

Power/Energy resources

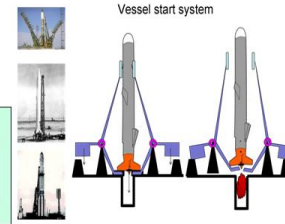
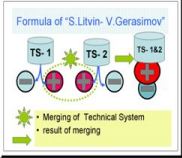
- Resources are energy, elements and information in the system and its environment.
- Find and use ready resources.
- Uncover and use latent resources.
- Derive and combine resources.



- Power/Energy resources are energy, forces, money etc. available in the system.
- Find and use ready or latent energy resources.
- Use heat from engine to heat passenger cabin
- Consider using energy flows and dissipated or harmful energy.
- Use dissipated heat from refrigerators to heating the store
- Derive and combine power/energy resources.
- Hybrid vehicles combine internal combustion engines with battery and electric motor.

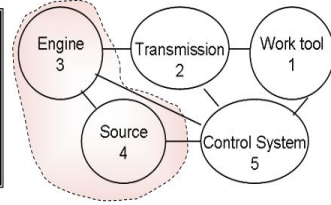


$$i = \frac{N \cdot \sum F}{\sum (\text{cost}) + HF}$$



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Resources from environment



Elements

- Elements
- Element resources are objects, materials, substances etc. available in the system.
- Find and use ready or latent element resources.
- Use snow as an air filter media in polar regions.
- Consider using elements flows and elements traditionally viewed as waste or harm.
- Use animal waste as fertilizer
- Derive and combine element resources.
- Combine air and hotel travel bookings to save money



Resources of field and materials

Problem of small stability of canopy regarding to wind stress



We can use energy of wind for support of form and remove defined disadvantages and air as the special free of charge element

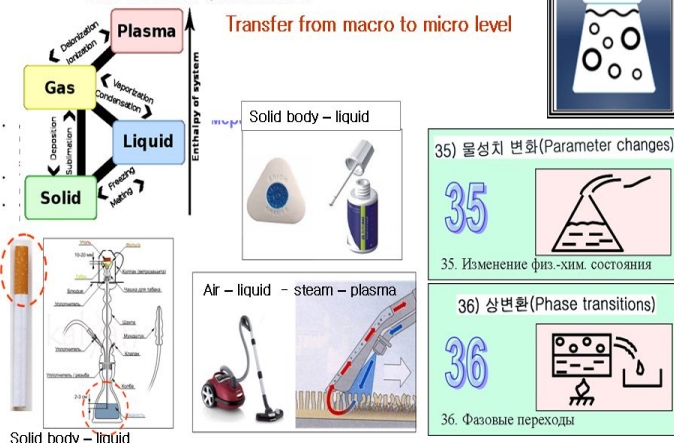
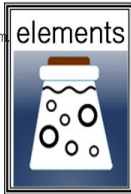
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Silica gel is a commonly used desiccant as beads packed in a permeable bag

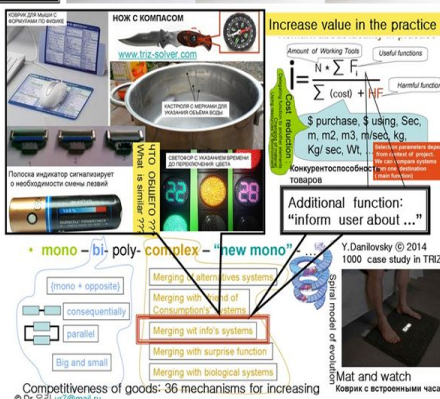
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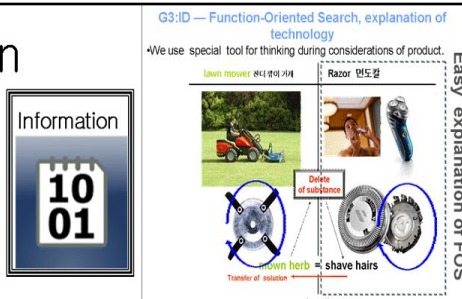
Information

- Information resources are changes in the system properties.
- Find and use ready or latent information resources.
- Use customers' feedback to improve a product.
- Consider various flows and changes as sources of information, including harmful ones or "noise".
- Temperature sensitive color changing plastic for child feeding spoon.
- Derive and combine information resources.
- Add markers or easily detected elements.
- Add an aromatic compound in natural gas to alert users to leakage.



