



# TRIZ Tools for Main Parameters of Value Identification

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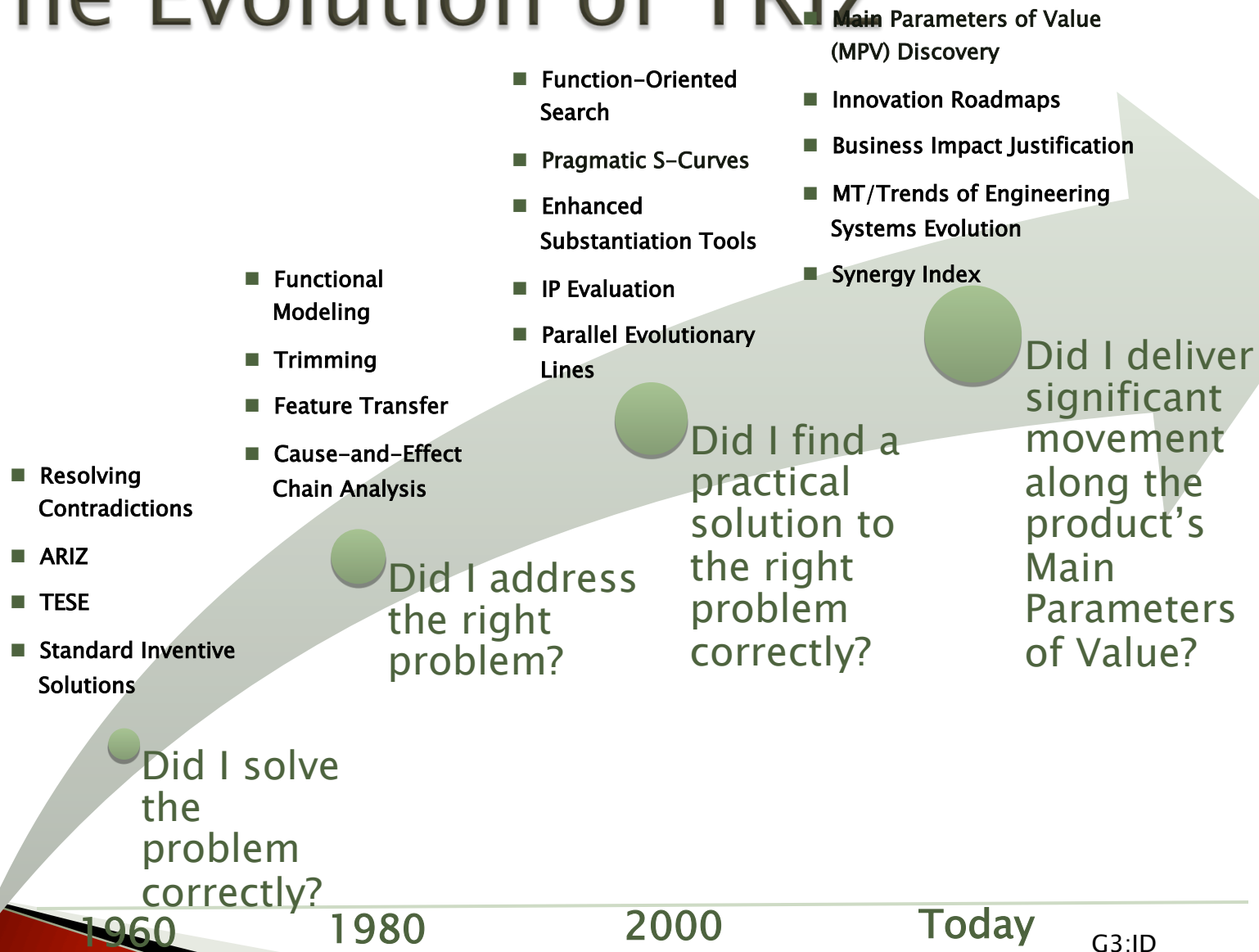
# Agenda

- ▶ Business need for MPV
- ▶ MPV definition and role of MPVs
- ▶ PV classification
- ▶ MPV Discovery: Voice of the Product
- ▶ MPV translation into PPV
- ▶ Case Study

# Business Need for MPV: How to Identify Correct Innovation Objectives?

- ▶ Today there is no direct connection between business challenges and underlying technical problems
- ▶ Executives of industrial companies are operating with business categories like annual revenue, profit margin, market potential, market share, return on investment, etc.
- ▶ There is a serious gap between business consulting companies that usually address business issues and technology consulting firms and R&D departments that are dealing with technical problems
- ▶ There is an obvious need for effective methodological tools and corresponding providers that are capable to connect business challenges and specific technical problems of products/processes
- ▶ Main Parameters of Value (MPV) Discovery is a tool/technique that addresses the above mentioned business need

# The Evolution of TRIZ



# TRIZ Methodology Development



## TRIZ Paradigm shifts:

- Analyze a technology instead of a thinking process (systematic approach)
- Select evolutionary winners, not losers (Trends of Engineering System Evolution)
- Resolve Contradictions, don't compromise
- Step-by-step creativity instead of insight (ARIZ)

## Advanced TRIZ Paradigm shifts:

- Focus on Functions, not components
- Address Key Problems, not initial ones
- Adapt existing solutions, don't always invent. Leverage global knowledge (FOS)
- Innovate against right target (MPV)
- Develop practical products, not ideas

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# MPV Definitions

**Main Parameter of Value (MPV):**  
Key attribute/outcome of a product/service that is hereto unsatisfied and important to the purchase decision process

**Innovation:**  
Significant improvement along at least one Main Parameter of Value



# MPV Example: What do Consumers Want from Domestic Airlines?

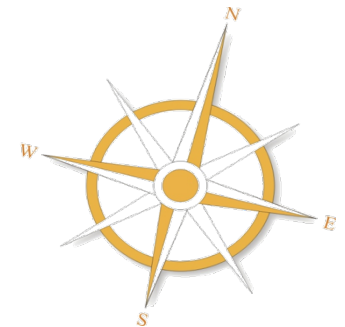
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# Why Worry about Main Parameters of Value?

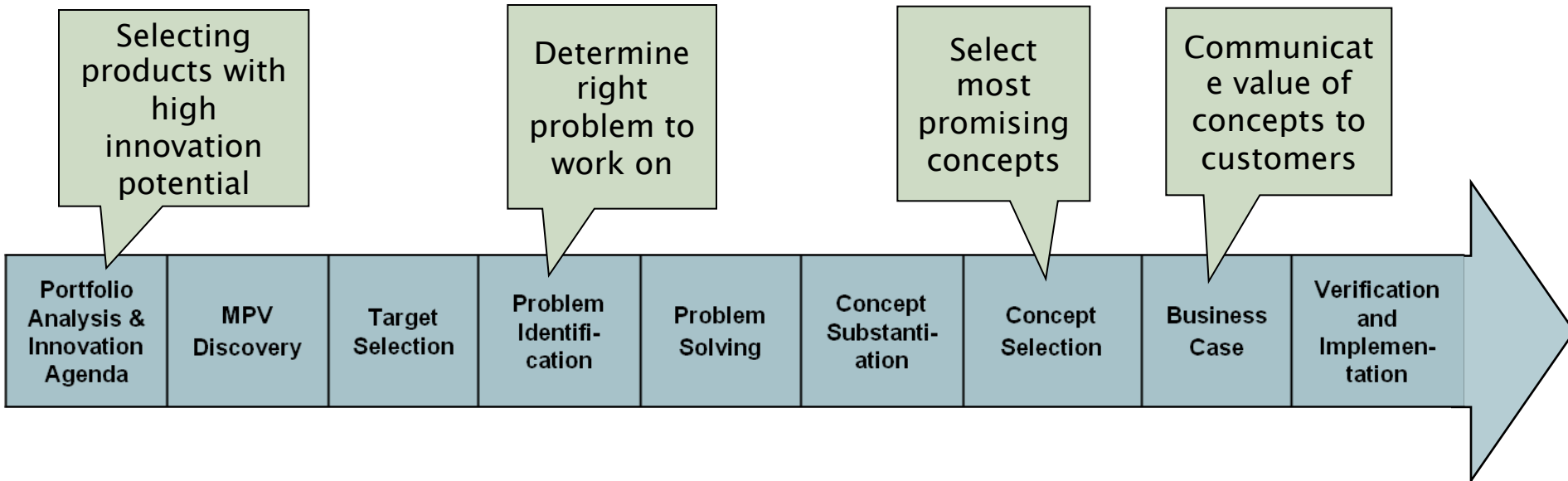
- The ultimate goal of innovation is to maximize business growth and profitability within the constraints of available resources
- MPVs reflect what matters to customers, hence they are the best compass by which to guide innovation efforts
- Identify, define and prioritize the most promising innovation opportunities
- Develop a business case in absence of complete information
- Maintain focus on key factors of business success as concepts are being developed without bogging down in minutiae



# Examples of Main Parameters of Value

Product	MPVs
Toothbrush	<ul style="list-style-type: none"> <li>• Effectiveness of plaque removal</li> <li>• Convenience</li> <li>• Safety (no gum damages)</li> <li>• <b>Ability to remove plaque from under the gum</b></li> <li>• <b>Safety (limited conditions for pathogenic bacteria growth)</b></li> </ul>
Shaver	<ul style="list-style-type: none"> <li>• Effectiveness of hair removal</li> <li>• Safety (no skin damages)</li> <li>• <b>Time between shavings (ability to remove hair stubs)</b></li> </ul>
Soap	<ul style="list-style-type: none"> <li>• Effectiveness of dirt removal</li> <li>• Effectiveness of pathogenic bacteria removal</li> <li>• <b>Safety (skin sebum preservation)</b></li> <li>• <b>Safety (useful micro-flora preservation)</b></li> <li>• <b>Sustainability</b></li> </ul>

# MPVs in the Innovation Process

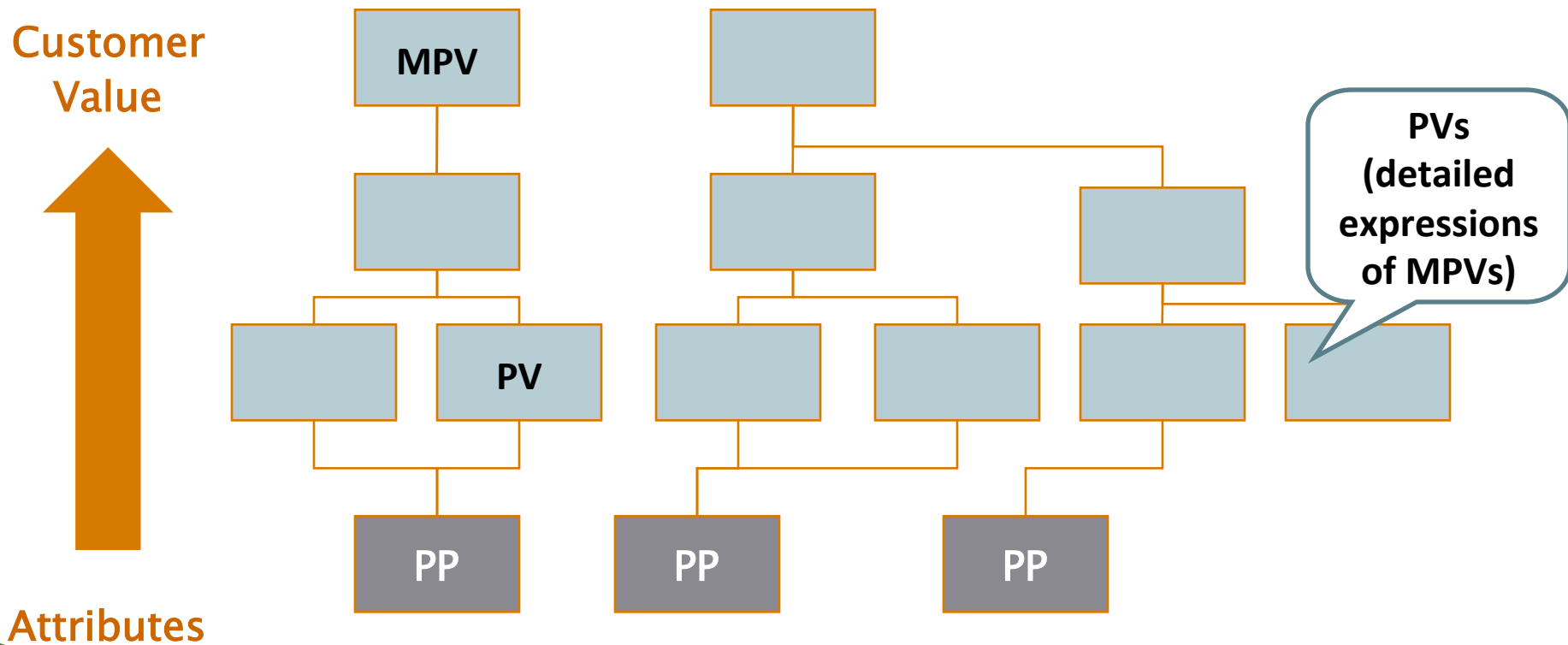


- One or two MPVs are usually the starting point for innovation process
- A broader set of MPVs (and PVs) is used to evaluate products that result from the innovation process

