

Frameworks for innovation

- studies of technology innovation and systems (SoS) for energy, defence and security

Brief presentation of themes in a doctoral thesis (in print)

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Disruptive innovation, how to govern innovation and innovation processes – a constructive view

- **Standard definition of innovation: Value added new services and products. Disruptive means large or severe impacts for the incumbent (Christensen interpretation)**
- **Innovation is apotheosized: Not only beneficial and valueable to society , often hailed and savior of economy in the future, the environment and the planet. Latest: IMF communiqué**
- **Innovation means transition and transformation: innovation is creation - occasionally with destructive consequences. Schumpeter**
- **Digitisation a main source of disruptions: “We´re really just at the beginning of that process [digital disruption of news industry]. It´s creative disruption, as we would call it in Silicon Valley, but it can be pretty ugly in the short term”.**
- **”Innovations” not considered (discovery, inventions, new product design and appearance, incremental developments etc)**
- **Technology centered**

Three fields of inquiry - contextual backgrounds

Energy Sector

Technology based
Systemic
Infrastructural
Major intermediary resource
Security of supply – a social concern
Major transitions have taken and do take place
Private - Public
Commercial - competitive
Public concerns – welfare and environment
Externalities (environmental impacts)
Re-regulation (economy and environment)

Defence

Technology intense
Systemic – joint operations - Net Centric Warfare (NCW)
Technical industrial and commercial elements that grow (i.e. cyber, logistics and other supply services)
Life, death, freedom and property at stakes- strong democratic as social and economic values
A public concern - state monopoly of violence (terrorism attacking)
Adversary, antagonism, uncertainties, secrecy, deception
Transitional (balancing legacy – extreme)

Security

Technology dependent
Common (critical) infrastructure (systems) vulnerability
Uncertainty, covert, emergencies
Private – public concern
International terrorism – hybrid wars

Observations:

Technology induced or affected – direct or indirectly

Innovation is a truly evolutionary process

Innovation has emergence characteristics

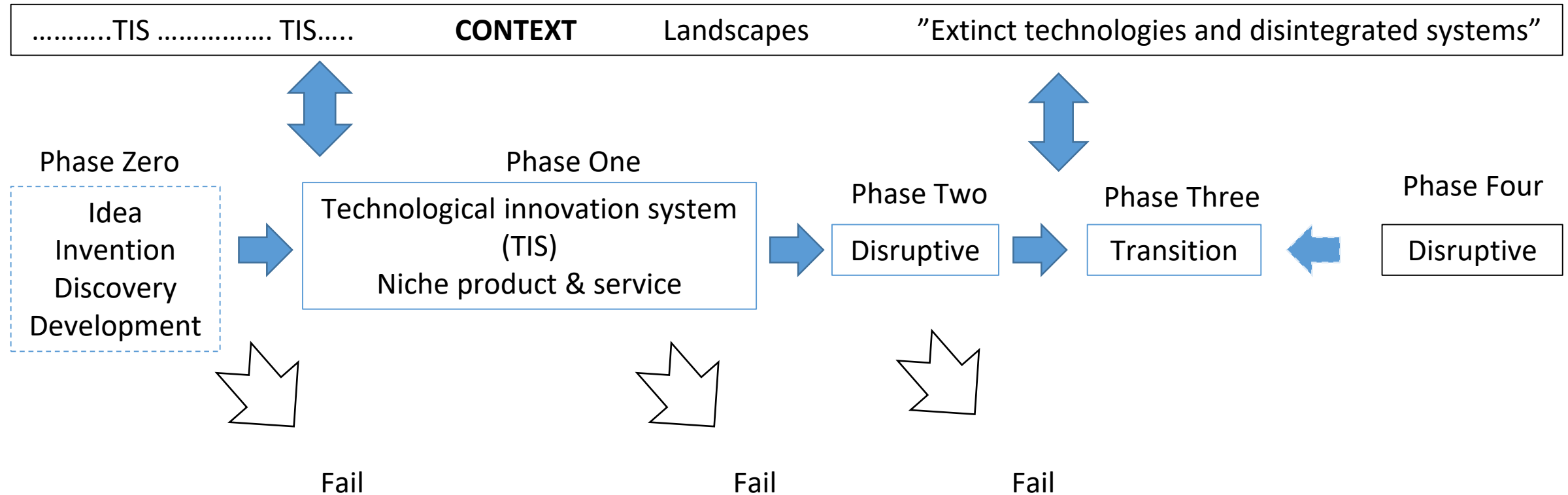
Systemic

Combination and interplay of systems

Association and integration of systems pivotal

System of systems (SoS)

