Insights into the Innovation Process

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• Your name?
• Your field of expertise?
• What made you come?
• About what would you like to learn today and tomorrow?
Today

11:00 Models of the innovation process  
12:30 Lunch break  
13:30 Adoption of inventions  
15:00 Coffee break  
15:20 Barriers to innovation  
17:00 End day 1

Tomorrow

09:00 Coping with barriers to innovation  
10:30 Coffee break  
10:50 Implications I  
12:20 Lunch break  
13:20 Implications II  
15:00 End
Original Meaning of Innovation

• innovation (n.)
  mid-15c., “restoration, renewal”, from Latin innovationem (nominative innovatio), noun of action from past participle stem of innovare (see innovate).

• innovate (v.)
  1540s, “introduce as new”, from Latin innovatus, past participle of innovare “to renew, restore; to change”, from in- “into” + novus “new”. Meaning “make changes in something established” is from 1590s.

And let it be noted that there is no more delicate matter to take in hand, nor more dangerous to conduct, nor more doubtful in its success, than to set up as a leader in the introduction of changes.

For he who innovates will have for his enemies all those who are well off under the existing order of things, and only the lukewarm supporters in those who might be better off under the new.

This lukewarm temper arises partly from the fear of adversaries who have the laws on their side and partly from the incredulity of mankind, who will never admit the merit of anything new, until they have seen it proved by the event.

The Prince, Niccolò Machiavelli, 1532
• Innovation is the market introduction of a technical or organisational novelty, not just its invention.

• We must always start from the satisfaction of wants, since they are the end of all production.

• Times of innovation...are times of effort and sacrifice, of work for the future, while the harvest comes after.

• It is not the owner of stage-coaches who builds railways.

• The process of creative destruction is the essential fact about capitalism.
Frascati Manual: Proposed standard practice for surveys on research and experimental development. OECD 1963

(1) Basic Research is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view.

(2) Applied Research is also original investigation undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific practical aim or objective.

(3) Experimental development is systematic work, drawing on knowledge gained from research and practical experience, that is directed to producing new materials, products and devices; to installing new processes, systems and services; or to improving substantially those already produced or installed.
An **innovation** is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations.

**Oslo Manual:**
Proposed guidelines for collecting and interpreting technological innovation data. OECD 1992

**Linear Model of Innovation**
Modern innovation research rejects the idea that innovation simply flows from some earlier process of scientific or technological discovery – the so-called ‘linear model’ of innovation. Instead, it stresses the interactive and dynamic character of innovation.

**Innovation is systemic.**

In addition to the independent decision-making at the level of the enterprise or the network, it depends critically on broader factors including the institutional and organisational framework, regulatory systems, infrastructures, the processes which create and distribute scientific knowledge and, not least, the social and cultural context.

The majority of European countries are striving in the direction of developing a more holistic innovation policy. However, it is concluded that the innovation policies in European countries are still dominantly linear despite the fact that holistic policy seems to be the driving vision.
Insights into Innovation, Science Vol 304, 2004

- Invention is the creation and establishment of something new.
- Innovation is an invention that becomes economically successful.
- Invention intentionally includes fixation, and thereby highlights the elusive nature of innovation with its connotation of influence and success.
- Invention and innovation feed back upon each other in a complex dynamic.

Researchers
Leonard Kleinrock
Federico Faggin

Inventors
Tim Berners-Lee
Ed Roberts (MITS Altair 8800)

Creators of Innovation
Mosaic
Netscape
Apple
Acorn
Commodore
RadioShack
<table>
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<tr>
<th>Researchers</th>
<th>Inventors</th>
<th>Creators of Innovation</th>
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<tbody>
<tr>
<td>William Guier</td>
<td>Johns Hopkins University</td>
<td>Roger Easton</td>
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<tr>
<td>George Weiffenbach</td>
<td>Applied Physics Laboratory</td>
<td>United States</td>
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<td></td>
<td>Defense Advanced Research Projects Agency</td>
<td>Naval Research Laboratory</td>
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<td></td>
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<td>William Perry</td>
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Joe Gebbia, Co-Founder and CPO of Airbnb  
[https://www.youtube.com/watch?v=e6Xt0RvTR6A](https://www.youtube.com/watch?v=e6Xt0RvTR6A)

Perry Chen, Co-Founder and CEO of Kickstarter  
[https://www.youtube.com/watch?v=sHVBVAGUwCg](https://www.youtube.com/watch?v=sHVBVAGUwCg)
Holistic Model of Innovation

Innovation as defined by Horizon 2020

Innovation is the process, including its outcome, by which new ideas respond to societal or economic needs and demand and generate new products, services or business and organisational models that are successfully introduced into an existing market or that are able to create new markets and that contribute value to society.
General Implications from Complexity Science

- Each output is simultaneously an input and thus cause and effect cannot be separated.