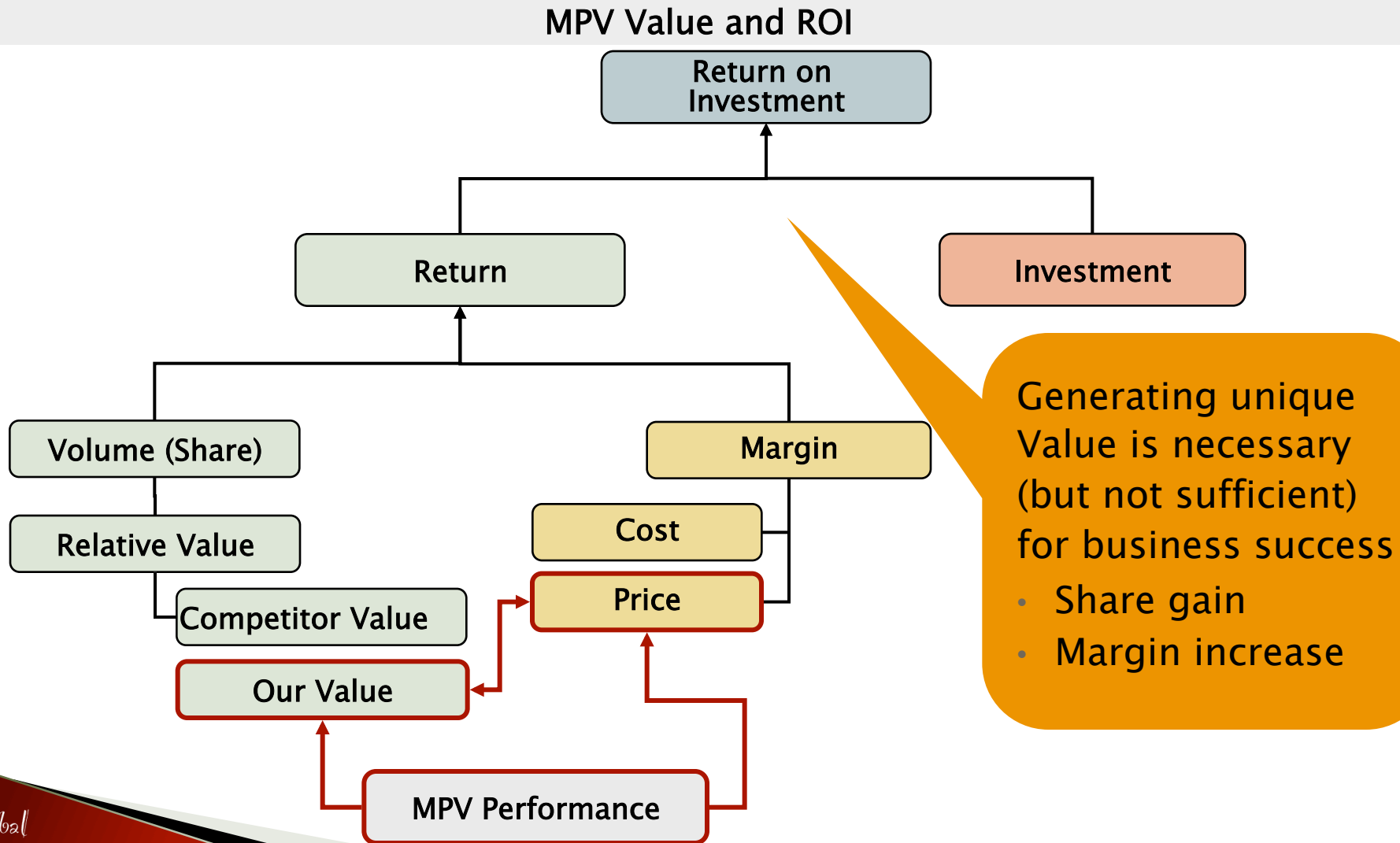
The MPV framework focuses innovation efforts on delivering value to customers and profitability to the company

# MPV Hierarchy: Mapping Back from High level Motivators to Physical Parameters

- High level MPVs are linked to more detailed Parameters of Value (PVs) which are matched to physical parameters (PPs)



# Targeted Innovation and Main Parameters of Value



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# Main Parameters of Value vs. Parameters of Value

**Main Parameter of Value (MPV): focus of innovation efforts**

	Important	Unimportant
Unsatisfied	MPV	PV
Satisfied	PV	PV

- Typically there are many Parameters of Value (PVs) for a given product
- Main Parameters of Value (MPVs) tend to be those that are both important and unsatisfied by current offerings

# Parameters of Value Classification

## Main Parameters of Value (MPVs):

Well understood, primary focus of buyers, important dimension of competition

## Latent Main

Parameters of Value: Overlooked, accepted limitation of current technology

Unsatisfied

Known /  
Clearly Expressed

Unknown /  
Unexpressed

MPV

Latent MPV

Satisfied

PV

Tacit PV

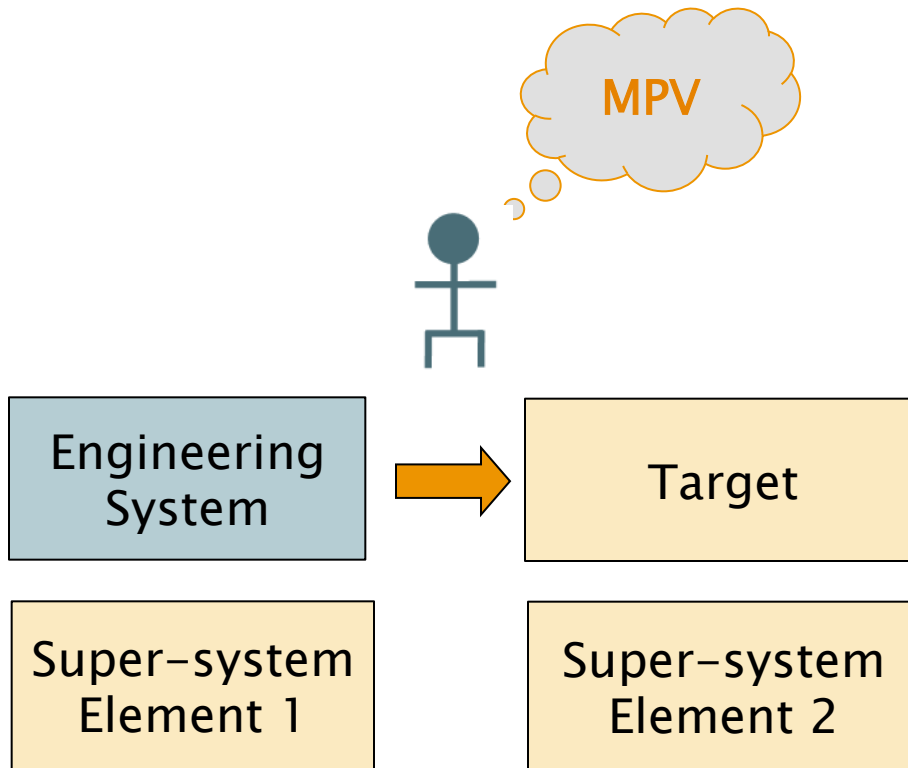
Tacit Parameters of Value: Overlooked, delivered as artifact of current technology

## Parameters of Value

(PVs): Well understood, assumed to be satisfied by all products in the buyers consideration set

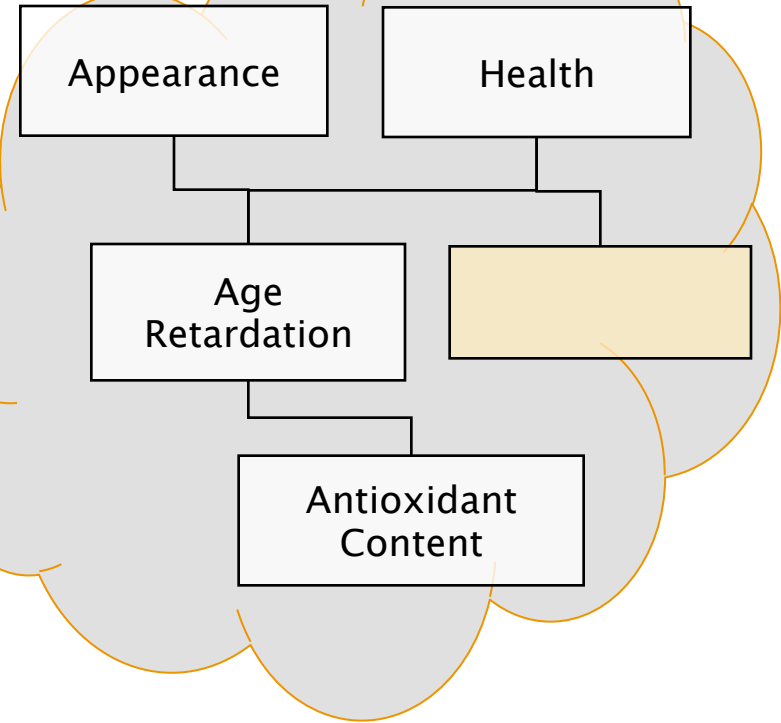


# MPV Context: Stakeholder Perspective

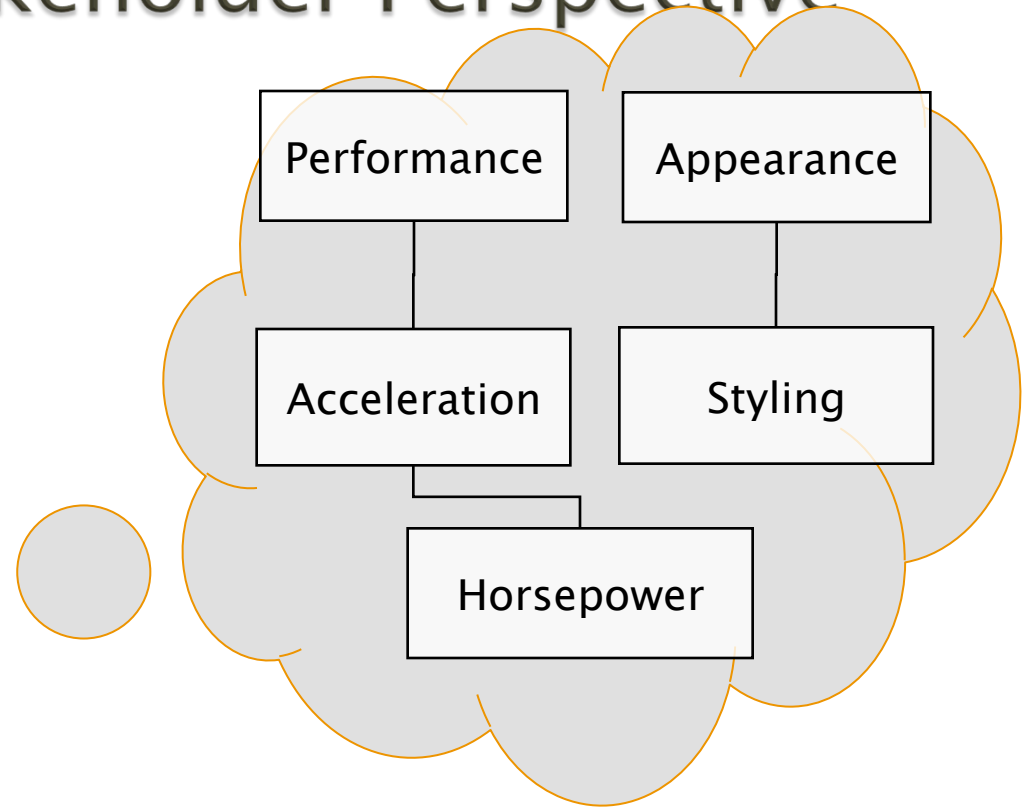


- ▶ MPVs exist in the mind of key stakeholders
  - Note: MPVs can therefore change without changing the engineering system
- ▶ Value derives from stakeholder perception of how engineering system performance affects MPVs
- ▶ Willingness to pay derives from:
  - Value of the engineering system relative to next best alternative
  - Price of next best alternative

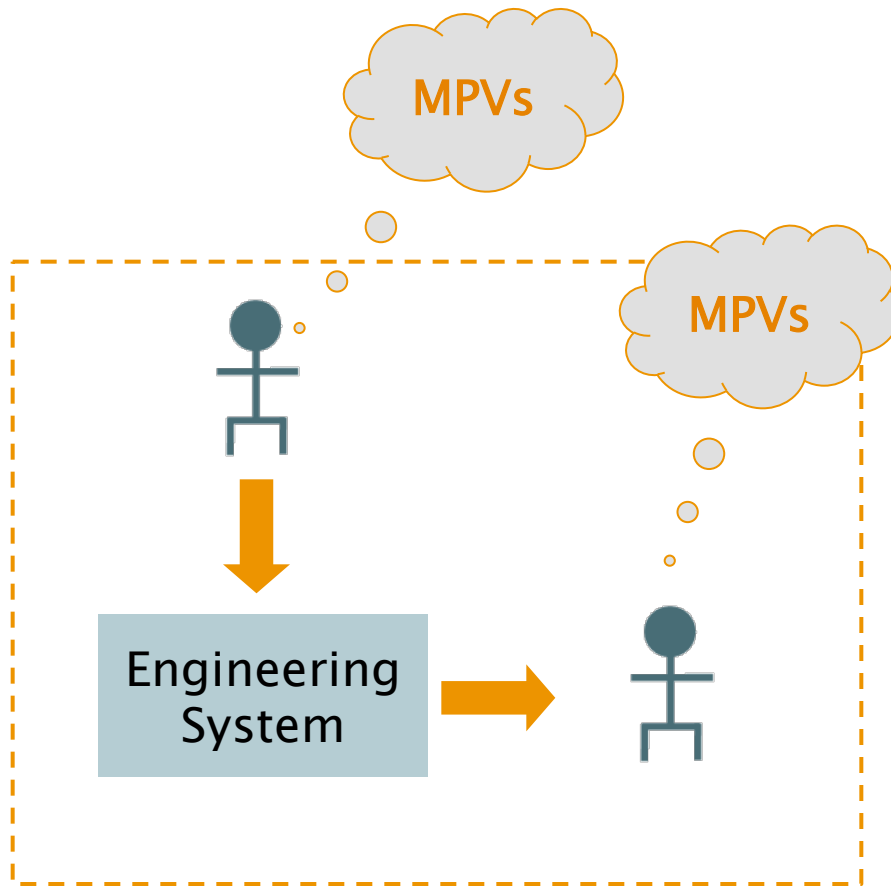
# MPV Context: Stakeholder Perspective



# MPV Context: Stakeholder Perspective



# MPV Context: Stakeholder Actions



- ▶ Stakeholders can be an element of the supersystem in which the engineering system functions
- ▶ A Stakeholder may be the target of the engineering system
- ▶ A stakeholder may perform functions within the supersystem

