

# ***Railway Innovation***

## Railway and Mobility: International Week

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# Contents: Railway Innovation

1. "S" Curves and Creative Destruction
2. Railway Innovation Needs
3. Example: Traffic Management Systems
4. Example: Tourism Post Covid-19
5. Example: An Integrated Long Distance Transport System for Austria

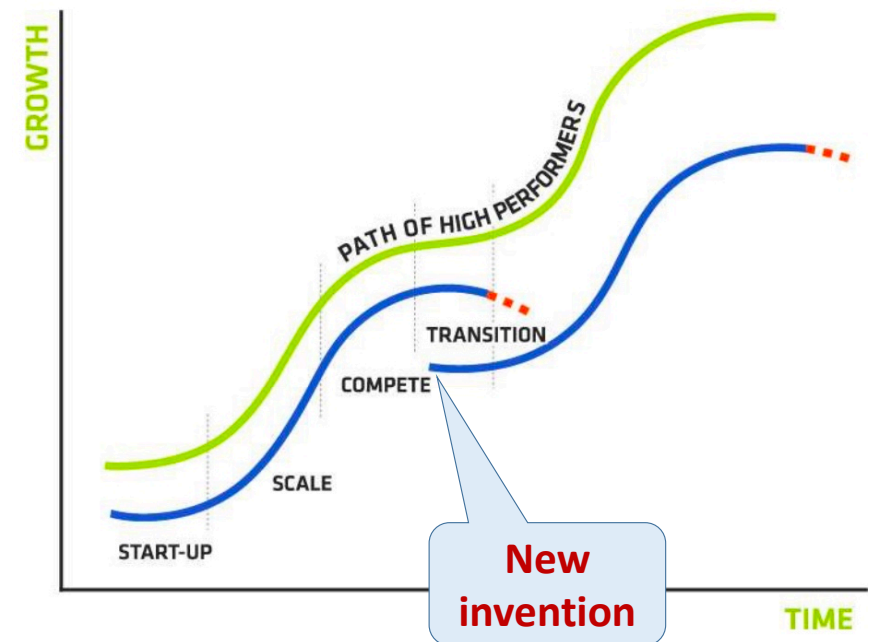
# 1. Innovation: Incremental vs. Disruptive Change

## Double "S" Curve

### New invention ...

- Improve & optimise (faster, easier ...);
- Develop and popularise use cases (what's a smart phone for?);
- Rapid adoption (everyone gets one);
- Continue optimisation (slow, small);

**New invention ... repeat.**

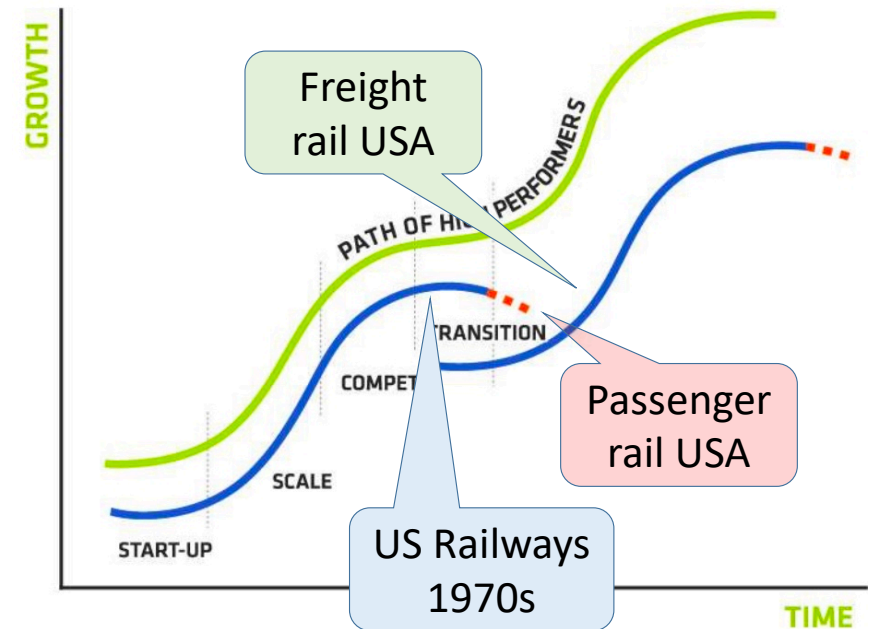


Source: Ron Neumann, Innovation and the S-Curve 2013, SlideShare.

# Creative Destruction: Replacing old products and processes

## *US Railway Example*

- Railways were “only” form of long distance transport 1850 – 1920;
- Road + Air competition 1920 – 1970;
- Railway business failure 1970s;
- Railways focuses on niche market: long distance freight transport, and leaves long distance passenger market.



