



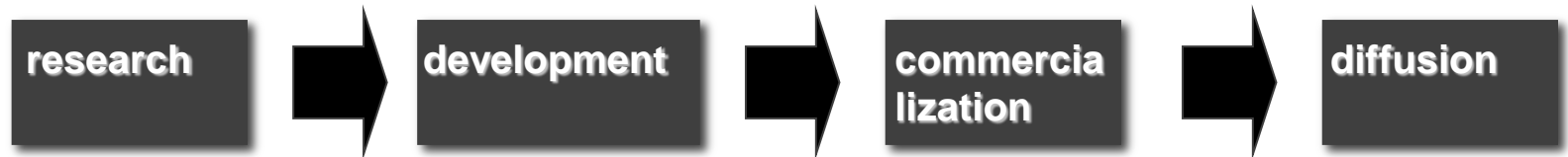
Innovation Systems

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Three main models of innovation

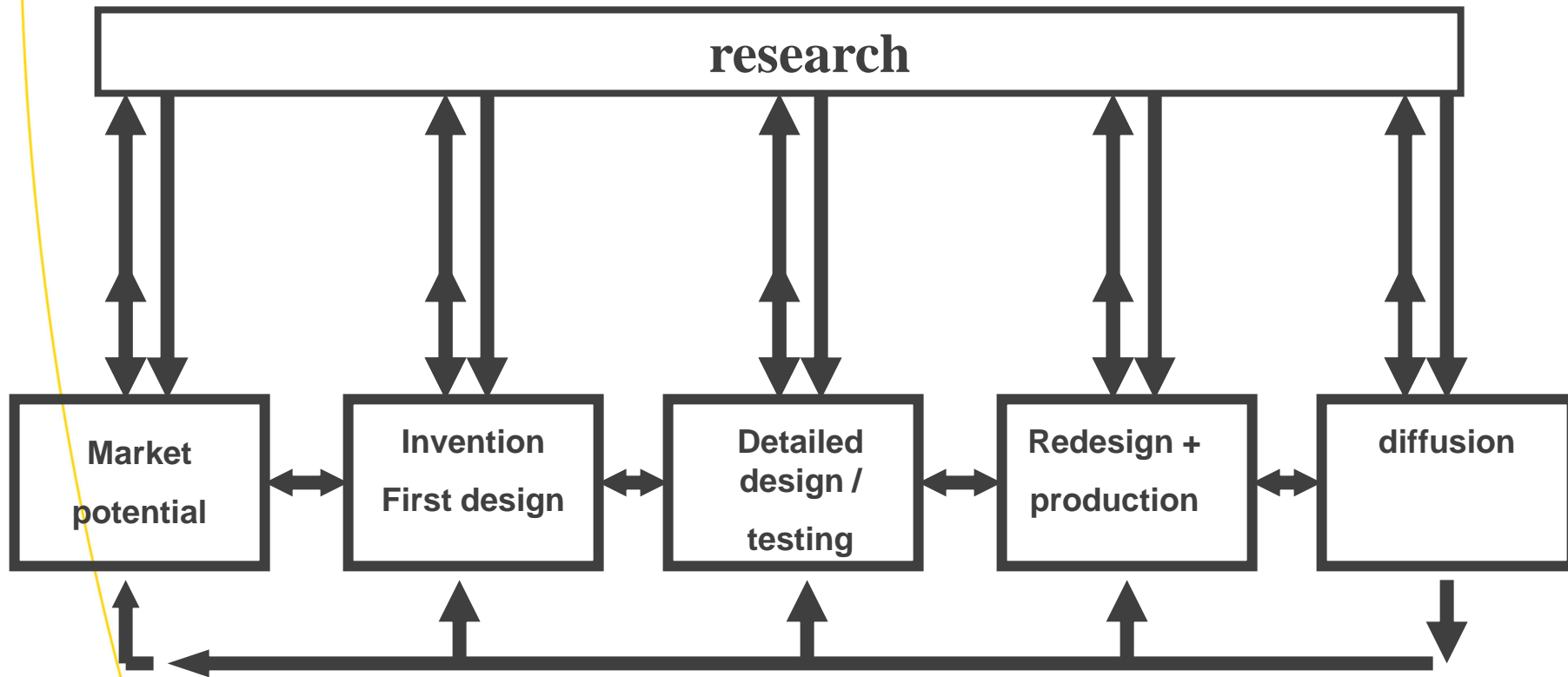
- Linear model



- Theoretically oversimplified
- But: mega impact on policy and firm strategies
- Resulted in neoclassical market failure argument



