

# Innovation Discipline

**Michael Treacy**  
**The Front End of Innovation**  
**May 23-24, 2006**



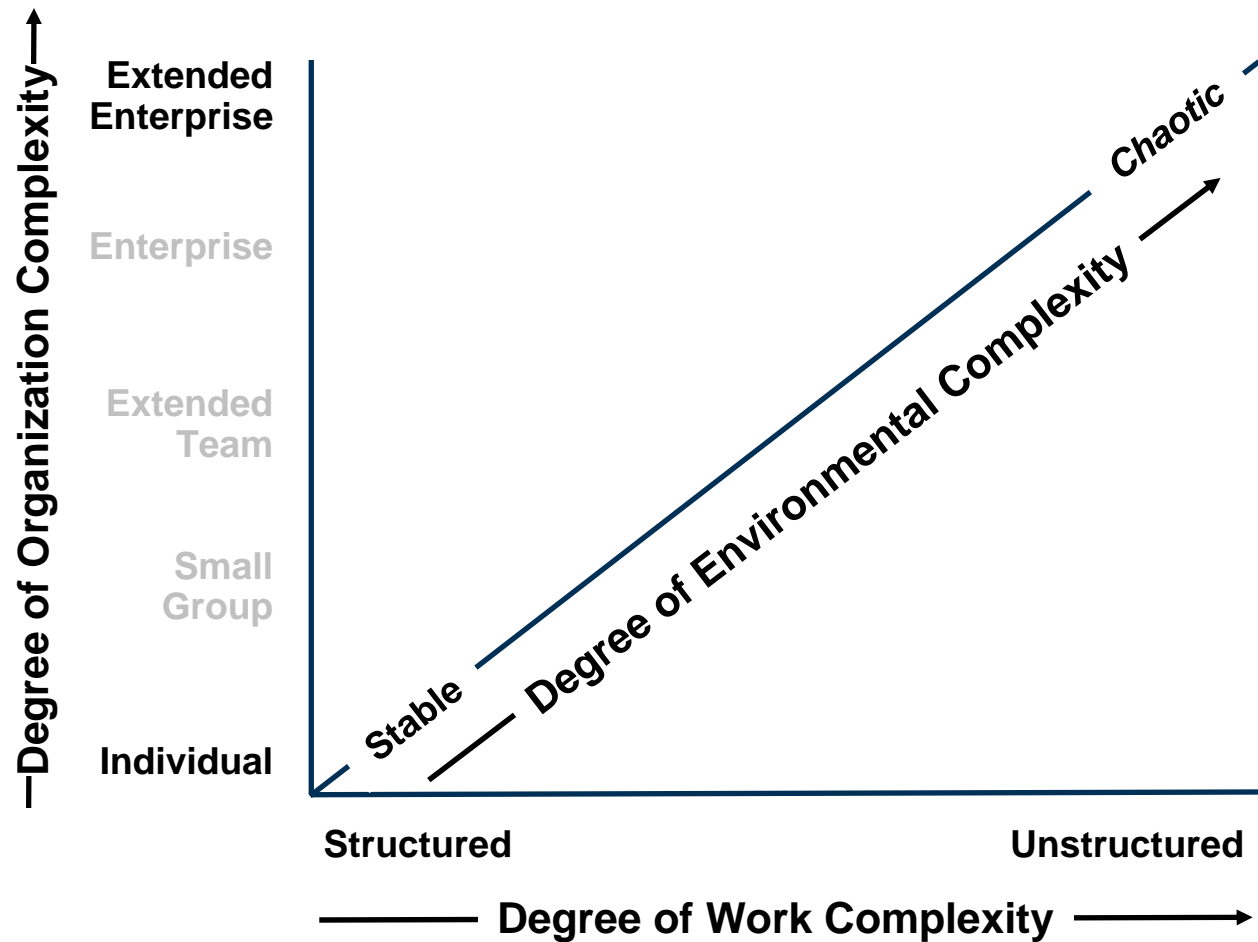
## Performance Discipline: A new understanding of what drives business performance

A company possesses a performance discipline when the risks of performance against a particular objective have been largely eliminated and only hard work remains

- Dupont – safety
- Toyota – quality
- FedEx – reliability
- GE – productivity
- JCI – growth
- BMW - innovation

