



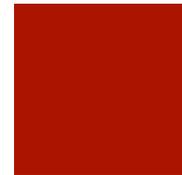
Adoption and Diffusion of ICT Innovations

Lauri Frank, University of Jyväskylä, Finland

- Concepts and history of Innovation Diffusion research
- Special characteristics of ICT innovations
- Innovation Adoption and Diffusion

3rd of May 2010, Copenhagen

About me

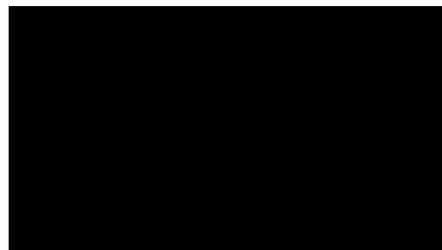


- DSc (Econ) in Technology Research (Economics), Lappeenranta University of Technology
- Current positions:
 - Assistant professor, e-business, Dept. of CS & IS, Faculty of IT, University of Jyväskylä 1/2005-
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 - Adjunct professor, School of Business, Lappeenranta University of Technology 11/2006-
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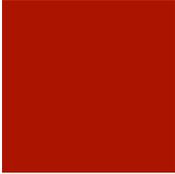


Jyväskylä and its university

- The city of Jyväskylä
 - 270 km from Helsinki
 - Site of many education related firsts in Finland
 - Approx. 126 000 inhabitants, 40 000 students
- University of Jyväskylä
 - The oldest Finnish-speaking University in the world
 - Founded 1863
 - Over 16 000 students
 - Seven faculties, 80 majors and 120 subjects
 - Largest IT-programme in the country in terms of attendance



Content



- 1st lecture: Adoption and Diffusion of ICT Innovations
 - Introduction to the lectures
 - Participants will learn the basic concepts and theories related to the Innovation Diffusion Theory (IDT) and to relate these to the ICT field
- 2nd lecture: Diffusion of ICT innovations in the Information Society: case Broadband in Finland
 - Participants will be informed on the case of broadband diffusion in Finland



Innovation Adoption and Diffusion

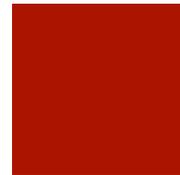
Lauri Frank, University of Jyväskylä

- Concepts and history of Innovation Diffusion research
- Special characteristics of ICT innovations
- Innovation Adoption and Diffusion



Concepts, history and special characteristics of ICT innovations

What is an innovation?



An Innovation may be a new

- product
 - service
 - production process technology
 - structure or administrative system
 - plan or program
-
- "If an idea seems new to the individual, it is an innovation" (Rogers, 2003)

Basic Concepts



- Innovation
 - A new idea, product, service or process
 - New information to the potential adopter
- Adoption
 - The individual process of accepting an innovation
- Diffusion
 - The spread of an innovation within the adopting population
 - The aggregate of adoptions

Innovation characteristics



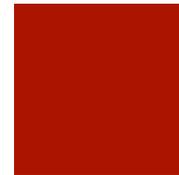
- *Radical vs. Incremental (Freeman 1994)*
- *Disruptive vs. Sustaining (Bower & Christensen 1995)*
- *Discontinuous vs. Continuous (Tushman & Anderson 1986)*
 - Radical innovations are described as fundamental changes that represent revolutionary changes in technology
 - Incremental innovations are minor improvements or simple adjustments in current technology
- In practice: think of a radical and an incremental ICT innovation

Radical vs. Incremental Innovation (modified from Ansoff 1988)



