

**Main Parameters of Value: TRIZ-based Tool  
Connecting Business Challenges to Technical  
Problems in Product/Process Innovation**

**7<sup>th</sup> Japan TRIZ Symposium 2011 Yokohama, Japan**

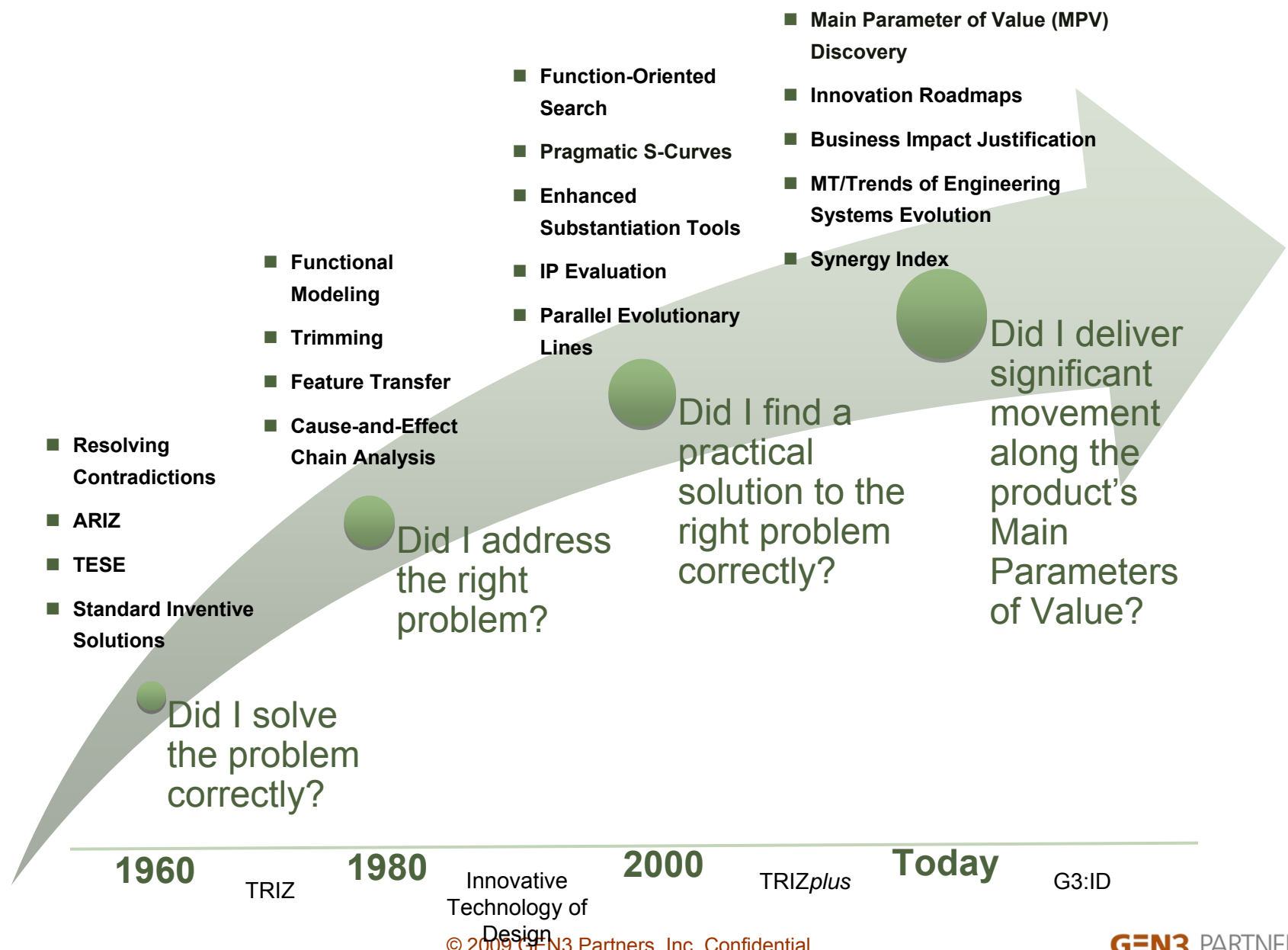
**Dr. Simon Litvin, Chief Scientific Officer,  
TRIZ Master  
September 9, 2011**

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

- **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 Systematic Innovation





### 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)

### G3:ID 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



*Originator of TRIZ G. Altshuller (r.) with Simon Litvin (l.), ca. 1979*

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**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?

11:16A	CANCELLED
5A 10:30A	CANCELLED
5A 10:15A	CANCELLED
7A 6:50A	DELAYED
7A 7:20A	DELAYED
10:00A	CANCELLED
17A 10:10A	DELAYED





- **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**

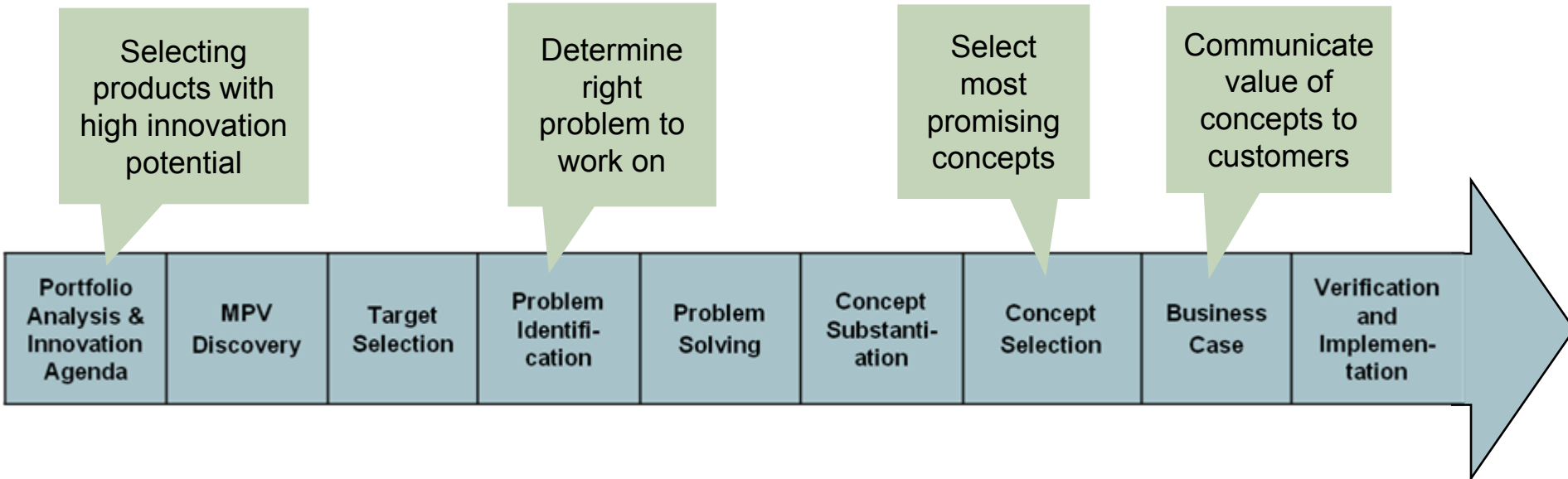




- **Key dimension of Value:**
  - Derived directly through end-use/consumption, or
  - Indirectly in the intermediate processes of other stakeholders
  
- **Independent of a given product**
  - Attribute of the market
  - May be unfulfilled (or latent)
  
- **Central to purchase decision**
  - Important to one or more stakeholders
  - Distinguishes offerings from one another



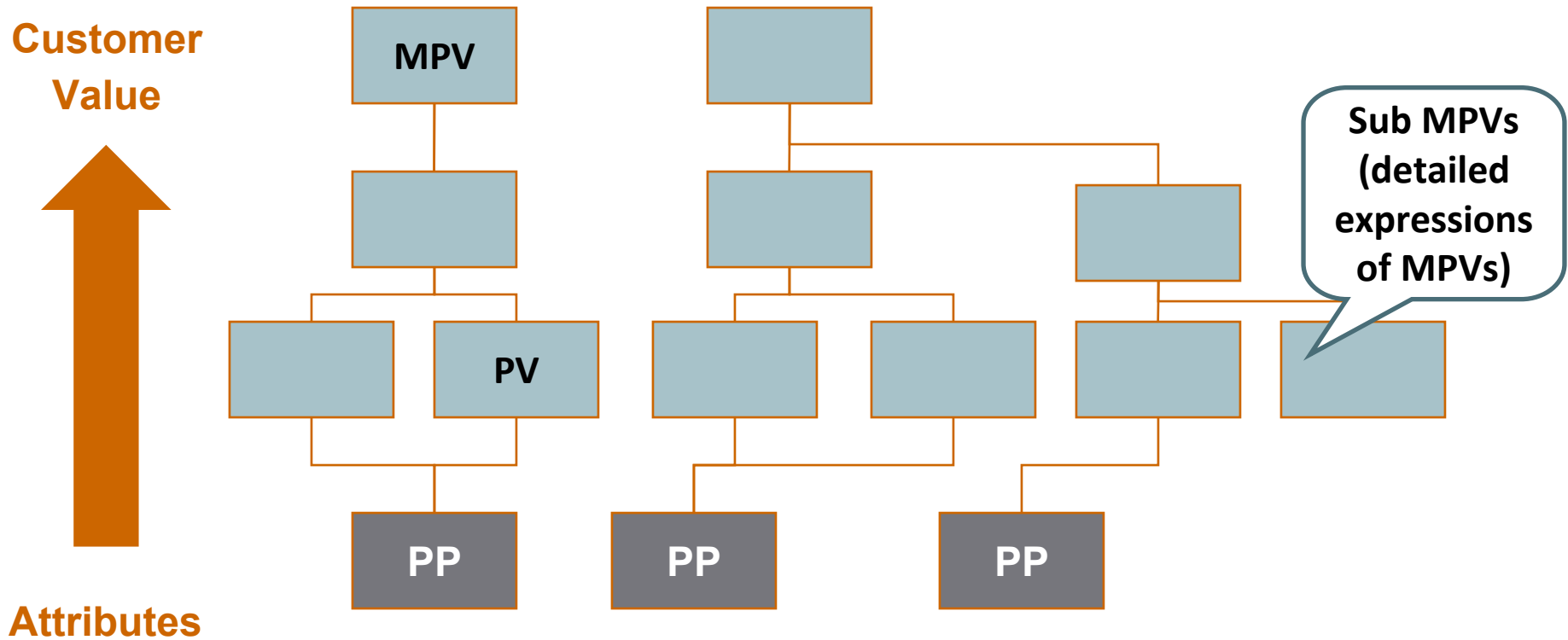
Product	MPVs
Toothbrush	<ul style="list-style-type: none"> <li>• Effectiveness of plaque removal</li> <li>• Convenience</li> <li>• Safety (no gum damages)</li> <li>• <b>Ability to remove plaque from under the gum</b></li> <li>• <b>Safety (limited conditions for pathogenic bacteria growth)</b></li> </ul>
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>