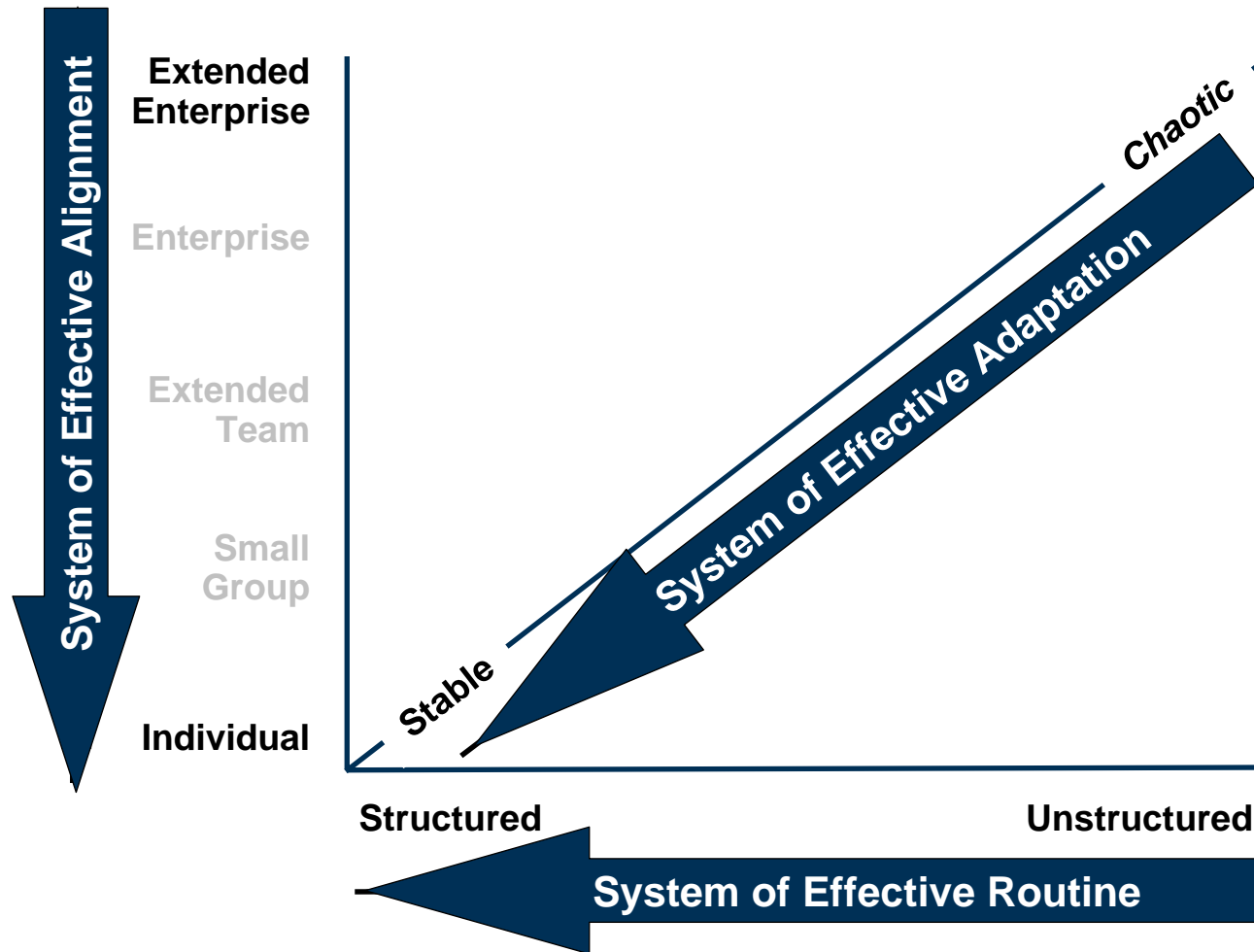


# Performance complexity grows along three dimensions



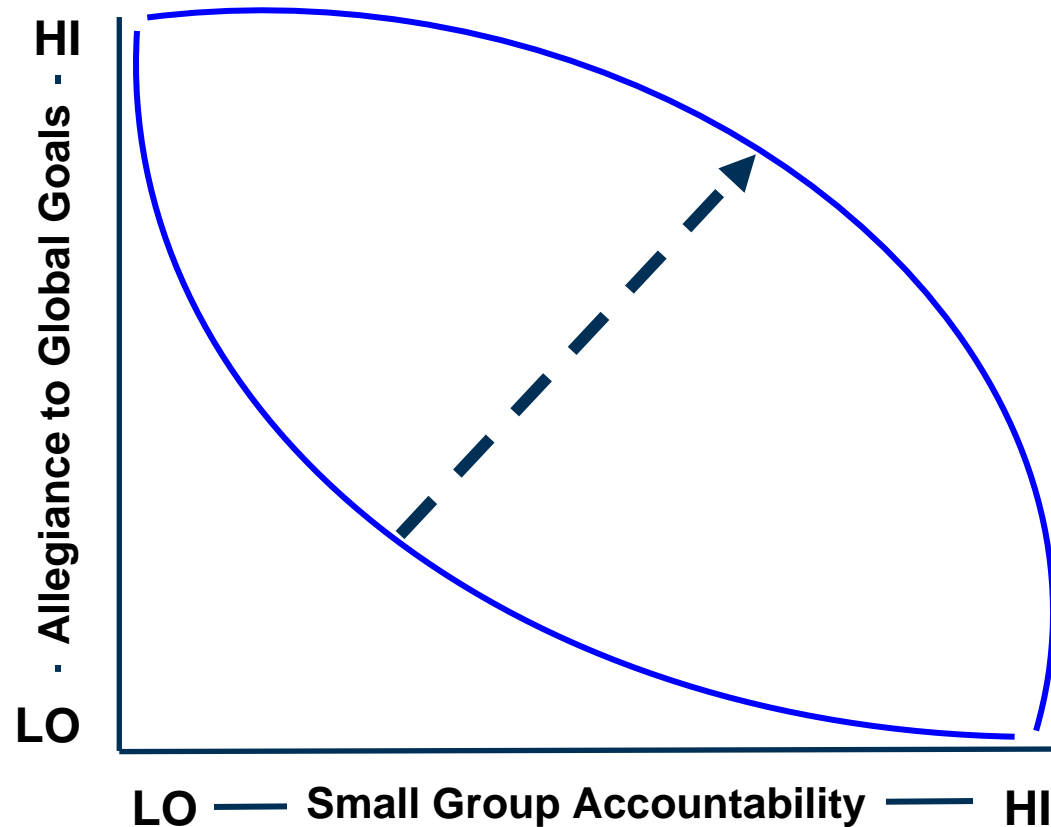


# Performance Discipline reduces complexity



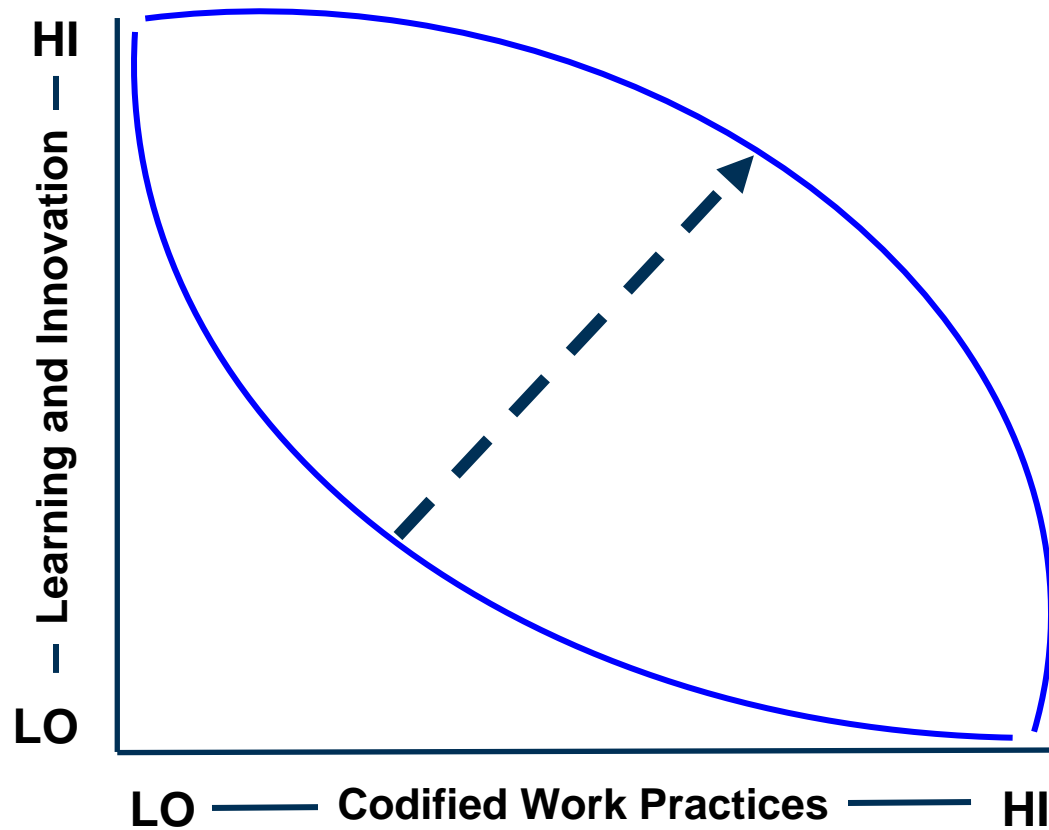


# High-performing companies resolve contradictions of Effective Alignment



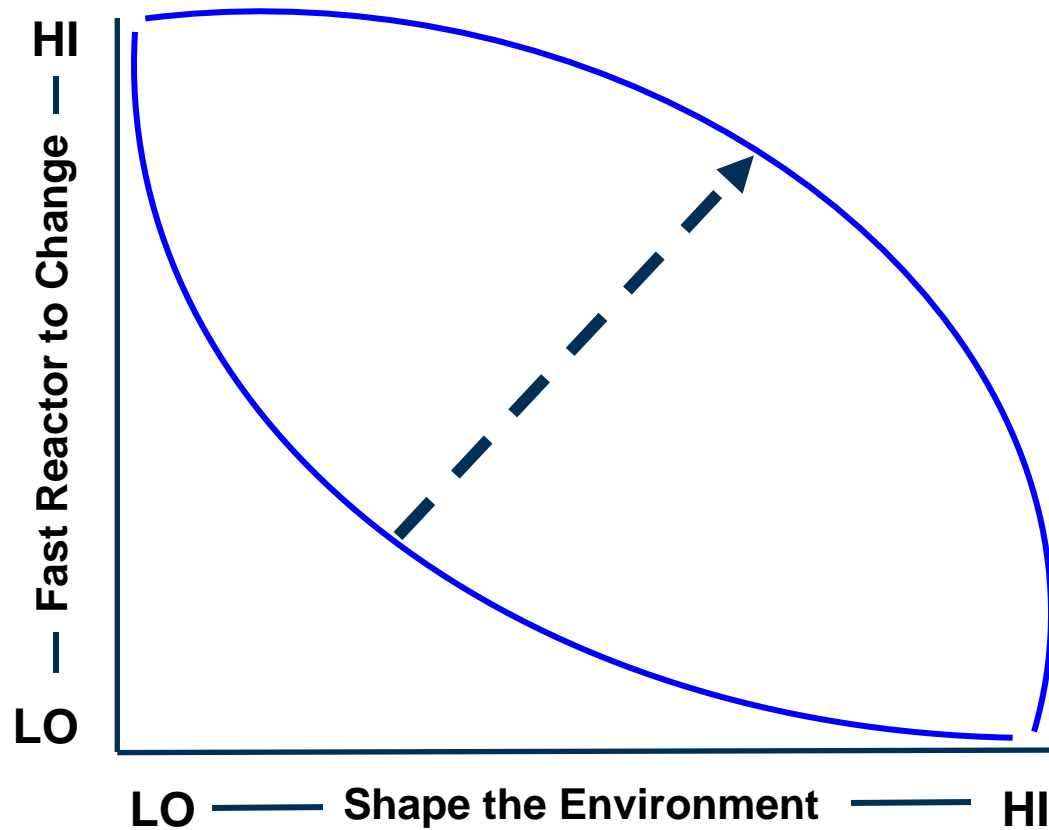


# High-performing companies resolve contradictions of Effective Routine



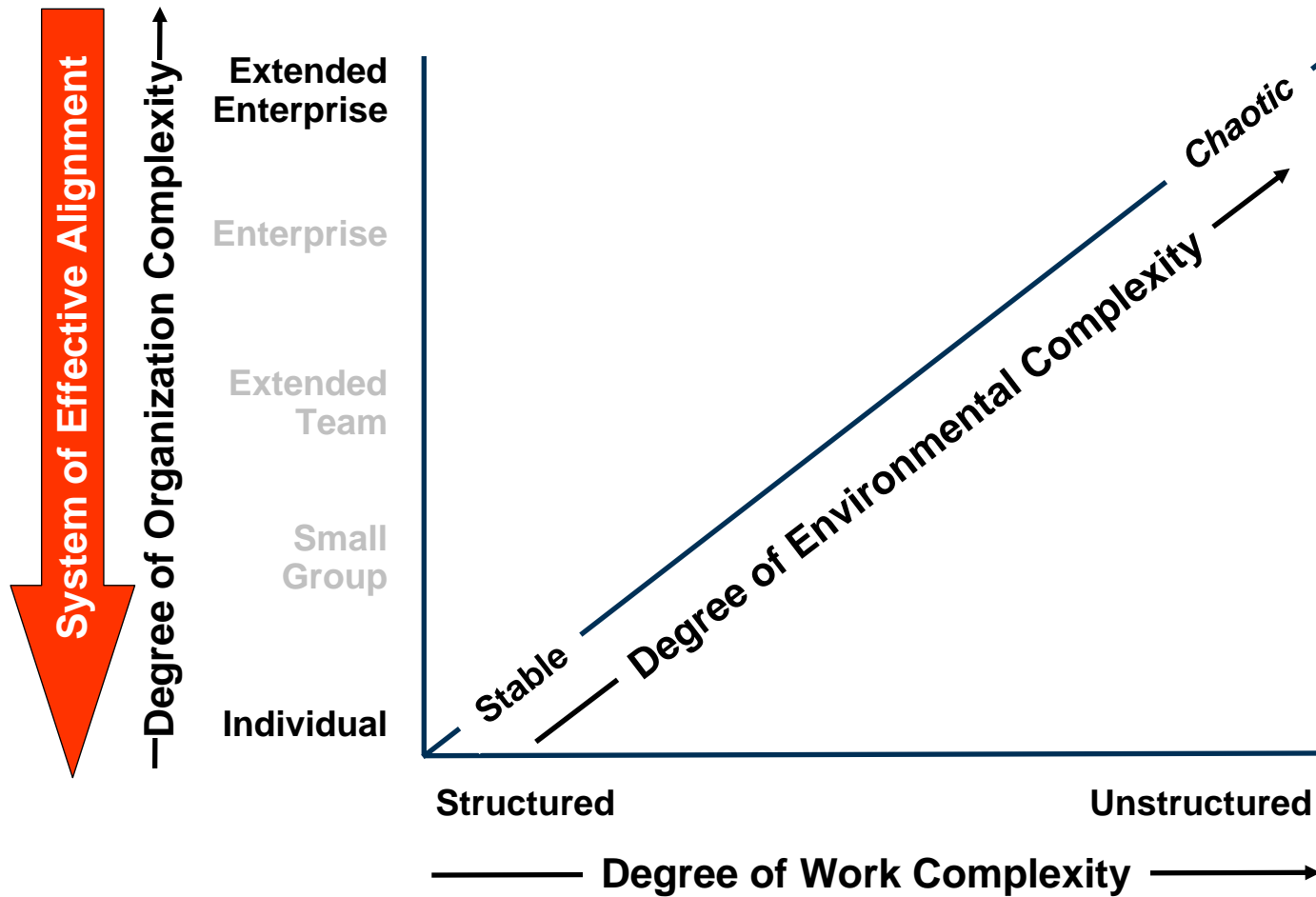


# High-performing companies resolve contradictions of Effective Adaptability





# Innovation Discipline





# Why does Effective Alignment matter in Product Innovation?

## **Optimizes the investment in innovation**

- Are we spending our resources on the right opportunities?
- Are we spending at the right level of commitment?

## **Ensures that innovation efforts map to the strategic needs of the business**

- Do we need product, process, or service improvement?
- What mix of quick hits and longer term improvements do we need?

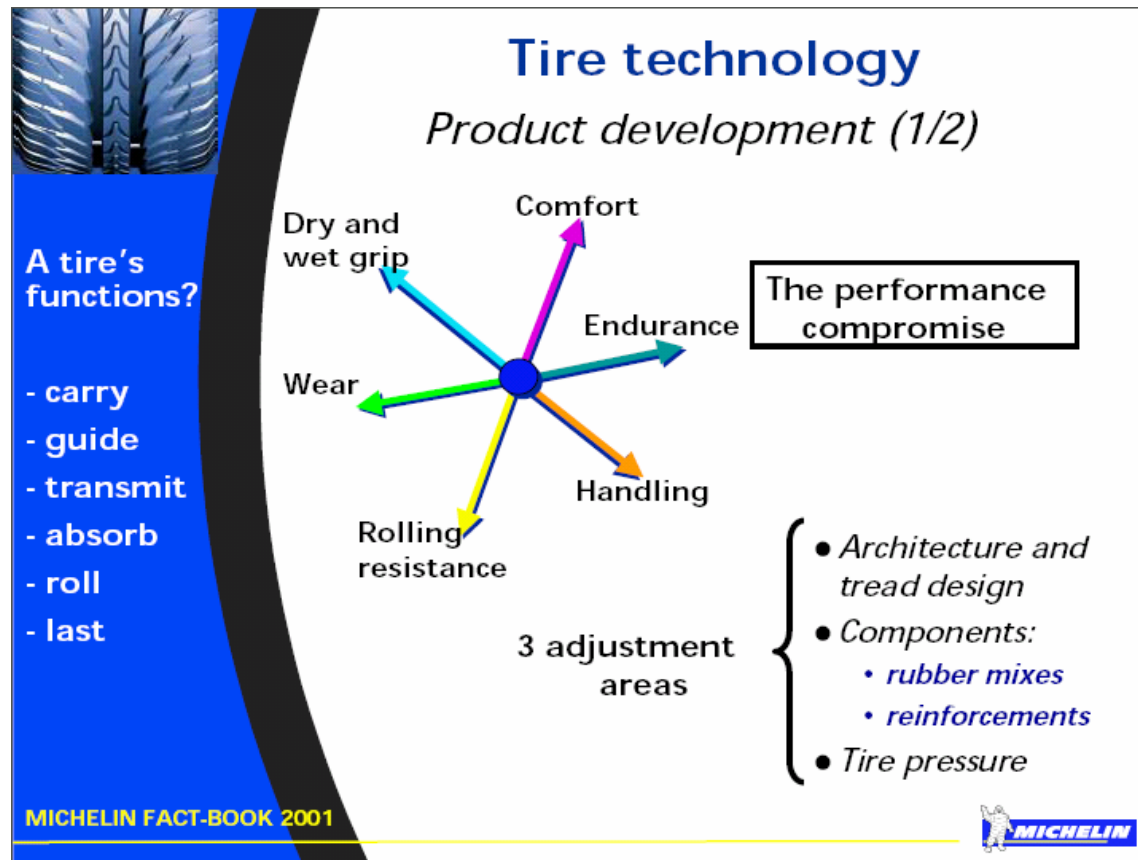
## **Aligns the organization to achieve results effectively and efficiently**

- Coordinate R&D and marketing
- Coordinate IT and customer service operations
- Coordinate process improvement and manufacturing



# Effective Alignment: What innovation is and what it is not

**Innovation = significant improvement along main parameters of customer value**





## Effective Alignment: What innovation is and what it is not

**Innovation = significant improvement  
along main parameters  
of customer value**

**Targeting**

*What are the main  
parameters of  
value that drive  
purchase  
decisions?*

**Supply Side**

*Which  
technologies can  
create significant  
improvements in a  
parameter of  
value?*

**Demand Side**

*What impact  
will those  
improvements  
have on the  
sources of new  
revenues?*



## Effective Alignment: Defining the Innovation Agenda

### **Innovation = significant improvement along main parameters of customer value**

- An **Innovation Agenda** requires an extensive characterization and prioritization of each business unit's products and services to determine:
  - Their relative value to customers and shareholders
  - Their potential for innovation
  - The payoffs from those innovations
- A **Portfolio Landscape** maps existing products and services on relative value and is the basis for an initial filtering of innovation opportunities