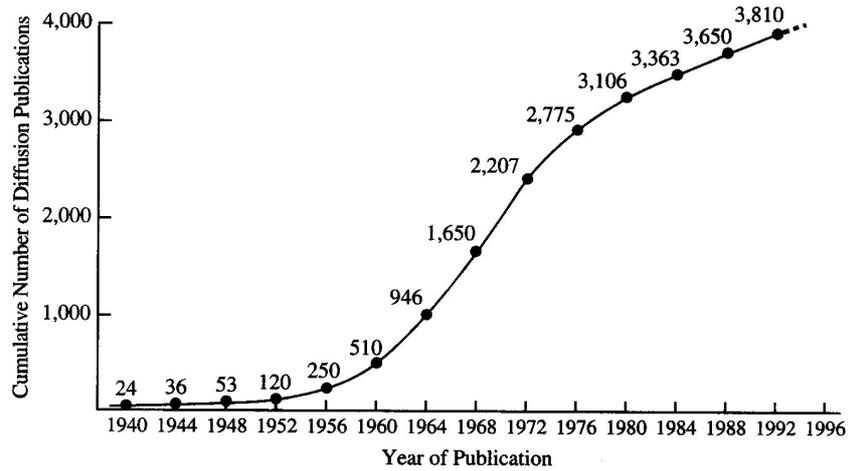
	Market		
Technology		Uncertain	Certain
Uncertain		Radical Innovation	Evolutionary technology innovation
Certain		Evolutionary market innovation	Incremental Innovation

The History of Innovation Diffusion Research

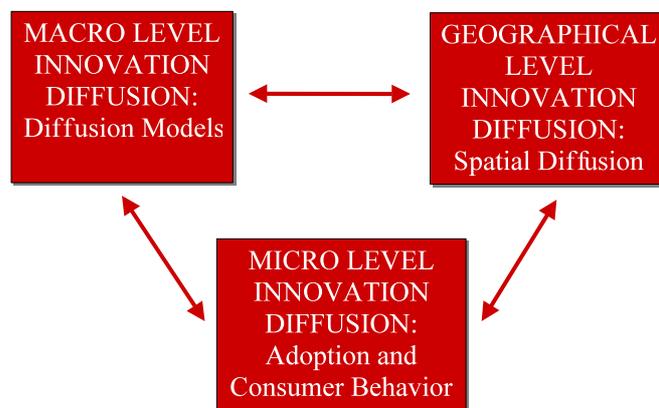


- Started in early 20th century
 - Sociologist Tarde: imitation & innovation
 - Anthropological research on imitation behaviour
 - Definition of the diffusion of innovation
 - hybrid corn study 1943
 - medical sociology since 1950's
 - communication since 1960's
 - marketing since 1970's
 - Bass model 1969
- Diffusion research is multi-disciplinary

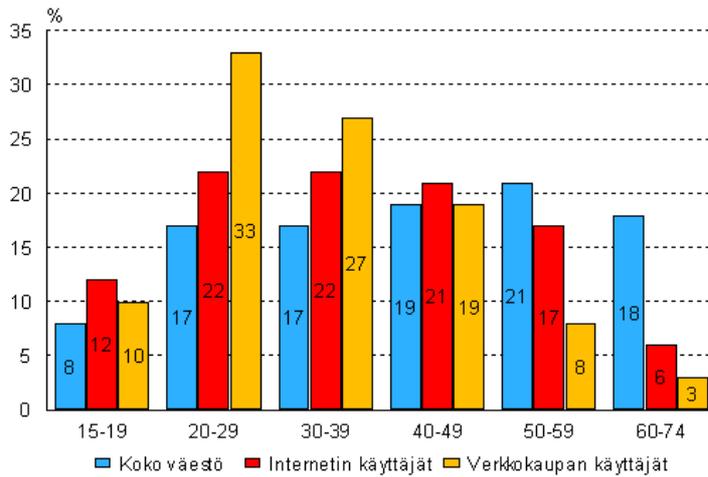
The Diffusion of Diffusion Research (Rogers 2003)