- A response once observed for a given stimulus may not be the same for the same stimulus given later.
  
  *Principles of Self-Organization; Heinz von Foerster; 1984*

- A complex system not only depends on its past but accurate longer range forecasts are impossible.
  
  *Deterministic Nonperiodic Flow; Edward Lorenz; 1963*

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Adoption of Inventions

- The percentage of adopters increases over time, with early adopters leading the way followed by the early majority and then the late majority.

- Innovators are those who adopt new ideas early, often taking risks before most others.

- The curve shows a lag phase before the majority begins to adopt.

- The late majority follows closely after the earlier groups, completing the adoption process.

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Acknowledging the Tipping Point Phenomenon I

- The tipping point is the critical point in an evolving situation that leads to a new and irreversible development.
- The term originated in the field of epidemiology when an infectious disease reaches a point beyond any ability to control it from spreading more widely.
- Marketers see it as a threshold that, once reached, will result in additional sales.
- A tipping point is an addition or increment that in itself might not seem extraordinary but that unexpectedly is just the amount of additional change that will lead to a big effect.
The great majority of inventions never get off the bottom of the curve, and never produce appropriate returns.
• What does this entail for you as innovation agent?
• What questions come up?
Barriers to Innovation

Adoption Uncertainty
Valley of Death – and beyond I
**Path Dependence I**

Adam Smith’s invisible hand of the market: The market will settle on a product distribution and prices that are beneficial to all the individual members of a community, and hence to the community as a whole.

but

What happens if there is competition among entities whose market successes are self-reinforcing?

**Path Dependence II**

Random Distribution

Power Law Distribution
Path Dependence in Action

Path Dependence: Emergent Properties

- **Multiple Equilibria**
  Initially, quite different asymptotic market-share solutions are possible. The outcome is indeterminate; it is not unique and not predictable.

- **Possible Inefficiency**
  If one product / service is inherently “better” than the other, but has “bad luck” in gaining early adherents, the eventual outcome may not be of maximum possible benefit.

- **Lock-In**
  Once a solution is reached it is difficult to exit from.

- **Path Dependence**
  The early history of market shares can determine which solution prevails.
Conditions for Path Dependence: Network Effect

- A network effect is the effect that one user of a good or service has on the value of that product to other people.
- When network effect is present, the value of a product or service increases as more people use it.

Conditions for Path Dependence: Production Costs

Accumulated production costs

\[ \frac{\text{production costs per unit}}{\text{R&D costs}} \rightarrow 0 \]
Further Barriers to Innovation

- **Non-excludability:**
  Inventions may spread freely once revealed.

- **Externalities:**
  Market price of an existing product or service fails to incorporate the full opportunity cost to society of producing.

- **Landlord-tenant problem:**
  As long as the landlord pays for the equipment and the tenant pays the energy bills, the investment in new, energy-efficient appliances will not be made.
To become innovative technological inventions need to be accompanied by business model inventions.

A business model describes the rationale of
- how an organization
- creates, delivers, and captures value,
- in economic, social, cultural or other contexts.

What does Adoption Uncertainty, Path Dependence and other barriers to innovation bring about for you as innovation agents?
- What questions come up?
Coping with Barriers to Innovations

Surpassing Organizational Solipsism I

- Solipsism is the philosophical idea that only one's own mind is sure to exist.
- As an epistemological position, solipsism holds, that knowledge of anything outside one’s own mind is unsure.
- Maturana and Varela explain that at least 80 percent of the information that the brain works with is information already in the brain. We create our own worlds by what we choose to notice, creating a world of distinctions that make sense to us. Information from the external world is a minor influence.
Surpassing Organizational Solipsism II

Effectuation: Principles of effective innovation

• Start with who you are, what you know, and whom you know
  – Not pre-set goals

• Invest what you can afford to lose – extreme case € 0,00
  – Not expected return

• Build a network of self-selected stakeholders
  – Not competitive analysis

• Embrace and leverage surprises
  – Not avoid them

• Co-create the future
  – Not inevitable trends
**Effectuation: Inverting conventional wisdom**