# MPV Context: Stakeholder Actions



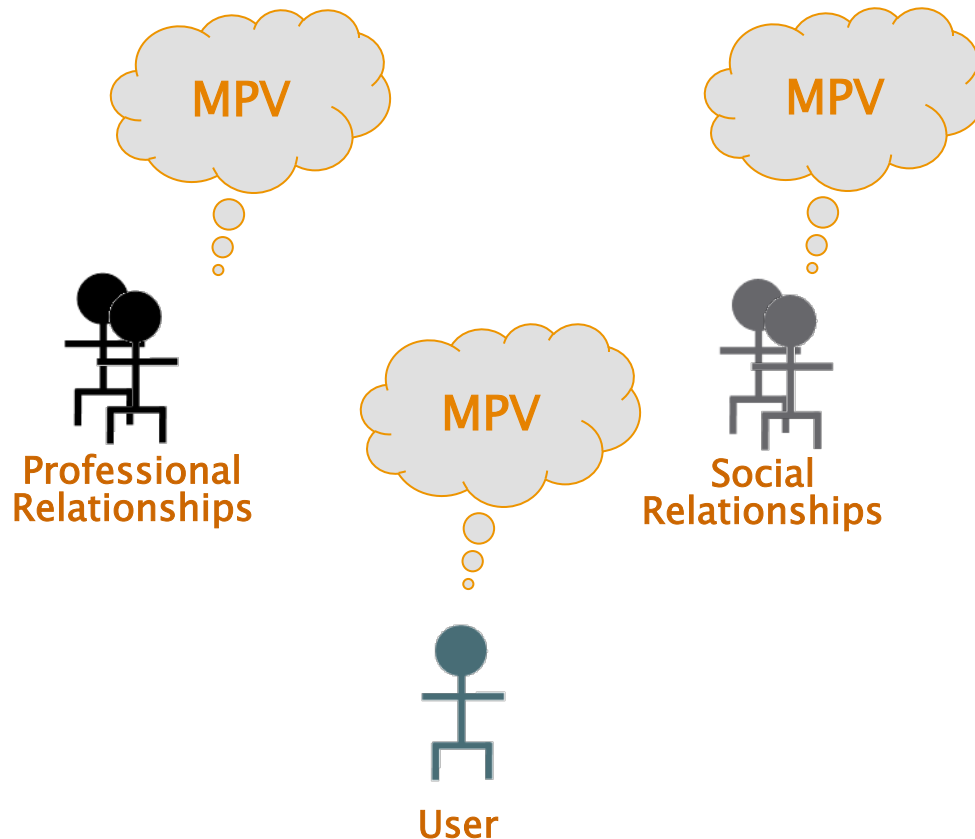
- Engineering System = razor
- Face (whiskers) is target of engineering system
- User shaves self
- One stakeholder → one set of MPVs

# MPV Context: Stakeholder Actions



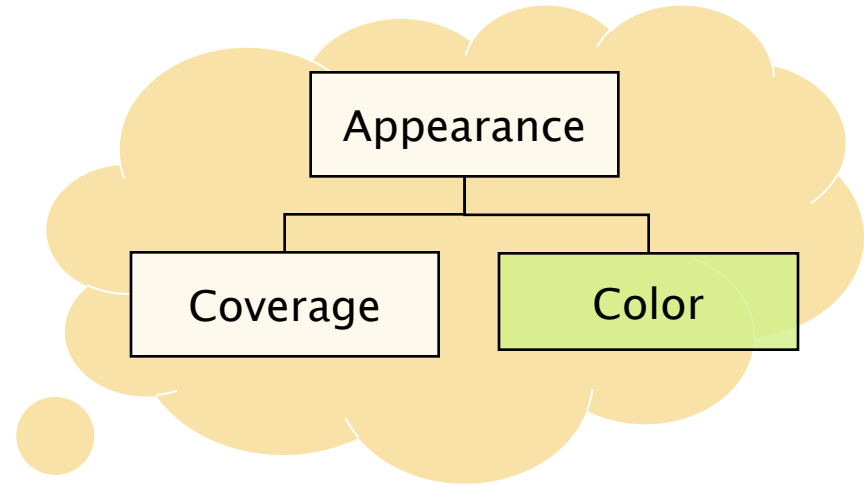
- Engineering System = razor
- Face (whiskers) is target of engineering system
- Barber shaves customer
- Two stakeholders → two set of MPVs

# MPV Context: Stakeholder Interactions / Awareness



- ▶ User/stakeholder MPVs may be related to other players important to the user who may also interact with, or be affected by, the engineering system

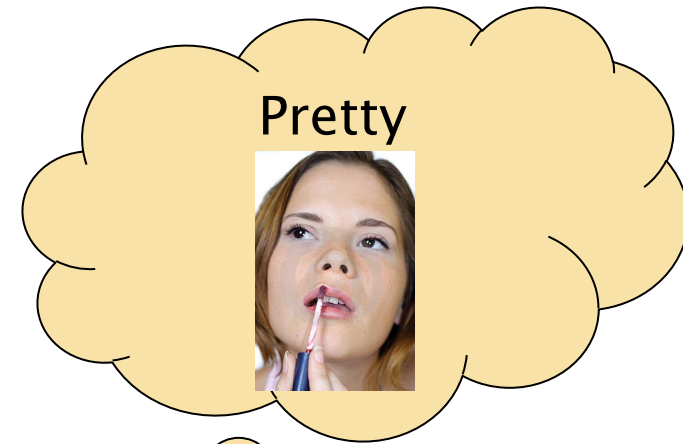
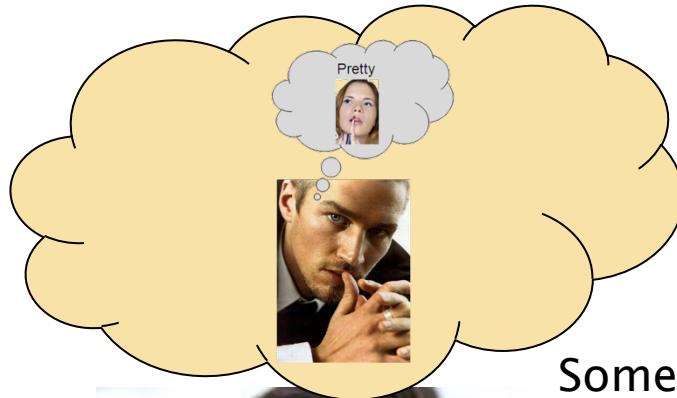
# MPV Context: Stakeholder Interactions / Awareness



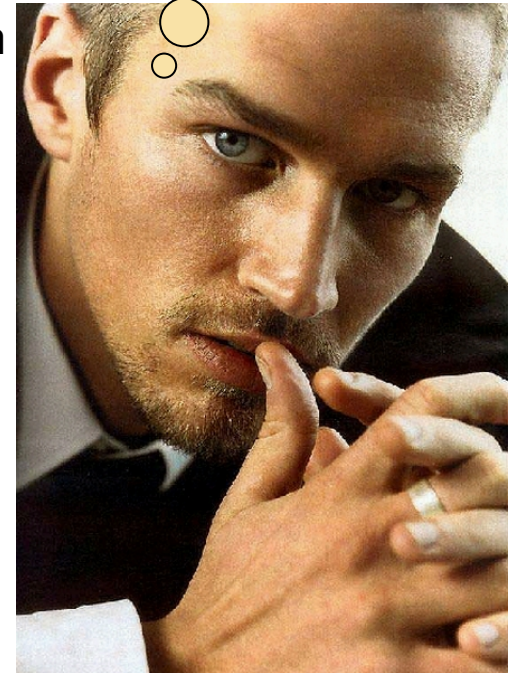
Some products are judged by the impact they have on other stakeholders



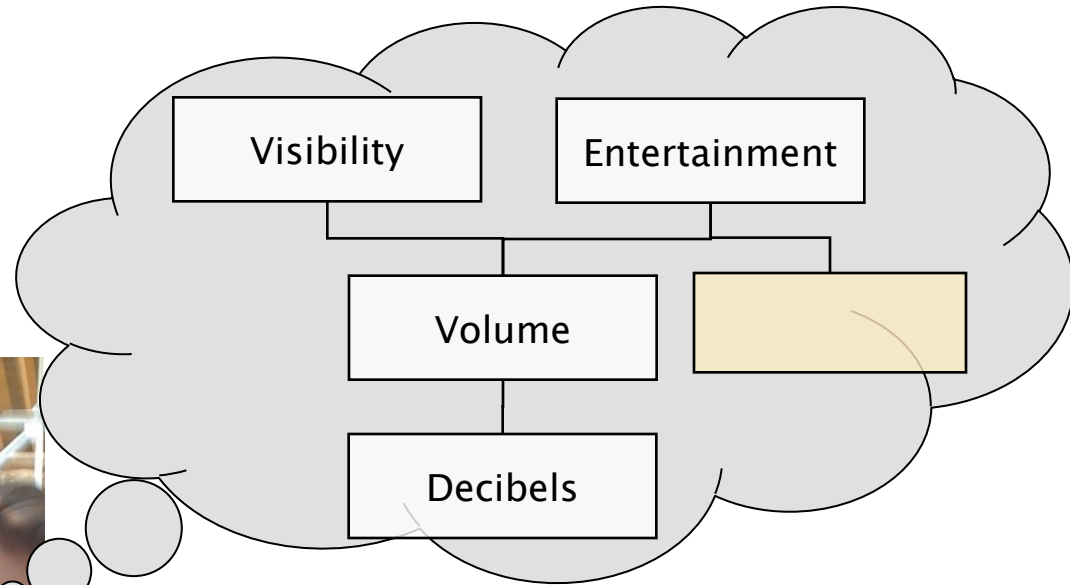
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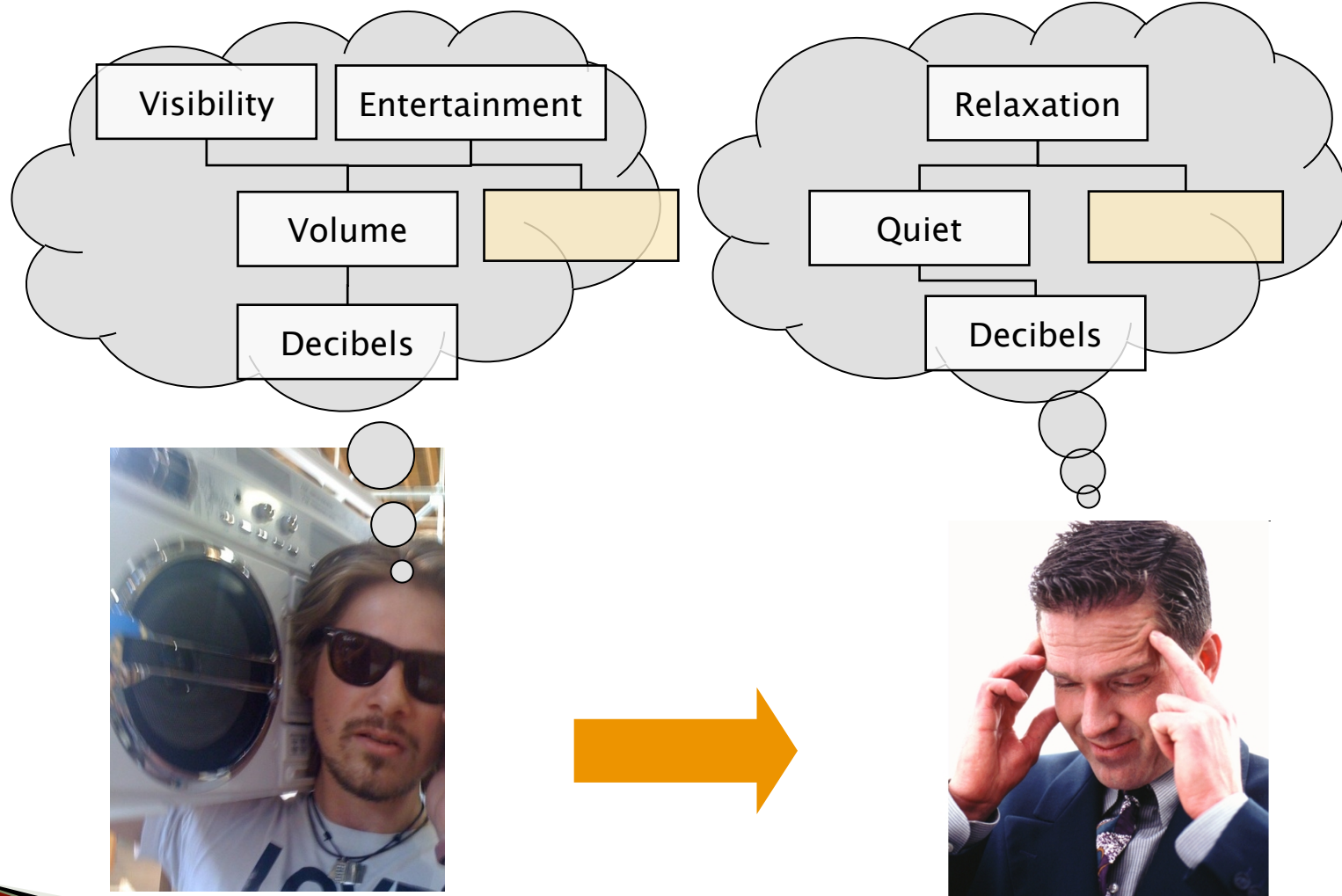