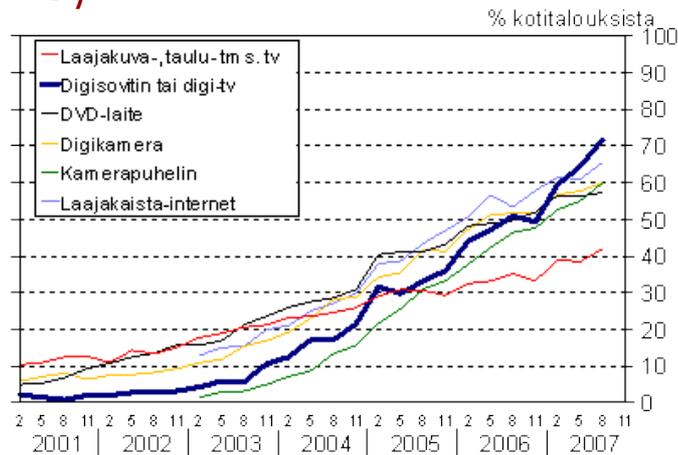
Different Levels of Diffusion



Adoption of Internet and webshopping by age groups (Statistics Finland 2004)

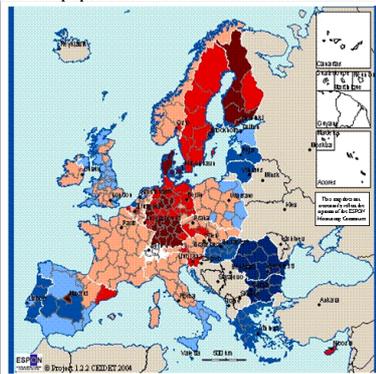


Diffusion of selected ICT devices in Finland (Statistics Finland)



Internet use of firms in Europe

Estimated proportion of firms with Internet access 2003

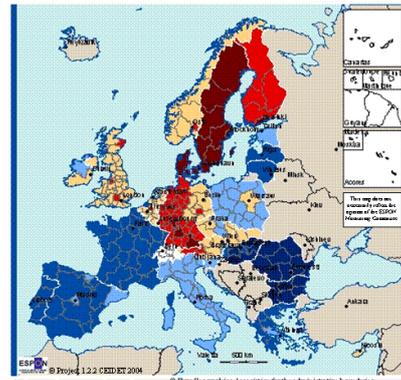


Estimated proportion of firms with Internet access 2003 (%)



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Origin of data: Estimation based on data from Eurostat, eEurope+ and ESPON Data Base.
Source: Estimation based on data from Eurostat, eEurope+ and ESPON Data Base.

Estimated proportion of firms with own website 2003



Estimated proportion of firms with own website 2003 (%)



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Special Characteristics of IT Innovations

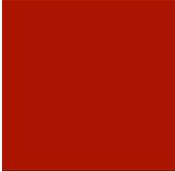
1. High uncertainty (turbulence)
 - Market uncertainty
 - Technological uncertainty
2. Network effects (or externalities)

Market uncertainty



- A great deal of high tech products fail to diffuse:
 - 90-95 % of product ideas never get to the markets
 - 30-50% of innovations fail diffusing the markets
 - Technology knowledge is not enough for successful product launch
- Uncertainty about the size and the characteristics of markets
 - Diffusion research: Does the innovation get adopted – and if it does, how fast?
- Market uncertainty increases the perceived risk of a potential adopter
 - Increased risk delays adoption

Technological uncertainty



- Competing technologies
 - Increases uncertainty and possibly delays diffusion as adopters wait for the "winning technology"
 - Lack of standards increases uncertainty
- Multiple layers
 - ICT: Device + service + application
- Technical reliability and product age
- (Data) security
 - Lack of confidence, e.g. towards webstores

Network Effects



- Definition:
 - “The buyer of the last unit of a good has a higher benefit than the buyer of the first because the sale of the earlier units has created some benefits in a related dimension” (Economides, 1991)
- Significantly influence the diffusion (Church and Gandal, 1993; Katz and Shapiro, 1985; Witt, 1997)

