Customer-Centric Innovation

Prof. Frank T. Piller | RWTH Aachen University

About me: Frank Piller

Professor of Technology & Innovation Management
at RWTH Aachen University

Studying innovation since 1994, but also practicing it
by helping large companies to innovate
and by being involved in a number of startups

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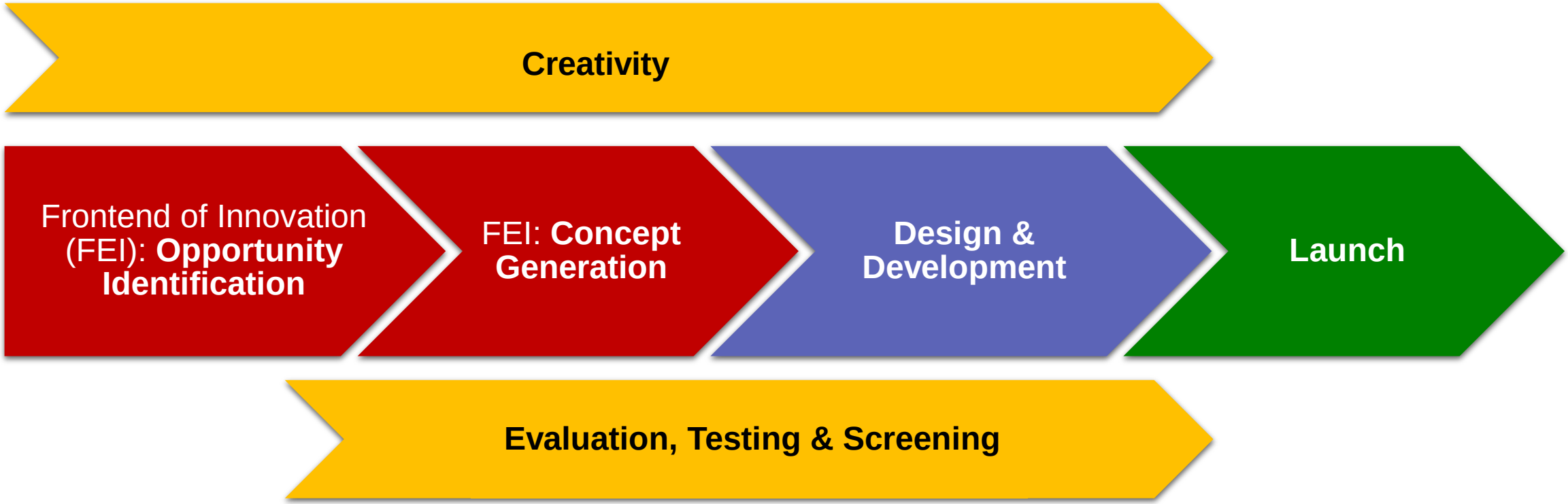
A magic formula for innovation?

$$I=f(n,op,u_f,o,c,pd,\$,l)$$

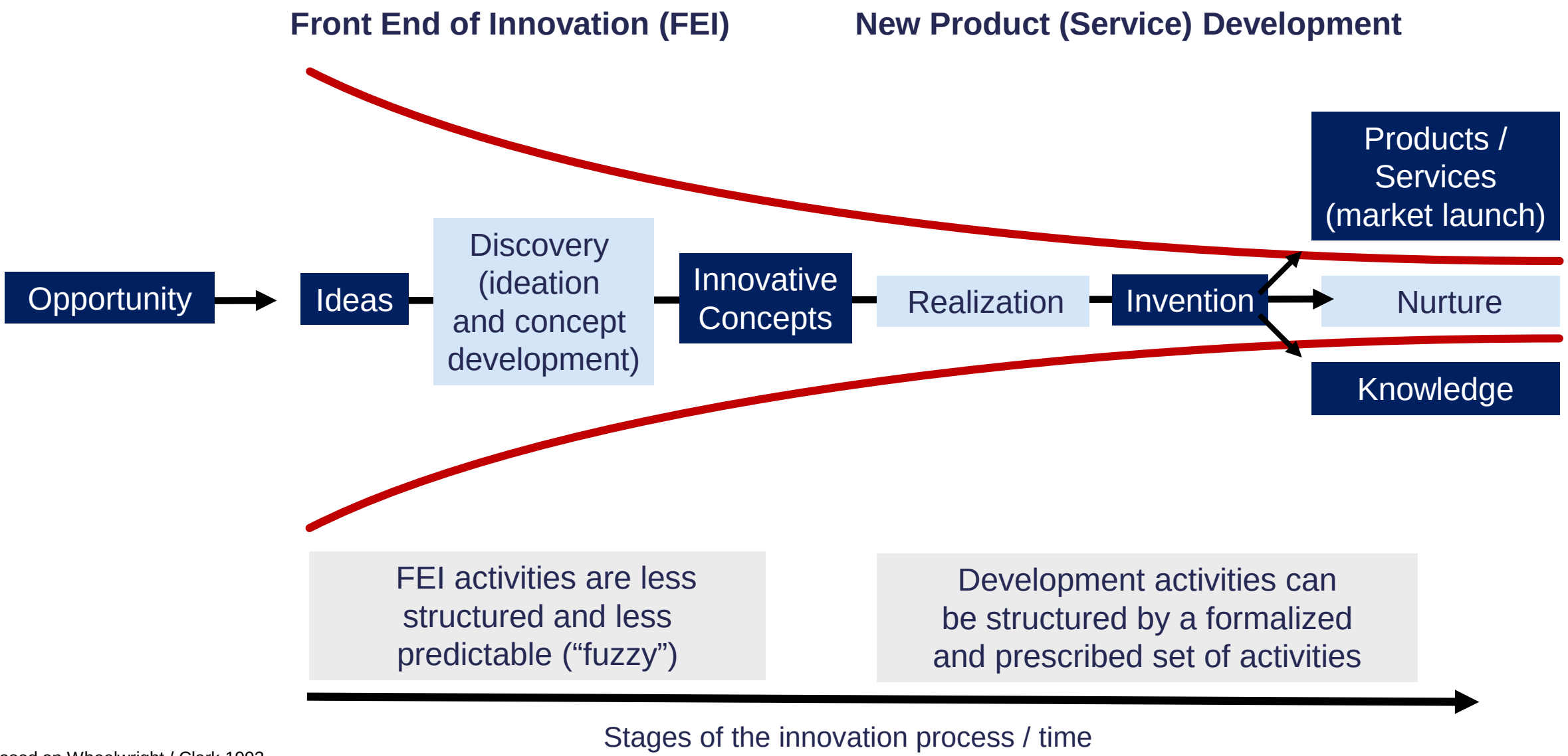
I=f(need, opportunity, (frustrated)user, openness, creativity, process&discipline, budget, luck)

The Basic New Product* Process



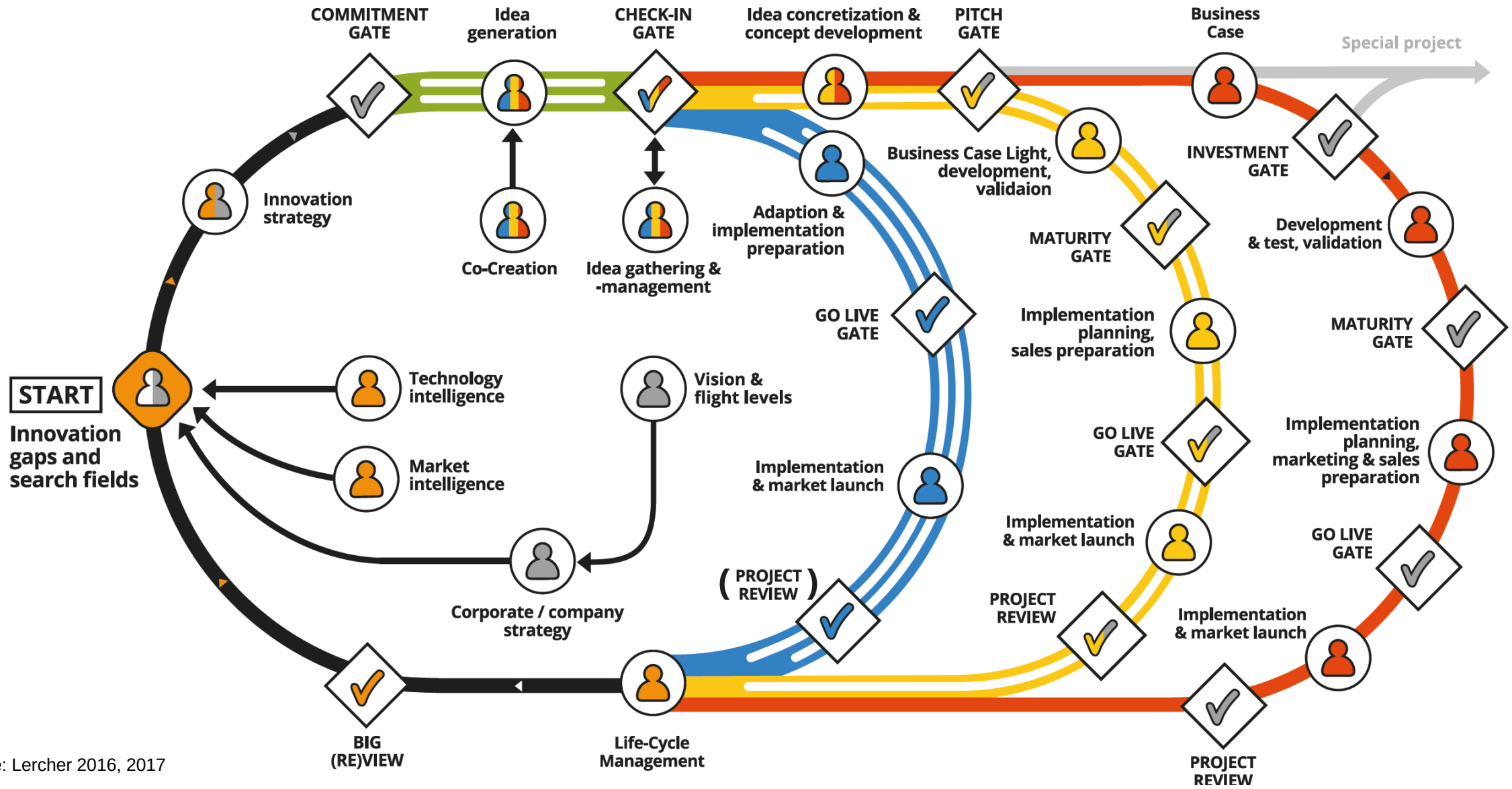
* The same process applies to **service development**

The Development Funnel



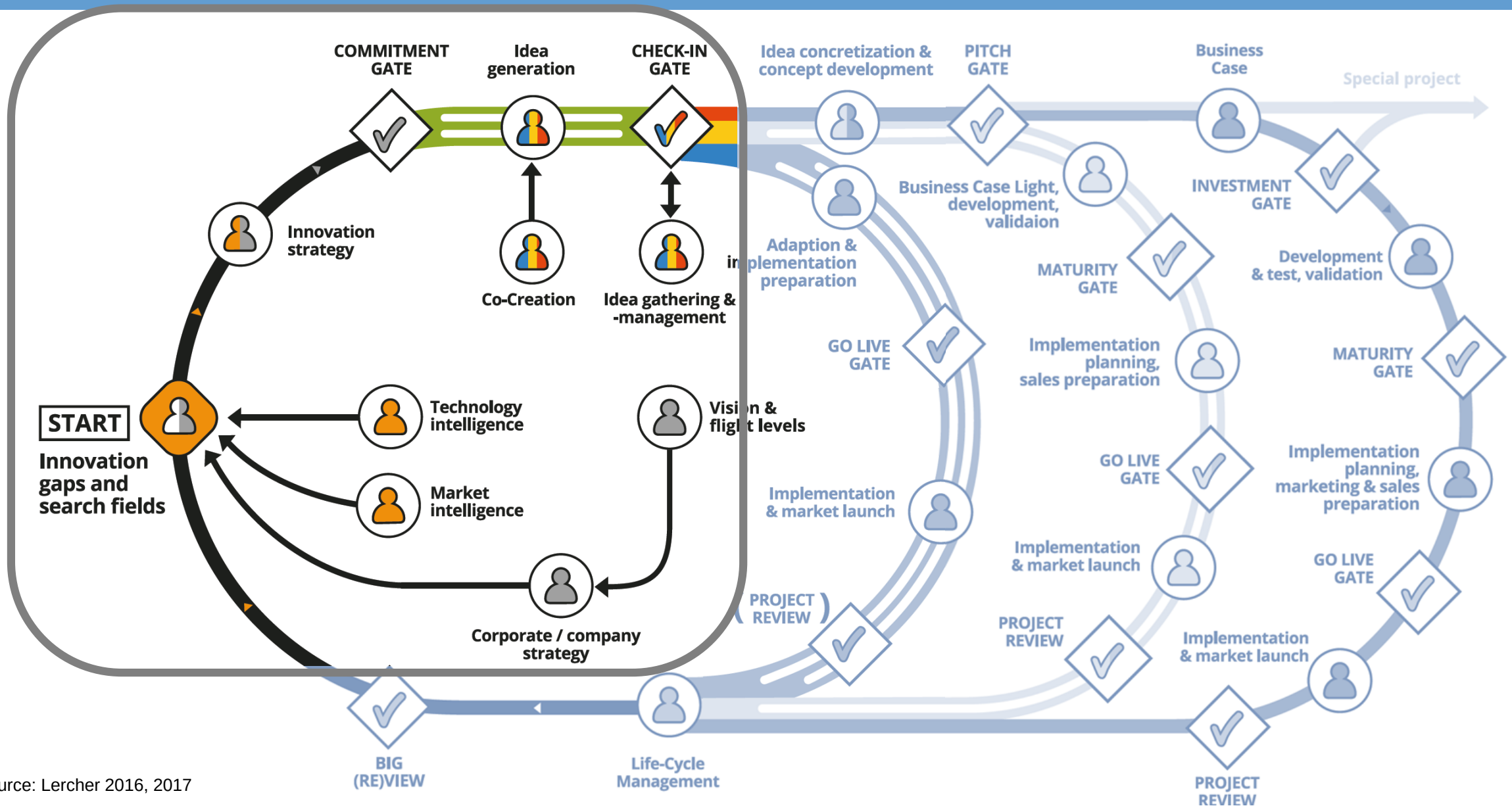
Based on Wheelwright / Clark 1992

The Big Picture



Source: Lercher 2016, 2017

The Frontend of Innovation (FEI)

