TNO innovation for life

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Industrial Innovation Policy and Clean advanced manufacturing: Policy Challenges at the Network level

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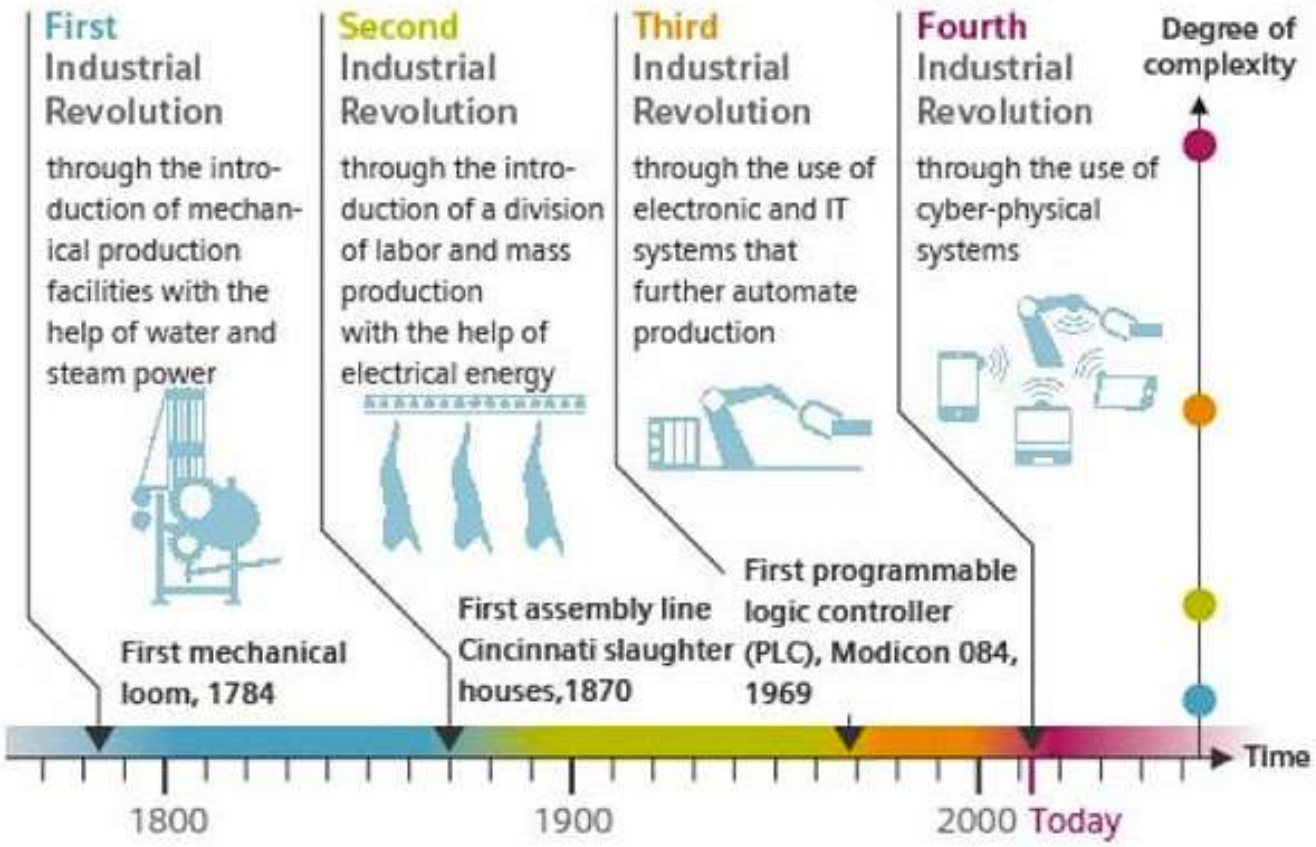
OUTLINE

- Features of Smart Industry (industry 4.0)
- Example of new production processes with Key Enabling Technologies
- Problem of aligning heterogeneous preferences in business models
- A behavioural approach to explore conditions for behavioural convergence across actors
- Exploration of dynamic drivers with two actors (regulators and companies)

