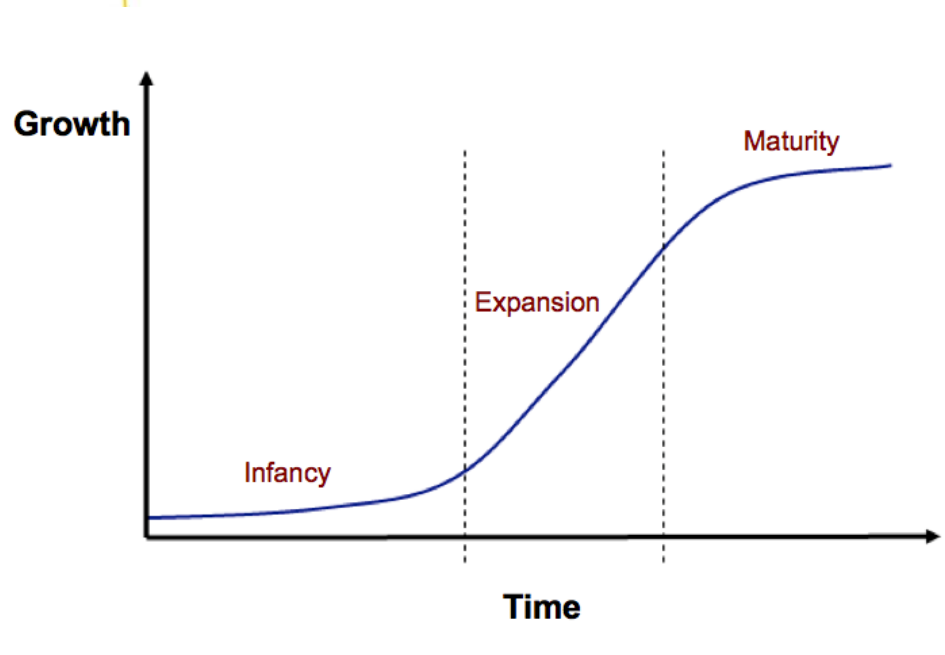




**Innovation barriers in residential
energy use: Dutch experiences**
Robert Harmsen
ADVANCE workshop 20 January 2015



How technologies diffuse



- Growth and speed (time) of diffusion constrained by:
 - Slow stock turnover (s)
 - Immaturity supply chain (s)
 - System lock-in (s & g)
 - Competing options (s & g)



This presentation

- Focus on residential sector
- Focus on existing buildings
- Focus on space heating:
 - Linked to both quality of building shell and conversion technology
 - Turnover building stock is slow (0.5% average demolition rate in EU)
 - Buildings are renovated every 30-40 years (main drivers so far: end-of-life of components/systems, living quality/comfort, economic value)



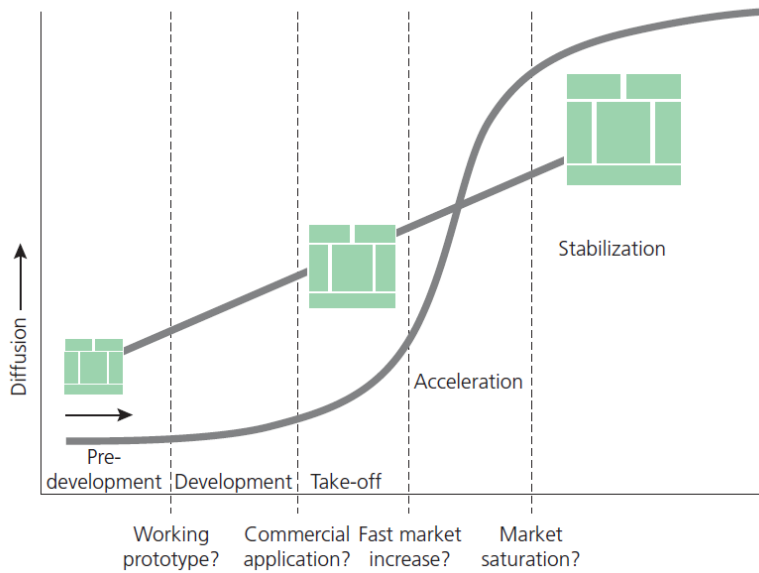
Approach: Innovation System Analysis

- Development and diffusion of a technology goes faster if its innovation system functions well.
- In a mature and well-functioning innovation system 7 key-processes are carried out properly.

