Innovation Systems and the “Functions of Innovations Systems” approach

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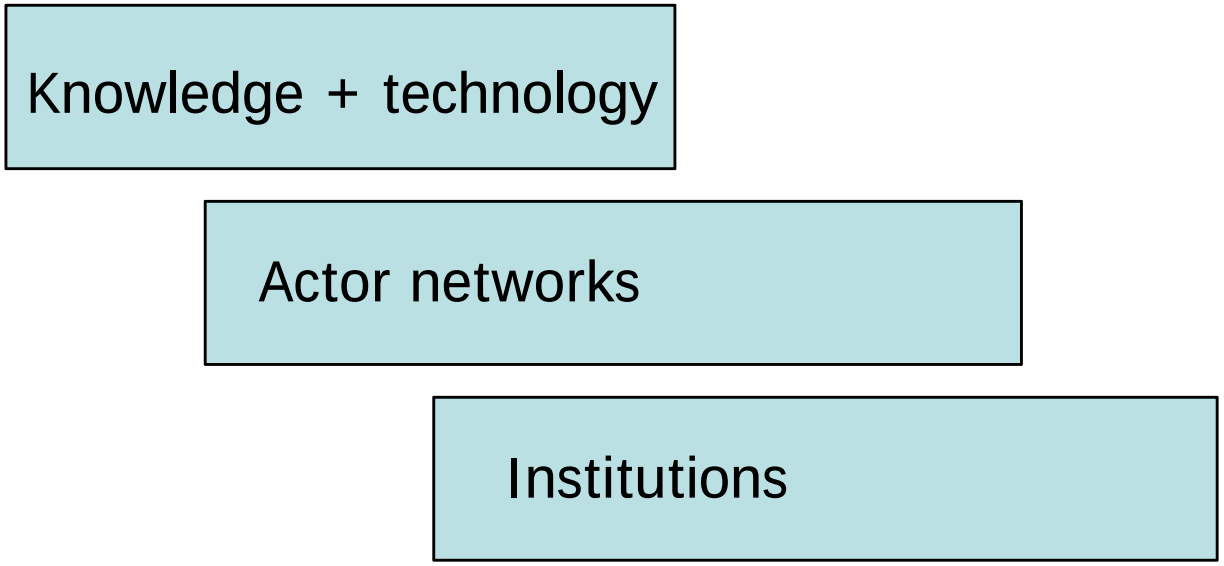
Innovation systems

Sociotechnical configuration

within which innovations are developed and implemented



Knowledge and technology

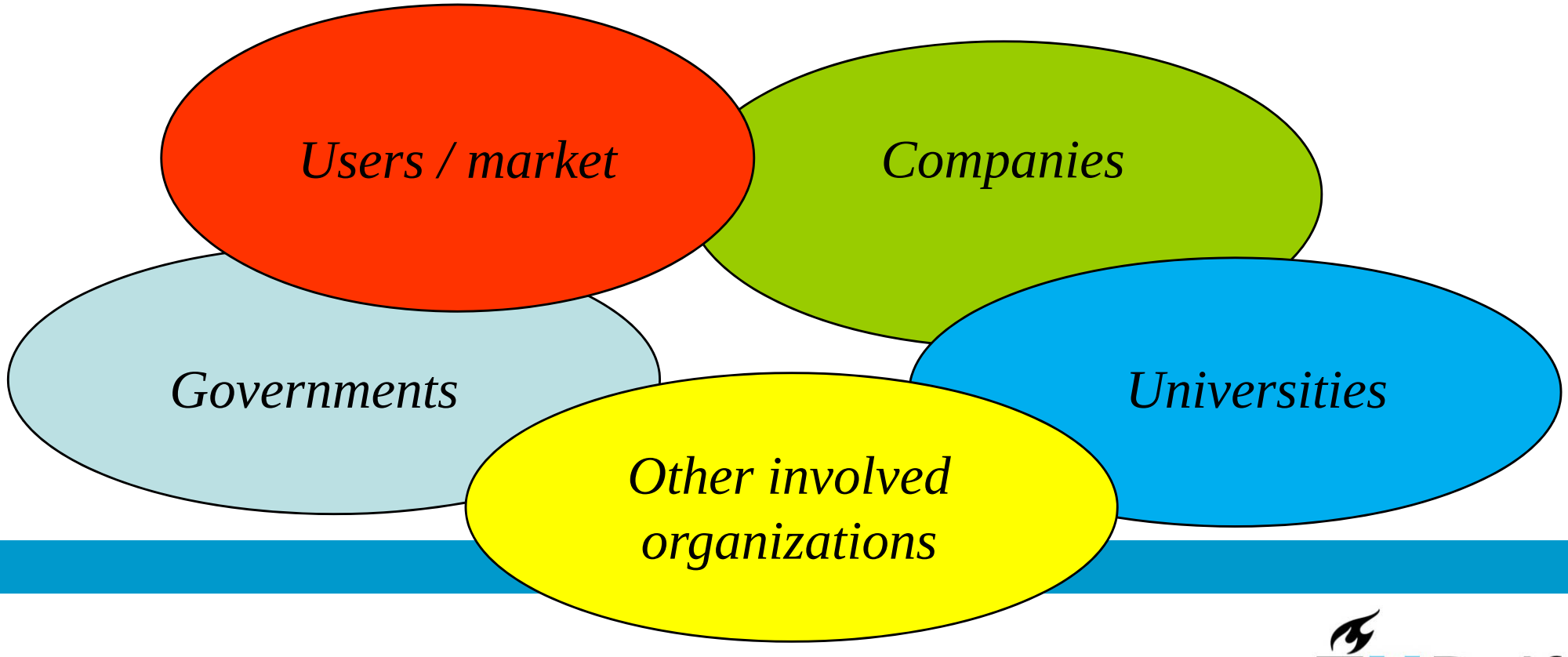
‘Hardware’

