

MOT 2421 Emerging and Breakthrough Technologies

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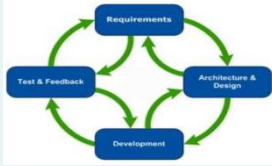

Lecture 6: Hype cycle and technology development

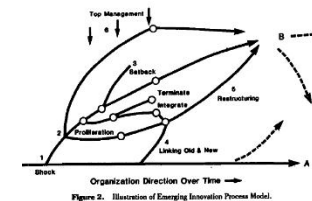
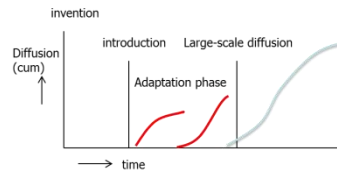
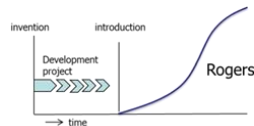
Welcome, we will start at 8.45




Three levels of innovation processes

Alternative models, theories on each level

Project (level 1)	Stage-gate 	Agile-projects 	Hybrid-projects	Ad-hoc 



A) Hype cycle
B) Technology development

Discipline (level 3)	The genius inventor 	The fertile R&D context 	Invention is combining technologies 	-
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1 Topic

2 Levels

3 Learning goals

4 Schedule

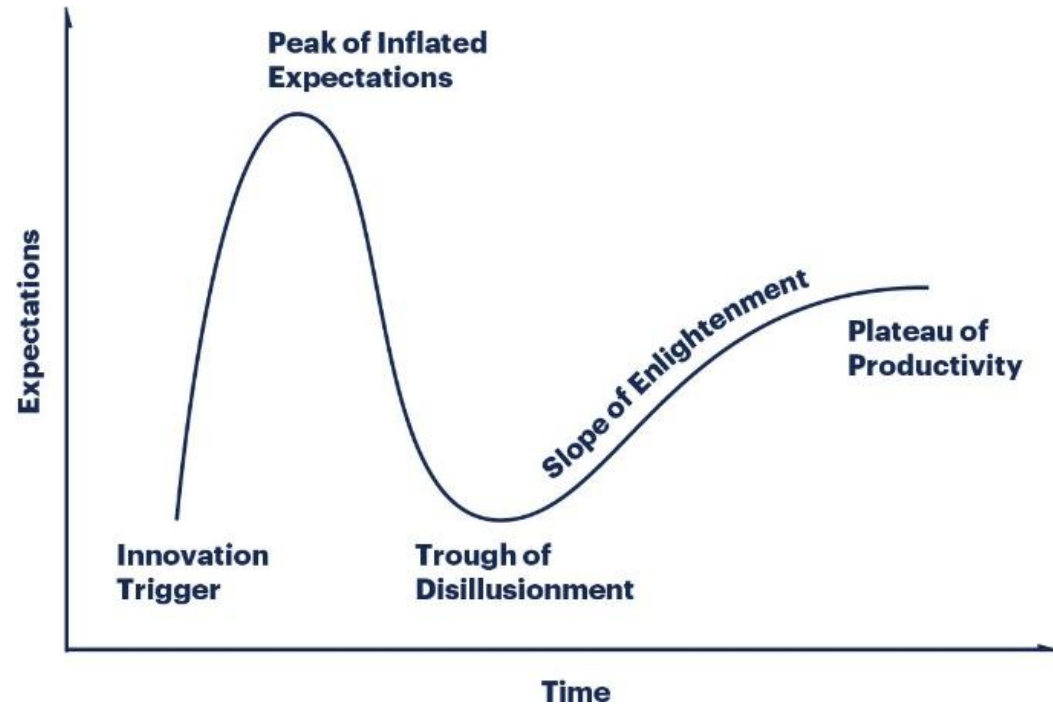
5 innovation project

6 Project phases

Hype cycle

Topics

1. Picture and description
2. Relevance
3. Discussion
4. Consequences



<https://www.gartner.com/en/research/methodologies/gartner-hype-cycle>

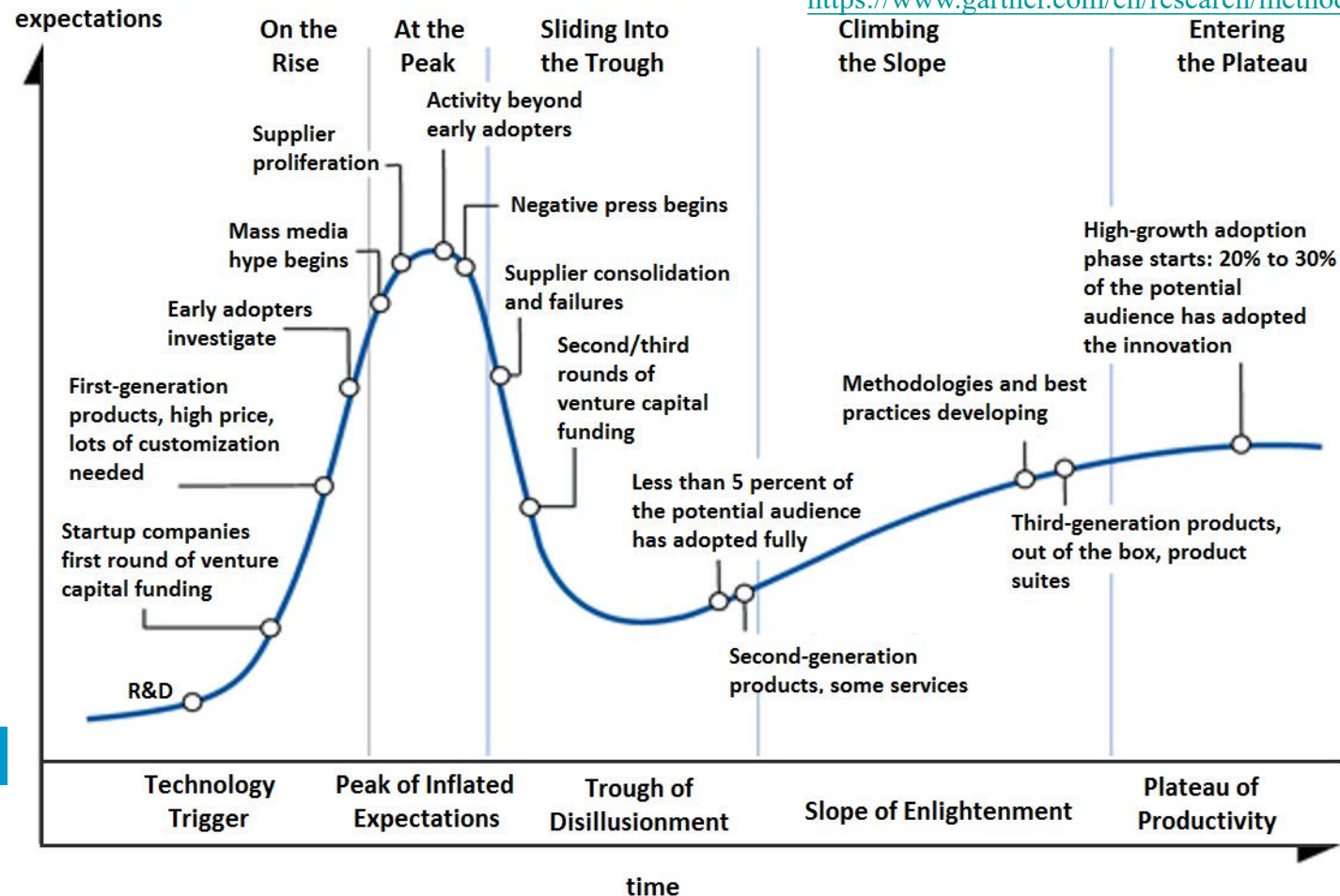
Hype cycle

1. Picture and description

Interpreting technology hype

Gartner Hype Cycles provide a graphic representation of the maturity and adoption of technologies and applications, and how they are potentially relevant to solving real business problems and exploiting new opportunities.