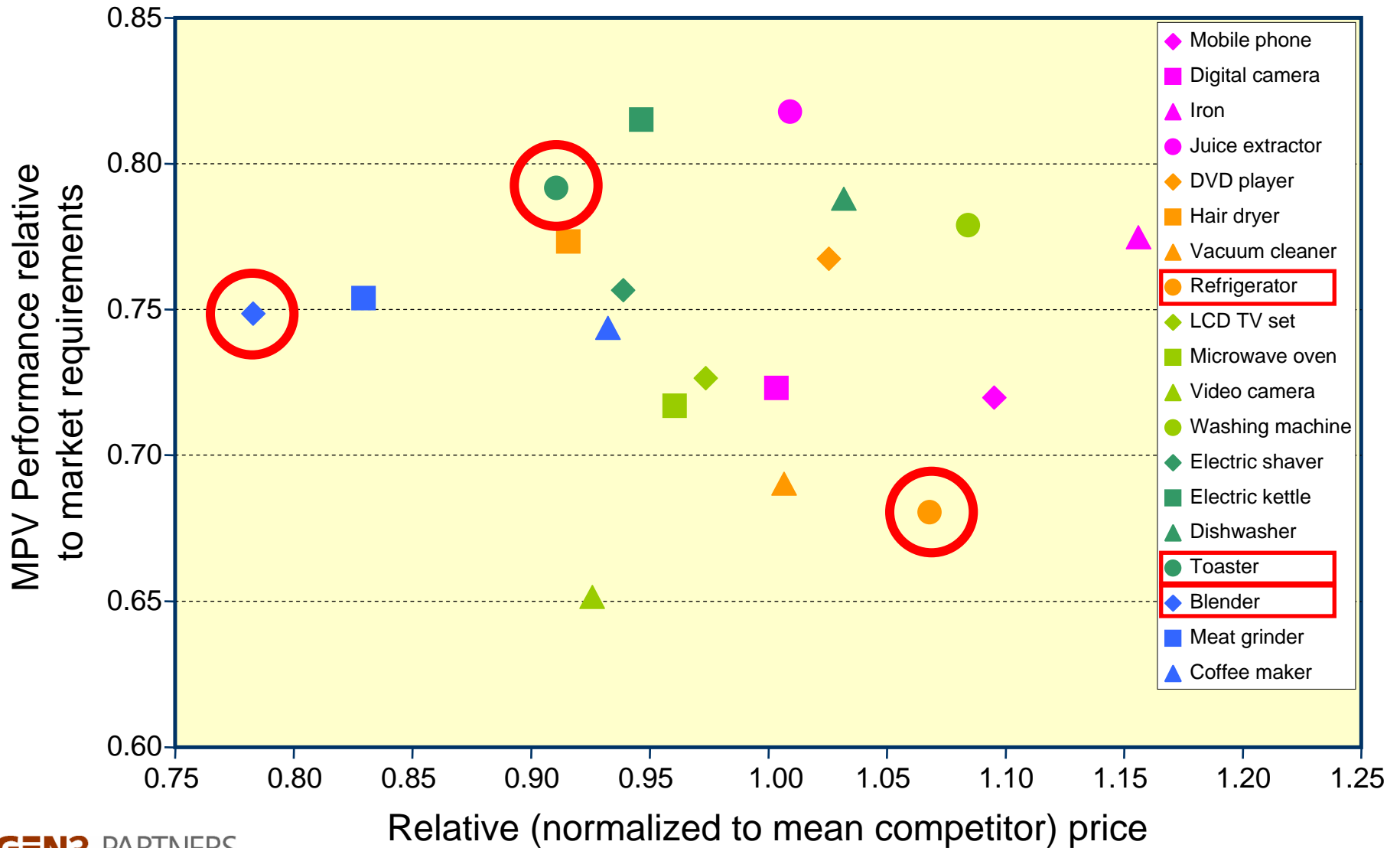
## An example product line inventory

- Mobile phone
- Digital camera
- Iron
- Juice extractor
- DVD player
- Hair drier
- Vacuum cleaner
- Refrigerator
- LCD TV set

- Microwave oven
- Video camera
- Washing machine
- Electric shaver
- Electric kettle
- Dishwasher
- Toaster
- Blender
- Meat grinder
- Coffee machine