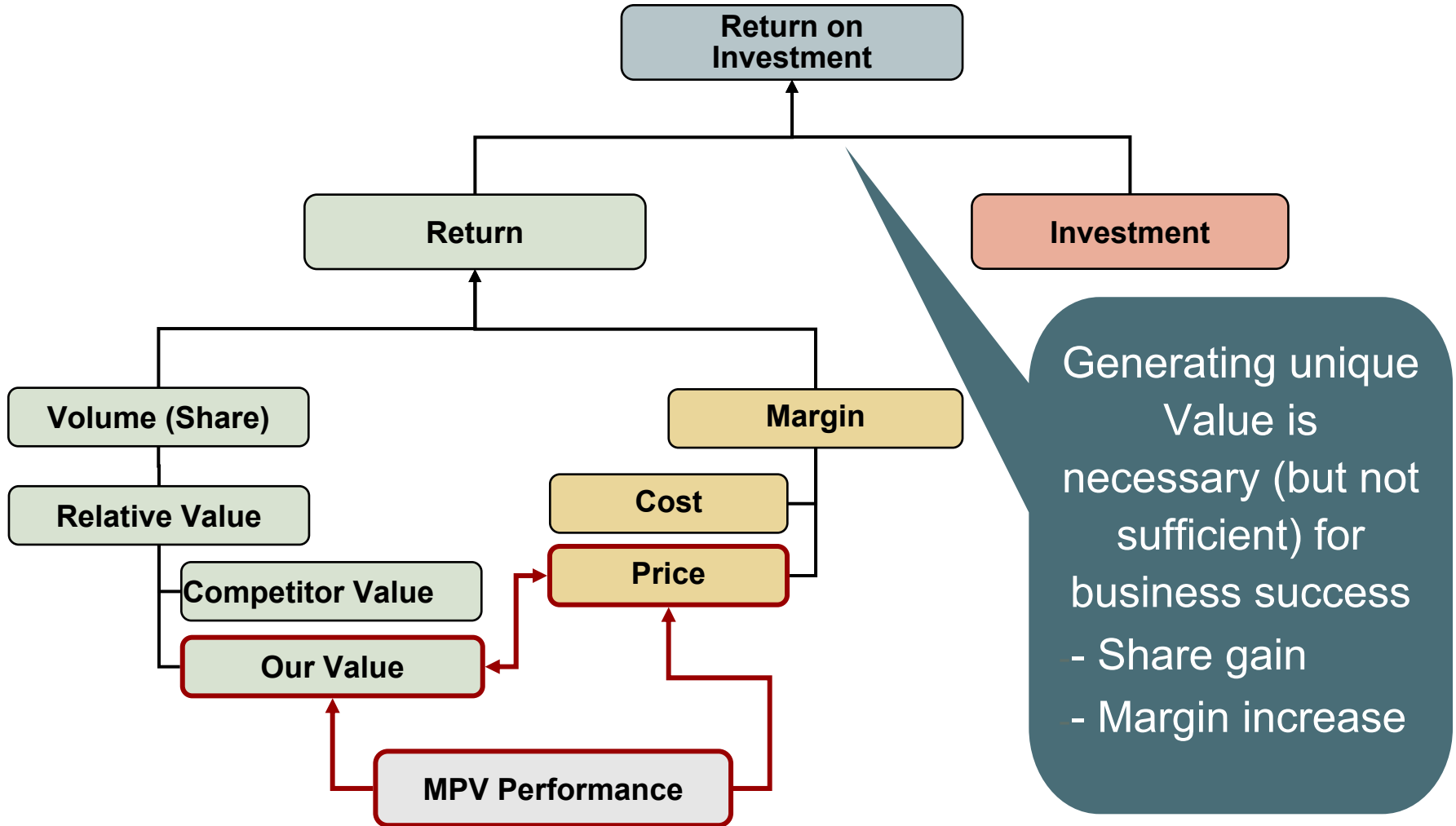
- One or two MPVs are usually the starting point for innovation process
- A broader set of MPVs (and PVs) is used to evaluate products that result from the innovation process

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

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



## MPV Value and ROI





- Business need for MPV
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**Main  
Parameter of  
Value (MPV):  
focus of  
innovation  
efforts**

	Important	Unimportant
Unsatisfied	<b>MPV</b>	<b>PV</b>
Satisfied	<b>PV</b>	<b>PV</b>

- 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



**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**

<b>MPV</b>	<b>Latent MPV</b>
<b>PV</b>	<b>Tacit PV</b>

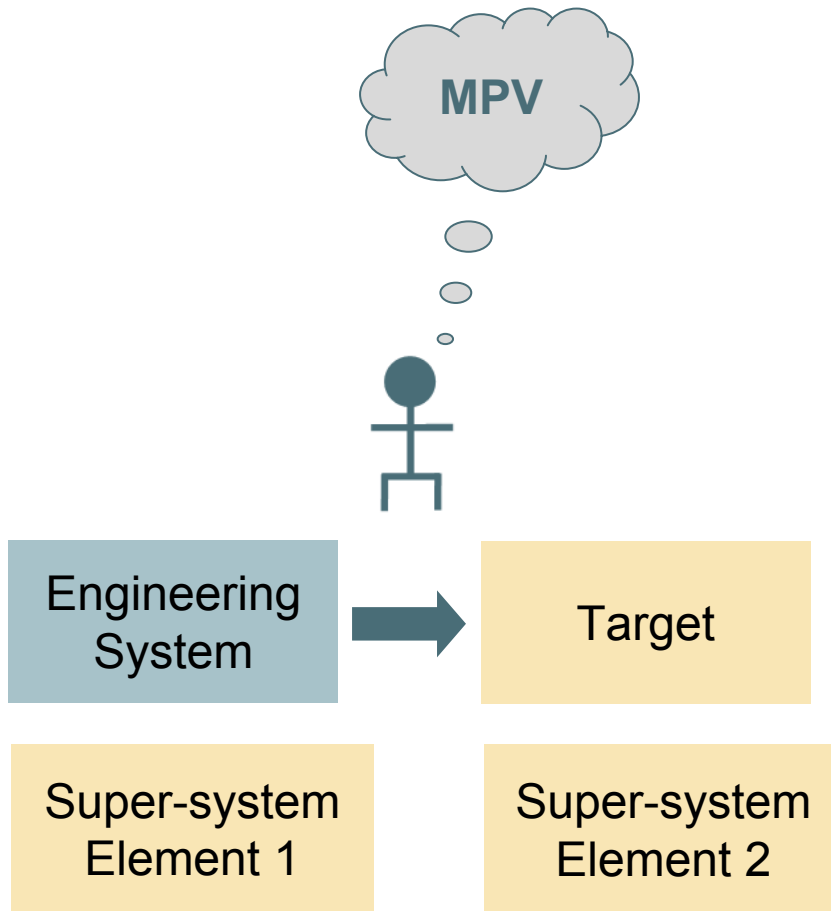
Satisfied

**Parameters of Value (PVs):**

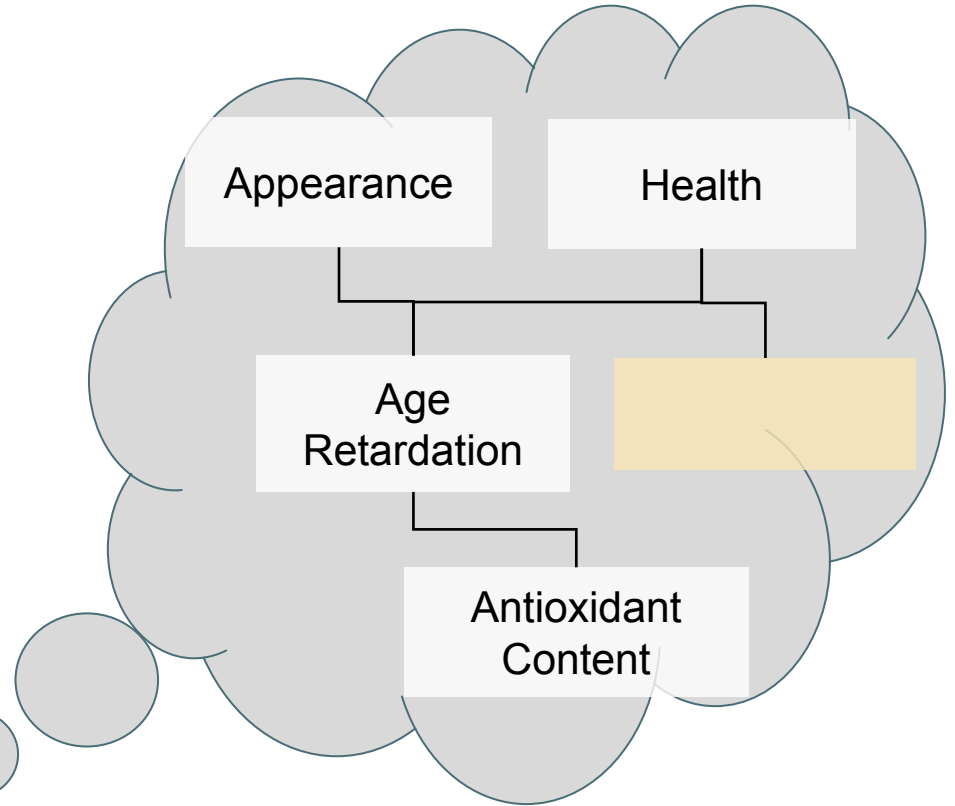
Well understood, assumed to be satisfied by all products in the buyers consideration set

