



# Product Development of Complex Systems Now and in the Future

Christer Norström

# Outline

- What are the characteristics of complex systems?
- What is the current paradigm?
- What is happening right now?
- What are the driving factors for changing the paradigm?
- Who will be the winners?
- What are the keys for being successful?
- Discussion

# What is a complex industrial system?

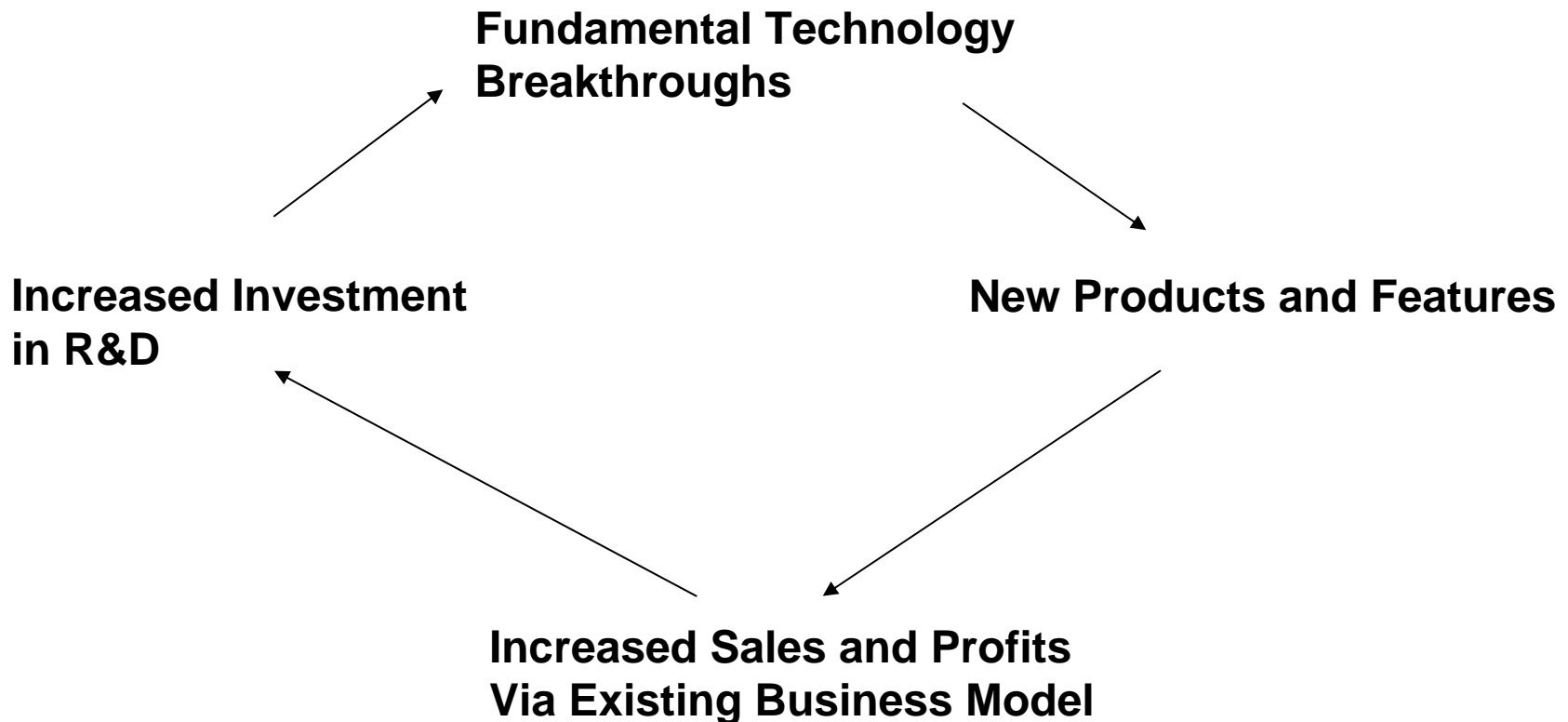
- **Complex system** is a system comprised of interconnected simple parts, that together exhibit a high degree of complexity from which emerges a higher order behavior.
- **No single** person understands the complete system.
- The system is long-living and has been developed by generations of engineers.
- ...

