Insights into the Innovation Process

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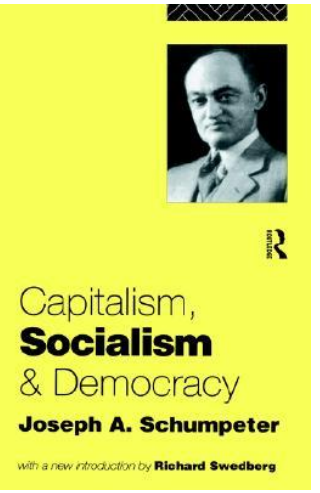
Original Meaning of Innovation

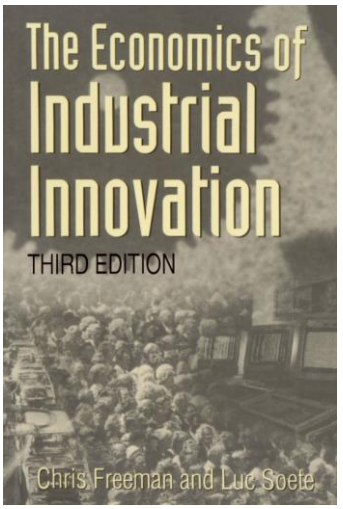
- **innovation (n.)**
  mid-15c., "restoration, renewal", from Latin *innovationem* (nominative *innovatio*), noun of action from past participle stem of *innovare* (see *innovate*).

- **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.

Innovation in Economy



- **Joseph Schumpeter identified innovation as the critical dimension of economic change.**
- **He sought to prove that innovation-originated market power could provide better results than the invisible hand and price competition.**
- **According to Schumpeter innovation is**
  - the introduction of new goods,
  - the introduction of new methods of production,
  - the opening of new markets,
  - the conquest of new sources of supply and
  - the carrying out of a new organization
  of any industry.



Frascati Manual, created by Chris Freeman
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.

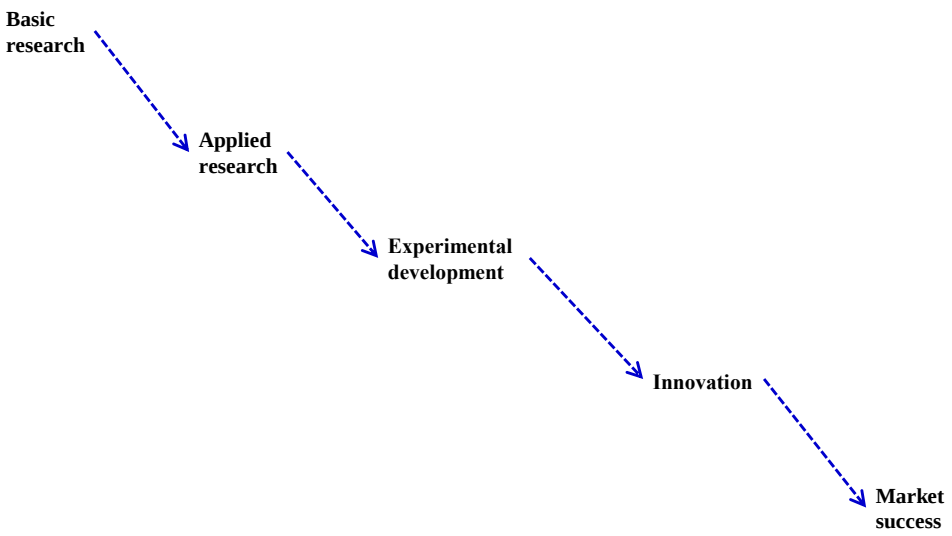
Oslo Manual
Proposed guidelines for collecting and interpreting technological innovation data, OECD 1992

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.