- Chain Linked model (Klein and Rosenberg, 1986)



- Added complexity to linear model
- Phases of innovation still dominate

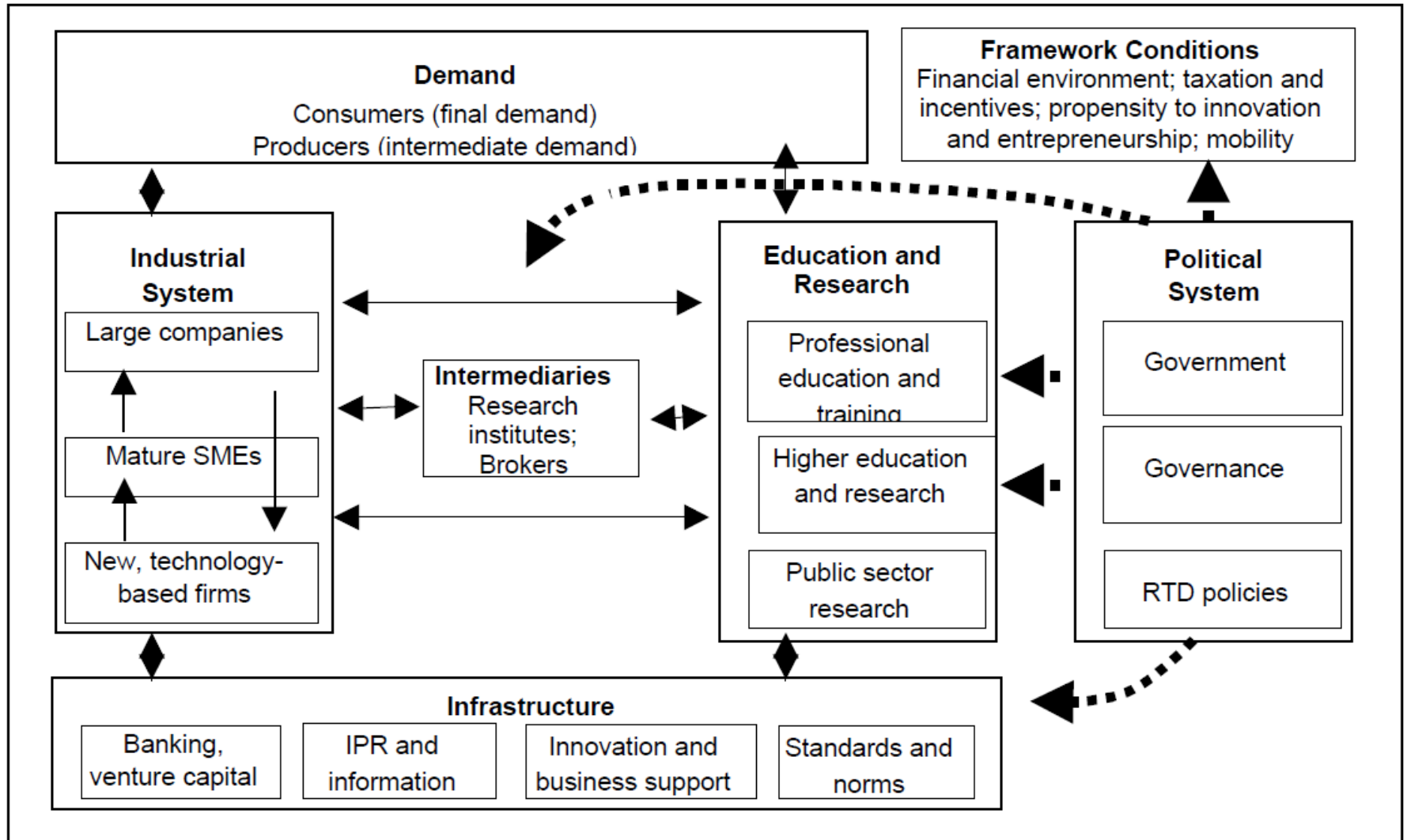


- Innovation systems
 - Transformative shift in perspective
 - Highlights the socio-institutional environment in which entrepreneurs and firms operate / innovate
 - Stresses a multitude of factors that have impact on innovation
 - Not just R&D and demand
 - Policy: paradigm shift from market failure to system failure
 - Many innovation system agencies in place