# The Closed Innovation Paradigm

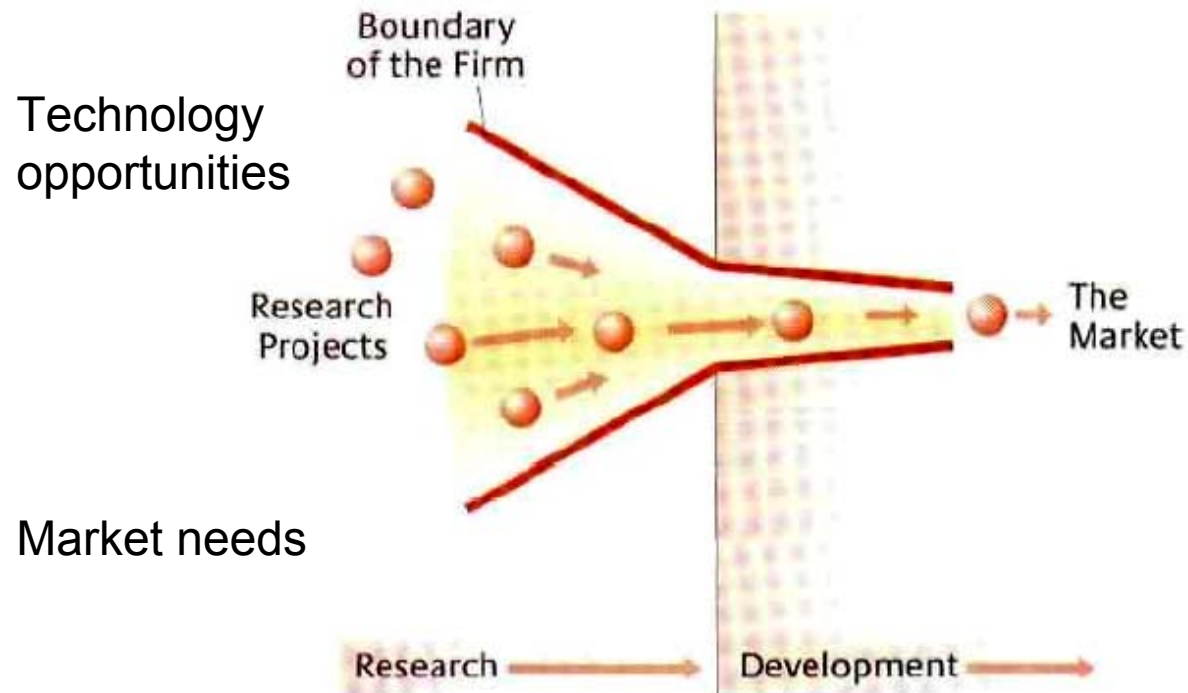
## **R&D seen as a necessary strategic asset:**

- If we discover a new technology ourselves, we will get to the market first
- The company that gets an innovation first usually wins
- This means that we must have the best and brightest people working within our organization
  - If we are no. 1 in making R&D investments, we will discover the best ideas and lead the market
- We must control Intellectual Property (IP) so that our competitors don't profit from our ideas