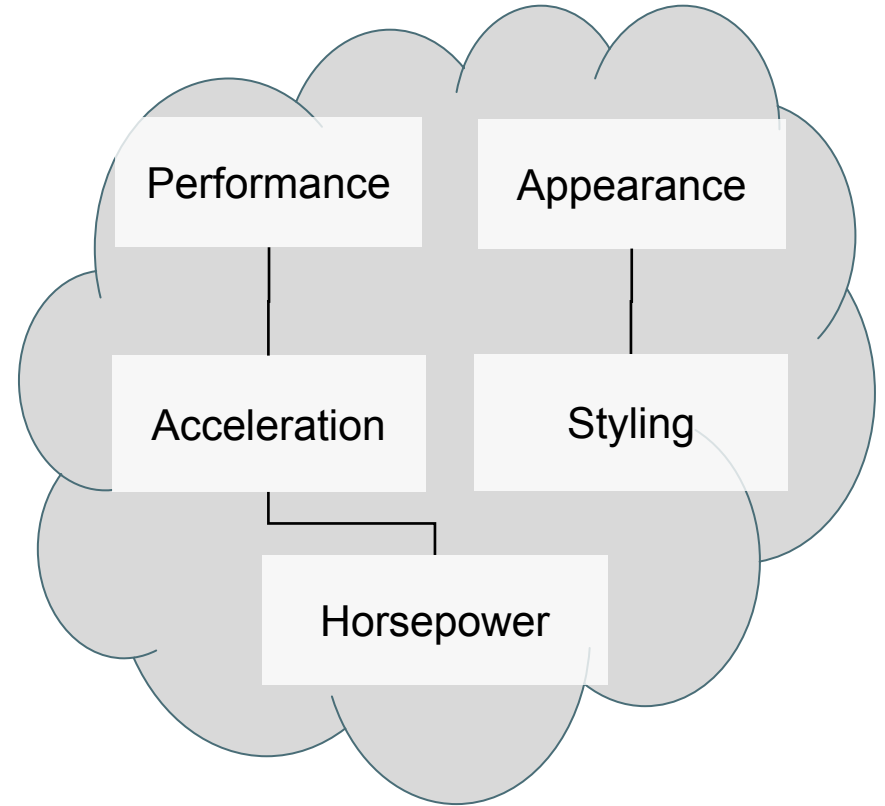
**Tacit Parameters of Value:**

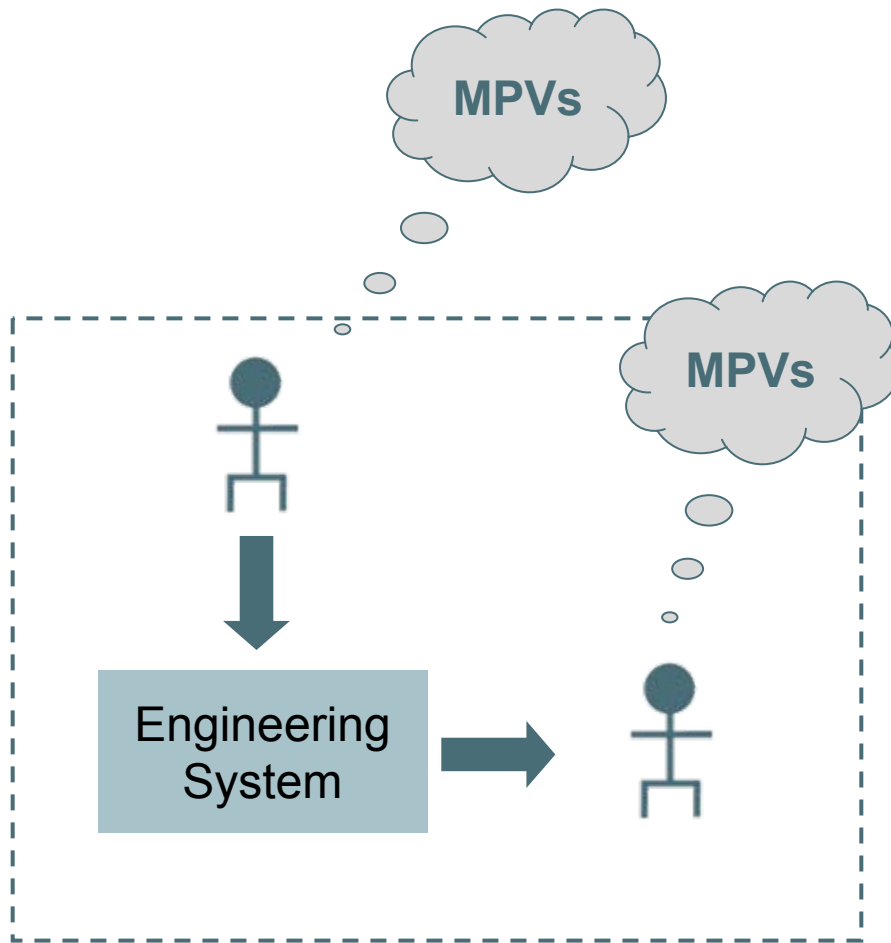
Overlooked, delivered as artifact of current technology



- 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







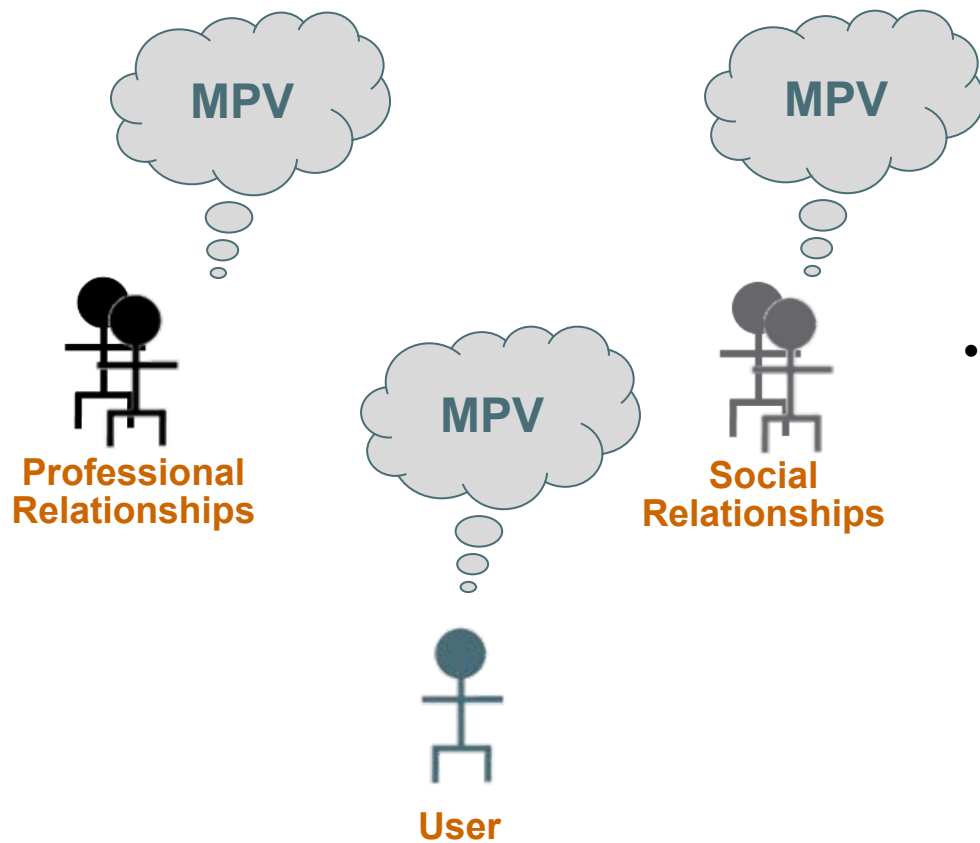
- Stakeholders can be an element of the supersystem in which the engineering system functions
- A Stakeholder may be the target of the engineering system
- A stakeholder may perform functions within the supersystem



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

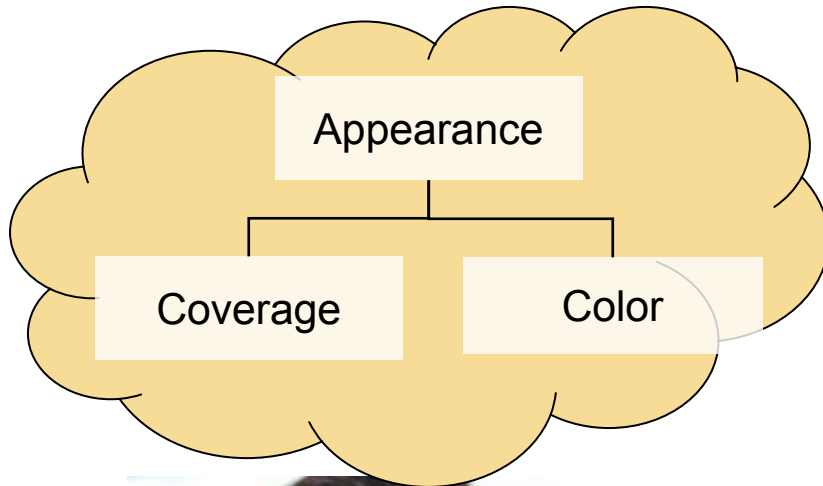


- Engineering System = razor
- Face (whiskers) is target of engineering system
- Barber shaves customer
- Two stakeholders → two set of MPVs

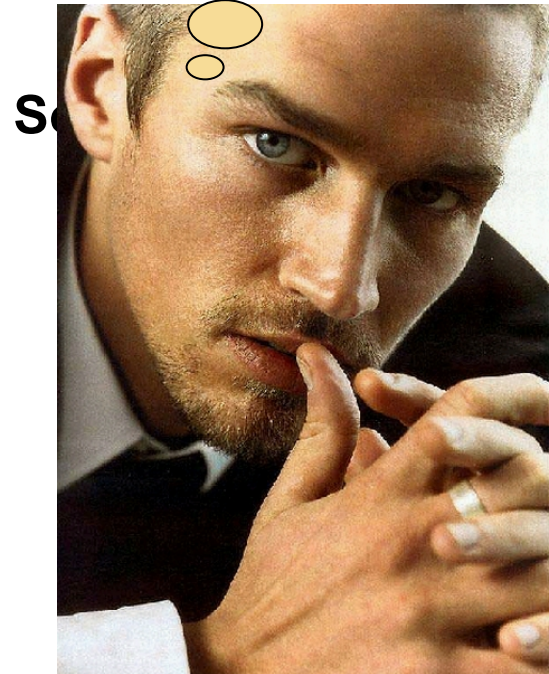
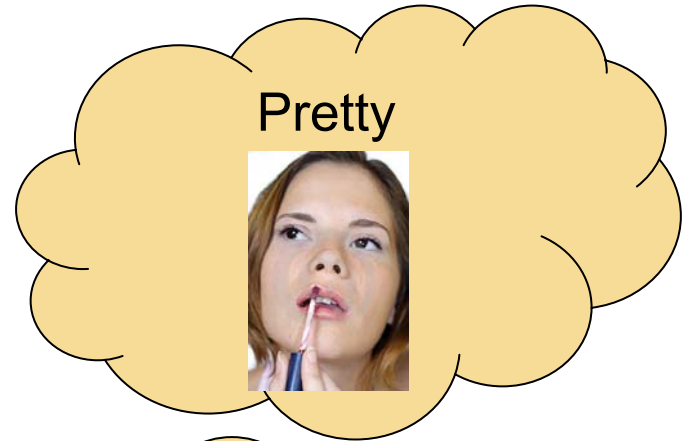
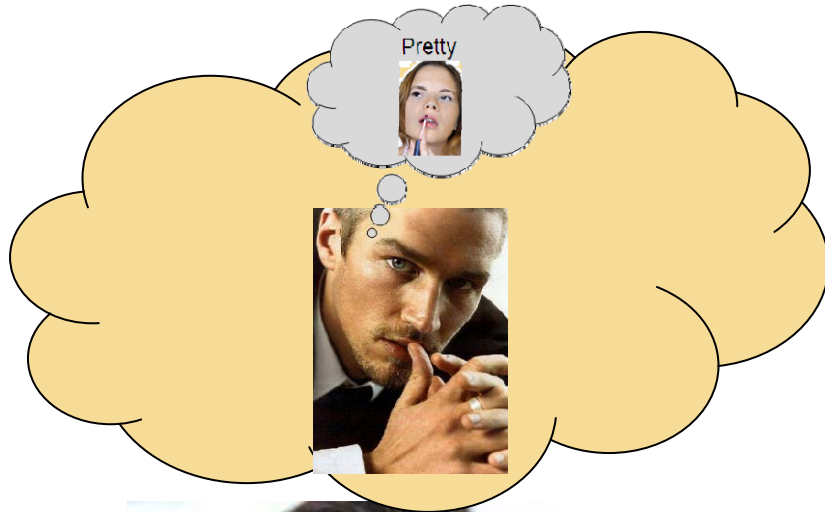


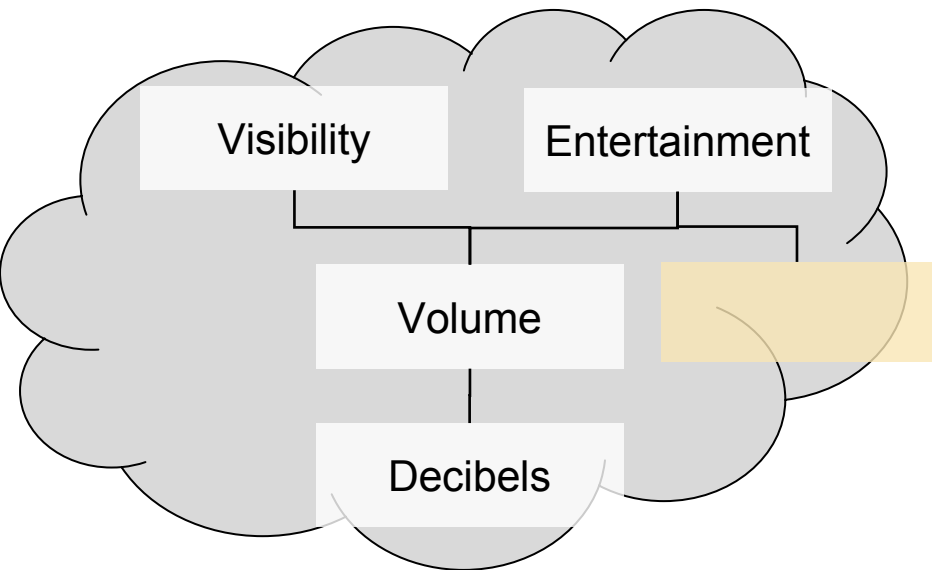
- User/stakeholder MPVs may be related to other players important to the user who may also interact with, or be affected by, the engineering system