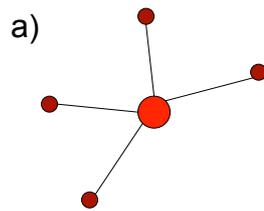
Network Effects



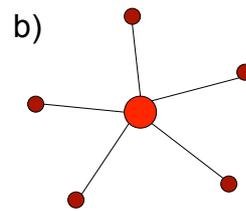
- A user gets more utility of a network the more users the network has:
 - a phone user needs also other phone users for using his phone
 - a subscriber profits increasingly from a growing network: the number of connections in a network is $n(n-1)$
- However, the number of possible connections is not the actual network of a subscriber
 - everyone doesn't necessarily communicate with each other; the effect is greater if everyone does so

Network Effects Example

One additional subscriber joins a four-subscriber network



12 possible connections
→ One additional user yields 8 new connection possibilities



20 possible connections

Direct and Indirect Network Effects

- Direct effects
 - A user benefits directly of new users joining the network
 - New possibilities for using the form of communication
 - e.g. a possibility to call the new user
- Indirect effects
 - A user benefits indirectly of new users joining the network
 - The product provider benefits from a larger network
 - Economies of scale
 - Decreasing price
 - Interconnectivity with other networks
 - Better service for a larger network

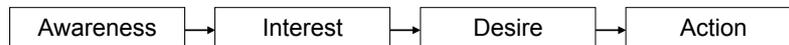


Innovation adoption

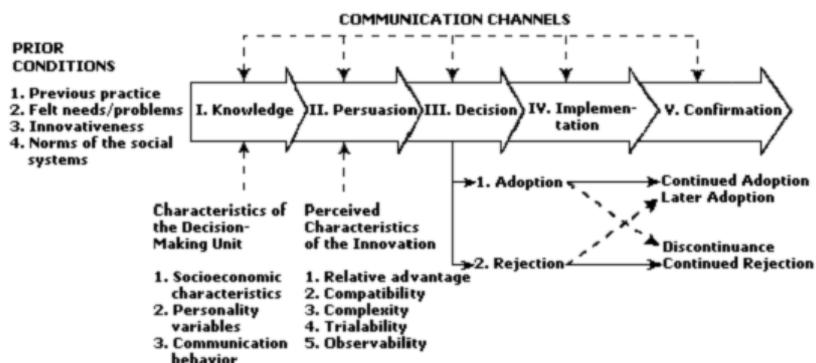
- Innovation adoption
 - Is adoption the same as purchase?
- Adoption process
- Factors affecting adoption
- Adopter groups

Adoption process models

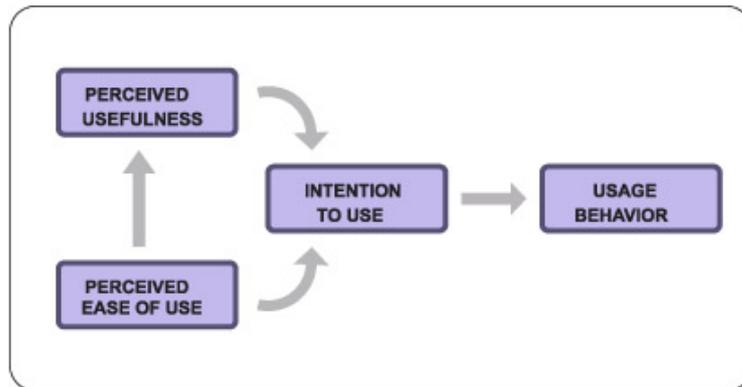
- The potential adopter proceeds through different phases to a decision point, where he either adopts or rejects the innovation
- Process model (AIDA):



Adoption process (Rogers 1995)



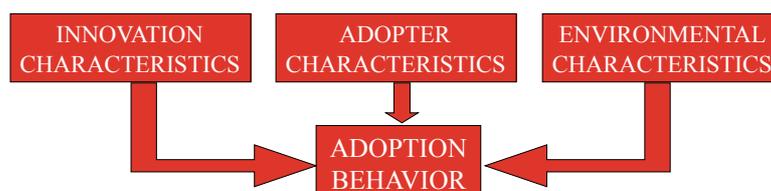
Technology acceptance model (TAM, Davis et al. 1989)