Paradigm shift – smart industry

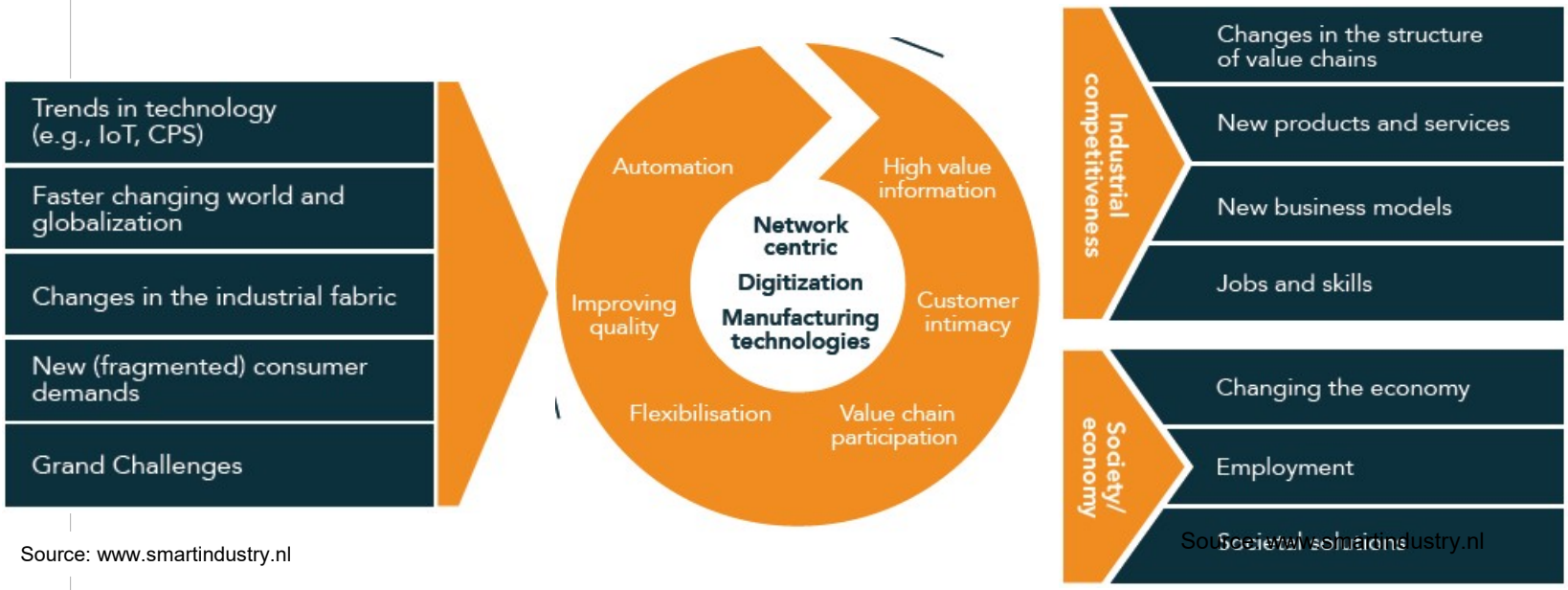


Source:DFKI (2011)

