MOT131A Emerging and Breakthrough Technologies

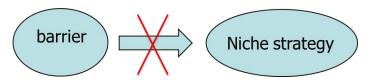
Prof. dr. J. Roland Ortt Lecture 10:

- 1. Strategies during the adaptation phase of the pattern (of one technology)
- 2. Application and future work
- 3. Interaction between technologies

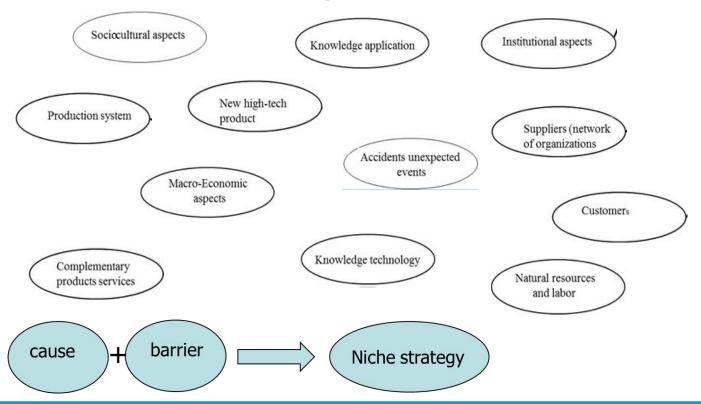




1. Strategies to overcome barriers

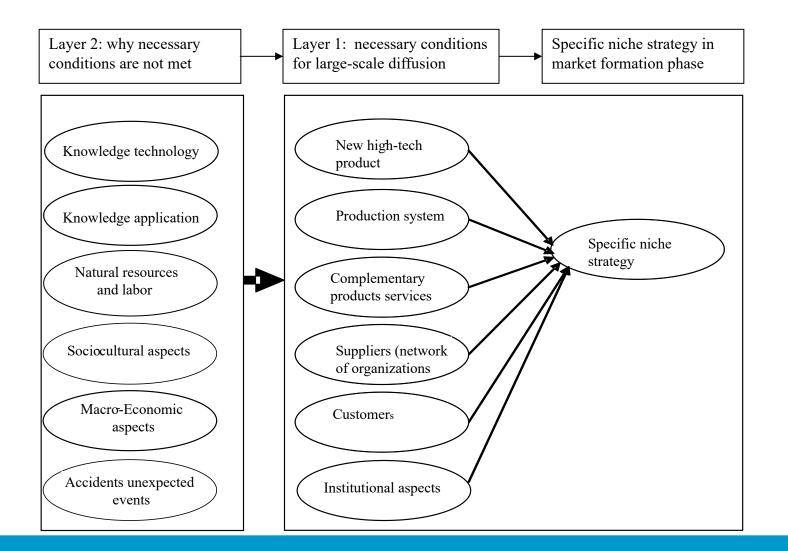


2. Many barriers to large-scale diffusion!









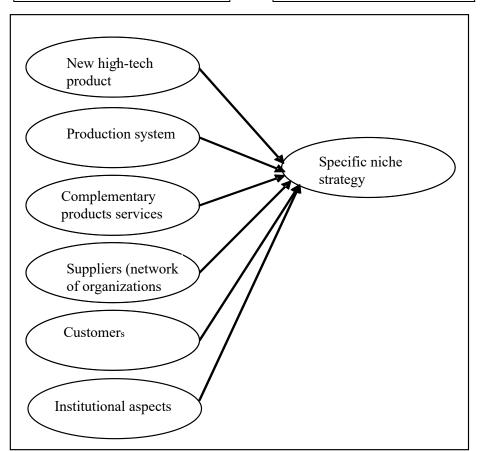
Ten niche strategies

- 1 Demo, experiment and develop niche strategy
- 2 Top niche strategy
- 3 Subsidized niche strategy
- 4 Redesign niche strategy
- 5 Dedicated system or stand-alone niche strategy
- 6 Hybridization or adaptor niche strategy
- 7 Educate niche strategy
- 8 Geographic niche strategy
- 9 Lead user niche strategy
- 10 Explore multiple markets niche strategy



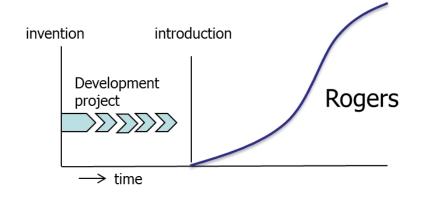






Where did you see these necessary conditions before?