<https://www.gartner.com/en/research/methodologies/gartner-hype-cycle>



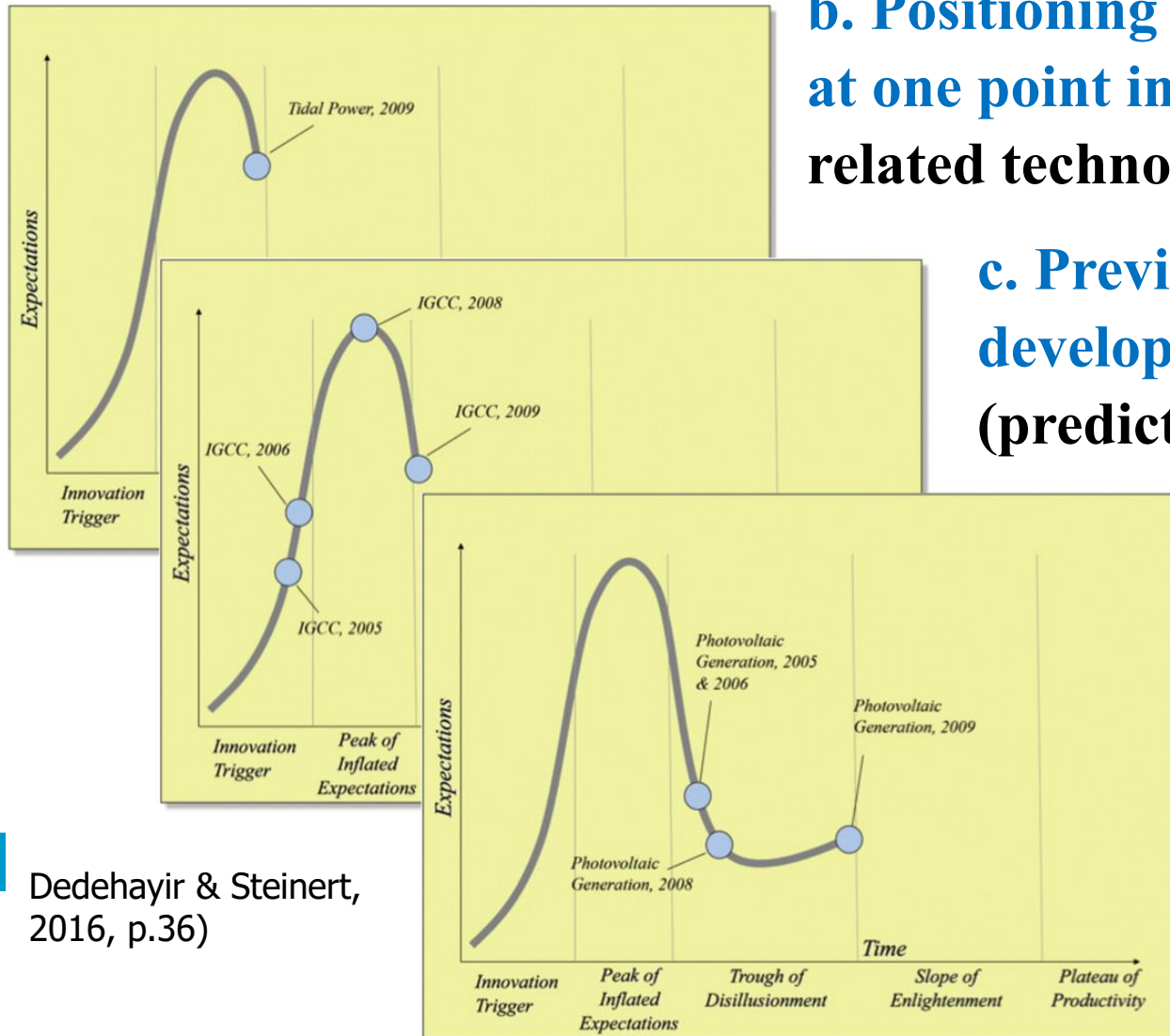
Hype cycle

2. Relevance

a. Tracking one technology over time
(describing evolution)

b. Positioning multiple technologies
at one point in time (benchmarking
related technologies)

c. Previewing technology
development over time
(predicting evolution)



Dedehayir & Steinert,
2016, p.36)

Hype cycle

3. Discussion

- Assumptions
- Defining and measuring of the hype cycle
- Explaining the hype cycle
- Validation of the hype cycle
- Expectations and the start (at the time of invention)

Assumptions of the hype cycle

- Similar pattern of expectation for new technologies over time?
- Similar expectations about a technology held by widely different stakeholders?
- Positive expectations are first while negative expectations come later.
Hence the debate between different groups of stakeholders that hold opposing views regarding a technology are not taken into account.
- Relationship between expectations and technology?
(co-evolution, expectations cause technology development or reverse?)
- Similar events and steps over time during the hype cycle?
(are the events over the hype cycle (slide 4) illustrative or predictive?)
-

Hype cycle

3. Discussion

Defining and measuring of the hype cycle

Definition of the hype

- Expectations or visibility on the y-axis?