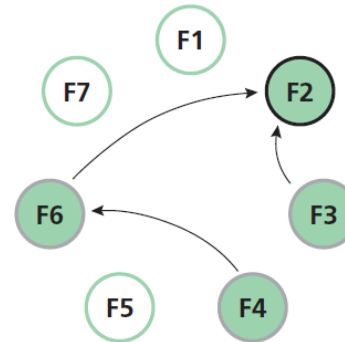




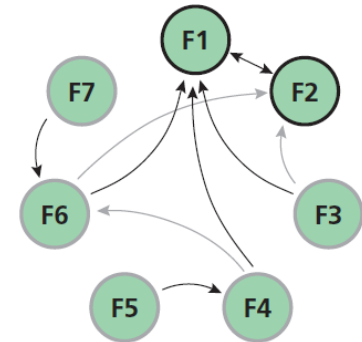
In each phase of development other functions needs emphasis



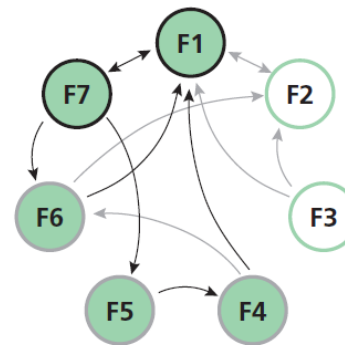
1. Pre-development



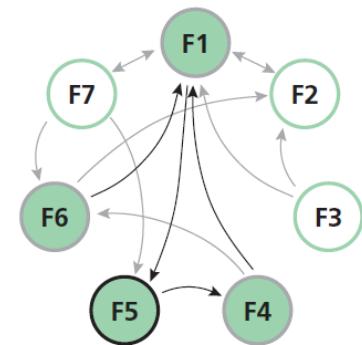
2. Development



3. Take-off

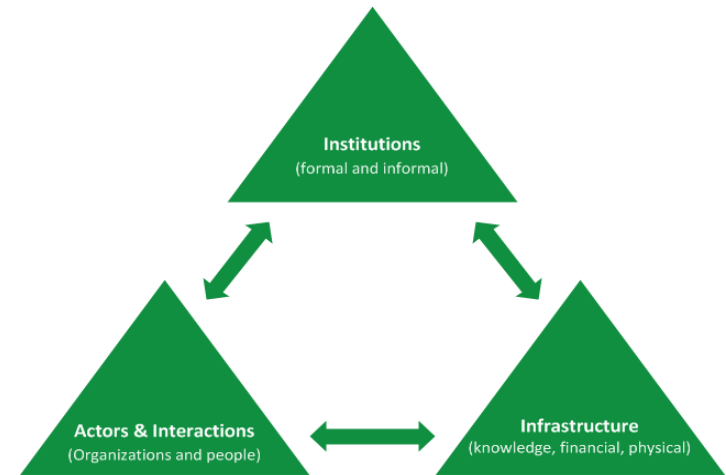


4. Acceleration



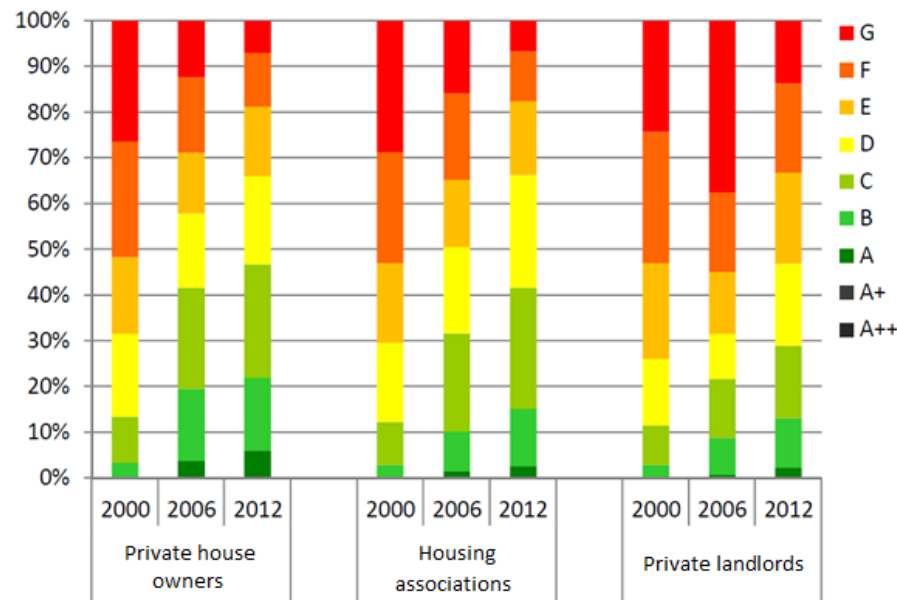
Innovation system analysis

- An innovation system functions better if problems in its structure are solved.
- The structure of an innovation system consists of 4 elements: Actors, Interactions, Institutions and Infrastructure.
- Feedback between these elements makes an innovation system dynamic and complex.