Paradigm shift – Smart Industry

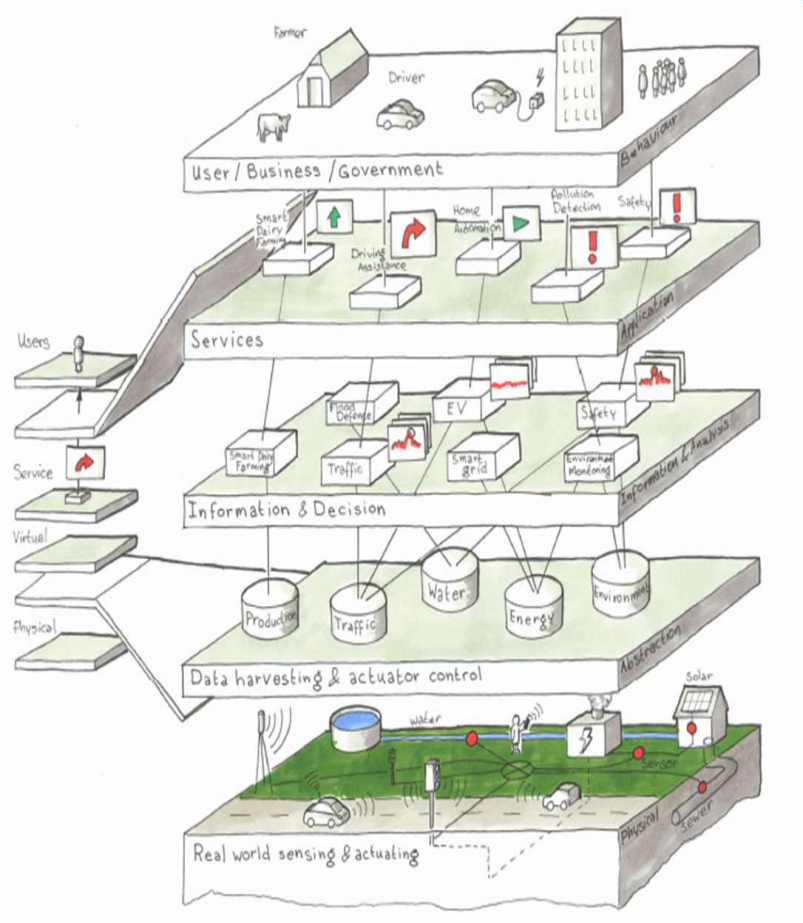
What is this and why now?

Smart Industries are industries that have a high degree of flexibility in production in terms of product needs, volume, timing, resource efficiency and cost. They are able to (fine-) tune to customers' needs, and are enabled, networked and driven by ICT and the latest available proven manufacturing techniques.



Source: www.smartindustry.nl

The cyber-physical challenges for smart industry that TNO focuses on



- Strategy and Policy
- Information value analysis incl. policy
- Business value across chains

- Big data visualisation
- Security and privacy
- Context aware and adaptive services

- Real-time analytics: learning/behavioural
- Data delivery/logistics: fusion, timing, streaming
- Complex event processing,
- Distributed control (Supply/demand engines)

- Data standards: interop, semantics
- Scalable, high performance IoT architectures
- Virtualisation/software defined networking

- Industry grade access networks (LTE, wifi)
- Information centric embedded system design