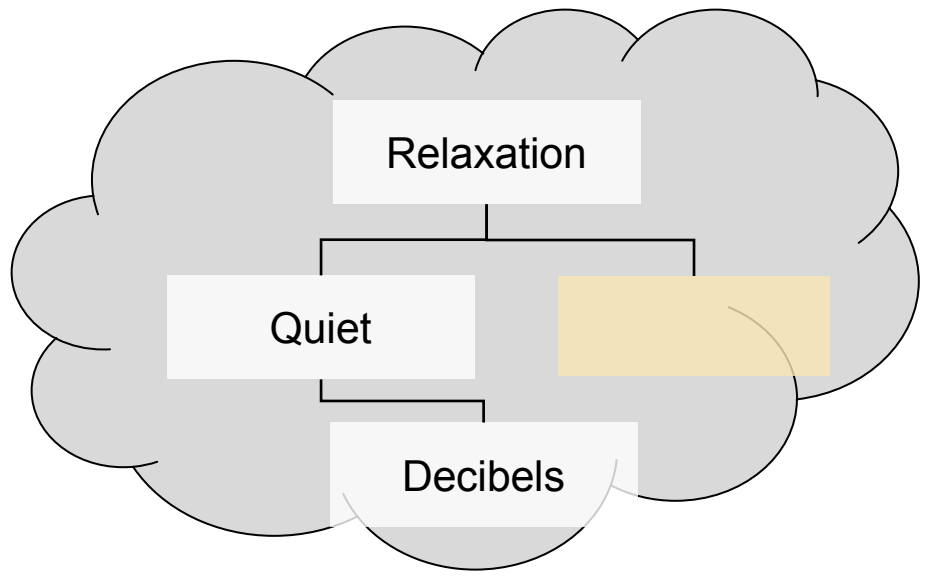
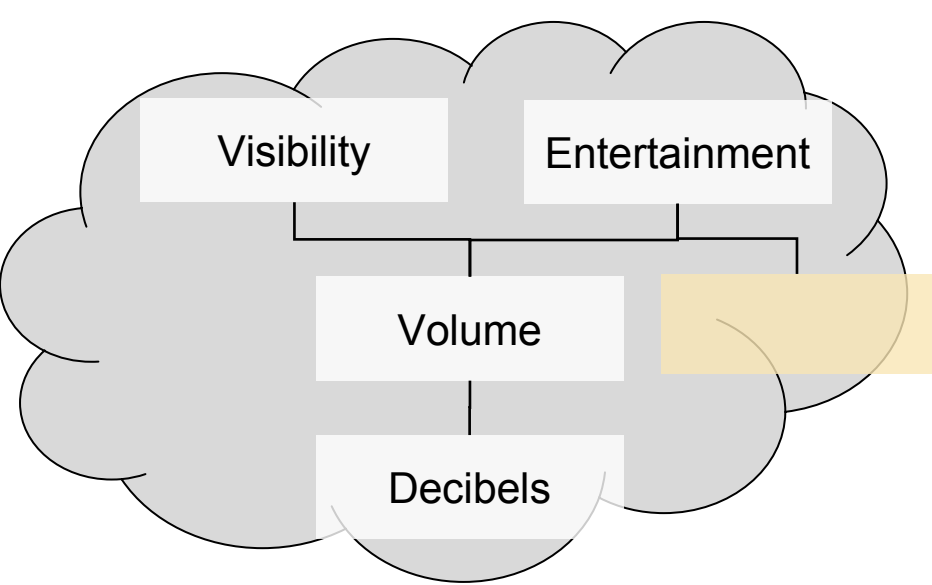


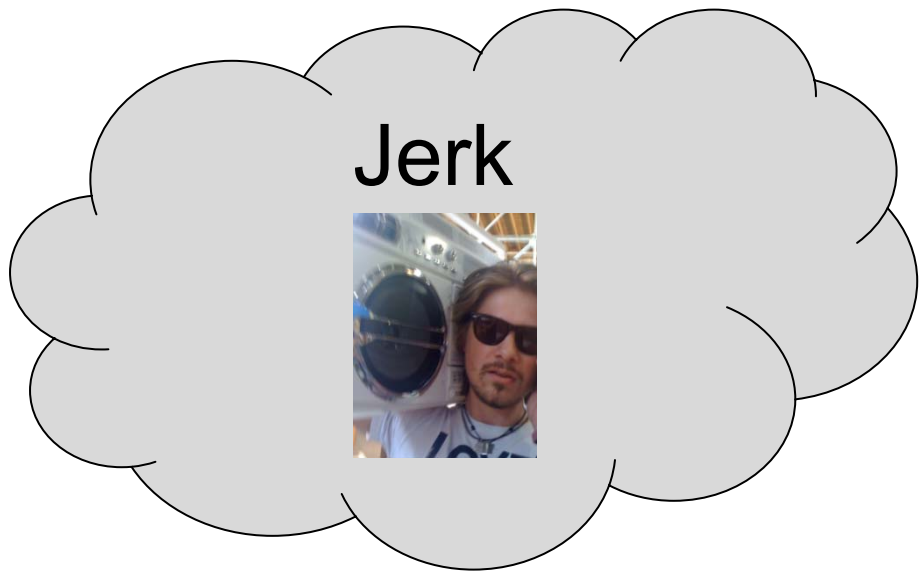
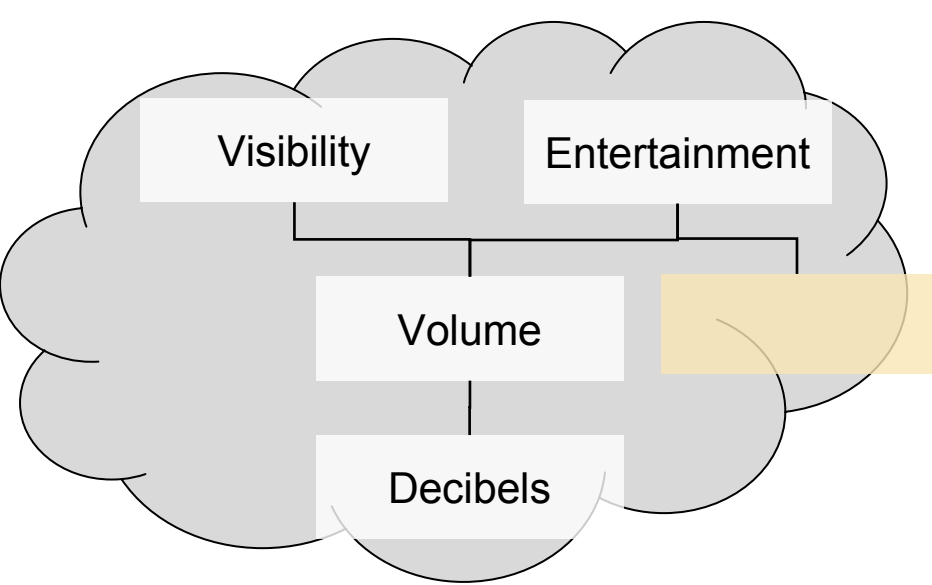
**Some products are judged by the impact they have on other stakeholders**