Information

- Information resources are changes in the system properties.
- Find and use ready or latent information resources.
- Innovation Challenge: Utilize global knowledge to achieve more effective innovation faster
- G3:ID tools that address this challenge: Function-Oriented Search (FOS), Global Knowledge Network (GKN).
- FOS and GKN Synopsis: It is method of analogy for solve problem with function's criteria.



Derived

MATCHem



Function: Creating of information

Derived resources become available after transforming ready resources.

- Use scientific effects to transform available resources into a form that you need.
- Accelerate chemical reactions with a catalyst.
- Transform energy (Mechanical, Thermal, Chemical, Electrical, Magnetic) or substances (solid, liquid, gas, plasma) into other type.
- Solar powered calculator.
- For human interactions transform emotions (love, anger, fear, etc.) or images (positive, negative, neutral) into desirable type.
- Offer door prizes to boost attendance events.

MATCHem

Moscow University (모스 부흥)

Etching of asides (photography's process)

E-paper

Touch screen panel

Magnet liquids

250°C

21:00:30

Solar battery and wind turbine

SOLAR CELL GENERATOR

WIND GENERATOR

HOT WATER

Thermal energy in the movement

Reason field diagram

Response action

MATCHem

37 열팽창 (Thermal expansion)

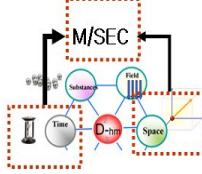
37. Temperature 팽창계열, 팽창

Derived

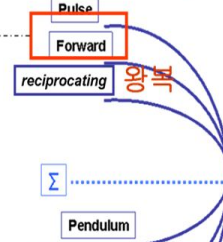


Derived resources become available after transforming ready resources.

Use scientific effects to transform available resources into a form that you need.



Conductivity 1



14. SPHEROIDALITY (곡면체의 원리)

Decision / Решение

14. Сферичность (Кривизна поверхности)

14. 曲率 (Curvature increase)

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Increasing efficiency of filter

Rotary movement

Forward movement

This example for TRIZ education was created in Phuket island (Thailand)

Derived



Conductivity 1

New system

Turn of axis	Pulse	forward	friction	pendulum	rotary	wave

Old system

Recharging of mobile phones

Shake 1 minute

Wireless power

Vibration during walking

Safety valve for steam

Door for pressure

Water door

Air door

Ultrasonic knife

Laser cutting

MATCHem

Consideration of knife

Heat tenderizer

Ultrasonic knife

Laser cutting

MATCHem

Intensify



Insufficient elements, energy and information resources can be concentrated or accumulated.

- Concentrate resources in a specific area.
- Accumulate resources over time.
- Water towers accumulate water overnight to use during the day.
- Derive and/or combine concentrated or accumulated resources.
- Combine savings account with mutual fund investments.



MATCHem

MATCHem as navigation system in internet

Gravity field

Mechanical cutting

Ultrasonic knife

Laser cutting

Thermal cutting equipment

oxy fuel cutting

MATCHem

Use Time

(Preliminary action)



Time resources are time intervals before, during (pauses) and after the function performance.

- Use available time resources.
- Modify process in order to obtain new time resources (for example, transition from continuous to periodic action).

Preliminary action

Performing something in advance with:

- Elements and objects that the system works with and on.

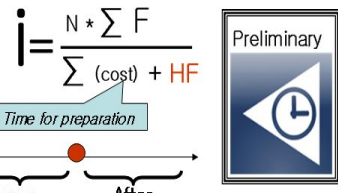
Install fire extinguishers in buildings

- Activity, process, action or interaction.

Publish an agenda before a meeting.

- Environment in and around the system.

Pre-release advertisement to build demand prior to introduction.



10 예비 작용 (Preliminary action)

10. Предварительное действие

$T^o(+)\rightarrow T^o(-)$

Powder

cartridge

Tea

Tea bags

Tobacco pipe

Cigar

MATCHem

Post process time

$i = \frac{N \cdot \sum F}{\sum (cost) + HF}$

Post process time

Perform something post process with:

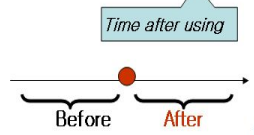
- Elements and objects that the system works with and on.