Measurement of the hype cycle

- What is the unit of analysis for which we measure expectations?
How is that defined and measured?
(technology, generic product, discipline?)
- What are expectations?
How are they defined and measured?
(expectations about technical or economic performance or societal impact?)
(expectations by whom?)

Can we find proxies to assess expectations (visibility)?

- News-data
- Scientific articles
- Patents

Hype cycle

3. Discussion

Defining and measuring the hype cycle (2)

Can we find proxies to assess expectations?

- News-data
- Scientific articles
- Patents



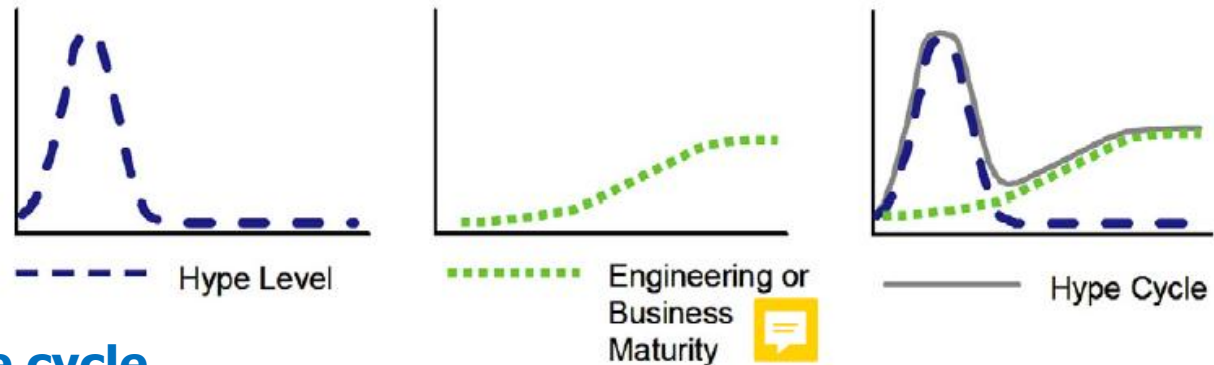
Do proxies measure the same thing?

- Expectations versus visibility
- Difference in practice
 - Visibility = number of publications, patents, news.
 - Expectations = type of visibility (positive or negative) requiring content analysis

Hype cycle

3. Discussion

O. Dedehayir, M. Steinert / *Technological Forecasting & Social Change* 108 (2016) 28–41



Explaining the hype cycle

- As a combination of 2 cycles Fig. 1. The two curves that form the hype cycle (adapted from Fenn, 2007).

PS: engineering and business maturity are very different

PS: how can curves with different Y-axis be combined in one curve?

- Psychological mechanisms (Dedehayir & Steinert (2016, p.29)

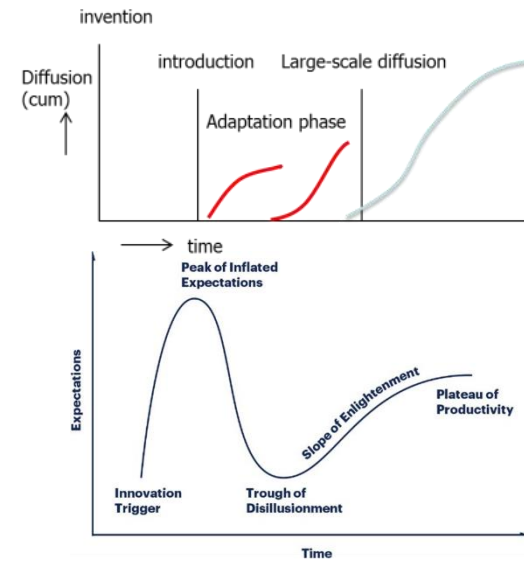
Fenn and Raskino (2008) argue that three human nature phenomena are responsible for the curve's shape: attraction to novelty (and the love for sharing), social contagion, and heuristic attitude in decision-making. Together, these phenomena lead people to assess a new technology's potential with overenthusiasm. The media additionally tend to focus on potentially big stories and the resulting collective hypes the number of supporters over a critical mass. Once a technology begins to hype, decision makers in organizations may follow the trend rather than carefully assessing the technology's potential themselves. This is potentially a dangerous tactic as the sharp peak of enthusiasm of the new technology is often followed by disappointing early results of the first generation of applications, causing the hype to suddenly ebb and collapse into a trough.

Hype cycle

3. Discussion

Explaining the hype cycle

Any other possible causes?



<https://www.gartner.com/en/research/methodologies/gartner-hype-cycle>

- Underestimating the scope of the system.
- Underestimating the problems with mundane issues like institutions.
- Underestimating time/resources required to increase performance and lower price.
- Underestimating competition with old technology and with alternative new technologies