- Analysis of these dynamics can show the difference between fundamental problems/barriers and symptomatic problems/barriers.





Huge potential for efficient buildings in Dutch residential sector



Given that there are ~7 mln houses in the Netherlands and more than half of the houses still has an energy label D or lower, the potential for efficient buildings is considerable.



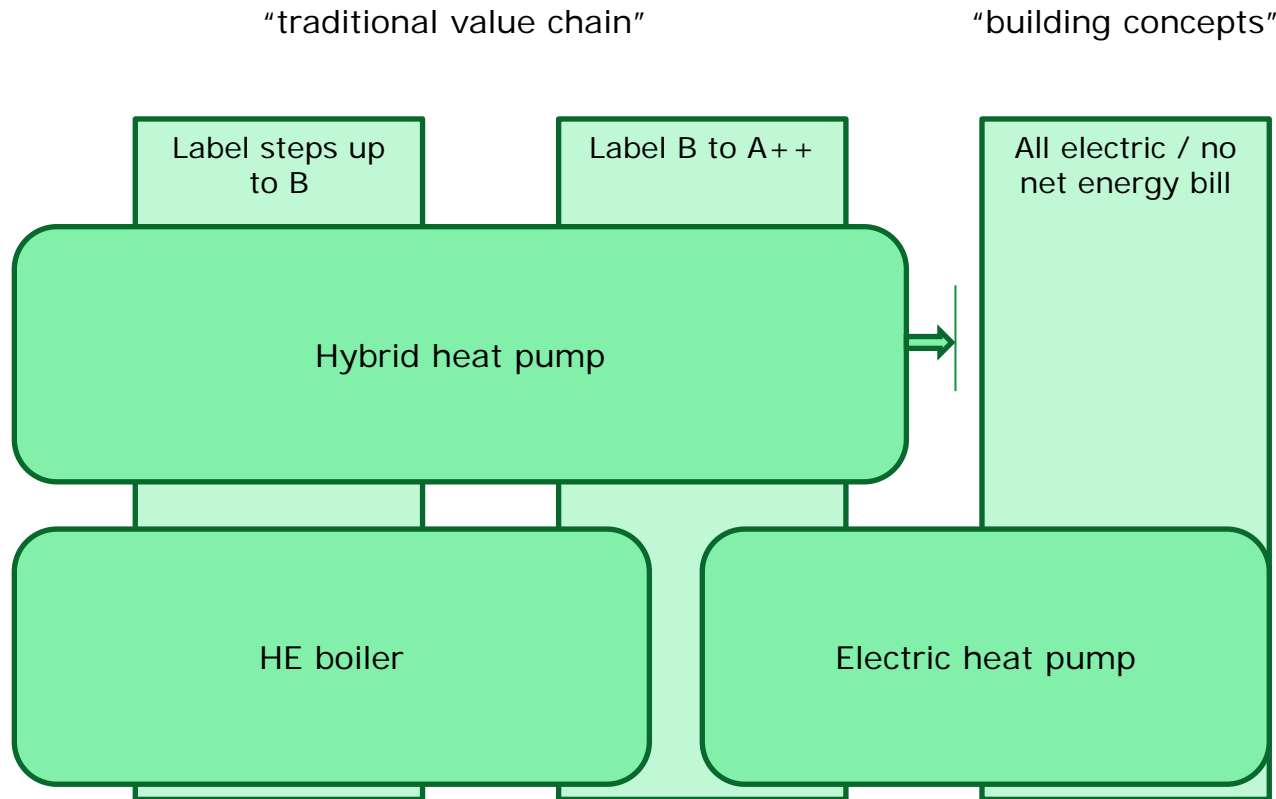
Trends observed in the renovation market

- Building concepts
- Energy cooperatives
- Renovation shops





Different innovation systems aiming for different goals: Dutch experience



Fierce competition between innovation systems in traditional value chain, hardly any competition regarding building concepts.