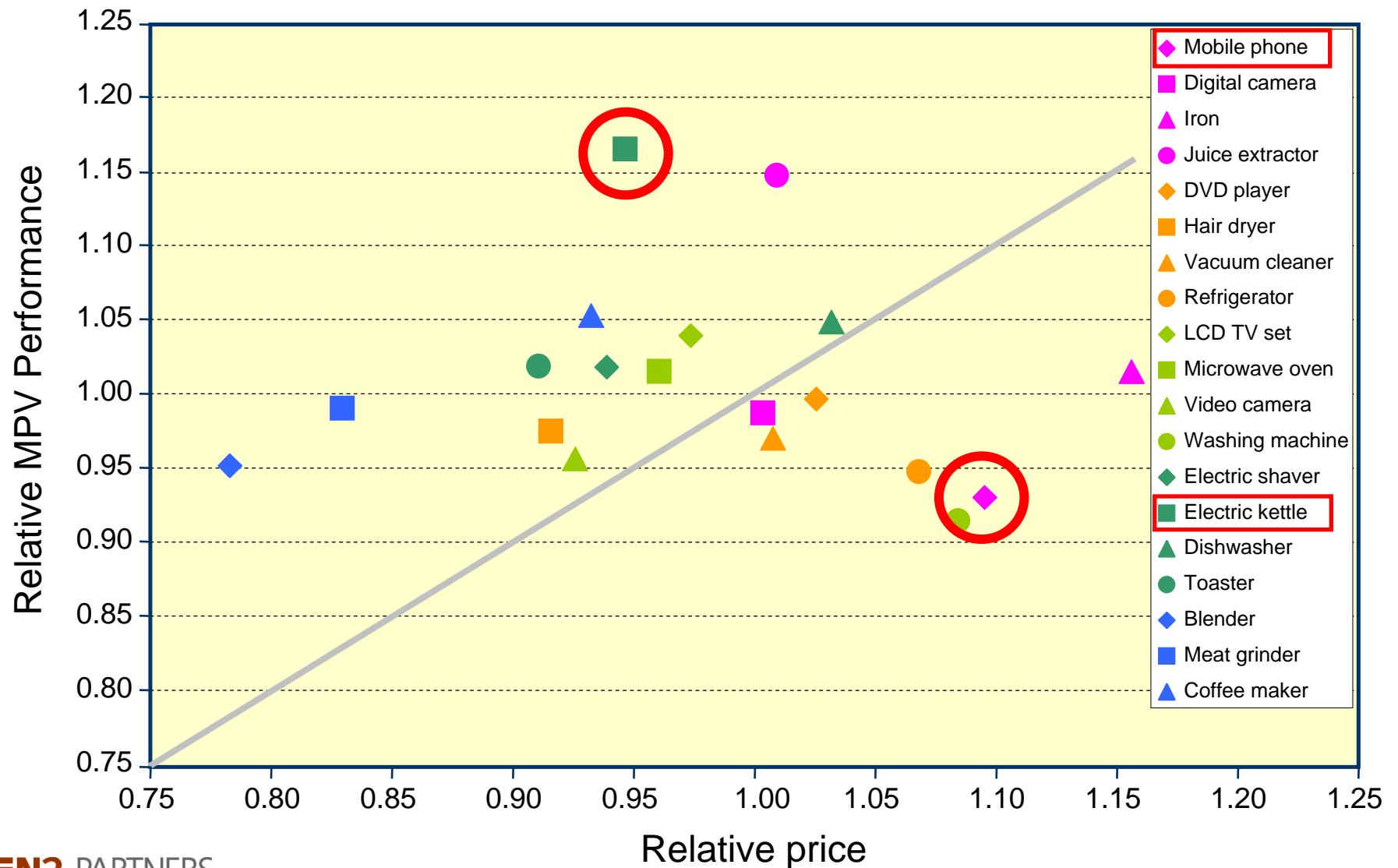


# Major Products Landscape



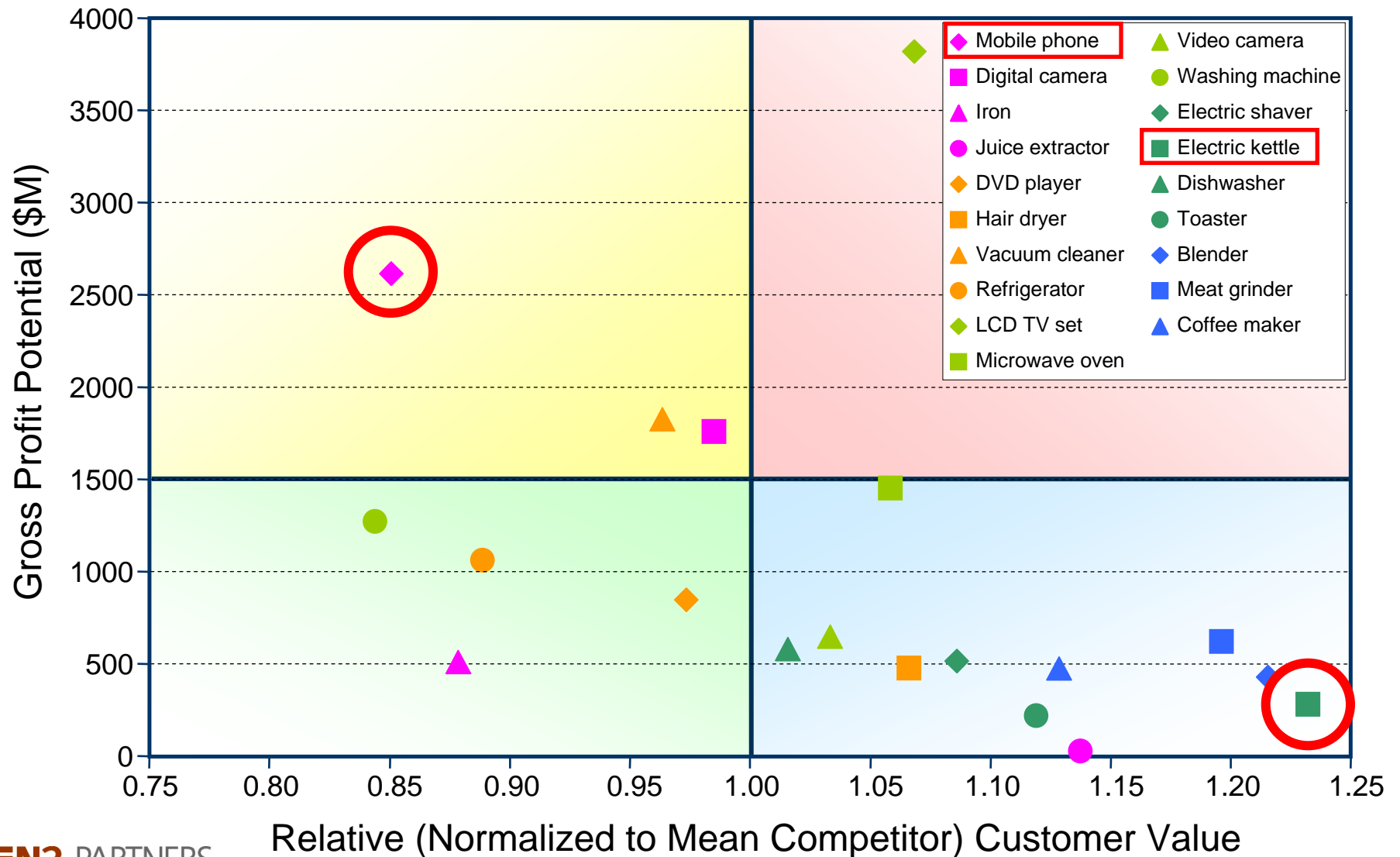


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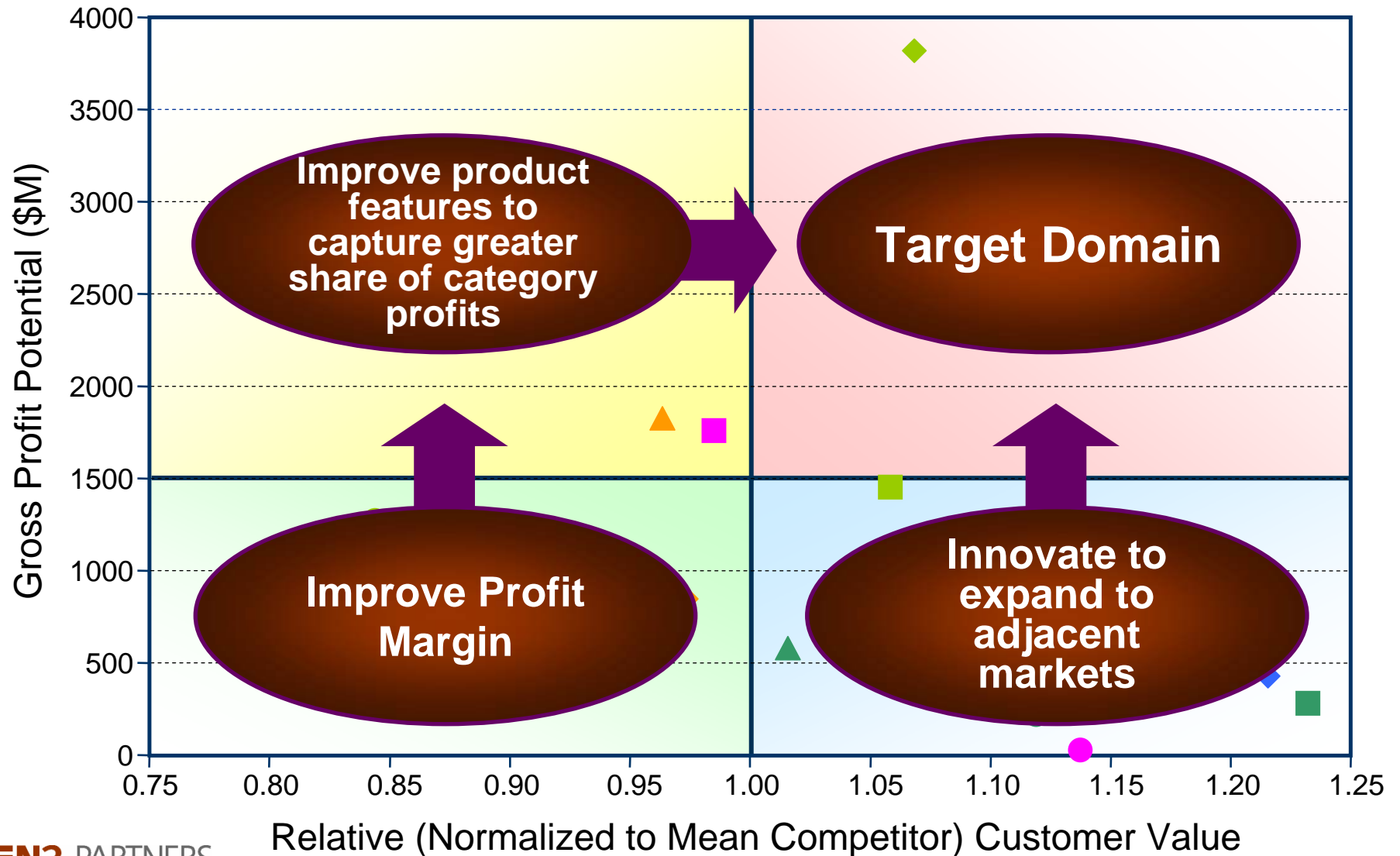


# Major Products Landscape





# Different Innovation Strategies for Different Products

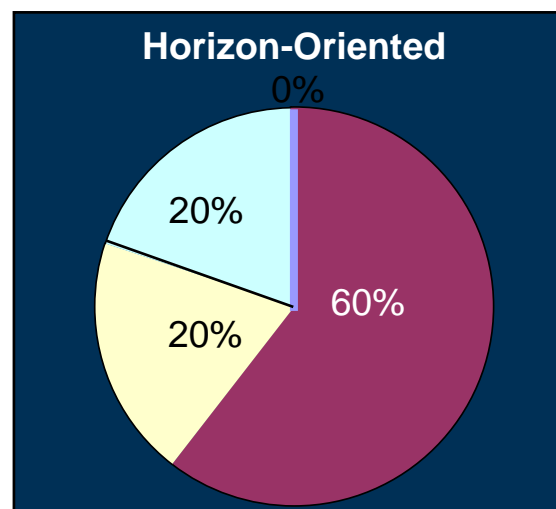
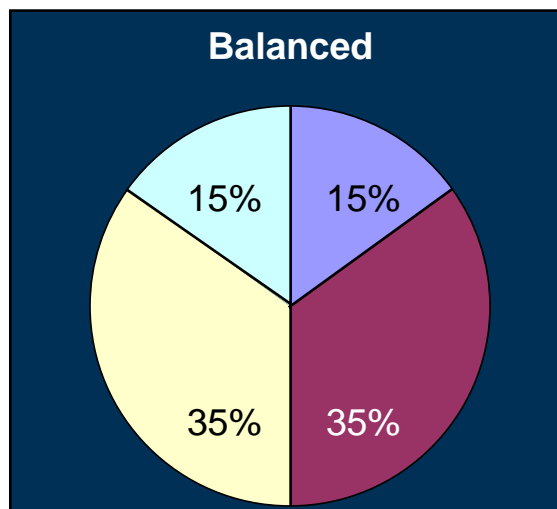
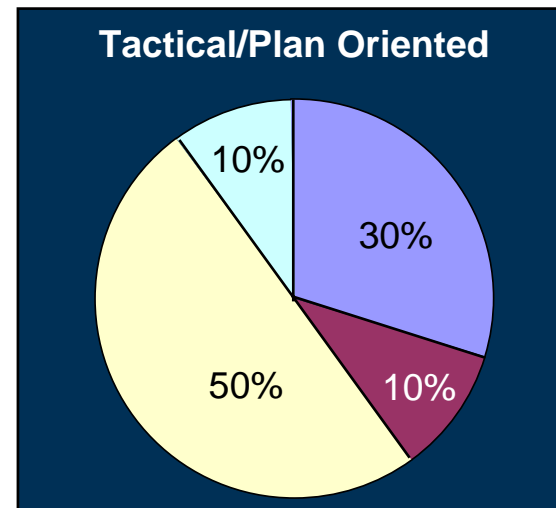
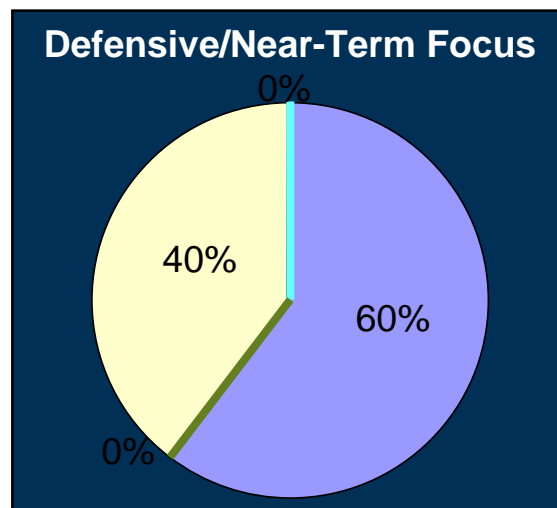




# Four Strategies for Prioritizing Innovation

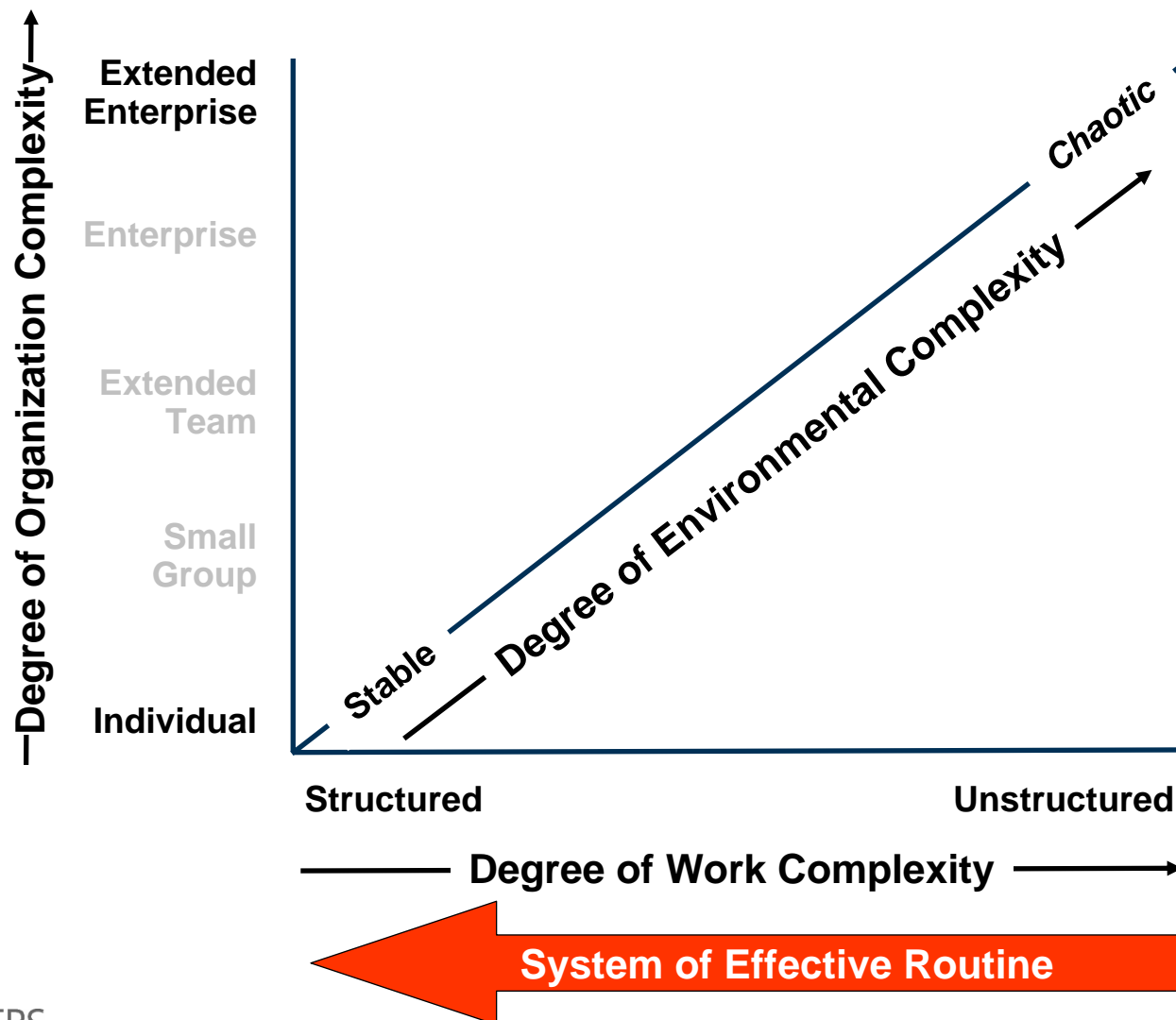
## Priorities

- Competitive Urgency
- Market Attractiveness
- Business Impact
- Technical Synergy



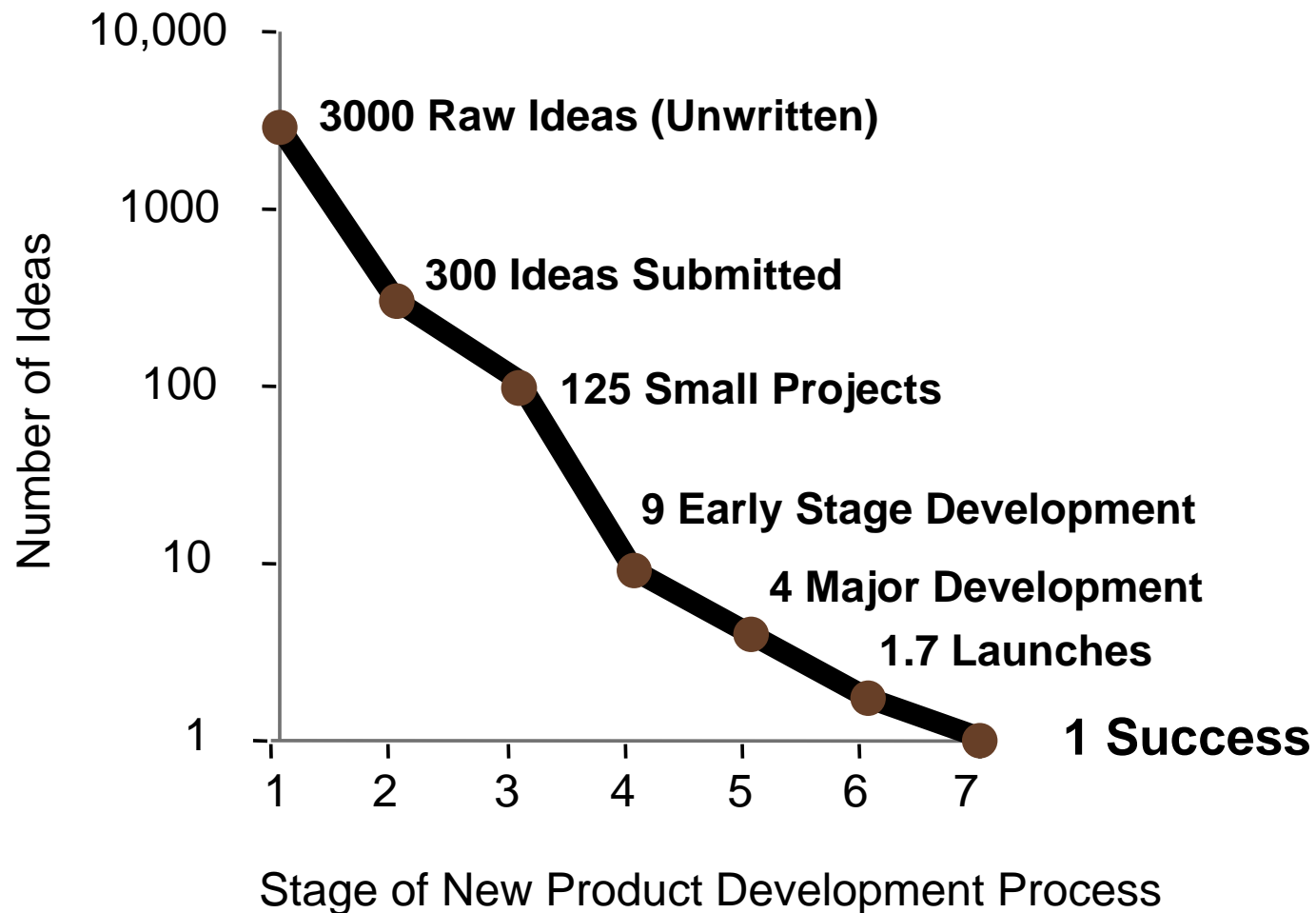


# Innovation Discipline





## Effective Routine: Evidence that we must do better



Source: G. Stevens and J. Burley, "3000 Raw Ideas = 1 Commercial Success!"  
*Research•Technology Management*, 40(3): 16-27, May-June, 1997.