Innovation system = NIS

- National Innovation Systems still dominate
- Original contributions were Nation oriented
 - OECD work of Lundvall
 - Lundvall, B-Å. (ed.) (1992). National Innovation Systems: Towards a Theory of Innovation and Interactive Learning, Pinter, London.
 - Early work by Chris Freeman
 - FREEMAN, C. (1987), Technology and Economic Performance: Lessons from Japan, Pinter, London
- NIS studies often present detailed accounts of national innovation system structures



Arnold and Kuhlman, 2001



- Analyses shed light on the historical evolution of innovation systems and the variety in economic systems
 - Location and path dependence matter (evolutionary perspective)
- Differences in economic performance are related to NIS structure
- Policy makers copy best practices from other countries
 - No recipe for success



- Even though very positive outcomes
 - Paradigm shift in science and policy
- Also criticism
 - Lack of explanatory power
 - Lack of analytical rigor
 - Too descriptive
 - Lack of theorizing
 - Not enough attention for dynamics



Innovation Systems \neq NIS

- Regional Innovation Systems
 - 5 Most cited IS articles in top 10 are RIS
 - Cooke, Breschi, Ashheim
- Technological Innovation Systems
 - 1 in top 10, 3 in top 20 Hekkert, Jacobsson and Markard
- Sectoral Innovation Systems
 - 2 in top 10: Malerba and Geels (criticism)



- All three perspectives made steps in dealing with criticisms
 - SIS: closer to a theoretical model
 - RIS: more attention for theory building
 - Explicit hypothesis testing
 - TIS: Closer to theoretical model + strong attention for dynamics
 - Reduction of complexity helps to improve rigor



IS looks at the big picture

- Takes into account that innovation:
 - Is the result of complex interaction between organizations
 - Is dependent on multiple resources
 - Is dependent on formal and informal institutions that shape behavior of innovators and other actors



The alternative: specialize

- Institutional literature
 - Influence of institutions on organizations and innovation or vice versa, IPR studies
- Network studies
 - Influence of R&D network structure (e.g. strong / weak ties) on innovation
- Resource based view
 - Influence of firm specific resources on innovation
- Attention for specific actors
 - Role of users, role of intermediary actors, role of serial entrepreneurs



- Specialization reduces complexity
- Allows for much better theorizing
- Allows for more rigorous research design
- But: you miss a large part of the picture



Ideal world

- Integration of outcomes of specialized studies in the broader model of innovation systems
- Second best:
 - Apply some micro level methods in the broader context of an innovation system analysis
 - Focus of this summer school



Technological Innovation Systems

- Focus on emerging technological fields
- Fits in new field of Societal Transitions
 - Imported IS framework from innovation studies community to transitions community
- Also contribution to improving IS concept
 - Focus on dynamics of IS
 - Shift from structure to functioning
 - New methods: process analysis / event analysis (afternoon workshop)



Why dynamics?

- The time, costs and risk incurred by firms in developing an innovation are inversely related to the developmental progress of building an innovation system for the new technology (free after VandeVen, 1999)
- More novel innovations require greater change in all system functions and therefore greater development time and greater chance of failure (vandeVen, 1999)
- Free goodies – positive externalities (Jacobsson, 2008)
 - Skilled labor, well functioning education system
 - Legitimacy
 - Markets
 - Knowledge
 - Standards

