Innovazione e sviluppo prodotto
&
Innovation Management & New Product Development

New Product Development:
New concept generation and the use of TRIZ

Raffaella Manzini, Valentina Lazzarotti, Gloria Puliga

Development process

FASE 0 — Planning or declaration of intent

FASE 1 — **Concept design**

FASE 2 — System level design (pre-design)

FASE 3 — Detailed design

FASE 4 — Test and improvement

FASE 5 — Production

FASE 6 — Marketing and Commercialization

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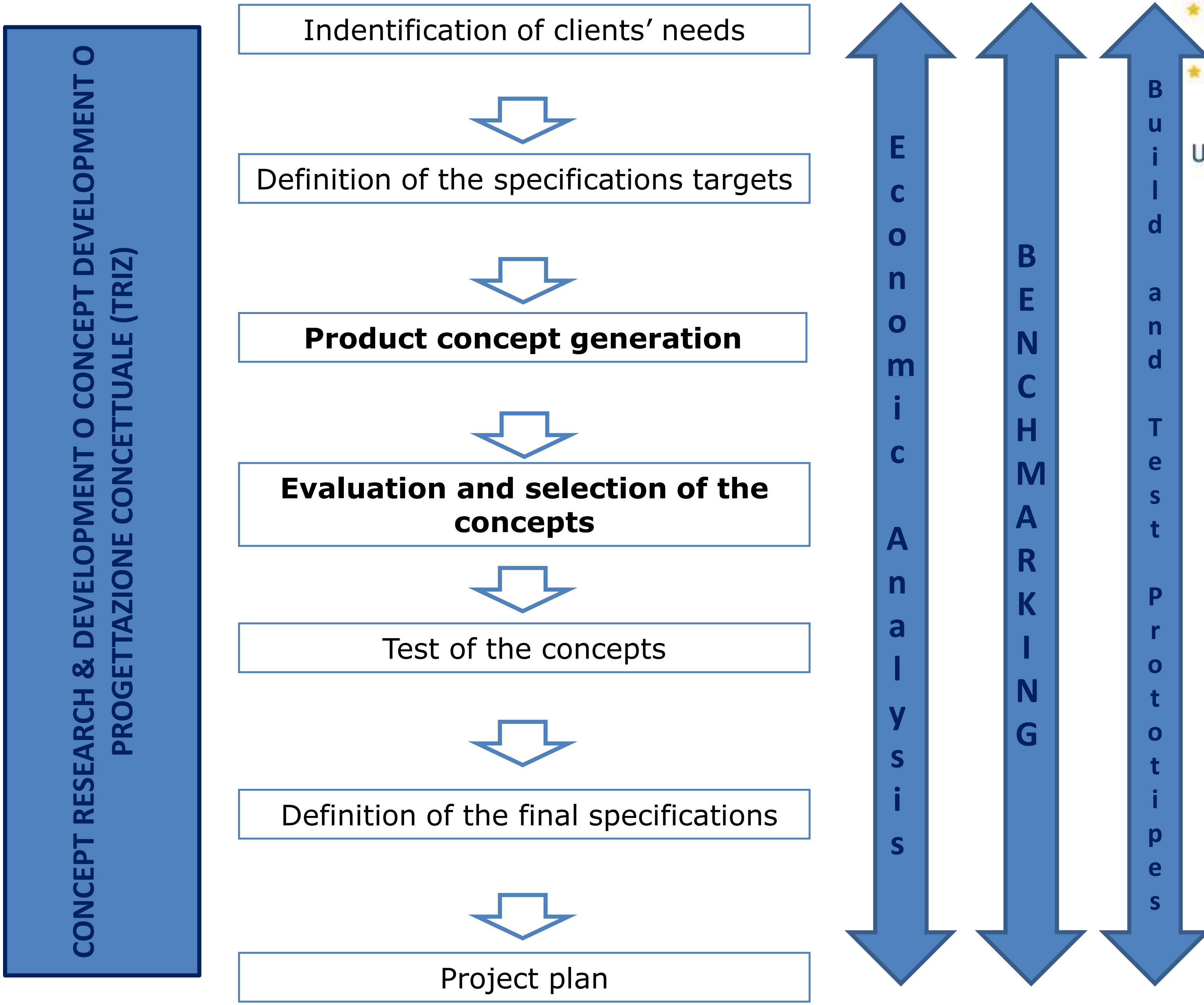