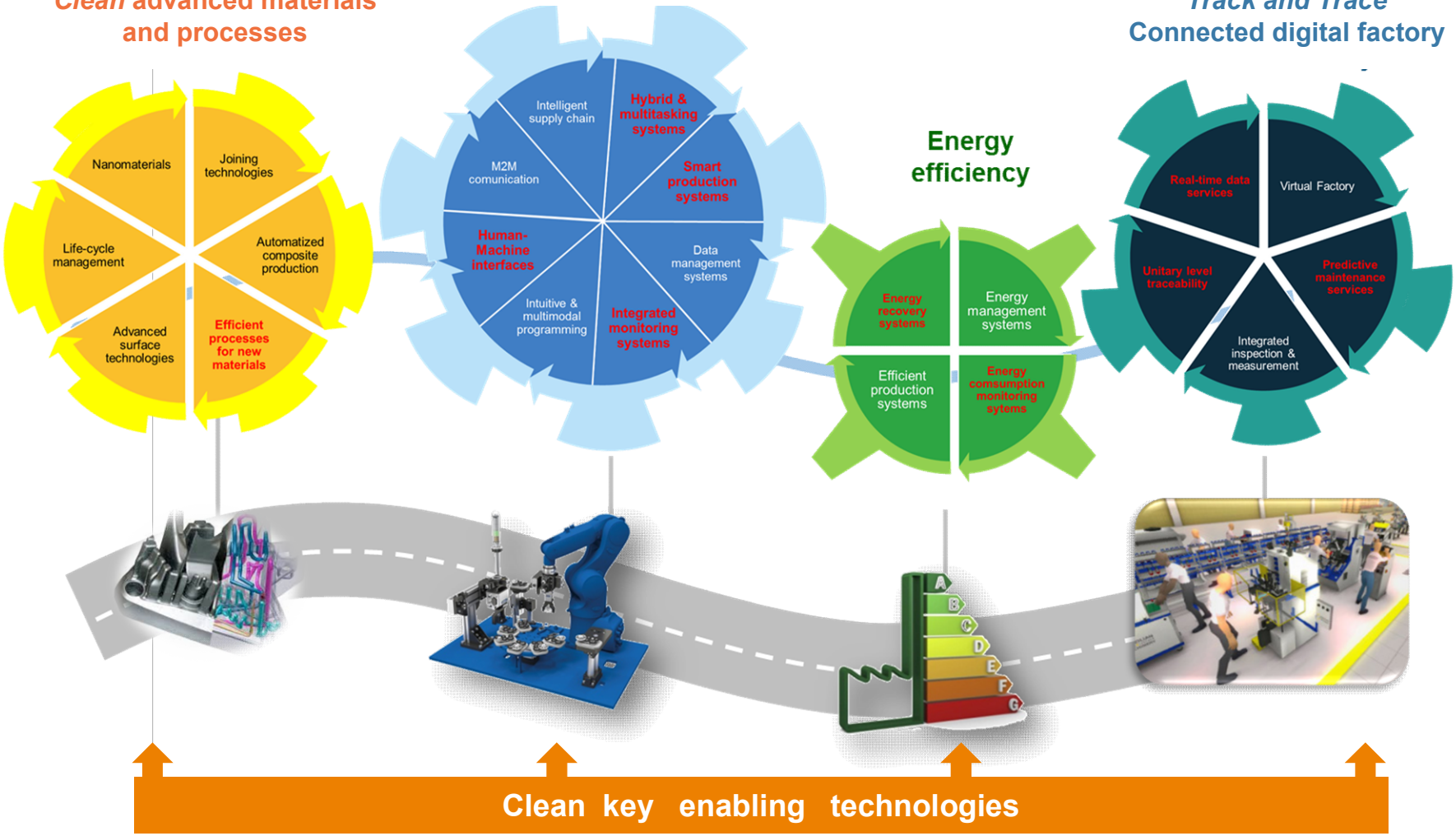
TNO innovation for life

Zero waste intelligent manufacturing

Flexible, smart and *resource efficient* manufacturing systems

***Clean* advanced materials and processes**

Track and Trace
Connected digital factory



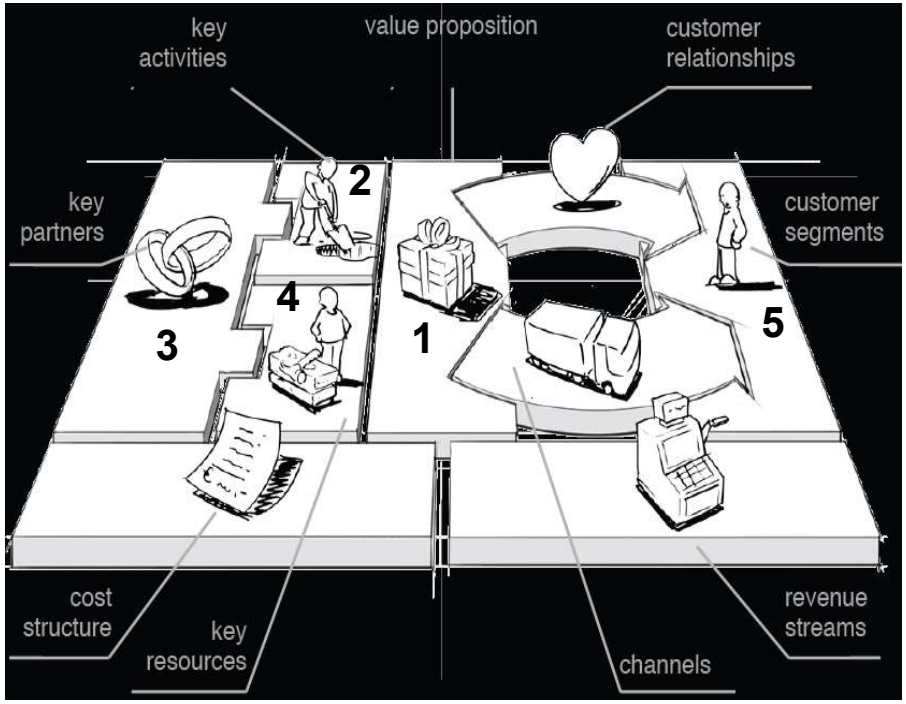
Printed Electronics - ACREO

- See PDF

Roadmap for Industry 4.0

	2018	2025	2035
Smart Industry transition strategy			
Horizontal integration along the entire value network (inter-sectors)	Methods for new economic models		
	Framework and methods for new business models		
	Alignment and application protocols across value networks		
Systems integration product-service systems	Integration of real and virtual worlds / interfaces for customer intimacy, manufacturing networks and frameworks for big data governance		
	Systems engineering		