# MPV Context: Stakeholder Interactions / Awareness

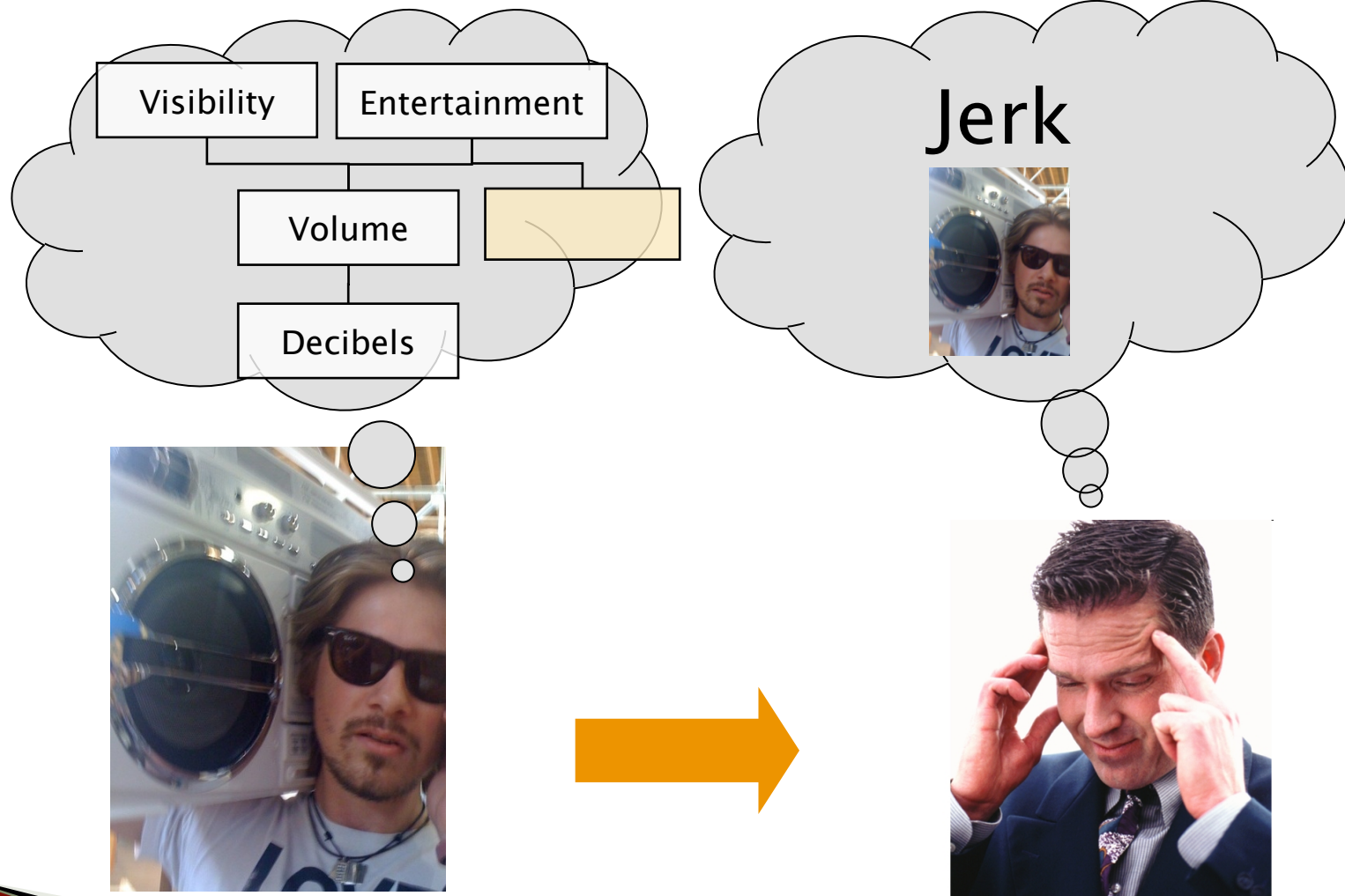


Product use can affect other stakeholders

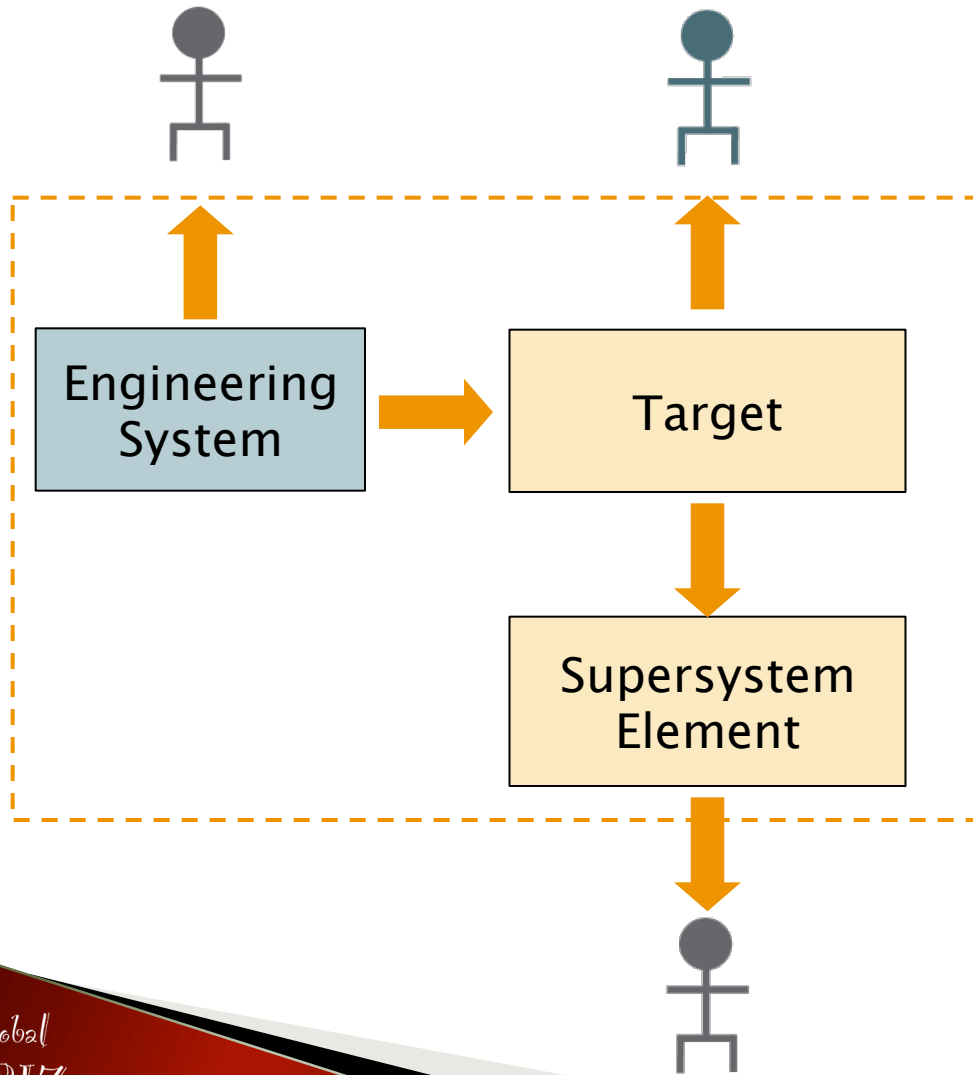
# MPV Context: Stakeholder Interactions / Awareness



# MPV Context: Stakeholder Interactions / Awareness



# MPV Context: Engineering System Impact



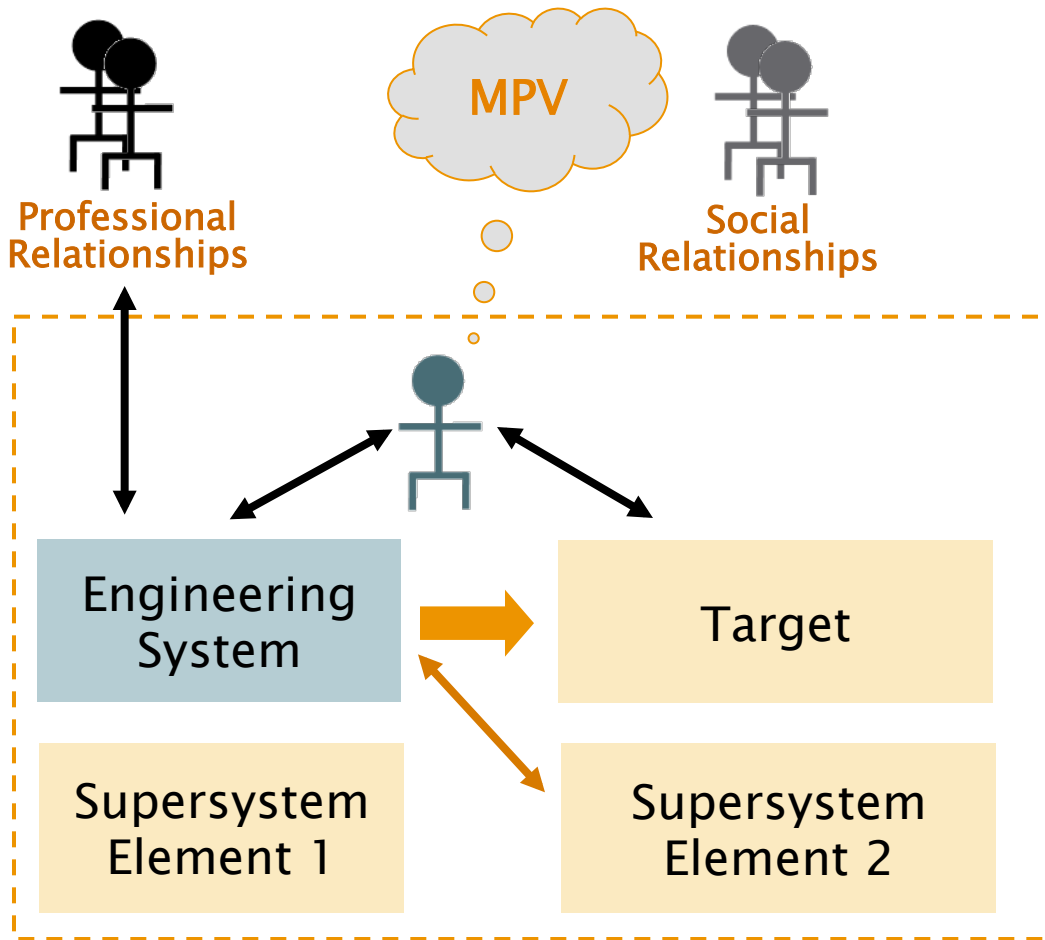
- ▶ Satisfaction of stakeholder MPVs may result directly from the functions of the engineering system
- ▶ Satisfaction of MPVs may also result indirectly from:
  - Impact of engineering system on other supersystem elements
  - Overall performance of the supersystem

# MPV Context: Engineering System Impact

Example of stakeholders being indirectly affected by target of the engineering system – separation in time



# MPV Context: MPV Importance by Occasion



The relative importance of MPVs can vary from one use occasion to another

# MPV Context: MPV Importance by Occasion



	Sound Quality	Portability
Home	X	
Commuting		X





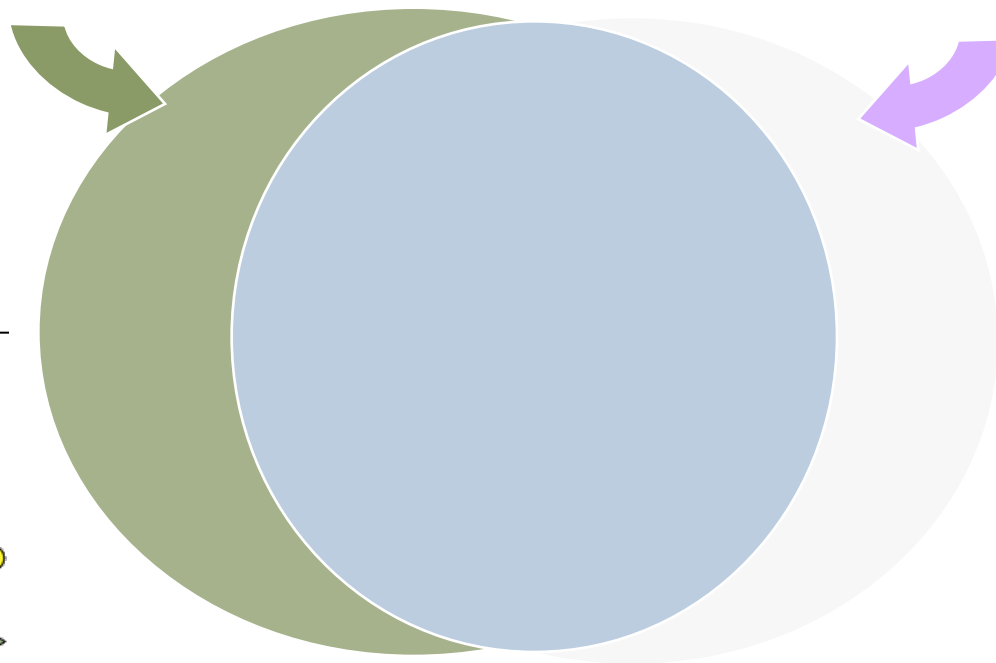
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- ▶ **MPV Discovery: Voice of the Product**
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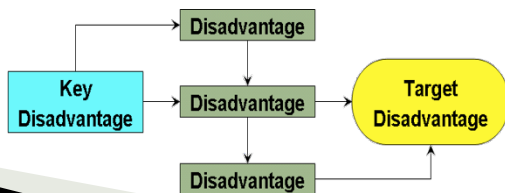
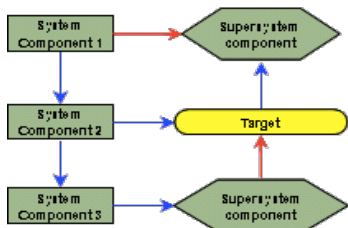
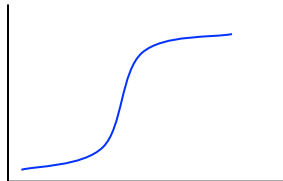
# MPV Discovery: VOC and VOP Cooperation

**“Voice of the Product”**  
(Objective Functional Parameters of Value)

**“Voice of the Customer”**  
(Market Parameters of Value – needs, occasions, actions)



Trend Analysis



# Voice of the Customer Limitations

## We are not very good at identifying needs

- Limitations of market surveys – people don't know what they don't know
- Product presumptions limit needs assessment – people can't believe they may ask for some advanced product's features and parameters of value



# Limitations of VOC

- For example, was any MP3 user really envisioning a single round knob for all music control?

The “Standard”

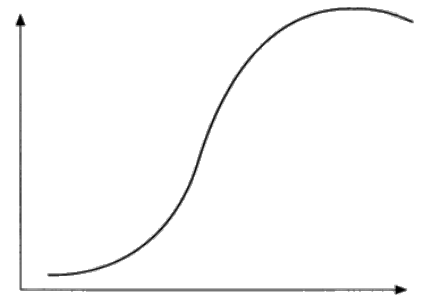


The Breakthrough



# Limitations of VOC

- Customer insights do not provide all answers:
  - What technologies are emerging that will enable a completely different product concept?
  - What technologies in other industries provide important learnings for my product and its evolution?
  - What position on the “S curve” of technology evolution does my product lie on and what are the implications?



# Limitations of VOC

- This is not meant to imply that the customer is unimportant or uninformed...