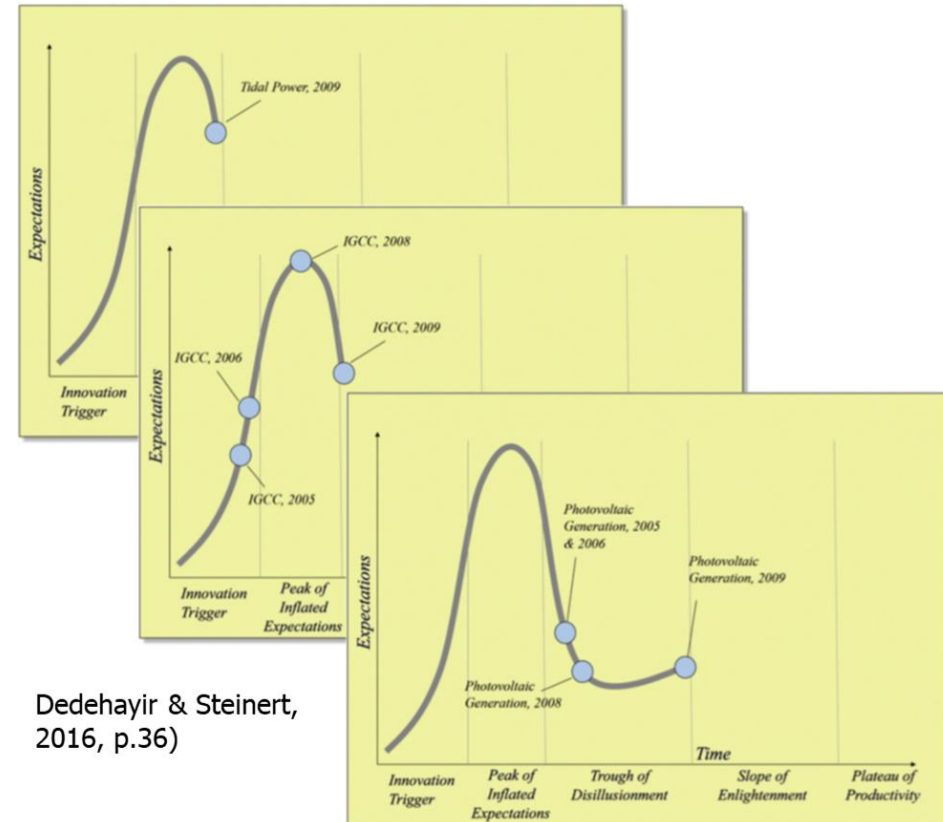
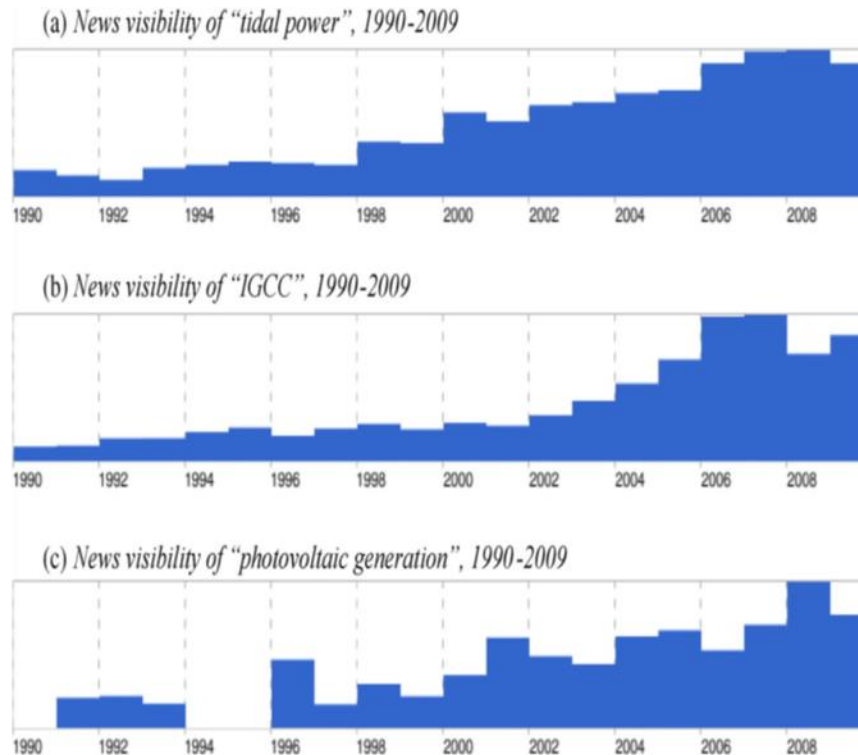
Model of relevant (F)actors

1. Product perform
2. Price
3. Production
4. Compl prod/serv
5. Network of supply
6. Customers
7. Institutions

Hype cycle

3. Discussion

Validation of the hype cycle



Dedehayir & Steinert,
2016, p.36)

Dedehayir & Steinert,
2016, p.36)

Hype cycle

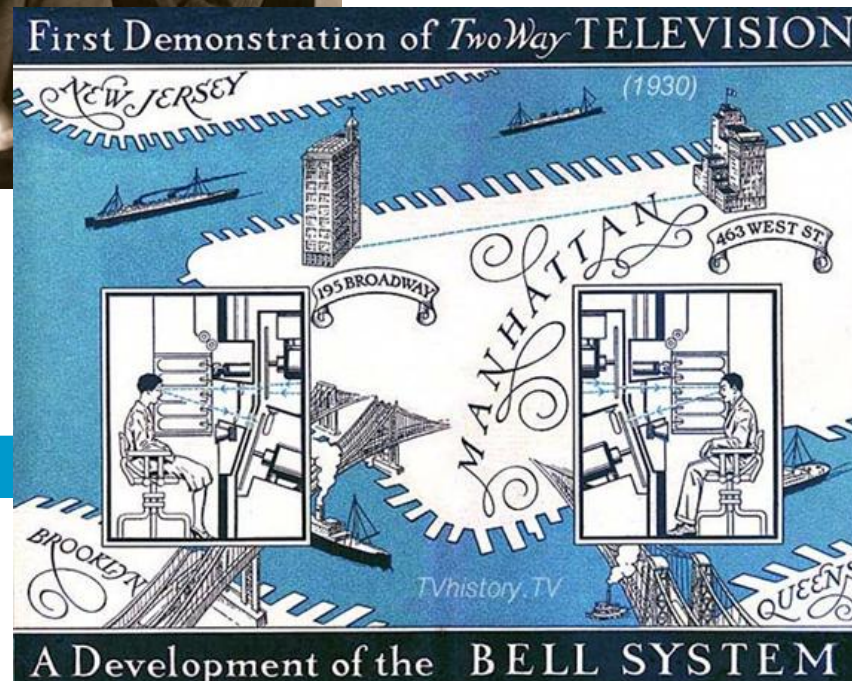
3. Discussion

Expectations and the start (at the time of invention)



the New York Daily Mirror 1930

Prediction (in 1930): in 5 years many American households will have a video-telephone



Hype cycle

3. Discussion

Expectations and the start (at the time of invention)