Age wine and cheese.

- Activity, process, action or interaction.

Harvest green bananas to ripen during shipment.

- Environment in and around the system.



20 유용한 작용의 지속 (Continuity of useful action)

20. Непрерывность полезного действия

BROWN Leaves, stew, woody materials

GREEN Grass, food scraps, manures

COMPOST

COMPOST HAPPENS

MACRO-ORGANISMS Earthworms, insects, etc.

MICRO-ORGANISMS Bacteria, fungi, microbes

WATER

AIR



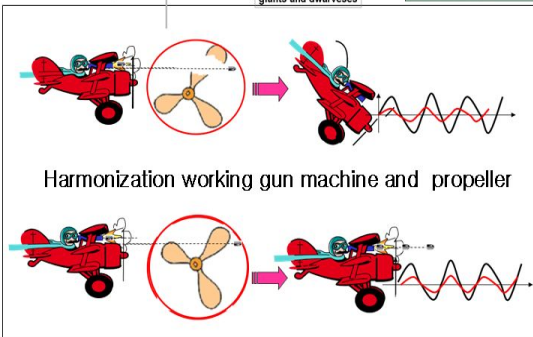
Use pauses



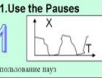
Use or create pauses in a process to perform something with:

- Elements and objects that the system works with and on.

- Perform maintenance work during vacations.
- Activity, process, action or interaction.
- Conduct training during pauses in work (at lunch time).
- Environment in and around the system.
- Crop rotation to restore soil.



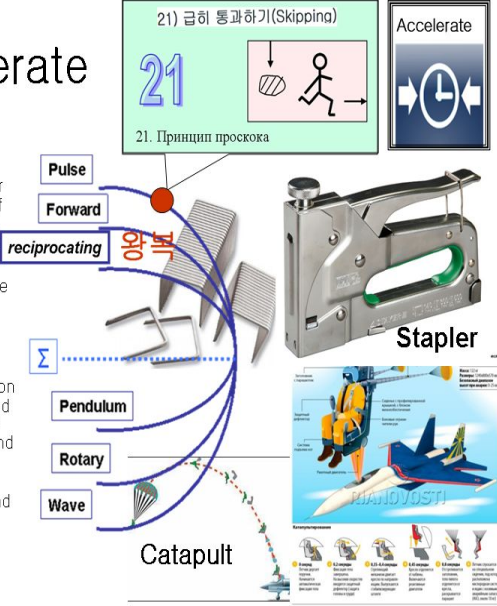
Pauses



Accelerate

Accelerate an activity, process, action or interaction to:

- Rush through risky or dangerous phases of the process.
- Quickly remove a bandage to lessen pain.
- Create additional time resources.
- Rapid prototyping to shorten the design cycle.
- Get positive effects on elements, objects and environment that the system works with and on.
- Flash frozen food to preserve nutrients and flavor.

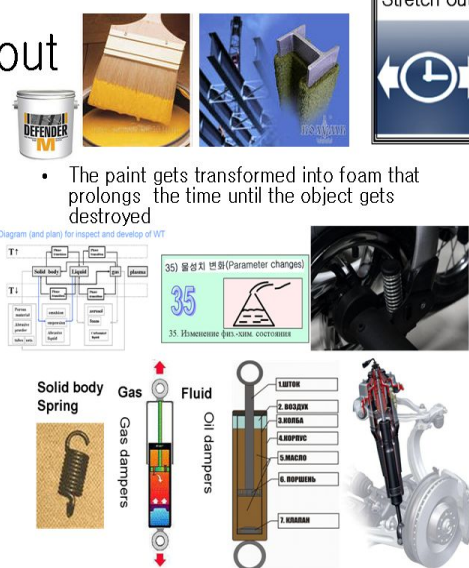


Stretch out

Stretch out an activity, process, action or interaction to:

- Increase positive effects on a system by giving additional time to the process.

- Bonsai. Make small cuts over a long period of time.
- Reduce negative effects by the distributing or dissipating over a long period of time.
- Monthly re-payment plans.