Why are assumptions for the diffusion model and necessary conditions the same?



Model of relevant (F)actors 1. Product perform 2. Price 3. Production 4. Compl prod/serv 5. Network of supply 6. Customers Score V X

Institutions



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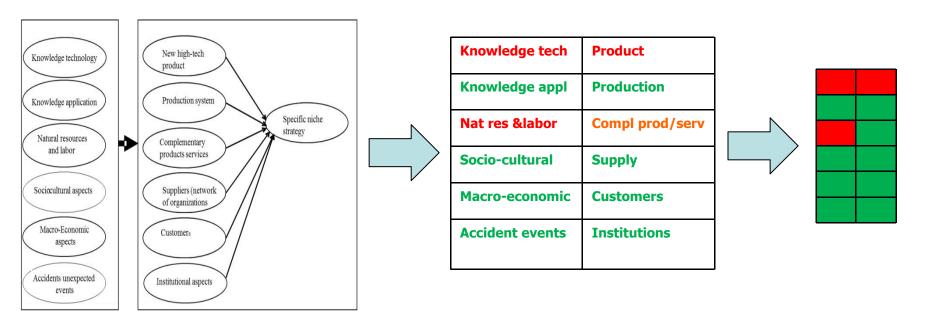


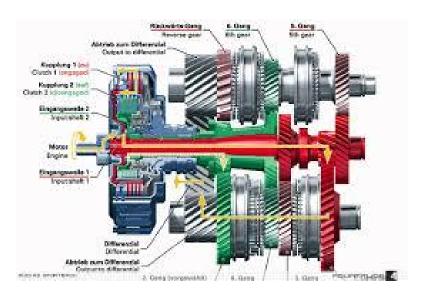


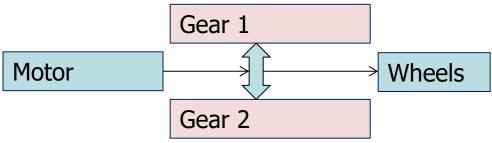
Two question for the outboard case

- 1. Timing of a niche strategy:
- 2. Type of strategy:

when to enter the market? type of (niche) strategy?







Benefits of DCT: Smooth, fast gear change without power loss

Case-study: Dual Clutch Technology (DCT)

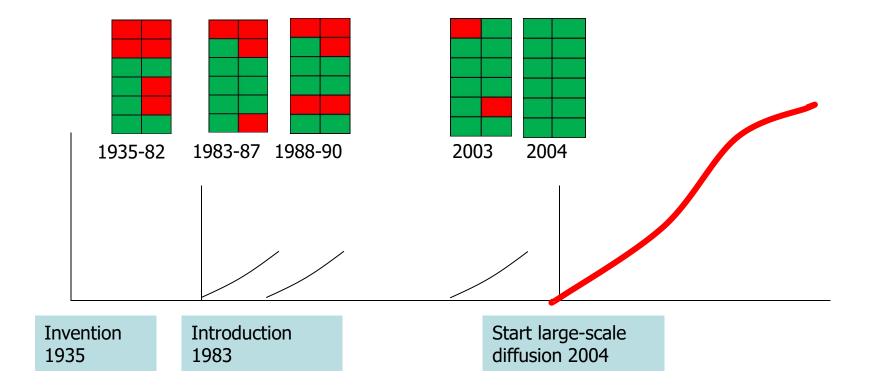
Invention: 1935 Introduction: 1983 Large-scale dif: 2004

Market formation between 1983-2004 (21 years!)





