



Users, consumers and citizens in the innovation system

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Objectives

- Demand side of innovations
- Main theories and research questions
- Involvement of users, consumers and citizens in innovation system
- How user producer interaction (UPI) influences dynamics of innovation
- Different UPI concepts, demand articulation
- Citizens innovation, open innovation



Problem

Failure to involve users major reason for unsuccessful innovation processes

(e.g. Nahuis/Moors 2012; Boon *et al.* 2011; Peine 2011; Smits *et al* 2008, 2007, Oudshoorn /Pinch 2008, 2005)

Difficulties in dealing with user-related issues in design account for majority of failures (Hyysalo 2010)

Merits of user involvement are clear, but many barriers to effectively organise it

How to explain this user-technology paradox?



Linear innovation processes



Linear drug R&D pipeline

Target
identification
& validation

Screening and
pre-clinical
trials

Clinical
trials

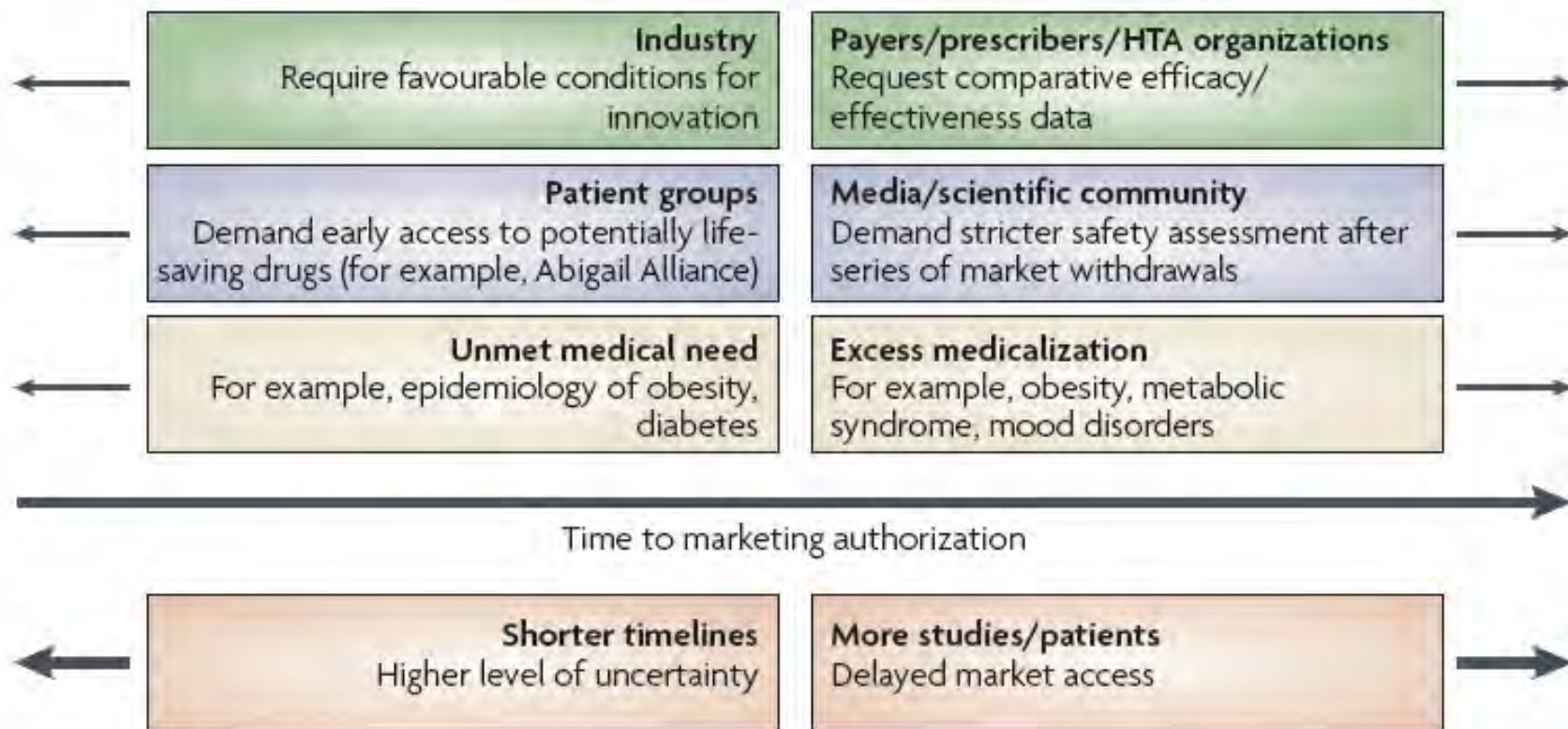
Registration
and market
introduction

Health care arena



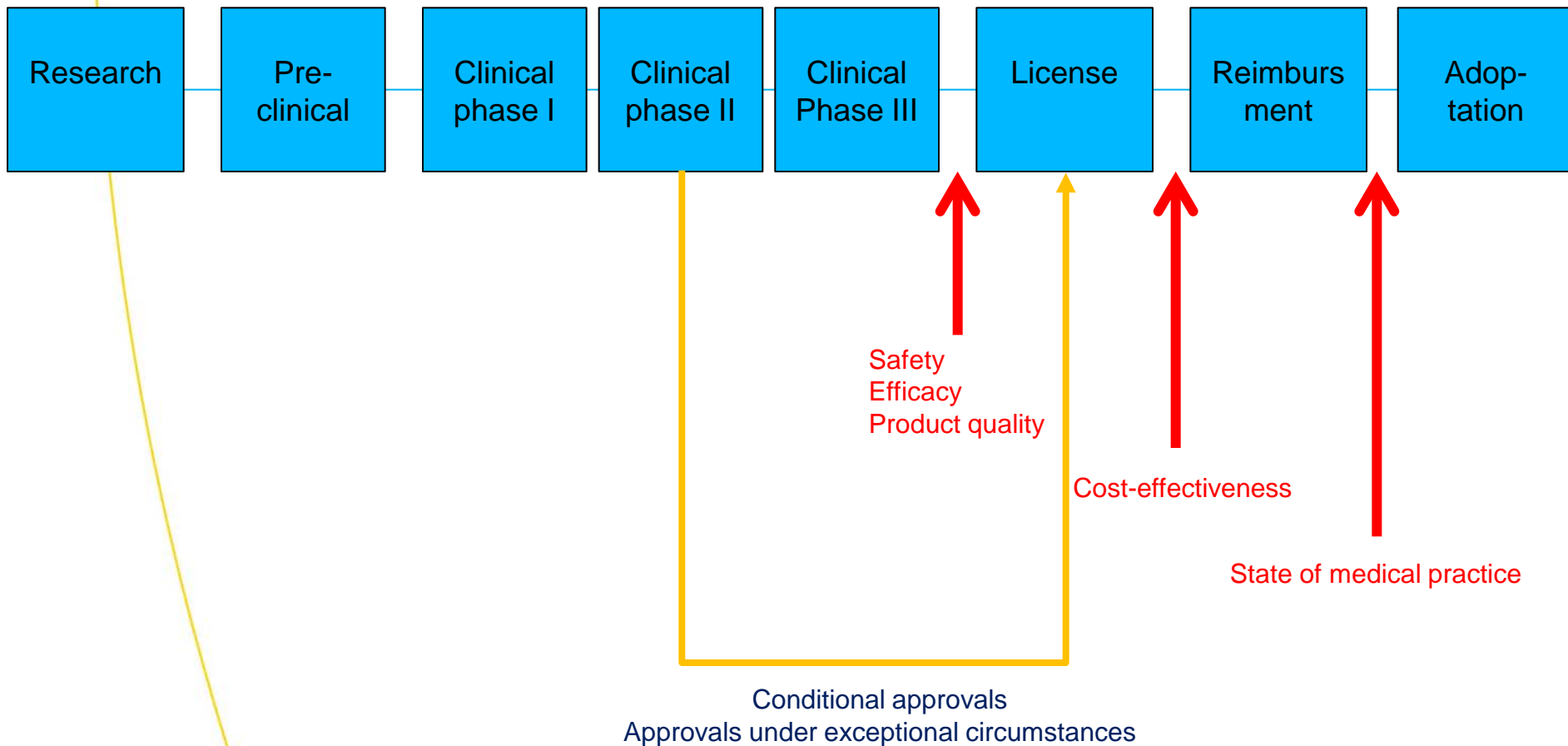
Different actors: different wishes & preferences

Eichler *et al.* 2008





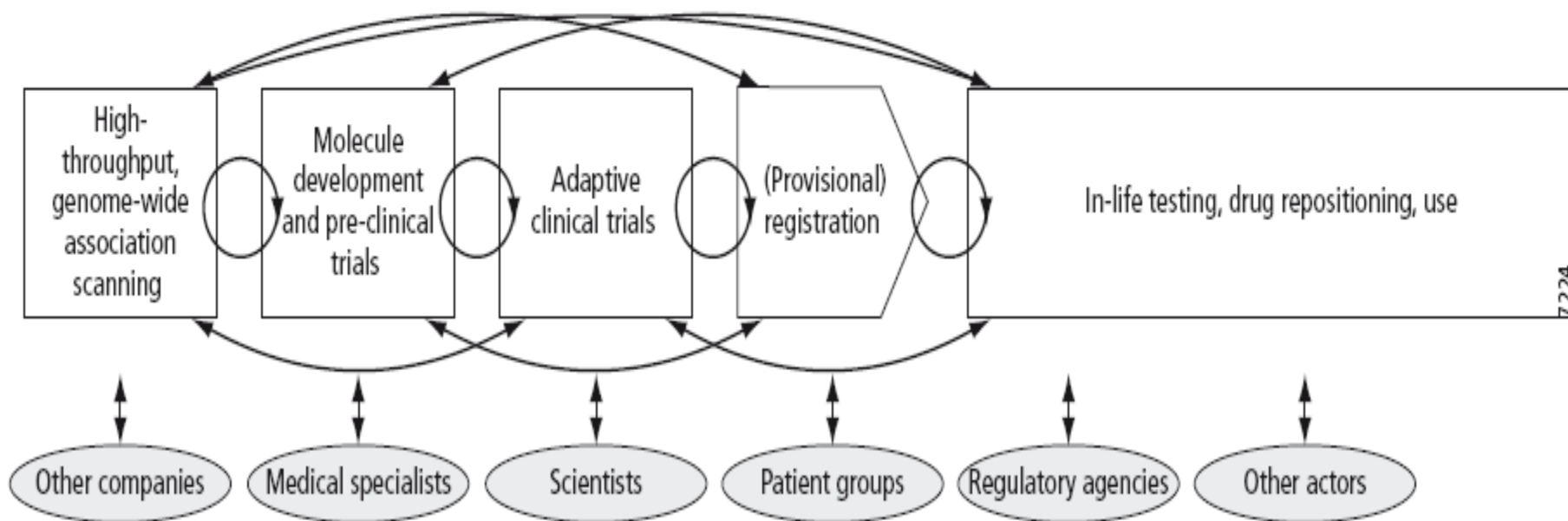
Hurdles in innovation process





Systemic perspective on innovation

Vision of non-linear, 'open' drug R&D innovation process





Problem analysis

How do users contribute to innovation?