Stretch out

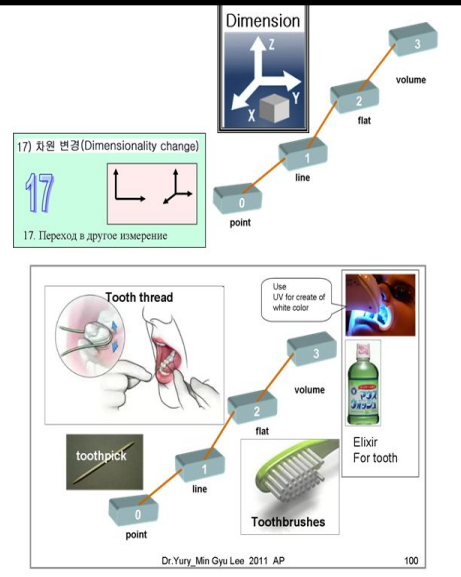
Another dimension

Space resources are available unoccupied space in the system and its surroundings.

- Find and use available space resources.
- Rearrange or modify elements to create usable space.

Another dimension Use additional dimensions as a resource:

- Consider multi-level composition of elements, put them on their side or an angle, or an opposite surface.
- Multi-story parking garage.
- Transition the activity, process, action or interaction from a point to linear, from linear to a surface, from surface to a volume.
- Two-layer bridge - each layer is a one-way road.
- Find and use additional dimensions in the environment and around the system.
- Spiral staircase uses less floor area.



Asymmetry

Utilize transition to asymmetry as resource:

- Transform elements or their composition asymmetrically by changing their form or structure.

- Special connectors with complex shape/pin configurations to ensure correct assembly
- Insert asymmetry into activity, process, action or interaction.
- Schedule start time of an event to odd minutes of the hour to make it more memorable.
- Transform interactions between the system and its environment into an asymmetric relationship.
- Allow staff to start and finish work at different times to avoid rush hours.



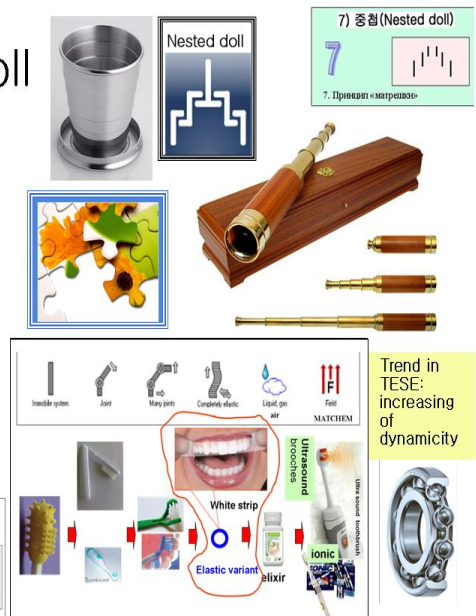
Asymmetry

Nesting doll

Place one entity inside another:

- Transform elements or their composition into nested configuration.
- Measuring cups or spoons
- Insert one activity, process, action or interaction into another.
- Putting one business inside another - bank inside supermarket.
- Transition to a nested environment.

Las Vegas style: the guest must pass through the casino area to get to the hotel.



Trend in TESE: increasing of dynamicity

Take out the part

Sub trend 1
Individual - collectives

7.1

technique

nature

Sub trend 2
universal - special

7.2

Atomic watch for astronomical measure

Peoples, dogs, fish...

2) 추출 (Separation)

2. Принцип вынесения

Big noise of wind turbines

Take something out of the system:

- Relocate elements or their parts to outside the system.
- Outsource design, or HR administration activities.
- Perform activity, process, action or interaction, fully or partially outside the system.

Locate a noisy compressor outside the building where the compressed air is used.

- Reconfigure system environment to accept relocated elements or functions.

Supermarkets pump bakery odors around the store to help advertise bread products.

TS → Super system as model

Past → Super System → Future

TESE information

Technical System (TS)

Sub TS → Future of STS

Localize

Localize something into a specific place:

- Place elements or their parts in a specific place.

Position factory or service center near customers.

- Perform activity, process, action or interaction fully or partly in a specific place.

Kids area in restaurant.

- Change or substitute the environment in a specific place.