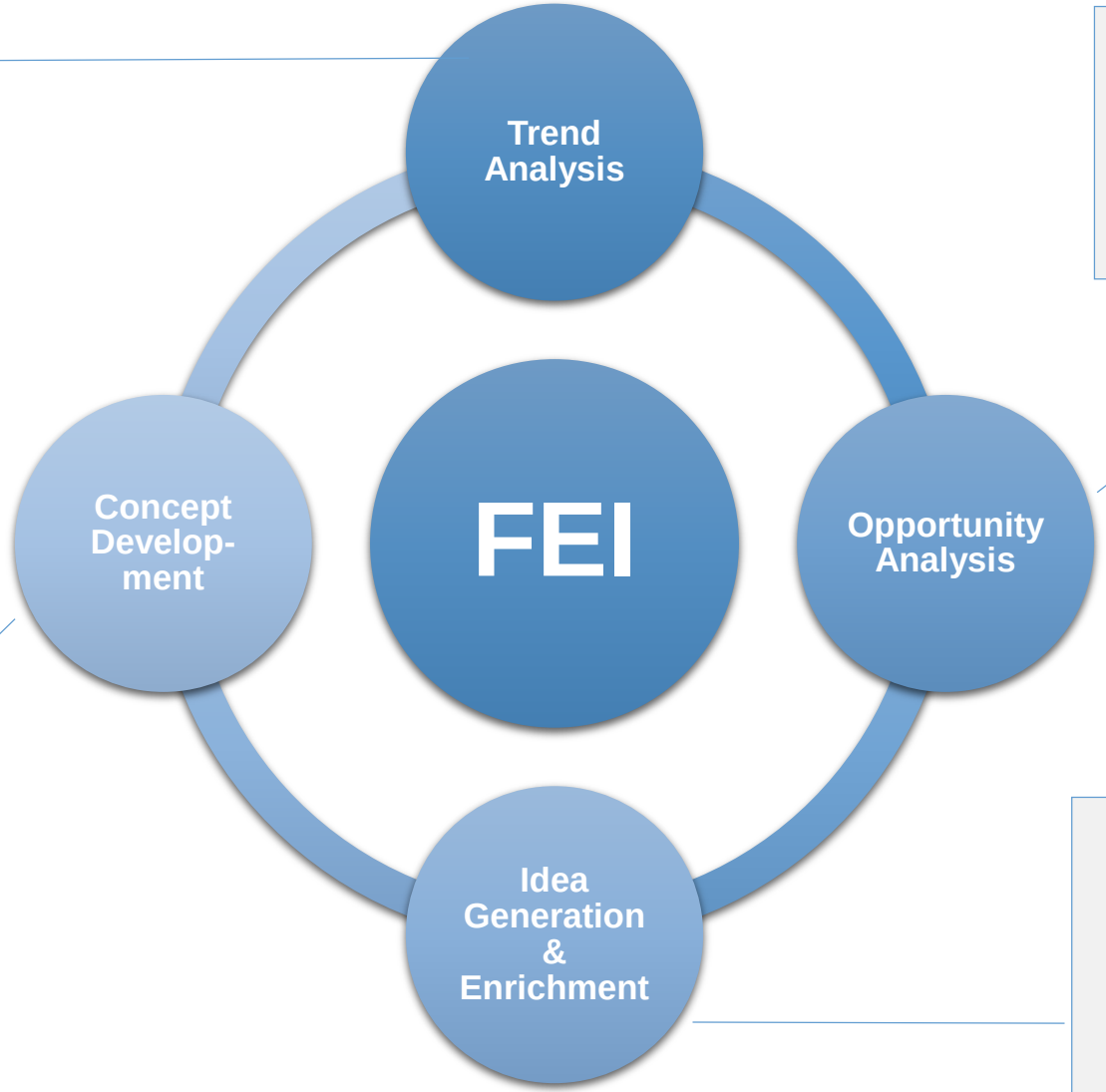


Source: Lercher 2016, 2017

Four main clusters of FEI activities

1) Understanding the external environment of our business units & our customers

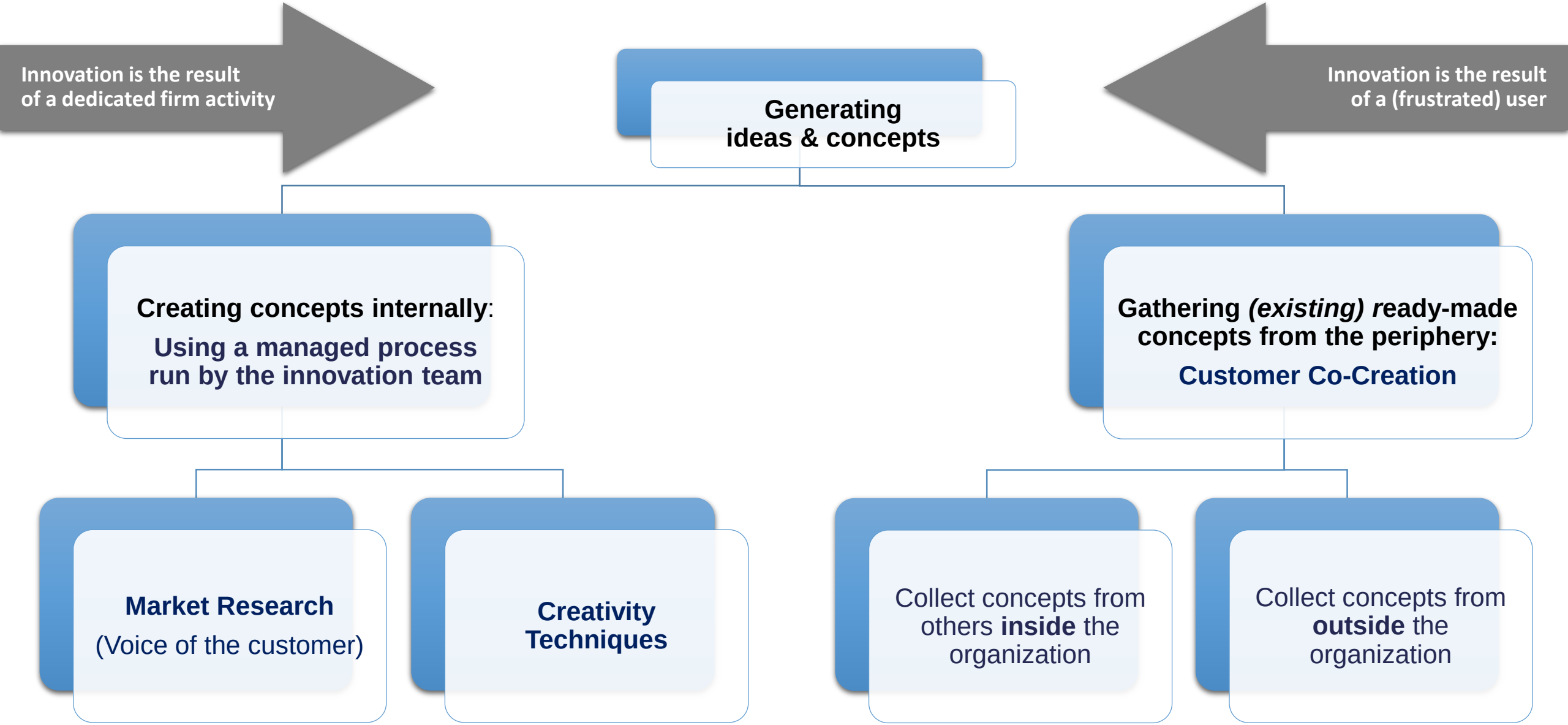
2) Identifying gaps between our present state and an envisioned future



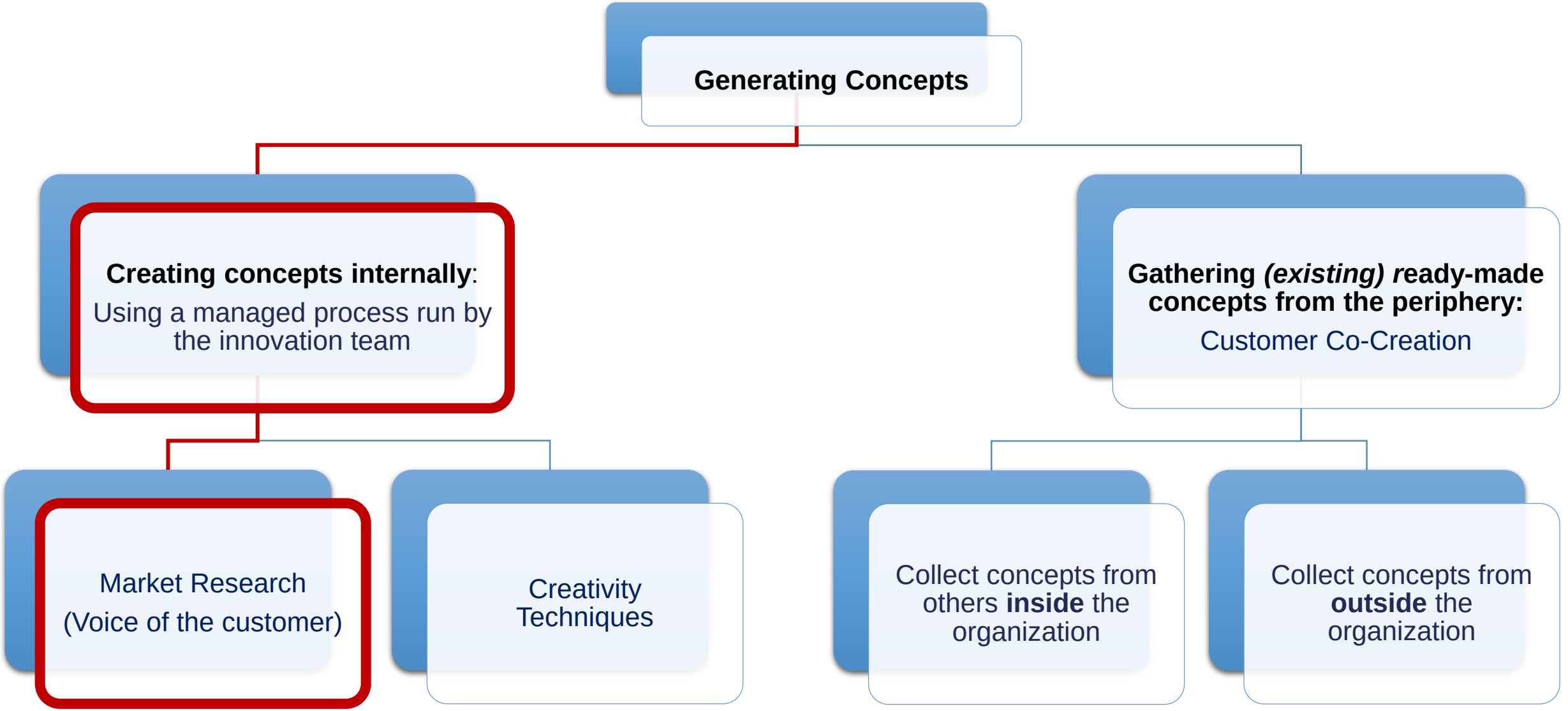
4) Combining ideas into concepts which cover primary features and customer benefits of future solution

3) Creating alternatives for solutions to benefit from opportunities identified in previous stage

Methods for generating ideas & concepts

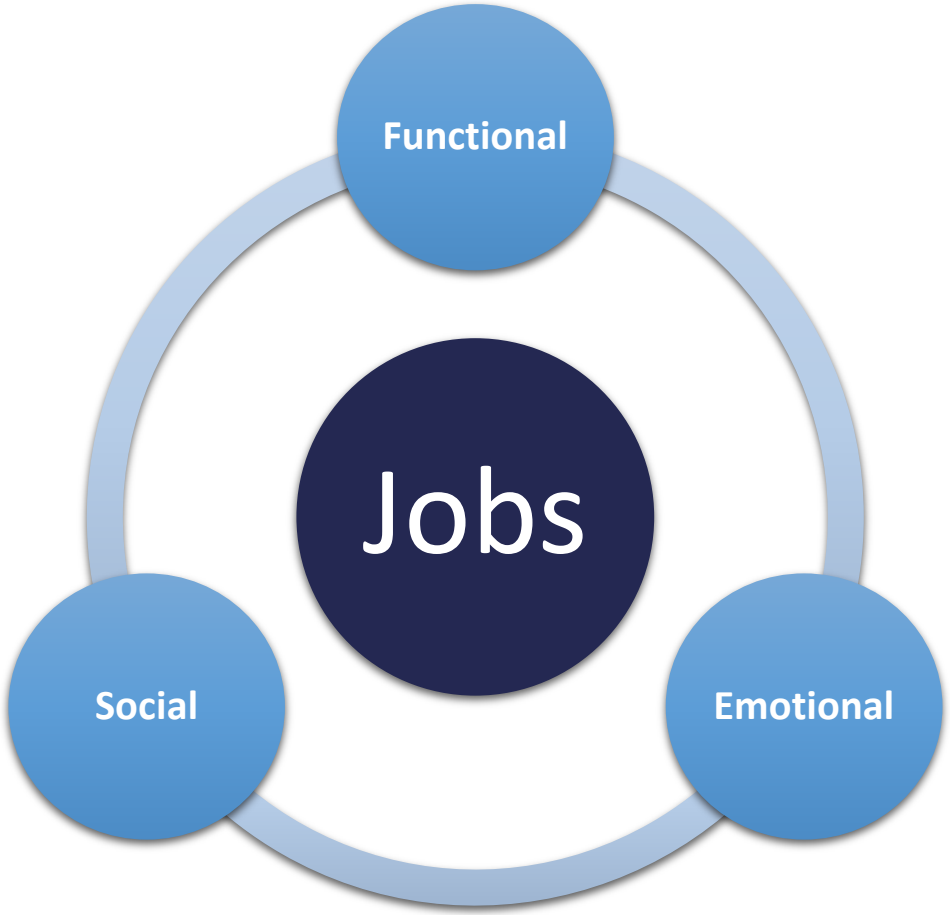


Methods for generating ideas & concepts



Job-based thinking for innovation

Formulating jobs: Three dimensions



Formulating jobs: Examples

1) **Action verb** (with direction)
2) **Object of action**
3) **Contextual clarification**

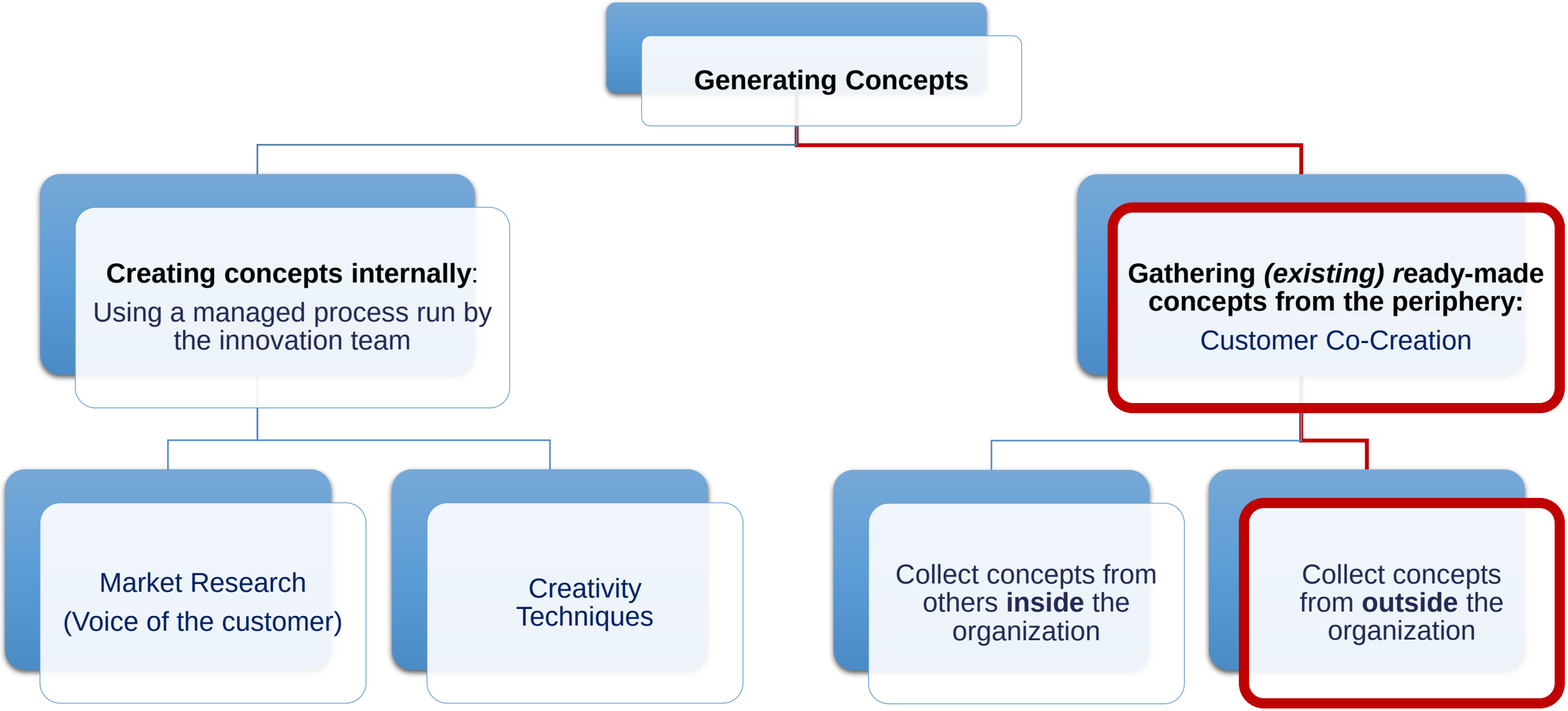
The example of a powertool (driller)

Functional: „Reduce likelihood of hitting the water pipe when renovating an old house“

Emotional: „Provide me with larger satisfaction once I finished the task“

Social: „Reduce the disturbance for my neighbors“

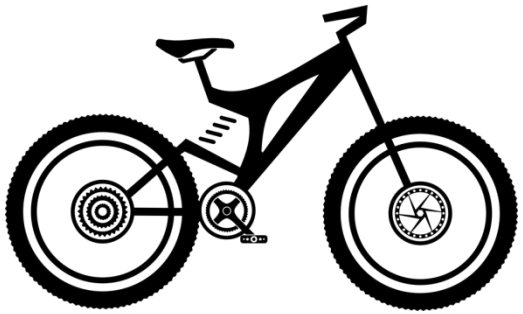
Methods for generating product concepts



Lead users as the source of functional novel innovation

Users as the source of innovation:

User as originators of first-of-type innovations and major improvements of existing products



Mountain bike

Open Source Software

Scientific Instruments

Petroleum Processing

Conclusions: The Frontend of Innovation

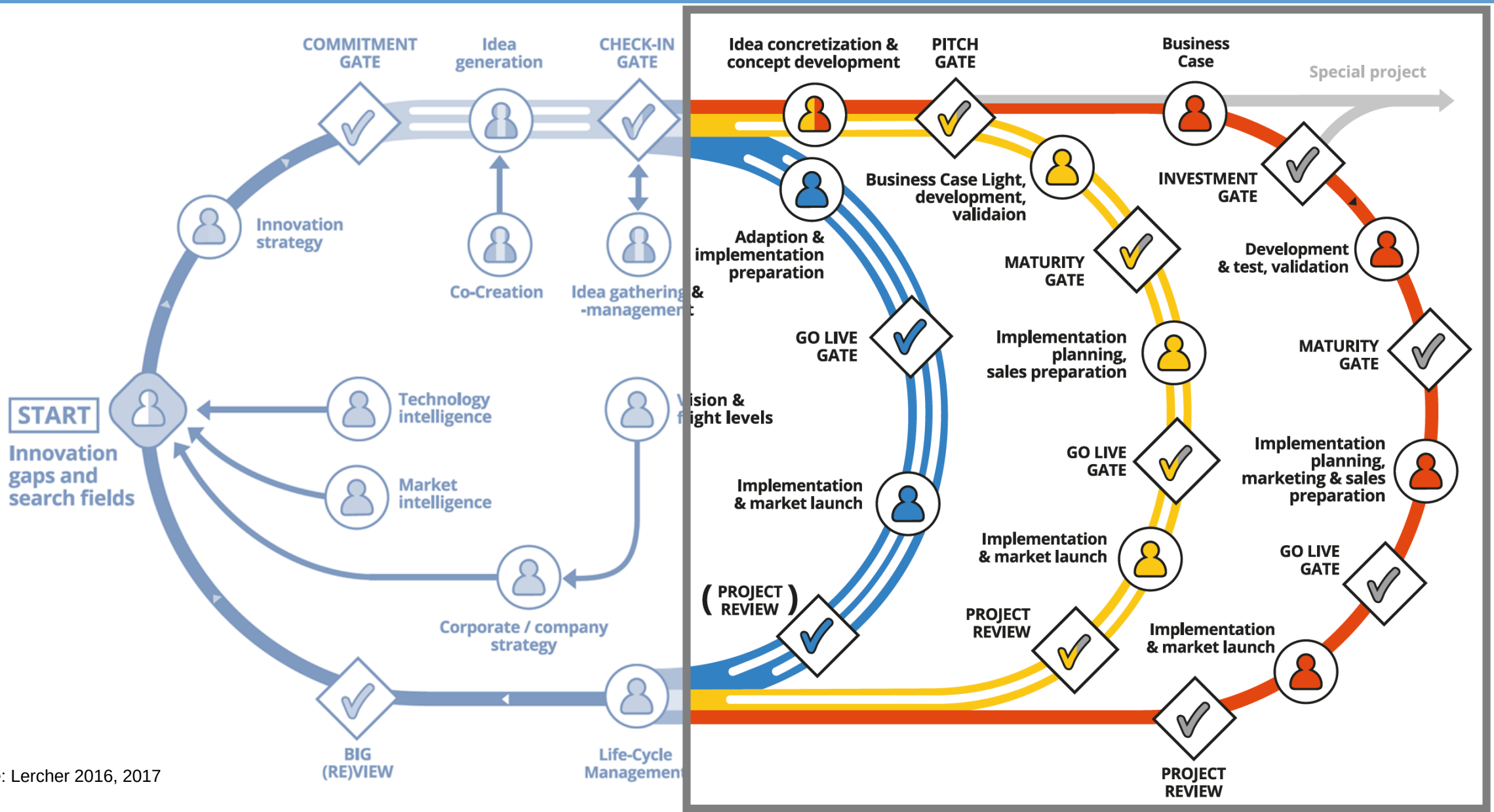
The Frontend of Innovation (FEI) is …

- **a customer-centric process of opportunity recognition** *(technological opportunities, but especially open problems ("jobs") of customers, i.e. customer insights)*
- **ideation and**
- **concept development.**

The ingredients of the FEI are: **Dedicated methods of analysis, creativity**, but also lots of **evaluation and selection.**

It is **followed by the (technical) development stage**, where **technical problem solving, product design & engineering** takes place. After a **final screen**, the new product is then ready for **launch**.