# Closed Innovation Paradigm – the business logics



# The Closed Innovation Paradigm – the process



# Some erosion factors (of CI)

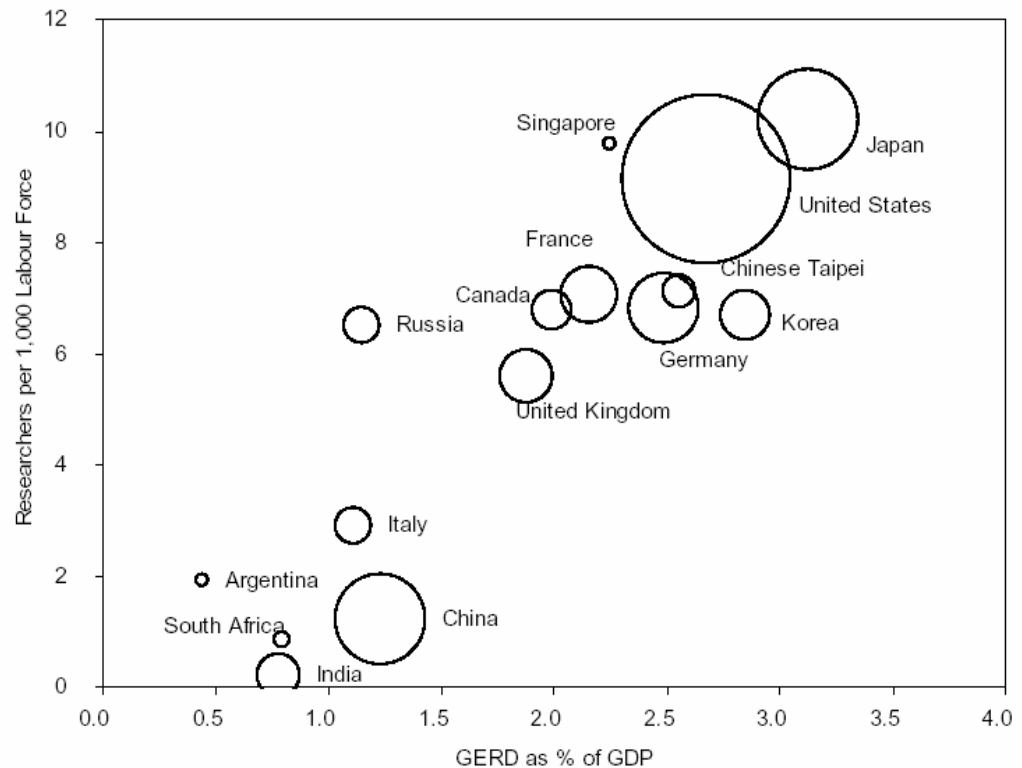
1. Increasing availability (and mobility) of skilled workers
2. The Venture capital market (from 1980)
  - \$700 million in 1980s, \$80 billion in 2000
  - Booming stock market → unchallenged compensation packages when joining start-ups
3. External options for ideas sitting on the shelf
  - Factors 1 + 2 + shorter product life cycle → new path to market
4. The increasing capability of external suppliers
5. The Internet and globalisation – communication and interaction is cheap and 24h/day

# What is the global trend?

Though the R&D intensity of most non-OECD countries remains low

- Growing importance of non-OECD countries in science and innovation.
- Growing competition for scarce talent – important role for international mobility.
- Some non-OECD countries are trying to leapfrog.

R&D expenditure in 2004  
(circles reflect size of spending in billion USD)



# So... What does this mean?

- The erosion factors have rearranged the knowledge landscape:
  - Distribution of knowledge has shifted from closed R&D centres to diffused pools across the landscape.
  - Companies can find vital knowledge in customers, suppliers, universities, labs, consultants and start-ups.
- **Companies must structure themselves to leverage these distributed pools!**