Source: Ron Neumann, Innovation and the S-Curve 2013, SlideShare.



# Disruptive Innovation Process: Railway Example

## *What is railway's product?*

- Transport of goods and people  
→ *not providing railway service!*

## *Who are railway's competition?*

- Other modes of transport (road, air).

## *In which markets can railways succeed?*

- Long distance passenger market
- Long distance freight market
- Others ...

## *What must railways do to succeed in these markets?*

- Technical and social innovation to meet customer needs & increase efficiency.



# How do you innovate?

- Invent something totally new → Electricity
- Combine technologies in a new way → iPhone
- Create new needs (social, political) → facebook
- Optimise and improve existing technologies and processes
- More ...

## 2. Railway Innovation Needs

### Transport Policy: Cars, Trucks, Trains or Planes?

#### Highway: Cars/Trucks

##### Positives:

- Fast
- Direct
- Secure
- Low cost
- Flexible timing

##### Negatives:

- Increase roadway congestion
- GHG - noise (*future electric?*)
- Safety (*automatic driving?*)
- Do cars pay full social costs?

Solutions on the horizon!

#### Trains

##### Positives:

- Moderately fast
- Energy efficient
- Electric = less GHG (source?)
- Excellent safety
- Reduce roadway congestion

##### Negatives:

- Slow total trip time
- Higher cost (social costs?)
- Noise
- Schedule = Inflexible timing

#### Planes

##### Positives:

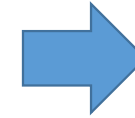
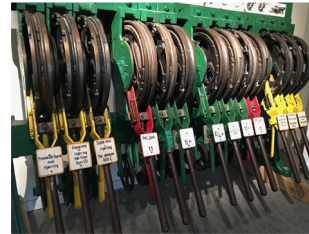
- Very fast
- Excellent safety record

##### Negatives:

- GHG – noise
- Access and security time
- High cost (social costs?)
- Schedule = Inflexible timing <sup>7</sup>

Starting point for railway innovation: relative weaknesses versus competition.

# Railways Need Innovation!



... to compete successfully with autos, trucks & planes in the future.

Starting point → Look at rail negatives and competitor positives:

- **Speed** – what do customers *really* want (trip time, schedule)?
- **Costs** – *fairer policies* for recognising and allocating external costs (GHG, social)?
- **Railway technology** – noise reduction, wheel mechanics, infrastructure, etc.
- **Information technology** – train control, customer interfaces, business systems, etc.

# Example: Automated Trains

## Automatic Train Operation: Benefits



**Increase  
capacity**



**Improve  
flexibility**



**Save  
energy**



**Enhance  
passenger  
experience**

Source: Siemens (photo); Julie Morel, Alstom, Presentation at EC Digital Transport Days, November 2020 (data graphic).



# EU Railway Research Program

## Shift2Rail

- Joint Undertaking = combination of company and EC funding;
- Highly focused on implementation of research results;

Source: European Union, Innovation in Action, Joint Undertakings for cutting-edge research in Europe, 2020.

## WHY DOES EUROPE NEED JOINT UNDERTAKINGS?

### CUTTING-EDGE RESEARCH & INNOVATION

We are agile, efficient and truly inclusive public-private partnerships, capable of leveraging knowledge, skills and expertise. We keep ahead of the curve by delivering scientific excellence and innovation across key industrial sectors - smarter and greener mobility, innovative healthcare, improved circular economy, cleaner energy and better electronics.

### GREEN RECOVERY

We are scaling up investments needed in strategic sectors in order to support the transition towards a green economy, meeting the goals of the European Green Deal and Digital Europe.

### ENHANCING EU COMPETITIVENESS

Through a close cooperation of research and industry, and an alignment with other European and national policies, we effectively contribute to strengthening EU leadership on a global stage.

### MISSION-ORIENTED

By embedding the partnerships within the EU's policy and regulatory framework, we ensure that research is oriented towards the right priorities, bringing real added value to Europe's economy and society and maximising the resources available at regional, European and global level.

### ACHIEVING GREAT THINGS TOGETHER

We cooperate closely with the European Commission, Parliament and Council, as well as with relevant regulatory bodies and national authorities in the participating countries, contributing to overall European strategy and policies. From industry to digital, energy and health, we bring research to the market, and we produce competitive results, by creating jobs and growth.