Five – the contextual phase



The innovation cycle – up to 5 + 1 steps,
not necessarily follows each others

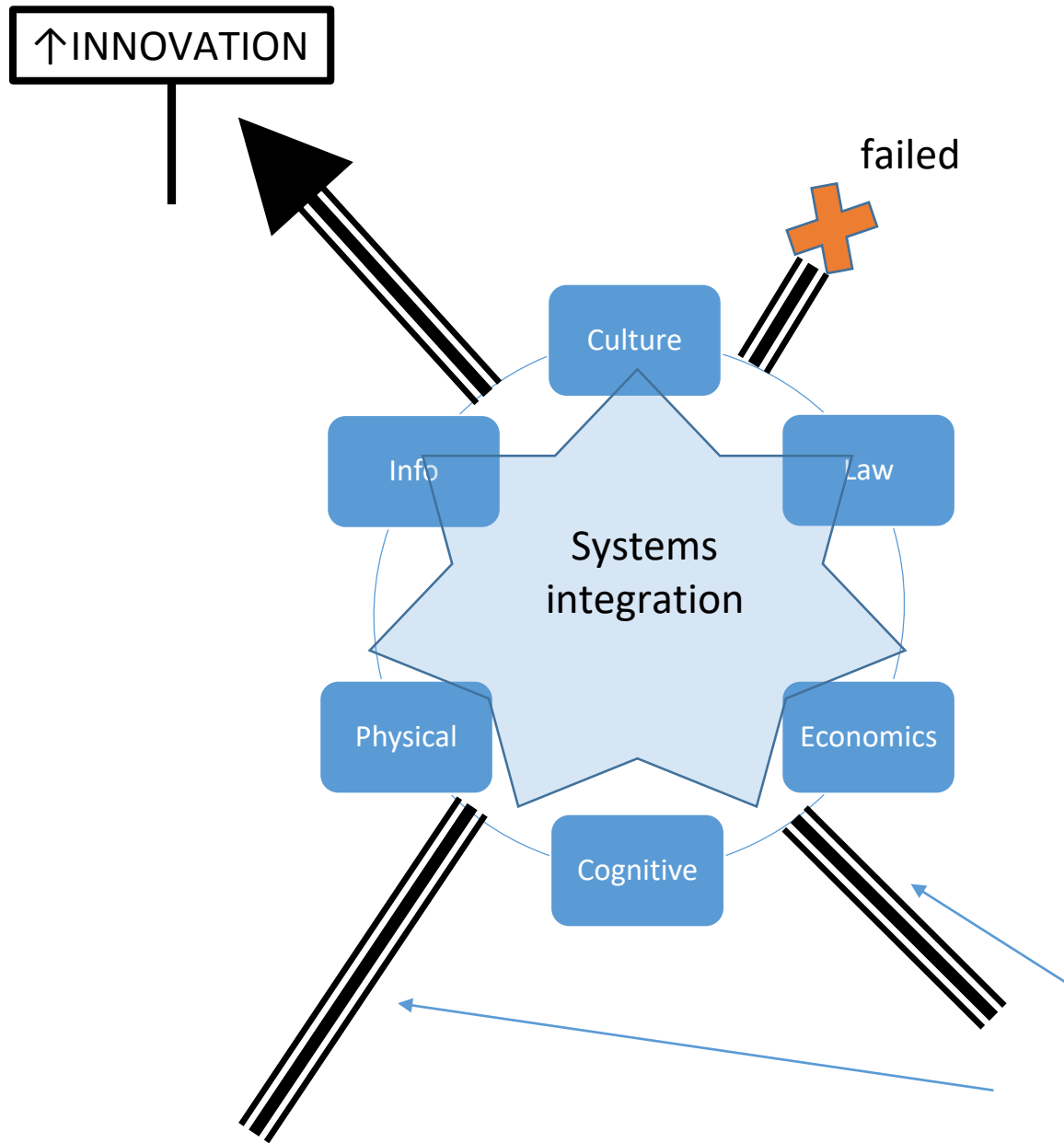
Methodology and tools used for establishing an architectural framework

– a synthesis

- > Case and sector studies
- > Systems thinking and acting (evolutionary, holistic (cross disciplinary), learning & experimentation, modelling etc)
 - > Theories and approaches for governance
- > Systems engineering (protocols, standards) (stakeholders, concerns, design, life cycles etc)
- > Enterprise architectures (i e MODAF, NAF, TOGAF, business oriented frameworks and concepts)

Pillars to governance of innovation and innovation processes:

- pivotal process of association and integration of systems (SoS)
- a theoretical outline of systems integration and association



**Visualization (I) of the
innovation view – architectural
framework in action**

Configurations (schemes and
approaches) for innovation

The dimensions of the architectural framework

Technological			Social Organizational		
Physical (SI) alignment (inter- operability)	Informational (exchange) IoT	Cognitive & technology harmonisation (professions, disciplines, schools, tacit knowledge)	Legal (rules, regulation, administrative control, decision domains, proprietary, IPR)	Economic (business models and control, incentives, externalities)	Cultural (values, behaviour, language, trust)
<i>Governance (leadership and management) discriminates – (mere) applying, mastering or supreme innovating</i>					