## Why the Front-End of Innovation Often Fails

- **Unfocused objectives** – Innovating in areas other than MPVs
- **Solving the wrong problem** – the stated problem often isn't the key problem
- **Missing a moving target** – inability to predict the evolution of the system
- **Compromise** – the sire of mediocrity
- **Limited search for solutions** – looking in all the familiar places
- **Human limitations** – psychological inertia



# What is required to establish Effective Routine in Product Innovation?

## **Technique: Powerful, shared methodology for innovation**

- Problem identification
- Problem solving
- Concept substantiation

## **Talent: Skill development leading to mastery of innovation**

- Training, apprenticeship, mentoring
- Center of Excellence staffed by masters

## **Continuous improvement**



## Talent: A System for Developing Innovation Mastery

- Is project management an innate skill, a developed expertise, or a profession?
  - The Project Management Institute has grown from 12k to 171k members in 10 years



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- Technical expertise  $\neq$  Functional expertise  $\neq$  Innovation expertise

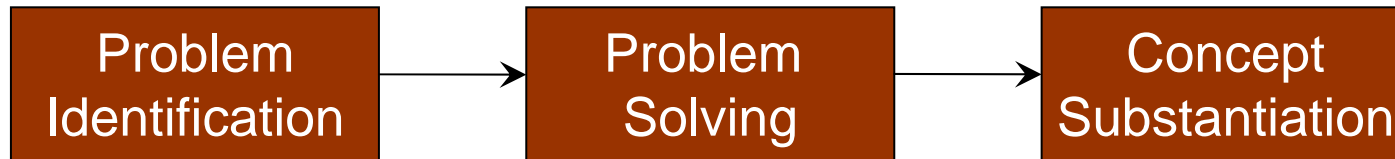


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- Why do we think that innovation is an innate skill? Why do we think that anyone can do it?
- Technical expertise  $\neq$  Functional expertise  $\neq$  Innovation expertise
- What's required:
  - Innovation methodology training, apprenticeship and mentoring
  - Innovation Masters as role models and expert advisors



# Technique: The Purpose and Impact of Methodology



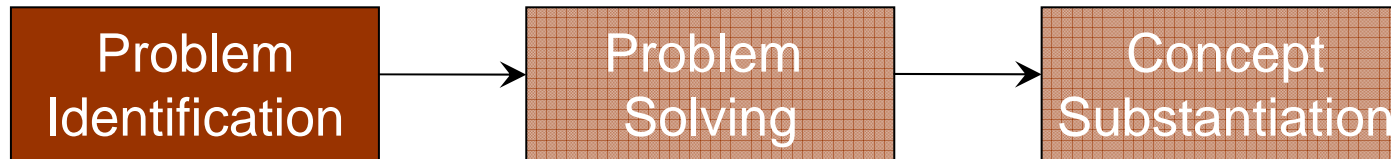
- Identify “system dependencies” which increases alternative innovation strategies
- Identify key challenges (not just symptoms!) which should be addressed
- Connect key challenges to strategic priorities

- Avoid the limitations of psychological inertia
- Resolve opposing requirements without compromise
- Expand the search for existing innovative solutions

- Demonstrate that conceptual designs are practical
- Confirm that innovative solutions can be implemented on required terms and budgetary constraints



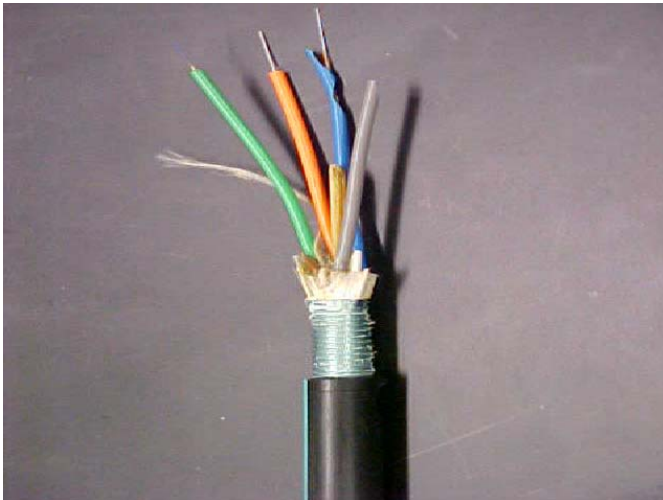
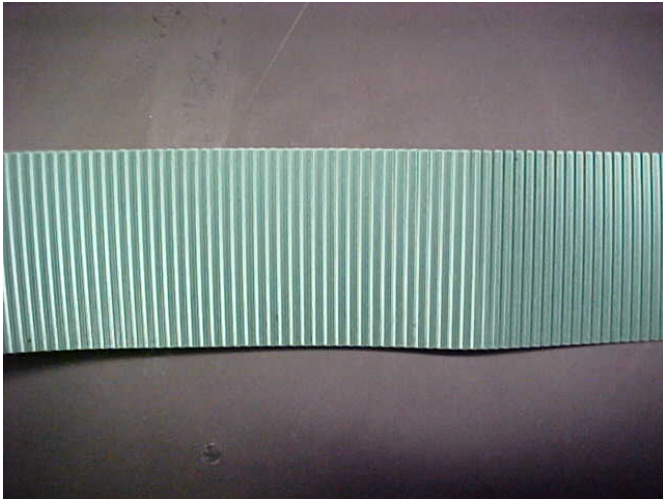
## Technique: Tools for improving Innovation



- S-curve evaluation of innovation strategies
- Functional architecture analysis
- Component analysis
- Cause-effect chain analysis