Road from initial invention (by manufacturer, user, community) to a stabilised, widespread innovation takes years

Technology and practices of people who adopt it and who develop it tend to change over time

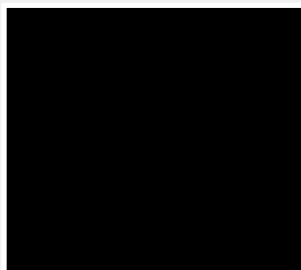
What is the role of users in this intertwined change of technology, practices, and organisations



Supply side

Variety creation:

Heterogeneous actors supply technological alternatives during the innovation process :



treated here as a 'black box'

Supply side provides technological variety for selection

User-producer interaction

Demand side provides legitimacy as feedback

Demand side

Selection processes:

Heterogeneous actors can provide social acceptance (legitimacy) during the innovation process:

Socio-political acceptance

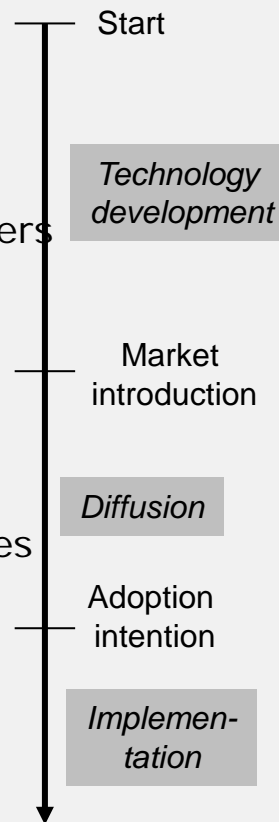
- Public preferences
- Politics
- Government & policy makers
- Media & opinion makers
- NGO's

Market acceptance

- Adopters
- Disposers
- Supply chain intermediaries

Community acceptance

- Users, citizens
- Local stakeholders





The background: Orthodox economics

- Perfect rationality and optimizing decision: bounded rational choices
- The production function: A strange definition of technology
- Technical change is fully exogenous, black box
- The economy is static, only responding to external changes



From science push to demand pull

Science-push model Bush (1945)

-favoured by scientists

Demand-pull model Schmookler (1966)

Changed market demands calls for innovation

Mowery & Rosenberg (1979): both demand and supply side influences are crucial for innovation



Learning by doing/ Learning by using

- **Learning by Doing** (Arrow, 1962):
 - Learning after the R&D stage, from experience reduces labor costs (per unit of output)
- **Learning by using** (Rosenberg, 1982):
 - “For in an economy with complex new technologies, there are essential aspects of learning that are a function not of the experience involved in producing the product but of its *utilization* by the final user.” (p. 122)



Study of users in innovation has matured greatly over last decades

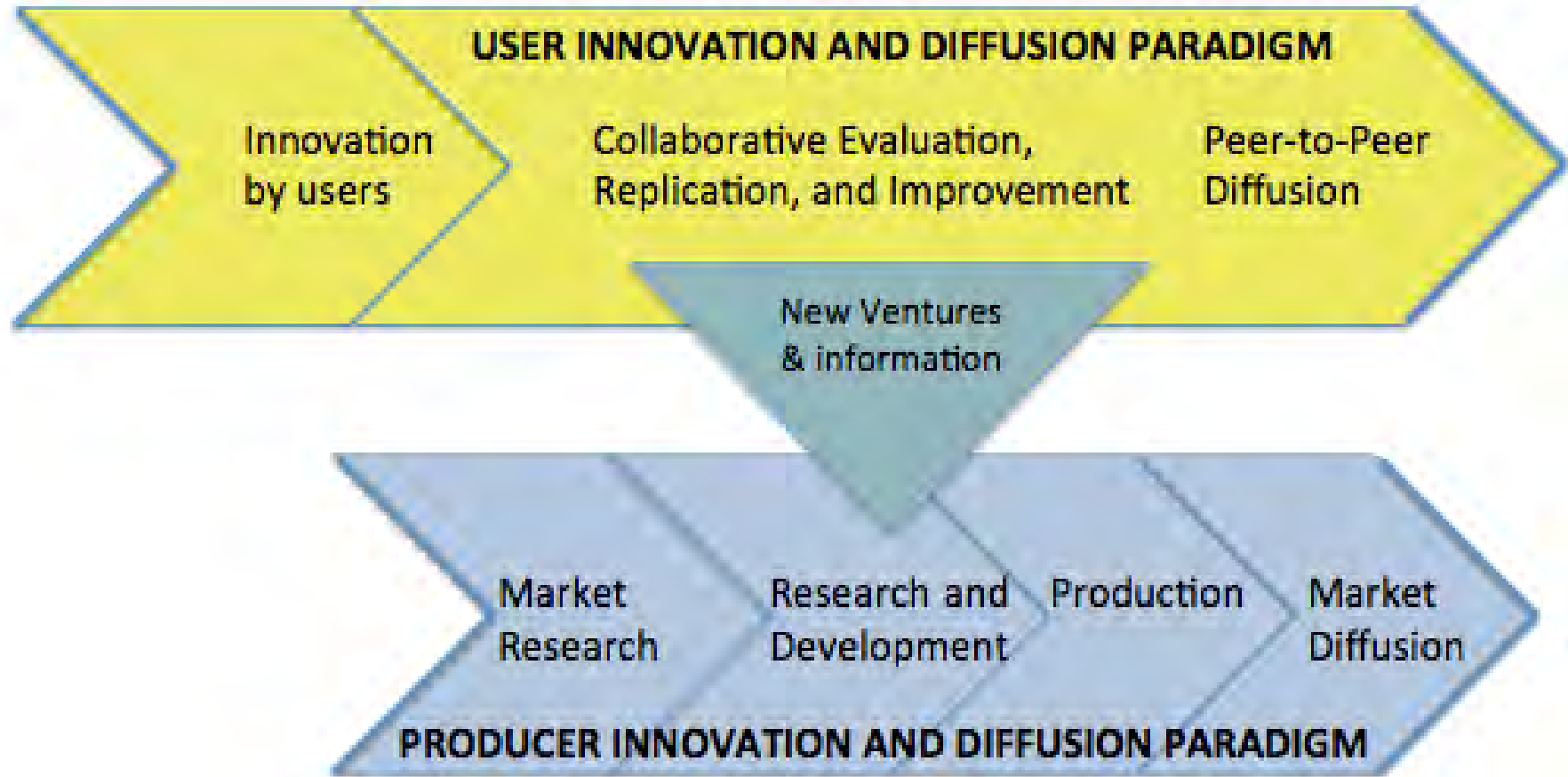
Research on innovation by users has established that users innovate and modify a significant part of both industrial and consumer goods