# Shift2Rail: Objectives and Vision

## S2R OBJECTIVES



**+50%**

**INCREASE** RELIABILITY & PUNCTUALITY **BY 50%**



**x2**

**DOUBLE** RAILWAY CAPACITY



**HALVE LIFE-CYCLE COSTS** OF RAILWAY TRANSPORTS



CONTRIBUTE TO **REDUCTION OF NEGATIVE EXTERNALITIES**, SUCH AS NOISE, VIBRATIONS, EMISSIONS & OTHER ENVIRONMENTAL IMPACTS



CONTRIBUTE TO THE **ACHIEVEMENT OF THE SINGLE EUROPEAN RAILWAY AREA (SERA)**

## S2R VISION

To deliver, through railway research and innovation, the capabilities to bring about the most sustainable, cost-efficient, high-performing, time driven, digital and competitive customer-centred transport mode for Europe.

# Shift2Rail: Innovation Capabilities

## Innovation Capabilities

Shift2Rail projects are delivering twelve Innovation Capabilities, essential to meet the needs of railway operators and network managers and pave the way to the digital railway system and multimodal European mobility.

#1



AUTOMATED  
TRAIN OPERATION

#2



MOBILITY  
AS A SERVICE

#3



LOGISTICS  
ON DEMAND

#4



MORE VALUE  
FROM DATA

#5



OPTIMUM  
ENERGY USE

#6



SERVICE TIMED  
TO THE SECOND

#7



LOW COST  
RAILWAY

#8



GUARANTEED ASSET  
HEALTH & AVAILABILITY

#9



INTELLIGENT  
TRAINS

#10



STATIONS & "SMART"  
CITY MOBILITY

#11



ENVIRONMENTAL &  
SOCIAL SUSTAINABILITY

#12



RAPID & RELIABLE  
R&D DELIVERY



### 3. Example: Traffic Management Systems



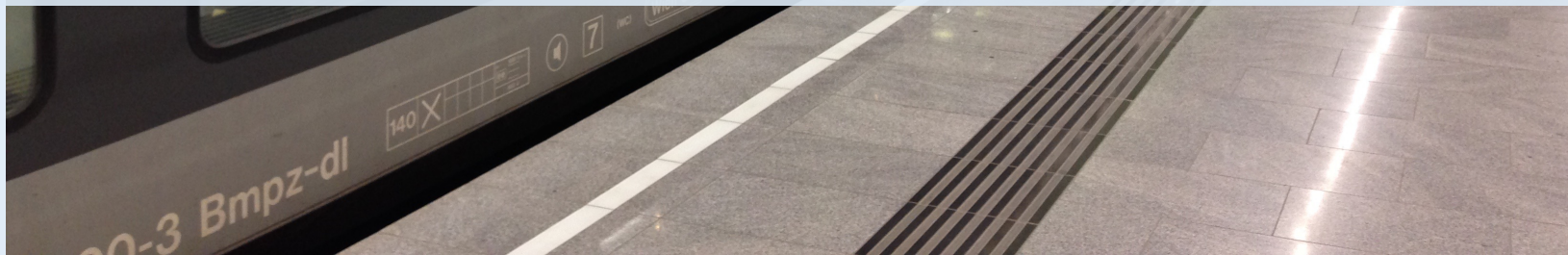
## 4. Example: Tourism Post Covid-19







## 5. Example: An Integrated Long Distance Transport System for Austria



# Integrated Long Distance Transport System for Austria

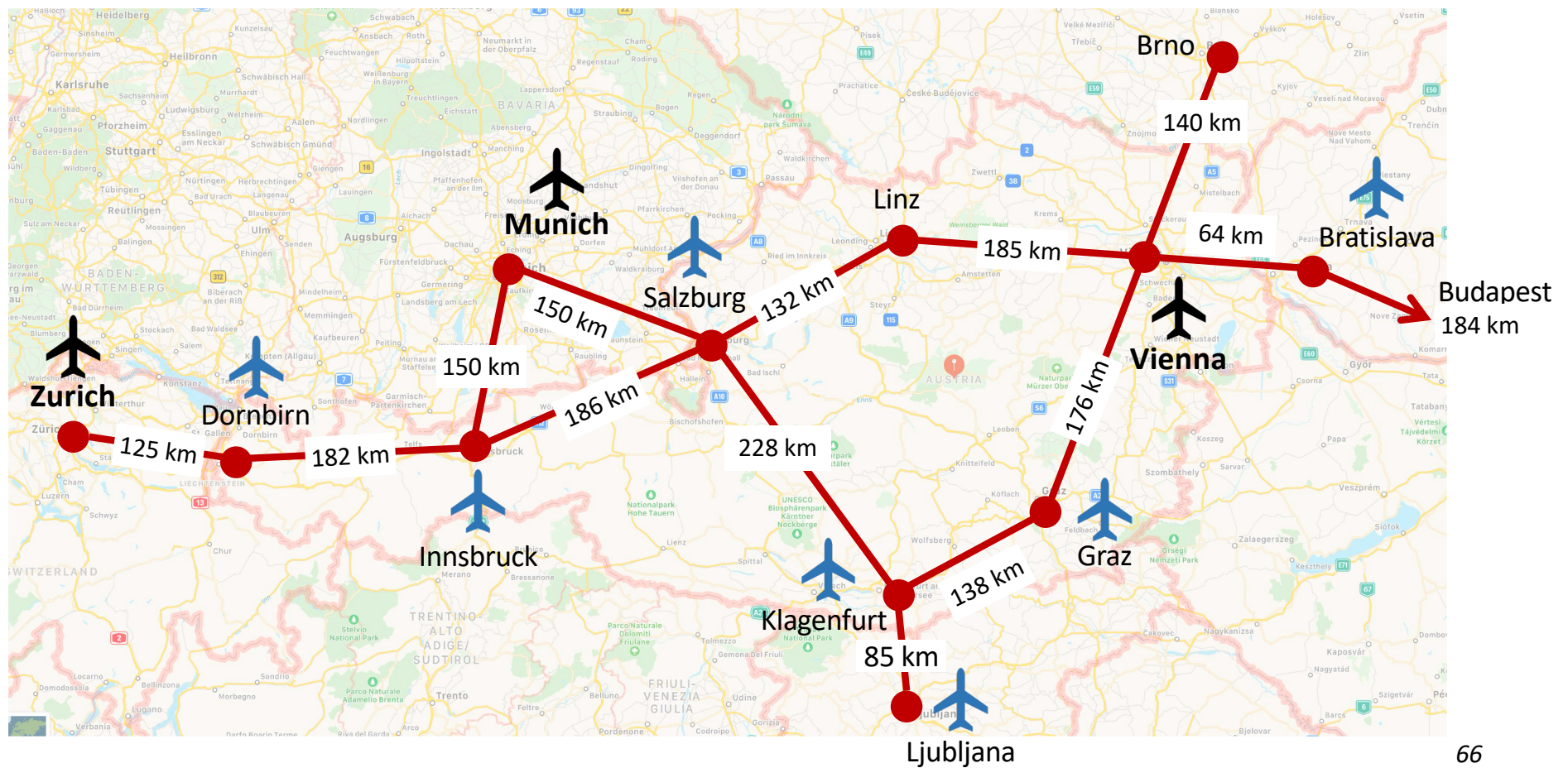
## Combined Bus + Train + Plane network to reduce GHG emissions:

- Reduce short distance flights;
- Provide direct railway and bus service to hub airports;
- Eliminate some minor airports and expand others into hubs;
- Improve railway service on hub lines: high quality, frequent, fast;
- Use Swiss Bahn 2000 approach for infrastructure: as fast as needed;
- Provide integrated ticketing, check-in and baggage handling;