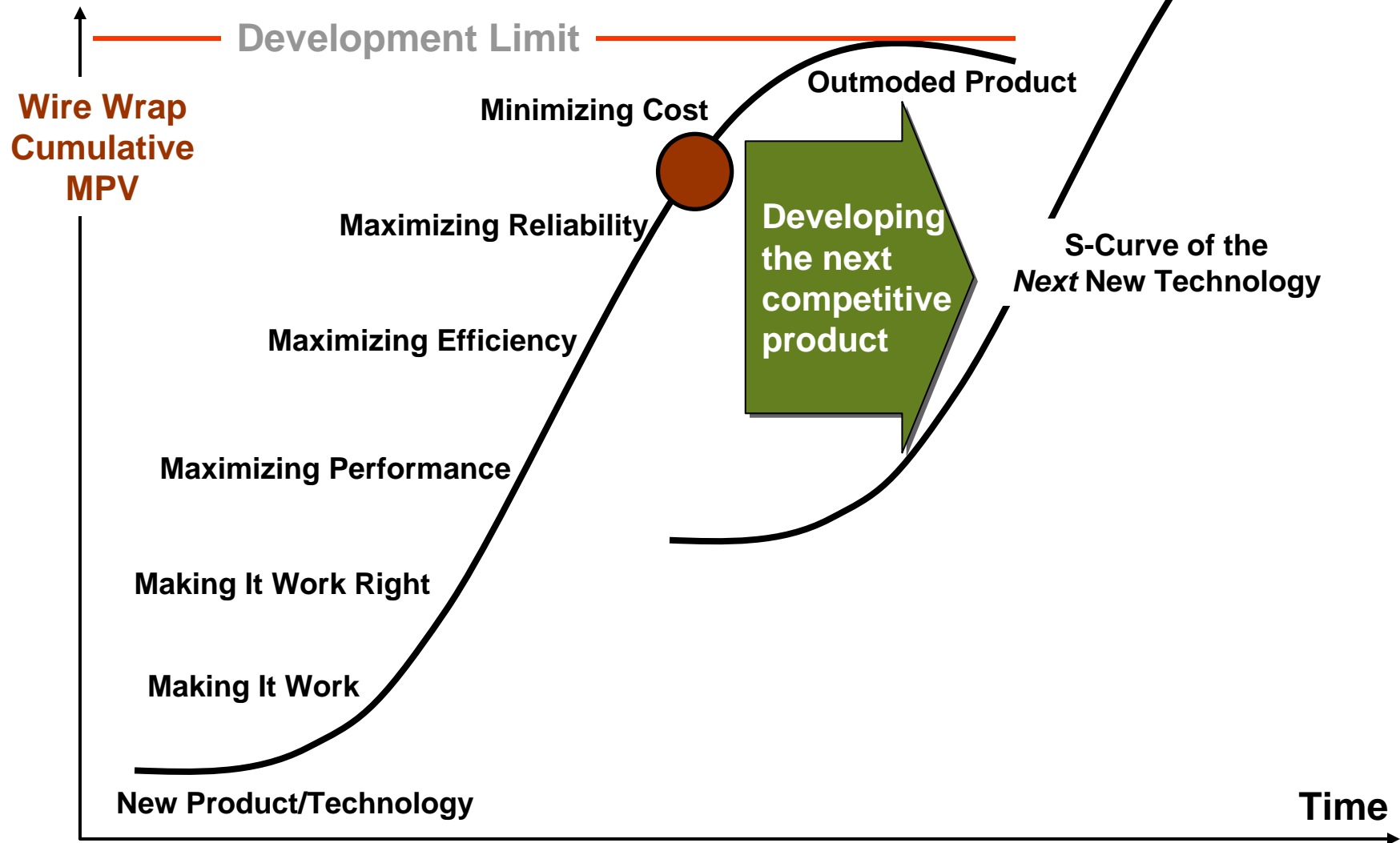


# Corrugated Steel Cable Wrap



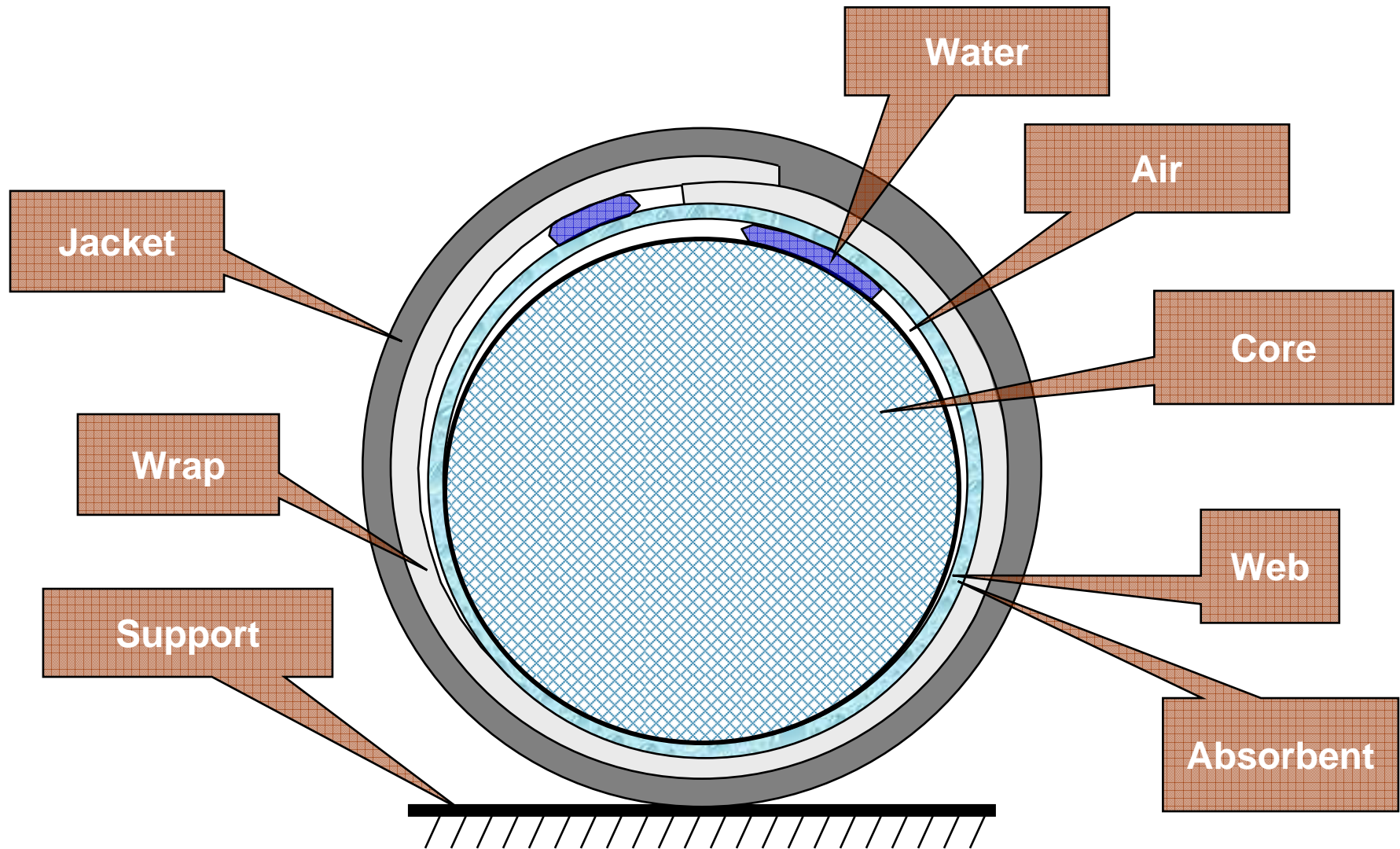


# S-Curve evaluation of innovation strategies



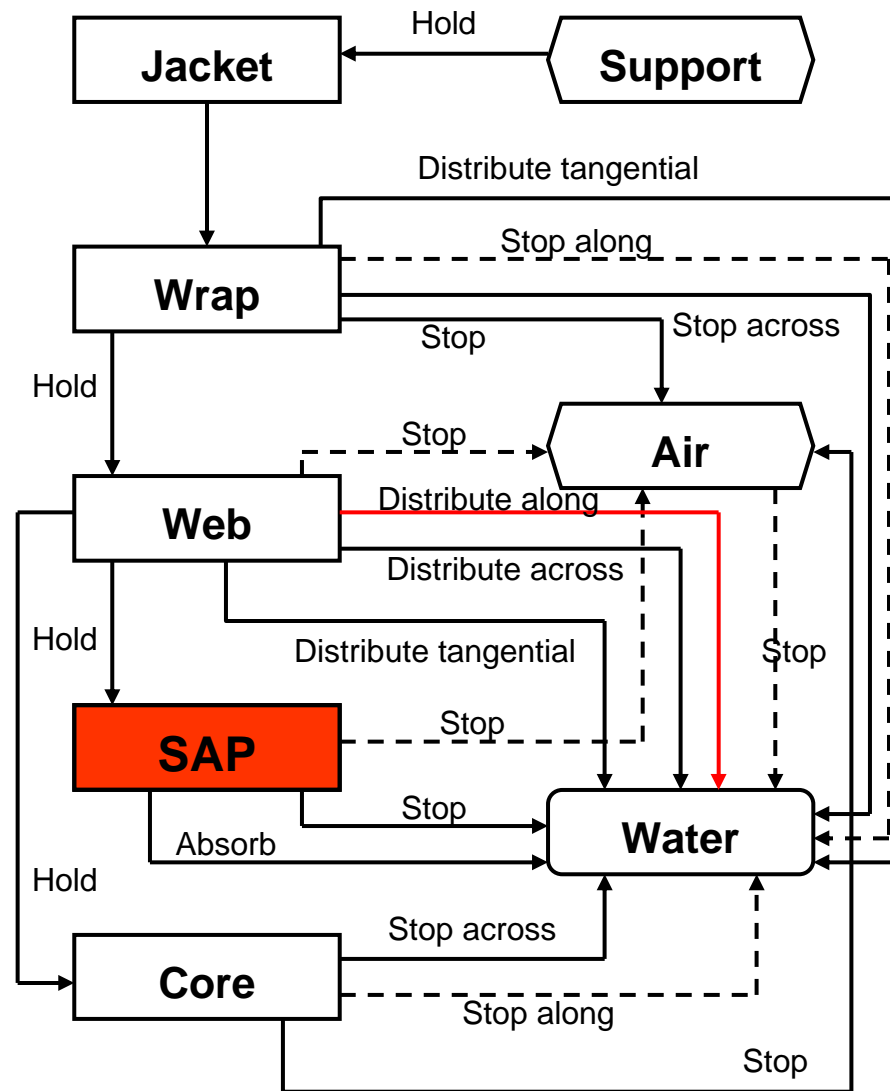


# Corrugated Steel Cable Wrap Components



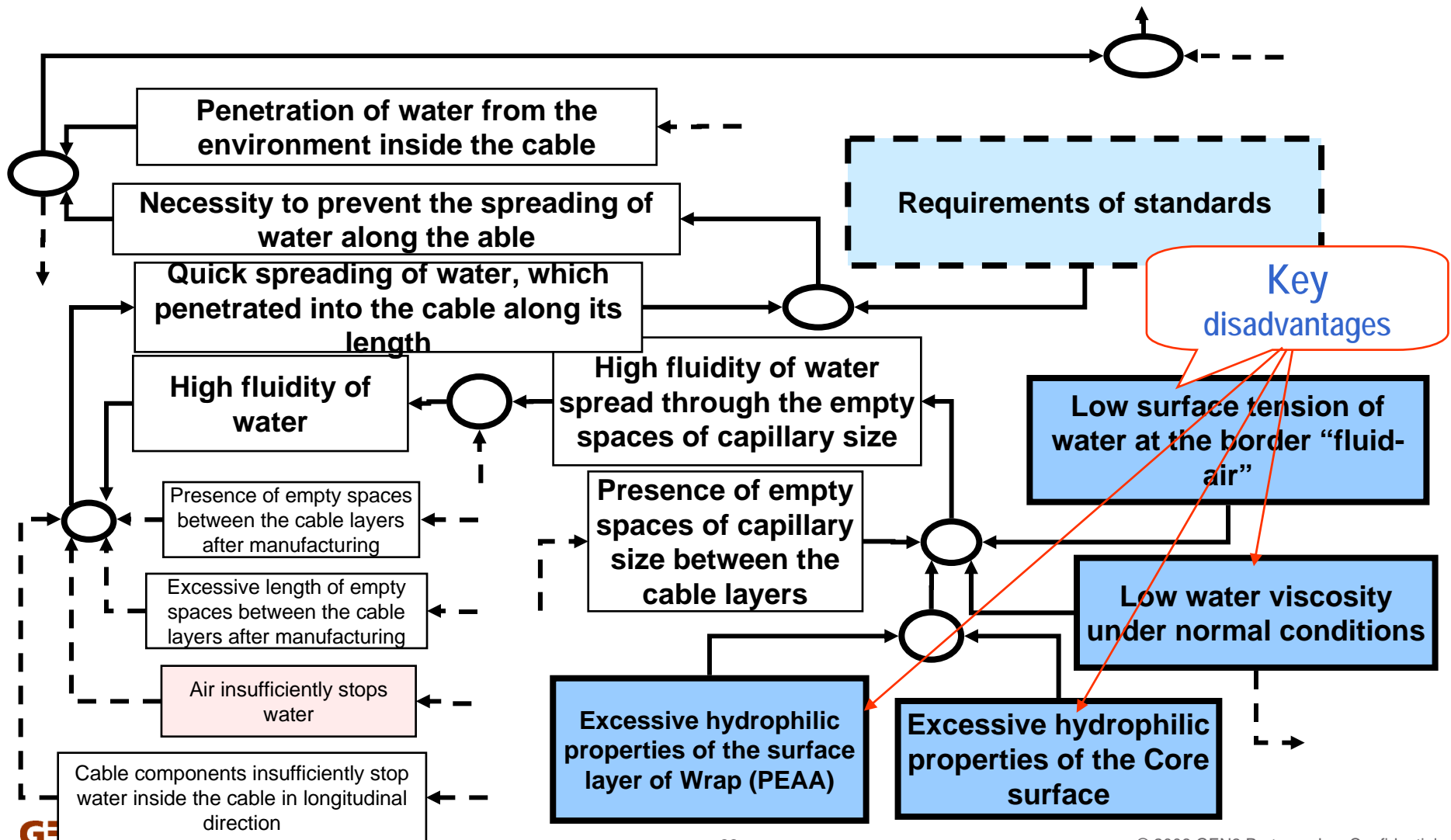


# Function Model — Current System



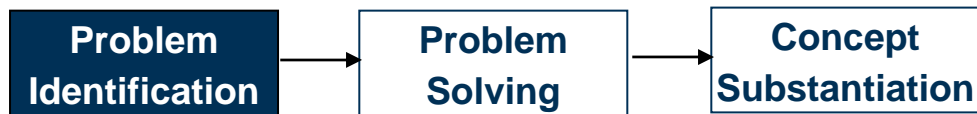


# Cause and Effect Chain Analysis

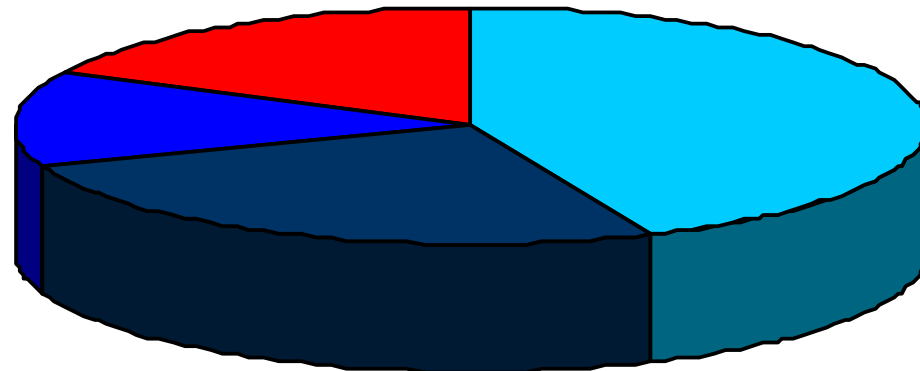




# Function Analysis

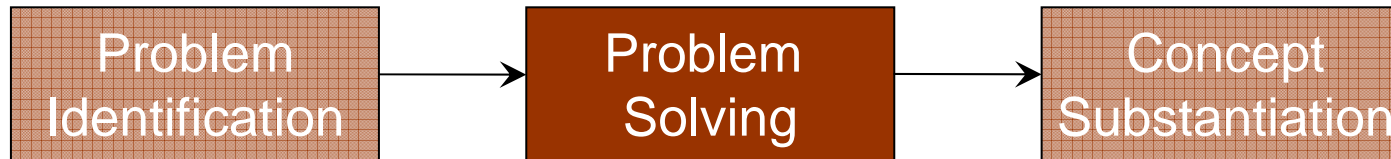


- Useful functions Adequate Performance
- Useful functions Insufficient Performance
- Useful functions Excessive Performance
- Harmful Functions