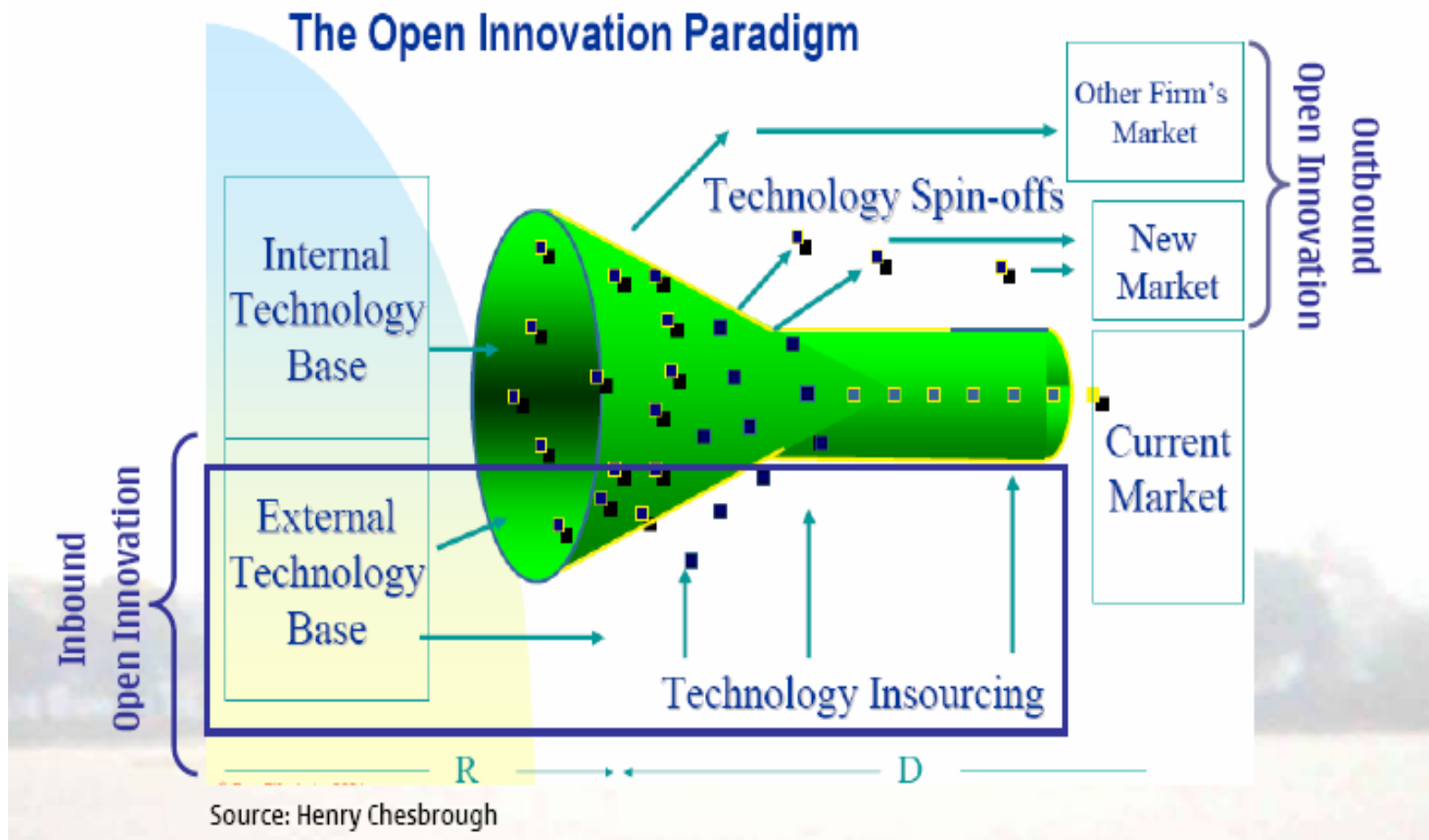
**“Inside there are more than 8’600 scientists advancing our products; outside are 1,5 million.”**