Factors Affecting the Adoption of an Innovation

- Three sets of factors can be thought to affect the adoption decision of innovations:

1. Factors related to Innovation
2. Factors related to Adoption Unit (here consumer)
3. Factors related to Environment



Innovation Characteristics #1



- **Relative Advantage**

- *The degree to which the new equipment is perceived as being better than that which precedes it*
- Often expressed as economic profitability, social prestige, or other benefits

- **Complexity**

- *The degree to which a new technology is perceived as relatively difficult to understand and to use*
- If a technology is perceived as being too complex, people will try it less likely

Innovation Characteristics #2



- **Compatibility**

- *The degree to which an innovation is consistent with existing values, past experience, and current needs*
- The more compatible with potential adopters' needs and values, the more likely the innovation will be adopted

- **Observability**

- *The degree to which the operations and results of a new innovation are observable to others*
- The more visible a new innovation the more likely it will be adopted

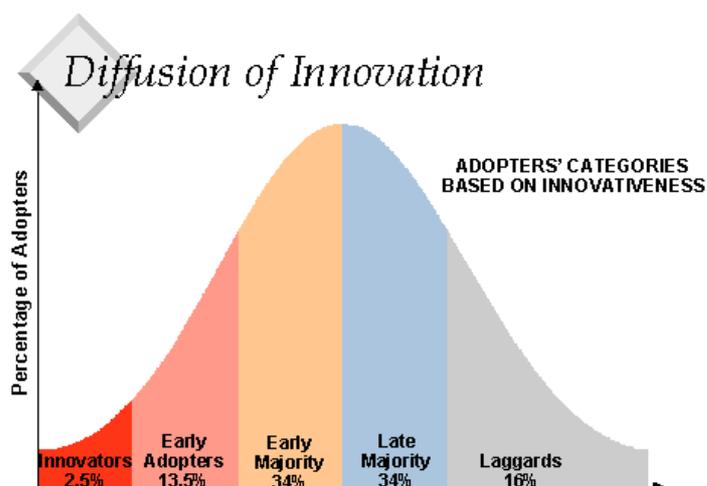
- **Trialability**

- *The possibility to test a new innovation before adopting*
- Trialability reduces uncertainty and greatly increases the rate of adoption

Adopter Categorization

- The best known categorization is based on the innovativeness of adopters:
“Innovativeness is the degree to which an individual or other adoption unit is relatively earlier in adopting new ideas than the other members of a system.” (Rogers 2003)
- In practice 'innovativeness' is difficult to measure and adopters are often grouped using:
 - Their adoption time of an innovation
 - Self-evaluation
 - Demographic factors

Adopter Categories



Category Characteristics (Rogers / Moore)



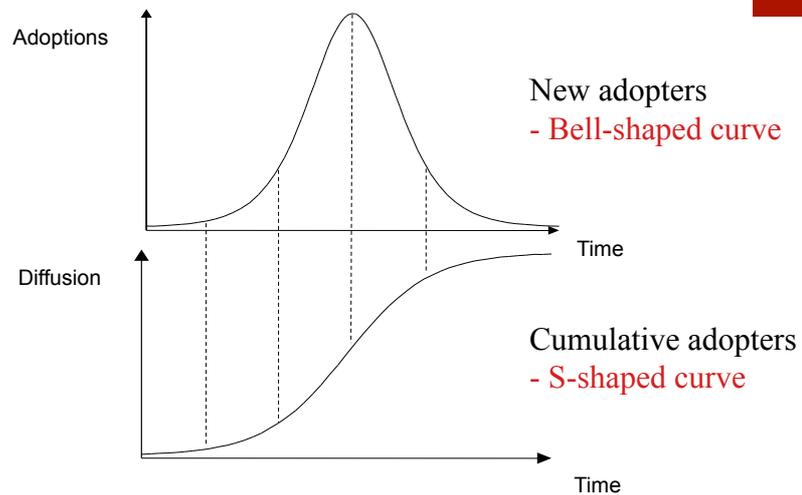
	Innovators	Early Adopters	Early Majority	Late Majority	Laggards
Percentage of all adopters	2.5 %	13.5%	34 %	34 %	16 %
Relationship to technology	Love technology	Technology as an enabler	Neutral	Technology is a necessary evil	Hate new technology
Reason to buy	Technological novelty value	Creates competitive advantage	Advantages provided by technology	Network pressure or econ. reasons	No other option
Marketing strategy	Increase awareness with media marketing	Stress benefits and be prepared to adapt	Pay attention on distribution channels and re-evaluate price	Re-evaluate pricing strategy (discounts)	No specific strategy
Communications channel	Mass media	Mass media (and grapevine)	Mass media and grapevine	Grapevine (and mass media)	Grapevine