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CONCEPT development

PROJECT PLAN/ PROJECT MISSION → **CONCEPT RESEARCH & DEVELOPMENT** → PROJECT APPROVAL → DEVELOPMENT PLAN

- Customer needs identification
- Target product specification
- Benchmarking
- Concept generation, evaluation, selection TRIZ
- Final target product specification

Techniques for supporting new concept generation

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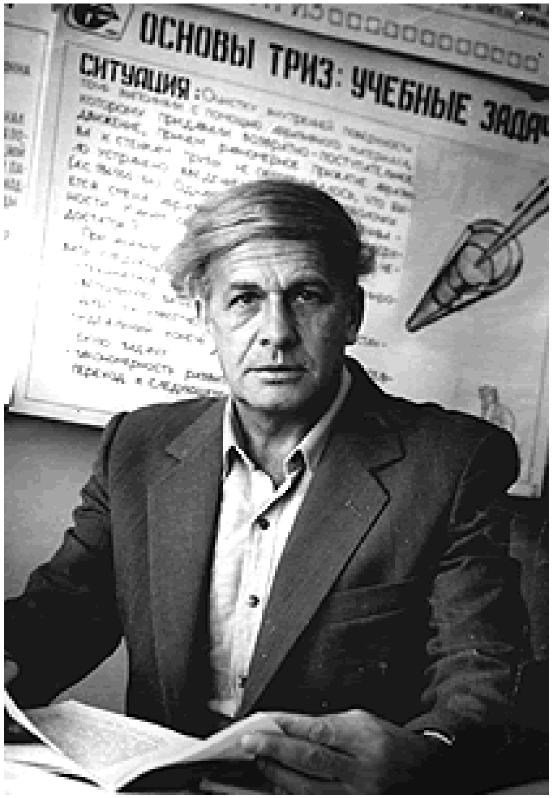
- Quality function deployment
- Lead users analysis
- Benchmarking
- Brainstorming
- Lateral thinking
- Serendipity
- ….
- ….
- **TRIZ: theory of inventive problem solving**

