

Can Standards Help? Flexibility and Change of Large Infrastructure Systems

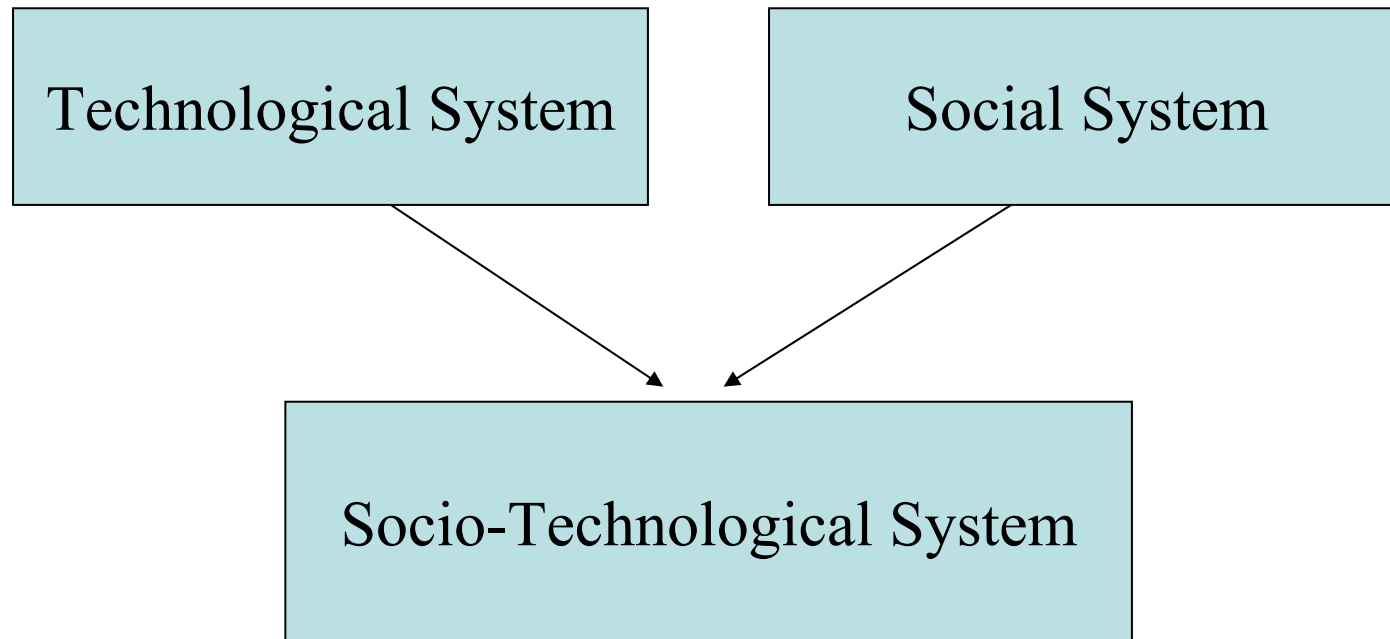