- Improve railway station quality considering needs of air passengers;
- Focus on high quality travel experience rather than cheap flights;

**Emphasise Virtuous Cycle → increase railway demand = more + better service**



# Cities, Airports and Travel Distances



185 km radius  
... travel by rail

Zurich

Dornbirn

Innsbruck

Munich

Salzburg

Klagenfurt

Ljubljana

Graz

Vienna

Brno

Bratislava

Budapest

125 km

182 km

150 km

186 km

132 km

185 km

64 km

176 km

228 km

138 km

85 km

150 km

140 km

184 km

New Hub?

Airport "closed"



# Innovation = Willingness to take risks

## **Social – Political – Technical ... aspects of integrated transport network:**

- Economics: What are the actual and *perceived* economic benefits of airports?
- Economics: What is the future of low cost airline direct flights to minor airports?
- Customer Market: Can customers be attracted to higher quality service?
- Technology: Can service and operations be fully integrated across modes (e.g., IT)?
- Politics: Is there willingness to close minor airports?
- Politics: Will governments start taking climate change seriously (e.g., airline taxes)?
- Etc. Etc. Etc. ...

# Summary

## Innovation and railways

- Two types of innovation: incremental (small, continuous), disruptive (large, sudden);
- How do you innovate? ... Compare strengths & weaknesses with your competition;
- Market niche strategy → specialise based on your strengths (US freight rail);
- Shift2Rail = European railway innovation joint undertaking → big opportunity!
- Innovation = change business processes to take **FULL** advantage of new technology;
- Innovation = take advantage of **opportunities** to introduce more/larger change;
- Innovation = consider new customer needs, needs they may not even recognise;
- Innovation = take risks ... social – political – technical





## Andrew Nash

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This presentation was developed by Andrew Nash for the St. Pölten University of Applied Science's International Week 2020.