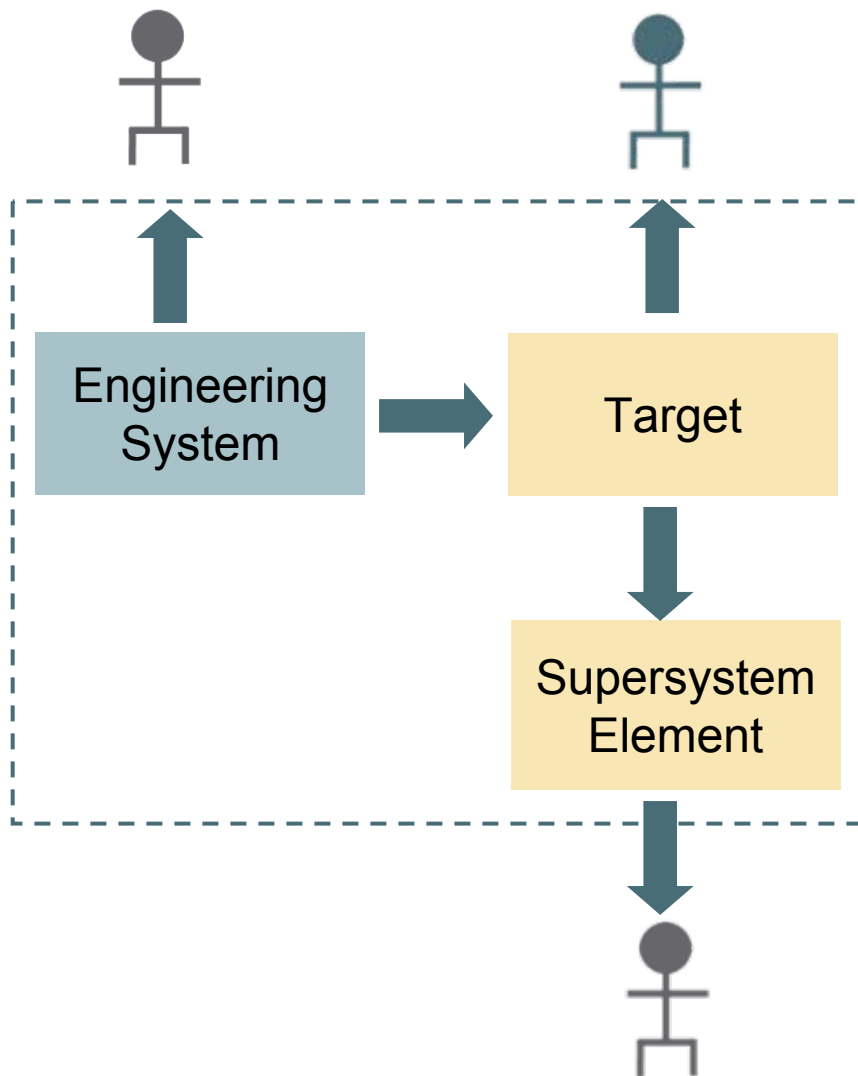




**Product use can affect other stakeholders**



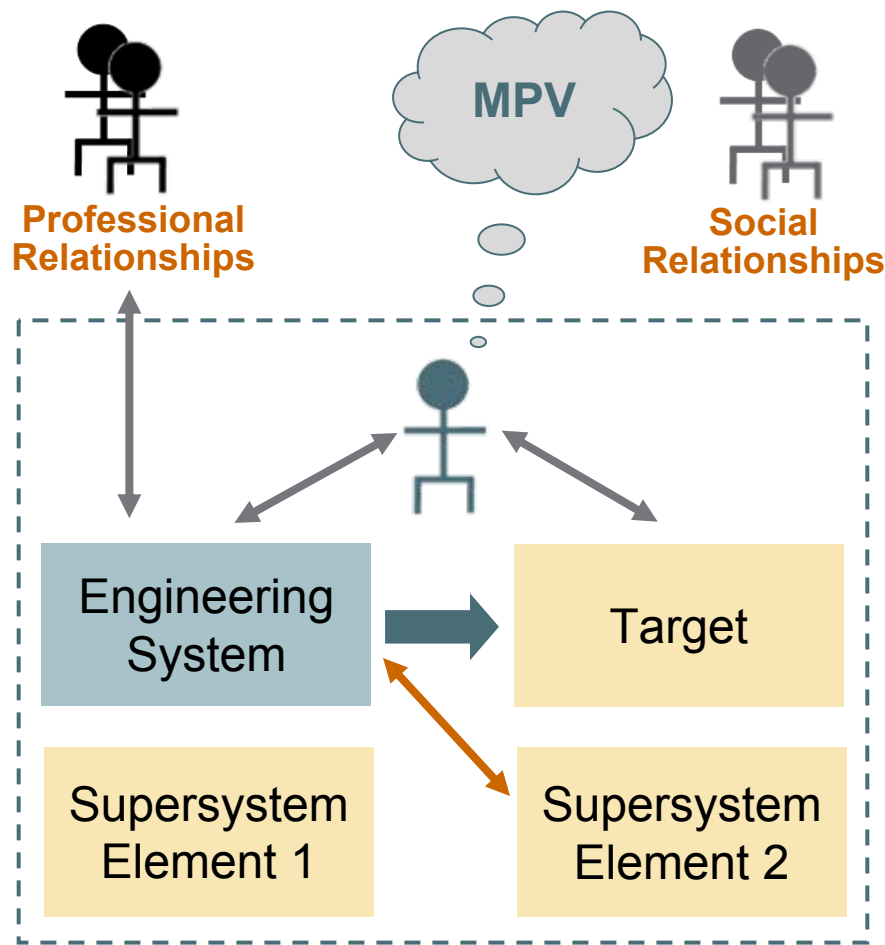




- Satisfaction of stakeholder MPVs may result directly from the functions of the engineering system
- Satisfaction of MPVs may also result indirectly from:
  - Impact of engineering system on other supersystem elements
  - Overall performance of the supersystem

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





**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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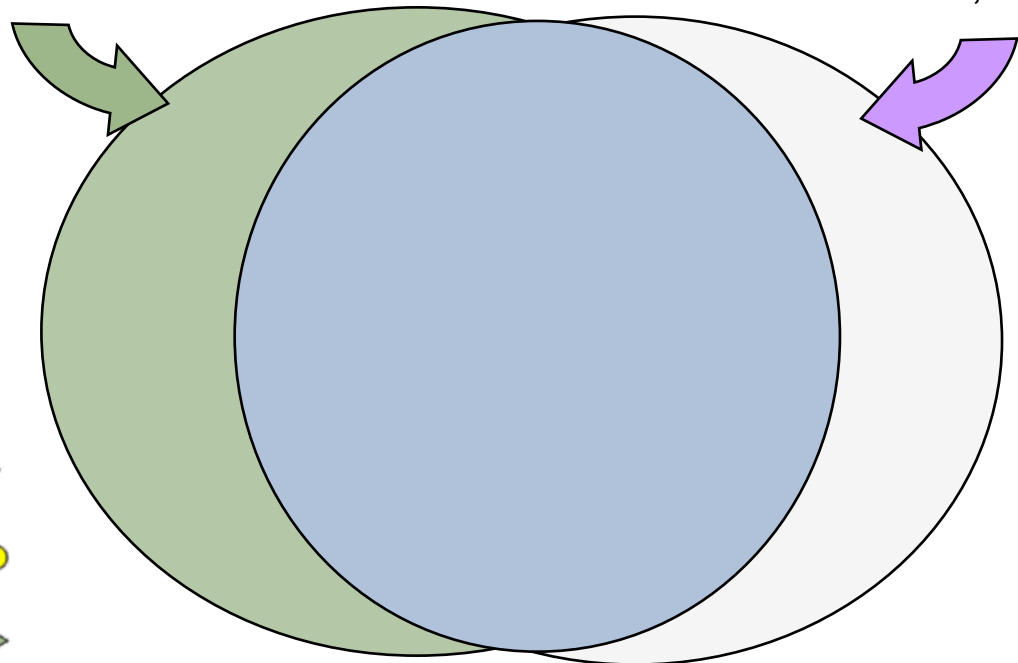


## “Voice of the Product”

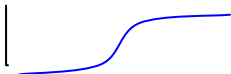
(Objective Functional Parameters of Value)

## “Voice of the Customer”

(Market Parameters of Value – needs, occasions, actions)



Trend Analysis



Function Analysis



Cause-Effect Chain Analysis



## 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



WEBSHOTS

### Context Framing and MPV Hypotheses

- MPV Hypotheses
- Occasion Hypotheses

### VOP Analysis

- Functional Analysis
- TESE
- Patent Analysis

### Field Visit Preparation and Execution

- Learning Objective Development
- Target Customer Selection
- Team Formation
- Interviews / Observations

### Post interview Analysis


- Interview Breakdown
- Occasion Summary Update
- Functional Model Update
- MPV Hierarchy



## 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?* 

- 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**

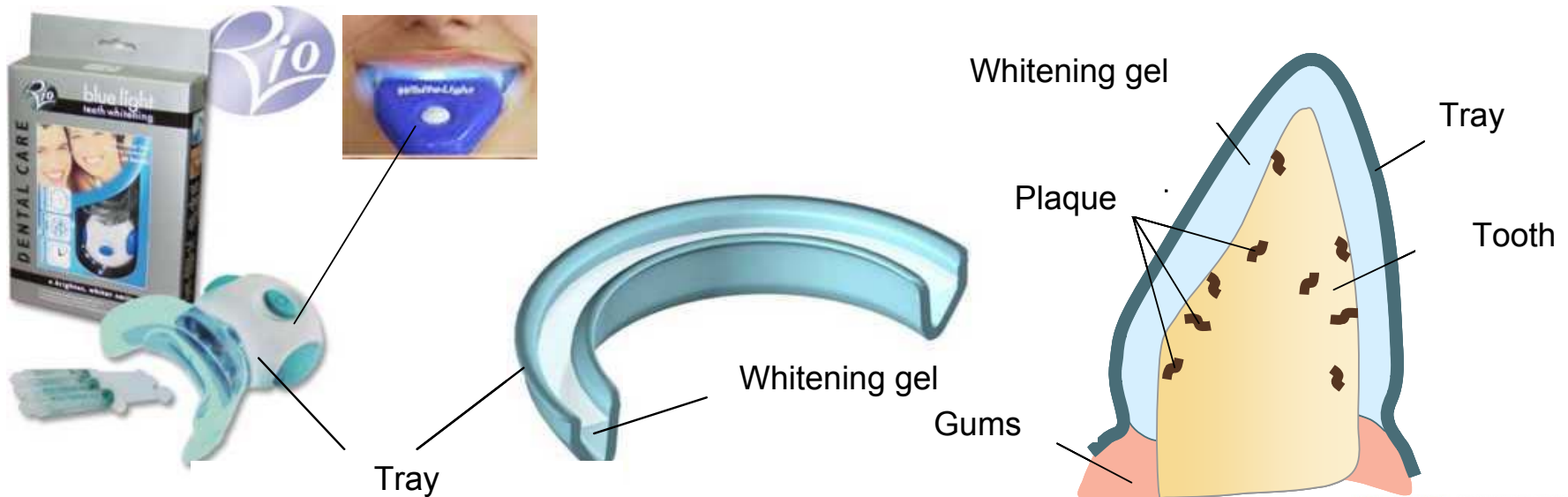


## 1. Select object of improvement

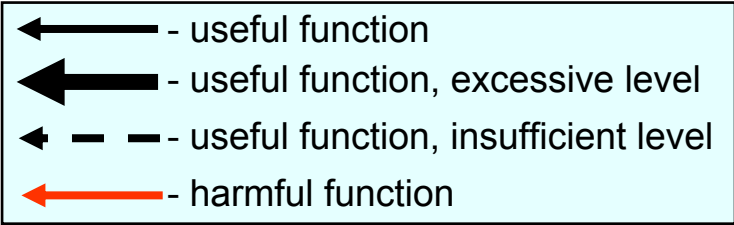
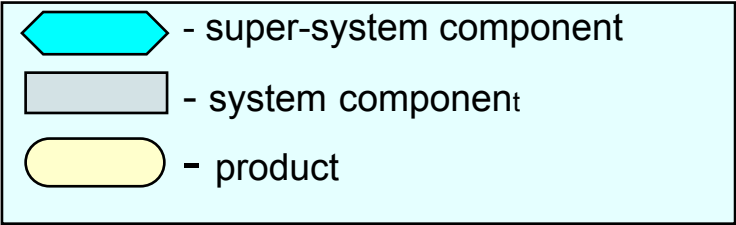
Device for at home teeth whitening consists of polymer tray filled with whitening gel. The tray should be placed on the teeth for a night during a week.

## 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?

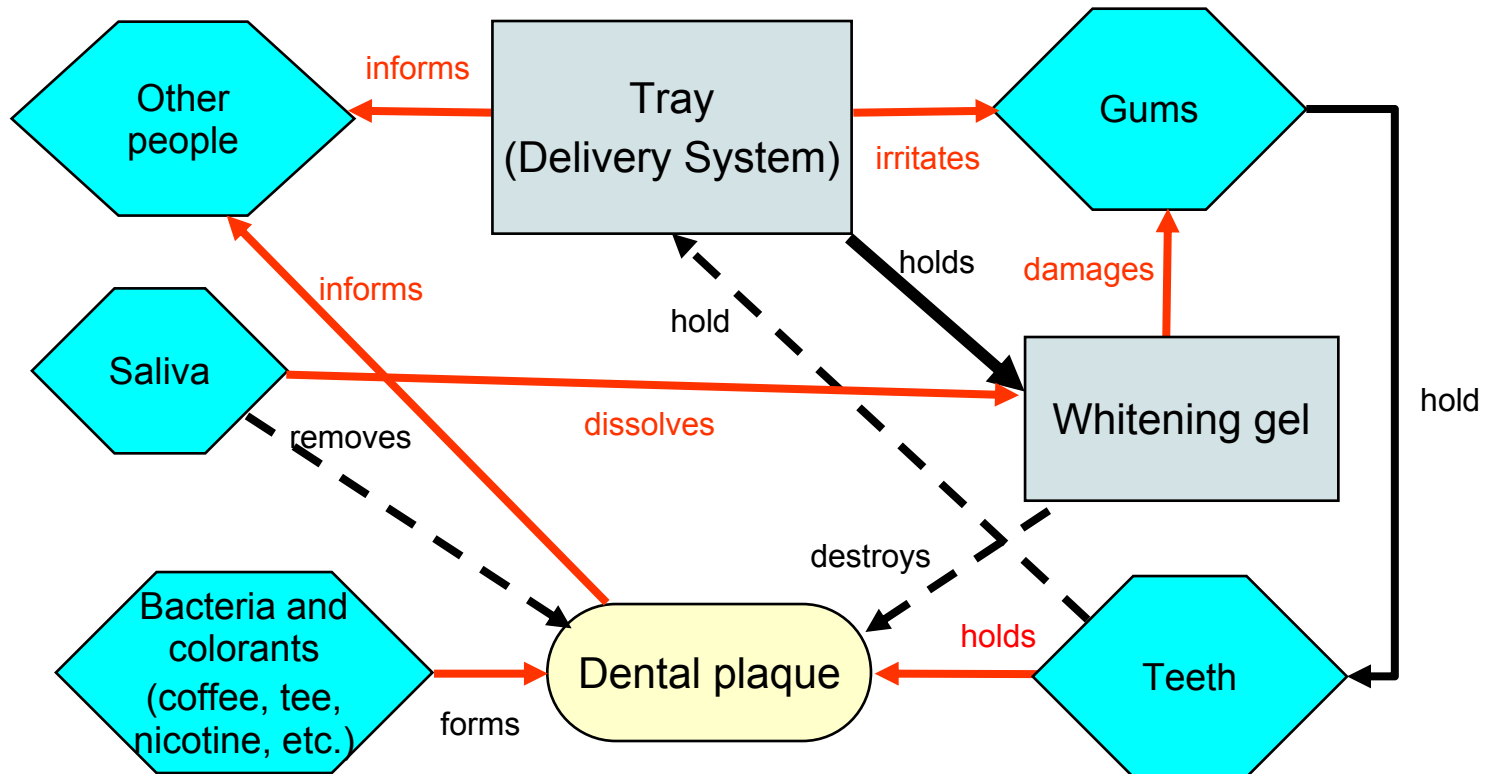






## 4. Build Function Model

Functional model at exploitation stage



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

## 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

## 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.

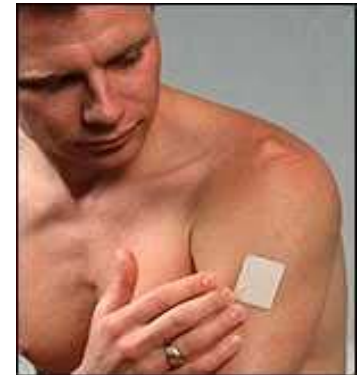
Key problem examples:

- 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

## 10. Resolve KP using TRIZ/G3:ID 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)



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

G3:ID recommended to introduce a new delivery system - 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

**G3:ID solution simultaneously increased the efficiency of the teeth whitening process and reduced harmful effects and product cost**

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

G3:ID solution led P&G to launch WhiteStrips® in the US in 2000, and in Canada in 2002.

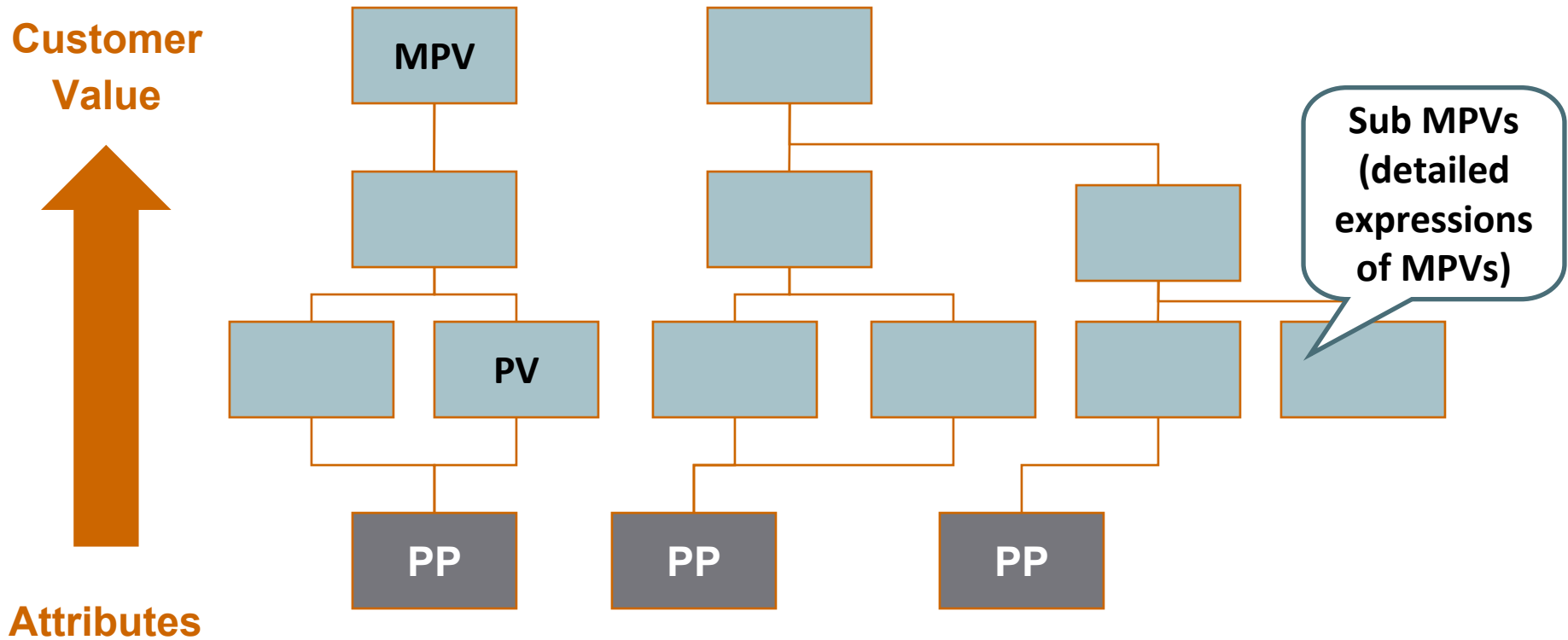
*According to Times & Trends (June 2003) “WhiteStrips whitens 5 times better than the leading paint-on whitening gel.”*

- 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 and SpinBrush with propelling Crest to be the company’s 12th billion-dollar brand/business.



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## 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.

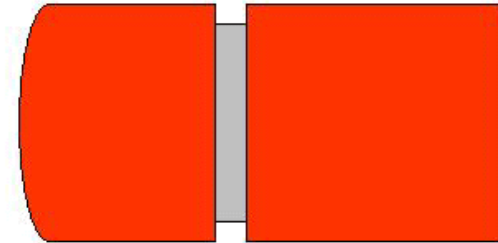
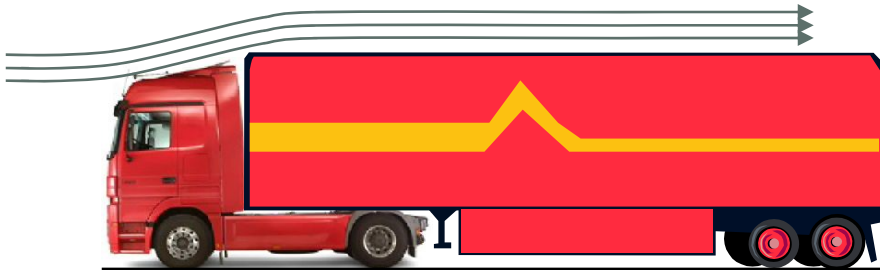
## MPV Example 2: MPV Translation into PPV for Heavy Truck



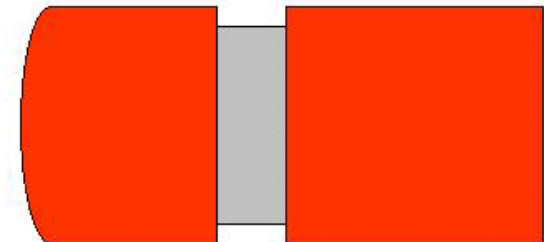
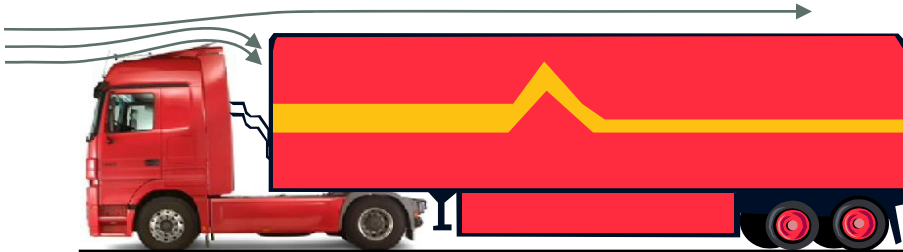
MPV	Sub 1 MPV	Sub 2 MPV	Physical Parameter
<b>Fuel Economy</b>	<ul style="list-style-type: none"> <li>Aerodynamic drag</li> </ul>	<ul style="list-style-type: none"> <li>Form drag</li> <li>Resistance from friction against external surfaces</li> <li>Resistance generated by protruding parts of the car</li> <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>

- **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 (-)

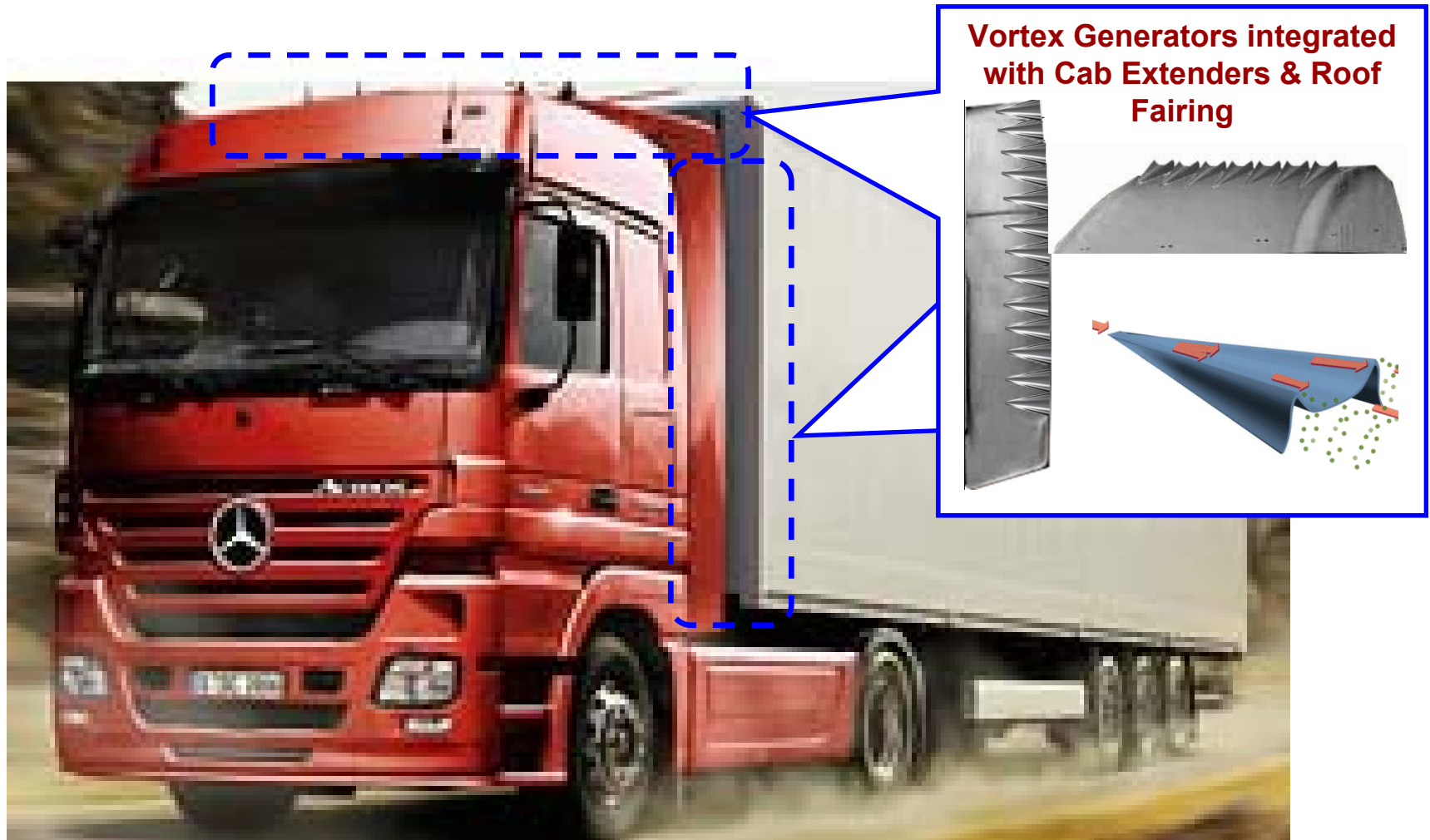


Large gap: **good** maneuverability (+), **high** aerodynamic drag (-)

