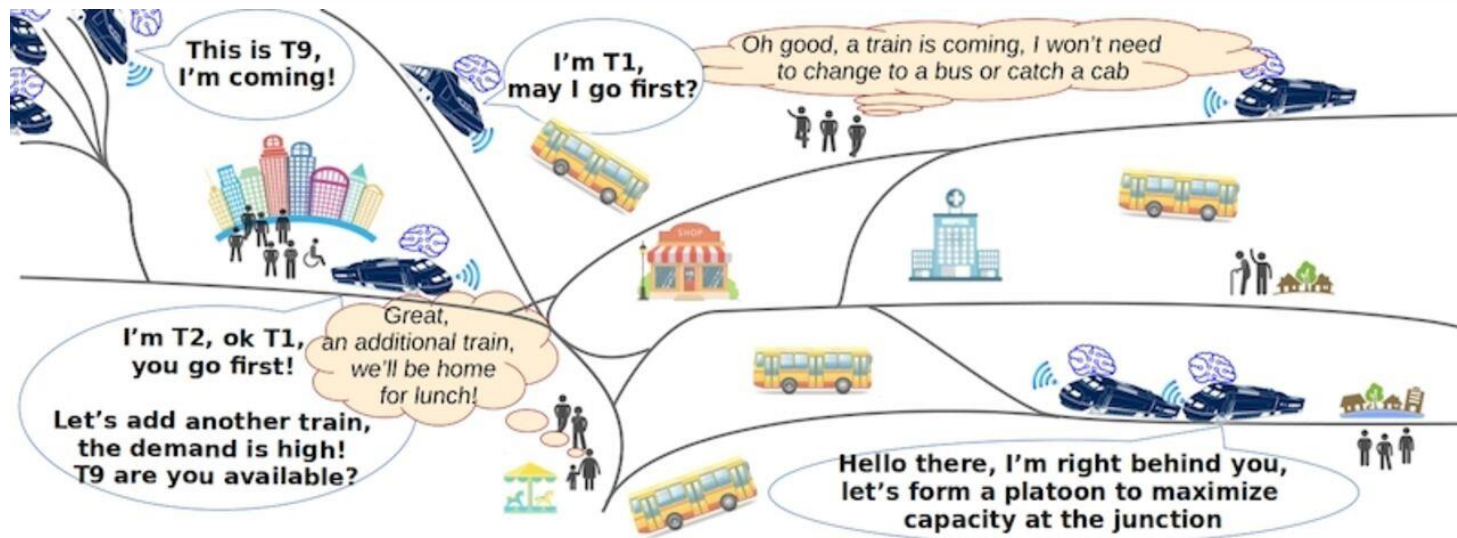


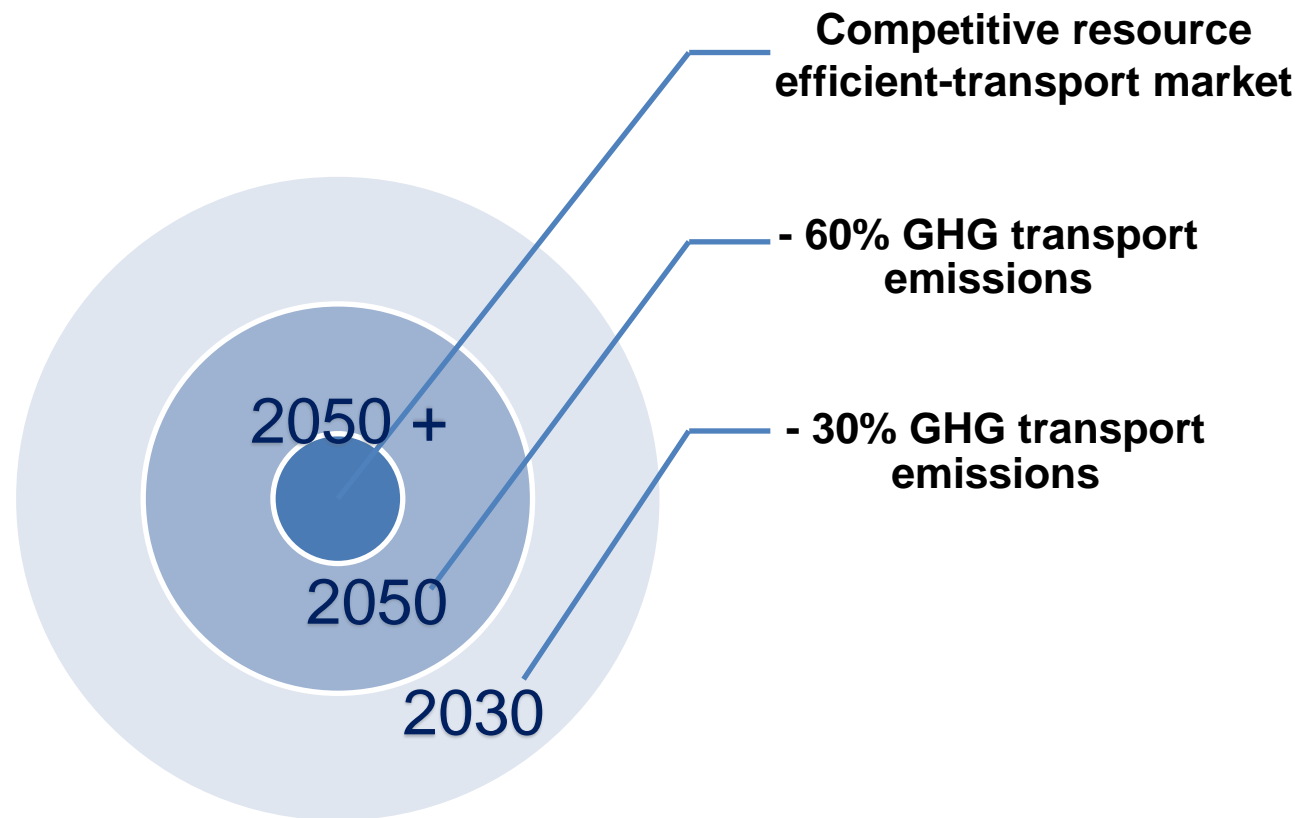
The role of self-organising rail traffic in EC's transport goals: Analysis and recommendations