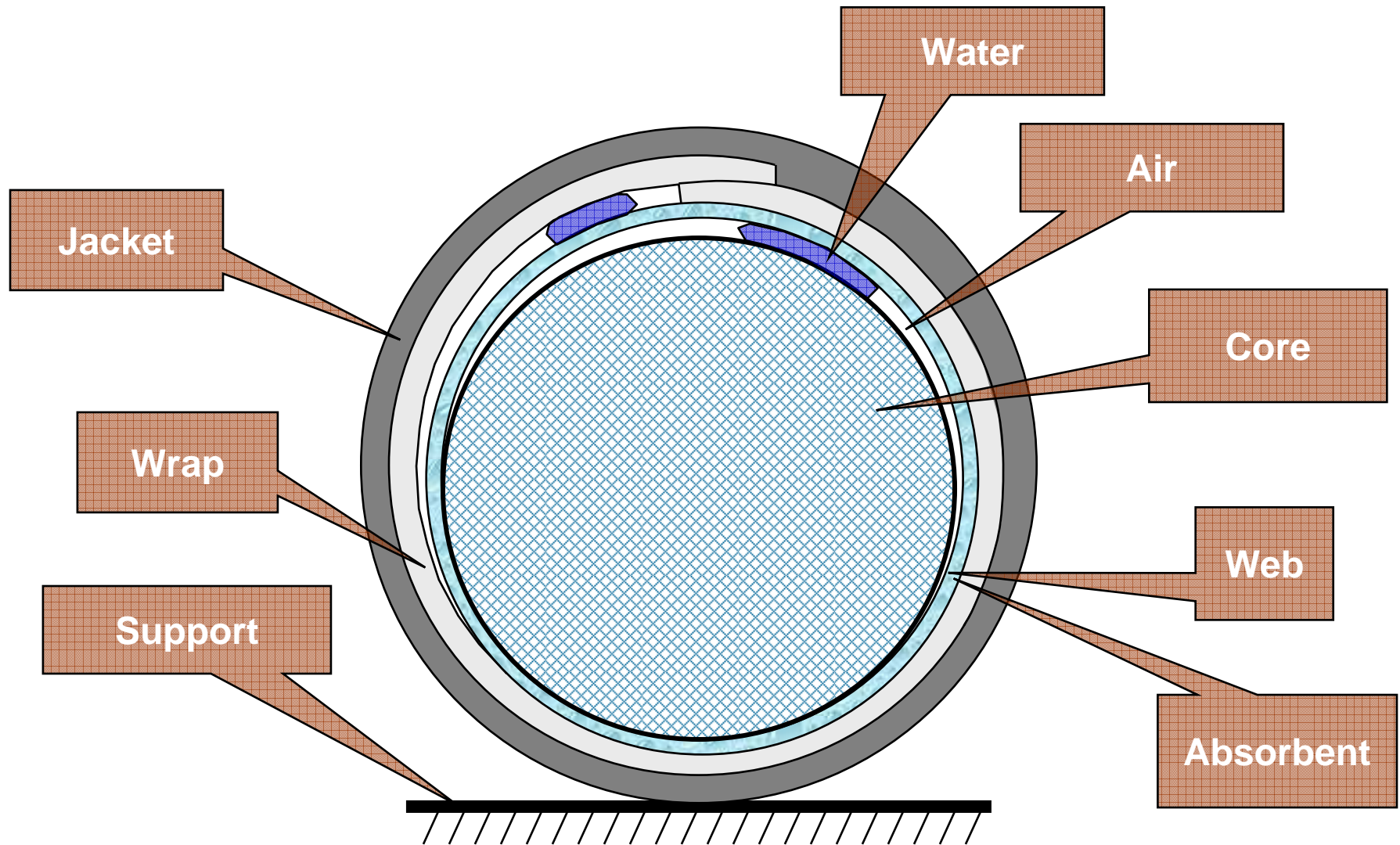
## Technique: Tools for improving Innovation



- S-curve evaluation of innovation strategies
- Functional architecture analysis
- Component analysis
- Cause-effect chain analysis
- Trimming and feature transfer
- Functional architecture redesign
- Function oriented search
- Trends of technology evolution
- Inventive principles



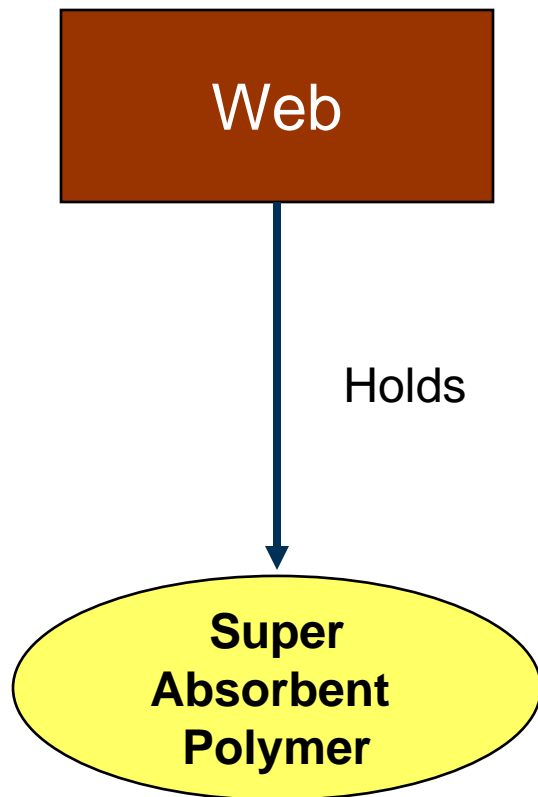
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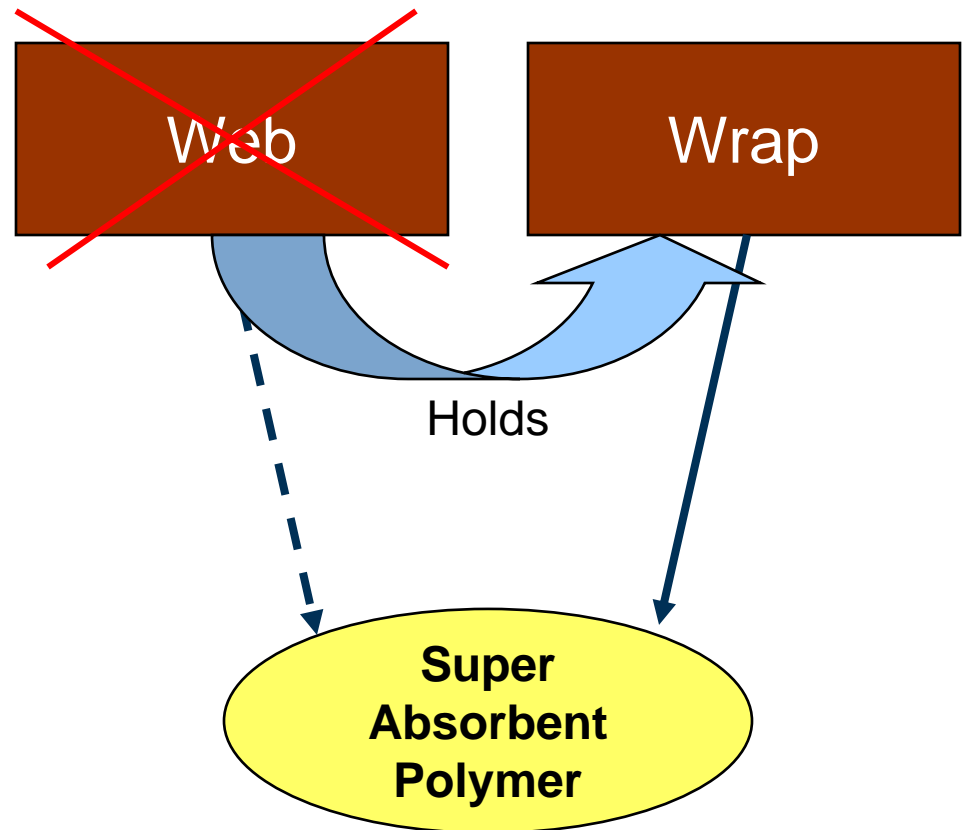


# Trimming – Teaching components new tricks

Before Trimming

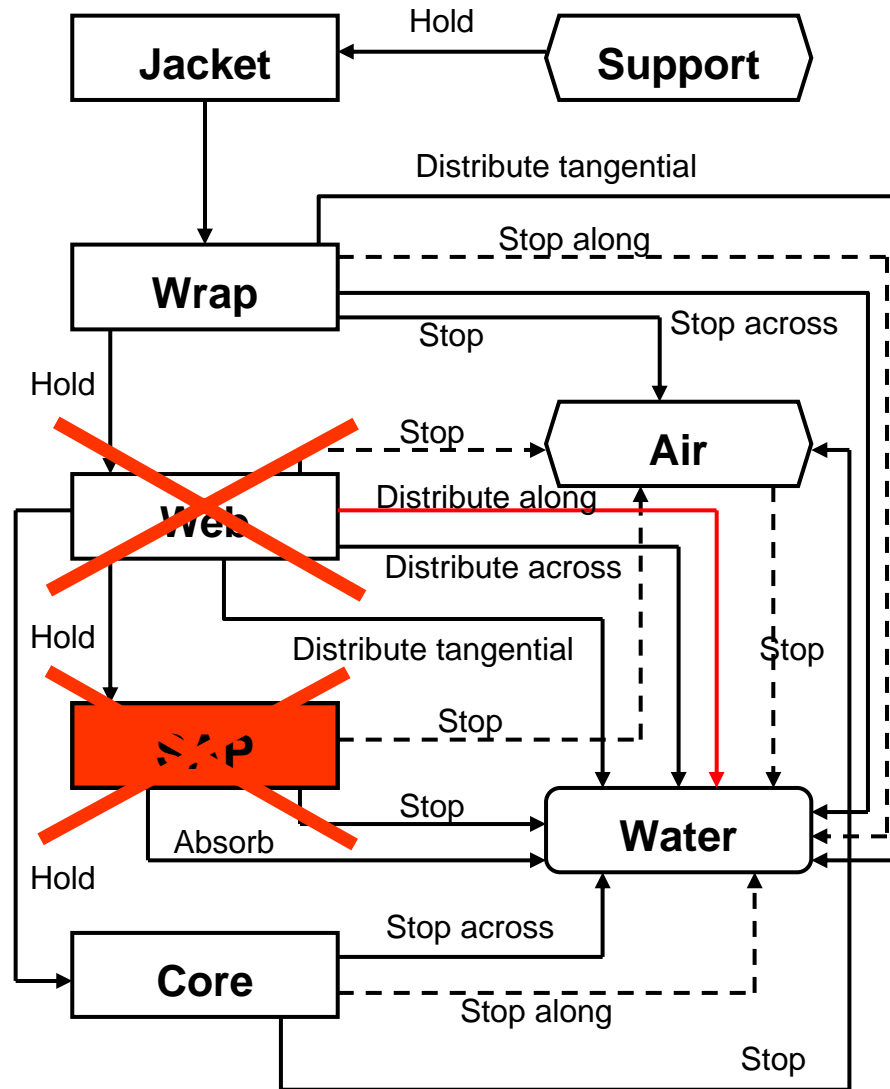


After Trimming





# Functional Architecture Redesign





# Functional Taxonomies of Science and Technology

## How many ways are there to change temperature?

Boiling	Gas discharge ionization	Mechanocaloric effect
Capillary pressure	Heat and electric conduction in heat pipe	Melting of solid (decrease in mass)
Combining heat pipe evaporators to common condenser	Heat diode effect in gravity-assisted heat pipe	Peltier effect
Corona discharge	Heat of wetting	Ranque effect
Crystallization of overcooled liquid	Heat pipe thermal superconductivity	Reverse pyroelectric effect
Curie temperature	Hydrodynamic cavitation	Single-electron tunneling
Decolorization of heat treated electrochromic films	Hyperboloid of one sheet	Skin-effect
Deformation of elastic body	Inertia	Spiral
Dehydration of alcohol	Isothermicity of heat pipe condenser surface	Superthermal conductivity
Dufour effect	Johnson-Rahbeck effect	Thermal action produced by Foucault currents
Endothermic reactions	Joule-Lenz law	Thermal effect of hydrogen absorption/desorption in intermetallic compounds
Ettingshausen effect	Joule-Thomson effect	Thermal expansion of solid bodies
Evaporation enhancement in capillary grooves with porous coat	Laminar flow	Thermoacoustic effect
Exothermic reaction	Light absorption	Thermochromism
Ferromagnetism	Light focusing	Thermomechanical effect
Formation of gas hydrates	Light reflection	Thermoresistive effect
Free convection	Magneto-active bubbling heat transfer	Thomson effect
Friction	Magnetocaloric effect	Turbulent flow
	Magneto-controlled local heat transfer	