Studies at home and workplaces revealed importance of domestication and user-centred adjustment of new technology



Selection environment

Raasch & Von Hippel (2012)





Demand side: innovation theories

- . *User Producer Interaction*
- . *Diffusion of Innovation*
- . *User Innovation*



User-producer interactions

- On pure markets, economic actors are separated, relying only on quantitative information.
 - But: Is information about volumes and prices sufficient in innovative activities?
- More detailed, qualitative information is necessary, about needs, wishes, preferences
- Innovative activities involve interdependent relationships between users and producers (interactions)



Sources of Innovation

- Users as the actual source of innovation
 - Articulation of a need
 - ... through provision of a solution
- Examples and Relevance
 - Industrial goods (vHippel I)
 - Consumer goods (vHippel II)
- *Lead-user* method and other toolkits for innovation

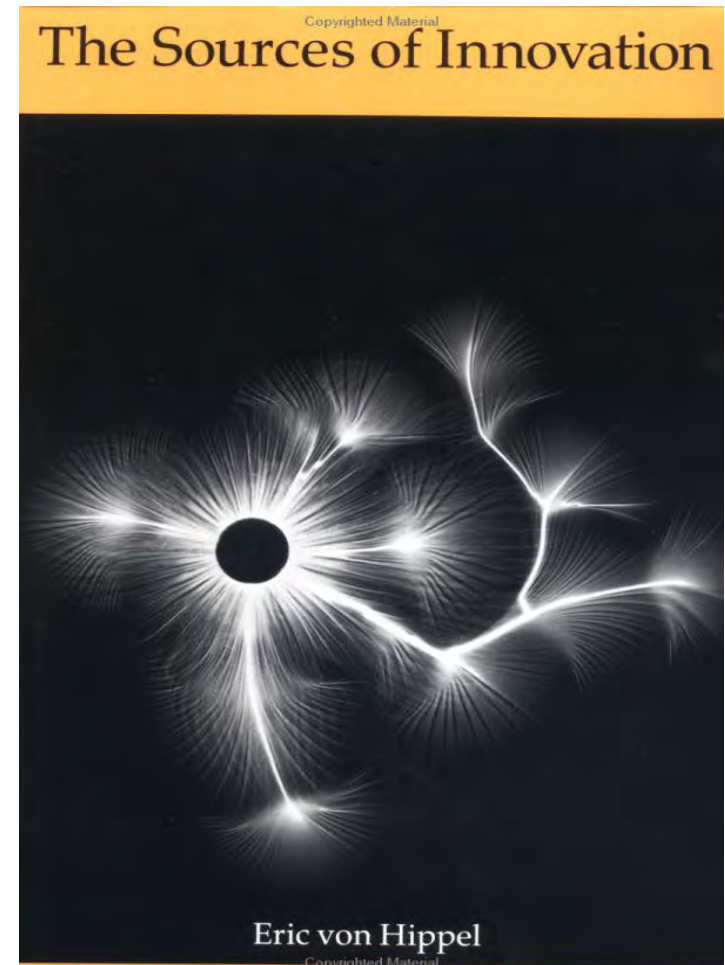






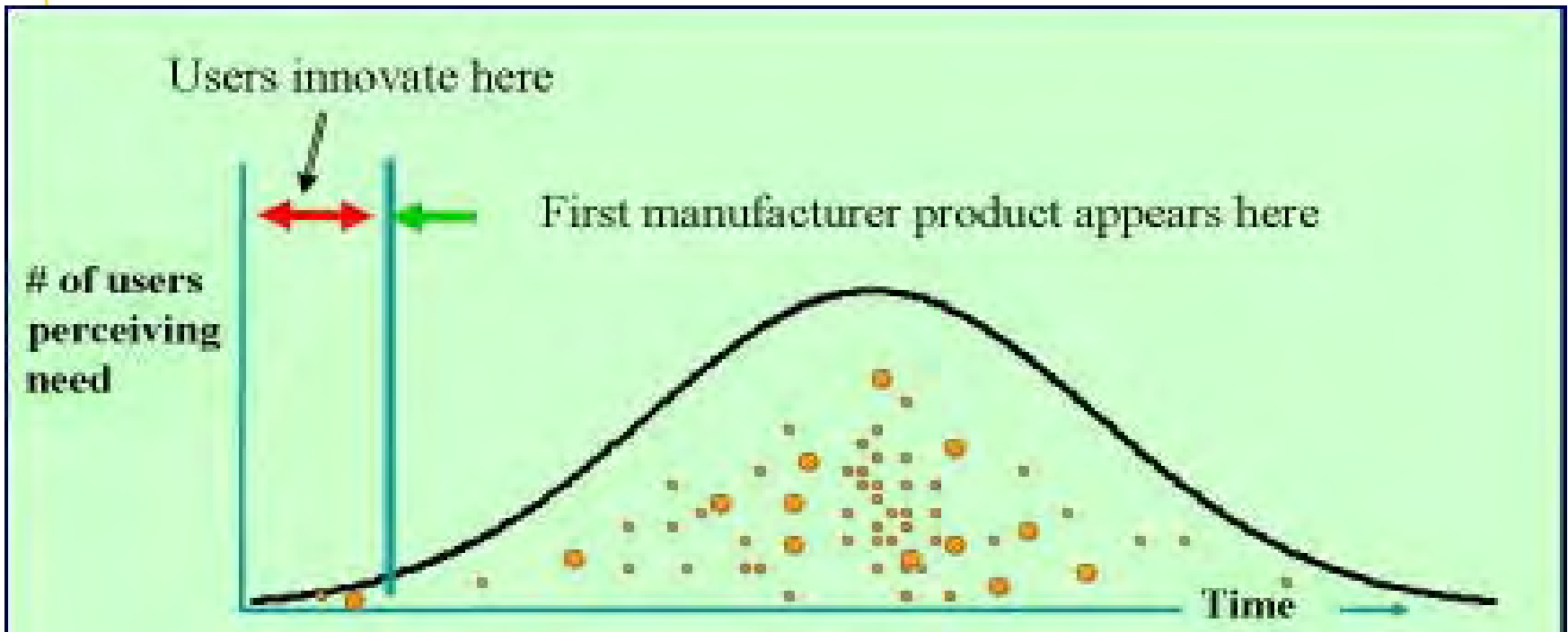
Table 3
Frequency of user-dominated innovative processes by type of instrument

Major improvement innovations affecting	% User dominated	Innovation process dominated by			Total
		User	Manufacturer	NA	
Gas chromatography	82%	9	2	0	11
Nuclear magnetic resonance	79%	11	3	0	14
Ultraviolet spectrophotometry	100%	5	0	0	5
Transmission electron microscope	79%	11	3	0	14
Total	81%	36	8	0	44



Diffusion of User Innovations

- User innovations typically occur early in diffusion
- Lead users
 - Ahead of market trends: articulating need
 - Exceptionally knowledgeable: developing a solutions



Source: von Hippel 2007



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Sources of Innovation



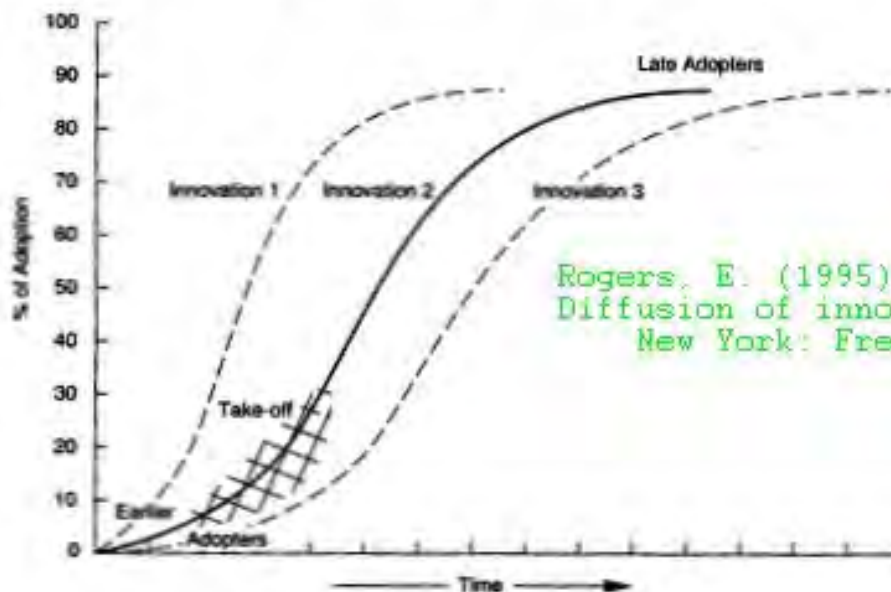


Diffusion of Innovation (Rogers)

- Diffusion of an innovation within a population
- Normality of adoption within a social system
- Categories of adopters

FIGURE 6.5 Shapes of curves of diffusion for innovations that spread over various periods of time

SOURCE: Everett M. Rogers, *Diffusion of Innovations*, 3rd ed. (New York: Free Press, 1962), p. 11.



Rogers, E. (1995).
Diffusion of innovations.
New York: Free Press.