Adopter characteristics and environmental factors

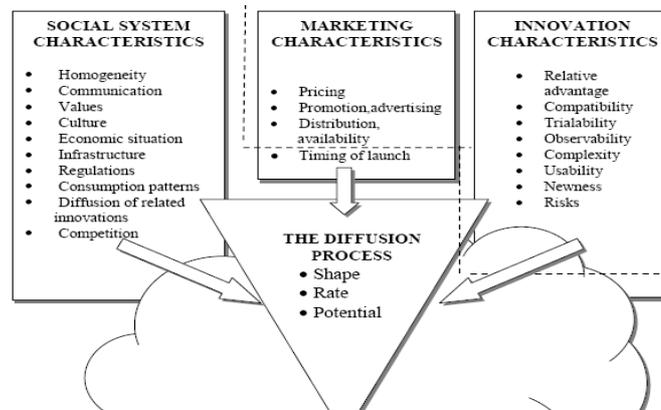


- Demographic factors
 - Age
 - Gender
 - Profession
 - Education
 - Income
- Psychographic factors
 - Involvement
 - Innovativeness
 - Need of distinction
 - Communication behaviour
 - Risk behaviour
- Environment / Society
 - Norms and laws
 - Social distinction and pressure

Adoption and Diffusion

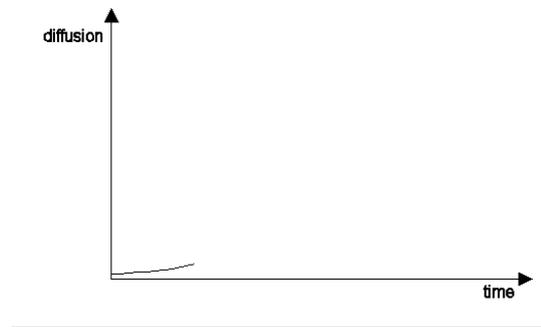


Factors Affecting Diffusion (Puumalainen 2002)



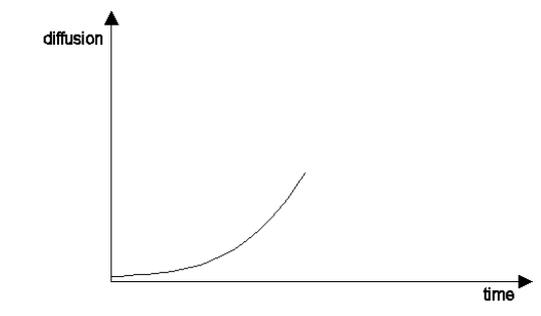
Diffusion process 1/4

First only a few individuals adopt the innovation in each time period; those are innovators



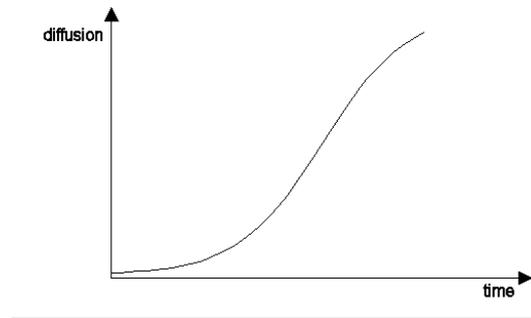
Diffusion process 2/4

Soon the diffusion curve begins to climb, as more and more individuals adopt in each succeeding time period