<https://nl.wikipedia.org/wiki/Videotex>

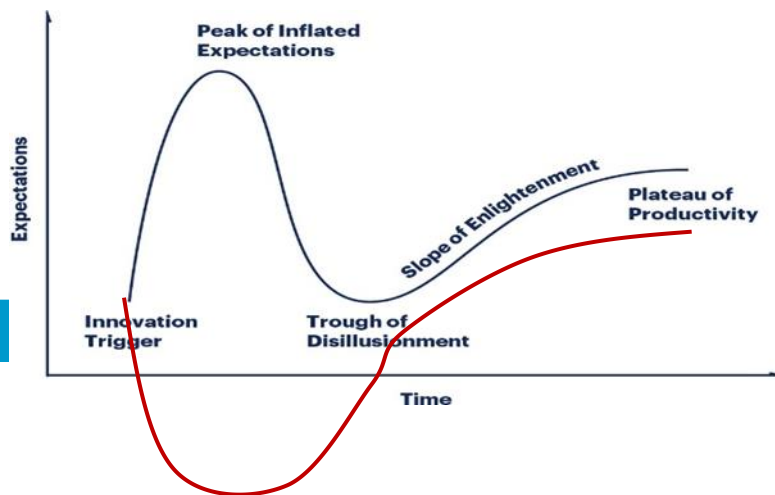


Fedida and Malik (1980) Viewdata revolution

General predictions at the invention communication technology

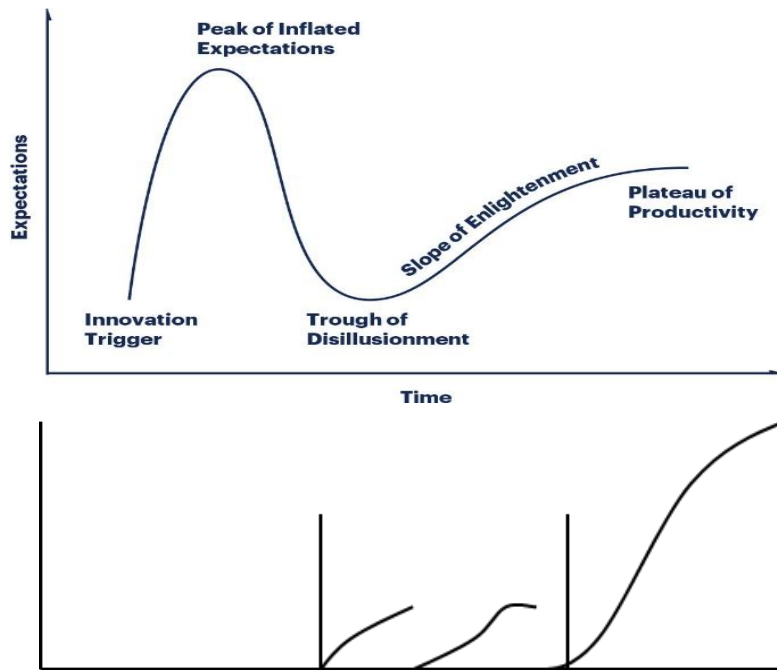
Rogers (1986): two opposing views hyper
enthusiastic and hyper pessimistic
Usually about the following topics

- Effect on the economy
- Effect on Urban structure
- Effect on social organization
- Effect on individuals (children)
- Substitution effect




Hype cycle

4. Consequences



Synchronization of expectations and development/diffusion?
The role of expectations in funding

The background image shows a vast industrial hangar filled with aircraft components. A large white aircraft with blue wingtips and a blue fuselage is the central focus. The hangar floor is marked with yellow lines, and various tools, equipment, and workers are visible around the aircraft. The hangar's structure is made of steel beams and supports.

MOT 2421

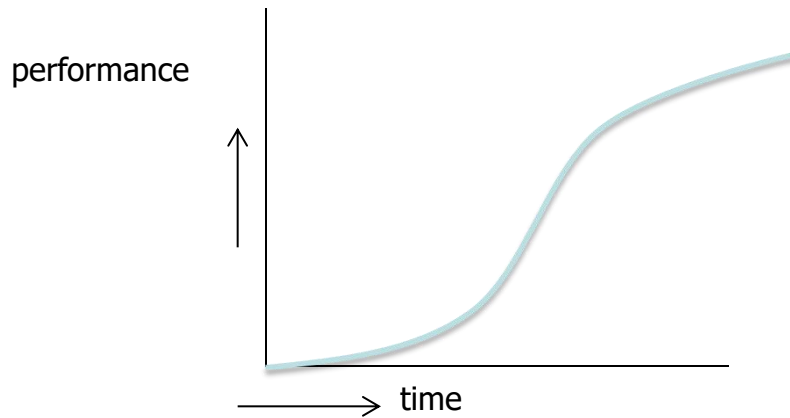
**After a short break
we will start again at 09.50**