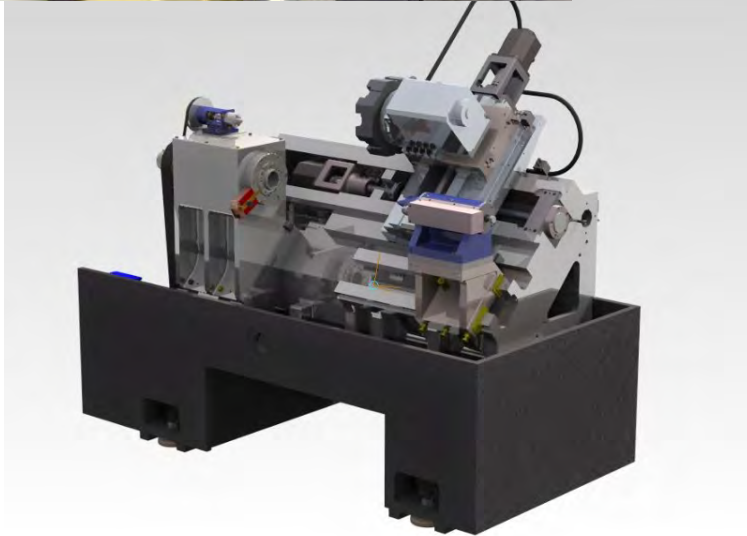
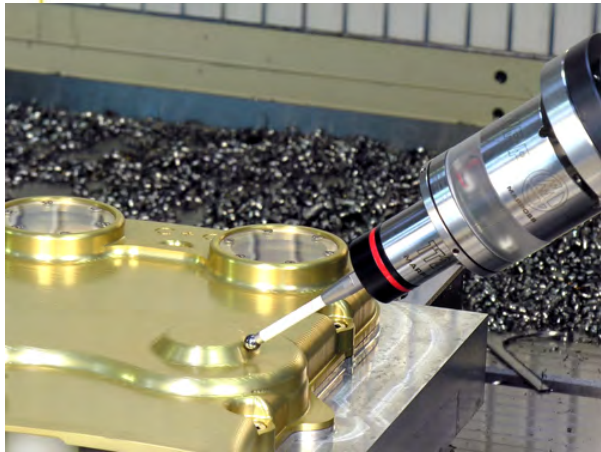


Rogers model of diffusion

- What can the model explain?
 - Characteristics of adopters
 - Adoption decisions and characteristics of innovations
 - The timing of diffusion processes
 - For practitioners: Prevention of non-diffusion



Industrial vs. consumer goods





User perspective

- Different *user involvement models*: user configurations, scripts, framing etc
- Different types of *user-producer interaction*: demand articulation, interactive learning, broadening, framing
- User involvement can be beneficial to co-evolutionary innovation processes
- Questions remain about needs, ideas, values, representation of users in innovation



Starting points

- 1) User-Producer Interaction as umbrella concept: **various types of interaction**

General UPI objectives: (Smits & Den Hertog 07):

- 1) More effective articulation of social needs
- 2) Enhanced competitive strength enterprises
- 3) Improved acceptance + societal embedding new technologies
- 4) Improved learning capacity of social networks
- 5) Enhanced democracy

2) **Setting or organization of UPI**

- > Objectives and characteristics context are important



Five reasons for user involvement

1. Address market failures + ways to overcome them
2. Employing experiential knowledge of users and their creative potential
3. Instrumental to process, supporting boundary conditions of innovations, enhance effectiveness
4. 'Champion' the innovation, counteract resistance
5. Increasing moral and democratic value of innovation processes

(Smits & Boon 2008)



Types of UPI

Evolutionary economics

1. Demand articulation
2. Learning by using / interactive learning
- 3) Innofusion / first user enrolment

Constructive Technology Assessment

- 4) Broadening

Social Construction of Technology

- 5) Framing

Semiotic approaches

- 7) Configuring the user, scripts
- 8) User representation



User Producer Interaction in context: a typology (Nahuis & Moors 2011)

		<i>Demand</i>			
		<i>Homogeneous</i>		<i>Heterogeneous</i>	
		<i>Protected space</i>	<i>Wider world</i>	<i>Protected space</i>	<i>Wider world</i>
<i>Technology</i>	<i>Specific</i>	Demand articulation Enriching	Configuring the user	Demand articulation Learning by interacting Broadening Enriching Frame sharing User representation	Learning by using Configuring the user
	<i>Flexible</i>	Demand articulation Learning by interacting User innovation Enriching	Demand articulation Configuring the user	User innovation Broadening Frame sharing	Demand articulation Learning by using Innofusion User innovation