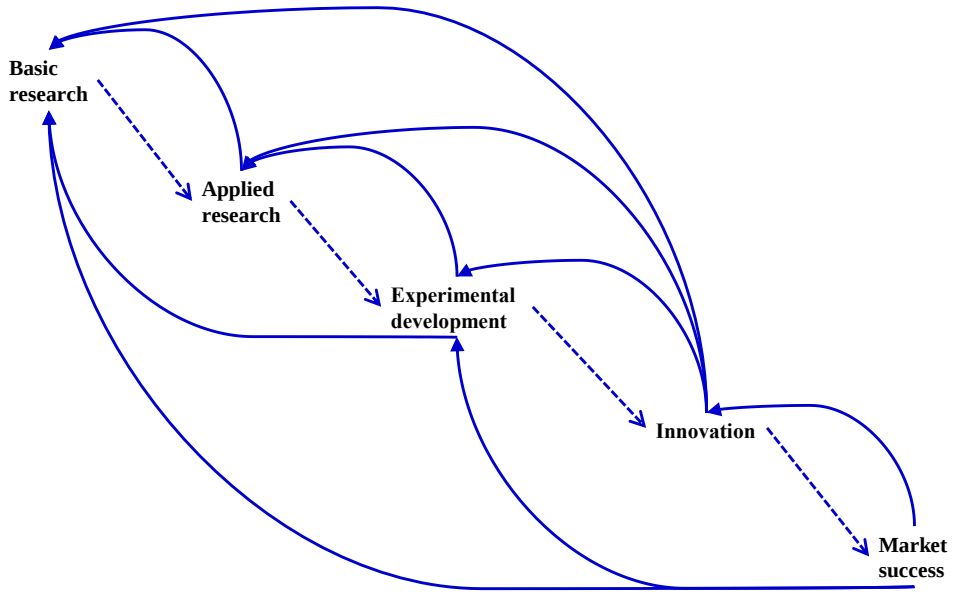
Máire Geoghegan-Quinn, Commissioner for Research, Innovation and Science, 19.07.2010

- **Investment in research and innovation is the only smart and lasting way out of crisis and towards sustainable and socially equitable growth.**
- **Translating research into new technologies, products and services is at the heart.**
- **This initiative aims to boost the whole innovation chain from 'research to retail'.**

Linear (Tayloristic) Model of Innovation

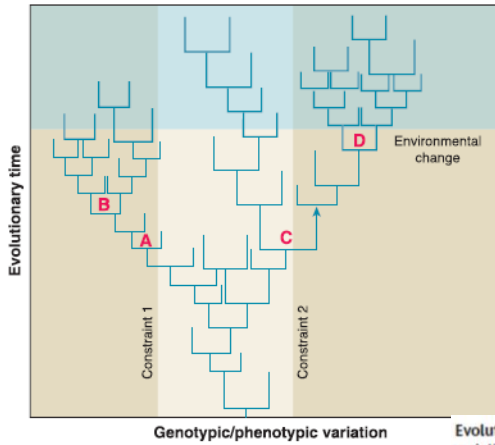


Enhanced Model of Innovation



Green Paper on Innovation, European Commission 1995

An innovation is a new or improved product, equipment or service which is successful on the market.



Insights into Innovation, Science Vol 304, 2004

Invention is the creation and establishment of something new.

Innovation is an invention that becomes economically successful.

Evolutionary invention and innovation. In general, genetic or phenotypic variation in organisms starts to accumulate in the center between two developmental barriers that are difficult for selection to overcome (constraint 1 and constraint 2) (**A** and **C**). Once selection overcomes these constraints and the variation becomes fixed in the population of a particular organism, it is called an "invention." (**B**) Sometimes an invention is of immediate value to the organism in its current environment and so can be defined as innovative. (**D**) Alternatively, an invention may become innovative only later, when there is a change in the environment. In both cases, the invention becomes an innovation because it forms the basis of a series of subsequent adaptive radiations. Invention need not imply innovation, which often depends on additional environmental events (D). Often inventions are recognized after the fact—sometimes long after they have emerged.

Five-Year Assessment of the European Union Research Framework Programmes 1999-2003

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.