Knowledge gained by:

- Learning by searching (R&D)
- Learning by doing (practical knowledge)
- Learning by using
- Learning by interacting

Actor neworks

Actors are individuals and organisations that are involved in developing and/or implementing technology



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Institutions

Institutions are ‘rules of the game’ that influence technology development and implementation

Examples:

- Laws
- Policy measures and programs
- Formal policy goals
- Already available knowledge
- Local technical circumstances e.g. the state of the electricity grid
- Local cultural circumstances
- Local political circumstances
- Local habits

Old linear standard model of technology development

Development of new fundamental knowledge	->	development of a new product or system	->	first introduction in market niche	->	broad implementation in the market

Critique to the old linear model

- Too simple
- In reality, feedback loops exist
- Not all innovations start with knowledge development

Solution

- Take the whole innovation context into consideration, including several feedback loops

The “Functions of Innovation Systems” approach

What are the requirements for successful development and implementation of a technology

7 ‘functions’:

1. Entrepreneurial activities
2. Knowledge development
3. Knowledge diffusion
4. Guidance of the search
5. Market formation
6. Mobilization of resources
7. Creating legitimacy

Function 1: Entrepreneurial activities

incumbents and/or

new entrants / startups

Outcome of analysis of wind turbine development in The Netherlands and Denmark 1973-2000:

Successful firms are often new entrants

Function 2: Knowledge development

learning by searching

learning by doing

learning by using

done by universities, research centers, R&D departments of firms

Outcome of analysis of wind turbine development in The Netherlands and Denmark 1973-2000 :

only learning by searching (R&D) is not enough!

Function 3: Knowledge diffusion

interactive learning within the same or between different actors categories

Outcome of analysis of wind turbine development in The Netherlands and Denmark 1973-2000 :

incorporating knowledge from users is important!

Function 4: Guidance of the search

laws

policy programs

already available knowledge

local technical circumstances e.g. the state of the electricity grid

local cultural circumstances

local political circumstances

Outcome of analysis of wind turbine development in The Netherlands and Denmark 1973-2000 :

influence of policy programs and goals was and still is very important

Function 5: Market development

involving the (foreseen) market already at an early stage

possibly via market subsidies

Outcome of analysis of wind turbine development in The Netherlands and Denmark 1973-2000:

In the Netherlands the market subsidies started at a very late stage and therefore the market remained very small.

