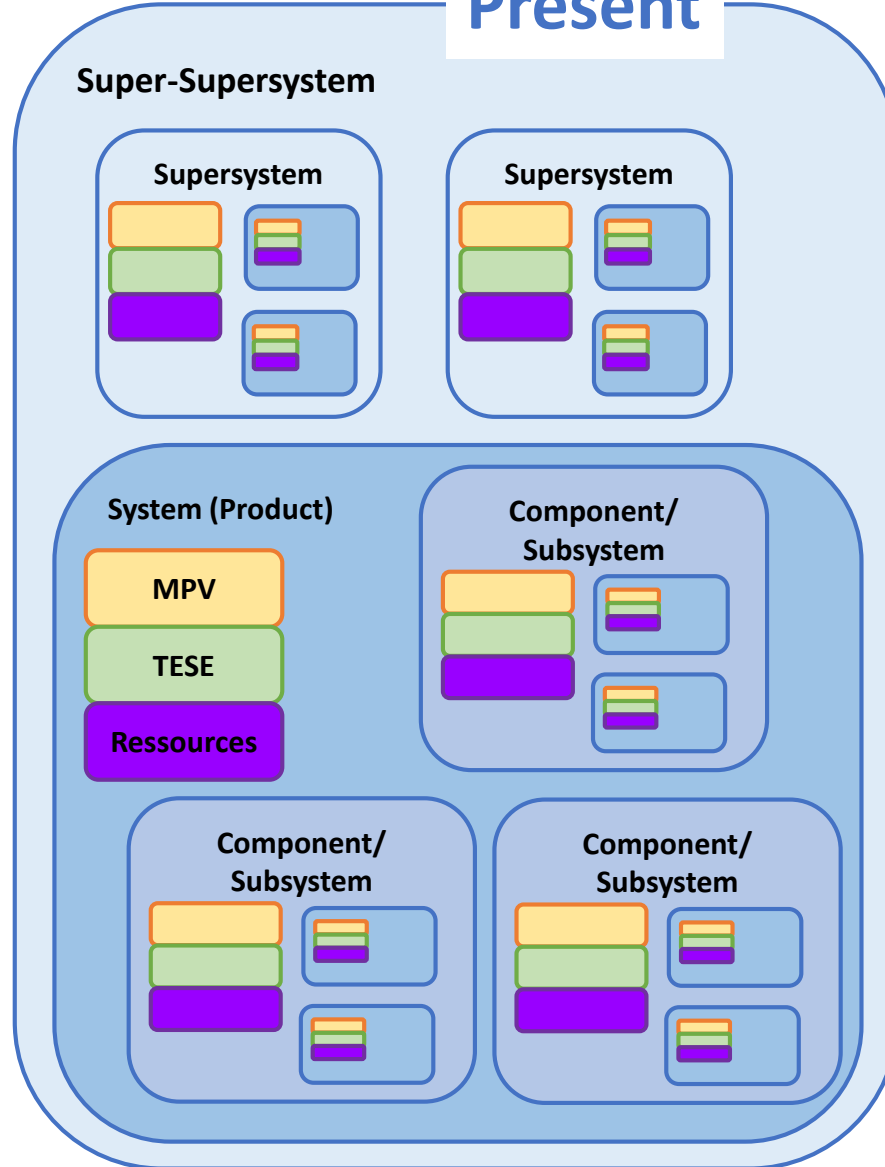
- Based on Nested Function Models we can further gather additional information like resources of each component, defining several operating conditions (operating times), costs etc.
- Gradually, a structured „Product Map“ is generated that enhances decision making for management and problem solving processes within and across departments.