There is a clear distinction between

- **Research**
- **Invention**
- **Innovation**

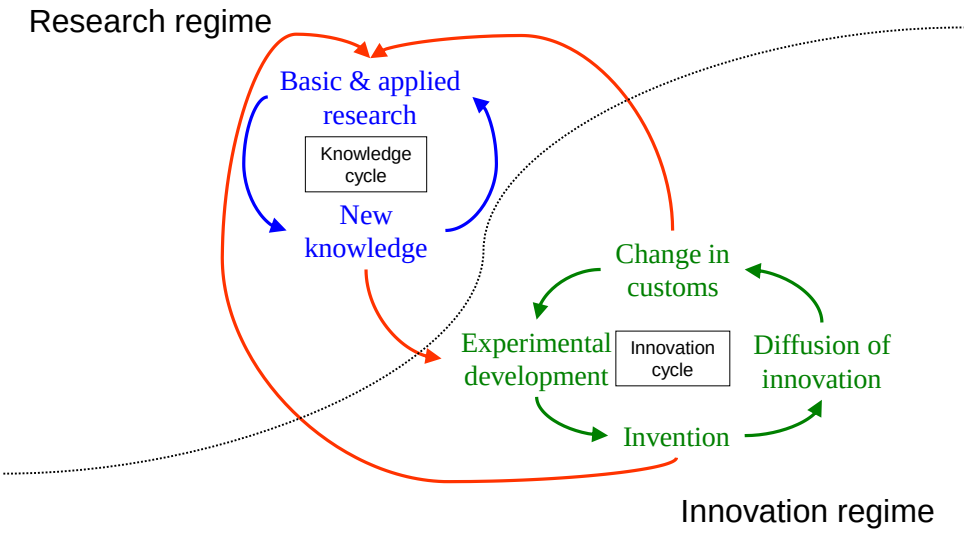
Researchers	Inventors	Creators of Innovation
Leonard Kleinrock 	**Tim Berners-Lee** 	**Mosaic** **Netscape**
Federico Faggin 	**Ed Roberts (MITS Altair 8800)** 	**Apple** **Acorn** **Commodore** **RadioShack**

Researchers	Inventors	Creators of Innovation
William Guier George Weiffenbach	Johns Hopkins University Applied Physics Laboratory Defense Advanced Research Projects Agency	Roger Easton United States Naval Research Laboratory William Perry

Joe Gebbia, Co-Founder and CPO of Airbnb
https://www.youtube.com/watch?v=e6Xt0RvTR6A

Perry Chen, Co-Founder and CEO of Kickstarter
https://www.youtube.com/watch?v=sHVBVAGUwCg

Systemic Model of Innovation

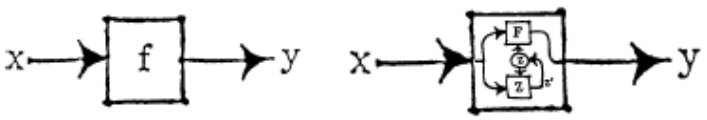


General Implications from Complexity Science

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

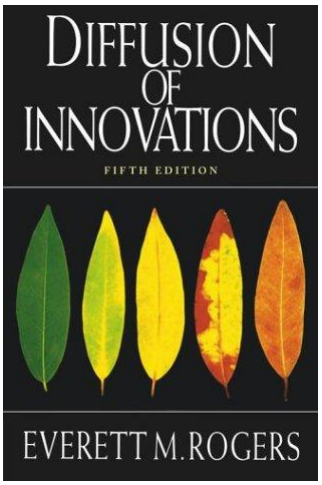
- **A response once observed for a given stimulus may not be the same for the same stimulus given later.**

Principles of Self-Organization; Heinz von Foerster; 1984

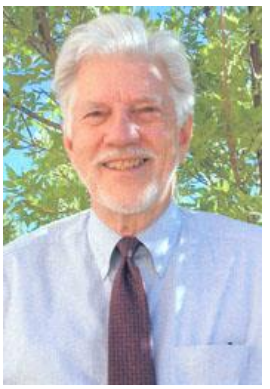


- **A complex system not only depends on its past but accurate longer range forecasts are impossible.**