vertical integration (intra-sectors)	Sensors data analyses infrastructures and protocols for process guidance data based		
	Intelligence, flexibility and adaptivity		
New social organisation of industry and work	Design of workplace and acceptance of technology		
	Multimodal assistance systems		
Continuos development of Smart Industry	Cyber-physical communication systems for smart industry		
	IoT security and safety protocols and regulations		
	Industry platform development		

Agents in Basic Business Model



Great advances in business models ontologies.
BUT
Knowledge and models available are descriptive/qualitative far from enabling prediction of outcomes in complex settings

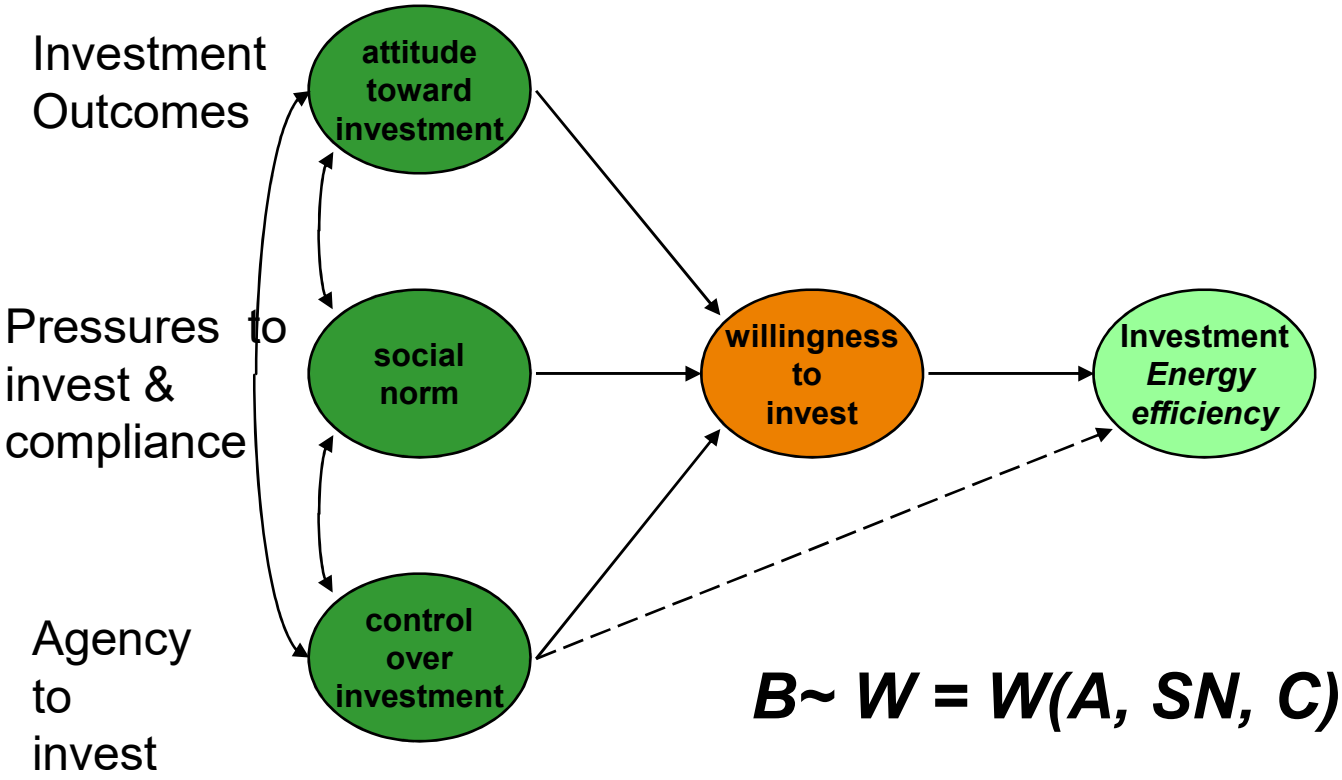
Core issues:
Value Proposition and relations/interactions between agents in the system enabling/limiting convergence around an innovation.