„Completing“ the Map

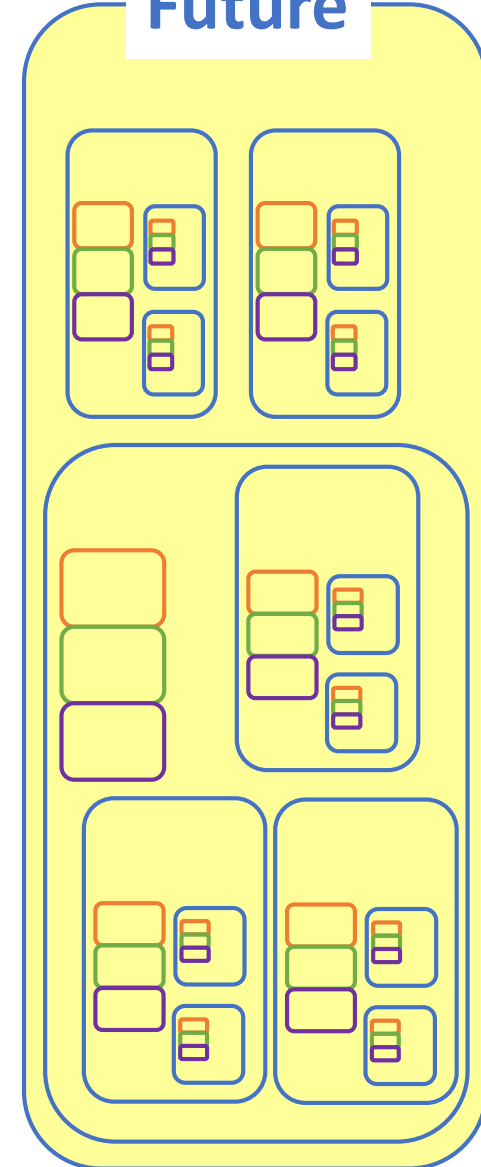
Past



Present



Future



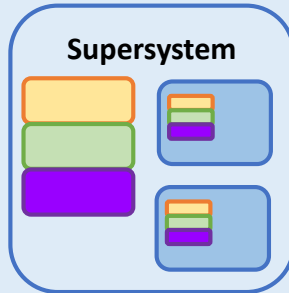
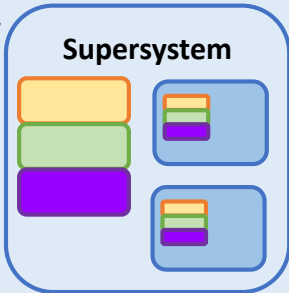
Working with the Map



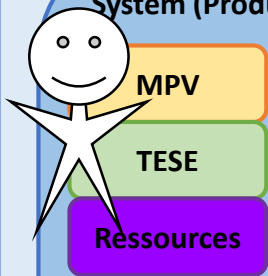
Present

Future

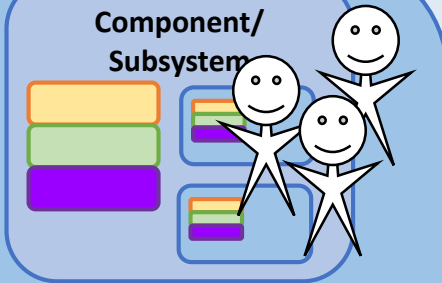
Super-Supersystem



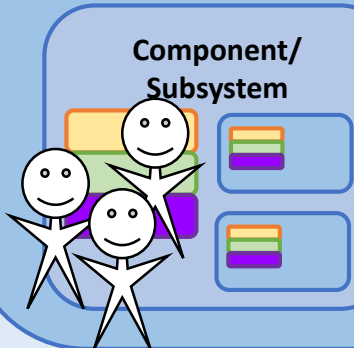
System (Product)