Implementation and Project Phase



Source: Lercher 2016, 2017

Innovation & Creativity Management

Prof. Frank T. Piller | RWTH Aachen University

Facets of creativity:
What are abilities of a creative person?













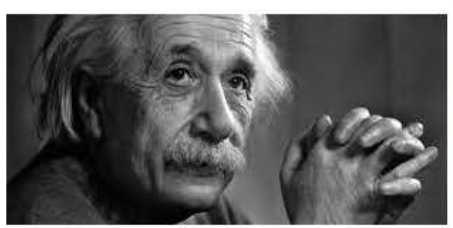


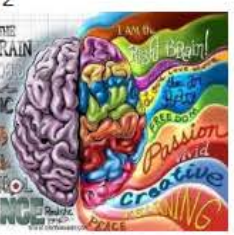








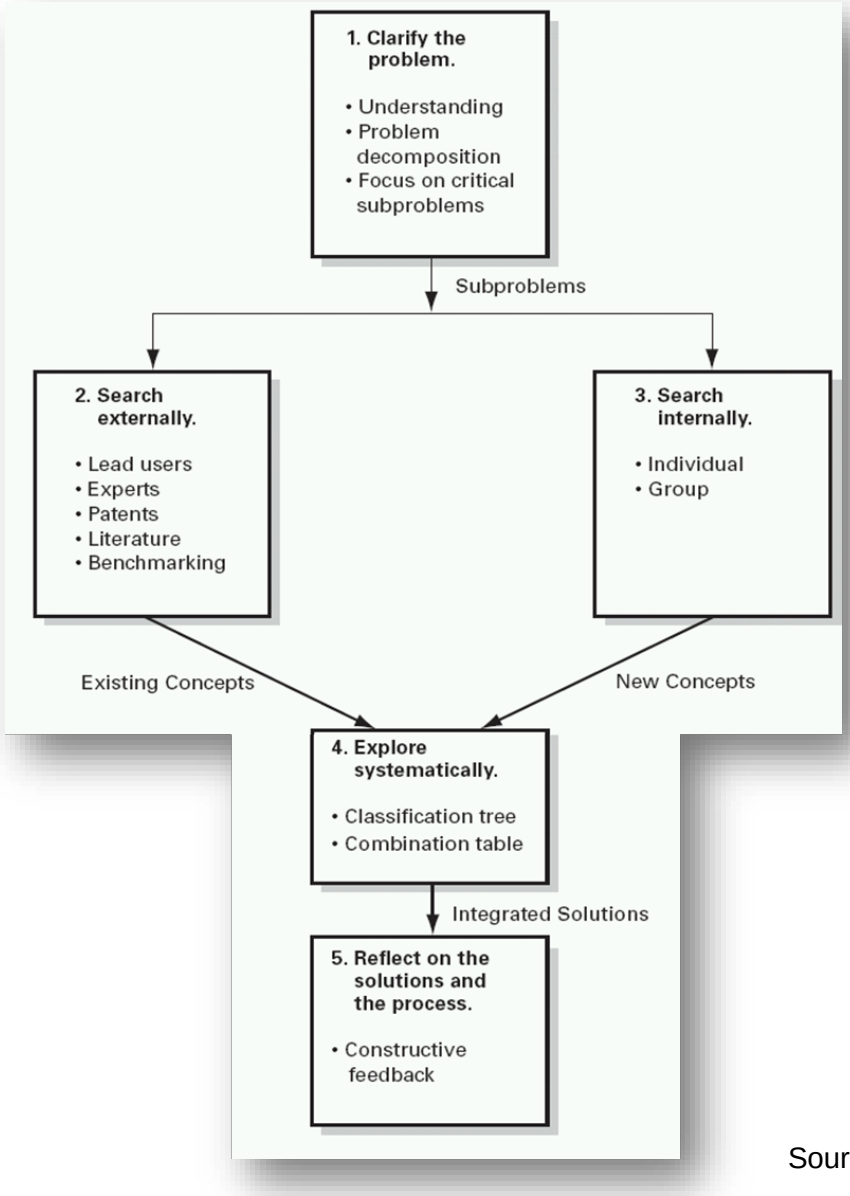









Scientific and technical problem solving

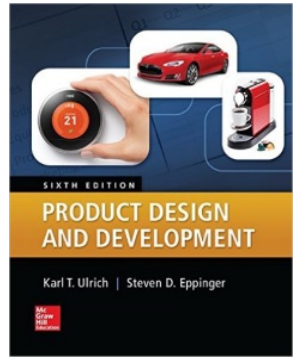


Problem solving has two components:

(1) Search process based on prior experience

(2) Trial-and-error-learning

Five-Step-Process of Concept Development according to Ulrich & Eppinger



Step 1: Clarify the Problem

Step 2: External Search

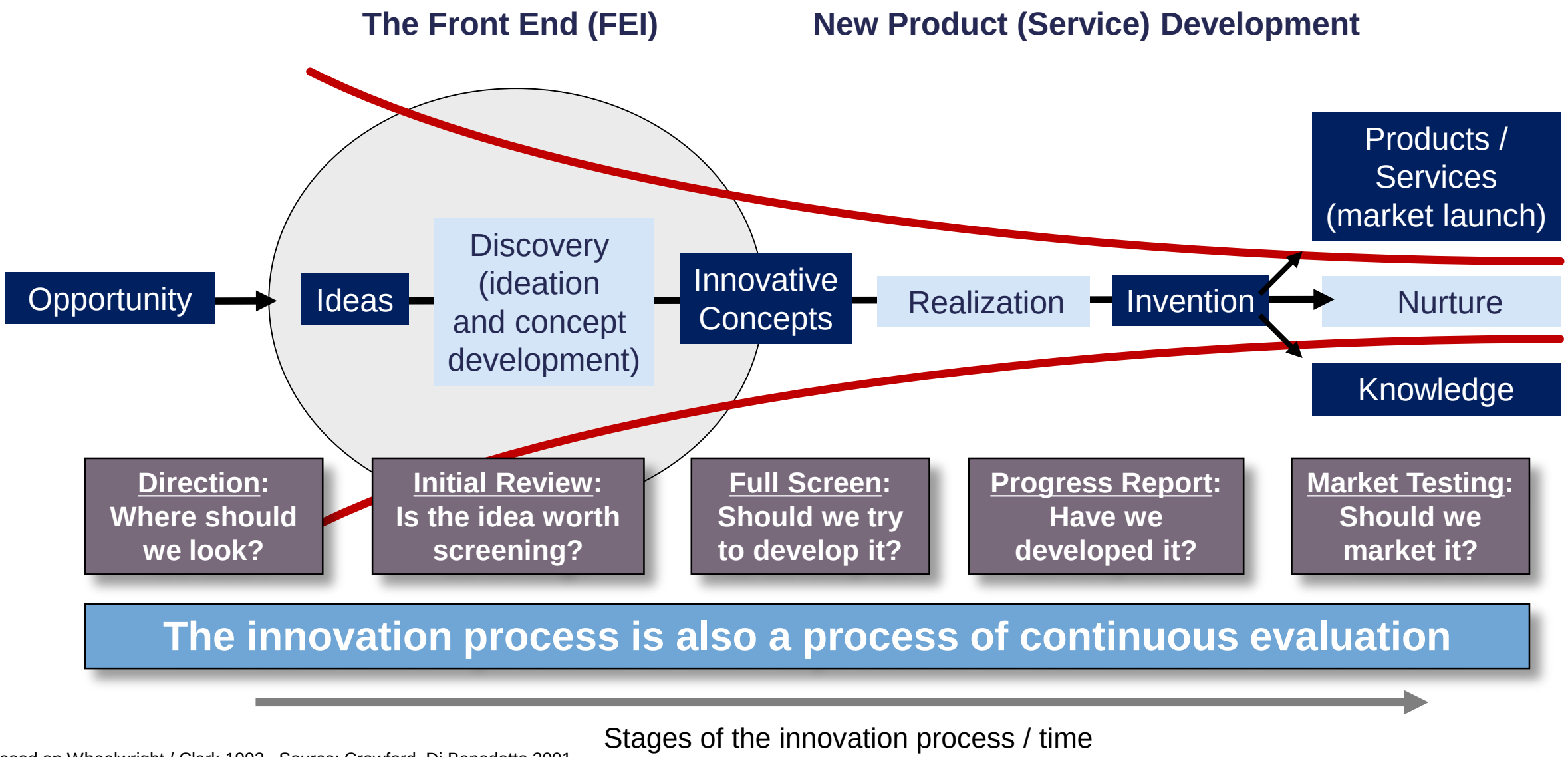
Step 3: Internal Search

Step 4: Explore Systematically

Step 5: Reflect on the Results and the Process

Source: Ulrich / Eppinger “Product Design & Development” (2011, 2015)

The Innovation Funnel



Based on Wheelwright / Clark 1992 , Source: Crawford, Di Benedetto 2001

A magic formula for innovation?

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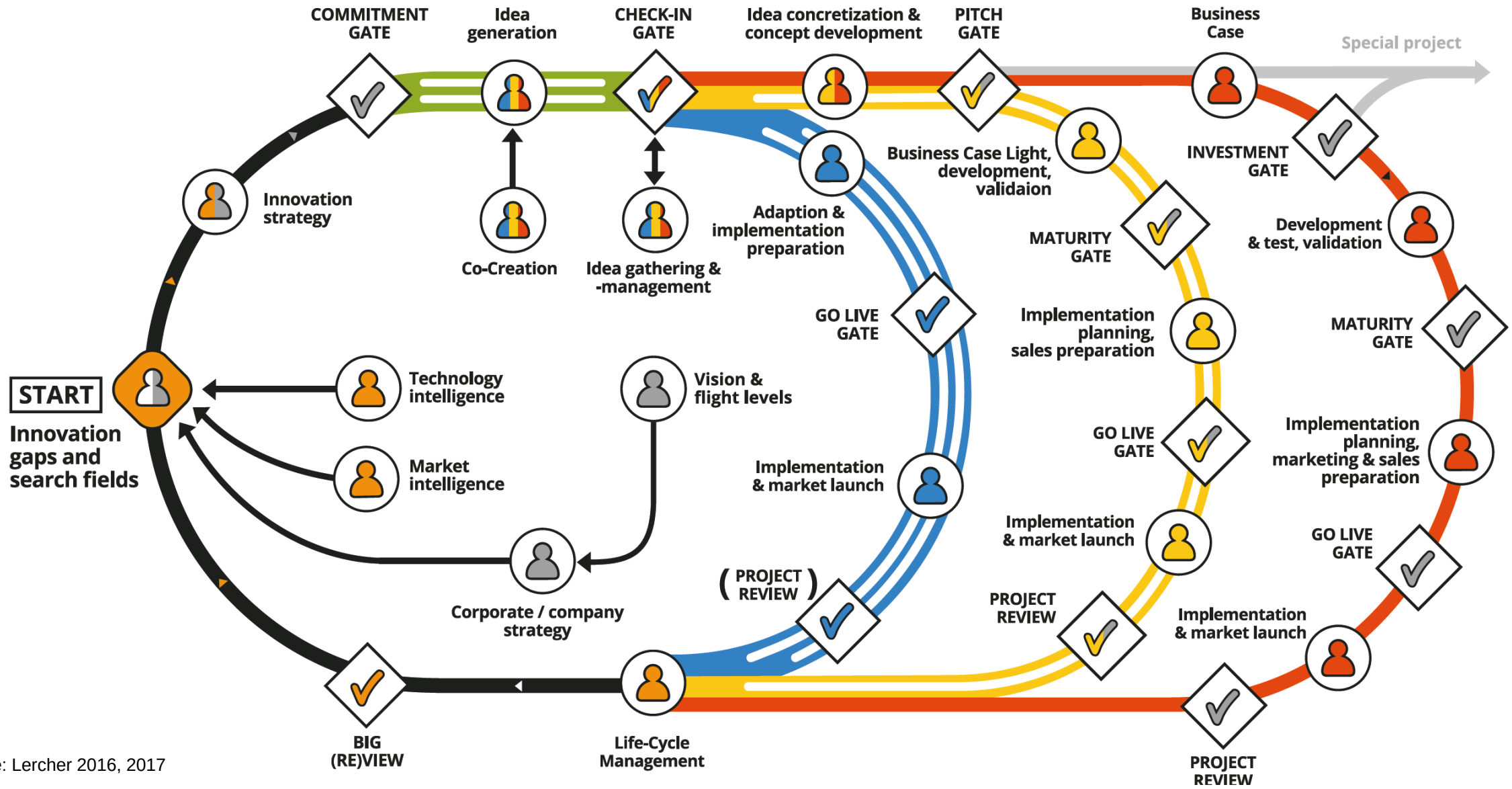

Source: Lercher 2016, 2017

Managing the Innovation Process

See you soon!

Please study the syllabus for all important information and organizational detail!

Research Area
Technology,
Innovation, Marketing,
Entrepreneurship

RWTH AACHEN UNIVERSITY

Managing Innovation: An introduction

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The objectives of this video module

This is not an innovation management class – but a motivation to study the management of innovation and technology in larger detail.

We will define some important terms and introduce some of the core frameworks and concepts of innovation management.

At the end of the module, **you will have more questions than answers** – but hopefully more background knowledge, too, when engaging in deeper study – either on your own or in own of our classes or workshops.

What is innovation?

Defining innovation

What is an innovation?

Your Top 10 of Innovation

In 2002, the BBC asked the listeners of its *Today* program on Radio 4 to **nominate their top ten inventions of all time**.
This is what the British public responded (in descending order):

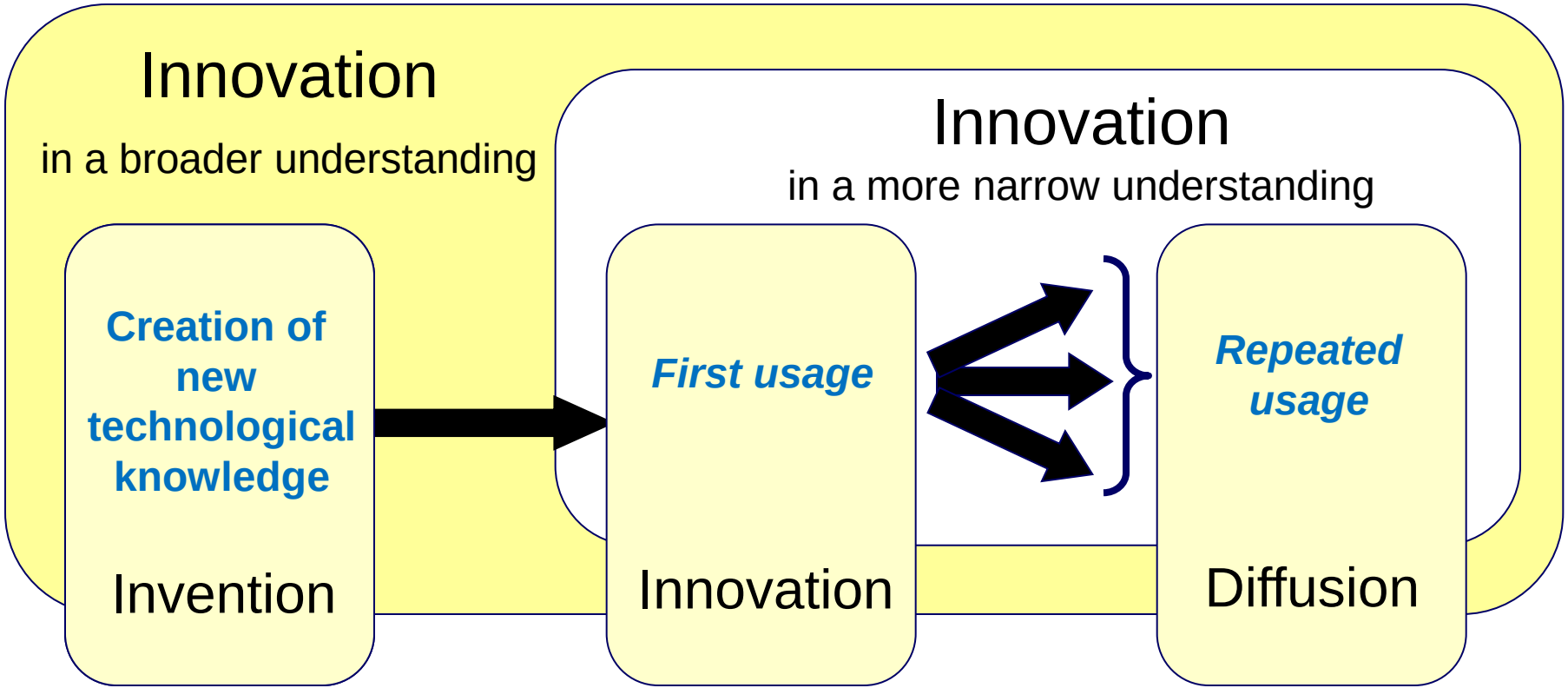
1. **Bicycle** (Pierre Lallement, 1866)
2. **Radio** (Guglielmo Marconi, 1897)
3. **Computer** (Alan Turing, 1945)
4. **Penicillin** (Florey and Heatley, 1940)
5. **Internal Combustion Engine** (Nicolaus C
6. **World Wide Web** (Tim Berners-Lee, 1989
7. **Light Bulb** (Thomas Edison and Joseph S
8. **Cat's Eyes** (Percy Shaw, 1936)
9. **Telephone** (Alexander G Bell, 1876)
10. **Television** (John Logie Baird, 1923)

Source: Smith (2006): Exploring Innovation. Chapter 1

Our definition of an innovation

An **innovation**
is the
creation (invention), introduction (launch) and **successful diffusion (adoption)**
of **products, services, systems, processes,**
or **even business models,** which are
new from the perspective of the particular organization and/or user.