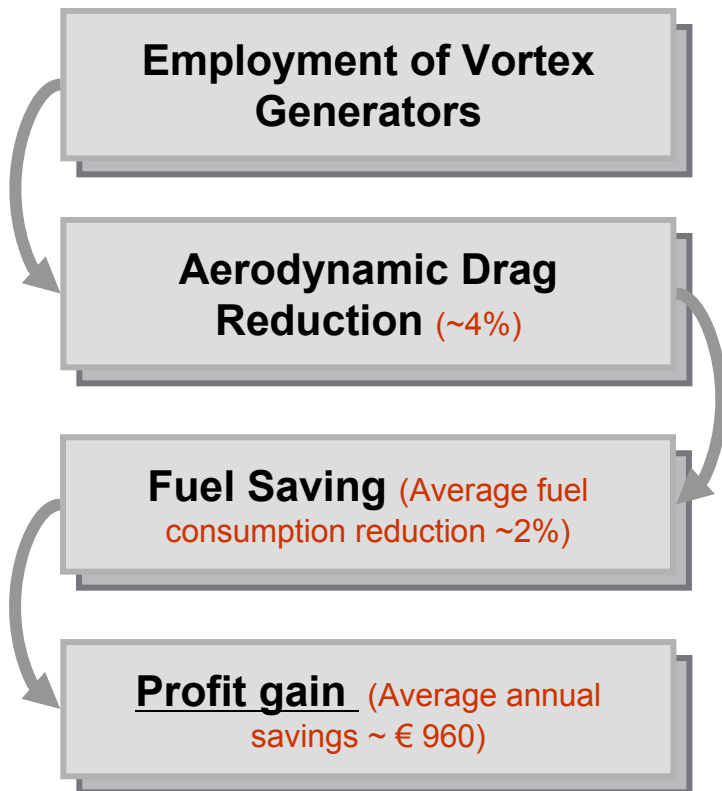




Solution was found using Trend of Increasing Dynamicity



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) -  $(150000/100) \times 32 \times 0.02 = \mathbf{960 \text{ liters}}$ ;
- ▶ Average annual savings –  $960 \times 1.0 = \mathbf{€ 960}$ .



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

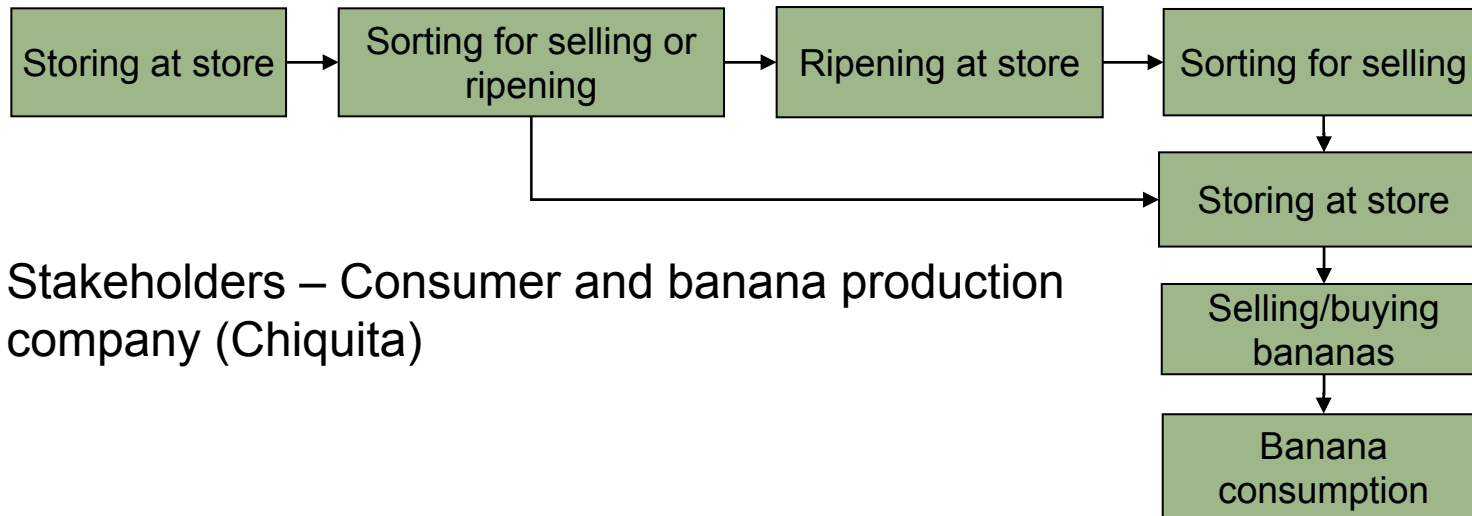
The object selected by banana production company Chiquita – Bananas

## 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

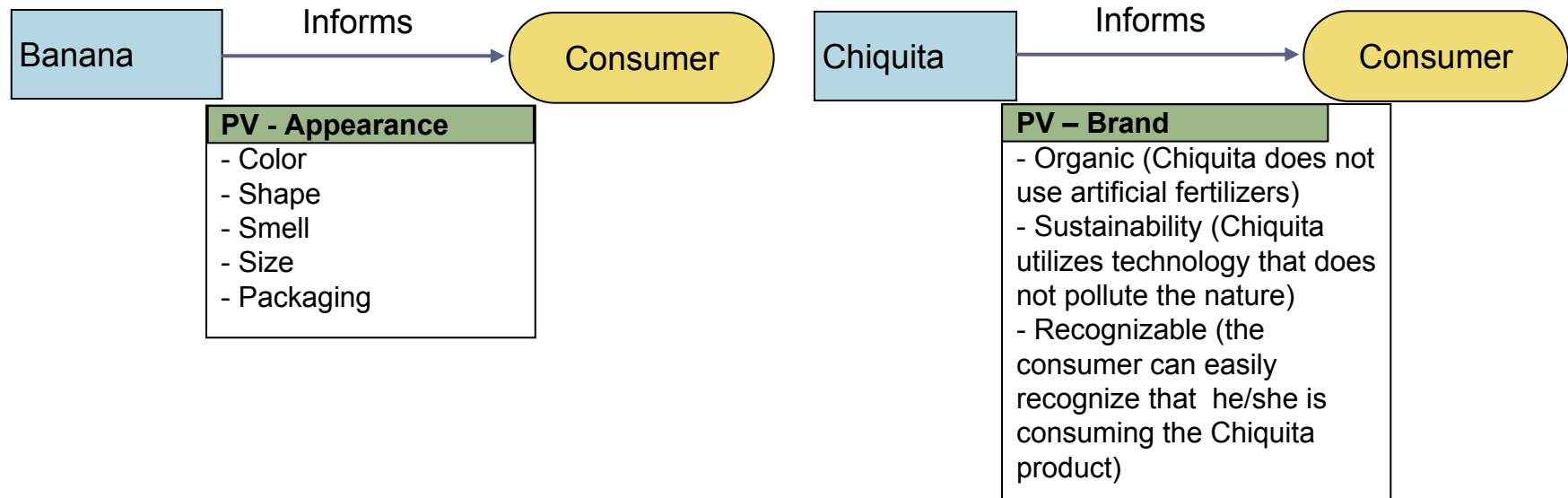
Selected stage – is selling/buying bananas



Stakeholders – Consumer and banana production company (Chiquita)

## 4. Build Functional Models for each Stakeholder

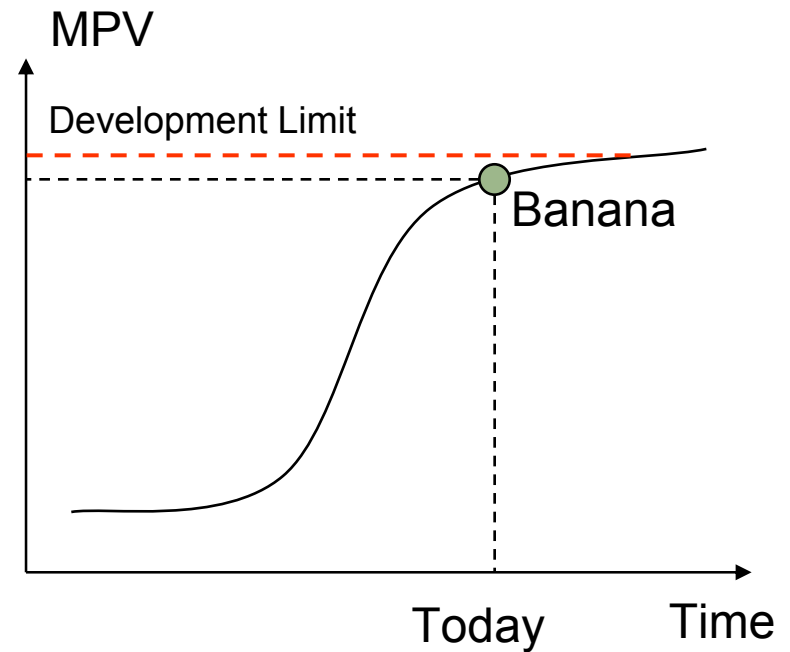
The fragments of Functional Model show two analyzed functions. Level of performance of these functions is characterized by corresponding Parameters of Value:



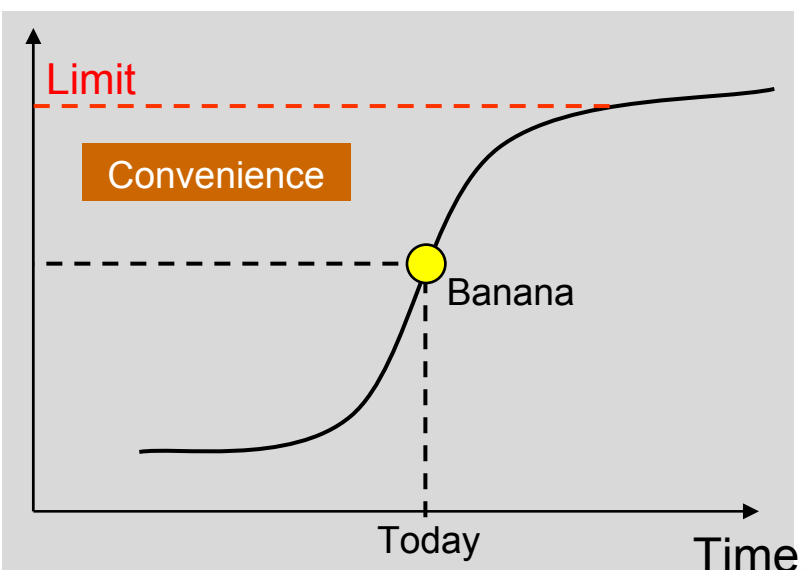
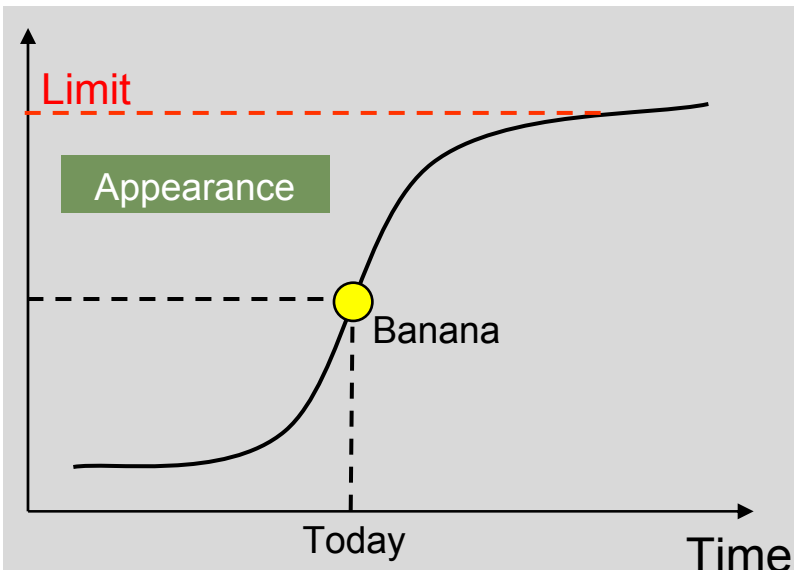
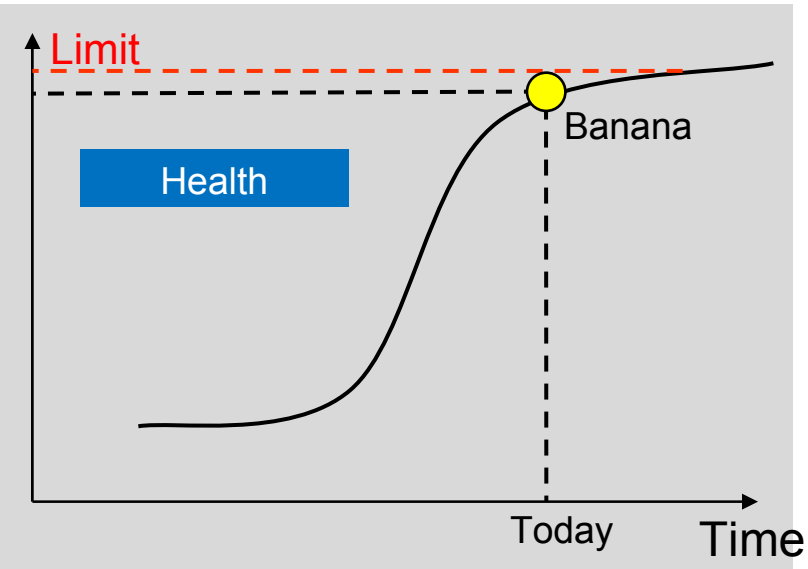
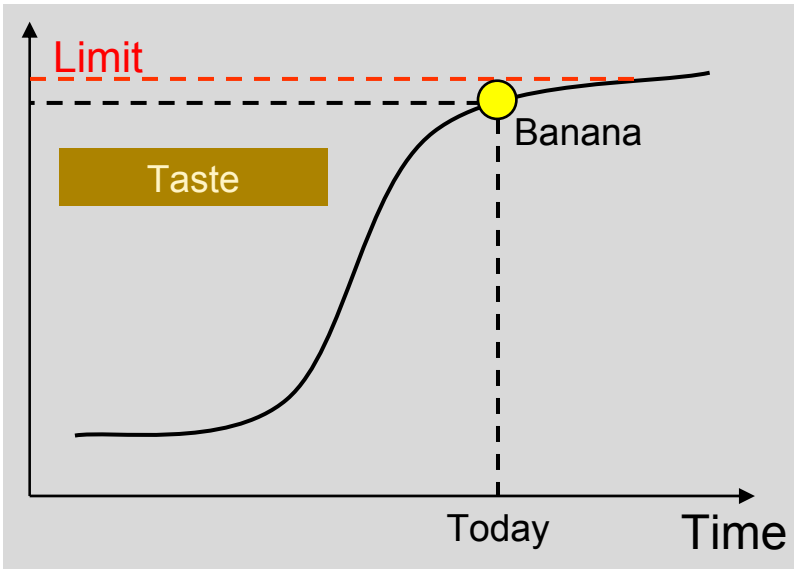


## 5. Perform Pragmatic TESE Analysis (including S-Curves) for all important PVs of the selected object

- 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



# S-Curve Analysis of Banana Products



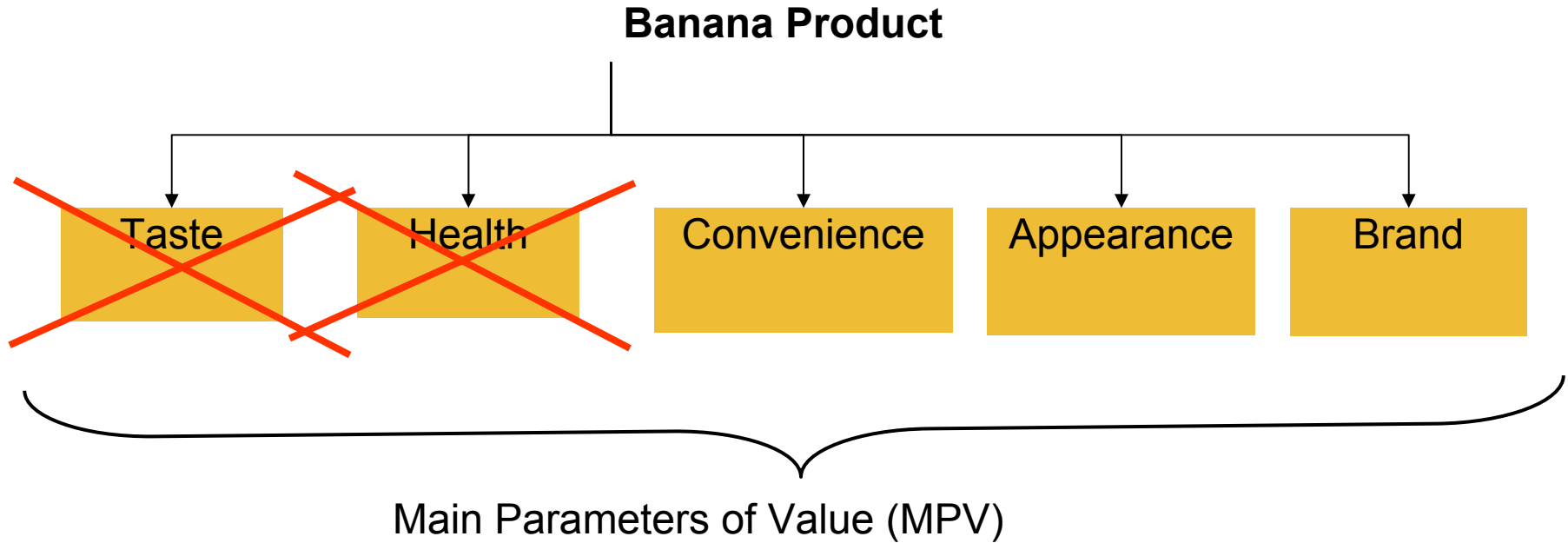


### 6. Compile a list of PVs resulted from FA and TESE Analysis

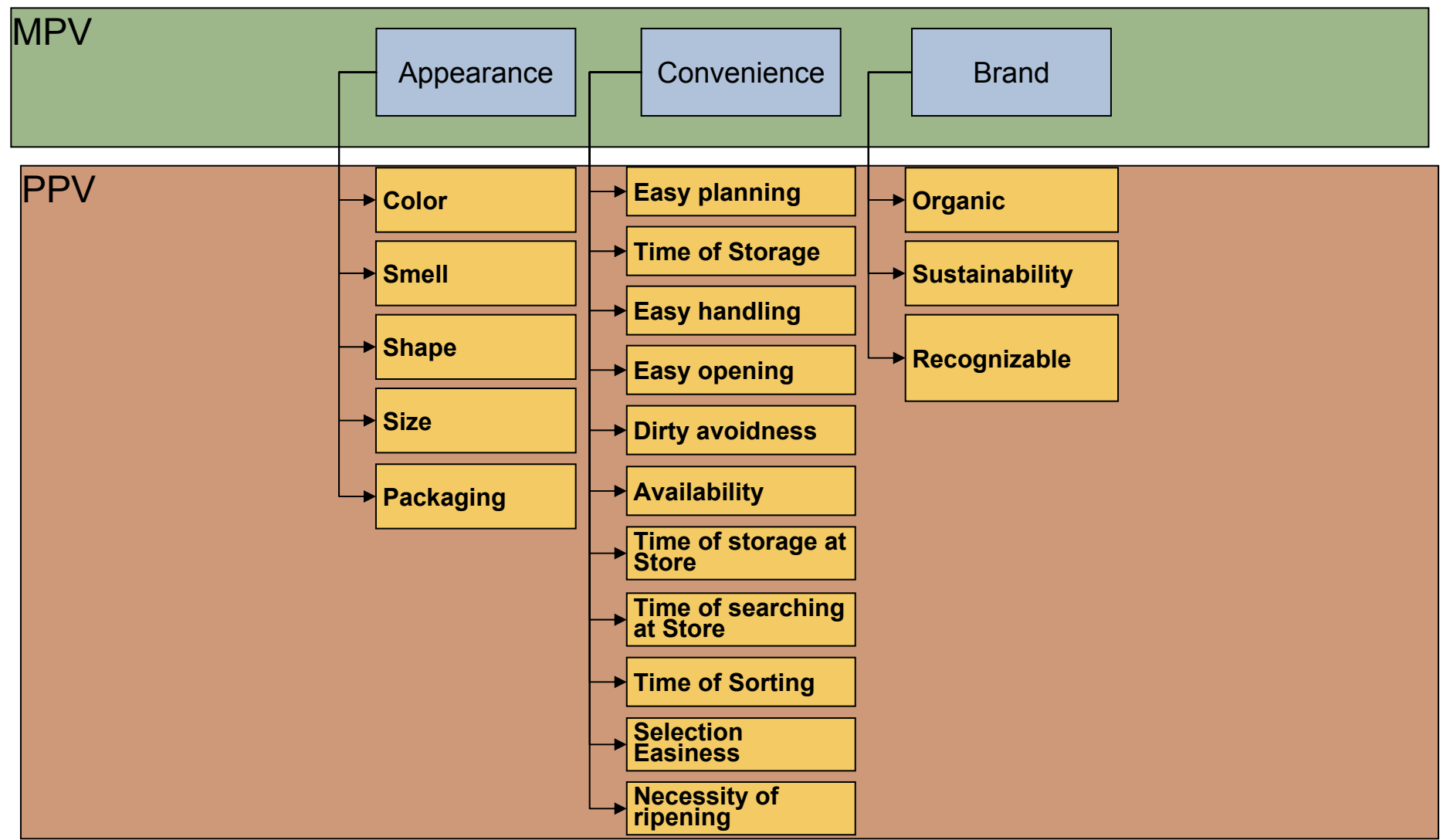
- In accordance to market investigations of consumer preferences and its own interests Chiquita's desire (Voice of the Customer) Chiquita selected the following parameters as MPVs:
  - Brand
  - Taste
  - Health
  - Appearance
  - Convenience
- Two of these parameters, Taste and Health, completely satisfy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



## 7. Select MPV candidates



### 8. For each selected MPV identify corresponding underlying PPVs

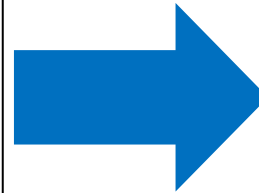




- 11. Develop a new product that addresses the initial business challenge
- 12. Develop a business case for the new product

**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



- **A new methodological tool/technique was developed that directly connect 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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