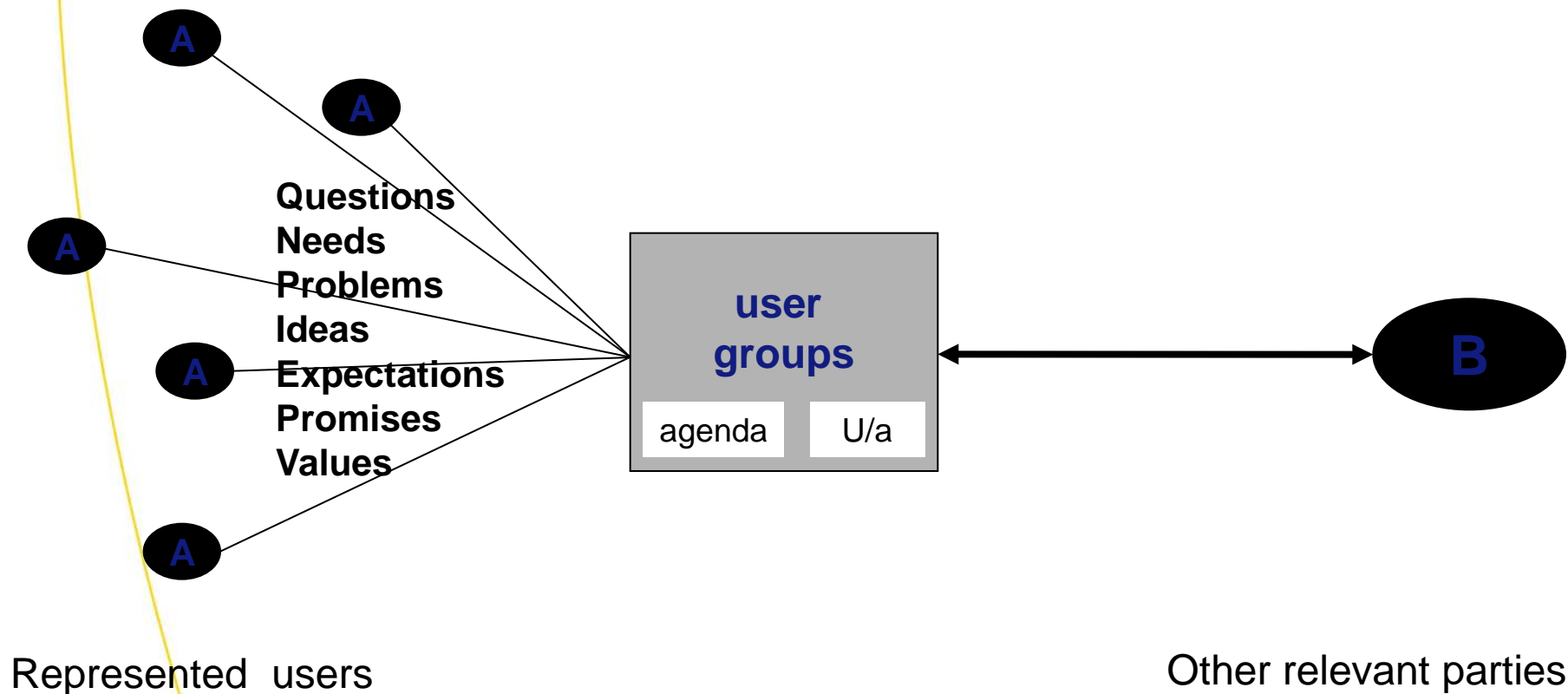
Demand articulation

- An iterative, inherently creative process in which stakeholders try to unravel preferences for and address what they perceive as important characteristics and values of an emerging innovation (Boon *et al.* 2011)
- Learning process: demands (1st order) and underlying assumptions/values (2nd order)