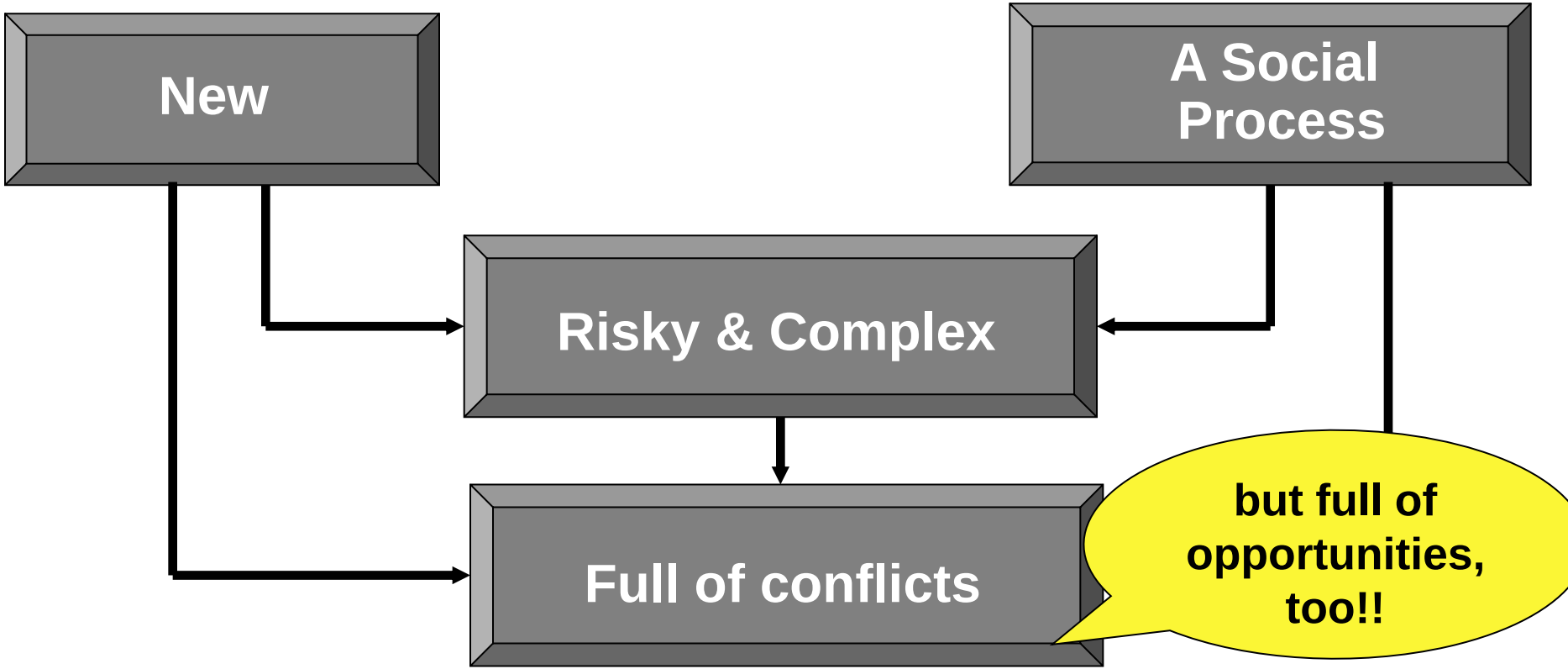
A broader perspective on innovation



What is special about innovation?

The nature of innovation

Innovation is an open ended problem, characterized by several characteristics



A typical story of innovation

The story of Barbie reminds us of some key characteristics of innovation:

- **Role of outsiders as the source of innovation** (innovative users play a central role)
- **Not always the result of a structured planning process**
- **A lot of resistance**
- **The power of working with prototypes**
- **The need for being open and un-biased**
- **So much coincidence & luck**

Innovation Management:

Making this a structured, systematic, and repeatable process

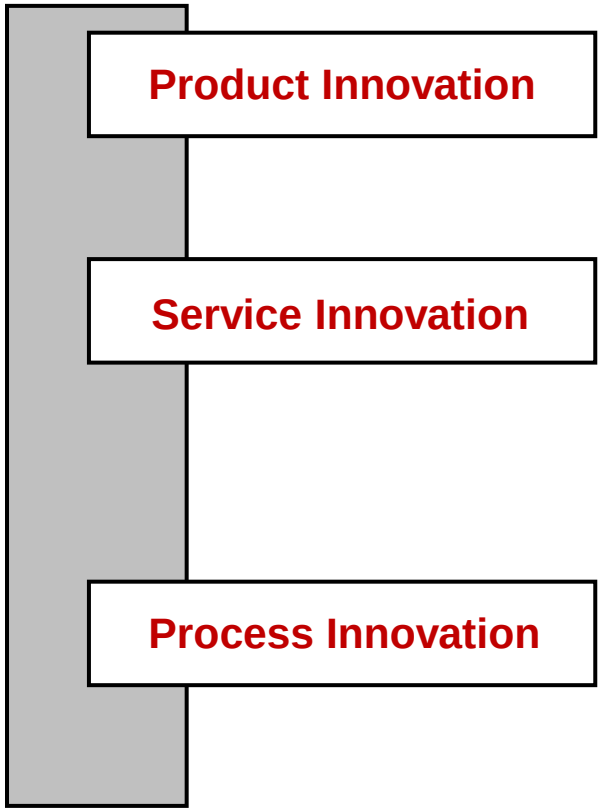
Innovation management is the systematic management of innovation processes. It refers both to product, process, and organizational innovation.

Innovation management includes a set of tools that allow managers and engineers to cooperate with a common understanding of processes and goals.

Are there different kinds of innovation?

Structuring different types of innovation (Part 1)

Different types of innovation (I): Outcome of the innovation process: Products, services, and processes



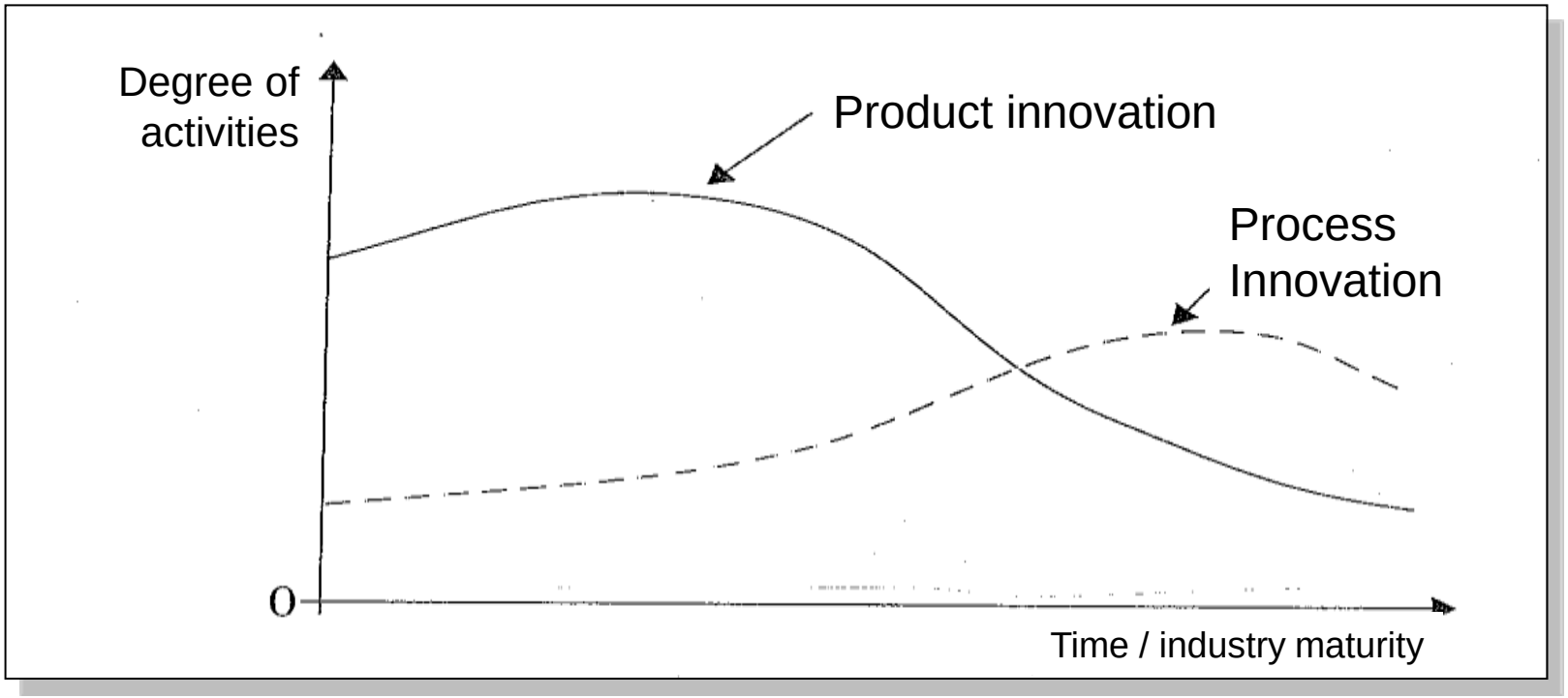
- Embodied in a company's tangible output: a new product offering (***new product development***)
- Can be new or improved offerings, often variants
- Example: iPod, Post-it, Pharmaceuticals

- Similar to product innovation, but the outcome is a new service offering
- Rather new perspective that services can be systematically innovated, too
- Example: New telephone banking process, new logistic service

- Concerning the way companies conduct their business – production, marketing techniques, etc.
- Objective: Improve efficiency of value creation
- Example: Assembly line production, airlines using e-tickets

The relation of product versus process technology

Object of analysis: industry level

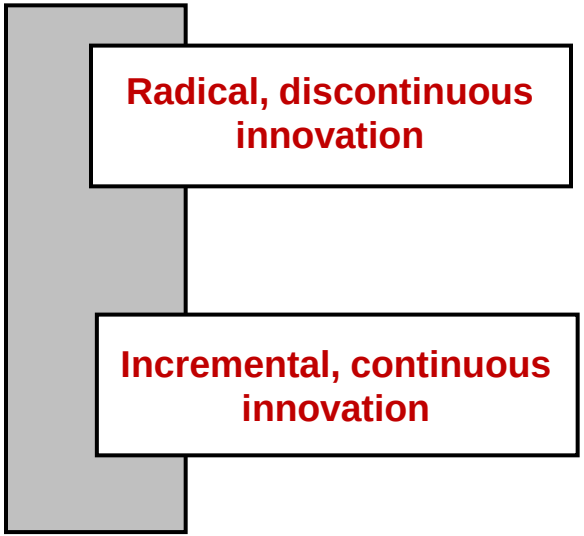


Source: James M. Utterback and William J. Abernathy. "A dynamic model of process and product innovation." *Omega* 3 (1975) 6: 639-656.

Different types of innovation (II): Degree of innovativeness (uncertainty): Radical *versus* incremental innovation

The innovativeness of an innovation process is characterized by the number of elements in a system effected by the innovation and the resulting uncertainty in performing the innovation project and diffusing its outcome.

It can be seen as the RESULT of an innovation process (output), but also as an OBJECTIVE when planning an innovation project (input).



- New to the world and fundamentally different to existing products and processes
- Risky and uncertain concerning technology, market acceptance, demand, regulation, …
- Example: Satellite phone technology

- Gradual changes or improvements to existing offerings
- Leveraging existing skills and knowledge
- Example: Development of the next MS Office package

Innovativeness as an input measure: Managing innovation based on the expected (desired) result

Why is it important for the manager of an innovation project to "define" the perceived (expected) degree of innovation when setting up the project?

- ***Information requirements***
- ***Budget & scheduling***
- ***Team composition***
- ***Stakeholder involvement***
- ***Internal communication of project …***

Why it is important to evaluate the achieved degree of innovativeness before the invention is being launched? to the market or its internal users?

- ***Marketing planning***
- ***Communications budget***
- ***Sales and launch execution …***

Some typical shares of different innovation types of a large consumer good company

- ***New-to-the-world*** *(really-new) products (**10% of new products**):* Inventions that create a whole new market. Ex.: Polaroid camera, Sony Walkman, Palm Pilot, Rollerblade skates, P&G Febreze and Dryel.
- ***New-to-the-firm products*** *(**20%**):* Products that take a firm into a category new to it. Ex.: P&G brand shampoo or coffee, Hallmark gift items, AT&T Universal credit card, Canon laser printer.
- ***Additions*** *to existing product lines (**26%**):* Line extensions and flankers that flesh out the product line in current markets. Ex.: Tide Liquid, Bud Light, Apple's iMac, HP LaserJet 7P.
- ***Improvements*** *and revisions to existing products (**26%**):* Current products made better. Ex.: P&G's continuing improvements to Tide detergent, Ivory soap.
- ***Repositionings*** *(**7%**):* Products that are retargeted for a new use or application. Also includes retargeting to new users or new target markets. Ex.: Arm & Hammer baking soda sold as a refrigerator deodorant; Aspirin repositioned as a safeguard against heart attacks.
- ***Cost reductions*** *(**11%**):* New products that provide the customer similar performance but at a lower cost. Exchanging components, materials, "cost engineering".

Source: Merle Crawford & Anthony Di Benedetto: New Products Management, 2011

Are there different kinds of innovation?

Structuring different types of innovation (Part 2)

Different types of innovation (III): Degree of change in the product system: Component versus architectural innovation

Source: Rebecca M. Henderson and Kim B. Clark. "Architectural Innovation: The Reconfiguration of Existing Product Technologies and the Failure of Established Firms." Administrative Science Quarterly 35 (1990) 1: 9-30.

System/ linkages \ *Components / core concepts*	Reinforced	Overturned
Unchanged	Incremental Innovation	Component Innovation
Changed	Architectural Innovation	Radical Innovation

Incremental Innovation	Gradual refinement/ improvement of existing components leaving the system unchanged
Radical Innovation	Complete overhaul of components and system
Component Innovation	Using new components within an unchanged system
Architectural Innovation	Reconfiguration of an existing system using unchanged or new components; main changes in design and way how components interact

Different types of innovation (IV): Degree of change from the firm perspective: Sustaining *versus* disruptive innovation

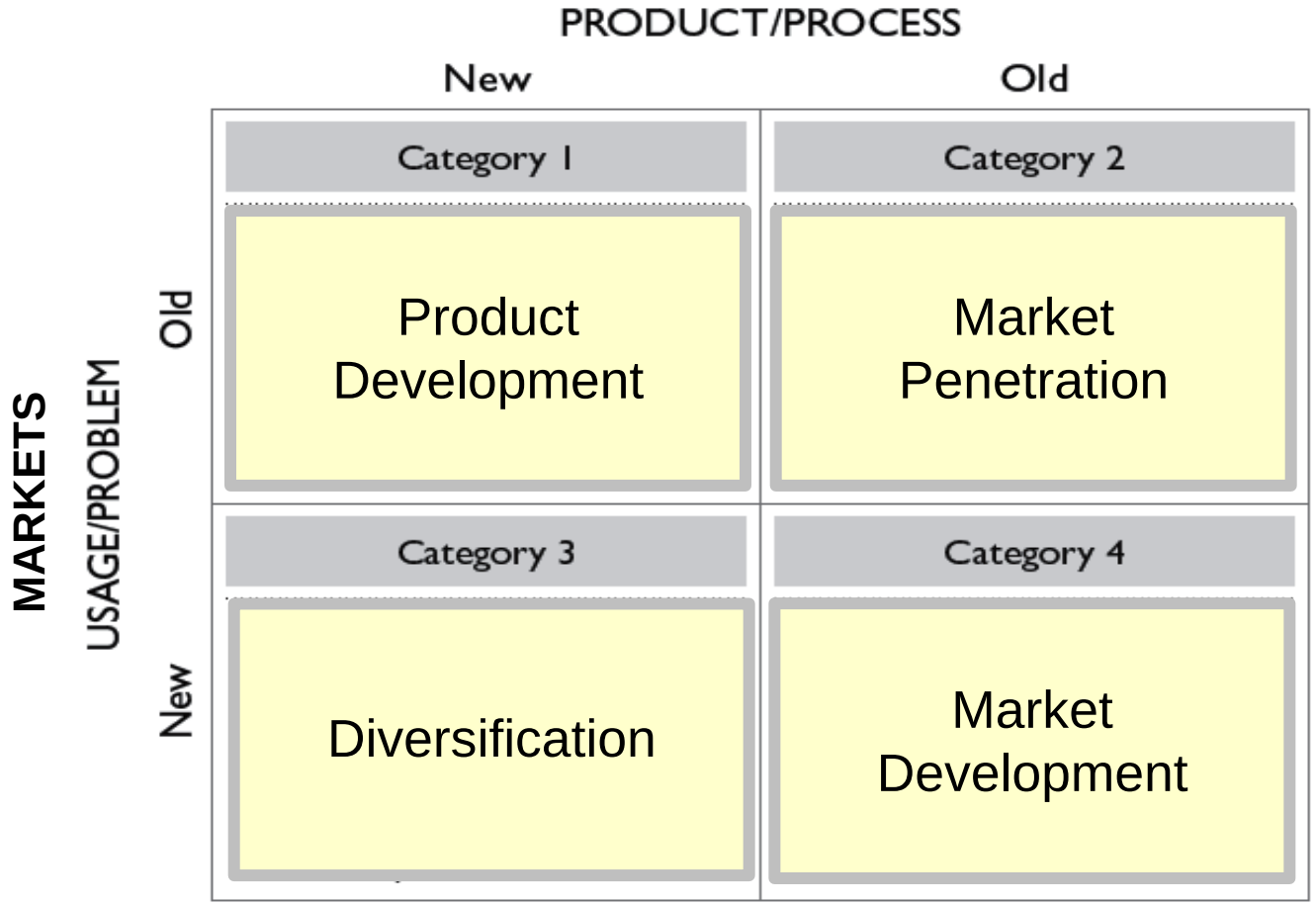
Performance improving ("sustaining") Innovation *(improvements of merit)*: Replacement of old model by a next and better version
Example: The new Volkswagen Golf.

