Frameworks for innovation

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

Bengt A Mölleryd
TeknLic
KTH Energy technology
FHS Military technology
IVA
The phenomena of innovation

“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”.

A challenge is that established organizations (companies) tend to resist new technologies and potential innovations that threaten to make their existing investment in production systems, people and knowledge and competence irrelevant and obsolete. History is full of organizations (companies) that were phased out of businesses by new technologies and innovations that they resisted and rejected. The innovator’s and inventor’s only option often is to start a new organization (company) to develop the technology. Start-ups and innovations are exciting ventures but the road is commonly fraught with many pitfalls and risks.
Value added new service or product (incl. process) (demand-factor and creativity)

The emergence of innovation (different from invention and discovery)

Manyfold patterns, with an entrepreneurial component

Disruptive innovation (phases out, destroys and creates)

Cooperating systems – Association of Systems - Integration of systems etc

System of systems
3 Contexts of innovation scanned and investigated

<table>
<thead>
<tr>
<th>Energy</th>
<th>Defence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial</td>
<td>State monopoly</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>Commercial elements (i.e., logistics and other supporting services)</td>
</tr>
<tr>
<td>Re-regulation</td>
<td>NCW</td>
</tr>
<tr>
<td>Public concerns</td>
<td>Systemic</td>
</tr>
<tr>
<td>Systemic</td>
<td></td>
</tr>
<tr>
<td>Digitization</td>
<td></td>
</tr>
<tr>
<td>Convergence energy web</td>
<td></td>
</tr>
</tbody>
</table>

**Security**
- Security of supply
- Flows - infrastructure
- Private – public
- Systemic
- Cyber
Stylized architecture framework for defence innovations

State – Governance
Civilian Politicians

Military HQ
(joint or sectoral command)

Doctrine

Marine

Air Force

Army

Military Services etc

Antagonist
(Intelligence)
Systems thinking and acting..... (Checkland, Churchman, Sterman etc)
Systems engineering (SEBoK etc)
Enterprise architectures and frameworks

MODAF,
NAF
TOGAF
NISP
Zachman framework
Osterwalder Business canvas
Business architectures
And several others
International standards and protocols 15288, 42010 etc
• Is there a (one) method to cheaply and effectively capture all types of innovation?
• Transparency?
• Most architectures and frameworks or models demand large investment in data and skills
• Continuously working large project organizations (legacy burden)
• “Light weight” architecture and framework
• Evolutionary and learning/experimental
Innovation view – a proposal:

Architectural framework which gives a robust strategic guidance to governance of innovation (success)
Modalities of association and integration of systems (the pivot) in a framework

- Informational
- Physical
- Technological
- Economical
- Cultural
- Social
- etc
## The Framework

### The main architectural dimensions for innovation

<table>
<thead>
<tr>
<th>Technological</th>
<th>Social Organizational</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical (SI) alignment (inter-operability)</td>
<td>Governance (leadership and management) – apply, master or innovate</td>
</tr>
<tr>
<td>Information exchange</td>
<td></td>
</tr>
<tr>
<td>Cognitive harmonization</td>
<td></td>
</tr>
<tr>
<td>Legal (administrative control, decision domains)</td>
<td></td>
</tr>
<tr>
<td>Economic (business models and control)</td>
<td></td>
</tr>
<tr>
<td>Cultural (values, behaviour)</td>
<td></td>
</tr>
</tbody>
</table>
Case studies

• Smart Grids and Storage

• Innoenergy Polygeneration – an energy multisourcing rescue and emergency module for producing power, heat, cold, fresh water etc

• A Command, Control, Communication and Information (C3I) System for Swedish Defence (& Security) (LedSyst)

• Configurations with some records of innovation (approx 30 Configs.)
<table>
<thead>
<tr>
<th></th>
<th>artillery and intelligence compatibility</th>
<th>service operation (artillery and intelligence)</th>
<th>domain lateral freedom</th>
<th>risk</th>
<th>Competence and trust</th>
<th>“Auftragstaktik” (Prussian Army)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>design</td>
<td>protocols &amp; standards (ISO 15288 et al)</td>
<td>(multi)technical protocols</td>
<td>life cycle configuration framework</td>
<td>stakeholders</td>
<td>Systems engineering (SEBoK etc)</td>
</tr>
<tr>
<td>U</td>
<td>SOA, classes</td>
<td>standards (ISO 42010, IDEAS et al)</td>
<td>class technologies framework</td>
<td>business model</td>
<td>enterprise</td>
<td>Enterprise Architectures (MODAF, NAF, TOGAF etc)</td>
</tr>
<tr>
<td>V</td>
<td>technology area with a potential for development &amp; innovation</td>
<td>partnering</td>
<td>public seed funding</td>
<td>joint agenda and mission</td>
<td>Strategic Innovation Agenda (VINNOVA)</td>
<td></td>
</tr>
<tr>
<td>X</td>
<td>explorative</td>
<td></td>
<td></td>
<td></td>
<td>Technology foresight</td>
<td></td>
</tr>
<tr>
<td>Y</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Z</td>
<td></td>
<td></td>
<td></td>
<td>Academy – Industry - Government</td>
<td>Triple Helix</td>
<td></td>
</tr>
</tbody>
</table>
Frameworks for innovation – technology innovation and systems for energy, defence and security

This study concerns technology innovation and systems for energy, defence and security. The study focus on ways and means of promoting and conditions for innovation or value adding new technologies, systems, services and products for the mentioned areas and purposes.

Attention is particularly paid to innovation as phenomena which emerge from organizing integrated system of systems by evolutionary processes with vital elements of experimenting and learning.

Focus is on radical technological innovations that have disruptive scope and consequences. Disruptive innovations are commonly induced and driven by technology and technological changes. Digitization with associated net technologies is a prime example of technologies that cause major disruptions of systems, industrial branches and firms, and whole sectors of society. Radical or paradigmatic innovations contrast to “normal innovations” which come from minor changes of processes, mere re-designs or changed fashions and images of the existing products and services to the customers and users.

The study is aiming at an innovation view, which is a rudimentary model and architectural framework with a purpose to provide robust and strategic guidance and means to governance of technological innovation. To the benefit for application and practice when designing and engineering innovation and innovating systems, the innovation view aligns with, but does not substitute recognised international enterprise architectural frameworks, systems engineering standards and protocols (for example ISO 15288, ISO 42010, NISP).

Cases of technological innovation and systems for energy, defence and security are studied with regards to the proposed innovation view and relevant architectural frameworks.
Bengt A Mölleryd
TeknLic

KTH Energy Technology, FHS Military Technology IVA

bamolleryd@gmail.com
Ph +46-705834472