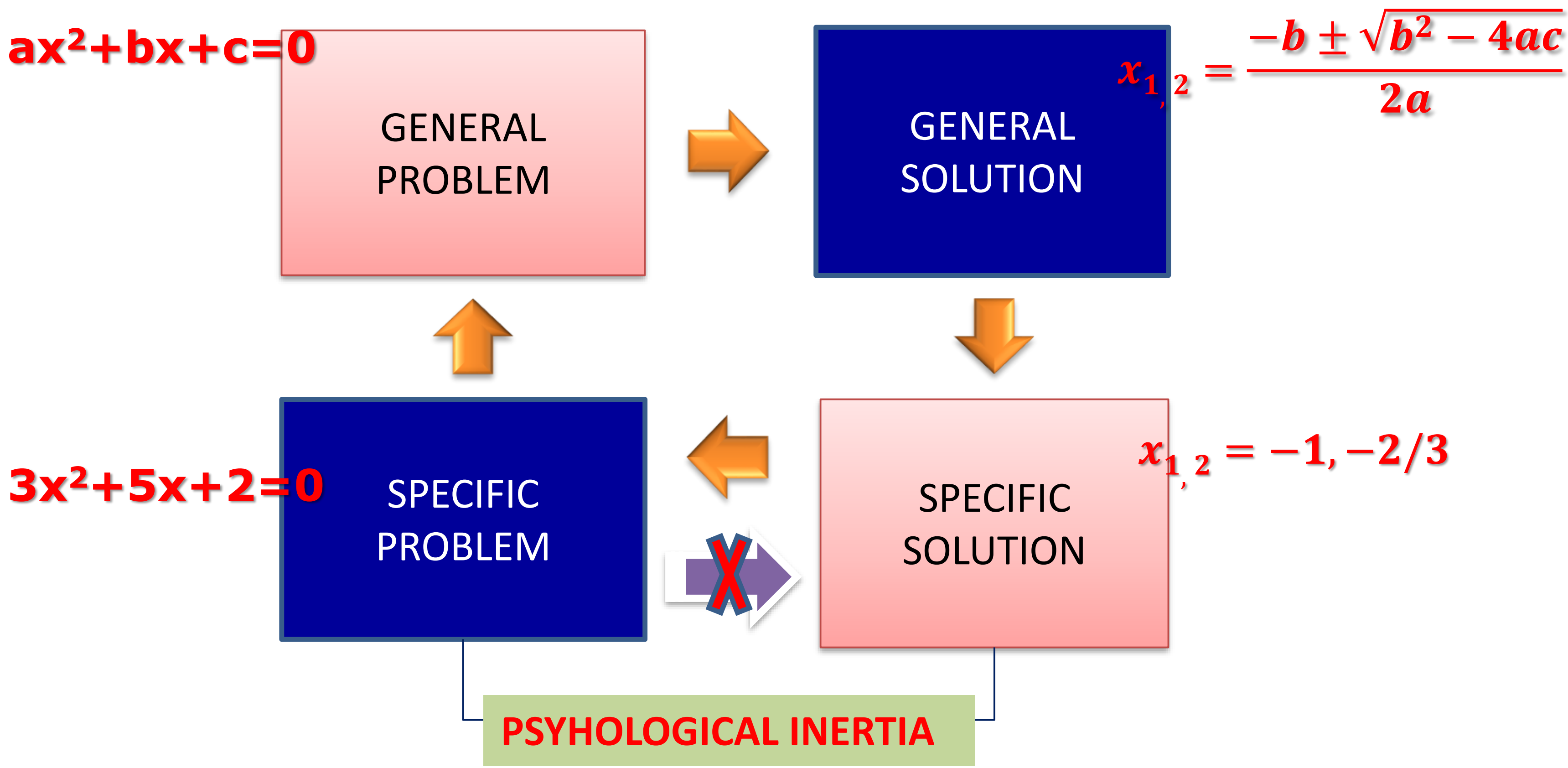
TRIZ: theory of inventive problem solving



теория решения изобретательских задач

- A theory developed by Genrich Altshuller in Russia in the late ’40s, based upon the following assumptions:
  – Inventors use patterns without awarness to develop new technology;
  – Technology evolution is a systematic process;
  – Innovation can be organised in a systematic way;
  – 98% of inventions use already known solution principles

TRIZ INVENTION MODEL: GENERAL FRAMEWORK



The problem of invention: psychological inertia

THINK TO A BALL…

The problem of invention: psychological inertia

WHICH ARE THE MINIMUM DIMENSIONS OF A CD READER?

The problem of invention: psychological inertia

WHICH ARE THE MINIMUM DIMENSIONS OF A PIZZA CARTON?

Invention vs. optimisation

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EXAMPLE: COMPACT PRINTER

AS-IS solution

Optimization

Invention

Optimization → works on technical parameters
Every qualified engineer might solve the technical problem

Invention → it is a <u>change in the perspective</u>: I am not working on technical parameters but on something completely new. I have to think «out of the box» → **TRIZ**