- Intermediary user organisations influence innovation processes and debates (Boon, 2009)



Demand articulation processes in innovation

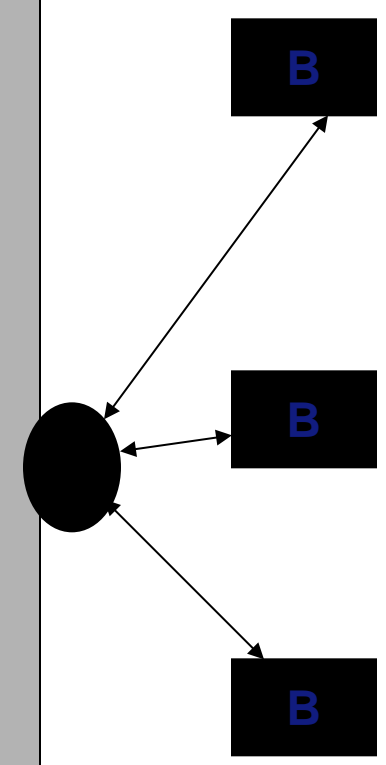
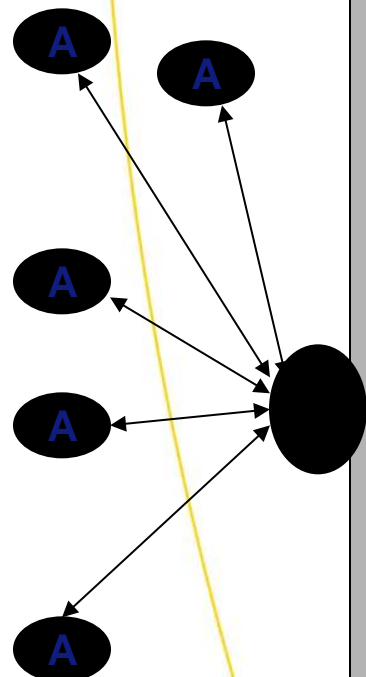
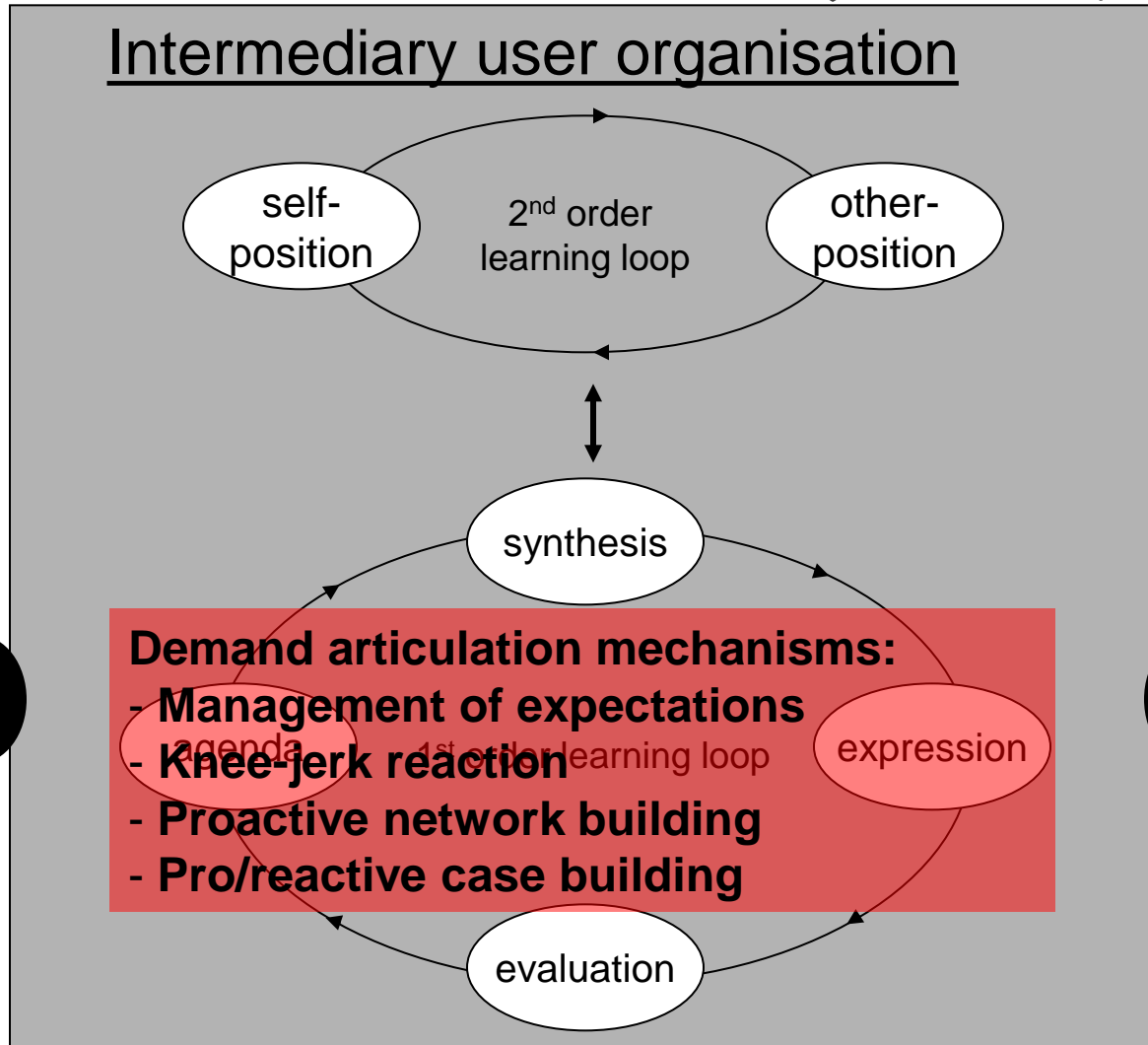
(Boon et al 2011)





