Climate change adaptation in the railway sector: an International Comparison

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ToPDAd

«Tool-supported Policy-Development
for regional Adaptation»

- Within European Community's Seventh Framework Program
- Ten partners from eight European countries

- Goal: To find the best **adaptation strategies** for companies and governments under consideration of the short- and long-term consequences of climate change.
- Deliverable: State-of-the-art socio-economic **methods and tools** to support regional decision makers.

- Focus on the three sectors **Tourism**, **Energy** and **Transport**.

Stakeholders Interviews

- Goals:
  - **Guarantee relevancy and quality** of the further research in ToPDAd.
  - Inquiry on the **current state of action and adaptation** concerning climate change.

- Experts and Stakeholders from different European countries
- Representing all three Sectors

- For the Rail Sector (network and/or operations):
  - Switzerland (4)
  - France (1)
  - UK (1)
  - Spain (1)
  - Finland (1)

Questions

- Worries for mid (20 y) and long (50 y) term
- Expected direct or indirect impacts
- Monitoring
- Strategies for adaptation and their implementation
- Policies required at state or EU-level
- Support required from researchers

Impacts (I)

- All agree that climate change is already observable
- More damage repair /maintenance costs expected because of extreme events (flooding, rainfall, wind, snow, temperatures)
- Long term unpredictable demand (location and season) but perhaps more passengers because of environmental concerns
- Aware of climate change but not on top of the list (RB, CH)
- Old outdated railways are particularly sensitive

Impacts (II)

- The impacts are often region specific and sometimes also very local:
    - The reduction of snow/ice events may be very beneficial but warmer climate substantially increases air conditioning use (Spain)
    - More rainy weather together with more thaw-frost cycles in autumn weakens the rail basements (Finland)
    - Lines that are close to the Coast are especially vulnerable for sea level rise and storm surges (UK, Finland)
- Some parts are more sensitive than others
    - Earthworks, drainage systems are the most vulnerable assets.
    - Thermal oscillation can be relevant for the health of the tracks.
    - Damage to the catenary due to surges from electrical storms and falling objects due to wind gusts.

Monitoring & Adaptation Strategies

- Monitoring climate change (mostly buying specific data) vs. reading specialized literature to gather information

- Time horizon for strategic planning varies among companies (2030-50)
- Climate change is part of risk analysis not always of the strategic planning
- Vulnerability to weather events should be reduced
- Need to coordinate with other operators (CER= European Railways)
- Intermodality would be an interesting strategy (but no coordination)
- Building standards should change because of warming climate
- Improvements on existing lines, build new lines(new or relocated demand), or even relocate some lines.
- Some companies (UK, France) developed an adaptation strategy based on “no regret” measures.

Requests/Issues

- Lack of consensus in science
- More comprehensive predictions (i.e. not just temperature but also blizzards, storms, wind, etc.)
- A summary of all national adaptation plans that exist up to date, to compare the initiatives + data on the strategic EU level.
- A summary of case-studies / best practices of adaptation

- Regionality is important → Tool integrating all climate change parameters and fine-tune them on the regional level.
- A tool to record extreme events in a systematic way.
- A GIS based tool providing predictions of weather events and acting as an early warning system
- Decision making tool to analyze and decide the best adaptation measures when planning the new infrastructure and maintaining the old one

Conclusions (I)

Major Impacts

- Resilience of sector toward changing average conditions
- Some vulnerability to increased weather variability
- Increased threat to infrastructure
- Social phenomena (e.g. “green” mode choices)

Monitoring

- Interest in sector-specific information
- Only little active monitoring yet

Conclusions (II)

Adaptation Process

- Measures concerning extreme weather events common
- Relatively high level of awareness, but strategic planning including climate change is rather moving its first steps…
- ...nevertheless, climate change is somewhat considered when building new infrastructure
- Awareness and strategic thinking → Network companies > Large (National) operators > Small operators
- No evidence of country specificity in the approach (despite country specific impacts!)

Policies and Tools

Stakeholders think rather of tools which allows a better monitoring but less of comprehensive tools able to evaluate future scenarios (i.e. cost-benefit analysis)

Thank you!