Multi-agent Consensus Problem

- Main idea
  - Having a set of agents to agree upon a certain value (usually global function) using only local information exchange (local interaction)
- Also known as:
  - Agreement problem (economics, social networks)
  - Load balancing (Computer Science & communications)
  - Synchronization (statistical mechanics)
  - Rendezvous and flocking (robotics)
- Old problem: Markov Chains (60's), Load balancing ('70), Distributed decision making (80's), flocking (00's)

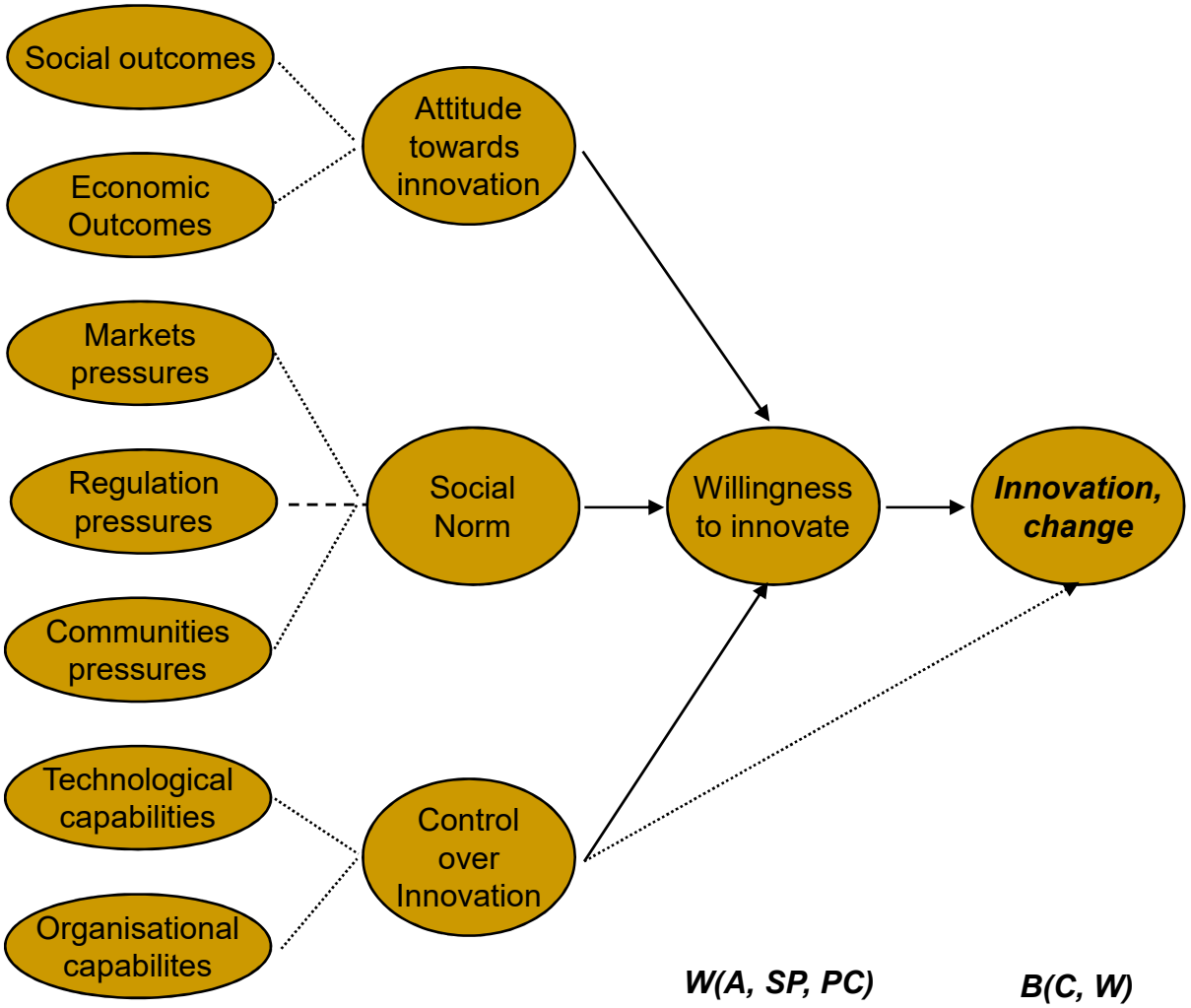
- Smart Industry: Dynamic competitive-collaborative value networks in business models