- ...it means that there is a perception gap – “we do not know what we don’t know”



# Two "Voices"

MARKETING

Voice of the Customer



**Breakthrough  
Innovation**

R&D  
RESTRICTED AREA

Voice of the Product



# Voice of the Product

- One of the reasons that Steve Jobs and others were so successful is that he and his colleagues innovated against, what we call, the Voice of the Product (VOP)
- We define VOP as a set of objectively determined indicators gleaned from the product and its related technologies that foreshadow the next evolutionary winners



# Latent MPV Identification: VOP Tools

## Initial MPVs

- MPV 1
- MPV 2
- MPV 3
- MPV 4
- MPV 5
- MPV 6

## Functional Analysis

*What are the non-existing, but potentially attractive properties that address poorly performing functions?*

## Industry Trends (Patents)

*What do other industry experts think about improvement of selected product and similar products?*

## General Trends (TESE)

*What would Leonardo da Vinci and Thomas Edison do if they had the same challenge - to improve selected product?*

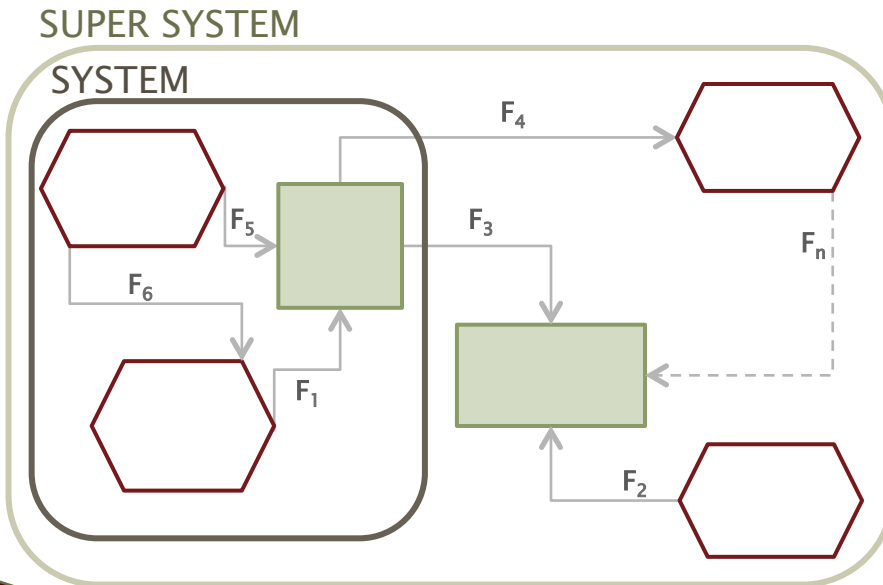
# Voice of the Product — Under the Hood



Identify  
Latent  
Functionality

GEN3 Tool: Function Analysis

How It Works

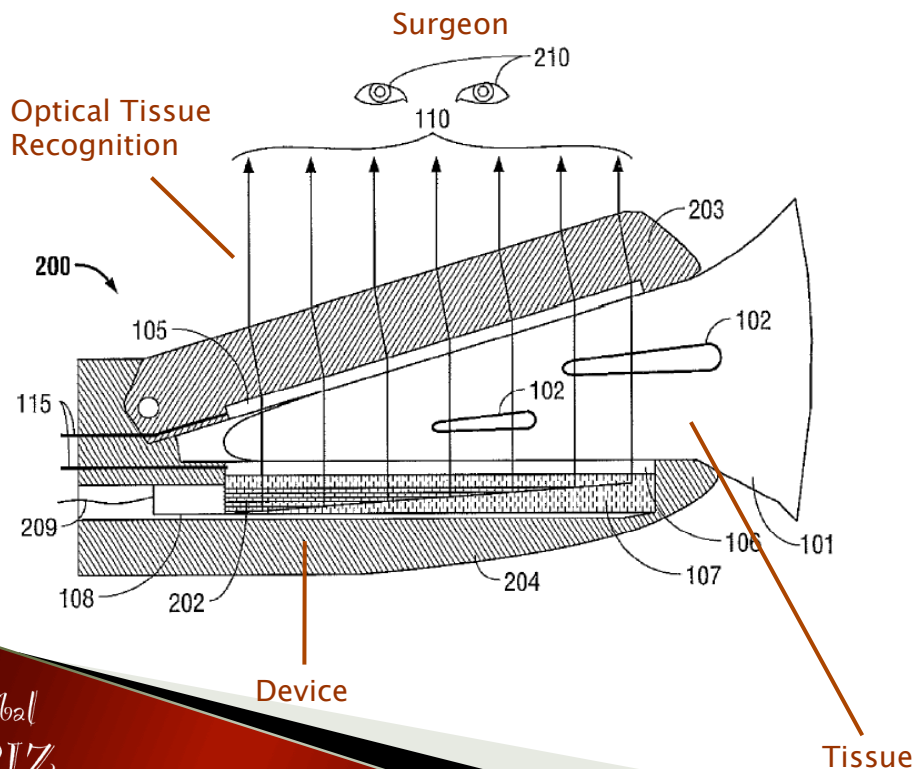


- Map the interactions (“functions”) inside the system
  - Are any of them harmful? Insufficient?
- Map the functions with the super system
  - Are there useful functions that we can transfer to the system?
- VOC does not necessarily reveal these value improvement directions

# Voice of the Product — Latent Functionality



## Example: Surgical Device



## Discovery of Latent Functionality

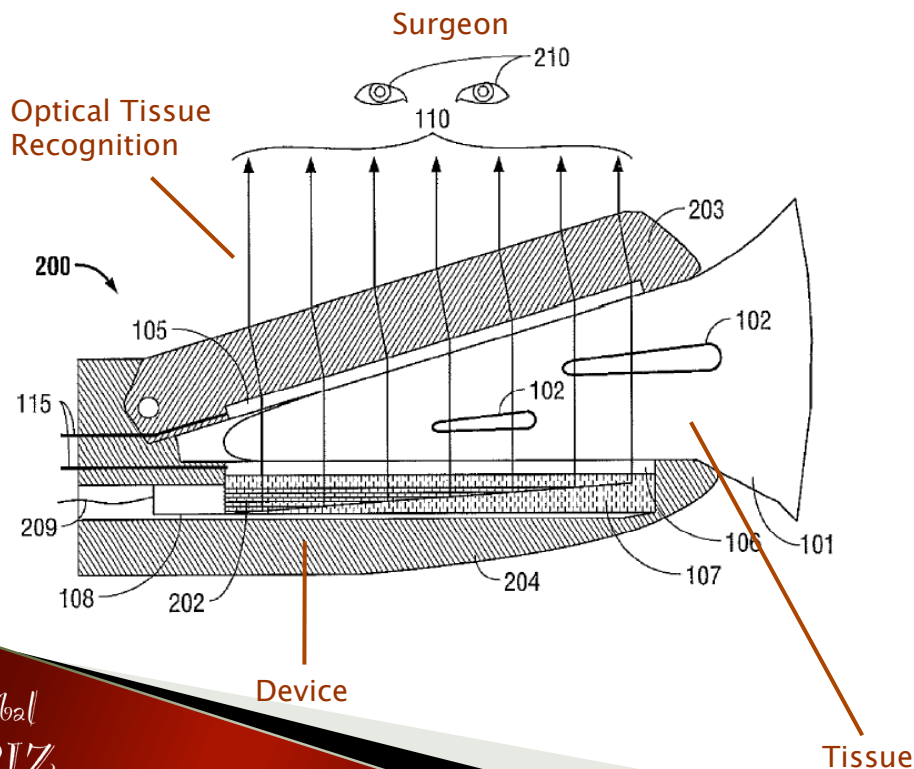
- Known MPVs from VOC were: Speed, Accuracy, Thermal Management
- Function modeling showed unexploited resources in the device:
  - Function: “Tissue informs surgeon”
  - The surgeon recognizes different tissues and uses this to decide where to cut
  - However, this function was performed insufficiently

# Voice of the Product —Latent Functionality



## Example: Surgical Device

## VOP Innovation



The device was equipped with a feature that detects and provides tissue parameters giving surgeons highly accurate information where to cut

# Voice of the Product — Under the Hood

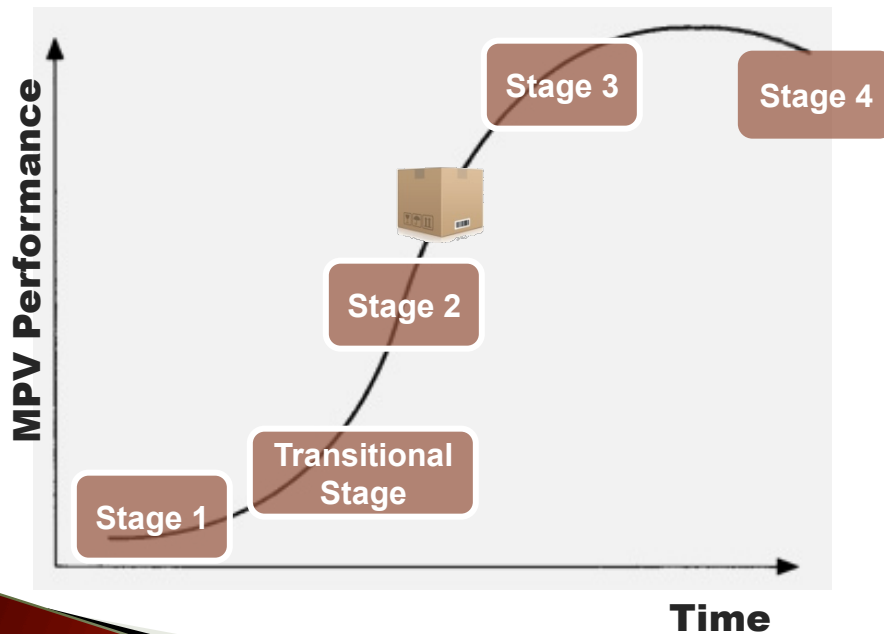
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Identify  
Evolutionary  
Stages

Tool: Trends of Technology Evolution

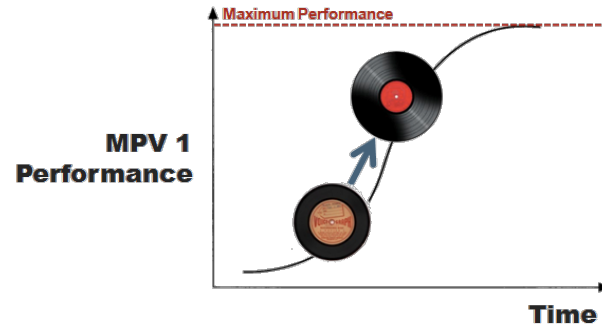
How It Works



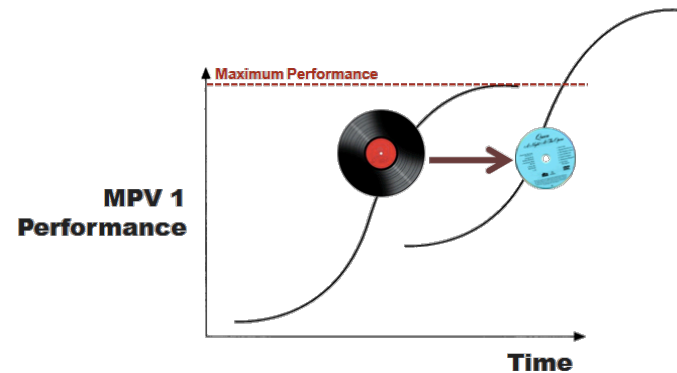
- Map the system on its S-Curve of Technology Evolution;
  - Just launched?
  - Quickly evolving?
  - Performance improvement slowing down?
  - Reaching the performance limit?
- For each stage strategies exist to achieve sustaining or breakthrough MPV improvement
- VOC does not necessarily reveal these value improvement directions

# What Is True Breakthrough Innovation?

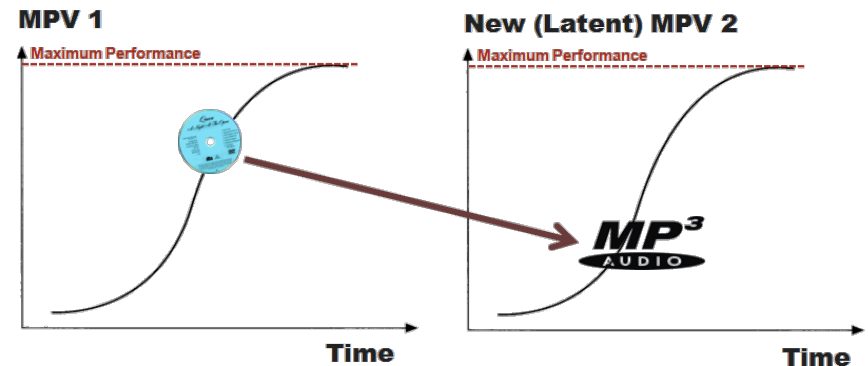
Increasing MPV performance incrementally  
→  
Sustaining Innovation



Increasing MPV performance *dramatically* with a different technology  
→  
Breakthrough Innovation



Addressing a new, latent MPV →  
Breakthrough Innovation



# MPV Discovery and Analysis (Voice of the Product) Algorithm

1. Select object of improvement (product or process)
2. Formulate business challenge for the selected object
3. Identify Stages of Life Cycle, Stakeholders, Targeted Market Niches and Typical Occasions
4. Build Function Models for each Stage of Life Cycle, Stakeholder, Targeted Market Niche and Typical Occasion
5. Perform Pragmatic TESE Analysis (including S-Curves) for all important PVs of the selected object
6. Compile a list of PVs resulted from FA and TESE Analysis
7. Select MPV candidates
8. For each selected MPV identify corresponding underlying PPVs
9. Using TRIZ/G3:ID problem identification tools identify Key Problems (KP) that prevent achieving high MPV performance
10. Resolve KP using TRIZ/G3:ID problem solving tools
11. Develop a new product/process that addresses the initial business challenge
12. Develop a business case (value proposition, market strategy recommendations, etc.) for the new product/process

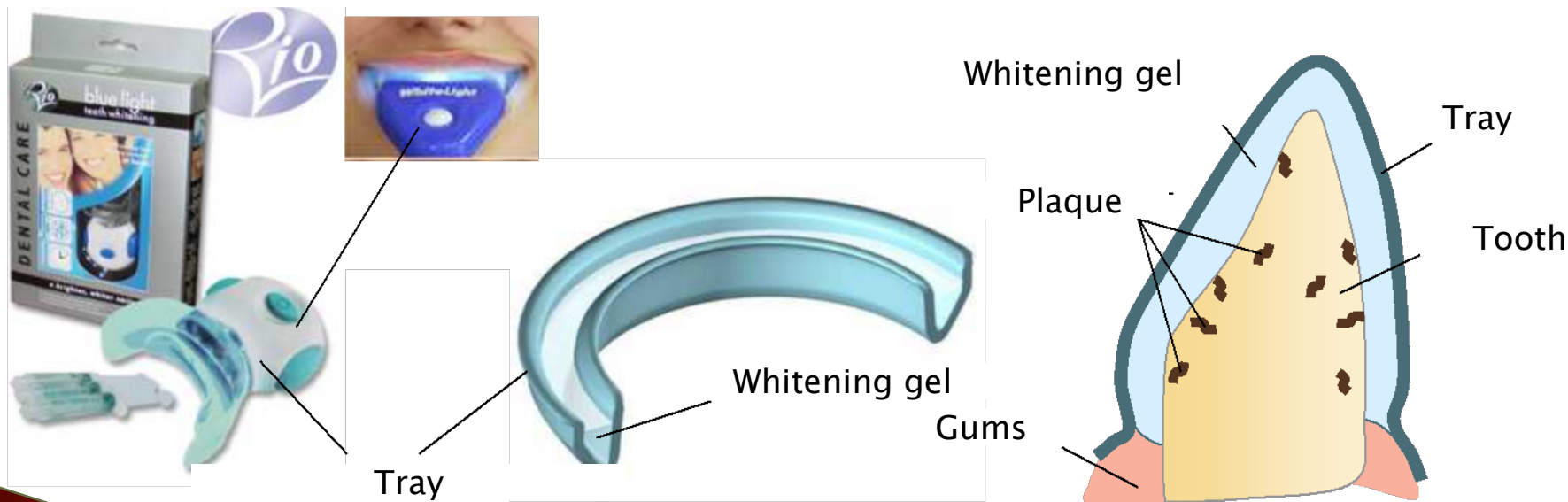
# MPV Example 1 – WhiteStrips™

## 1. Select object of improvement

Device for at home teeth whitening consists of polymer tray filled with whitening gel. The tray should be placed on the teeth for a night during a week.