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Four episodes of DCT after invention in 1935

Episode 1 (1935-1983) Innovation phase (no introduction)

- Original idea uninterrupted power for heavy vehicles.
- Problem knowledge of technology, low performance.
- 1970s Porsche starts working on DCT again.

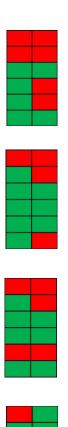
Episode 2 (1983-1987) Demo and develop niche strategy

- Endurance and race program (Porsche and Audi)
- Computer size and performance had progressed.
- New technological barriers (lubrication, ...)
- New potential barrier: image/New barrier: FIA bans DCT

Episode 3 (1988-89) Top end niche strategy (failed)

- Lack of quality for Porsche production car.
- Economic recession US.

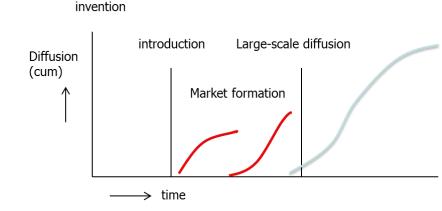
Episode 4 (2003) Top end niche strategy 2.0 (success)





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Conclusions



What to expect? (pattern)

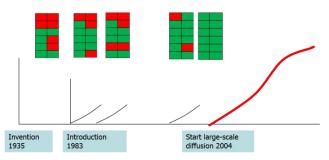
- Development lasts long, much longer than a project takes.
- Market formation last long and is different from a slow diffusion start.

Why? (actors and factors)

- Barriers to large scale diffusion (12)
- Tracked over time to choose strategy

What to do? (strategies)

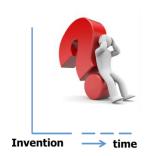
- We found ten niche strategies.
- We were able to relate the market situation (barriers and their causes) to the choice of niche strategies.



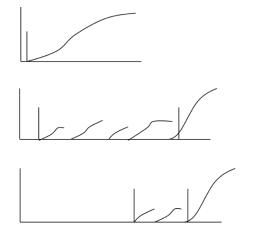




Discussion: what do we know?



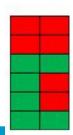
What to expect Pattern



Ten niche strategies + application

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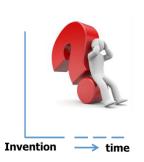
Why it emerges: (F)actors

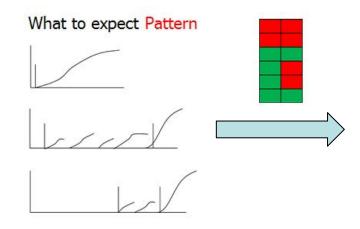






Discussion: what do we not know?





Ten niche strategies + application

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The exact mechanisms by which this pattern is created;

The effect of different policy interventions on the pattern?

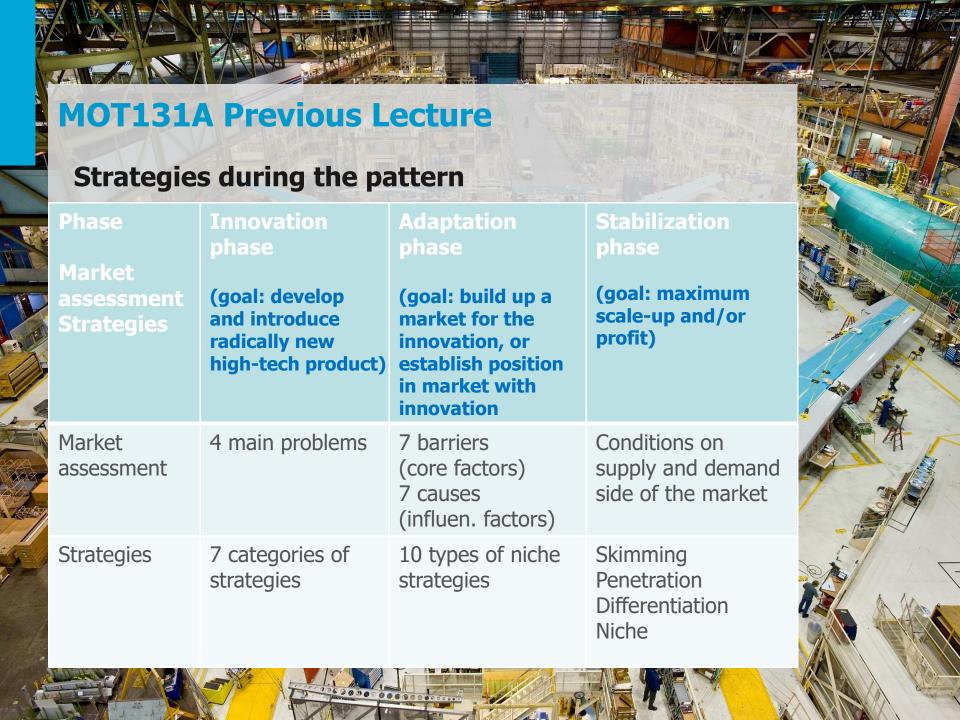
What about a full set of strategies: exit, wait, niche, large-scale intro How can strategies in