In Denmark market subsidies started early => larger market => more wind turbines sold and more feedback from the market to the companies

Function 6: Mobilization of resources

capital resources

human resources

physical resources

Outcome of analysis of wind turbine development in The Netherlands and Denmark 1973-2000:

All resources are important, not only investments in R&D

Function 7: Creating legitimacy

incumbent system in which technology will be implemented– e.g. the energy production system

global scale developments such as the economic crisis

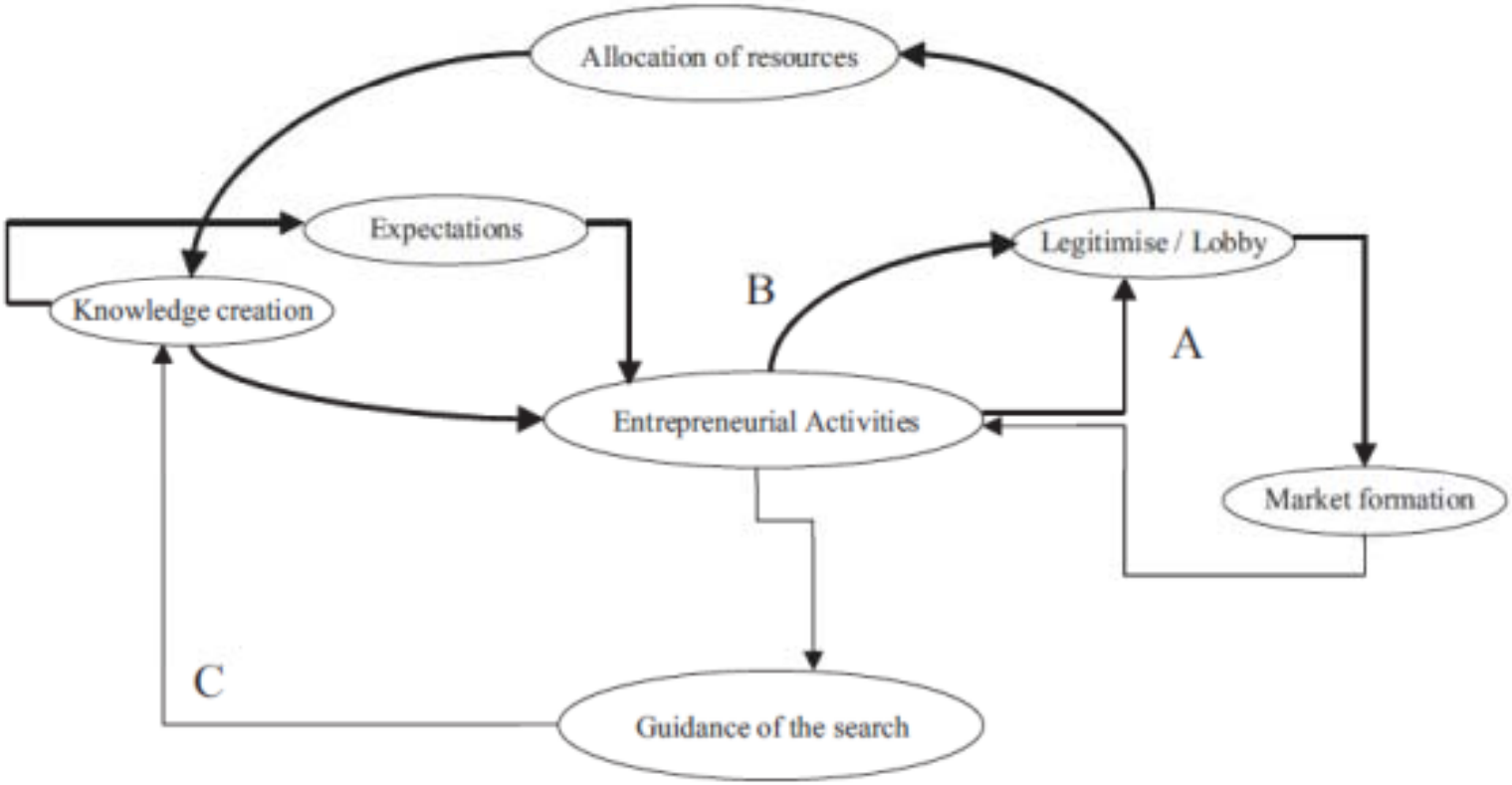
incumbent infrastructure

lobbying for legitimacy/support/policy measures/subsidies

Outcome of analysis of wind turbine development in The Netherlands and Denmark 1973-2000:

The role of the larger energy production system was very large. In the Netherlands the actors there have opposed wind turbines for a long time. This was a major bottleneck for implementation.

Feedback loops



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