*Larry Huston, Director of external innovation at P&G*

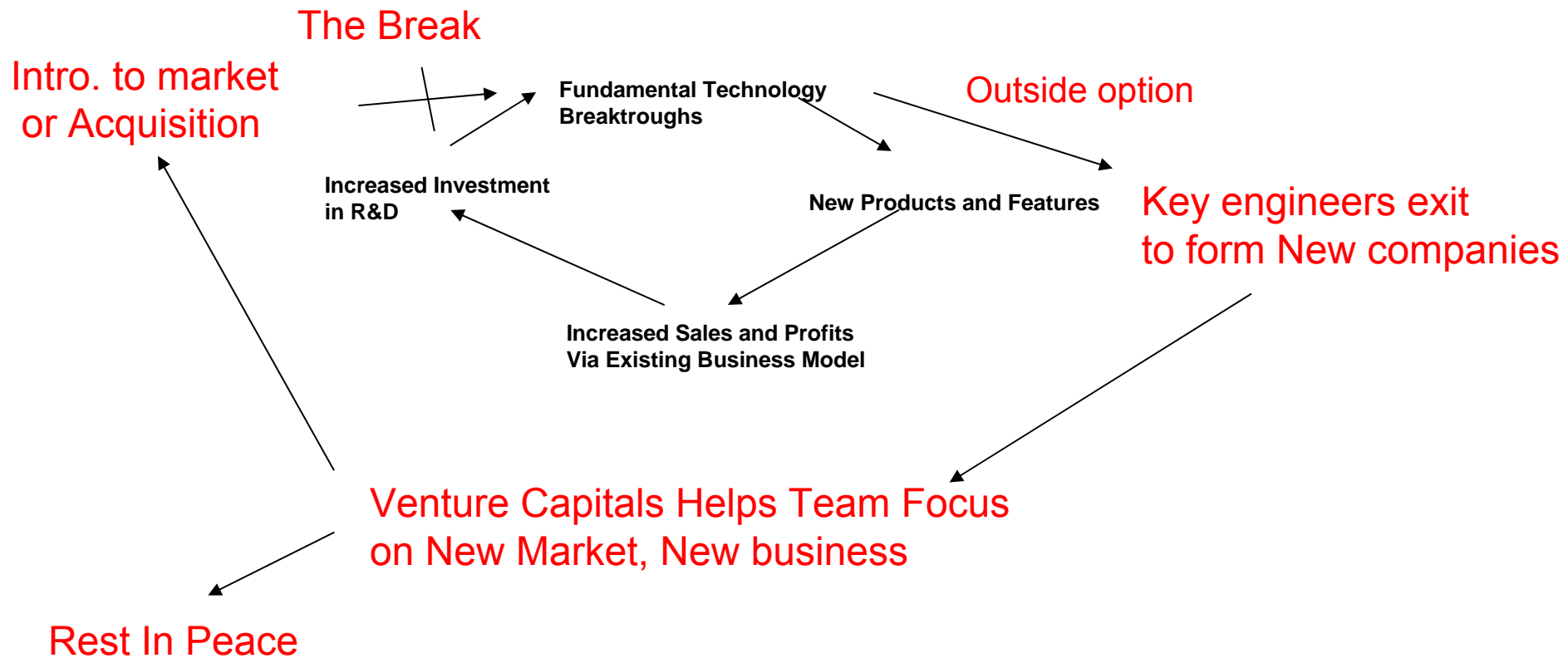
# Open Innovation

- Companies cannot afford to rely entirely on their own research
  - High probability that the best innovations occur outside our company, or even in another industry.
- Internal inventions not being used in a firm's business should be taken outside the company
  - Sometimes the greatest potential for our innovations lies outside our business
    - Work actively to investigate the true potential of R&D on other markets
    - *Sell, spin off or licence out*
- OI still involves a robust innovation and development process, but internal and external ideas can enter at any stage.
  - Maximum receptiveness to ideas