Efficiency improving Innovation *(Process innovation)* An offering of the same solution for the same customers at a lower price („low-end disruptions"). *Example: Walmart's retail innovations, "just in time" manufacturing by Toyota.*

Market creating Innovation *(disruptive business model innovation)*: Transformation of existing (complex or expensive) solutions in such a radical manner that a new market is created *(with a new class of customers)*. Result of combining a cost-reducing technology with a business model.
Example: Video streaming "on demand" replacing the video rental store

Source: Clayton Christensen & M. Overdorf: "Meeting the challenge of disruptive change" *Harvard Business Review*, *78* (2000) 2, 66-77.
Picture Source: Wikipedia Media Commons (CC BY-SA)

A common structure of innovation categories: The “Ansoff Matrix”



Source: Ansoff, I.: Strategies for Diversification, Harvard Business Review, Vol. 35 Issue 5,Sep-Oct 1957, pp. 113-124

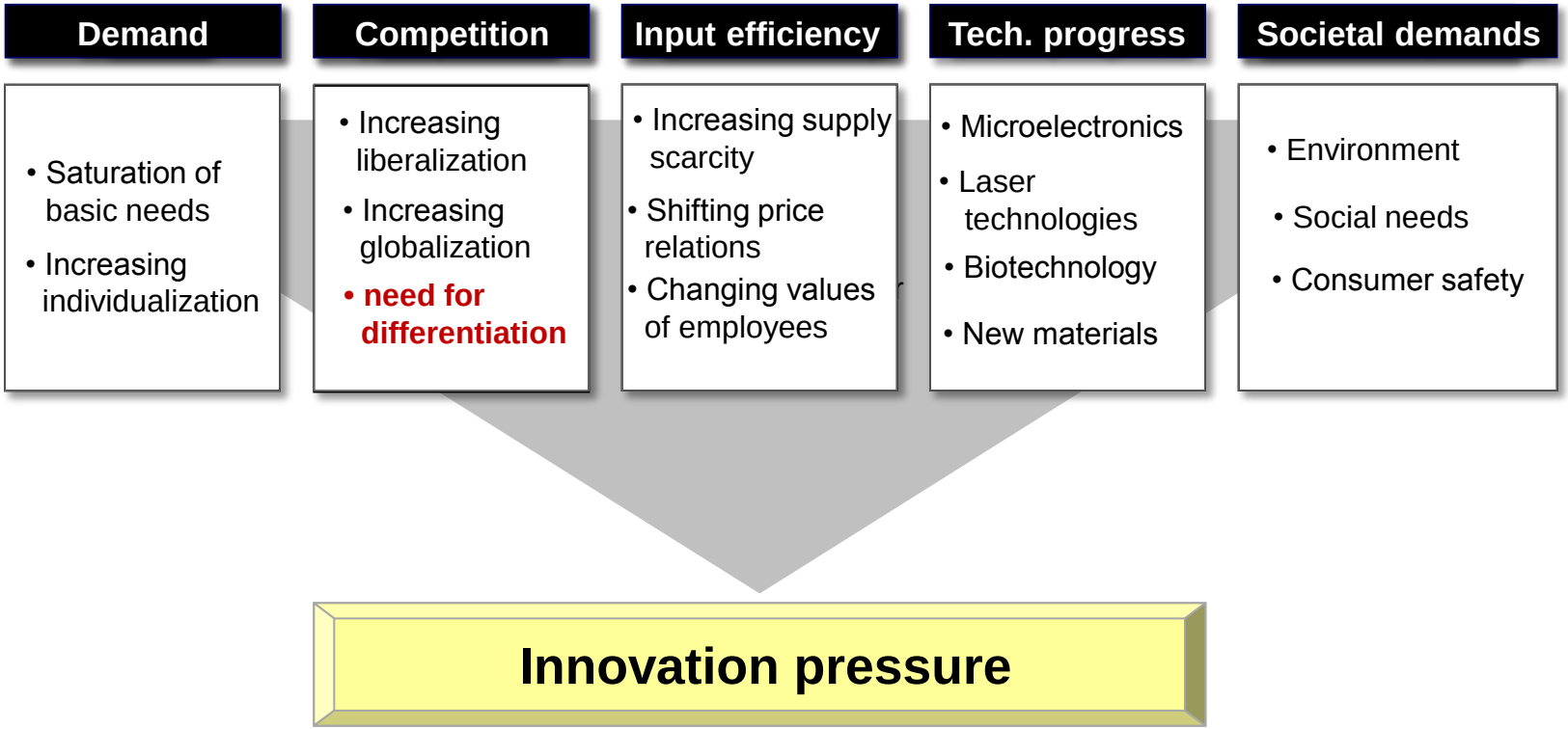
There are many shades of innovation – it is important to know what you want to achieve

(contingencies of an innovation project)

Why do we have to innovate?

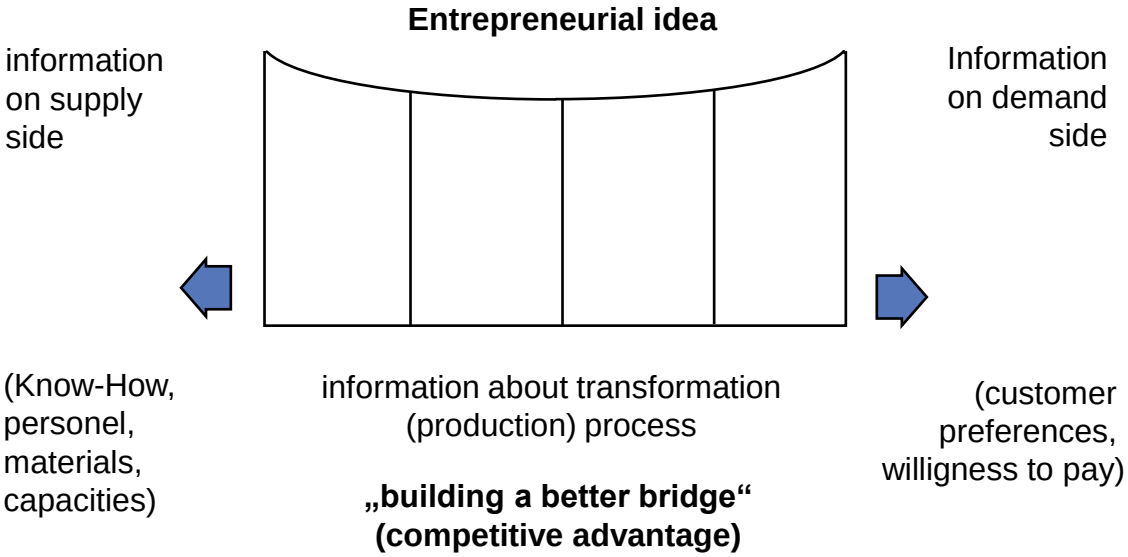
Outcomes and objectives of innovation

Why is innovation important for the company?



Why is innovation important for the company?

Schumpeter‘s Theory of Industrial Development



Entrepreneurship = the discovery and exploration of information advances

Innovation of an entrepreneur = „*Exploration of new combinations*“, the innovator becomes a „*creative destroyer*“

Why is innovation important for the company?

Michael Dell is a typical example of a Schumpeterian innovator

Entrepreneurial idea

information on supply side

(Know-How, personel, materials, capacities)

Information on demand side

(customer preferences, willigness to pay)

„building a better bridge“ (competitive advantage)

Michael Dell’s innovations:

Business Model Innovation, service innovation, plenty of process innovation, using the existing architecture of the PC industry

Why is innovation important from the perspective of our society and economy at large?

- To increase **economic growth** by **producing the same** with less factor input or by **producing more** with the same factor input *(quantitative growth)*
- To get products which **better fit to customer needs** (*qualitative growth*, enhancing consumer welfare)
- To **increase productivity of downstream industries** by supplying better components and machines
- To **support ecological or social sustainability** by producing products and services in a different, more efficient way

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- **Because knowledge once created can be used by others as well.**

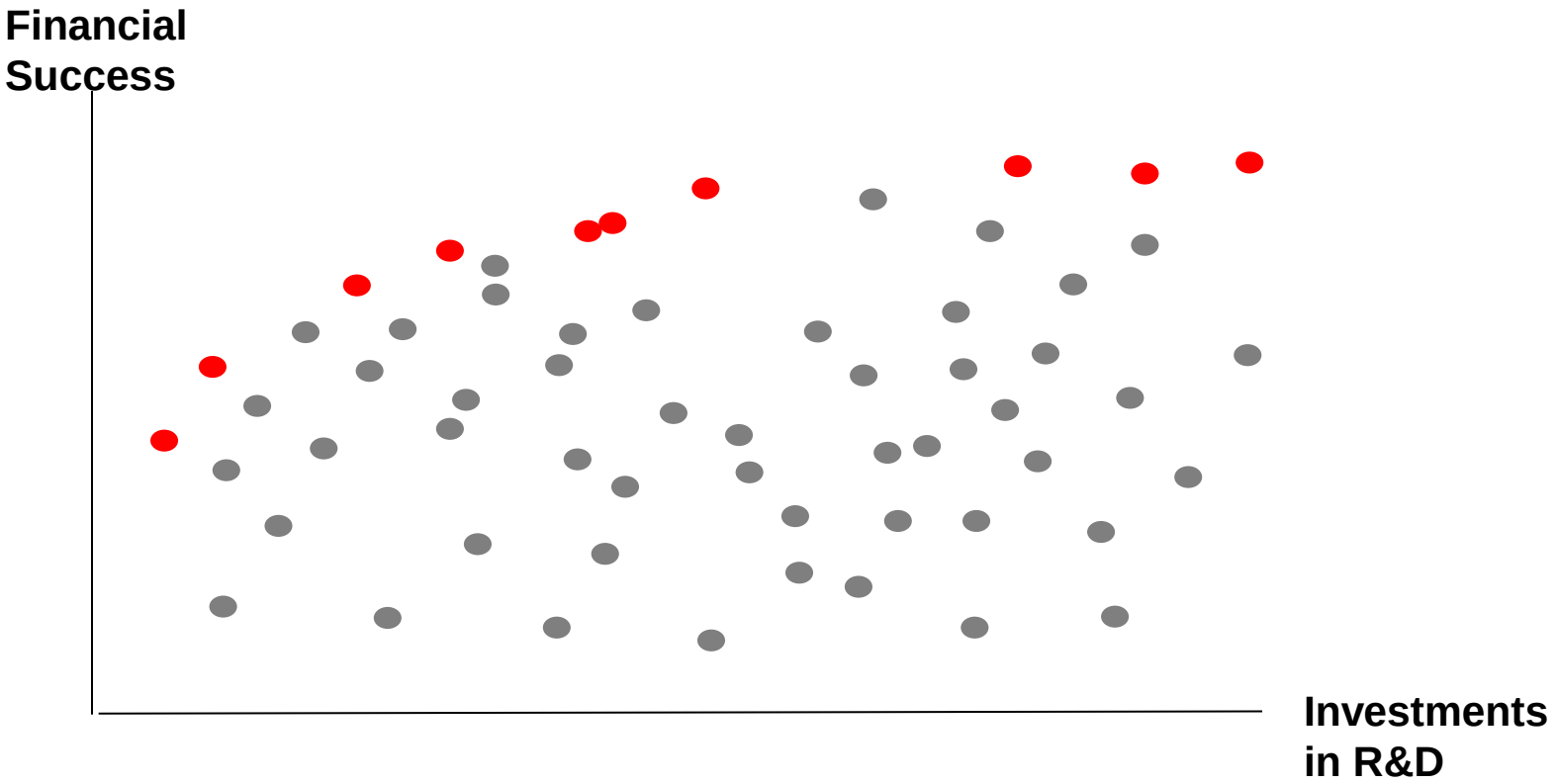
That **we have to innovate seems to be out of question today.**

The question is *how*.

From why to how

Searching for best practices of managing innovation

Relationship between R&D Input and Output



The consequence:

A focus on best practices and "proven" methods for successful innovation

The World's Most Innovative Companies

Forbes

OTHER LISTS

World's Billionaires
World's Most Powerful People
Forbes 400 Richest Americans
World's Leading Public Companies
World's Most Powerful Women

BROWSE THE LIST

Rank	Company	5-Year Avg. Sales Growth (%)	5-Year Avg. Net Income Growth (%)	Enterprise Value ($bil)	Innovation Premium*
1	Salesforce.com	39.5	78.7	20.7	75.1
2	Amazon.com	32.0	37.6	92.7	58.9
3	Intuitive Surgical	43.4	36.4	13.4	57.6
4	Tencent Holdings	69.0	75.4	46.5	52.3
5	Apple	35.1	60.7	303.4	48.2
6	Hindustan Unilever	10.0	4.0	15.5	47.7
7	Google	35.0	37.1	138.1	44.9
8	Natura Cosméticos	17.0	13.5	10.2	44.5
9	Bharat Heavy Electricals	27.2	25.0	19.5	43.6
10	Monsanto	13.4	44.7	41.3	42.6

TR50 – Companies finding innovative solutions to new challenges

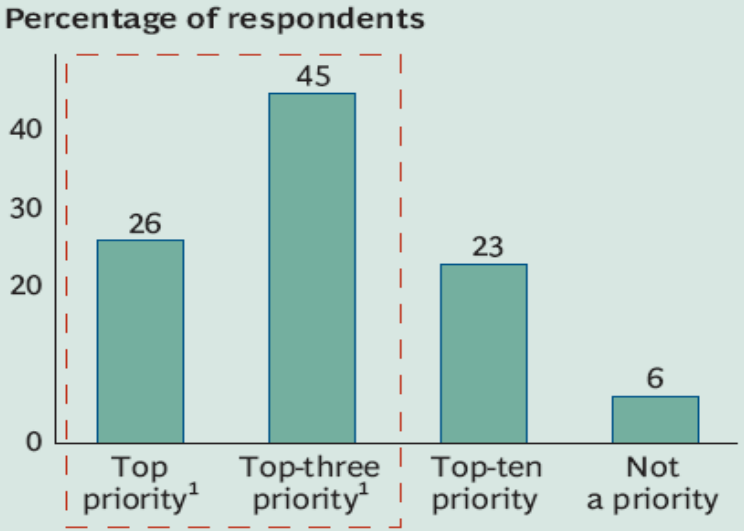
A123 Systems
Akamai
Amazon.com
Amyris
Apple
Applied Materials
ARM Holdings
Complete Genomics
First Solar
Geron
Goldwind Science and Technology
Google
HTC
IBM
iRobot
Nissan
Novartis
Pacific Biosciences
Roche
Siemens
Suntech
Toyota
Private Companies
American Superconductor
BIND Biosciences
BrightSource Energy
Calxeda
Cellular Dynamics International
Claros Diagnostics
Cotendo
Facebook
Groupon
Joule Unlimited
Lattice Power
Layar
Lyric Semiconductor
Novomer
PrimeSense
Serious Materials
Silver Spring Networks
SpaceX
Square
Synthetic Genomics
1366 Technologies
Twitter

Source: http://www.technologyreview.com/tr50/

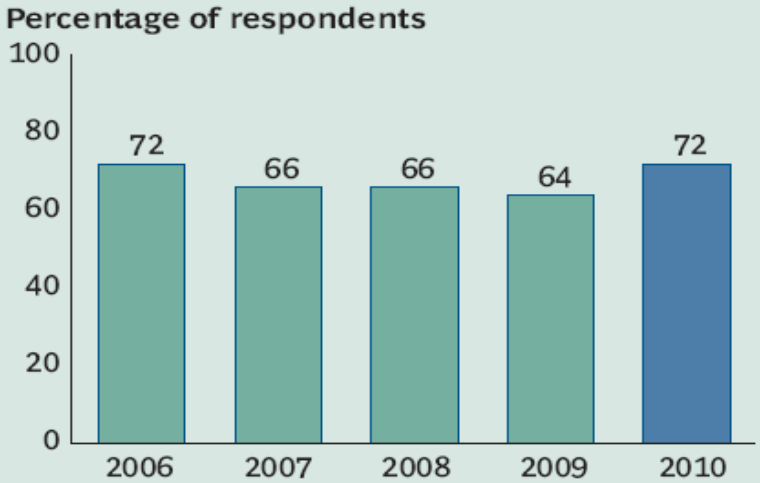
What do executives think and do about innovation?

Innovation is a top strategic goal of executives

Where does innovation rank among your company's strategic priorities?