## 2. Formulate business challenge for the selected object

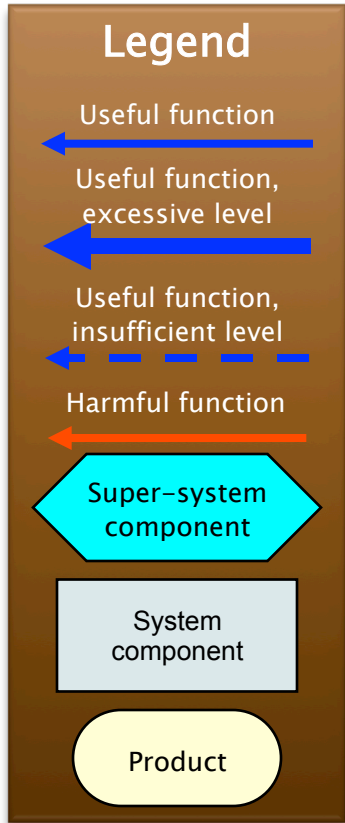
The market analysis performed by P&G clearly demonstrated that it was losing market share of teeth whitening business due to marginal difference in performance (teeth bleaching effectiveness) of existing products on the market. P&G formulated the following business challenge: how to make a teeth whitening product that would be the market winner?



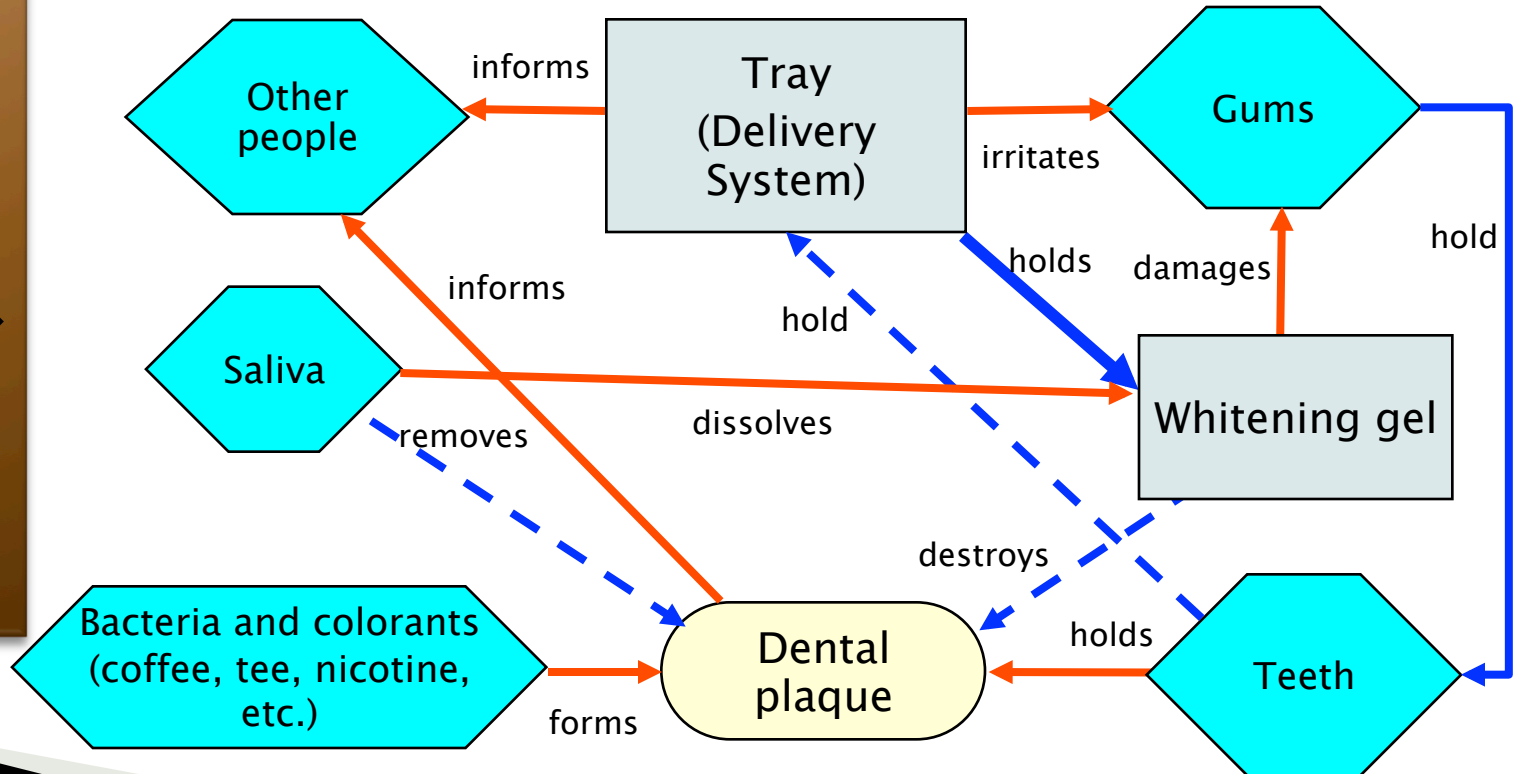


# MPV Example 1 – WhiteStrips™: Function Analysis

## 4. Build Function Model



Functional model at exploitation stage



# MPV Example 1 – WhiteStrips™: Function Analysis

Component	Harmful Function	Useful function, excessive level	Useful function, insufficient level
Tray	<ul style="list-style-type: none"> <li>• Informs (attracts attention) other people</li> <li>• Irritates gums</li> </ul>	<ul style="list-style-type: none"> <li>• Holds too much whitening gel (because it's dissolves in time by saliva)</li> </ul>	
Whitening gel	<ul style="list-style-type: none"> <li>• Damages gums</li> </ul>		<ul style="list-style-type: none"> <li>• Poorly destroys dental plaque</li> </ul>

Harmful Functions and Useful Functions with insufficient and excessive performance are sources for latent MPVs identification

# MPV Example 1 – WhiteStrips™:

## MPV and Key Problems Identification

### 6. List of PVs resulted from Function Analysis

- Intensity of whitening
- Application time
- Cost

Parameters of Value that were revealed from the Voice of the Customer, not all of them are Main

- Convenience (no gums irritation)
- Inconspicuousness
- Safety (no gums damaging)
- Cost

Parameters of Value discovered from the Voice of the Product, some of them latent

# MPV Example 1 – WhiteStrips™: MPV and Key Problems Identification

## 7. Select MPV candidates.

- The set of PVs above was recommended to address as MPVs in order to bring to the market a new generation Teeth Whitening device with a significantly higher value for the consumers

## 8. For each selected MPV identify corresponding underlying Physical PVs

- For Convenience and Inconspicuousness – Size of the delivery system
- For Safety – Concentration of whitening gel

## 9. Identify Key Problems that prevent achieving high MPV performance.

Key problem examples:

- Tray should be large to hold enough whitening gel; however it should be small to occupy less space in the mouth (be inconspicuous) and not irritating gums
- Concentration of whitening gel should be high to intensify bleaching process (destroying plaque); however it should be low in order not damaging gums

# MPV Example 1 – WhiteStrips™: Function–Oriented Search

10. Resolve KP using Advanced TRIZ problem solving tools

Applying Function–Oriented Search:

- Initial area: oral care
- Function: to deliver bleaching agent to the teeth
- Generalized function: to control release of substance
- Leading areas:
  - Medicine
  - Pharmacology
  - Agriculture
- Found solution: Anti–smoking patches

Stop–smoking patch applies modern transdermal controlled–release technology, which can constantly and gradually release the special formula. The patch could be transparent (inconspicuous)



# MPV Example 1 – White Strips™: Solution

11. Develop a new product/process that addresses the initial business challenge

A new delivery system was introduced to the market – a thin flexible film saturated with whitener and selectively adhered to teeth. This solution:

- Eliminated bleaching agent contact with saliva. It allows to use high concentration of agent and therefore increases bleaching efficiency
- Prevents swallowing of active ingredients and reduces harm to the user
- Flexible film provide better individual fit to teeth
- Reduces number and complexity of components and therefore decreases cost
- Complete invisibility increase user comfort

**GEN3 TRIZ solution simultaneously increased the efficiency of the teeth whitening process and reduced harmful effects and product cost**

# MPV Example 1 – White Strips™: Business Impact

## 12. Develop a business case for the new product

GEN3 TRIZ solution led P&G to launch WhiteStrips® in the US in 2000, and in Canada in 2002.

*According to Times & Trends (June 2003) “WhiteStrips whitens 5 times better than the leading paint-on whitening gel.”*

- First-year sales were \$129.6 million, topping the list of non-food products.
- Captured over 45% of whitening market. Along with SpinBrush, WhiteStrips leads double-digit growth in volume (18%), net sales (18%) and net earnings (19%) for P&G.
- P&G credits WhiteStrips with propelling Crest to be the company’s 12th billion-dollar brand/business.



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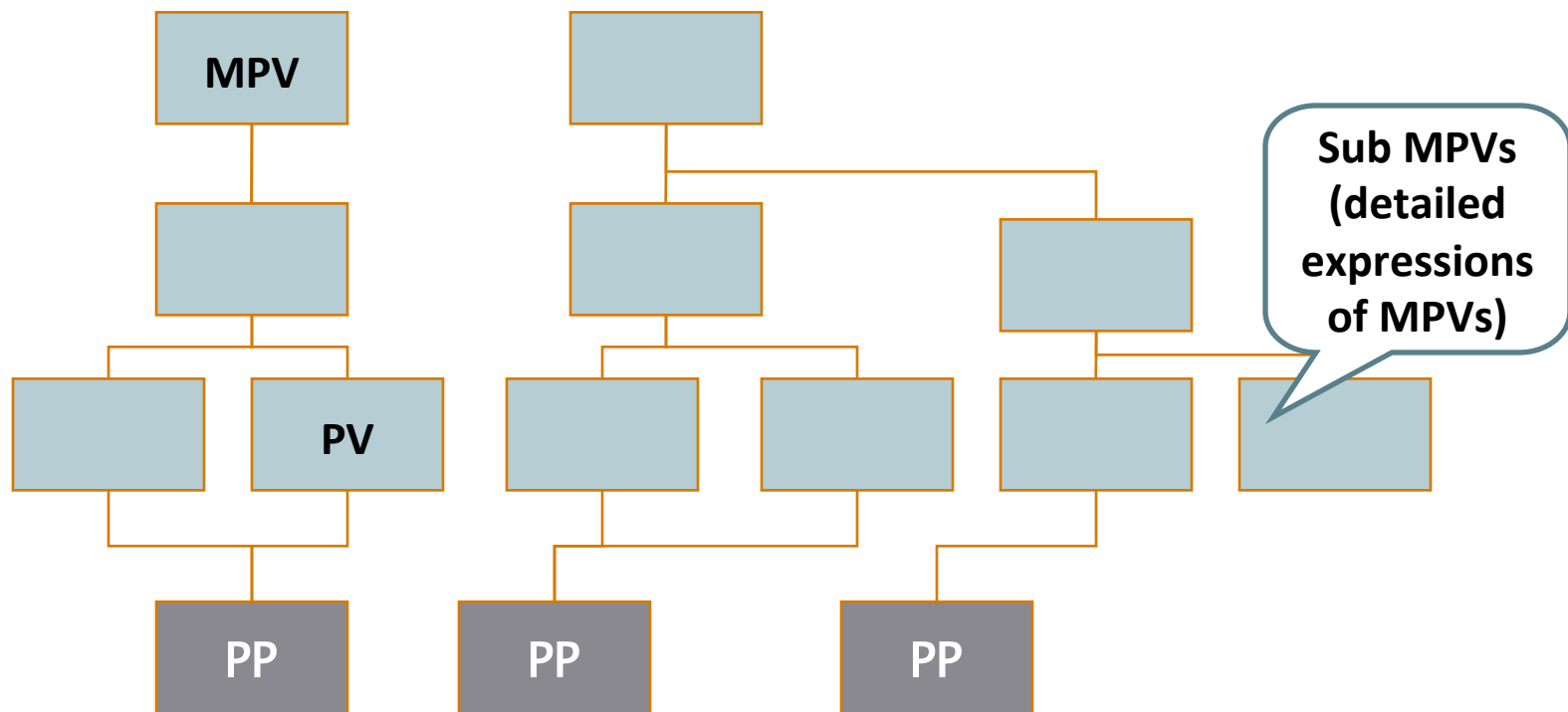
# MPV Hierarchy: Mapping Back From High Level Motivators To Physical Parameters

High level MPVs are linked to more detailed Parameters of Value (PVs) which are matched to physical parameters (PPs)

Customer Value



Attributes



# MPV Example 2 – Heavy Truck

## Heavy Truck



### ► Scenario:

A company that produces heavy trucks is looking to dramatically improve its position on the market

### ► Challenge:

One of the highest ranking MPVs for the company's customers (Fleet owners and Owner-Operators) is Fuel Efficiency. The company wants to identify the best ways to improve Fuel Efficiency.