How can strategies in different phases evolve into each other?

System's perspective including social technical economic factors: what about the effect of expectations, misinformation, etc etc







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How different technologies interact

Basic mechanisms

October 20, 2023

1. Evolution: One technology evolves naturally from the other

2. Discipline: Technologies same technological principles

3. Competition: Technologies competing with each other

4. Complement: Technologies are complementary

5. Supply: Technology as component

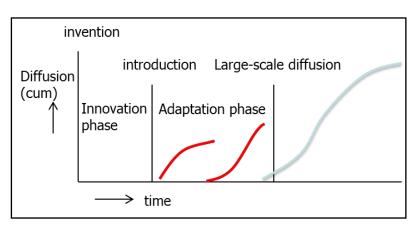




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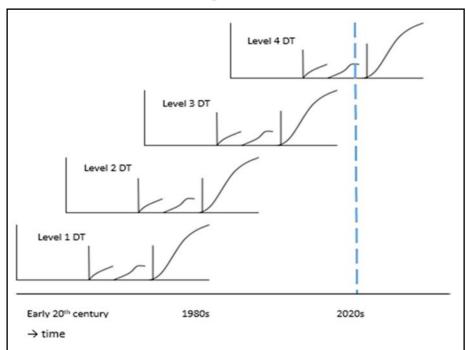
1. Evolution: One technology evolves naturally from the other

Different shifts within the pattern and across patterns



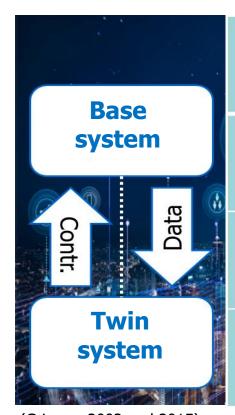
Definition of a technology

- 1. Technological principle
- 2. Functionality
- 3. Main subsystems





Example of evolution Digital Twin



(Grieves, 2002 and 2015)

1. 3d-model

2. Simulation

3. Data input

4. Control

(Ortt and Tiihonen, 2023)

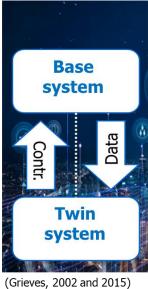
Definition of a technology

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Evolution:

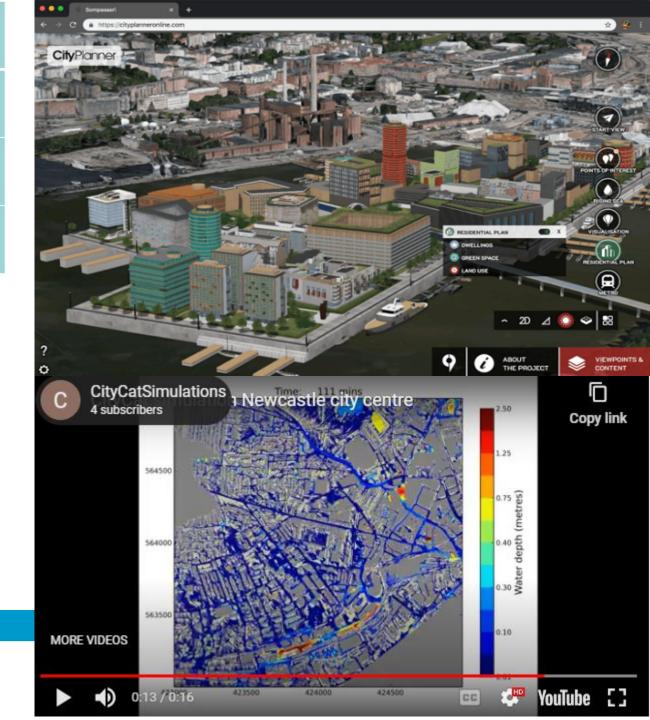
- 1. Principle is enhanced
- 2. New functionalities
- 3. Extra subsystems
- = new technology

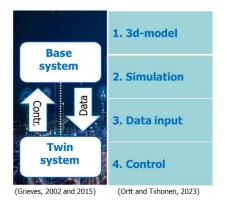




- 1. 3d-model
- 2. Simulation
- 3. Data input
- 4. Control

(Ortt and Tiihonen, 2023)





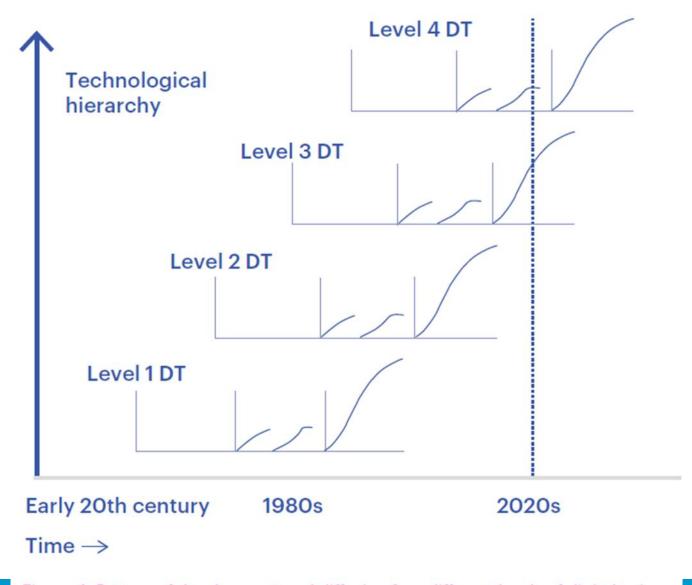


Figure 4: Pattern of development and diffusion four different levels of digital twins



2. Discipline

What is it?

How does it emerge? How does it evolve? The case of Quantum technology

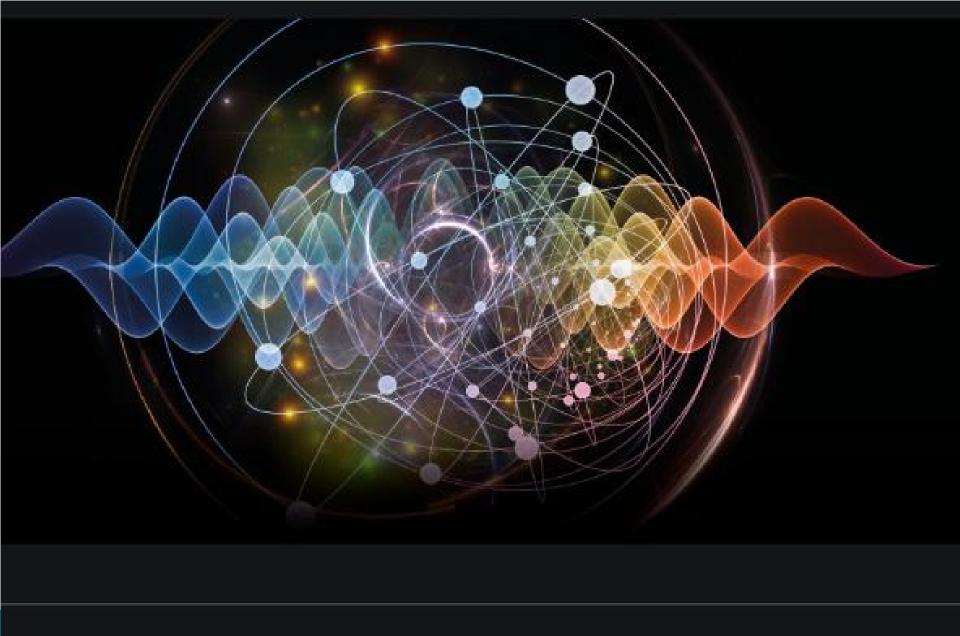
Technology = technical principle + functionality + components