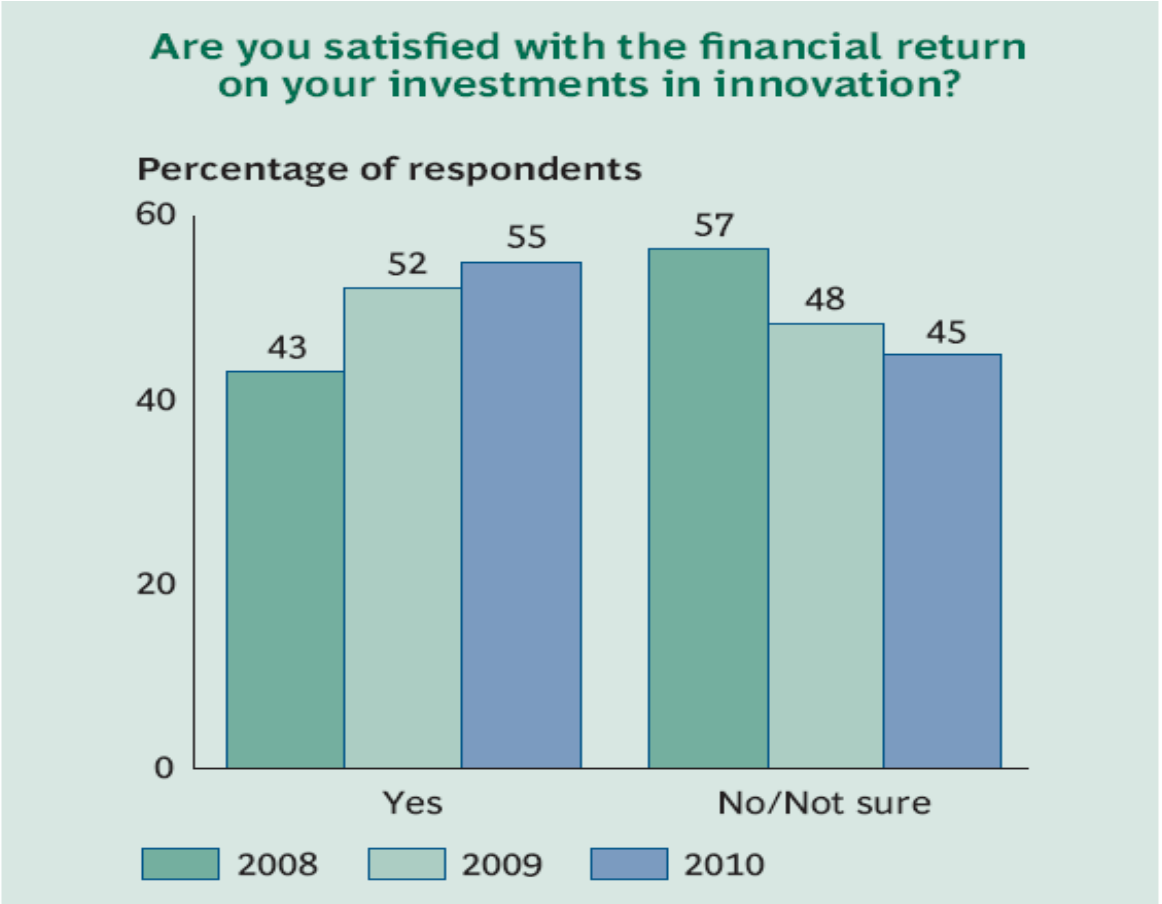
Percentage of respondents who consider innovation a top-three strategic priority



Sources: BCG Senior Executive Innovation Surveys, 2010, 2009, 2008, 2007, 2006.
[1]The total percentage of respondents who said that innovation is one of their company's top-three priorities rounds to 72 percent.

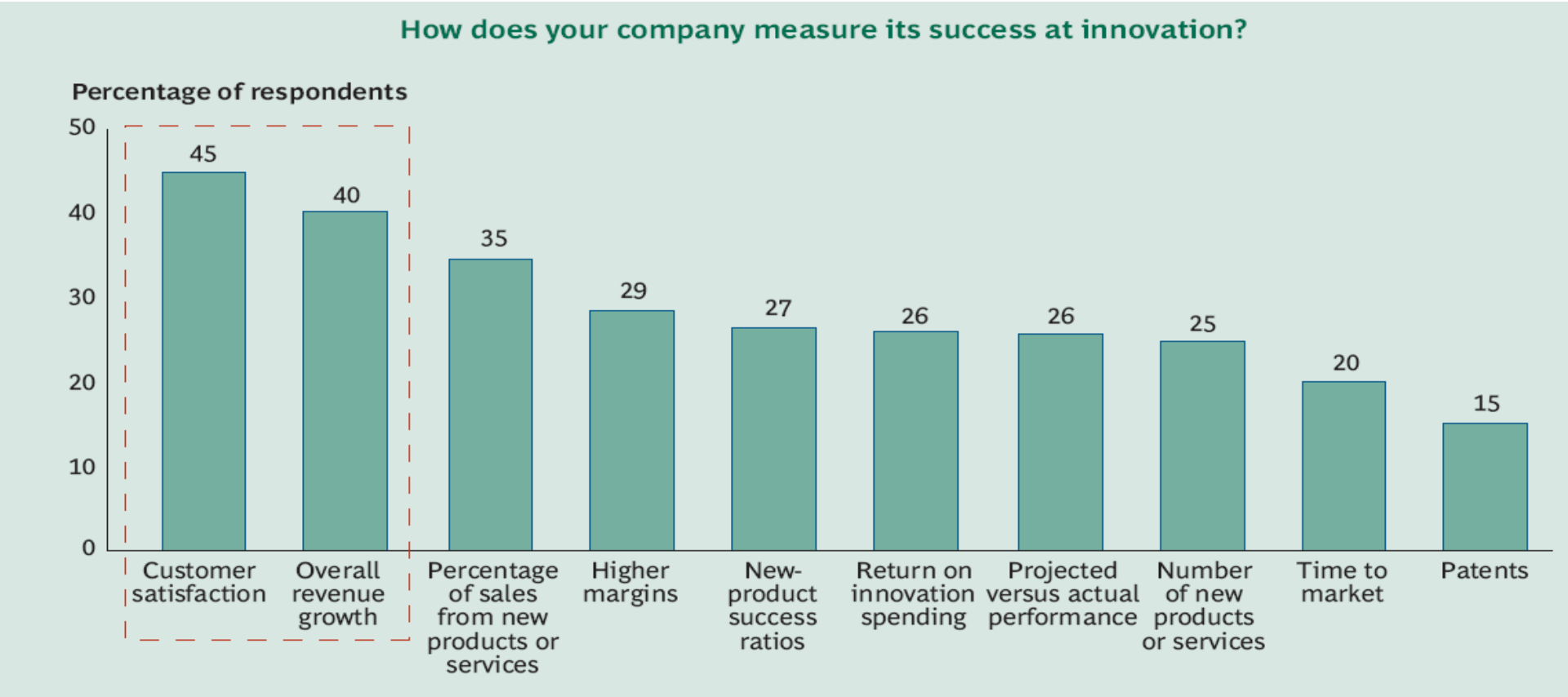
Source: BCG Innovation Survey 2010

Satisfaction with the return on innovation spending has risen for the past three years, but remains rather low



Source: BCG Innovation Survey 2010

How to measure success of innovation: customer satisfaction and revenue growth are dominating metrics



Source: BCG Innovation Survey 2010

A risk-averse culture and lengthy development times are the biggest hurdles to benefit from innovation

Source: BCG Innovation Survey 2010

Innovation management
(as a discipline of management research):

Identification of success factors and hurdles to achieve a high return on innovation spending. Development of corresponding tools and methods.

How does innovation happen?

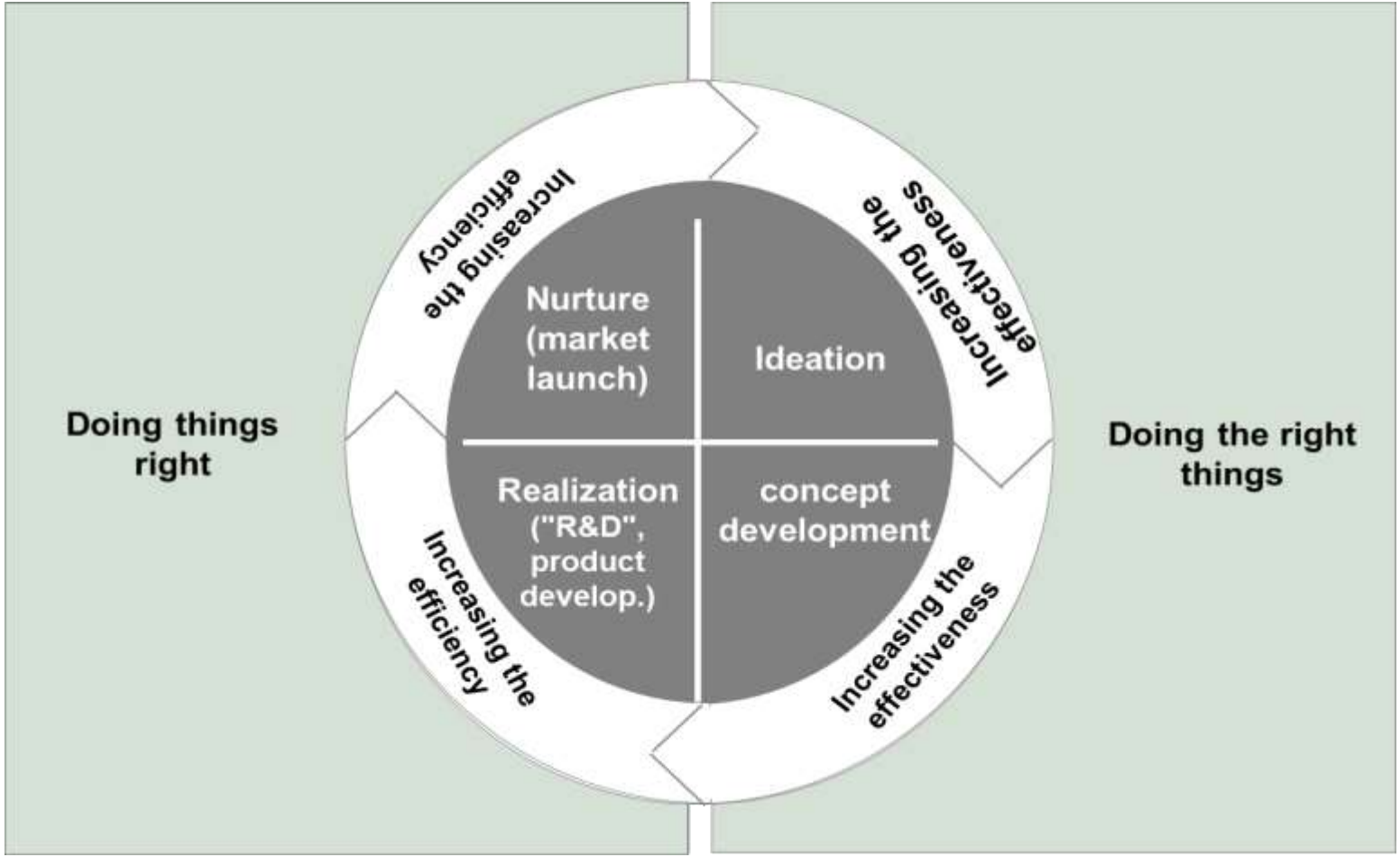
Innovation = information processing in a structured process

There are two main understanding how innovation happens

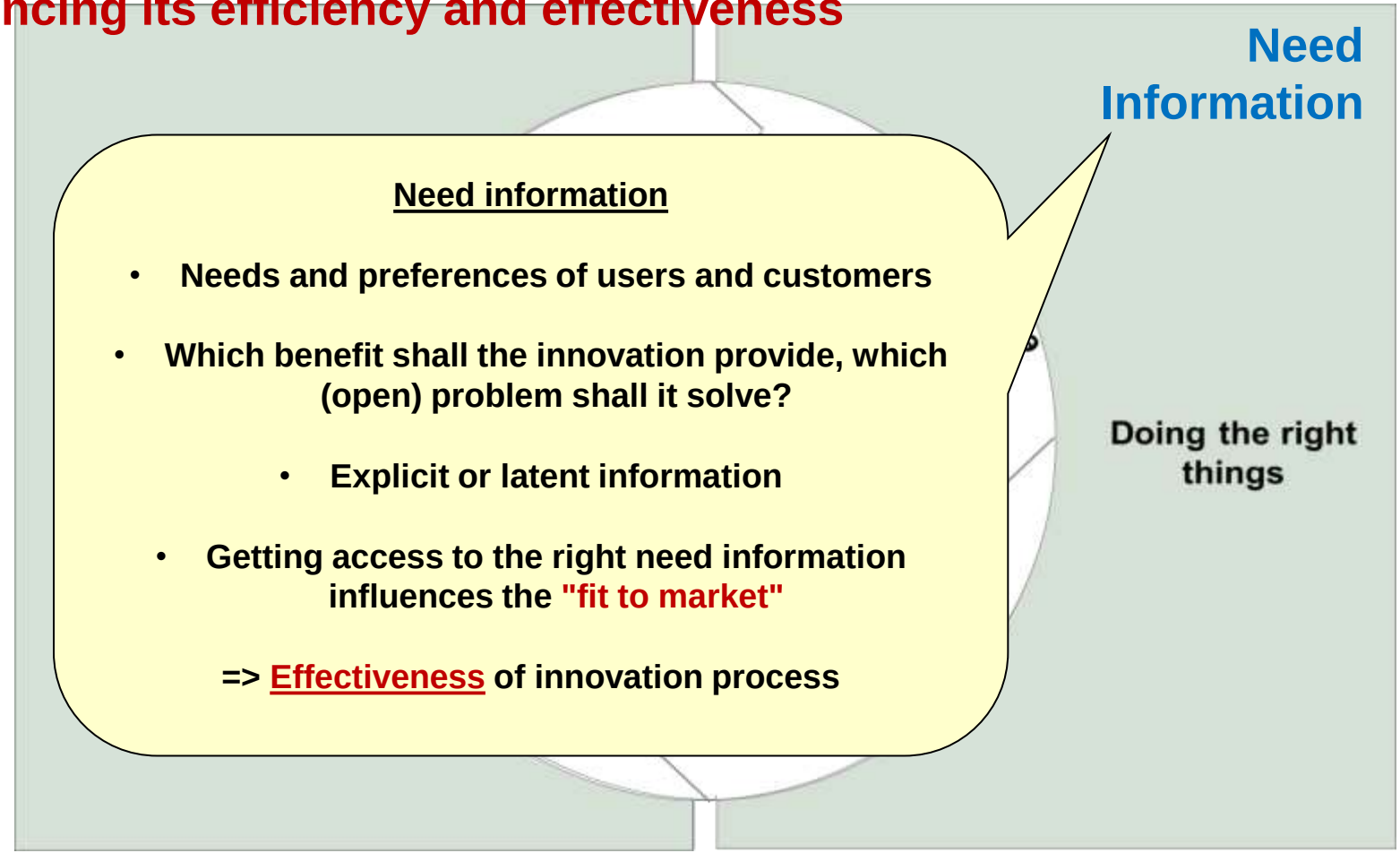
- **Innovation is the result of a (frustrated) user**
- Not a systematic process
- **Invention is happening anyway**. It is the task of the company to build "absorptive capacity" to capture this external input
- Focus on managing this **inflow of external input**
- User innovators *profit from using their invention*

- **Innovation is the result of a dedicated firm activity**
- It is a **systematic process of different stages**: From opportunity recognition towards market launch
- Managing the risk of innovation (uncertainty)
- Focus on internal **creativity and problem solving**
- Manufacturer innovators *profit from selling the innovation*

A typical structure of a systematic innovation process



Every innovation process requires two kinds of information, influencing its efficiency and effectiveness



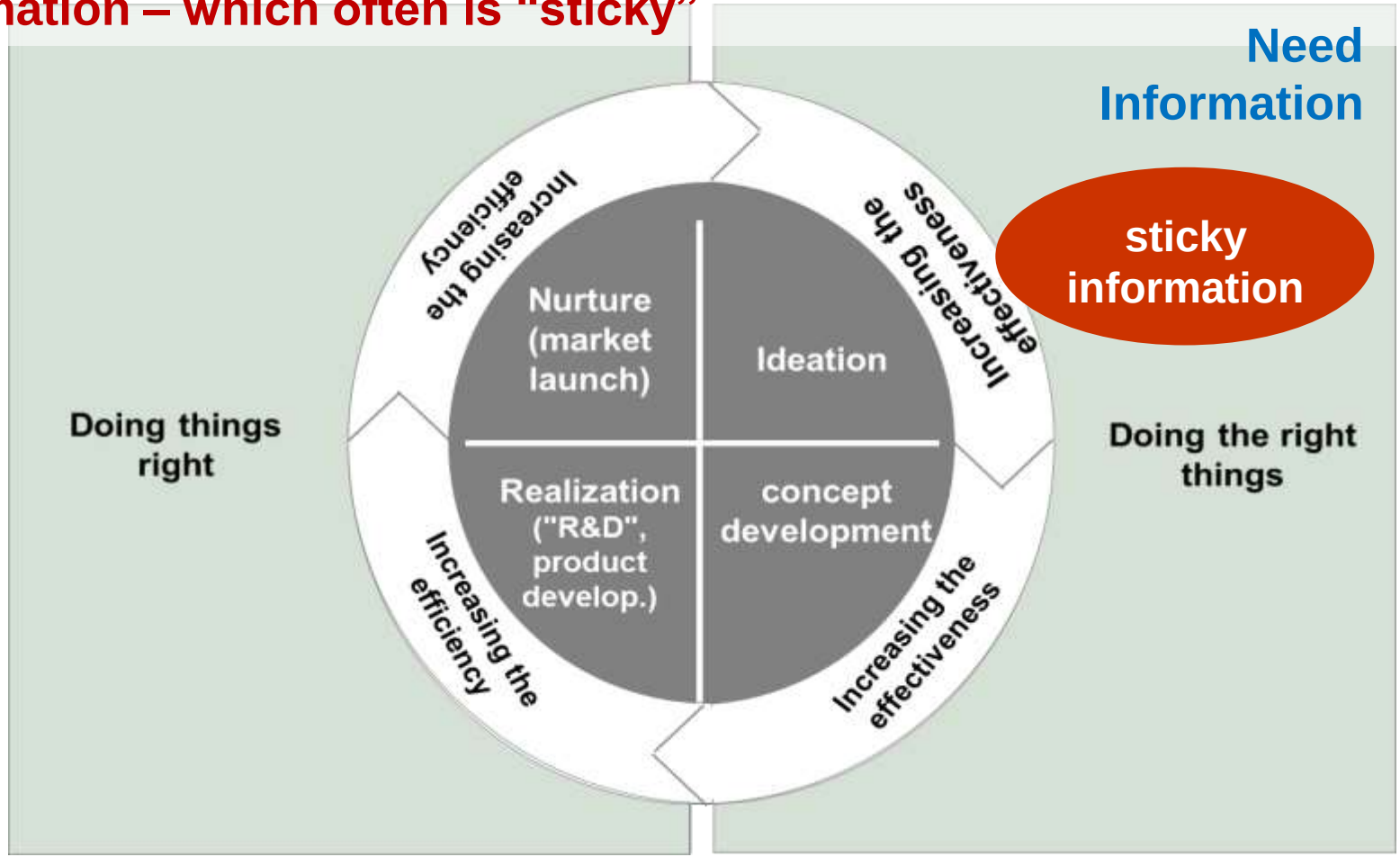
Need information

- Needs and preferences of users and customers
- Which benefit shall the innovation provide, which (open) problem shall it solve?
- Explicit or latent information
- Getting access to the right need information influences the "fit to market"

=> Effectiveness of innovation process

Most new products / services do not flop because of technical failure, but because they do not meet customer requirements – firms did not get sufficient access to need information.