Implementing TRIZ
a proposed framework

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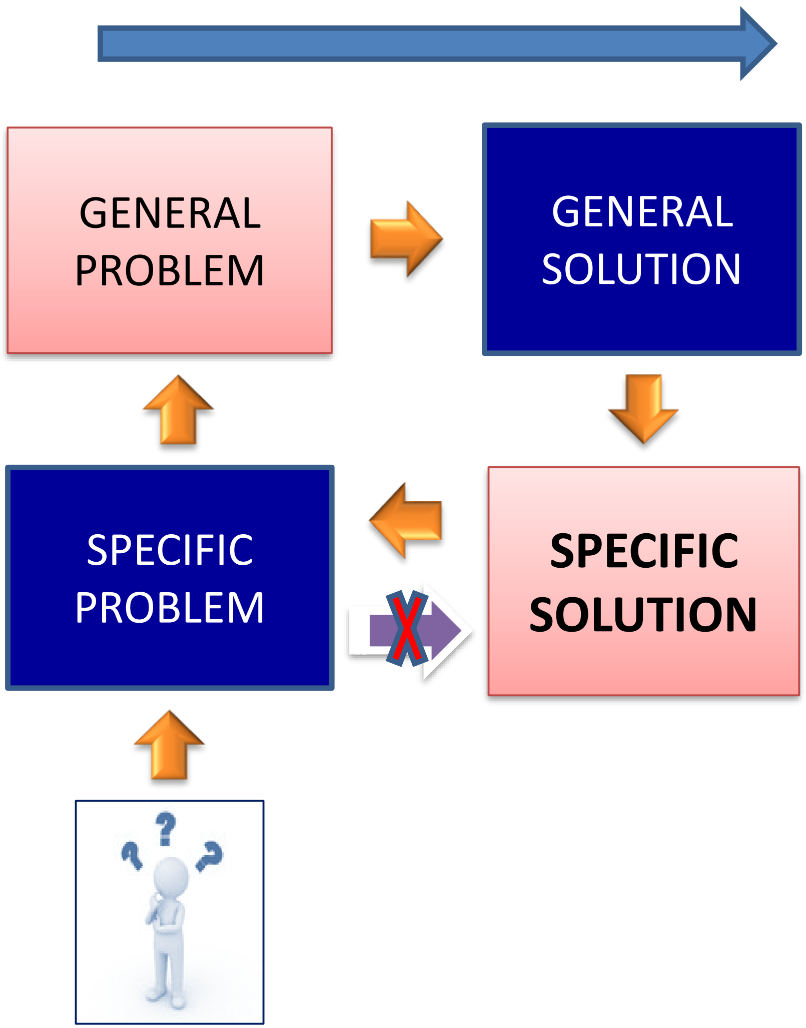
UNDERSTAND THE «HEARTH» OF THE PROBLEM
- PHYSICAL / TECHNICAL CONTRADICTIONS

PROBLEM ABSTRACTION (building a model)
- SU-FIELD ANALYSIS

HOW «MATURE» IS MY SYSTEM?
- Distance from IFR
- ITEMS

HOW DOES MY SYSTEM WORK?
- Describe your system/ products in the most objective way as possible ("film maker")
- Describe functions, value proposition, tangible and intangible features (product specifications)



FINDING A SOLUTION
- 40 PRINCIPLES
- SEPARATION PRINCIPLE

APPLYING THE SOLUTION TO THE SPECIFIC PROBLEM
- PATENT ANALYSIS
- Understanding evolutionary trends

Specific Problem

HOW «MATURE» IS MY SYSTEM?

- Distance from IFR
- ITEMS

HOW DOES MY SYSTEM WORK?

- Describe your system/ products in the most objective way as possible (“film maker”)
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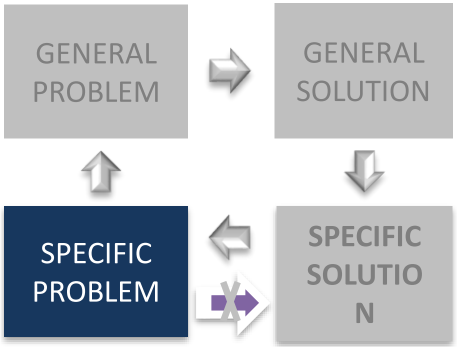


Film Maker

- The film maker aims to describe the main phases of the life of a product
- Provide general information about the system, describing them using the active form
- Describe the actual structure
- Description of how the system work, by detailing the phases of the life of the product ad the environment in which it acts
- Interactions of the product with other systems, close systems, “higher system” and environment
- Identification of the available resources (substances, fields, functional resources, information, time and space)