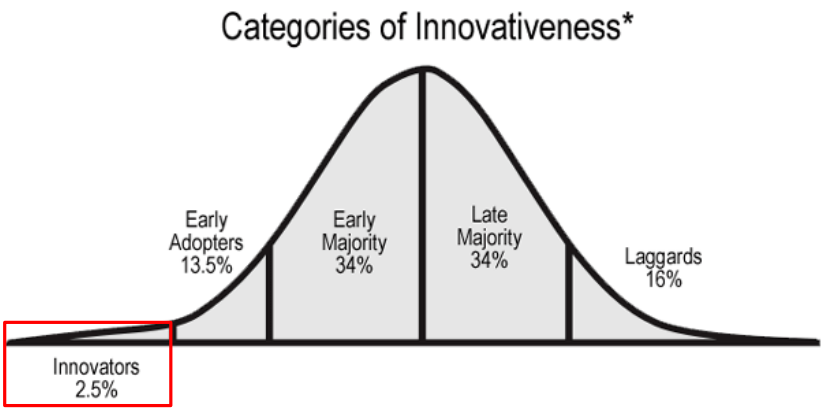
Deterministic Nonperiodic Flow; Edward Lorenz; 1963



Diffusion of innovations is
the spread of innovations,
through market or non-market channels,
from first implementation anywhere in the world
to other countries and regions,
and to other markets and firms.



Coping with Diffusion of Innovations

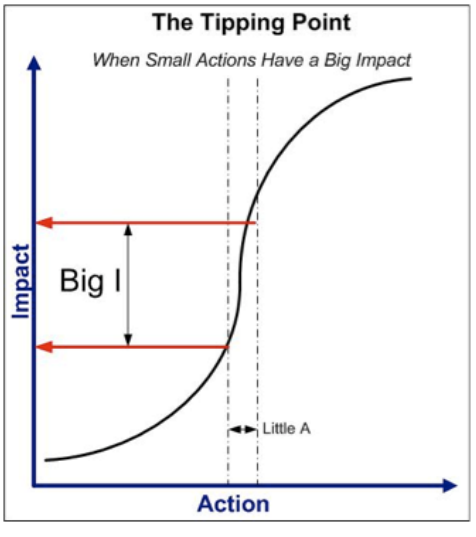


*From E.M. Rogers, *Diffusion of Innovations*, 4th edition (New York: The Free Press, 1995)

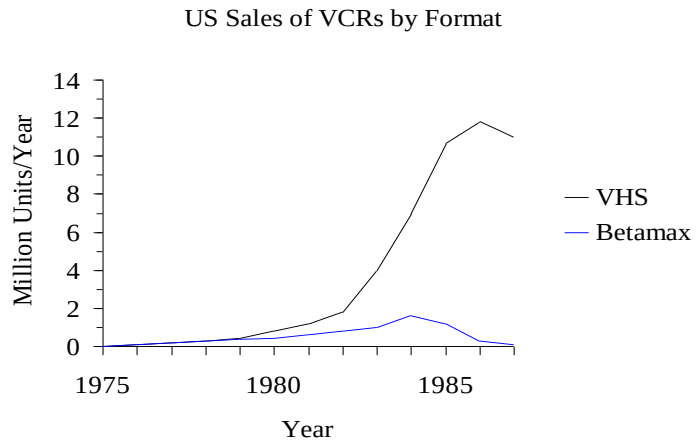
Acknowledging the Tipping Point Phenomenon I