Technology development

Topics

1. The performance curve
2. The mechanisms of performance improvement
3. The consequences for the performance curve

Ad 1. The performance curve

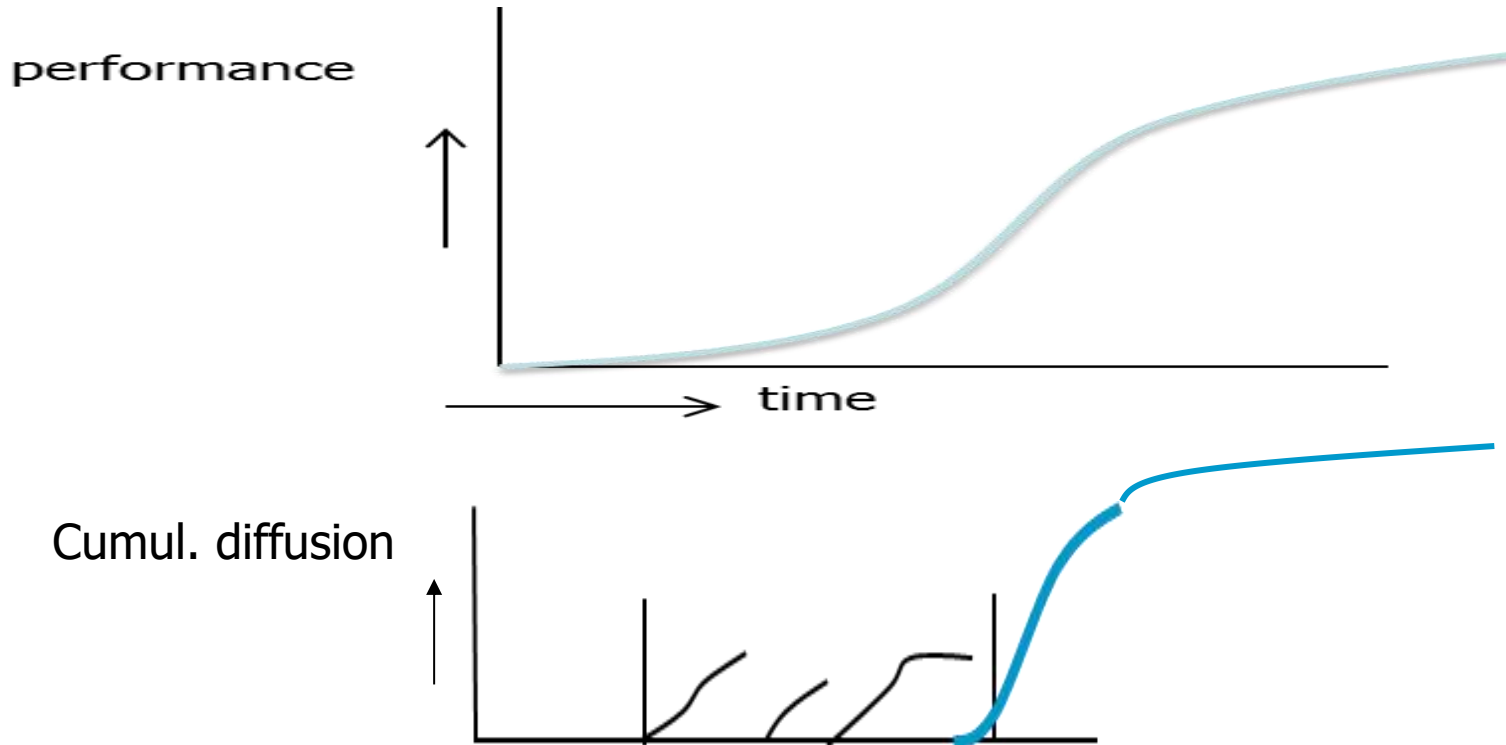


Classical performance curve

- Why this form?
- Link with diffusion pattern?
- Implications for pipeline model?

Ad 1. The performance curve

Link with diffusion pattern?





Ad 2. The mechanisms of performance improvement

Why do we document and know all details of technologies while, at the same time, we do not know the principles by which technologies evolve, or even what technology is?

“This sort of contrast between known content and less-known principles is not rare.” (Arthur, 2009, p.13)



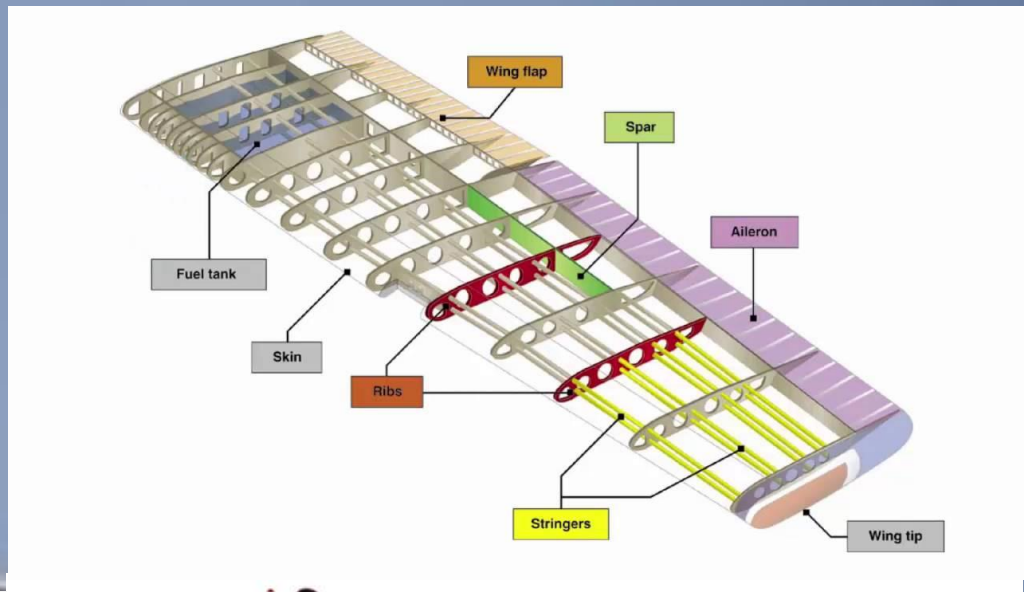
Subtopics

- Technology characteristics and definition
- Technology creation (Invention)
- Technology development (Evolution)

Arthur, W.B. (2009). The Nature of Technology; What it is and how it evolves. Allen Lane, Penguin Books, London.

Ad 2. The mechanisms of performance improvement

Technology characteristics and definition



Ad 2. The mechanisms of performance improvement

Technology characteristics and definition



Principles of technology (Arthur, 2009)

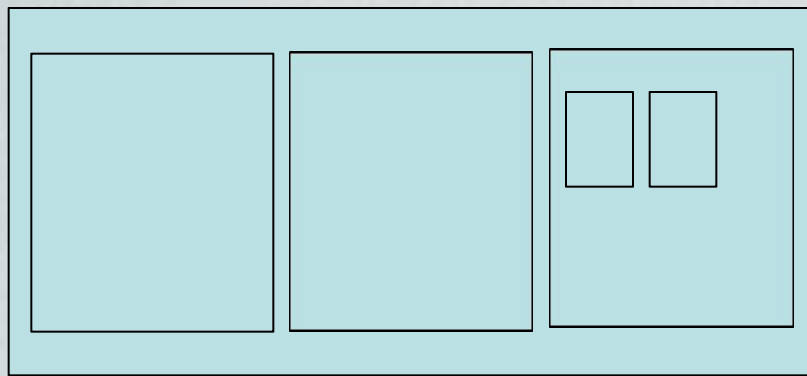
1. Technologies are combinations of components
2. Each component is a technology itself (recursive nature of technology).
3. Technologies are based on a technical principle and provide a specific functionality.

Defining a high-tech product (technology)

1. Principle
2. Functionality
3. Components

Ad 2. The mechanisms of performance improvement

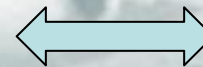
Technology characteristics and definition



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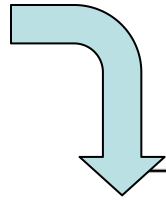
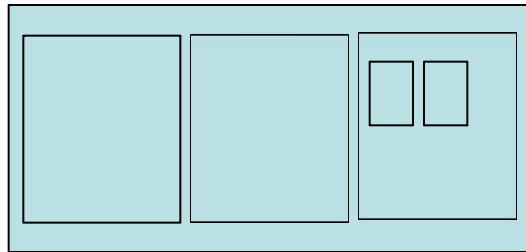
performance

time



Ad 2. The mechanisms of performance improvement

Technology characteristics and definition



The 4 Types of Technological Change

Core Concepts

Reinforced

Overtaken

Reinforced	Overtaken
Incremental Innovation	Modular Innovation
Architectural Innovation	Radical Innovation