Insights

High efficient boiler (traditional value chain)

- Mature technology.
- Vested interests.
- Systems changes are difficult.
- Being part of label step approach, delays deep renovation efforts

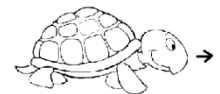
Heat pump in the traditional value chain

- In take-off phase.
- Fierce competition from HE boiler (system inertia, conservative supply chain)
- Delays deep renovation efforts

Heat pump in building concepts:

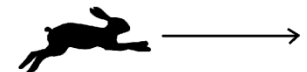
- In take-off phase
- Building concept = deep renovation
- New market entrants
- Interest from national, regional and local governments
- Protected niche gaining momentum

Traditionele waardeketen



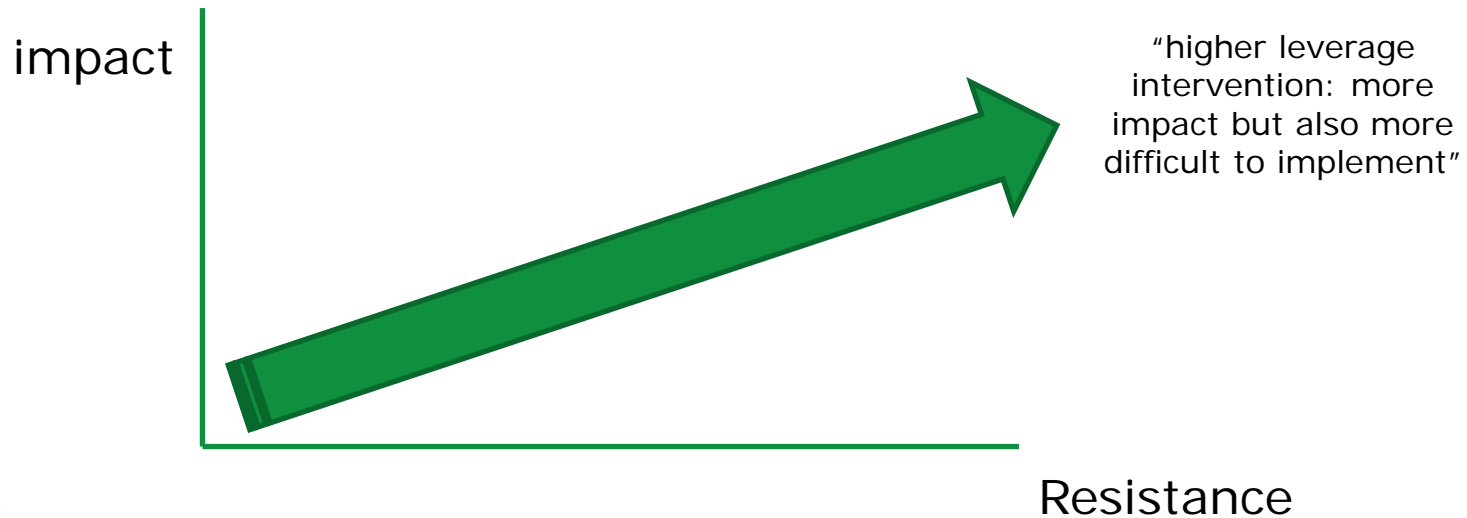
Pre-development | Development | Take-off | Acceleration

Bouwconcepten





Although high impact is often aimed at, because of (expected) resistance often the lower leverage interventions are chosen





Insights for IAM?

- Costs as the main driver of technology application is justifiable, but:
 - Underestimates e.g. the access to cheap capital barrier (?)
 - Creates a dependency on model inputs (energy prices, ΔI , technology & cost learning)
 - ...
- Institutional complexity (required system change) could be an interesting additional “axis” to model the diffusion of new technology
- For discussion:
 - Relevance of technology detail for (very) long term projections
 - Level of sector/technology detail needed to capture institutional complexity