- **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.**

Acknowledging the Tipping Point Phenomenon II

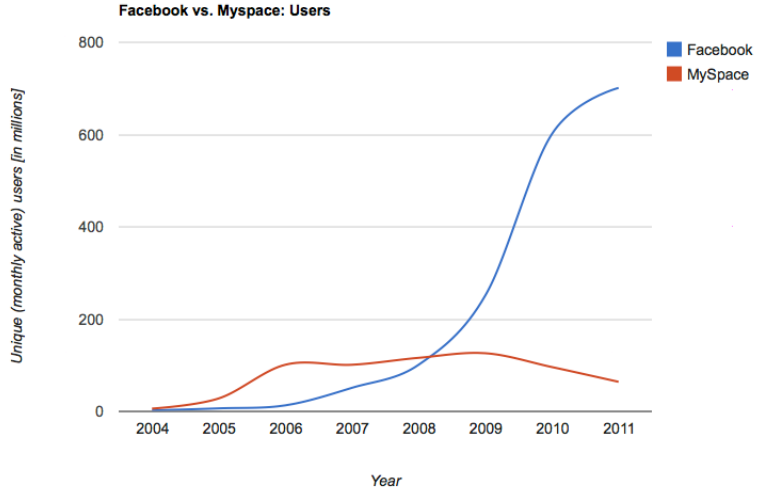


Tipping Point in Action I



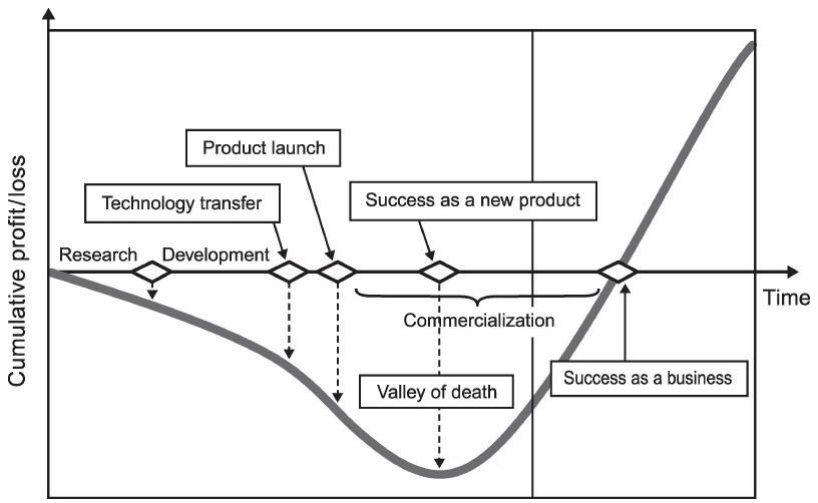
The great majority of inventions never get off the bottom of the curve, and never produce appropriate returns.

Tipping Point in Action II

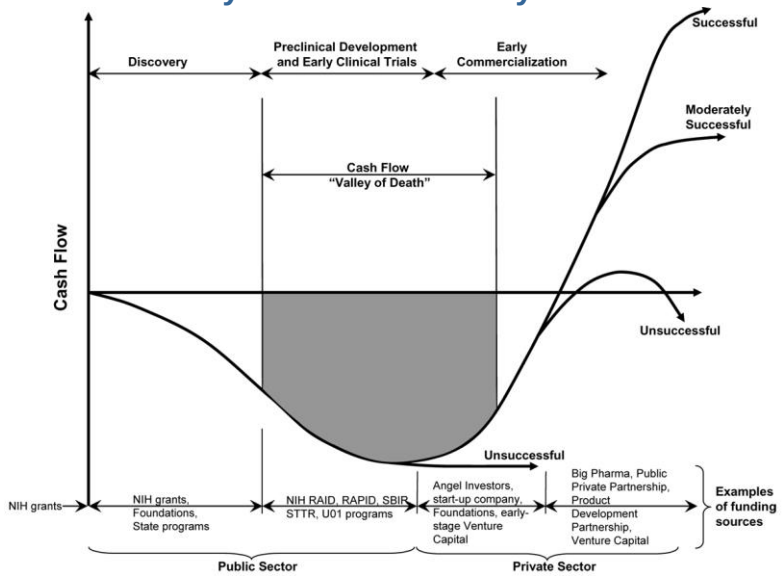


Barriers to Diffusion of Innovations

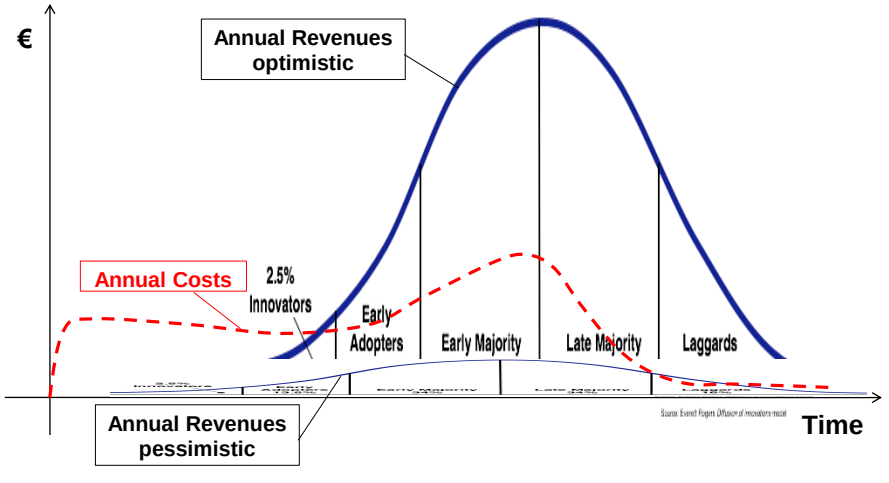
Adoption Uncertainty
Valley of Death – and beyond I