Demand articulation mechanisms

(based on Boon, 2009)





User Innovations

- Demand articulation: user as intermediary
- Community innovation (living labs) / public sector innovation / citizen innovations
- Open innovation

(Gault, 2012)



The future of user innovation

1990s were a decade of new digital artifacts:

- WWW
- Commercial Internet
- Linux operating system
- Digital cellular networks
- Tekst messaging
- Ever-more-powerful, cheaper computers



In 2000s many new ways of organizing work

- Death of Competition, Moore 1996 (business ecosystems)
- Open source initiatives
- Platform leadership, Gawer & Cusumano 2002
- Ecosystems, Iansiti & Levien 2004
- Wisdom of Crowds, Surowiecki 2004
- Democratizing Innovation, v. Hippel 2005 (distributed innovation)
- Wealth of Networks, Benkler 2006 (peer production)
- Crowdsourcing, Howe 2008
- Innovation tournaments, Terweisch et al 2009



From closed to open innovation

- Knowledge required for innovating becoming more organisationally dispersed
- Locus of innovation shifting from within the firm to networks, alliances, collaborations etc. – i.e. innovation increasingly co-produced with partners (suppliers, users, universities etc.)
- Various characterised (e.g. by Powell et al., Chesbrough, von Hippel etc.) as
 - open innovation
 - networked innovation
 - distributed innovation
 - interactive innovation
 - democratic innovation, citizens innovation
- Firms need good links with external knowledge sources + ability to exploit these promptly & effectively



Implications for policy

Producer faces *market failure*, legitimizing subsidies, patents, PPP

User faces *diffusion failure*, legitimizing...
(not a great deal of money!)

Innovation paradigms evolving: From *lone inventor* (1920s) to *closed innovation* (R&D lab, 1920-1980) to *open innovation* (1980-) to *user-centered innovation*?



Policy implications

User-centered innovation is increasing as computing and communication costs drop

User-centered innovation increases social welfare. Should be supported by policy



Further reading

Boon, W.P.C., E.H.M. Moors, S. Kuhlmann, R.E.H.M. Smits (2011) Demand articulation in emerging technologies. *Research Policy*, 40, pp.242-252

Goulden *et al.* (2014). Smart grids, smart users? The role of the user in demand side management. *Energy Research & Social Science* **2**, pp21-29.

Gault Fred (2012) User Innovation and the market, *Science and Public Policy* **39**, pp. 118-128

Hippel, E. *et al.* (2012) Comparing business and household sector innovation in consumer products. *Management Science* 58:9, pp1669-1681

Jong, J.P.J. de, E. von Hippel (2009) Transfers of user process innovation to proces equipment producers: A study of Dutch high-tech firms. *Research Policy* 38, pp.1181-1191

Nahuis, R., Moors, E.H.M. & Smits, R.E.H.M. (2012). User producer interaction in context. *Technological Forecasting and Social Change*, 79(6), 1121-1134.