Classic causation model from marketing textbooks

- Market definition
- Segmentation
- Targeting
- Positioning

Capturing an existing market

**The Customer**

- Co-creating a new market
- Stakeholder identification
- Segment definition
- Adding segments and partners
- Fabrication of new markets

Process of effectuation used by expert entrepreneurs

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**Effectuation: Strategic options**

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<thead>
<tr>
<th>Adoption uncertainty</th>
<th>High</th>
<th>Low</th>
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<tbody>
<tr>
<td>Plan according to market research</td>
<td>Persist on brilliant idea</td>
<td></td>
</tr>
<tr>
<td>Adapt to perceived demand</td>
<td>Co-create through stakeholder commitments</td>
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</tbody>
</table>

Control

- Low
- High
Lean Startup: Premise

- Every company has some methodology for product development, launch and life-cycle management.
- These processes provide detailed plans, checkpoints and goals for every step in getting a product out the door; sizing markets, estimating sales, developing marketing requirements documents, prioritising product features.
- Yet at the end of the day even with all these procedures the embarrassing fact is that 9 out of 10 of new products are failures.

Customer Development Model

The Customer Development Model starts with a simple idea:

Learning and discovering who a company’s initial customers will be, and what markets they are in, requires a simultaneous process to and a distinct process from product development.

### Lean Startup Guidelines

- Test your Business Model continuously.
- The question is not "Can this product be built?" Instead, the questions are "Should this product be built?" and "Can we build a sustainable business around this set of products and services?"
- Figure out the problem that needs to be solved and then develop a Minimum Viable Product / Service to begin the process of learning as quickly as possible.
- Focus on figuring the right thing to invent – the thing customers / payers / users want and will pay for.
- Focus on how to measure progress, how to setup milestones, how to prioritize work.
- Turn ideas into products, measure how customers respond, and then learn whether to pivot or persevere. Accelerate that feedback loop.
Value Proposition

- What value do we deliver to the Customer / User / Payer?
- Which one of our customer’s problems are we helping to solve?
- What bundles of products and services are we offering to each Customer Segment?
- Which customer needs are we satisfying?

Customers / Users / Payers

- For whom are we creating value?
- Who are our most important Customers / Users / Payers?
Channels

- Through which Channels do our Customer Segments want to be reached?
- How are we reaching them now?
- How are our Channels integrated?
- Which ones work best?
- Which ones are most cost-efficient?
- How are we integrating them with customer routines?

Customer Relationships

- What type of relationship does each of our Customer Segments expect us to establish and maintain with them?
- Which ones have we established?
- How are they integrated with the rest of our business model?
- How costly are they?
Revenue Streams

• For what value are our Customers / Users / Payers really willing to pay?
• For what do they currently pay?
• How are they currently paying?
• How would they prefer to pay?
• How much does each Revenue Stream contribute to overall revenues?

Partners

• Who are our Key Partners?
• Who are our Key Suppliers?
• Which Key Resources are we acquiring from partners?
• Which Key Activities do partners perform?
Resources, Activities and Costs

- What Key Resources do our Value Propositions require?
  Our Distribution Channels? Customer Relationships? Revenue Streams?
- What Key Activities do our Value Propositions require?
  Our Distribution Channels? Customer Relationships? Revenue streams?
- What are the most important costs inherent in our business model?
- Which Key Resources are most expensive?
- Which Key Activities are most expensive?

- What does Effectuation and Lean Startup require from you as innovation agents?
- In what ways can you make use of these concepts?
- What questions come up?
Implications

Resolution on EU research and innovative funding, European Parliament, 2011

• Takes the view that not all innovation is research-based and that not all research has innovation as its goal;
• Believes in consequence that the proposed reorganisation should cover the full spectrum of activities related to innovation, from concept to market, including non-technological, eco- and social innovation;
• Believes that this should include the promotion of innovative practices (such as innovative and pre-commercial public procurement, inducement prizes, IPR policies and lead market initiatives) and the facilitation of their widespread dissemination;
• Recalls that standardisation should be taken into account in addressing grand challenges and shaping priority areas of Common Strategic Framework for funding in research and innovation, but should not be a new separate instrument or activity
Regulation establishing Horizon 2020, European Union, 2013

- Horizon 2020 should support all stages in the research and innovation chain, including non-technological and social innovation and activities that are closer to the market, with innovation and research actions having a different funding rate based on the principle that the closer to the market the supported activity is, the larger the additional funding from other sources should be.
- Activities closer to the market include innovative financial instruments.
- The management of European research funding should be more trust-based and risk-tolerant towards participants.