Some fifty configurations (schemes and approaches) alleged with innovation – compared to the innovation view and framework for innovation

- *Development blocks (Dahmén) (A1)*
- *Governance by markets or administrative control – Williamson's categories of governance (A2)*
- *Synchronic and diachronic integration (A3)*
- *Partnering as a means to coordination and association (Axelson) (A4)*
- *Problem solving and learning in industry according to Abernathy (A5)*
- *An evolutionary perspective for innovation (Nelson et al) (A6)*
- *The innovation cycle according to Abernathy and Utterbach (A7)*
- *Architecture and product design according to Clark (A8)*
- *Context and design addressed in a theory of design (Alexander) (A9)*
- *Design and evolution from a core technology according to Clark (A10)*
- *Dominant design (Utterbach et al) (A11)*
- *Utterback: Mastering the dynamics of innovation (A12)*
- *Architecture and innovation (Lerner) (A13)*

Cont`d:

- ***“The social organisation wins over technology” (Lorber) (A14)***
- ***Technological innovation systems (TIS) (A15)***
- ***Business Canvas (Osterwalder & Pigneur) (B1)***
- ***The Rothwell & Zegveld Architectural framework for technological innovation (B2)***
- ***Geels Architectural framework for niche and incentive policy for systems innovation (also Röyrvik’s pentagon) (B3)***
- ***The Zachman framework (B4)***
- ***Innovation systems - sectoral innovation systems (Lundvall et al, Malerba et al) (B5)***
- ***Semi-public enterprise (C1)***
- ***Strong hierarchy (C2)***
- ***Triple helix (Etzkovitz et al) (C3)***
- ***Military innovation architectural frameworks – “the military paradigm” (C4)***
- ***The prime contractor principle in defence procurement and the Platform configuration (C5, see also F2)***

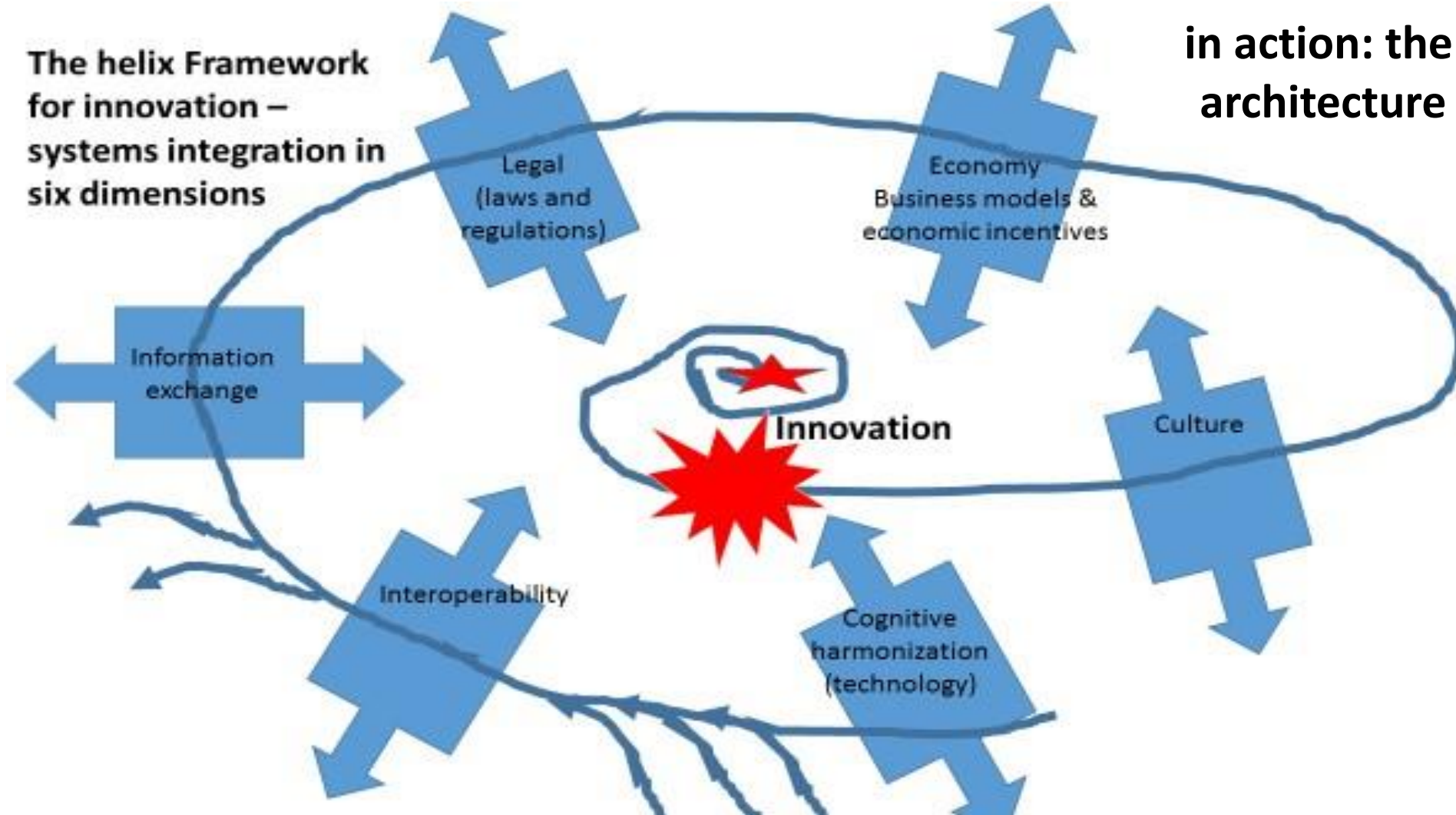
Cont`d:

- ***Civilian innovation architectural framework- Technology procurement (C6)***
- ***Federation (of autonomous partners) (D1)***
- ***Networks (D2)***
- ***Cluster (D3)***
- ***Internet of things (IoT) (D4)***
- ***DARPA – US agency dedicated to defence innovations (E1)***
- ***Strategic innovation agenda, SIA and programs, SIO (VINNOVA) (E2)***
- ***SBIR (E3))***
- ***Utility (E4)***
- ***The Enterprise (E5)***
- ***Pure market solutions (or “buying from the shelf”) (E6)***
- ***Complex product systems (CoPS) (F1)***
- ***Platforms (F2, see also C5)***
- ***Skunk works (F3)***
- ***In-house development (F4)***
- ***(Military) mission (or task force) (F5) (also see C4)***

Cont`d:

- ***The MITRE Approach for Agile Acquisition and Program (F6) – platforms, skunk works etc***
- ***‘Auftragstaktik’ (Prussian Army doctrine) (G1)***
- ***Technology foresight (incl “Back-casting”) (G2)***
- ***Science-based innovation (G3)***
- ***Systems engineering (H1)***
- ***Enterprise architectures (H2)***
- ***NATO Interoperability standards and profiles NISP (H3)***
- ***Polygeneration innovation project (case study)***
- ***Polygeneration project (case study)***
- ***Smart Grid (case study)***
- ***LedSyst project (case study)***

**Visualization (II) of the
innovation view –
architectural framework
in action: the systems
architecture evolves**



Reflections and tentative conclusions

- Disruptive innovation is a complex affair (with up- and downsides that are not easily anticipated, calculated or encapsulated)
- It is certain today that innovation meet great expectations, and is rightfully hailed and definitely has a great potential to contribute to and foster positive social change and development (in sectors such as energy, defence, security and also many others).
- Innovation is needed as effective response to vast social and economic challenges in our society as for example on the macro scale climate change and environmental concerns, and industrial competitiveness and growth, and in the micro scale such as national collaborative programs for development recently launched in Sweden.
- Innovation is also an important, in fact a vital part of the transition and transformation of the national economy and sectors in society - not only energy, defence and security but also many others, for example transport, health and welfare and media/communication. (Digitization is in our time maybe the capital factor of technological nature that brings -triggers changes that are definitely disruptive.)
- It is of course a great value if innovation and innovation processes can be governed for success (though through difficult waters and transitions).
- We have investigated cases studies and several schemes and approaches alleged with innovation, as the governance and management literature on innovation and innovation processes— not only to design governance constructively, but also tested.

Reflections cont'd

- From this ambition there seems to be a reasonable support of an innovation view concept and architectural framework for innovation - although it is not exactly corroborated (it is "dry tested").
- We have in the study suggested and articulated an architectural framework that is relevant and supports innovation and innovation processes. A pivot for innovation is systems integration and emergence of SoS.
- An excuse for a non-proof, the view and framework are not, and cannot be deterministic algorithms for innovation to succeed (context matters for example). It is not either a discourse that one can set up deliberately at one's own will and wishes.
- However the framework reminds us that innovation is neither a result of single technical breakthroughs (discovery and invention) nor a right and insightful economic policy for entrepreneurs nor a bright organisational constellation as triple helixes; innovation has to encompass and build on more dimensions, it is truly cross-dimensional (we have explored six of the dimensions) and trans-disciplinary/scientific. Goals for innovation are seldom straight-forward to the solution, often elusive. This is essential to remember when one tries for example to transform a business from hardware to the service innovation economy (Ericsson is a current example) or national strategic collaborative programs for meeting societal challenges (energy, climate, environment for example). A panacea for everything and all innovation is not realistic.

Questions? Comments?
Remarks?

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