Dr. ir. Egidio Quaglietta

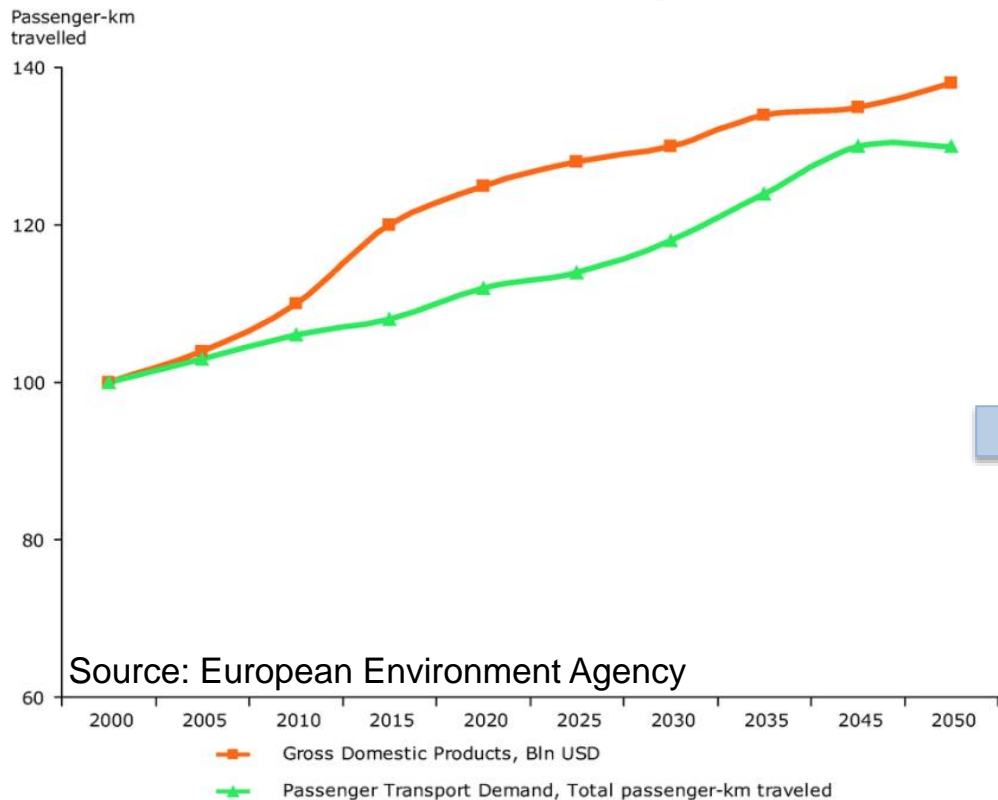
Paris, 13th May 2024

Background: EC White paper's goals

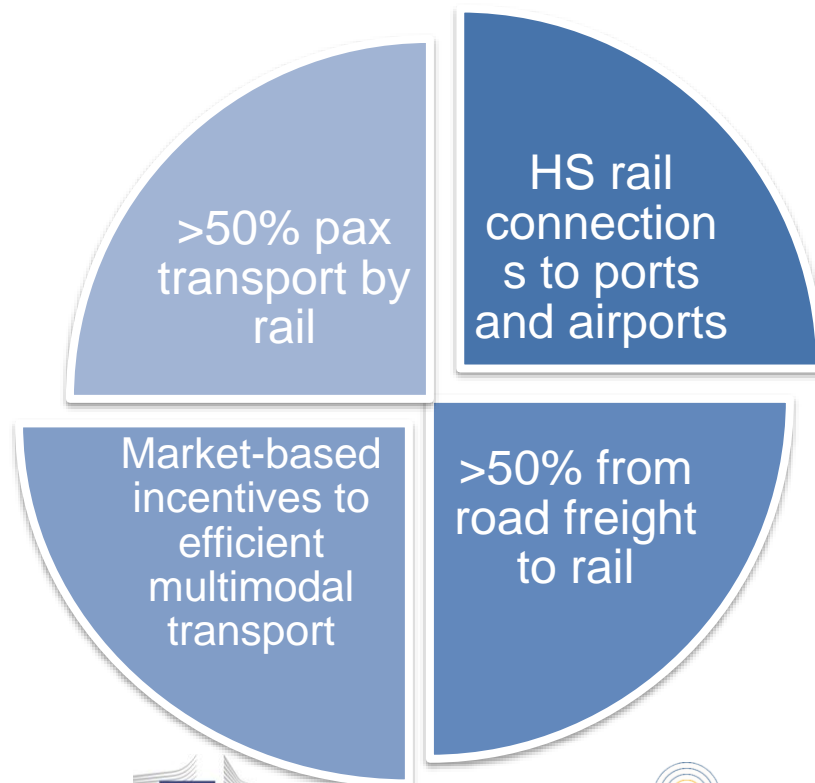


Background: EU travel demand and goals in 2050