Product Needs

No.		Need	Imp.
1	The suspension	reduces vibration to the hands.	3
2	The suspension	allows easy traversal of slow, difficult terrain.	2
3	The suspension	enables high-speed descents on bumpy trails.	5
4	The suspension	allows sensitivity adjustment.	3
5	The suspension	preserves the steering characteristics of the bike.	4
6	The suspension	remains rigid during hard cornering.	4
7	The suspension	is lightweight.	4
8	The suspension	provides stiff mounting points for the brakes.	2
9	The suspension	fits a wide variety of bikes, wheels, and tires.	5
10	The suspension	is easy to install.	1
11	The suspension	works with fenders.	1
12	The suspension	instills pride.	5
13	The suspension	is affordable for an amateur enthusiast.	5
14	The suspension	is not contaminated by water.	5
15	The suspension	is not contaminated by grunge.	5
16	The suspension	can be easily accessed for maintenance.	3
17	The suspension	allows easy replacement of worn parts.	1
18	The suspension	can be maintained with readily available tools.	3
19	The suspension	lasts a long time.	5
20	The suspension	is safe in a crash.	5

Product needs and specifications

	Product Needs	Technical Specifications
The Trolley (Case)	should have a low weight	Weight of the case below 2 kg
The Trolley (Case)	should be waterproof	Build with a waterproof material
The Trolley (Case)	should be as small (in terms of volume) as needed	The dimensions should be x*y*z

The Ideal Final Result (IFR)

- The way towards the Ideal Final Result (IFR) requires reduction (ideally, elimination) of ITEMS:
  - I → INFORMATION
  - T → TIME
  - E → ENERGY
  - M → MATERIAL
  - S → SPACE

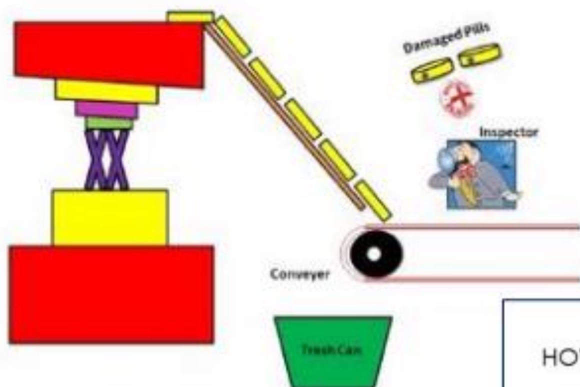
Ideality

Ideality Approach

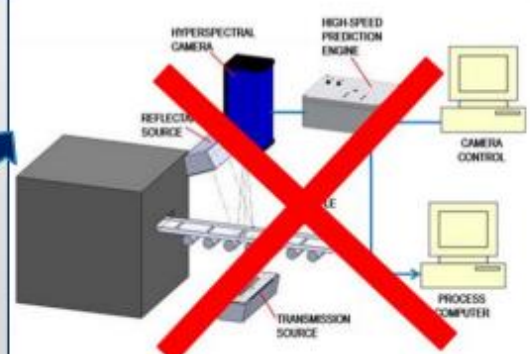
- The ideal system performs a required function without actually existing
- The function is often performed using existing resources
- ALL systems evolve in this direction over time by resolving contradictions
- Defining Ideality breaks psychological inertia

Ideality: example

Vibratory feed move pills around an internal spiral to top of vibratory bowl where the pills are discharged and slide down an incline plane onto a conveyor. As the pills go by, the inspectors identify and remove the damaged pills