Unchanged

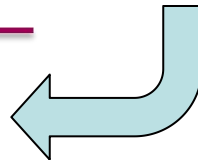
Changed

Linkages between Core Concepts and Components

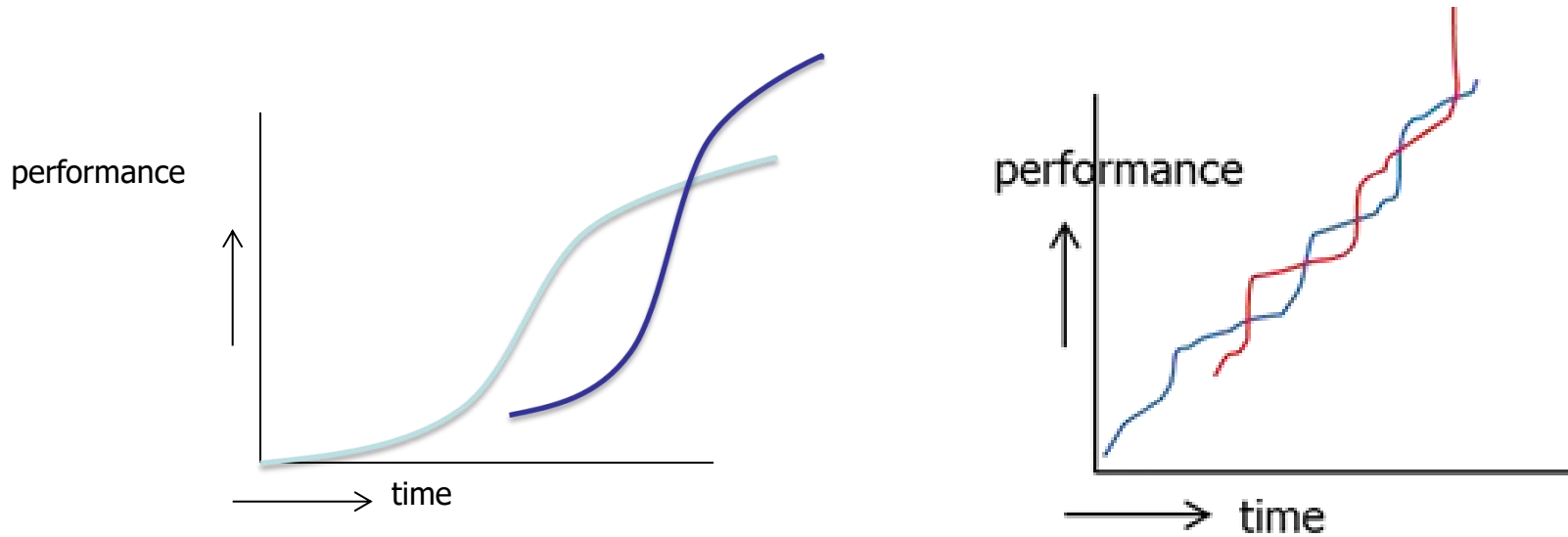
performance

time

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 (Mar 1990): 12.



Ad 3. The consequences



Consequences competition between technologies
- Why the delay?

Ad 2. The mechanisms of performance improvement

Technology creation Conditions favouring invention?

“The last major attempts to theorize about invention were in the 1930s, but the subject fell from fashion in the decades that followed, in no small part because the “creative act” deemed to be at its center was held to be imponderable.”(Arthur, 2009, p.107).



Theory 1: In this theory the invention is a miracle from the mind.

The implications:

- educate and select the brightest minds.
- It assumes a breakthrough step (not a small succession of small steps).



Theory 2: Supporting conditions:

- Novel technologies are shaped by social needs.
- They often come from experience gained outside the standard domain.
- They originate more often in conditions that support risk.
- They originate better with the exchange of knowledge.
- They are catalysed by networks of colleagues.

Implications?



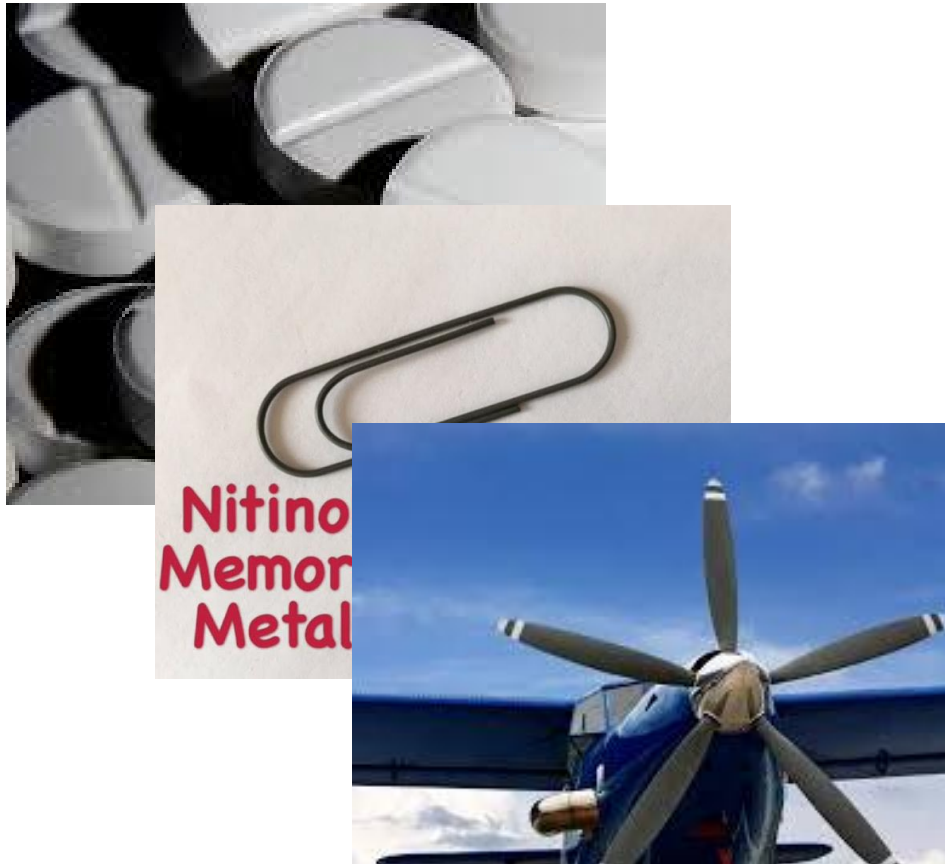
Invention mechanism is not understood but moment is well measurable

Arthur, W.B. (2009). *The Nature of Technology; What it is and how it evolves*. Allen Lane, Penguin Books, London.