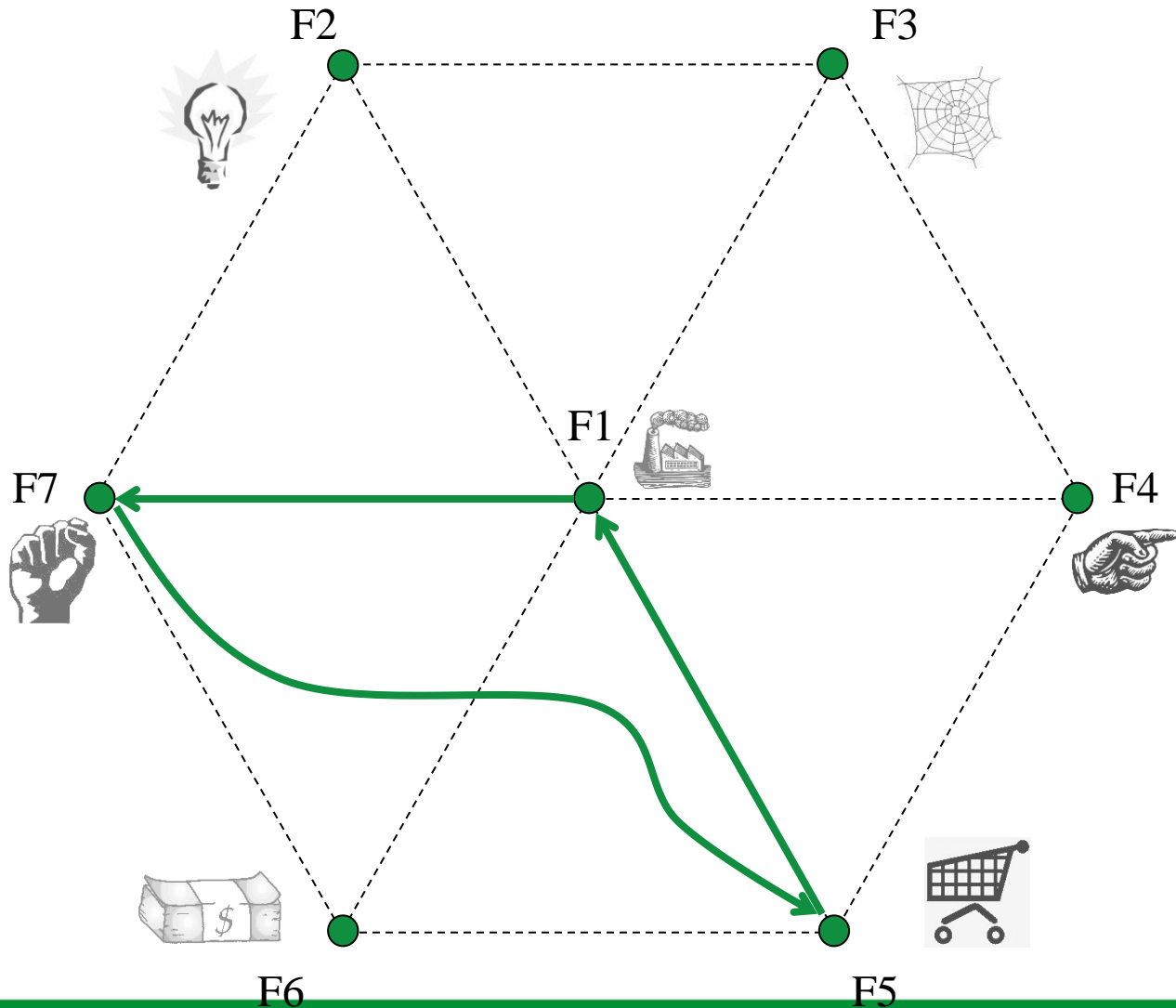


Thus:

- Understanding the emergence of radical / system innovations require a focus on building new TIS
- It is about understanding *structure building*
- Seven system functions are central in TIS build up
 - entrepreneurial experiments,
 - knowledge development and
 - Knowledge exchange,
 - guidance of the search,
 - resources mobilisation,
 - market formation,
 - counteract resistance to change



Positive feedbacks between functions accelerate IS build up





Motors of Innovation

- Suurs and Hekkert
- 4 motors identified
 - Science and Technology Push Motor
 - Entrepreneurial motor
 - System Building Motor
 - Market Motor
- Theory development on IS mechanisms at different stages of development



Be careful!

- No direct interaction between functions
- Always through actors



Functions concept is great!

- Big step forward in evaluating TIS
 - What structural configuration is working well?
- Excellent aggregation level to study TIS dynamics
 - Good for theory development
- Inroad for policy
 - Indicates systemic problems
 - Target for policy instruments



Unfortunately, also criticized

- Functionalist wording
- Shopping list
- Different lists in literature
 - Overview by Bergek et al. 2008 : 8 different lists
 - Sometimes different wording for same functions: knowledge development, create knowledge, R&D + competence building
 - Sometimes additional functions: provision of incubation activities (Edquist)



New research in Utrecht / Chalmers

- Aim: improving the rigor
- Is it possible to derive set of functions from a single theoretical perspective?
- Difficult since IS is multidisciplinary concept building on evolutionary and institutional thinking.