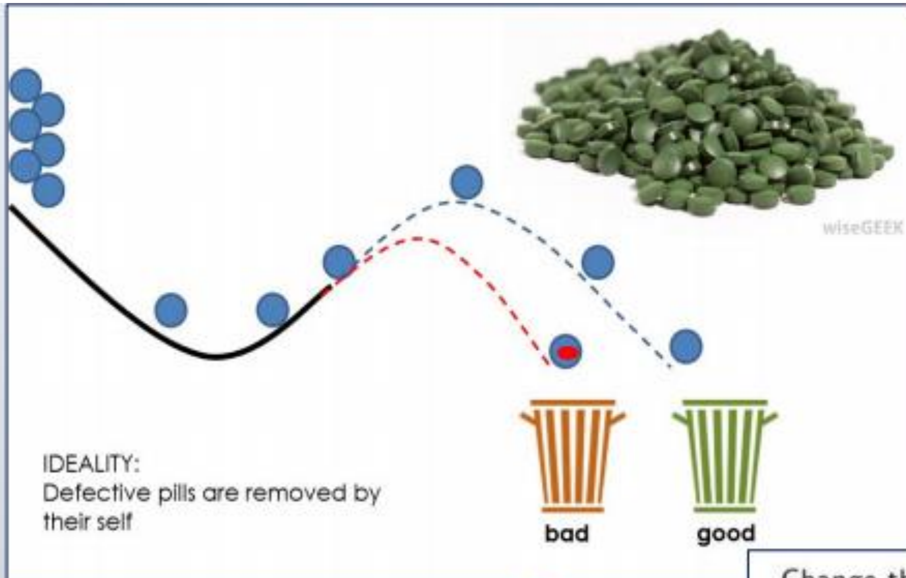


HOW To remove defective pills?

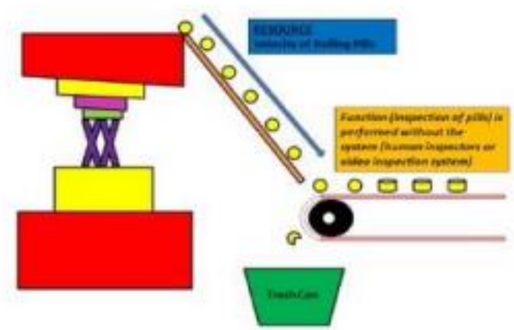


AVOID introducing external resources

Ideality: example



Change the escapement for the vibratory bowl so that the pills are ejected standing on their edge. Move the conveyor 3 inches. Pills that are round will roll at a velocity that allows them to jump to the conveyor. The pills that are chipped will slide or will roll at a lower velocity and fall into the trash



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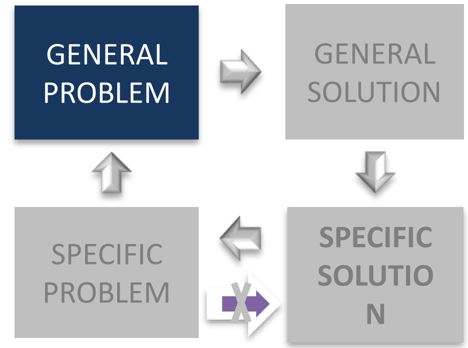
Problem generalisation



PROBLEM ABSTRACTION (building a model)

•SU-FIELD ANALYSIS

UNDERSTAND THE «HEARTH» OF THE PROBLEM

• PHYSICAL / TECHNICAL CONTRADDICTIONS

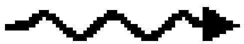
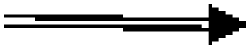
Su-field analysis

The minimum SF model includes:

- an "article" (S_1) representing an object that is changed or influenced in some way
- a tool (S_2) representing the means by which S_1 is changed or influenced
- energy (F) representing the interaction between S_1 and S_2

- *A vacuum cleaner cleaning a carpet*
  S_1 - carpet (article)
  S_2 - vacuum cleaner (tool)
  F - cleaning (mechanical field)