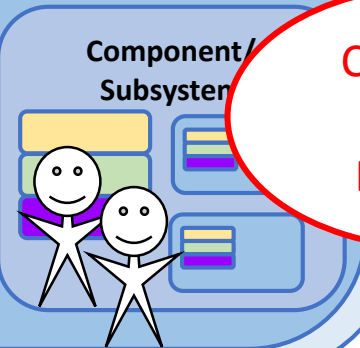
Component/ Subsystem



Component/ Subsystem



Component/ Subsystem



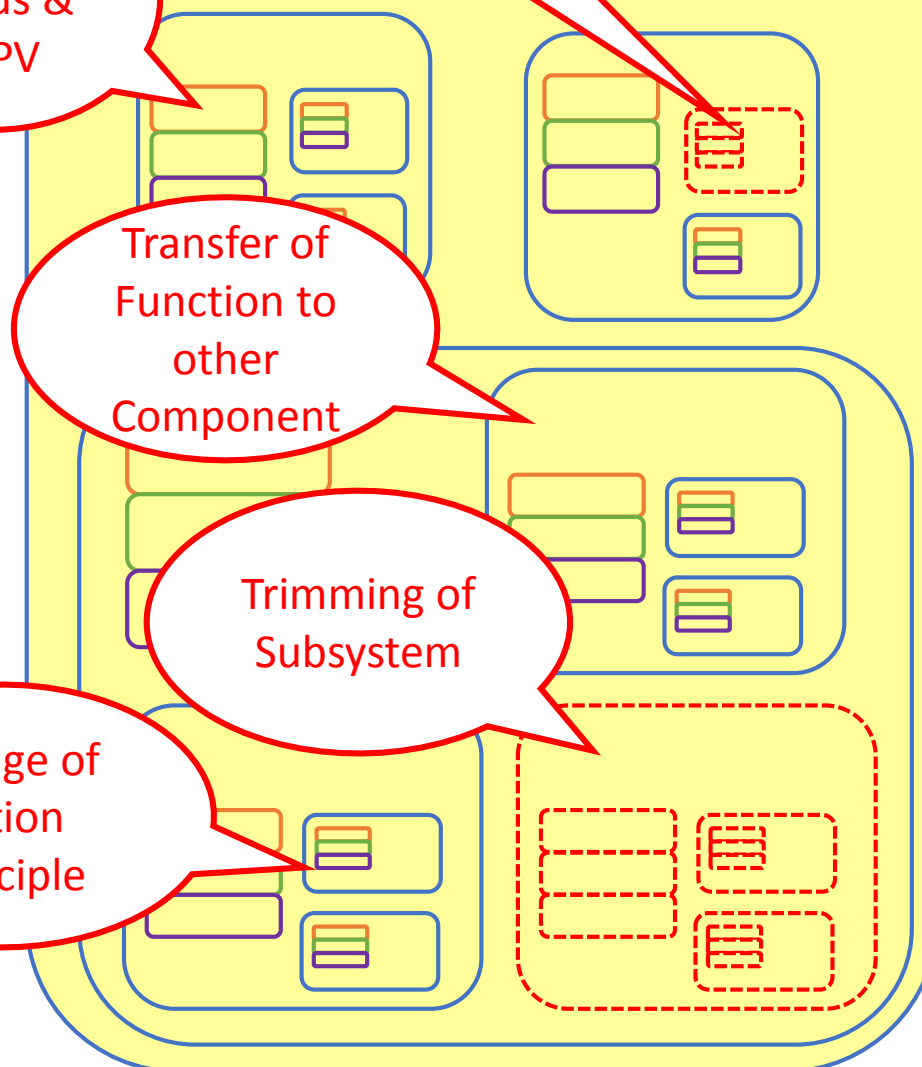
Changing needs & MPV

Material not available

Transfer of Function to other Component

Trimming of Subsystem

Change of Action Principle



Conclusion

Combining Nested Function Models with TESE, MPV and Ressources under aspects of 9 windows approach generates a structured product roadmap.

This product roadmap...

- ...gives Management an overview and supports substantiated decision making.
- ...enables companies to organize innovation activities, inventive problem solving and evaluation of possible future paths for products.
- ...helps to derive the right activities and decisions on investements, competence development, production and people management etc. to actively design future developments on technical and corporate level.

Critical view and next steps

Our next steps:

- Conduct pilot projects for complex systems and evaluate the added value of this approach.
- Identify traps and derive recommendations for building Nested Function Models (interface to other systems on same or higher level, working with different usage scenarios and timeframes...)
- Develop a software for generating NFM with all connected aspects like MPV, TESE, Ressources, costs etc.)

Subject matter	Paper deals with scientific issues of TRIZ development	<input type="checkbox"/>
	Paper deals with issues of practical TRIZ application for inventive problem solving, innovation activity, or TRIZ training	<input checked="" type="checkbox"/>
	Paper deals with issues other than TRIZ	<input type="checkbox"/>
Novelty	Paper describes a new TRIZ tool or section	<input type="checkbox"/>
	Fundamental modification of a known TRIZ tool or section	<input type="checkbox"/>
	Significant modification of a known TRIZ tool or section	<input type="checkbox"/>
	Noticeable improvement of a known TRIZ tool or section	<input type="checkbox"/>
	Minor improvement	<input checked="" type="checkbox"/>
	No novelty or deterioration	<input checked="" type="checkbox"/>
Relevance	Relevant for TRIZ in general, for all its applications as of the paper publication date	<input type="checkbox"/>
	Relevant for individual TRIZ sections and several TRIZ applications	<input type="checkbox"/>
	Relevant for one specific tool or section and for limited applications	<input type="checkbox"/>
	Relevant for special applications of TRIZ tool or section	<input checked="" type="checkbox"/>
	Irrelevant	<input type="checkbox"/>
Instrumentality	Proposed algorithms, methods, and concepts can be easily or have been implemented in computer software	<input checked="" type="checkbox"/>
	Proposed algorithms and methods are clear and precise, with explicitly defined application rules, but requiring some improvement to enable their implementation in computer software	<input type="checkbox"/>
	Some algorithms and rules are permit ambiguous interpretation	<input type="checkbox"/>
	Recommendations are too general and contain poor algorithms	<input type="checkbox"/>
	Recommendations, as proposed, yield no results	<input type="checkbox"/>
Reproducibility	Results can be reproduced by following author's recommendations	<input type="checkbox"/>
	Results can be reproduced by many specialists after additional training	<input type="checkbox"/>
	Paper deals with scientific issues of TRIZ development	<input type="checkbox"/>
	Paper deals with issues of practical TRIZ application for inventive problem solving, innovation activity, or TRIZ training	<input checked="" type="checkbox"/>
	Paper deals with issues other than TRIZ	<input type="checkbox"/>

Thank you for your patience!
We appreciate your comments and feedback!