What triggers investment decisions in companies and consumers? Support from governments?

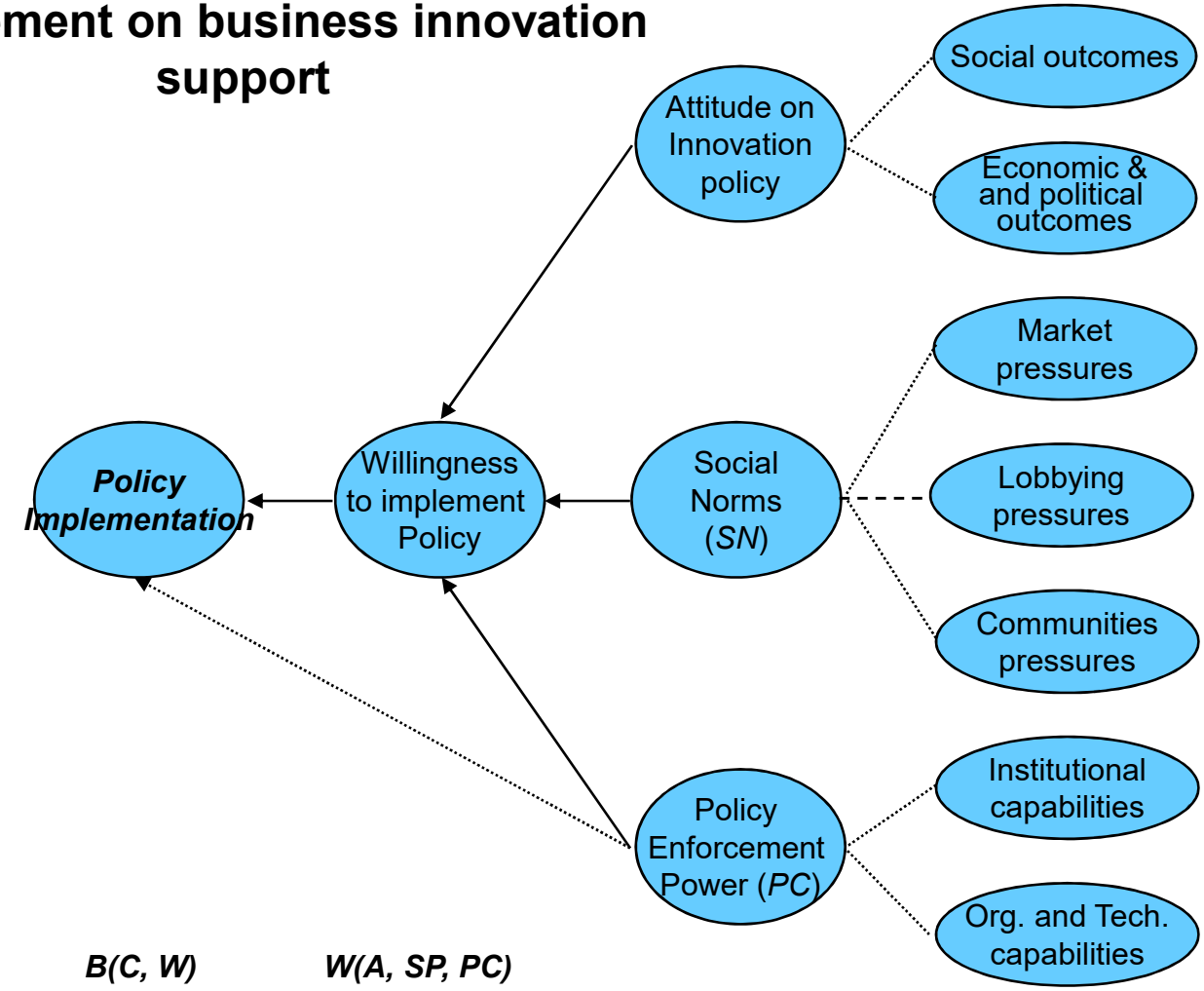


$$B \sim W = W(A, SN, C)$$

Companies' engagement on business innovation