Adoption Uncertainty
Valley of Death – and beyond II



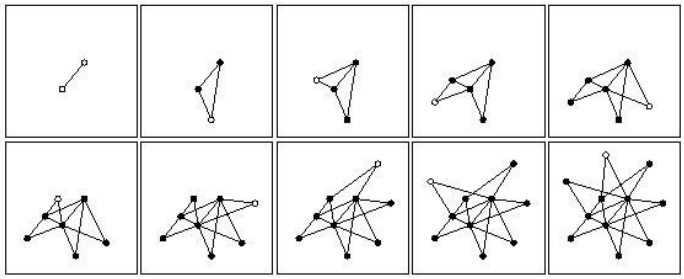
Adoption Uncertainty
Valley of Death – and beyond III



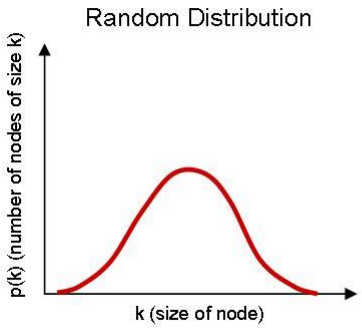
Path Dependence I

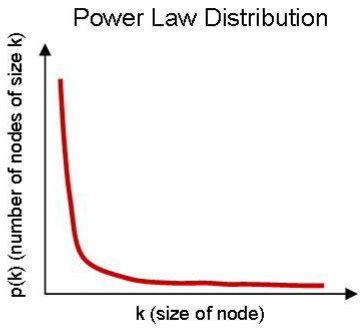
Adam Smith's invisible hand of the market:
The market will settle on a product distribution and prices that are beneficial to all the individual members of a community, and hence to the community as a whole.