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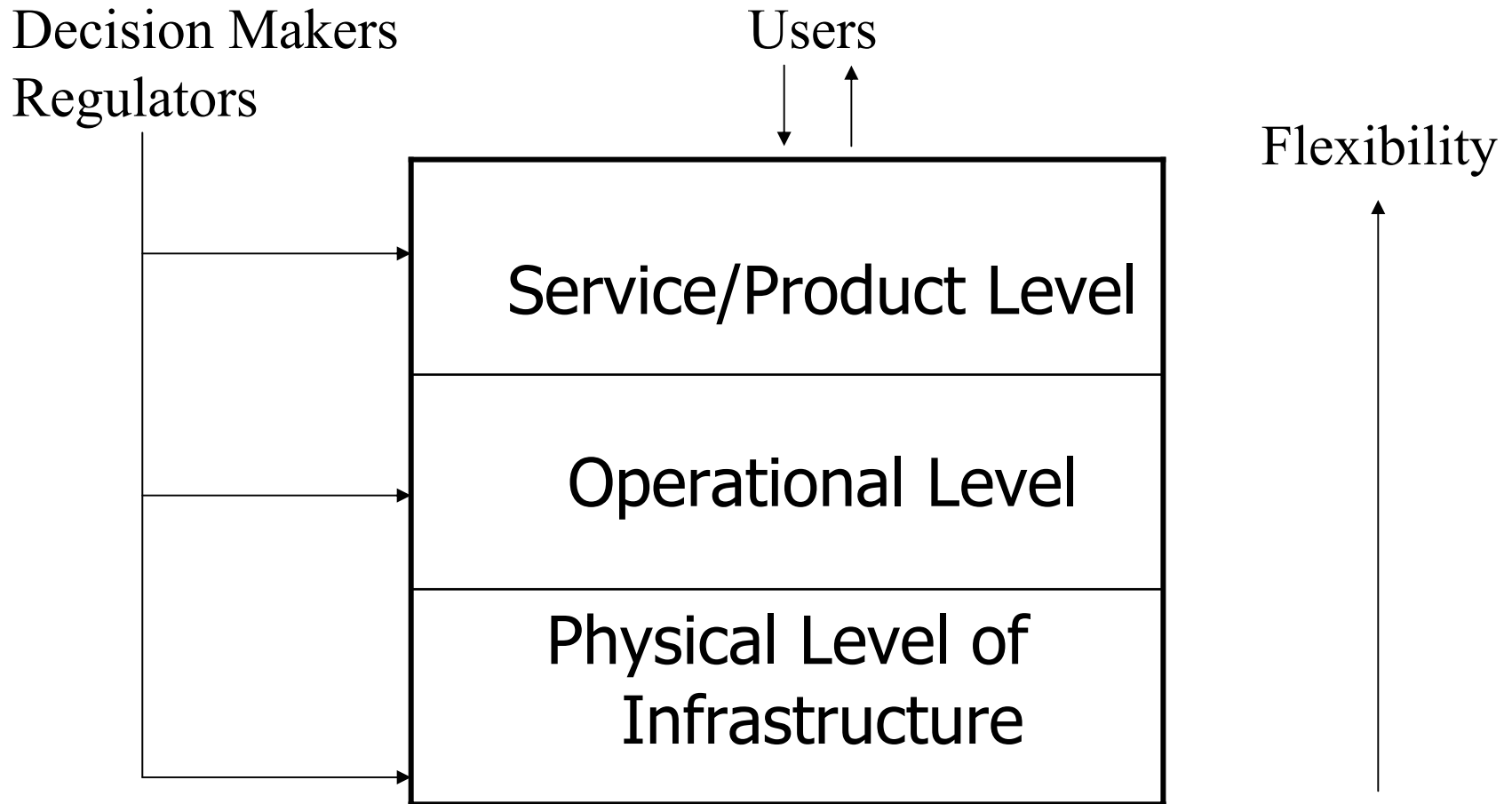
Outline