Many companies face the problem of obtaining the right need information – which often is “sticky”



Sticky information is information that is difficult to transfer between two actors

"The stickiness of a given unit of knowledge or information is defined as the **incremental expenditure required to transfer that unit from one place to another**, in a form that can be accessed by the recipient. When this expenditure is low, information stickiness is low; when it is high, stickiness is high. By implication, sticky information is harder to move." (Eric von Hippel, *Management Science* 1994)

Some reasons:

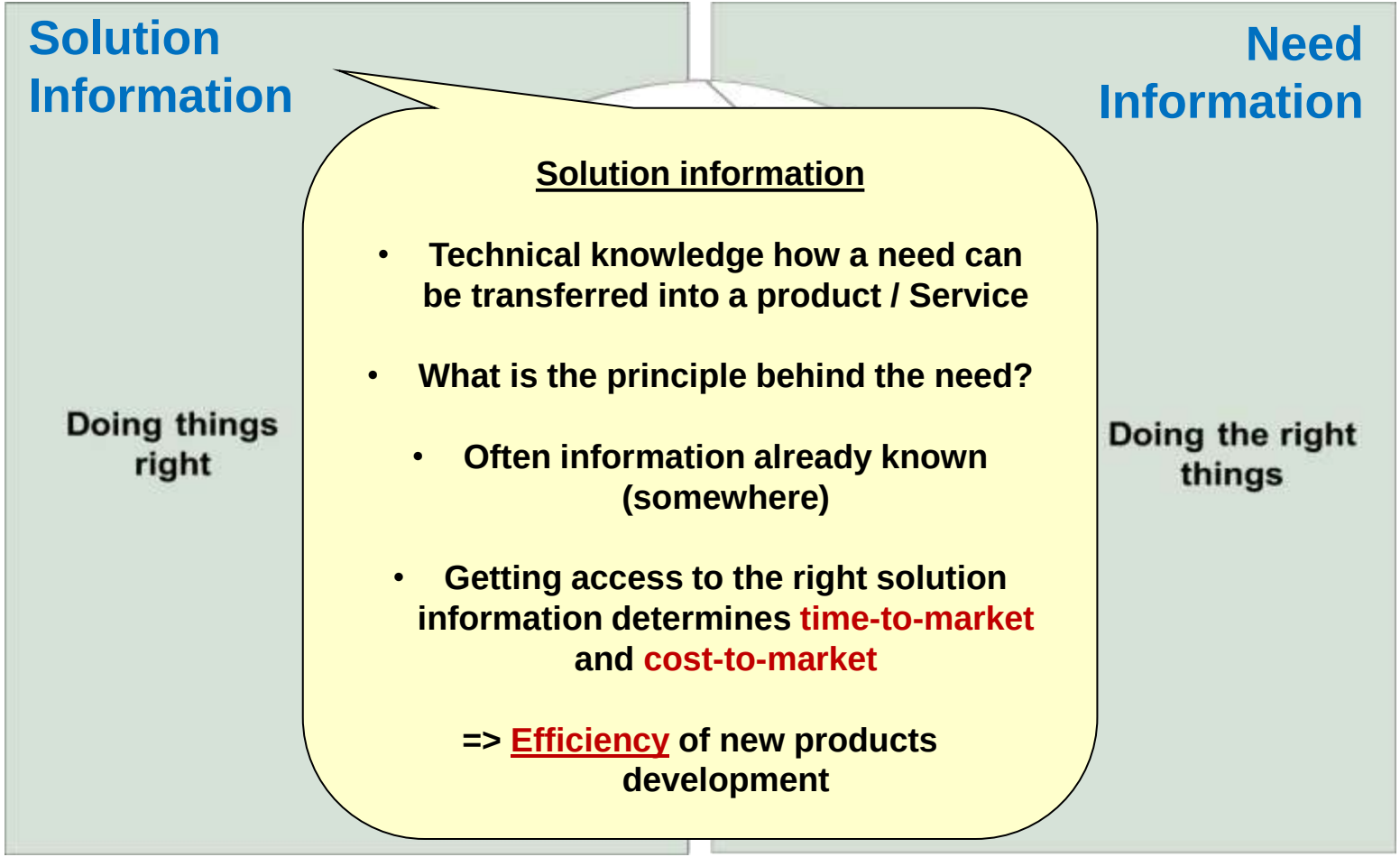
>> Information needed by developers may be ***tacit***

Can you tell your child how to ride a bike?

>> A ***lot*** of information is often needed by developers

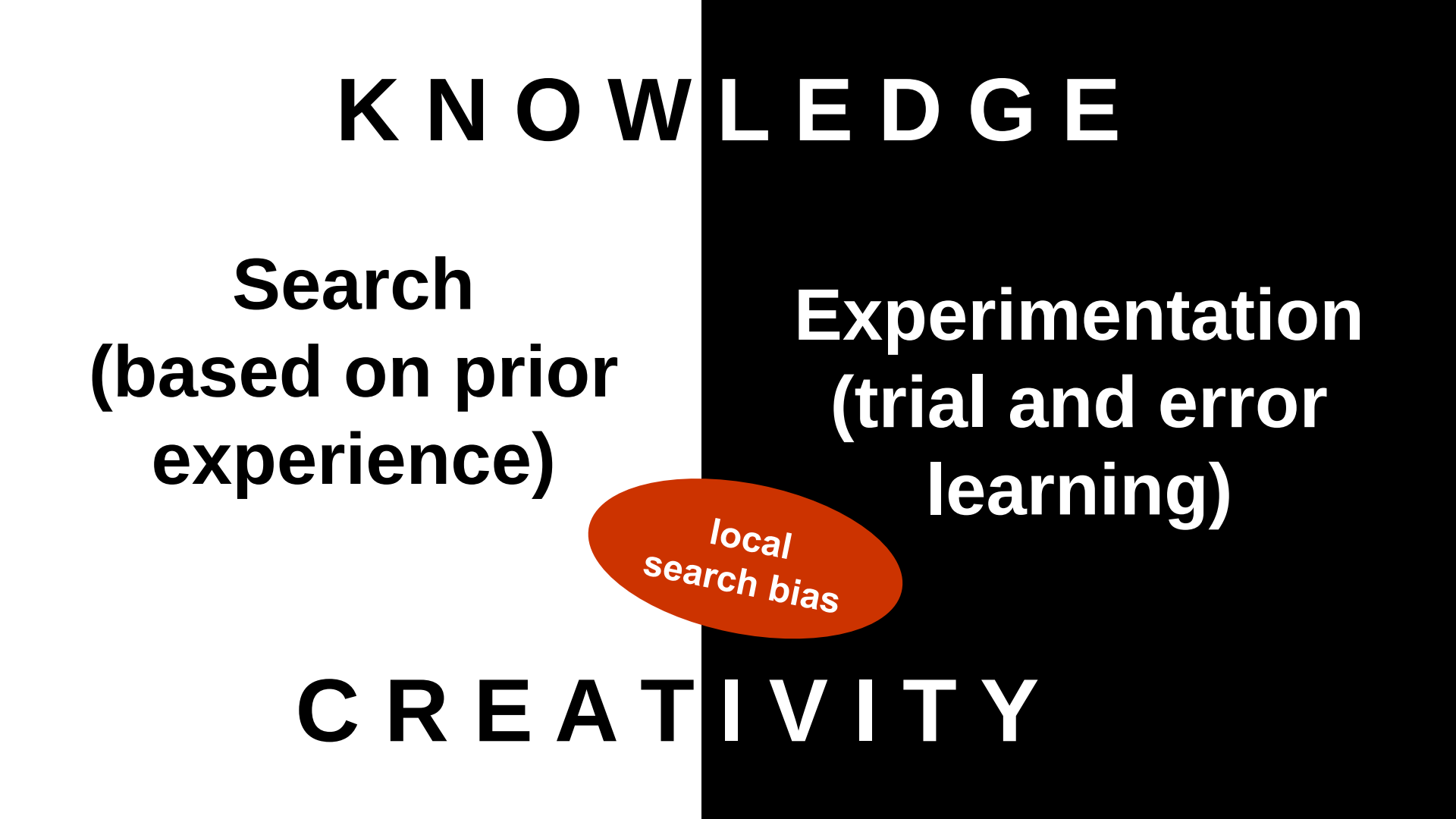
"You didn't tell me you were going to use the product that way!"

In development, firms need to get access to solution information



When an innovation project does not meet its "time to market" or "cost to market" objectives,
the cause often is that the development team did not have access to the right solution information – or was searching at the wrong place

Innovation (as an activity) = disciplined problem solving


KNOWLEDGE
Search (based on prior experience)
Experimentation (trial and error learning)
local search bias
CREATIVITY

We tend to search only in the “known” – we have a bias for local search

(“stuck in a paradigm”, “tunnel perspective”)

Local search: **To look only for solution information in your own technical domain based on previous experience**

- **Sometimes,** prior experience **is helpful** – when new problem is closely related to old problem (***continuous improvement***)
- **Sometimes**, Prior experience **is not helpful** – can impede problem resolution -> ***Problem: "stuck in a paradigm", "tunnel perspective"***

Local search bias: Negative biasing by previous experience may block an innovator to find the "best" solution for a given question

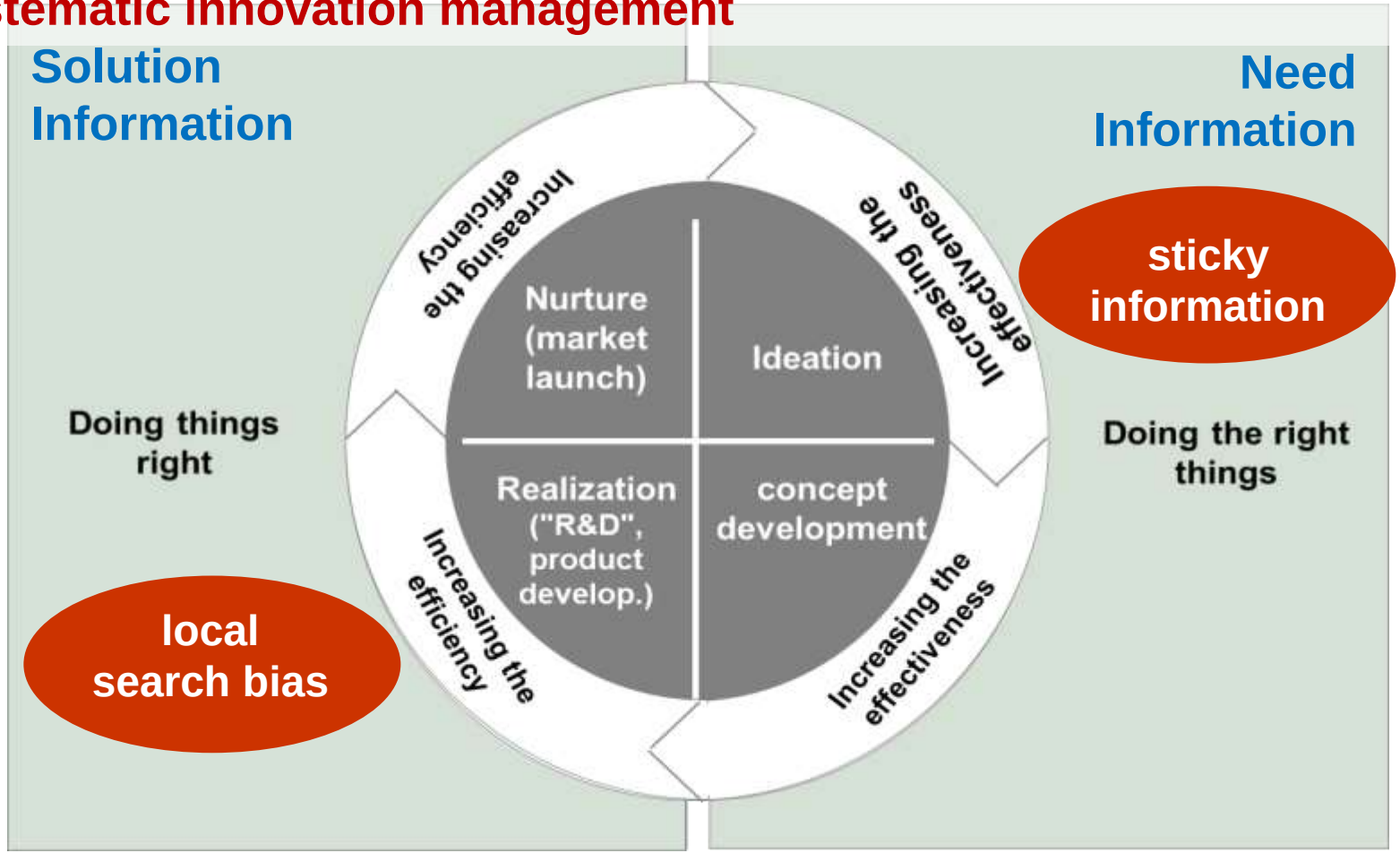
=> "reinventing the wheel"

=> long "time to market", high "cost to market"

Some reasons for local search:

Experience and previous training, Limited access to information available, Methods to evaluate information

Overcoming these two challenges is a central success factor of systematic innovation management



What are methods to reduce the problems of "stickiness of need information" and the "local search bias"?

Some measures to get access to (sticky) need information

Market research / "Voice of the customer" methods

- Qualitative research, e.g. trend scouts, focus groups
- Quantitative research, e.g. surveys
- Combined methods, e.g. "Outcome driven innovation"
- Trend studies, third-party-data

Observing customers

- "Empathic design", e.g. observing customers in real environments
- Clinics and lab research (usability)
- Participative design

Using past-data and iterations

- Exploration of last season's sales data, educated guess of experienced sales person etc.
- Purchasing trend studies, using analysts and consultants
- Study competitors

Some measures to reduce the local search problem

Change your search style

- Training to improve cognitive search style, get experience in search
- Creativity techniques like brainstorming, TRIZ, QFD, etc.

More effective external search

- Broaden the breath and width of search (**open innovation**)
- Assign gatekeepers and special boundary roles
- Build absorptive capacity: establish bridging strategies

Partner with organizations with different knowledge

- Alliances and networks, R&D consortia, supplier integration in R&D
- Mergers & acquisitions
- Informal organizational arrangements

Find people with different knowledge

- “Knowledge flows with people moving” => diversity in organizations
- Interdisciplinary teams
- Job rotation

Source: Building on Karim Lakhani (2007)

In our lectures, we will discuss these and other methods and organizational principles in larger detail

What is the *real* challenge of innovation?

Thinking about innovation shapes the way we manage it

Innovation often follows an established paradigm (basic model)

Ray Ewry (1873-1937) Olympic Games, London, 1908

World record: 1,98

Mildred McDaniel (1933) Olympic Games, Melbourne, 1956

World Record: 2,15

Richard Fosbury (1947), Olympic Games, Mexico, 1968

World Record: 2,24

Source: John Bessant, Exeter University
Picture Source: Wikipedia Media Commons (CC BY-SA)

How we think about something ... shapes the way we manage it.

Frugal innovation: Thinking differently, “stealing with pride” from other industries

GE MAC 5500: ~US$ 10,000

GE MACi: US$ 535

Commercially available printer, similar to the one used to print bus tickets

Simple Alpha-numeric display

Very few buttons

Commercially available charger, similar to cell phones

Same algorithm as high-end ECG machines delivers high clinical quality, adheres to FDA standards

No unnecessary features added

Use of near and far analogies

Source: S. Buse 2015; R. Tiwari & C. Herstatt Assessing India's lead market potential for cost-effective innovations. *Journal of Indian Business Research*, *4* (2012) 2, 97-115.

Successful Innovation Management:

Balancing Short-Term Profitability with Long-Term Sustainability

The fundamental problem of managing innovation on an aggregated level …

What is the *real* challenge of innovation?

The innovation challenge and the exploitation-exploration paradigm

Successful Innovation Management:

Balancing Short-Term Profitability with Long-Term Sustainability

The fundamental problem of managing innovation on an aggregated level …

Exploration versus exploitation

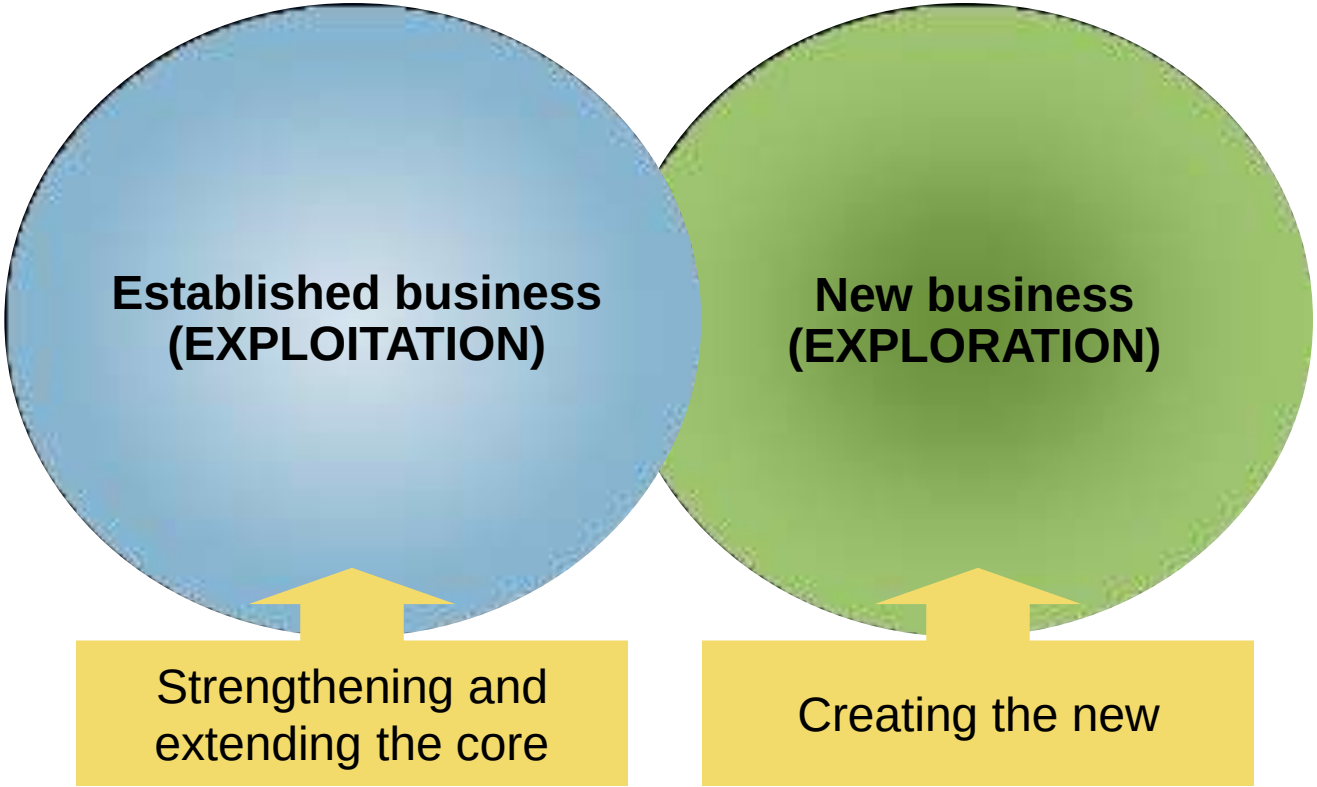
Foundation: Article by James March (1991)

James G. March, "Exploration and exploitation in organizational learning", *Organization Science,* 2 (1991) 1: 71-87.