# MPV Example 2: MPV Translation into PPV for Heavy Truck

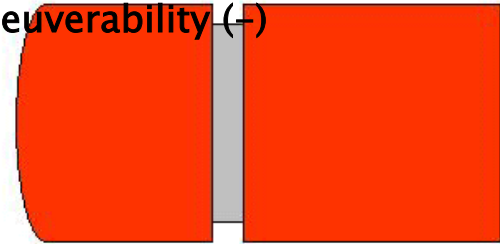
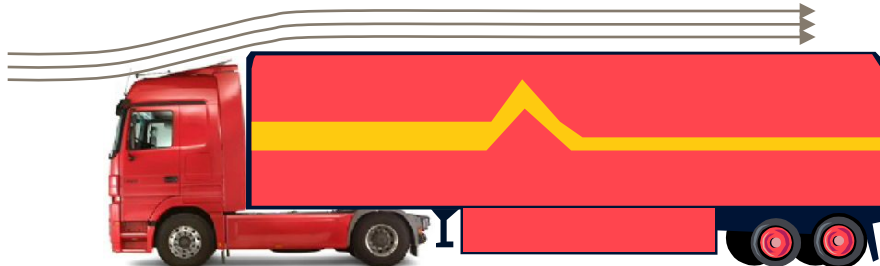


MPV	Sub 1 MPV	Sub 2 MPV	Physical Parameter
<b>Fuel Economy</b>	<ul style="list-style-type: none"> <li>Aerodynamic drag</li> </ul>	<ul style="list-style-type: none"> <li>Form drag</li> <li>Resistance from friction against external surfaces</li> <li>Resistance generated by protruding parts of the car</li> <li>Turbulence resistance</li> </ul>	<ul style="list-style-type: none"> <li>Air density</li> <li>Air viscosity</li> <li>Air temperature</li> <li>Area of the largest cross-section of the car</li> <li>Car speed</li> <li>Shape (size) of cabin, fairings, trailer</li> <li>Material surface energy</li> <li>Van-der-Waals forces (forces of mutual attraction of molecules)</li> </ul>
	<ul style="list-style-type: none"> <li>Cost effectiveness of engine</li> </ul>	<ul style="list-style-type: none"> <li>Engine efficiency</li> </ul>	<ul style="list-style-type: none"> <li>Combusting temperature of combustible mixture</li> <li>Combustible mixture density</li> <li>Size (arrangement) of piston-rod group</li> <li>Size of particles of atomized fuel</li> <li>Air temperature</li> <li>Uniformity of fuel mixture spray</li> <li>Excessive air coefficient</li> </ul>
	<ul style="list-style-type: none"> <li>Rolling resistance</li> </ul>	<ul style="list-style-type: none"> <li>Structure (composition) of road surface</li> <li>Truck weight</li> <li>Weight of cargo carried</li> <li>Quality and number of rolling contact bearings</li> </ul>	<ul style="list-style-type: none"> <li>Unevenness of road surface</li> <li>Unevenness of tire surface</li> <li>Shape (relief) of tire protector</li> <li>Mechanical parameters (rigidity, elasticity) of tire</li> <li>Metal density</li> <li>Size of point of contact between wheel and road pavement</li> <li>Load on one axis of truck</li> <li>Optimality of load-bearing structure</li> </ul>

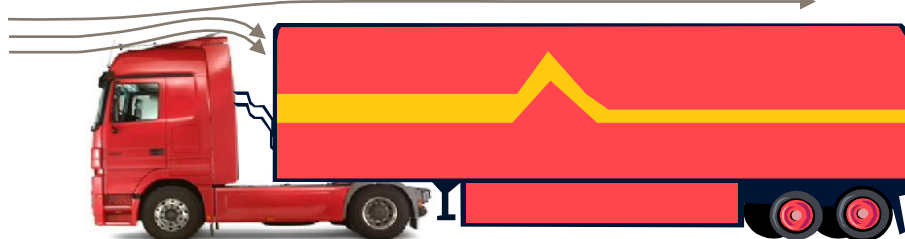
# MPV Example 2 – Heavy Truck: Key Problem

- Sub-MPV:  
Aerodynamic drag (resistance)
- Key Problem:  
The space between the cab and the trailer should be large to ensure maneuverability and it should be small to reduce aerodynamic drag

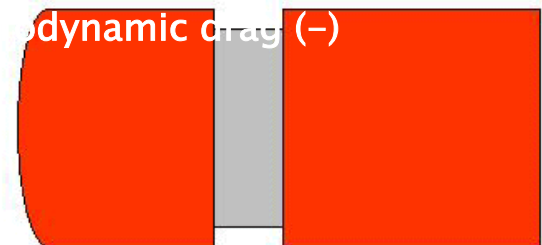
Small gap: low aerodynamic drag (+), poor maneuverability (-)



good



high



high aerodynamic drag (-)

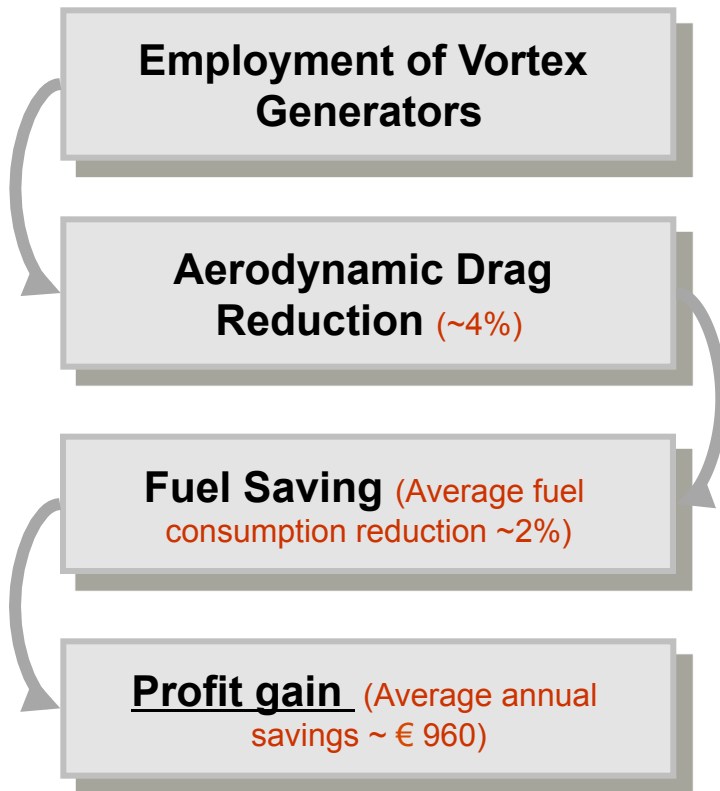
# MPV Example 2 – Heavy Truck: Solution

Solution was found using Trend of Increasing Dynamicity



# MPV Example 2 – Heavy Truck: Business Impact

Trace back the developed solutions to evaluate business impact on MPVs



## Assumptions:

- Average fuel consumption for the truck – 32 liters per 100 km;
- Average annual mileage of the truck – 150 000 km;
- Average price of diesel fuel (Europe) – €1 per liter;
- Average fuel consumption reduction from Vortex Generators Integrated with Cab Extenders – 2%.

## Results:

- Average amount of fuel saved (per year) –  $(150000/100) \times 32 \times 0.02 = 960$  liters;
- Average annual savings –  $960 \times 1.0 = \text{€ } 960$ .

# Agenda

- ▶ Business need for MPV
- ▶ MPV definition and role of MPVs
- ▶ PV classification
- ▶ MPV Discovery: Voice of the Product
- ▶ MPV translation into PPV
- ▶ Case Study

# MPV Case Study – Banana

## 1. Select object of improvement (product or process)

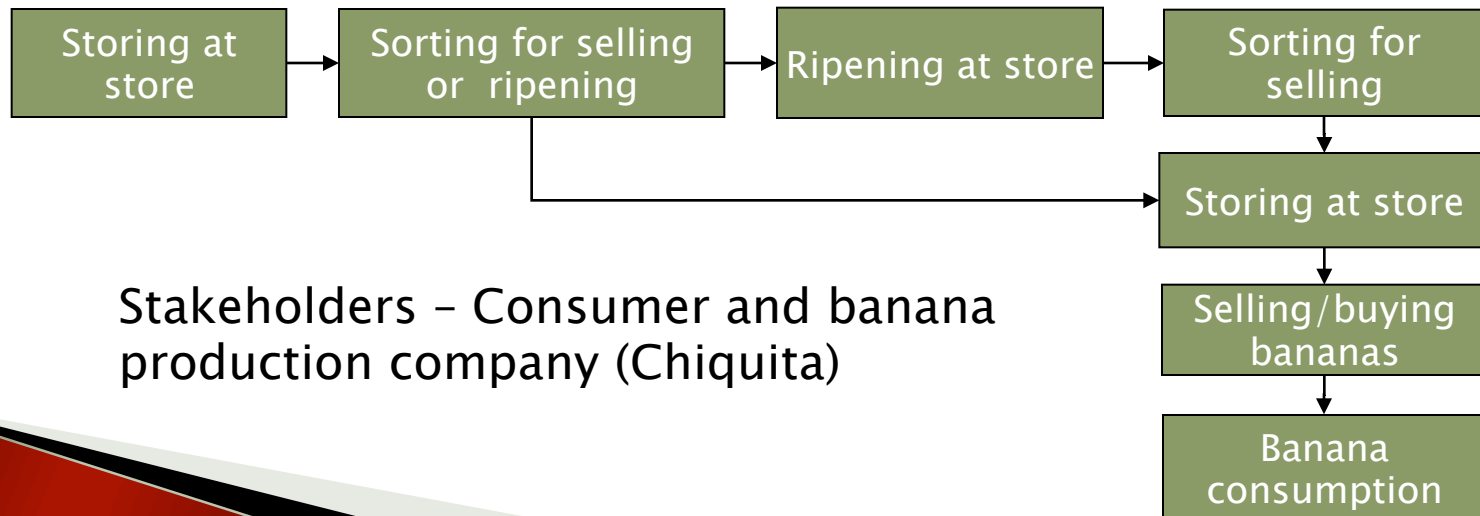
The object selected by banana production company Chiquita – Bananas

## 2. Formulate business challenge for the selected object

Chiquita's business challenge is low profit margin because banana is a commodity product

## 3. Identify Stages of Life Cycle and Stakeholders

Selected stage – is selling/buying bananas

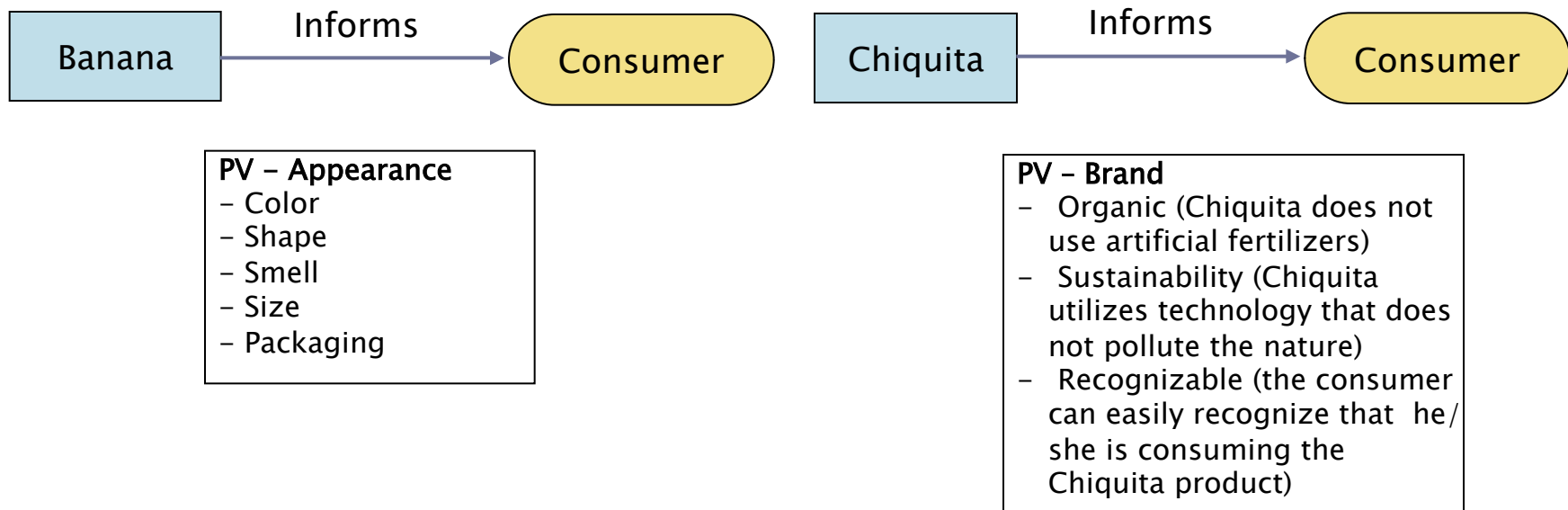




# MPV Case Study – Banana

## 4. Build Functional Models for each Stakeholder

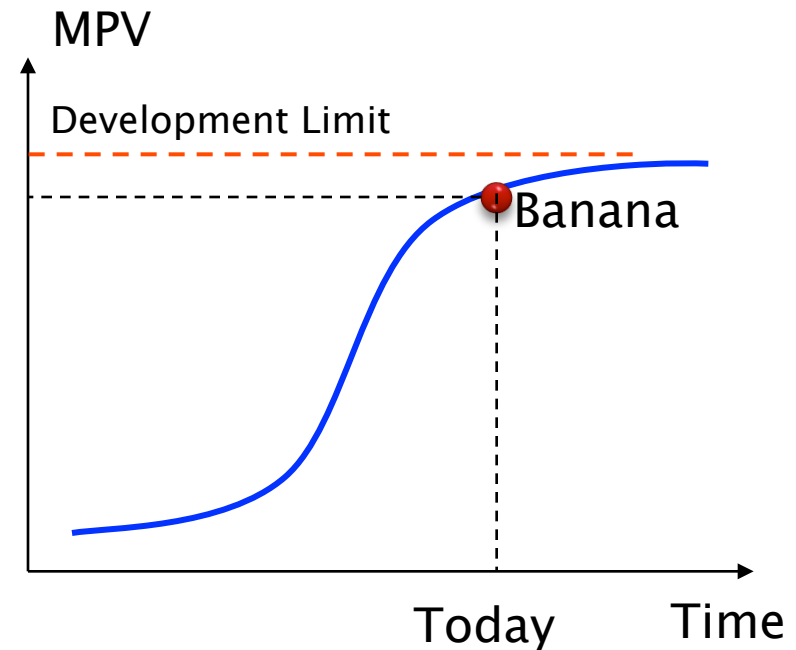
The fragments of Functional Model show two analyzed functions. Level of performance of these functions is characterized by corresponding Parameters of Value:



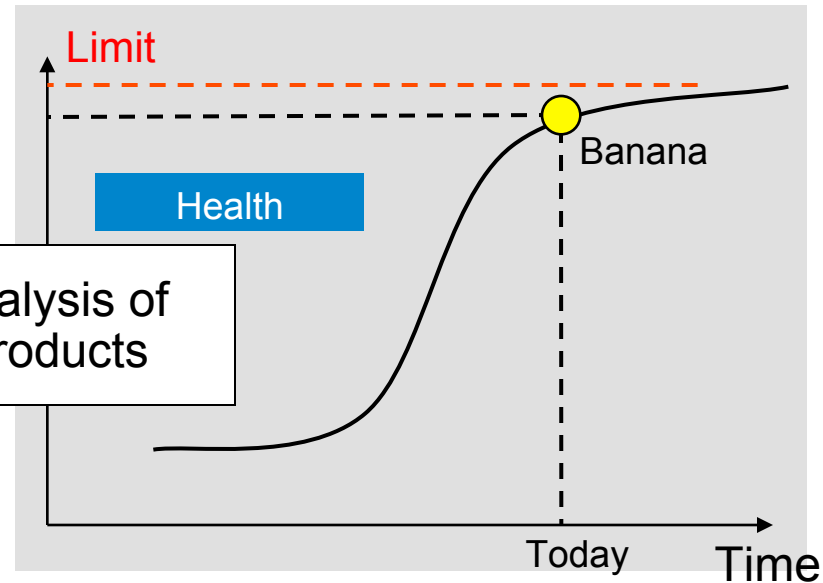
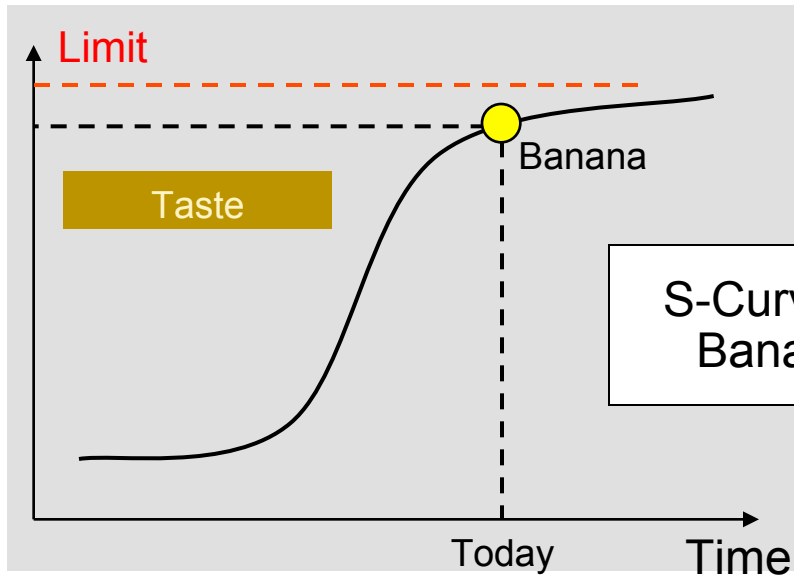
# MPV Case Study – Banana

## 5. Perform Pragmatic TESE Analysis (including S-Curves) for all important PVs of the selected object

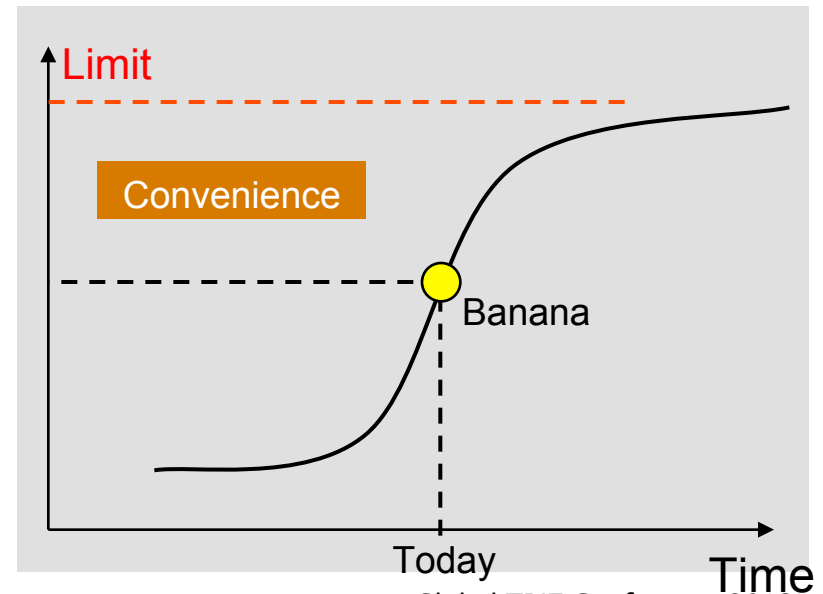
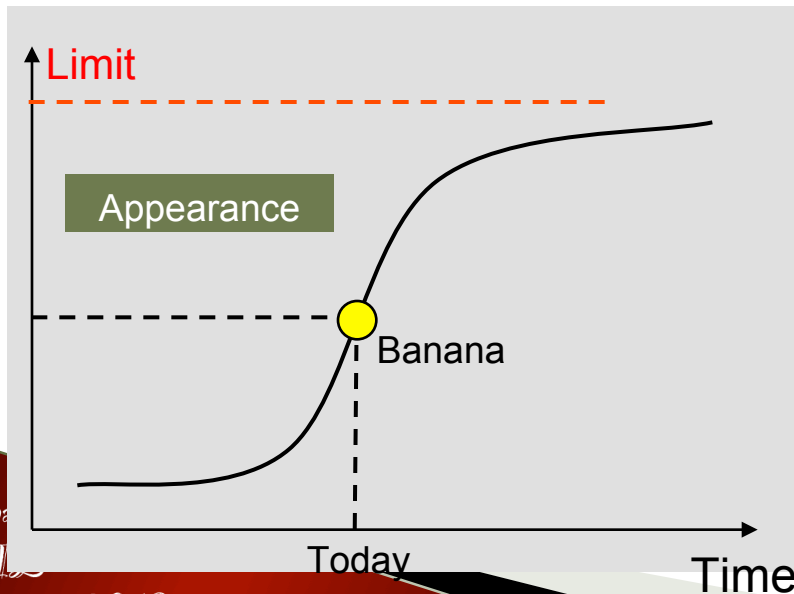
- The products on the second stage of evolution need further improvement of main function parameters. Hence, at this stage they have highest rank among all other parameters
- The mature products (that entered the market many years ago) are at the third stage of evolution and their main functional parameters have reached their theoretical limit. That's why these parameters should have a pretty low rank



# MPV Case Study – Banana



S-Curve Analysis of Banana Products



# MPV Case Study – Banana

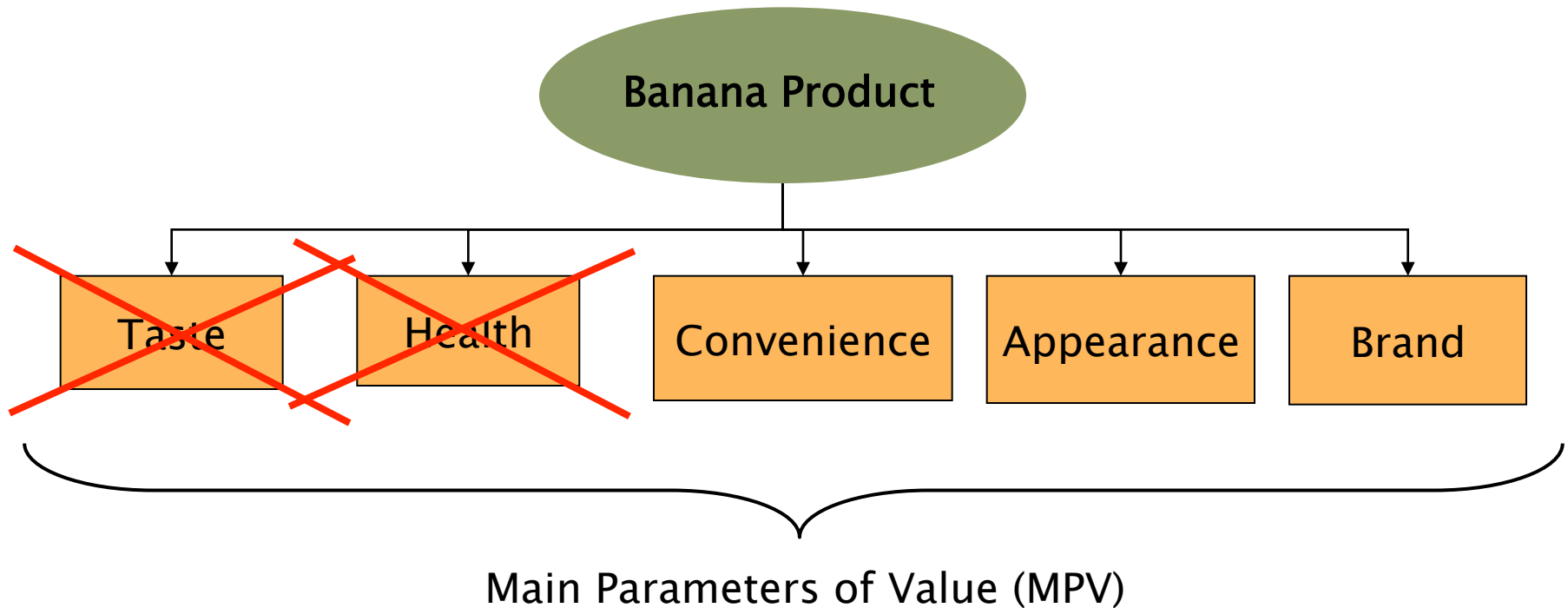
## 6. Compile a list of PVs resulted from FA and TESE Analysis

- In accordance to market investigations of consumer preferences and its own interests Chiquita's desire (Voice of the Customer) Chiquita selected the following parameters as MPVs:
  - Brand
  - Taste
  - Health
  - Appearance
  - Convenience
- Two of these parameters, Taste and Health, completely satisfy consumer and Chiquita's requirements. Hence, there is no need in further improvement of these parameters (that means that they are actually not MPVs).



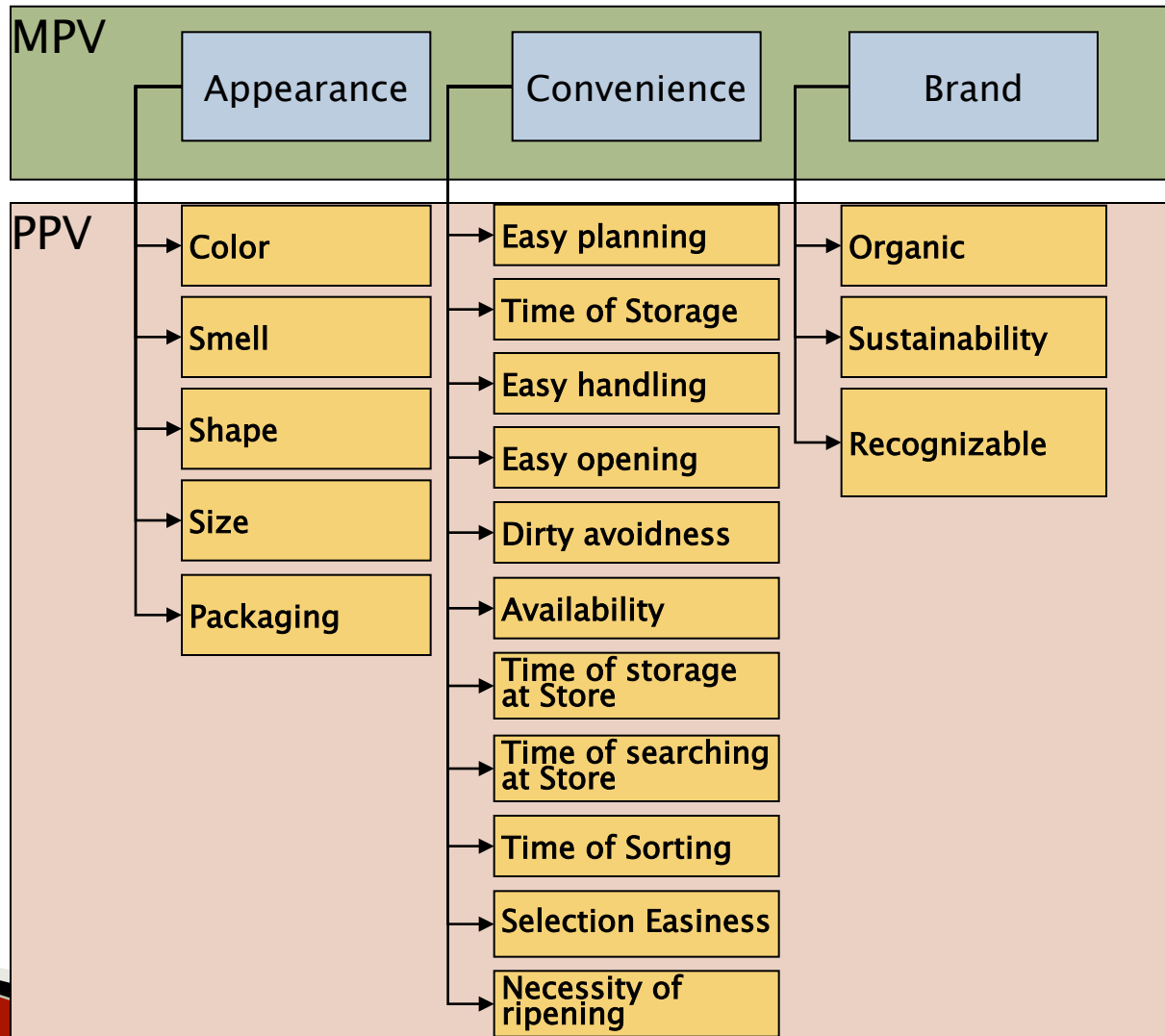
# MPV Case Study – Banana

## 7. Select MPV candidates



# MPV Case Study – Banana

8. For each selected MPV identify corresponding underlying PPVs

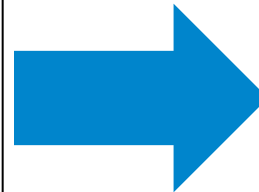


# MPV Case Study – *One Banana Please!*

11. Develop a new product that addresses the initial business challenge
12. Develop a business case for the new product

## Solution:

A new product was introduced to the market - Single Banana. The velocity of the supply chain was synchronized with the biological processes for the ripening of the fruit after harvesting. New equipment was developed for separating banana clusters into individual bananas



## Business case:

New channels offer new profit potential. Single Banana is a non-commodity product with significantly higher profit margins. It allows to bring it to the market within the Snack Foods category



# MPV Discovery: Conclusions

- ▶ A new methodological tool/technique was developed that directly connects business challenges and underlying technical problems – Main Parameters of Value (MPV) Discovery
- ▶ MPV – a key attribute of a product/service that is hereto unsatisfied and important to the purchase decision process
- ▶ MPV approach makes innovation measurable. Innovation is a significant improvement along at least one Main Parameter of Value
- ▶ Algorithm for MPV Discovery and Analysis was developed
- ▶ MPV Discovery was successfully applied for dozens products and processes in different industries.
- ▶ There are several products available on the market that were developed using MPV Discovery technique



# Thank you for your attention! Q & A



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