- Introduction
- Physical Inertia and Social Inertia
- Large Technological Systems
- Dealing with Uncertainty
- Conclusions

Understanding Infrastructures



Levels of Infrastructure



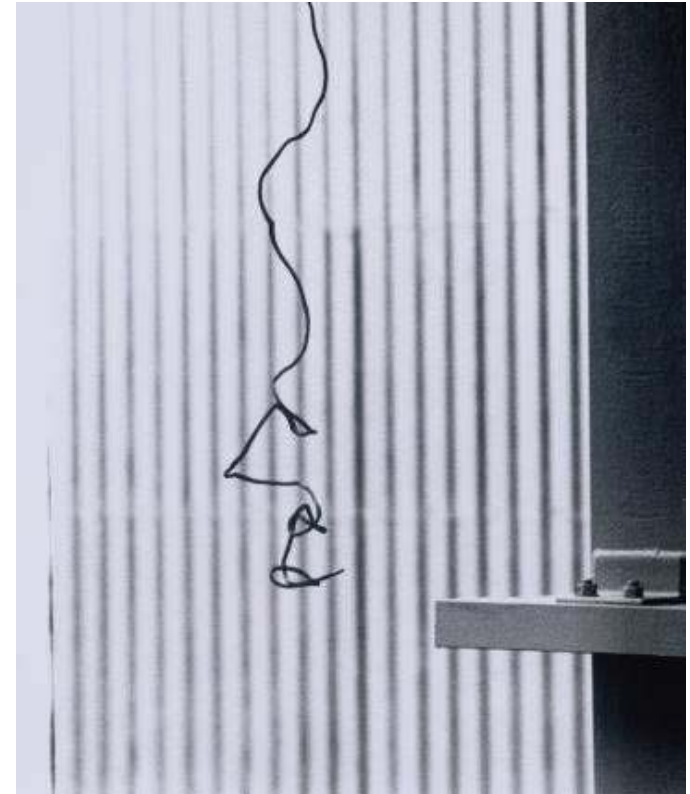
Dynamics on Different Levels

- Higher levels are more dynamic
- Lower levels more static and difficult to change



Statement of Problem

- Demand changes
- Need to adapt or replace system
- Replacing? Too costly, too risky
- Adapting? How?
- Standards can help!



Problems with System Change

- People oppose any change that doesn't jingle in their pockets
- Radical changes are extremely difficult to implement:
 - technological inertia
 - social inertia
- "Complex systems have to prefer evolution to revolution because big steps lead to extreme rates of change in other subsystems and thereby endanger the whole system" Heinz and Kill (1988, p.116)

Successful Technologies

- iPod: just simplicity of use?
- Technology that is backed up by the existing infrastructure
- Skype – “not a telephony replacement service”

- Evolution - constant integration of new technological solutions into existing network
- Case study: RFID – supply chain management

Types of Change

- Technological
 - Innovations
 - New functions
- Institutional
 - Liberalization, unbundling
- Social
 - Sustainable development
 - Consumer differentiation

Change in public values

1. Quality
 2. Accessibility (security of supply)
 3. Safety
 4. Affordability (efficiency)
- Change in one category leads to
- a. change in another one
 - b. change in technology (innovation)
 - c. both

Types of Change

- Predictable
 - Unpredictable
- There is always a certain degree of uncertainty about the future demand that infrastructure will face

Coping with Uncertainty

- ignoring uncertainty
- delaying the decision
- identifying, specifying, ranking uncertainty
- reducing uncertainty by taking affirmative actions

Tackling Uncertainty

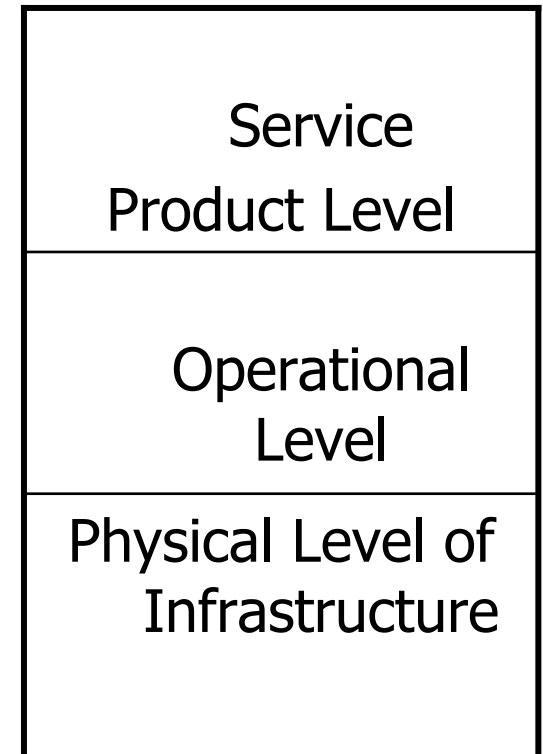
- To cope with predictable changes:
 - the real option theories
 - space design
- To cope with unpredictable changes:
 - standards increase flexibility