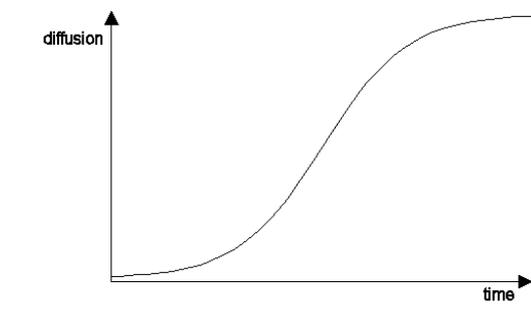
Diffusion process 3/4

Eventually, the trajectory of adoptions begins to level off, as fewer and fewer individuals remain who have not adopted the innovation

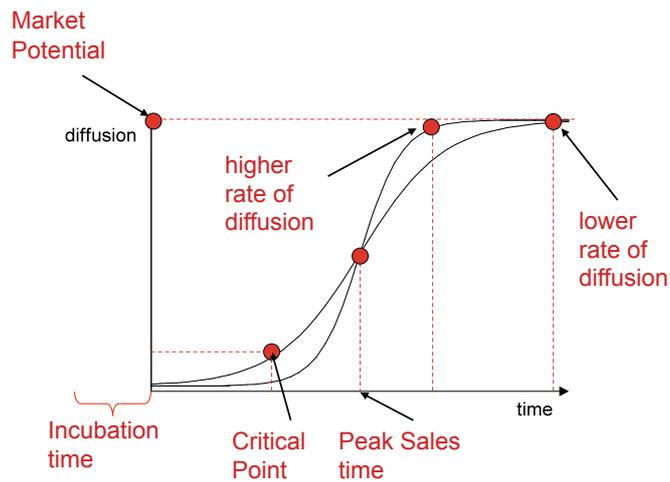


Diffusion process 4/4

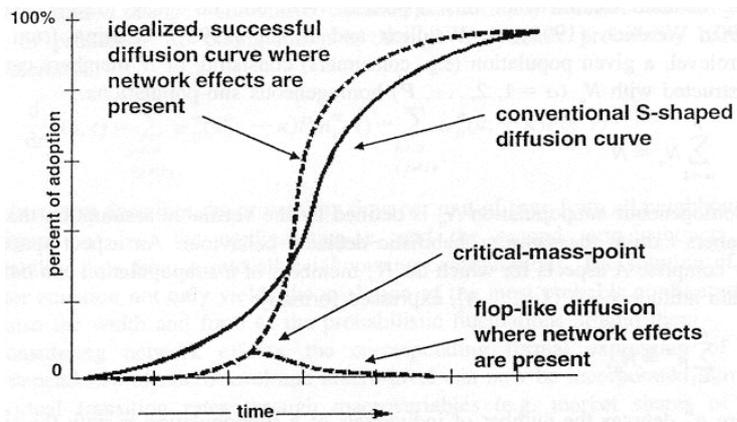
Finally, the S-shaped curve reaches its asymptote, and the diffusion process is finished



The diffusion curve



Diffusion with and without network effects



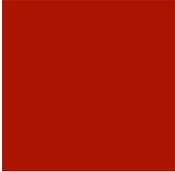
Diffusion without (Solid) and with (Dotted) Network Effects.
(Schroder, 2000)

Implications



- Diffusion may be facilitated by strengthening and supporting network effects
 - direct effects: subsidised (free) devices
 - indirect effects: production cost reductions transferred to consumer prices
- Critical mass must be achieved for the innovation to be successful

Summary



- ICT innovations have special characteristics:
 - Market and technology uncertainty
 - Network effects
- The adoption of an innovation
 - Adoption process
 - Innovation characteristics
 - Adopter groups
- The diffusion of an innovation
 - S-curve