Questions?

More suggestions

- How much of the delays and the **impacts we are experiencing today is coming from the fact that we are running so close to capacity** and how much is due to a real increase in the frequency of extreme weather.

- The first thing we need is **more specific and more regional information on climate change parameters**, but also on the international level. We need a **mapping of the vulnerability** on many different levels and for very specific cases.

- There is no real **mapping of incidents**, the consequences and **responses** yet.
  -> European wide system of logging minor and mayor disruptions.

- This paper reports on how climate change is perceived and approached through adaptation strategies by companies of the railway sector in Europe. The work is part of the EU project ToPDAd (www.topdad.eu) that investigates the impact of climate change on the transport, tourism and energy sectors.
- The work presented is part of a project aimed at developing adaptation strategies that stakeholders – policy makers or private firms – could implement to limit climate change negative effects. This includes the development of a specifically designed toolset which will assist them adapting the strategies to their individual needs.To identify particular sector needs related to climate change adaptation a series of face-to-face interviews with key stakeholderswere conducted. The work presented here considers only companies of the railway sector and consists of an analysis of these interviews. A total number of 10 interviews of companies based in Switzerland, UK, France, Spain, Netherlnads and Finland were collected.
- Two main aspects appear to affect the vulnerability of railways to climate change. The first is the degree of exposure to potentially damaging weather conditions now and in the future. The second is the average lifetime of assets (infrastructure, trains). The average lifetime of a railway car is 40 years, the average lifetime of the tracks is 100 years and can be even longer for bridges. This means that the infrastructure that is built and planned now will experience the conditions of 2050 and beyond. The change in climate conditions in this span of time in a specific area is what matters to the companies. Climate change is predicted to have a broad range of impacts that can be substantially different from region to region. Not surprisingly, preliminary analyses of the interviews show that the priorities very specific of the area where the companies are operating.
- The Swiss national railway company emphasizes general resilience to climate change over adaptation to specific threats because of the large land type and land use over Switzerland's small area. In contrast, smaller, regional companies put already today strong emphasis on their ability to deal with extreme weather events. In Finland and the UK railways located very close to the sea are one of the main issues because of expected rising sea level. A Scandinavian specific issue is the maintenance of railway basements. They are under much more stress if more rainy weather combines with more thaw-frost cycles in autumn as expected in the future.
- The interviews presented give insights which are potentially useful for policy makers, scientists and for the stakeholders themselves. For policy makers, they provide a qualitative feedback on already implemented policies and can inspire new policies. Scientists, similarly, get hints on what topics are more relevant for stakeholders and on the adaptation strategies they are implementing to cope with it. This is a suitable basis to evaluate current strategies and explore new ones. Stakeholders can profit from additional knowledge on current practice within their sector, and learn from the experiences of other companies encouraging a deeper reflection on their current approach.

Consequences (1)

Climatic variables		Roads	Railways	Ports	Airports
Air temperature	Average temperature	•	•		•
	Average daily temperature	•	•	•	•
	Daily thermal oscillation	•	•		
	Days of frost	•	•		•
	Heat waves	•	•	•	•
Relative humidity					•
Cloud cover and cloud ceiling					•
Precipitation	Average annual precipitation	•	•		•
	Intensity of extreme rainfall	•	•	•	•
	Duration of heavy rainfall	•	•	•	•
	Flooding	•	•		•
	Droughts	•	•		
Electrical storms			•		•
Snow		•	•		•
Floodwaters		•	•		
Water table		•	•	•	•
Fog	Fog intensity	•	•	•	•
	Frequency of intense fog	•	•	•	•
Wind	Intensity of extreme winds	•	•	•	•
	Frequency of strong winds	•	•	•	•
	Wind direction	•	•	•	•
	Wind direction variability				•
Waves	Wave height			•	
	Wave direction			•	
Sea level	Average level			•	•
	Variation due to storms			•	
Sea currents	Speed			•	
	Direction			•	
Sea water temperature				•	

Dependent on mode – on situation - location