Hire local people to acquire cultural knowledge of local customers.

Define, please, what can be bad in this process or what was disadvantages as reason for invent it?

3) Принцип посредника (Localize)

Disadvantages?

Harmonization and non harmonization as recommendation for application

Sub trend 1

Sub trend 3

Sub trend 4

Space (form)

Function of the surprise

Technical mimicry phenomena

giants and dwarves

exclude

Trimming of structure (cost reduction)

Delegating function to another the elements

Structure is the arrangement of system elements, links and interactions.

- Rearrange existing elements, links or interactions in the system.
- Add, remove or change elements, links or interactions in the system.
- Change how the system or its elements relate to their environment.
- Exclude
- Exclude something from the system.
- Remove an element or part while delegating its functions to the rest of the system or its surroundings.
- Exclude factory time clock -- team leader acts as timekeeper.
- Eliminate an activity, process, action or interaction (in whole or part) while getting the desired result.
- Eliminate raw material inventory -- just-in-time delivery.
- Exclude or neutralize the environment or some of its properties.
- Invisible Fence® for training pets to stay in an area.

Exclude

Excluding of toothpaste from system of cleaning

Today

Tomorrow

Hybrid system (A+B)

System A

System B

Integrate

Integrate something in the system to get a synergetic affect (1 + 1 > 2 rule):

- Integrate two or more elements or systems.

Swiss Army knife

- Combine activities, processes, actions or interactions (in whole or part).

Parallel processing - lunch and learn programs.

- Combine different environments or integrate additional properties into the existing environment.

One stop shops that offer a wide range of services in one location.

Integrate

IFR correspond with Ideality model

Version 1: Exist some X element for solve of current problem (remove or destroy of existing disadvantages)

Version 2: The system ITSELF can solve problem (remove or destroy of existing disadvantages)

IFR 1: There is X element in the bottle for remove of disadvantage -- "spend big time for looking for of cup"

IFR 2: The bottle can ITSELF removed of disadvantage -- "spend big time for looking for of cup"

Portals of answer -- using resource of cover, space in cover for hold of water

Example 1 vacuum cleaner

The air THEMSELVES cleans

25) 셀프 서비스 (Self-service)

Partitioning

1) 분리 (Segmentation)

Transfer to solve level according to easy approach to process of segmentation for substance and field.

Fragment of diagram

Sub-Trend: Substance Transition (Fragment)

Sub-Trend: Substance Transition (Fragment)

Divide something into subsets:

- Partition the system or its elements into independent parts.

Modular furniture.

- Divide activity, process or action into sub-procedures (compartmentalize).

Sub-dividing a large task into smaller tasks.

- Separate environment into sub-environments.

Marketing segmentation by demographics, psychographics, lifestyles, etc.

1) 분리 (Segmentation)

1.1. Принцип разделения

Old system

New system

Segmentation of light flow

mosaic

Inventions in the business

Hire purchase

Продажа в рассрочку

Сегментация ножа для рынка

Бойный нож разделён на части

Пазлы Puzzle

Mediator

Use something as a mediator:

- Insert a buffer or an action transmitting element into the system.

Ice cream cone - edible ice cream dish.

- Introduce an intermediate action into an activity or process.

Sugar coating a pill.

- Use an environmental buffer.

Gloves to get hot dishes out of an oven.

24) 매개물을 이용 (Intermediary)

24. Принцип посредника

Harmonization and non harmonization as recommendation for application

Sub trend 1

Sub trend 3

Sub trend 4

Space (form)

Function of the surprise

Technical mimicry phenomena

giants and dwarves

copy

Use a model or copy:

- Replace the system or some of its elements with models or copies.

Crash Dummies for automobile crash testing.

- Emulate activity, process, action or interaction.

Flight simulator.

- Simulate environmental conditions.

Tanning booth

$$i = \frac{\sum(f)}{\sum(\$)}$$

A. i is t if \$ is ↑
B. i is t if \$ is ↓

26) 복사(Copying)

26

Copy

What is there in common with these objects?
What trends can be recognized in the furnished examples?

Y. Danilovskiy © 2012

- Mock-up videocameras in the Louvre museum (the robber does not know, which camera is real and which is a mock-up).
- Inflated tanks and airplanes for misinforming the aviation reconnaissance of the enemy.
- Plastic mock-ups of foods in restaurants for demonstrating the look of proposed dishes

Partial action

Conditions and parameters are quantitative and qualitative variables of the system operation.