## How to teach the Wrap to secure the Absorbent

**Functional Search: How to secure a powdered material to a surface**

**Solution: Flocking**



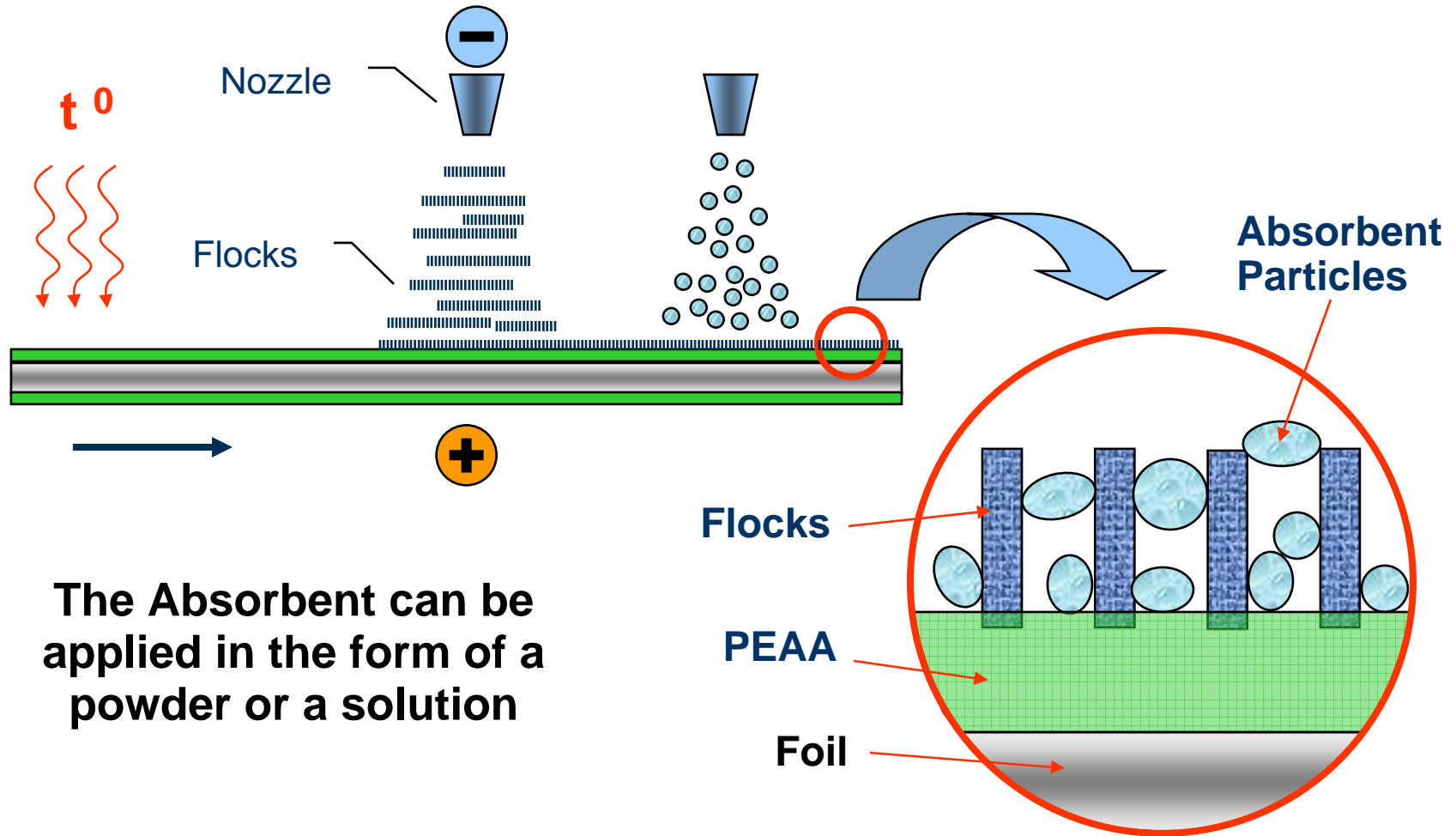


# Securing the Absorbent on a Flocked Surface

Melting  
PEAA

Flocking in an  
electrostatic field

Applying  
Absorbent



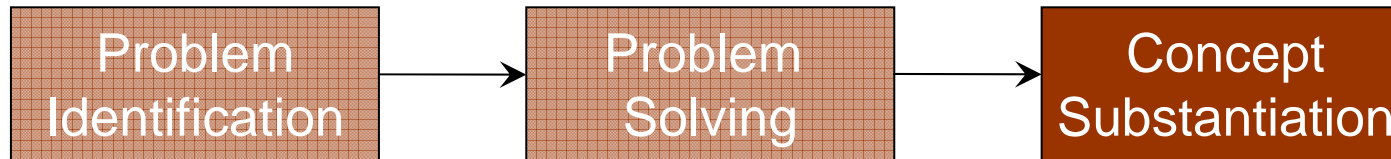


# How to lower the cost of Absorbents





## Technique: Tools for improving Innovation



- S-curve evaluation of innovation strategies
- Functional architecture analysis
- Component analysis
- Cause-effect chain analysis
- Trimming and feature transfer
- Functional architecture redesign
- Function oriented search
- Trends of technology evolution
- Inventive principles
- WW Knowledge Network
- Functional analysis of second order challenges
- Prototyping

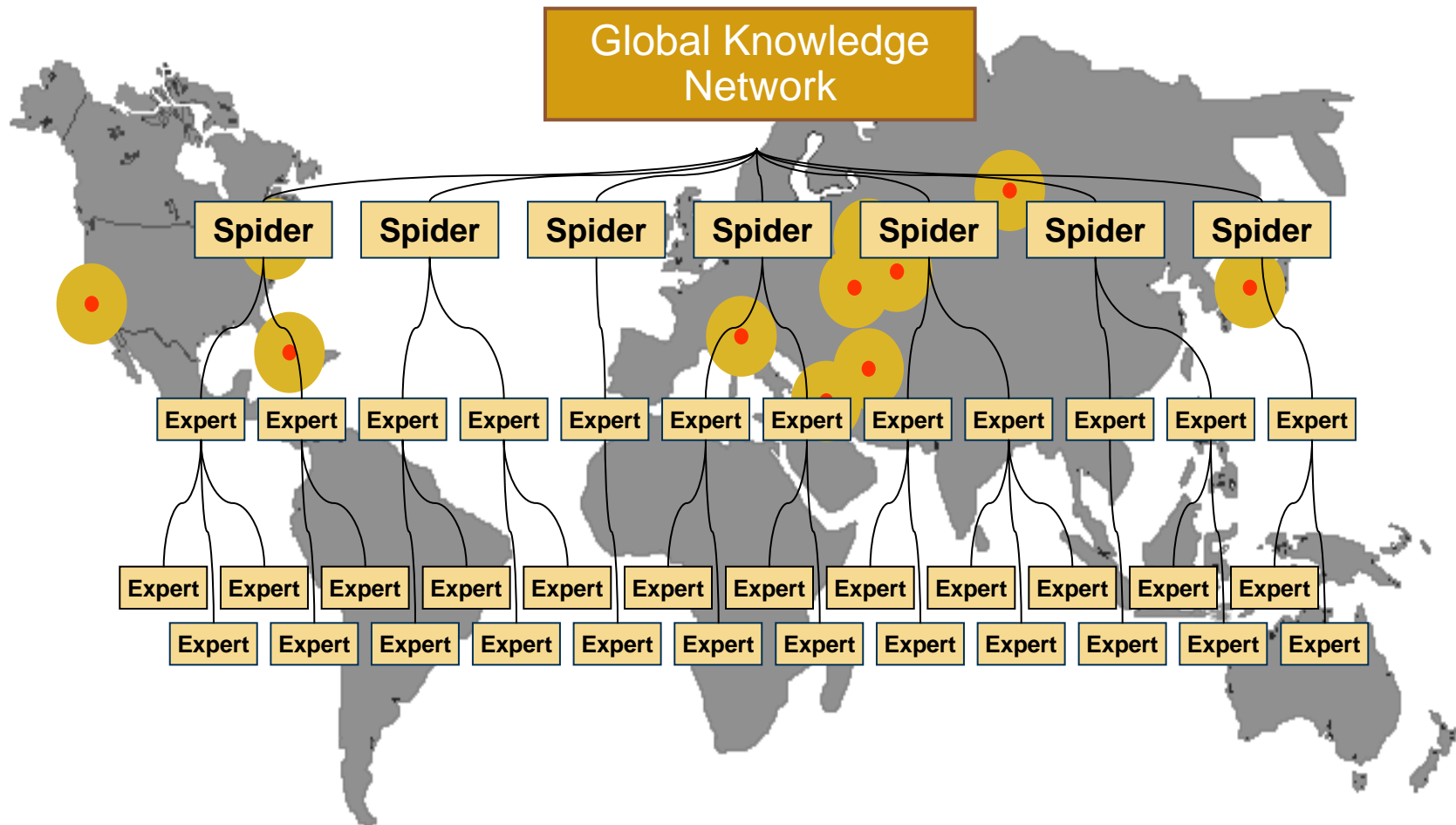


# There's a world of Validated Solutions out there





But, if you don't organize it, it might as well not exist





## Effective Routine: What is required

### **Technique: Powerful, shared methodology for innovation**

- Problem identification
- Problem solving
- Concept substantiation

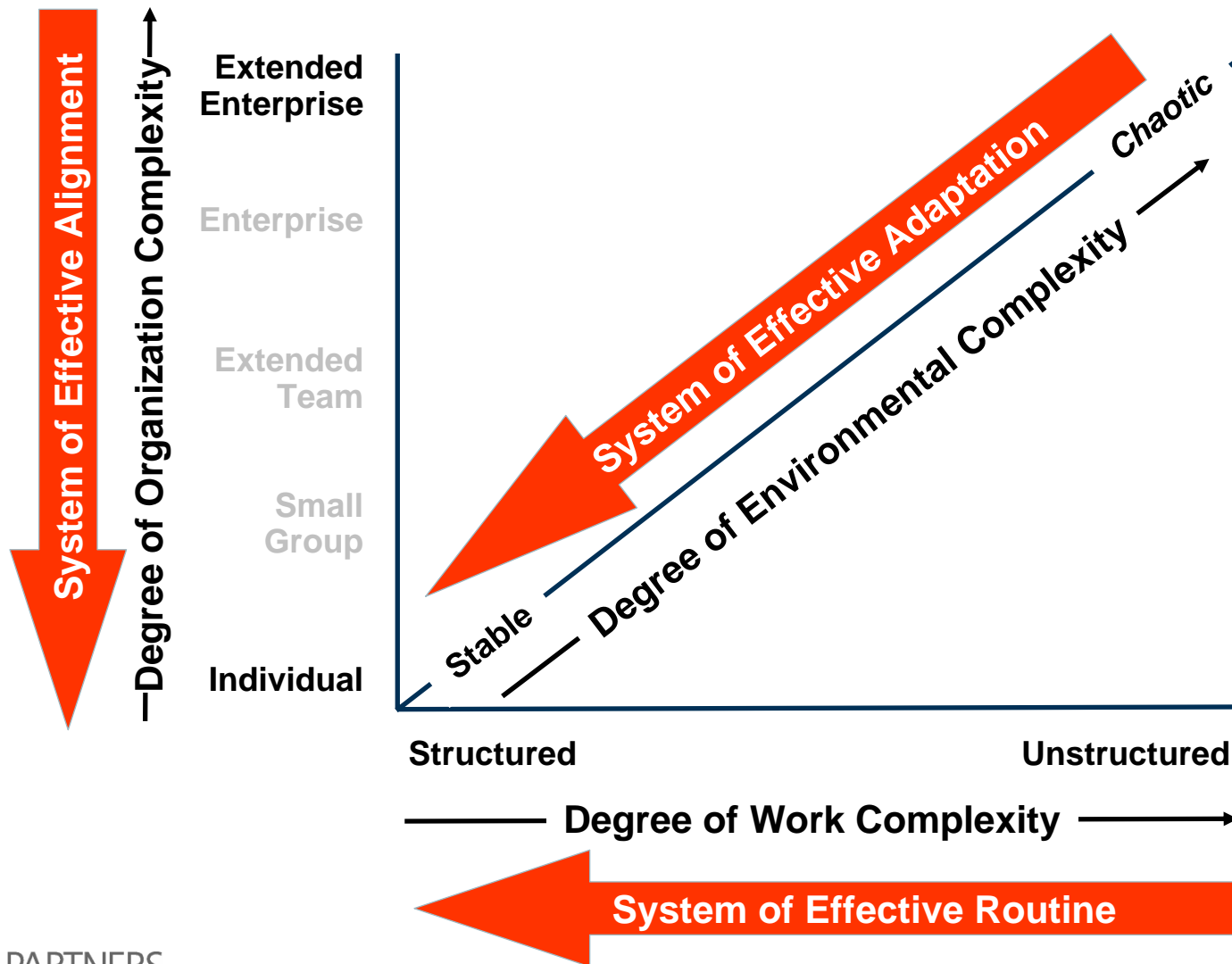
### **Talent: Skill development leading to mastery of innovation**

- Training, apprenticeship, mentoring
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### **Continuous improvement**



# Innovation Discipline





# Let's declare a revolution in product innovation

## Eight Principles of the Revolution

- Innovation is significant improvement along main parameters of customer value
- Maximize *risk-adjusted* returns on innovation
- Balance the Voice of the Customer against the Voice of the Technology
- Subordinate inspiration to systematic innovation
- Identifying the right innovation problem is key to success
- Function is our *purpose*; technology is merely our tool
- Compromise is the enemy of innovation
- Innovation is a discipline, requiring the mastery of defined skills



## Conclusions

- Product innovation is perhaps the last set of processes that have not been re-evaluated and re-engineered
- Problems of innovation must be submitted to rigorous analysis
- Start at the front end of innovation – that's where overall performance can most be impacted
- The job is bigger than R&D – It must involve senior leadership, marketing, and other functions as well

**We must turn the art of product innovation into the science of product innovation**

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