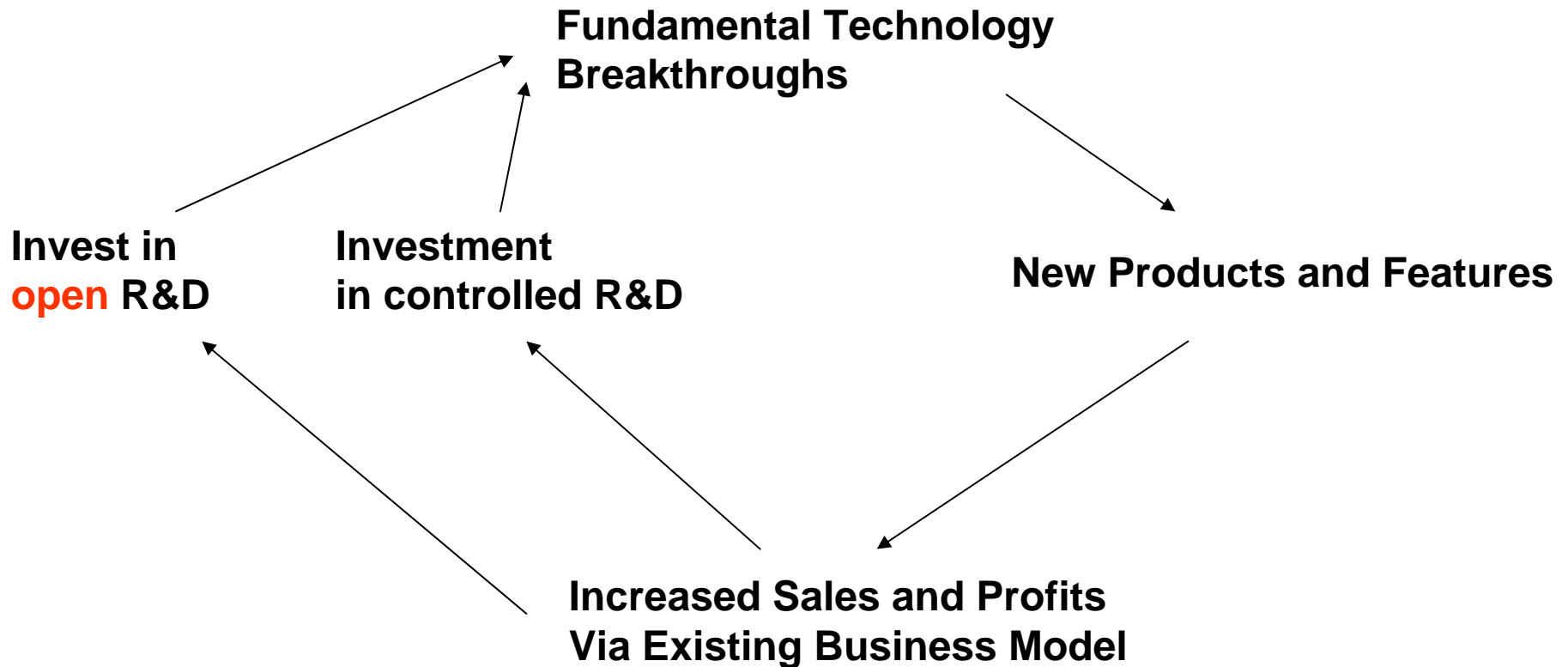
# Open Innovation – the process



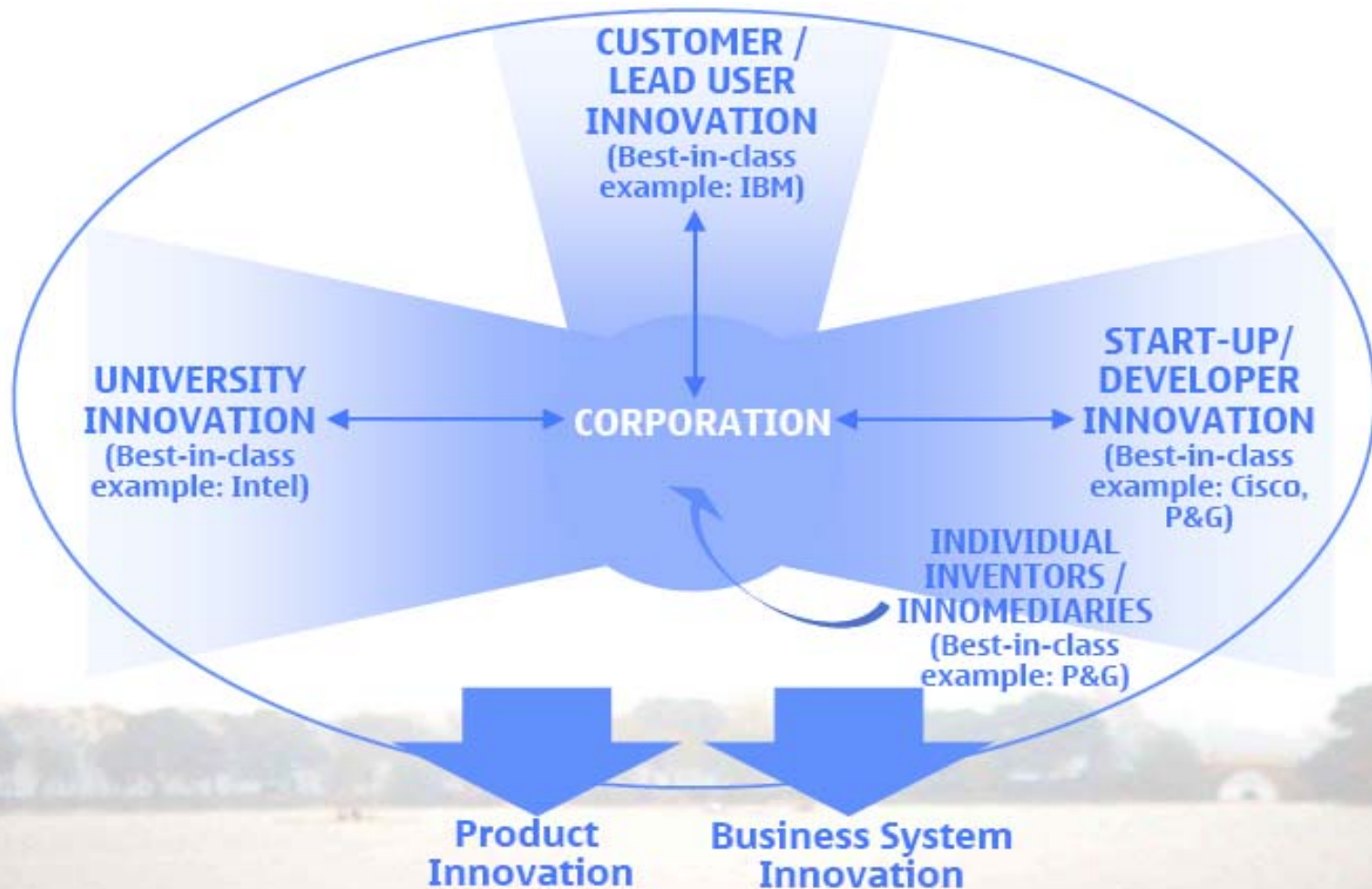
# The business logics - outbound



# Open Innovation - the business logics inbound



# The main sources of Open Innovation



# Contrasting CI and OI

## Closed Innovation

- The smart people in our field work for us.
- To profit from R&D, we must discover, and develop it ourselves.
- If we discover it ourselves, we will get to market first.
- If we create the most and best ideas in our industry, we will win
- We should restrict IP so that competitors don't profit from our ideas.

## Open Innovation

- Not all smart people work for us.
- External R&D can create significant value; internal R&D is needed to claim some of it.
- We don't need to originate R&D to profit from it.
- If we make the best use of internal + external ideas, we will win.
- We should profit from exporting our IP, and buy IP when it advances our business model.

# Industry positions



## Closed Innovation

- Example of industries nuclear power, aeroplanes
- Largely internal ideas
- Low labor mobility
- Little VC
- Few weak start-ups
- Universities unimportant

## Open Innovation

- Examples PCs, Movies
- Many external ideas
- High labor mobility
- Active VC
- Numerous start-ups
- Universities important