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

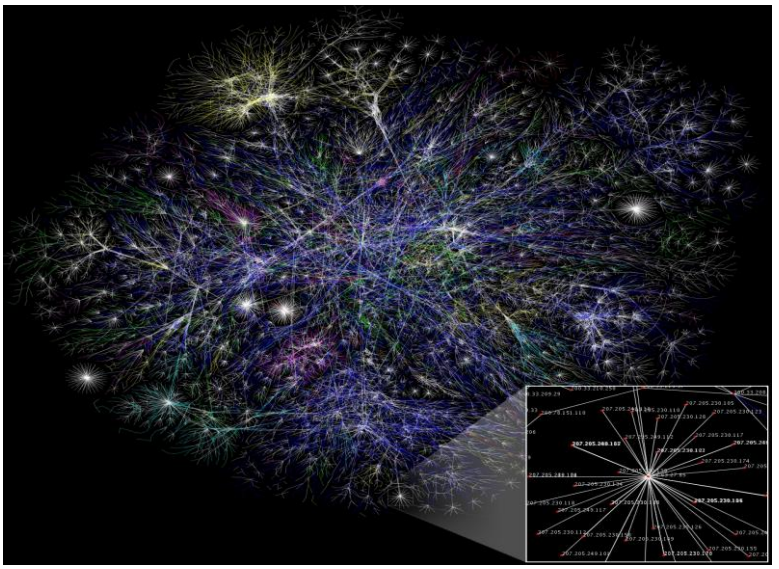


Path Dependence II





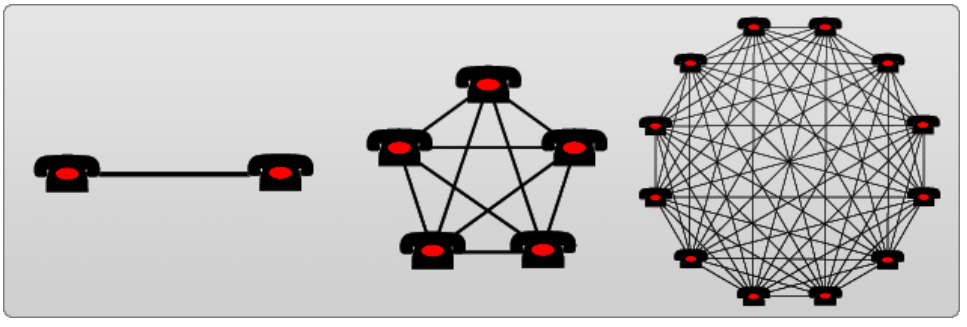
Path Dependence in Action



Path Dependence: Emergent Properties

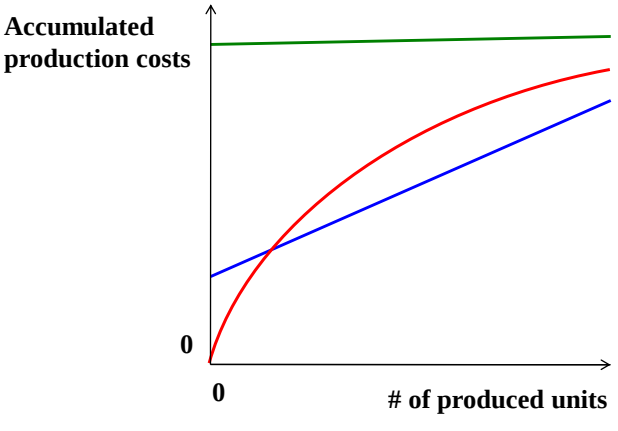
- **Multiple Equilibria**
  Initially, quite different asymptotic market-share solutions are possible. The outcome is indeterminate; it is not unique and not predictable.
- **Possible Inefficiency**
  If one product / service is inherently "better" than the other, but has "bad luck" in gaining early 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



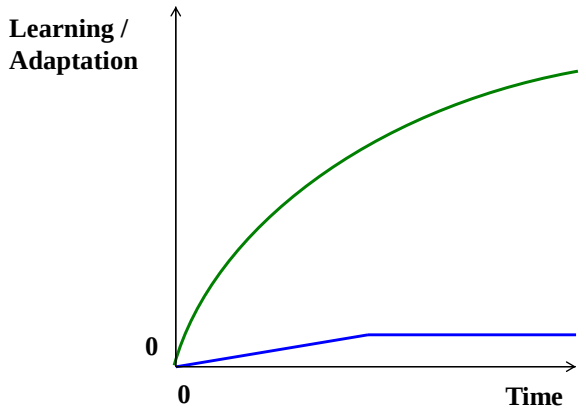
- **A network effect is the effect that one user of a good or service has on the value of that product to other people.**
- **When network effect is present, the value of a product or service increases as more people use it.**

Conditions for Path Dependence: Production Costs



$$\frac{\text{production costs per unit}}{\text{R\&D costs}} \longrightarrow 0$$

Conditions for Path Dependence: Learning and Adaptation

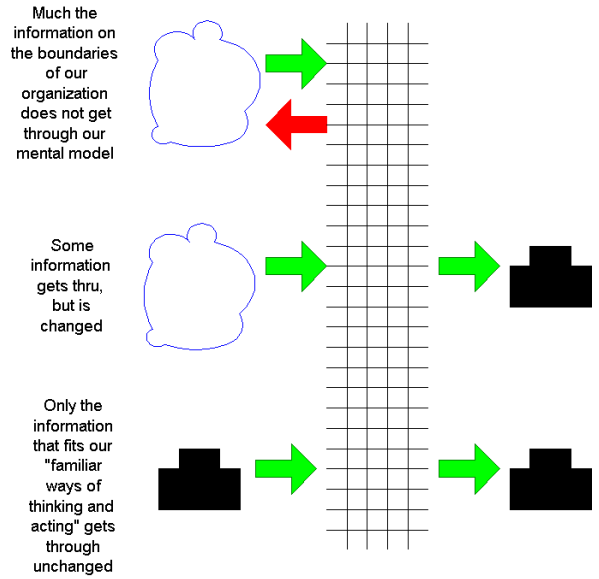


Coping with Barriers to Diffusion of Innovations

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



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.**

Effectuation: Key finding

Conventional Wisdom

To the extent we can predict the future, we can control it.