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Ad 2. The mechanisms of performance improvement

Technology creation (invention)



Motives to invent?

Motives to invent

1. Can start with a purpose (problem)
2. Can also start from an opportunity:
3. Can also start from (limits and problems and opportunities) inside existing technology.
4.

➡ Some inventive activity is predictable

Arthur, W.B. (2009). *The Nature of Technology; What it is and how it evolves*. Allen Lane, Penguin Books, London.

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Ad 2. The mechanisms of performance improvement

Technology creation (origine of invention)

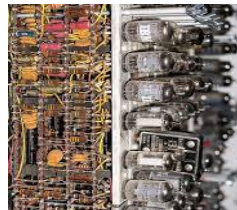
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2



3



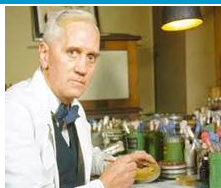
4



OR



5



OR



Origin invention :

1. Principle borrowed from other domain/purpose.
2. Principle recalled from the past (or re-invented).
3. Principle, conceptual solution, stitched together from existing subsystems. (or new combinations).
4. New natural phenomenon discovered in nature (or by new instruments) that can be used to provide functionality.
5. Discovery by accident (Serendipity)?



Invention may even be organised systematically once we understand the origins and mechanisms of invention

Arthur, W.B. (2009). *The Nature of Technology; What it is and how it evolves*. Allen Lane, Penguin Books, London.

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Ad 2. The mechanisms of performance improvement

Technology creation: Demystification of invention

- Conditions
- Motives
- Origines

➡ **In all of these cases technological principles already exists.**

Finding a principle may take a long time, it may be in the back of the mind for years.

“The solution, when it comes, may come abruptly.”(Arthur, 2009, p.115)

This seems to sustain the creative genius theories.

“The insight comes as a removal of a blockage, often stumbled upon (..)” (Arthur, 2009, p.116).

➡ **New technologies emerge by combining existing technologies/components (or by finding new phenomena)**

- Usher (1929) Invention proceeds from “the constructive assimilation of pre-existing elements into new synthesis.”
- Gilfillan (1935) Invention is “a new combination of prior art.”
- Ogburn (1922) “Inventions built cumulatively from earlier inventions.”
- Schumpeter. “Neue combinationen” in economy.

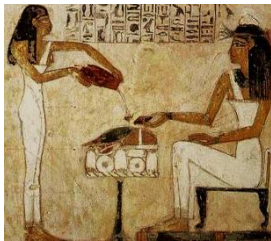
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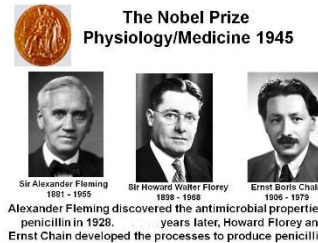
Ad 2. The mechanisms of performance improvement

Technology creation: Demystification of invention

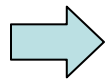
- Conditions
- Motives
- Origines



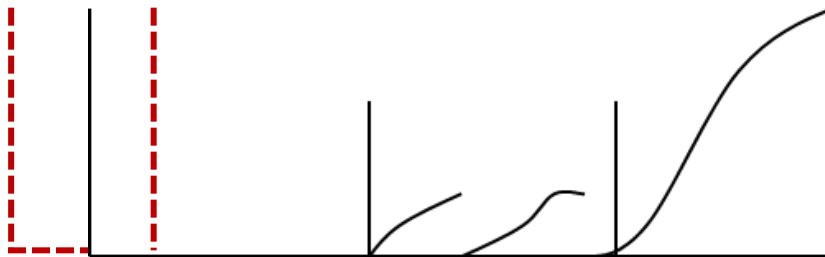
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Invention by one genius at one moment??

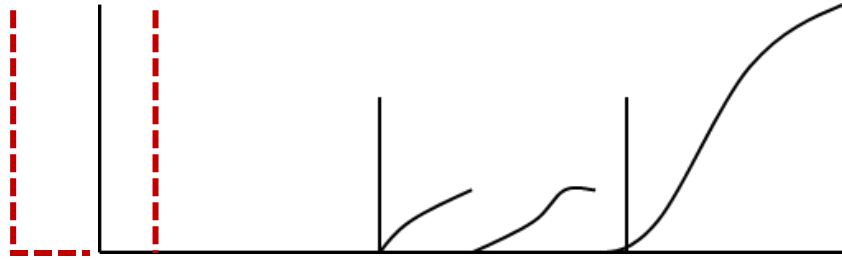


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Ad 2. The mechanisms of performance improvement

Demystification of invention: Invention as process



Arthur, W.B. (2009). *The Nature of Technology; What it is and how it evolves*. Allen Lane, Penguin Books, London.

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Ad 2. The mechanisms of performance improvement

Technology development (evolution)

Why do mobile phones (or jet engines or)
contain more and more parts over their life cycle?

- Example: modern jet-engines are 30-50 times more powerful than Whittles original jet engine but they also have many more parts: Whittles engine had a few hundred parts, a modern engine has more than 22.000 parts.

Why do products modular during their life cycle?

Ad 2. The mechanisms of performance improvement

Technology development mechanisms

1. Specialization
2. Internal replacement
3. Structural deepening
4. Lock-in and adaptive stretch
5. Substitution

Ad 2. The mechanisms of performance improvement

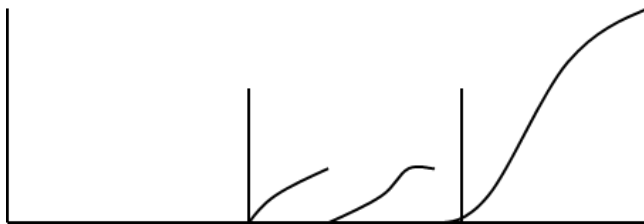
Technology development (evolution) as process (cycle)

The whole evolution can be seen as a kind of cycle (see p.141).

1. Origination
2. Structural deepening and internal replacement
3. Lock-in
4. Adaptive stretch
5. Substitution

Similar to cycle of scientific theory development as proposed by Kuhn.

What about variation selection in the beginning?
Before structural deepening?



For performance?

Arthur, W.B. (2009). *The Nature of Technology; What it is and how it evolves*. Allen Lane, Penguin Books, London.

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Questions?