Su-field analysis - language

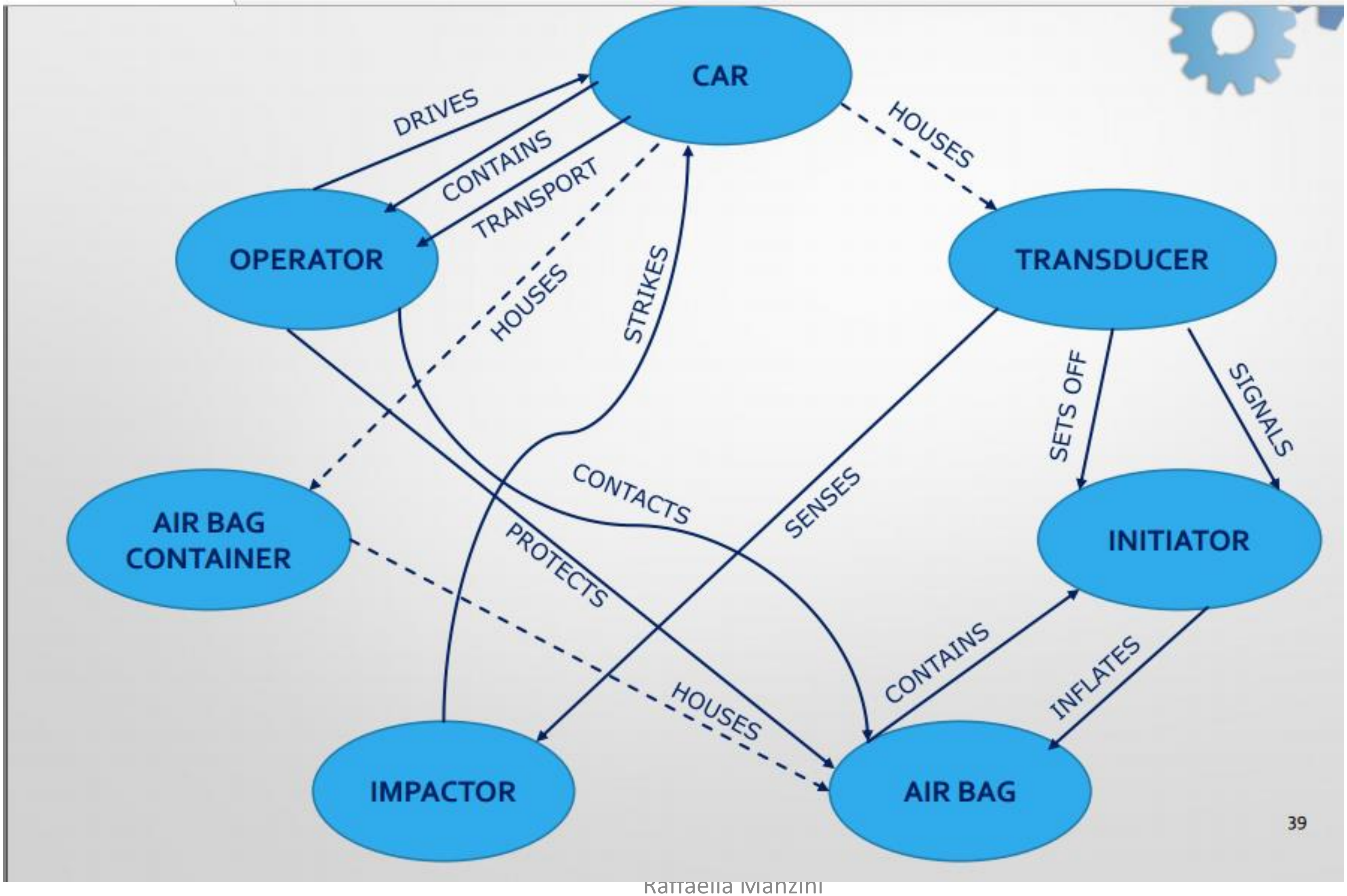
Symbol	Meaning
	Desired action or effect
	Insufficient (inefficient) desired action or effect
	Harmful action or effect
	Transition to a solution

Fields can be:
Me - mechanical
Th - thermal
Ch **-** chemical
E - electrical
M **-** magnetic

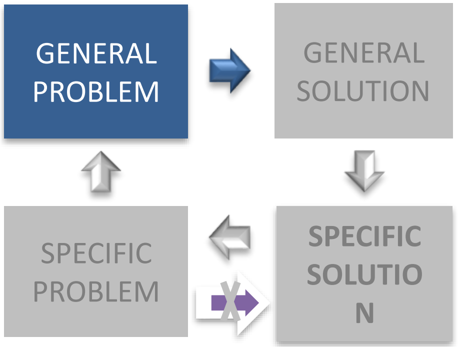
Applying su-field analysis

- Identify the elements of a system.
- Identify The fields.
- Construct the model.
- After completing these steps, stop to evaluate the completeness and effectiveness of the system. Bring into evidence if some element is missing, some effect is harmful, or not necessary, try to identify what it is.

Su-field analysis example: the airbag



From the general problem to the general solution



Undesired effects, inefficient effects are often generated by CONTRADICTIONS (conflicts in a system); they represent the general problem

Solving contradictions means moving towards a general solution for the general problem