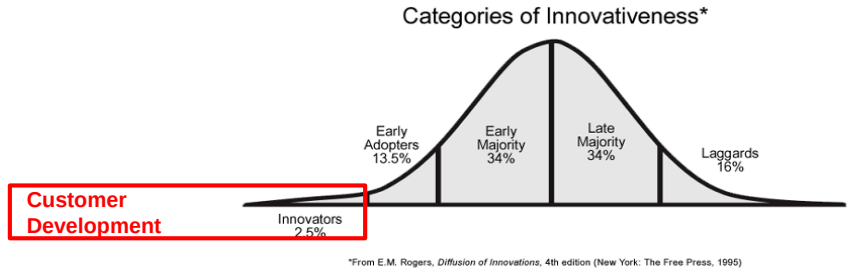
Effectual Logic

To the extent we can control the future, we don't need to predict it.

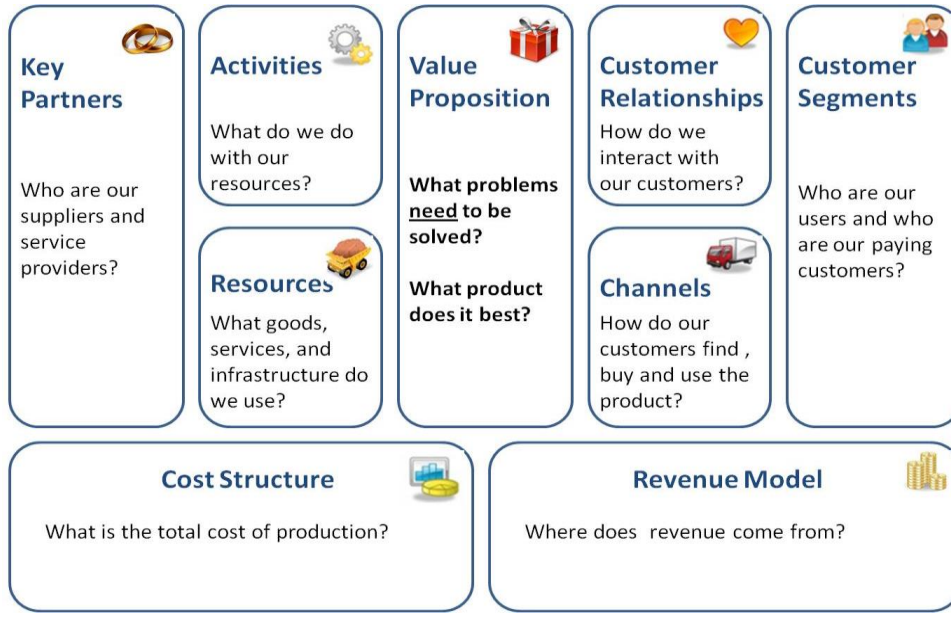
Customer Development Model

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.



Business Model Generation: The Business Model Canvas



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?**

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."**

Proposition by Saras Sarasvathy

- **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.**

References

- **Everett Rogers, Diffusion of Innovations**
- **http://effectuation.org/sites/default/files/research_papers/amr01-inevitability-to-contingency.pdf**
- **http://ec.europa.eu/research/reports/2004/pdf/fya_en.pdf**
- **http://www.stanford.edu/group/e145/cgi-bin/winter/drupal/upload/handouts/Four_Steps.pdf**
- **Alexander Osterwalder & Yves Pigneur, Business Model Generation**
- **http://www.vto.at/wp-content/uploads/2013/10/Why-the-Lean-Startup-Changes-Everything_S.Plank_HBR-052013.pdf**