- Change system parameters and conditions.
- Combine different changes in conditions or parameters.

Partial action

Perform something partially rather than completely (80/20 rule).

- Use partially finished elements or structures and complete it in another time or place.
- Leave final furniture assembly to the consumer.
- Perform activities, processes, actions or interactions partially and complete them when and where it is necessary.
- Score ceramic tile and then snap off along the score line.
- Transition to partial system interaction with the environment and return to full mode up on condition.

Introductory pricing to promote new products.

$$i = \frac{N * \sum F}{\sum (cost) + HF}$$

Time for preparation

Before After

Preliminary

16) 甲壳 또는 玻璃板 (Partial or excessive actions)

16. Принцип частичного или избыточного действия

10) 예비 작용 (Preliminary action)

10. Предварительное действие

$T^{(+)}$ → $T^{(-)}$

Partial act.

Matching

Harmonization and non harmonization as recommendation for application

Matching

Match functions or structures within a system:

- Match elements, links or interactions in the system (shapes, structures, properties, etc.)

Contoured shoe heels match how people walk.

- Synchronize activities, processes, actions or interactions in time (for example, resonance) and match in space.

Timing of traffic lights to match traffic patterns.

- Match system interaction with environment by changing its properties (inert or active environment).

Noise canceling headphones match two different sound waves in order to neutralize the ambient noise.

1 Sub trend 1

2 Sub trend 3

Time or Field

Frequency, resonance, temperatures,

3 Sub trend 1

4 Sub trend 4

Function of the surprise

Technical mimicry phenomena

giants and dwarves

Space (form)

Excessive action

Harmonization and non harmonization as recommendation for application

Excessive

Provide excess and then removing the remainder.

- Provide more than 100% of quantity (or exceed other parameters) and remove the rest.

For drywall repair, apply excess amount of mud and sand smooth.

- Overdo activities, processes, actions or interactions and then correct.

Contingency planning – plan for corrective actions on a project.

- Overload system interaction with environment and then suppress unnecessary ones.

Use "saturation" advertising (all media) to launch a new product.

1 Sub trend 1

2 Sub trend 3

Time or Field

Frequency, resonance, temperatures,

3 Sub trend 1

4 Sub trend 4

Function of the surprise

Technical mimicry phenomena

giants and dwarves

Space (form)

Dynamism

Humor

Make the system or its surrounding dynamic, adjustable or changeable:

- Increase flexibility of elements or links in the system: make them movable.

Adjustable steering wheel.

- Turn activities, processes, actions or interactions into changeable ones.

Flexible working hours.

- Transition to an environment with adjustable properties

Light-sensitive glasses

29) 공기 역학 (Pneumatics and hydraulics)

29. Пневматика и гидравлика

30) 유연한 껍질 및 이 필름 (Flexible shells and thin films)

30. Использование гибкой оболочки

15) 동적 특성 (Dynamic parts)

15. Принцип динамичности

"Scenario" from dynamism Increase

18) 기계적 진동 (Mechanical vibration)

18. Принцип механических колебаний

32) 색 변화 (Color changes)

32. Изменение цвета

Controllability

Increase controllability of the system:

- Insert controllable element into the system: insert additives to provide control.

Insert luminescent markers that are visible under UV light – park re-admission hand stamps.

- Introduce feedback into the activity, process, action or interaction.

Thermostat controls temperature accurately.

- Control external conditions and system interaction with the environment.

Customers see their food being prepared in a restaurant kitchen.

23) 피드백 (Feedback)

23. Принцип обратной связи

18) 기계적 진동 (Mechanical vibration)

18. Принцип механических колебаний

Vaccination

$$i = \frac{N * \sum F}{\sum (cost) + HF}$$



Change Conditions or Parameters
Conditions and parameters are quantitative and qualitative variables of the system operation.

- Change system parameters and conditions.
- Combine different changes in conditions or parameters.

Vaccination
Make the system tolerant, insensitive to undesirable changes:

- Insert neutralizing additives into system or its elements, or perform preliminary change opposite to undesirable one.