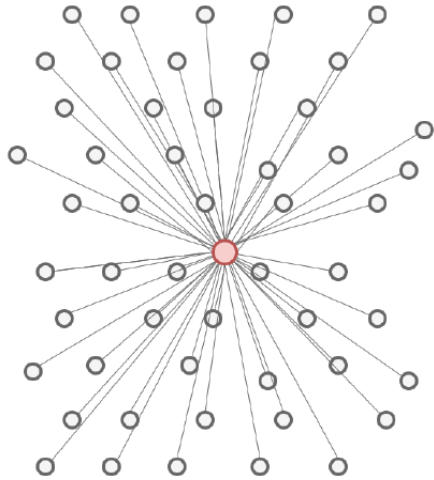
Rail demand increase for population growth



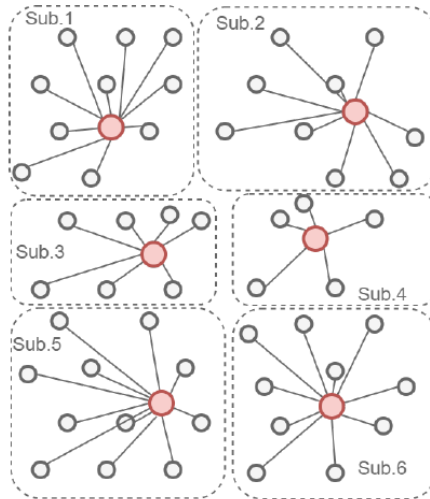
Massive modal shift to rail planned by the EU