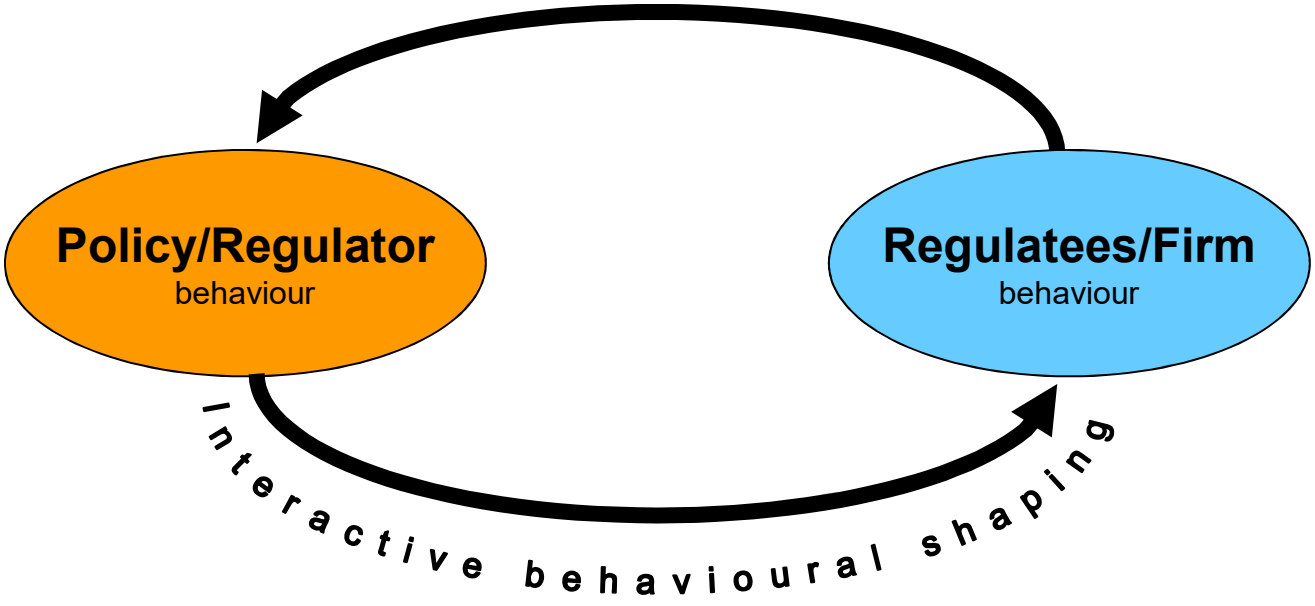


Determinants of government engagement on business innovation support



Next stage: non linear behavioural dynamics

System of two actors



Business innovation behavioural determinants