Relief valve protects equipment from over-pressure.

- Perform preliminary action to prevent, counteract or compensate undesirable activities.

Back up computer data to reduce loss from hard drive crash

- Modify or substitute environment to make the system resistant to undesirable change.

Use a helium-oxygen mix for diving to eliminate nitrogen narcosis.

- (passive) increase regarding to field
- (passive) increase regarding to substances
- (active) increase stability via function

Bumper (automobile)



Un submarino es un navio o buque capaz de navegar bajo la superficie del agua del mar o sumergido.
Submarine not afraid the storm

11 보상 (Beforehand compensation)
заранее подложенной подушки

Isolate

$$i = \frac{N * \sum F}{\sum (cost) + HF}$$



Isolate the system from undesirable changes:

- Introduce isolative permanent or renewable (self-recoverable) elements into the system to prevent undesirable changes.

Non-stick coatings on cooking pans.

- Perform action to isolate the system from undesirable activities.

Package food in CO2 or nitrogen atmosphere to prevent spoilage.

- Modify or substitute environment or its parts to isolate the system.

"Trade secrets" separate proprietary knowledge from general knowledge.

- (passive) increase regarding to field
- (passive) increase regarding to substances
- (active) increase stability via function



Существующее решение: Внутрь сигареты вкладывается разрушаемая капсула с ментолом, которая на последних секундах выкуривания маскирует запах табака запахом мяты.

Existing solution: put a cigarette into a crushable capsule with menthol, which is smoked in the last seconds masks the smell of tobacco smell of mint.

11 보상 (Beforehand compensation)
заранее подложенной подушки

Counteract

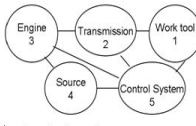
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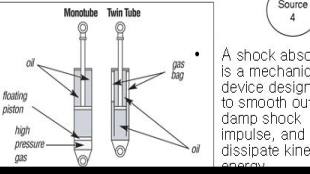
Counteract undesirable changes:

- Insert active elements to counteract undesirable changes.
- Counteract brushfire by setting a backfire.
- Perform activity, process or action to counteract undesirable activities in real-time.
- Airbag in a car.
- Modify or substitute environment in order to actively counteract undesirable changes.
- Decompression chambers counteract effects of rapid ascension of divers.

An airbag is a **active** vehicle safety device.



- (passive) increase regarding to field
- (passive) increase regarding to substances
- (active) increase stability via function



11 보상 (Beforehand compensation)
заранее подложенной подушки

23 피드백 (Feedback)
23. Принцип обратной связи

Carro de combate Helper for understanding

Evolution del tanque de supervivencia
Evolution survivability of tanks

Using optimal angle for increase stability

Easy protection

Counteract

Explosive reactive armor

Explosive Liner

Shaped Charge Jet

Explosive Reactive Armor (ERA)

M60A1 Patton tank with Israeli Blazer ERA.

Fotografia del carro de combate Schneider CA1.

ЭВОЛЮЦИЯ ЖИВУЩЕСТИ ТАНКОВ

Disposable

$$i = \frac{N * \sum F}{\sum (cost) + HF}$$



Use something disposable instead of a permanent one:

- Substitute permanent elements by a set of disposable ones.

Diapers.

- Instead of permanent action or interaction perform it once (only when necessary).

Car rental.

- Substitute permanent system surroundings by set of temporary ones.

Dissolving capsules for medicines



27 값싸고 짧은 수명 (Cheap disposables)

27

27. Принцип дешевой недолговечности

Inversion

Do something opposite.

- Change properties or parameters of the system or its elements by opposite ones: turned upside down or inside out, movable instead of immovable, cold instead of hot, etc.

Frappuccino - use cold coffee instead of hot.

- Replace action by the opposite ones, or reverse their sequence; substitute internal activities with external ones, or vice-versa.

Moving sidewalk with standing people.

- Substitute properties of the system's surroundings by opposite ones.

Test pressure vessels by varying pressure outside rather than inside the vessel.

Inversion

end

front

Working tool move
A paper is **moving**

Working tool move
A paper is **stop**

TS → Super system as model

Resources of space

Similar PC and Similar Solution

13 거꾸로 함 (The other way around)

13

13. Принцип «наоборот»