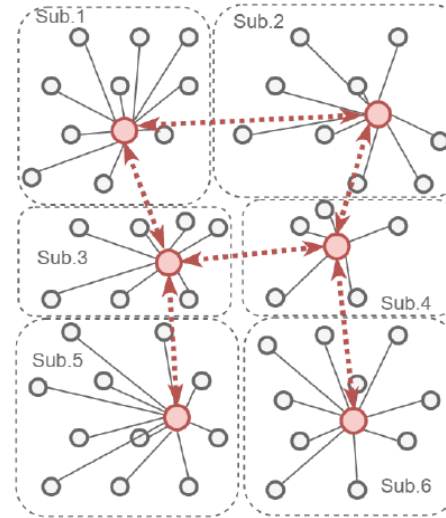
Centralised



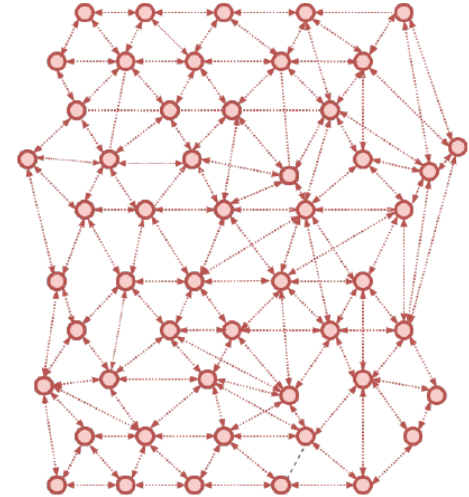
Decentralised



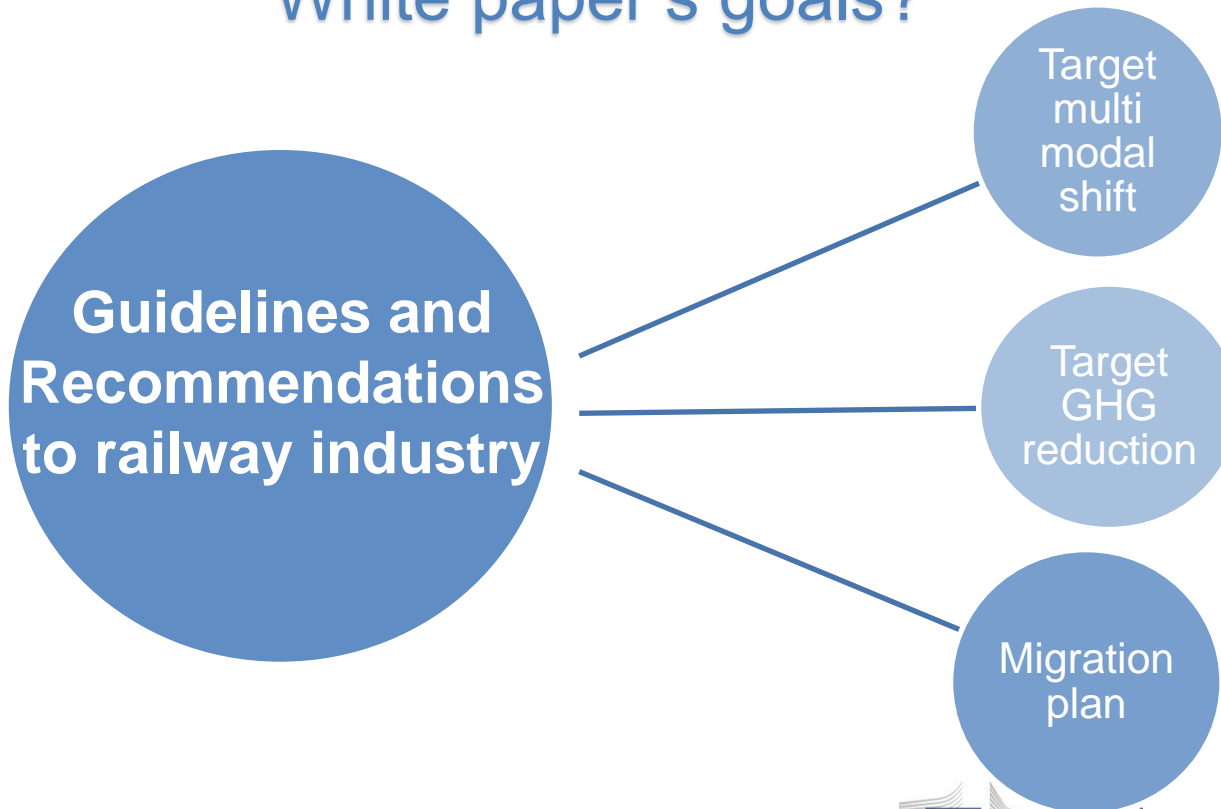
Distributed



Self-Organising (SO)



How can self-organizing rail operations enable achieving EC White paper's goals?



Delphi survey

1

- Current TM limitations
- Self-organisation potentials

2

- Strengths / Weaknesses
- Opportunities / Threats

3

- Critical step-changes
- Recommendations

Railway experts



Analysis targets

Gaps vs Potentials

SWOT

Migration

Delphi Survey on self-organising rail traffic

Gaps vs Potentials

Q1. Which gaps in TM vs EC goals?

Q2. Can SO fill gaps and how?

SWOT

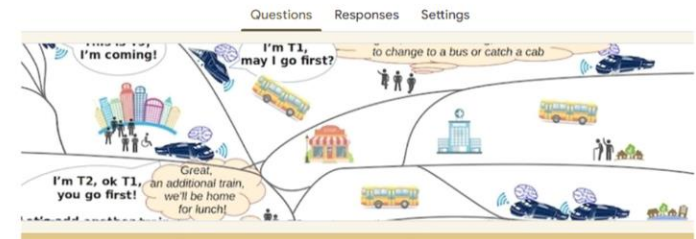