Traditional discipline = field of knowledge, practices and technologies (e.g. electronics, nuclear physics, solid state physics, ..)

Discipline = group of technologies

- principles in common (e.g. quantum technology, genetic engineering)





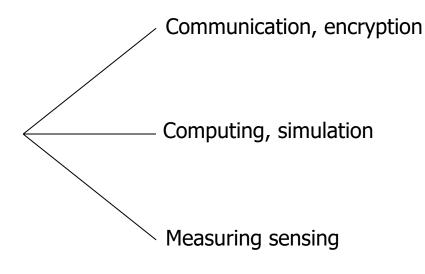


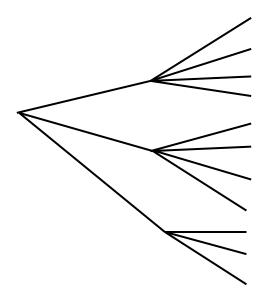
Discipline

What is it?
How does it evolve?

The case of Quantum technology





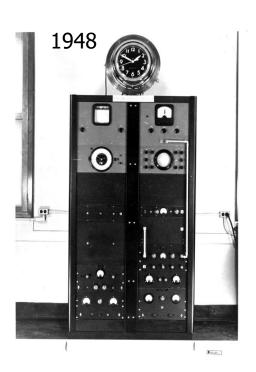




Discipline

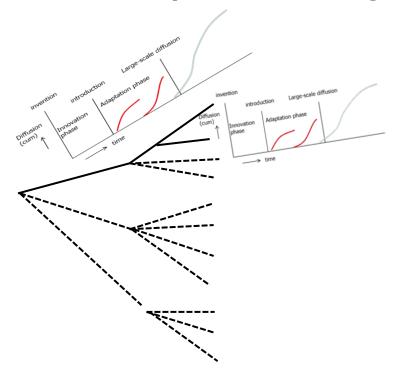
What is it?

How does it evolve? The case of Quantum technology



Time measurement history

- Project-level observations
- The pattern for time measurement
- Relationship with measuring sensing

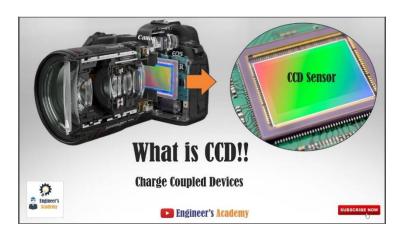


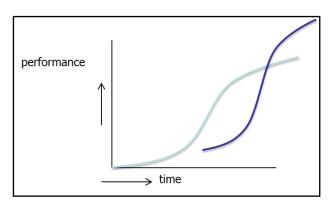


3. Competition

Technology = technical principle + functionality + components









4. Complement and 5. Supply

Complement: Software and Hardware

Supply: CCD-chip + batteries for digital photograph equipment

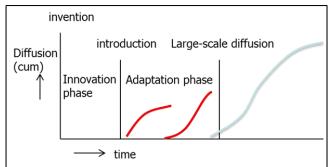


















Questions?