- **Exploration**: "... includes things captured by terms such as search, variation, risk taking, experimentation, play, flexibility, discovery, innovation." ***=> radical, disruptive innovation***
- **Exploitation**: "... includes such things as refinement, choice, production, efficiency, selection, implementation, execution." ***=> incremental, performance-improving innovation***

Firms need both sets of innovative activities for long time survival. *But as their execution demands very different activities, capabilities, processes, and evaluation criteria,* **firms often focus on exploitation – *and fail ...***

Firms need to master two distinct challenges at the same time



Fir me

Established business (EXPLOITATION)

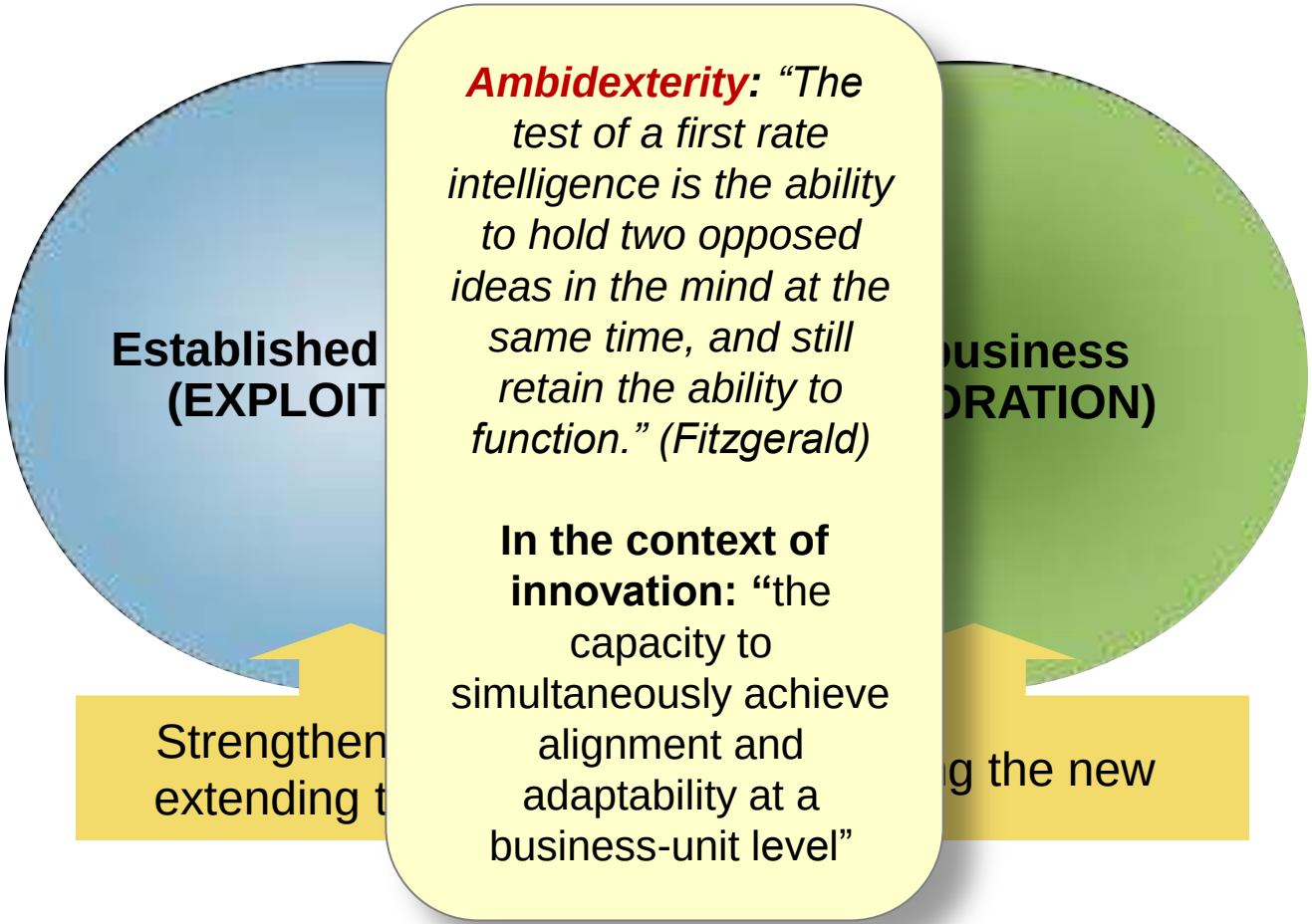
New business (EXPLORATION)

Pictures: Wikipedia Media Commons (CC BY-SA)

Firms need to master two distinct challeng

Source: licensemag.com, thedrum.com/news/2015/01/27, bbc.com/news/technology-31502898

Firms need to master two distinct challenges at the same time



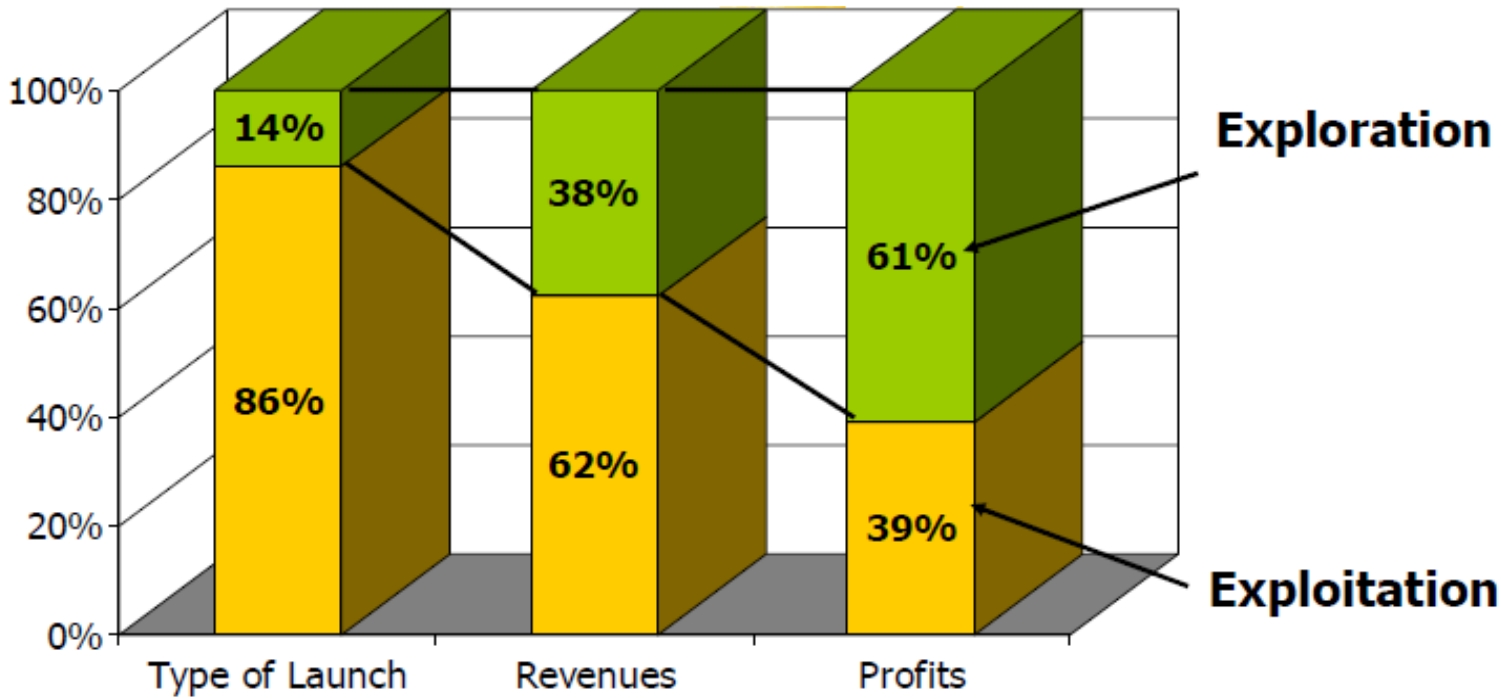
Ambidexterity*: *"The test of a first rate intelligence is the ability to hold two opposed ideas in the mind at the same time, and still retain the ability to function." (Fitzgerald)

In the context of innovation: "the capacity to simultaneously achieve alignment and adaptability at a business-unit level"

A risk-averse culture and lengthy development times are the biggest hurdles, finds BCG study

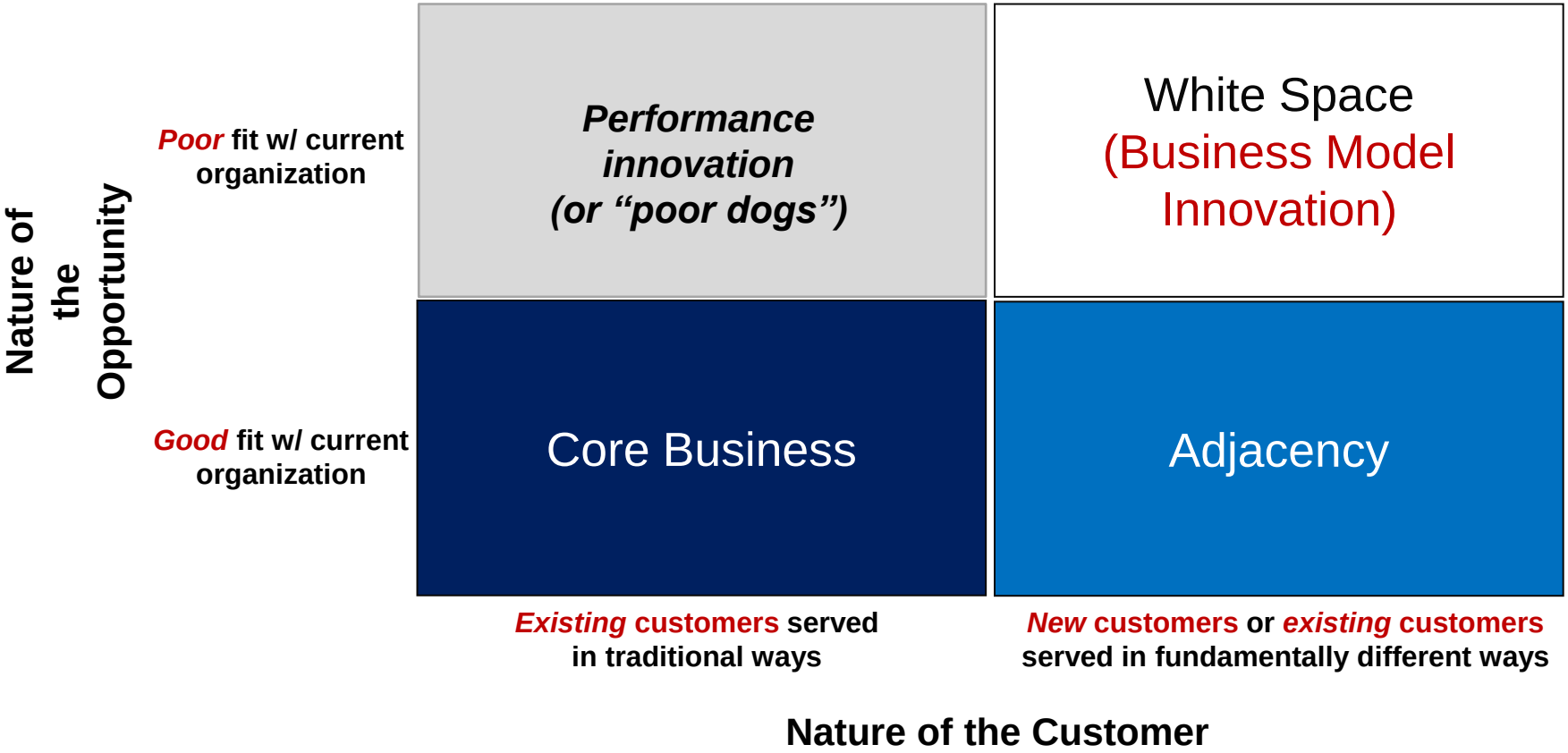
Source: BCG Innovation Survey 2010

Mastering exploration is important: It is key driver for profit



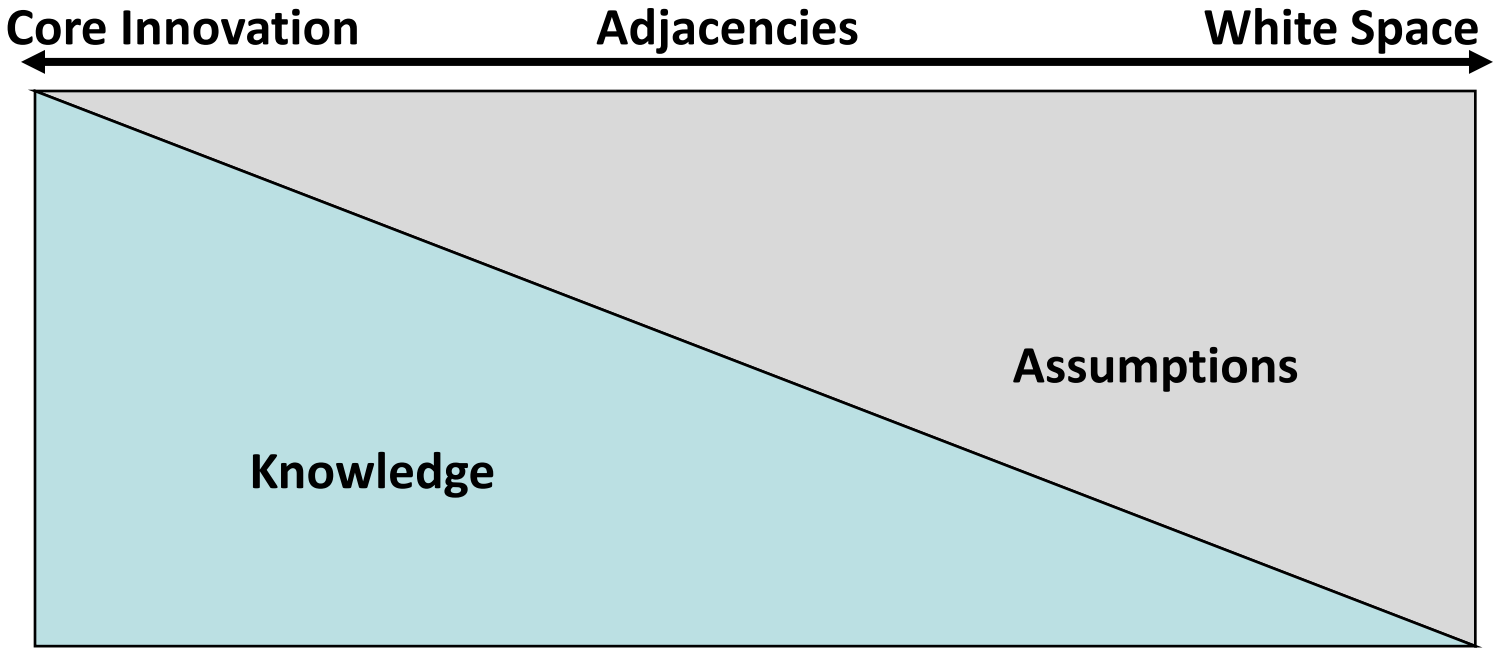
Source: PDMA Study 2010

Circumstances of innovation:
Fit of new opportunities and the nature of customers served



Source: M.W. Johnson: Seizing the White Space, 2010

The more we move to the “white space” (=engage in exploration), the more we have to build and manage assumptions



Source: M.W. Johnson: Seizing the White Space, 2010

The recent focus on business model innovation emphasizes an innovation system that allows firms to deal with assumptions about their future – *and to create (and test) new business models as systematically as new products*
(i.e. to engage in exploration)

What did we talk about in all the previous slides?

Summary and conclusions

A few important things to remember

- **Innovation** is the **creation (invention), introduction (launch) and successful diffusion** of products, systems, or processes which are **new from the perspective** of the particular organization or user.
- Innovations are **open ended, complex problems** and result from a **social process**.
- They often have their **origin in an user with an open need**, but also are the **result of a structured innovation activity** by a firm.
- **Identifying "best practices"** of firms with high innovation performance is a core activity in innovation research.

A few important things to remember

- **Addressing the two core problems of managing an innovation project:** getting access to the right “sticky” **need information**, and finding **technical solution information** without being limited by “local search”.

- The idea of the **stage-gate process** is to de-risk the consequences of making innovation activities under insufficient information.

- **Mental models** shape our understanding of innovation and provide the "sandbox where we play" to innovate: Need to **balance between exploration *(long-term sustainability)* and exploitation *(short-term profitability)*.** This is perhaps the largest challenge of managing innovation.

Stay open, start innovating, and to explore innovation

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