More emphasis on innovation*

- **Substantial support to activities** such as prototyping and testing, demonstrating and piloting, first market replication - establishing technical and economic viability in (near) operational environments

- **Significant support to demand side approaches**
  innovation procurement (pre-commercial procurement and public procurement of innovative solutions), standard-setting, inducement prices...

- **Piloting new forms and sources of innovation**
  extending beyond technological and research-based innovation

- **Leveraging and boosting engagement of industry**
  Public Private Partnerships, SME measures, Debt and Equity Instruments...

- **When you evaluate a proposal, you need to take into account innovation activities in the targeted innovation actions as well as in research and innovation actions**

*The definitions of the terms used are available in the Horizon 2020 Glossary on the Participant Portal.
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<thead>
<tr>
<th>Award criteria</th>
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<tr>
<td>Research and Innovation/Innovation</td>
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<tr>
<td><strong>Excellence</strong></td>
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<tr>
<td>Clarity and pertinence of the objectives</td>
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<td>Soundness of the concept, including trans-disciplinary considerations, where relevant</td>
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<tr>
<td>Extent that proposed work is ambitious, has innovation potential, and is beyond the state of the art (e.g. ground-breaking objectives, novel concepts and approaches)</td>
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<tr>
<td>Credibility of the proposed approach</td>
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<tr>
<td><strong>Impact</strong></td>
</tr>
<tr>
<td>The expected impacts listed in the work programme under the relevant topic</td>
</tr>
<tr>
<td>Enhancing innovation capacity and integration of new knowledge</td>
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<tr>
<td>Strengthening the competitiveness and growth of companies by developing innovations meeting the needs of European and global markets; and, where relevant, by delivering such innovations to the markets</td>
</tr>
<tr>
<td>Any other environmental and socially important impacts</td>
</tr>
<tr>
<td>Effectiveness of the proposed measures to exploit and disseminate the project results (including management of IPR), to communicate the project, and to manage research data where relevant</td>
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<tr>
<td><strong>Implementation</strong></td>
</tr>
<tr>
<td>Coherence and effectiveness of the work plan, including appropriateness of the allocation of tasks and resources</td>
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<tr>
<td>Complementarity of the participants within the consortium</td>
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<tr>
<td>Appropriateness of the management structures and procedures, including risk and innovation management</td>
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**Example of Expected Impact**
from *Call for developing governance for the advancement of Responsible Research and Innovation*

- Increase public-private partnership in the innovation process.
- Increase the social value and acceptability of innovation.
- Facilitate the emergence of new business models that embed sustainability and social responsibility throughout the entire business process.
Proposition from Effectuation

• While the probability of failure in new ventures may not be reducible because it depends on a seemingly inexhaustible variety of interacting factors, the costs of failure are another matter altogether.
• Innovations created through processes of effectuation, if they fail, will fail early and/or at lower levels of investment than those created through processes of conventional wisdom.
• Ergo, effectuation processes allow the economy to experiment with more numbers of new ideas at lower costs.

• What ideas / concepts are useful and in what ways?
• What questions come up?
Innovation is usually a group effort, involving collaboration between visionaries and engineers, and creativity comes from drawing on many sources.

A great team is pairing visionaries, who can generate ideas, with operating managers, who can execute them. Visions without execution are hallucinations.

Authority should be questioned, hierarchies should be circumvented, nonconformity should be admired, and creativity should be nurtured.

A lesson of digital-age innovation is that, now as in the past, physical proximity is beneficial. There is something special about meetings in the flesh.

- The capacity to integrate across organizational, intellectual, and cultural boundaries,
- the capacity to experiment,
- and the habits of thought that allow us to make sense of radically ambiguous situations and move forward in the face of uncertainty are the real wellsprings of innovation.
Innovation triggers innovation: Umdasch AG

1868  “Concession for Carpentry Trade” for Stefan Hopferwieser
1902  Production of the first “scaffolding frames for bridge construction”
1956  Development of the first shuttering boards for a power plant construction and creation of the name DOKA (after “Donaukraftwerk”, German for Danube power plant)
2008  Revenue of more than 1 billion euros and over 7,000 employees.
... thank you for participating

References

- Everett Rogers, Diffusion of Innovations
- http://www.stanford.edu/group/e145/cgi-bin/winter/drupal/upload/handouts/Four_Steps.pdf
- Alexander Osterwalder & Yves Pigneur, Business Model Generation