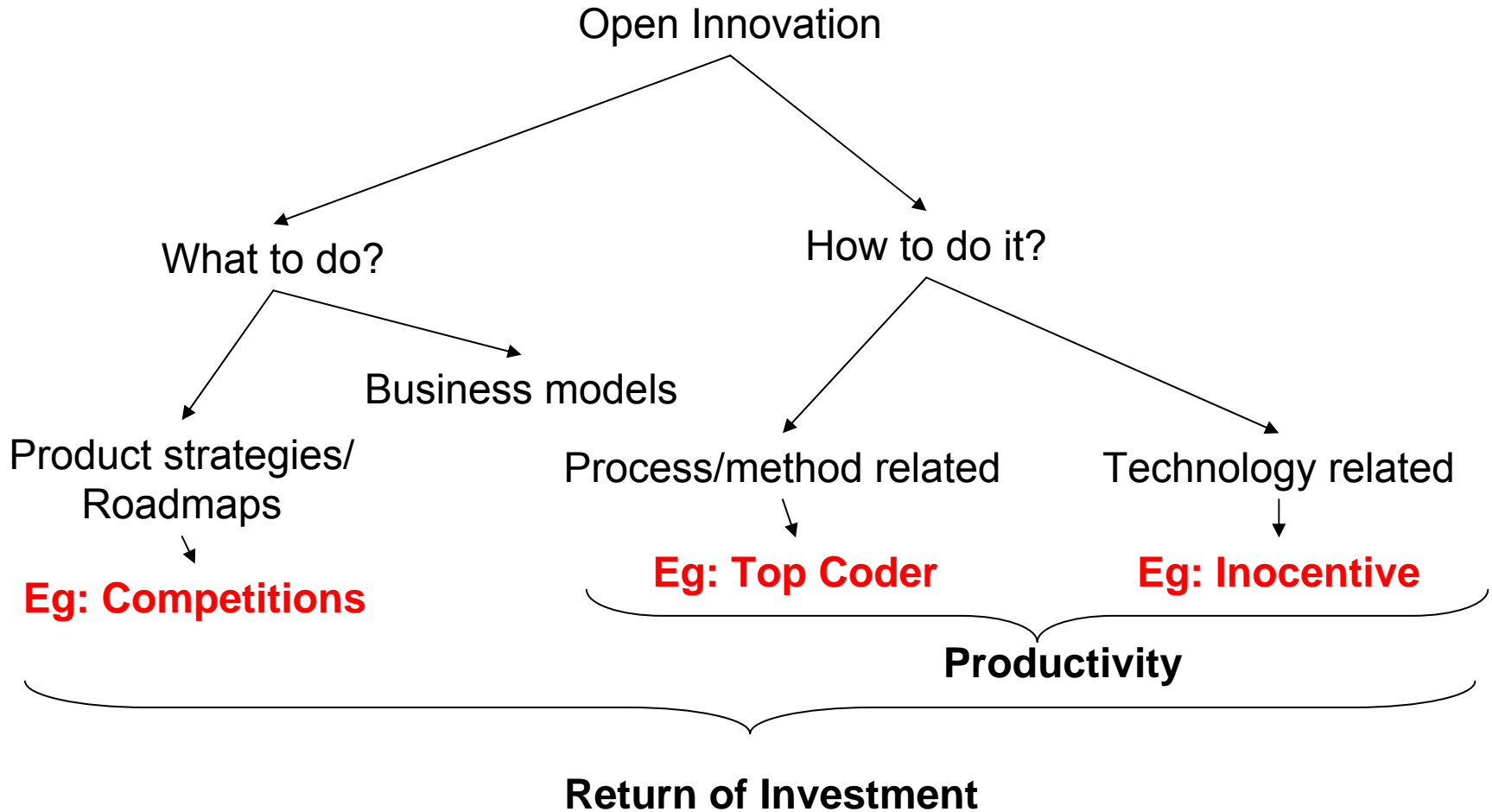
# Common misconceptions

<b>OI is not about...</b>		<b>...but rather</b>
Opening access to own resources	→	Strategic IPR management
Outsourced R&D	→	Strategic R&D
Technology only	→	Technology and business models
Technological invention	→	Commercial innovation
New ventures	→	Core product development process
Cutting research costs	→	Improving R&D ROI

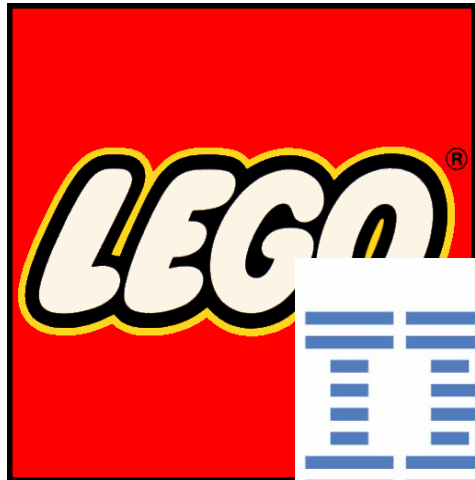
# Open innovation $\neq$ Open source

- Patenting and selling inventions  $\neq$  Sharing inventions
- BUT: The concept of utilising the intellectual resources of a global society applies to both Open Innovation and Open Source

# Where to use OI?



So is anyone out there doing  
this?



# Issues and Implications

- Even more focus on product strategies and business models (**WHAT**)
- Technology (**HOW**) – how to combine open with closed development?
  - Ease **integration** and **verification** of **external developed** functionality
    - Architecture supporting easy external integration is a must, e.g. via components
    - Model based development
  - How to handle **maintenance** efficiently?
- Management and culture (**HOW**)
  - Changing of development strategy (Culture change – Maximum receptiveness to ideas)
  - Understand the internal competence need
  - Top talent recruitment

# More to read

- Litterature:
  - **Henry Chesbrough** coined the term [Open Innovation](#) and is the author of [Open Innovation: The New Imperative for Creating and Profiting from Technology \(HBS Press, 2003\)](#). His most recent book is [Open Business Models: How to Thrive in the New Innovation Landscape \(HBS Press, 2006\)](#).
  - **Wikinomics: How Mass Collaboration Changes Everything (Hardcover)**  
by [Don Tapscott](#) (Author), [Anthony D. Williams](#) (Author)
  - Business week:  
[http://www.businessweek.com/innovate/di\\_special/wikinomics.htm](http://www.businessweek.com/innovate/di_special/wikinomics.htm)
- Web sites:
  - <http://www.openinnovation.eu/>
- Interesting web sites
  - [www.inocentive.com](http://www.inocentive.com)
  - [www.topcoder.com](http://www.topcoder.com)

# Slaskbilder