Predictable changes: Real Options

- Real options theory: uncertainty is seen as opportunity:
 - Identifying opportunities
 - Investing in real options
 - Use/disregard opportunity later
 - Value of options can be calculated

Predictable Changes: Space Design

- Expanding physical level:
 - Modular design
 - Life cycle approach
 - Robust design
- Expanding into higher levels
- Expanding into other infrastructures
 - Multifunctionality of infrastructures
- Expanding into non-infrastructure design
 - Spatial bundling



Unpredictable Changes: Use Standards

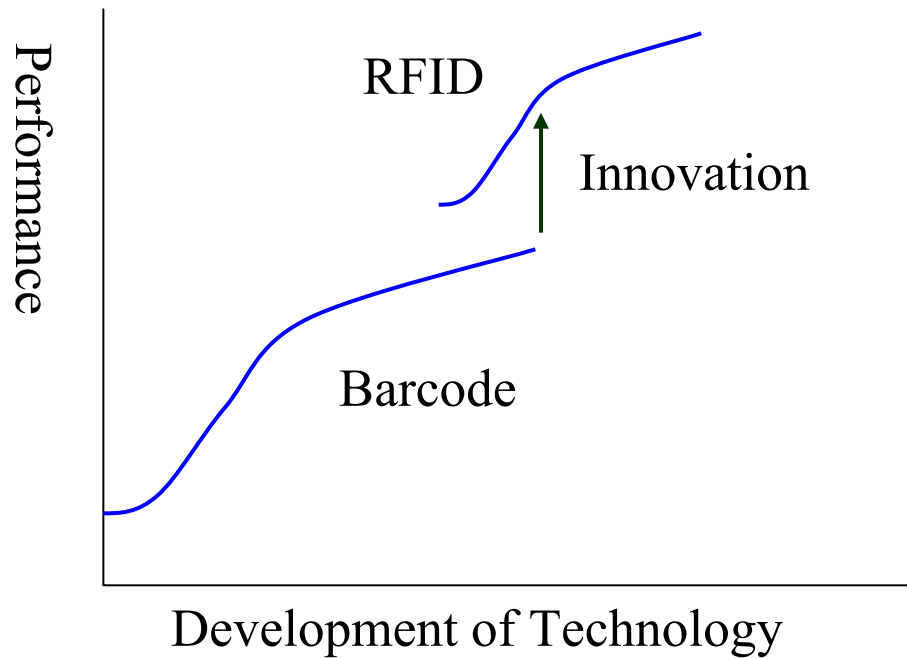
- exchangeability
 - portability
 - scalability
 - extendibility or upgradeability
 - integration
 - interconnectivity
 - reversibility
 - downgradeability
- (Egyedi, 2002)



Case Study: RFID Standards

- ISO/IEC 15434 on the syntax for high capacity ADC media
- ISO/IEC 15459 (part 1) on technical standard for identification of transport units
- ISO/IEC 15459 (part 2) on procedural standards for identification of transport units
- ISO/IEC 15418 EAN/UCC on fact data identifiers
- ISO/IEC 15424 on data carrier / symbology identifiers
- ISO/IEC 18000 on frequency identification for item management: Air interface
- ISO/IEC 15962 on data notation
- ISO/IEC 15963 on unique identification of RF tag
- ISO/IEC 15961 on data objects
- ISO/IEC 18046 on RFID tag and interrogator performance test method
- ISO/IEC 18047 on RFID device conformance test methods.

Case Study: RFID



Conclusions

- Changes in infrastructure happen parallel with changes in society
- Evolution - constant integration of new technological solutions into existing network
- Changes are difficult because of physical and social inertia
- Uncertainty can be tackled
- Standards can potentially improve flexibility

Questions and Comments