Q3. Which strengths / weaknesses?

Q4. Which opportunities / threats?

Migration

Q5. Which key steps towards SO?

Q6. Which recomms to deploy SO?



SORTEDMOBILITY Questionnaire: Potentials of self-organising rail traffic and recommendations

Submission deadline: Tuesday, 12th March 2024

Project web

Available online at:

<https://forms.gle/ZG5PLmCVKwk64gEN7>

Results: Gaps versus Potentials 1

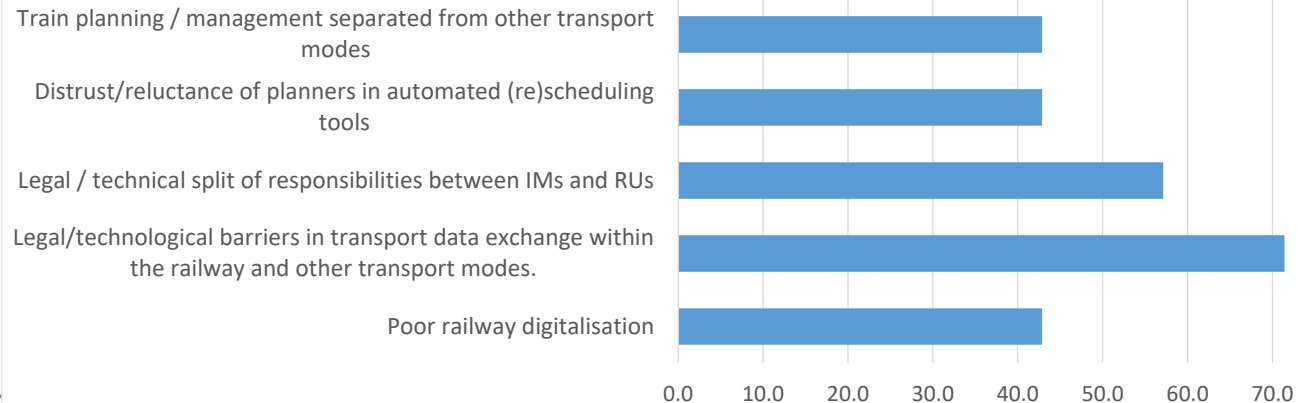
Current gaps in TM vs EC White paper goals

Legal/tech barriers in sharing data within railways and with other modes

Horizontal and vertical split in railway organisation (limits info sharing)

Train (re) scheduling poorly digitalised and no link with other modes

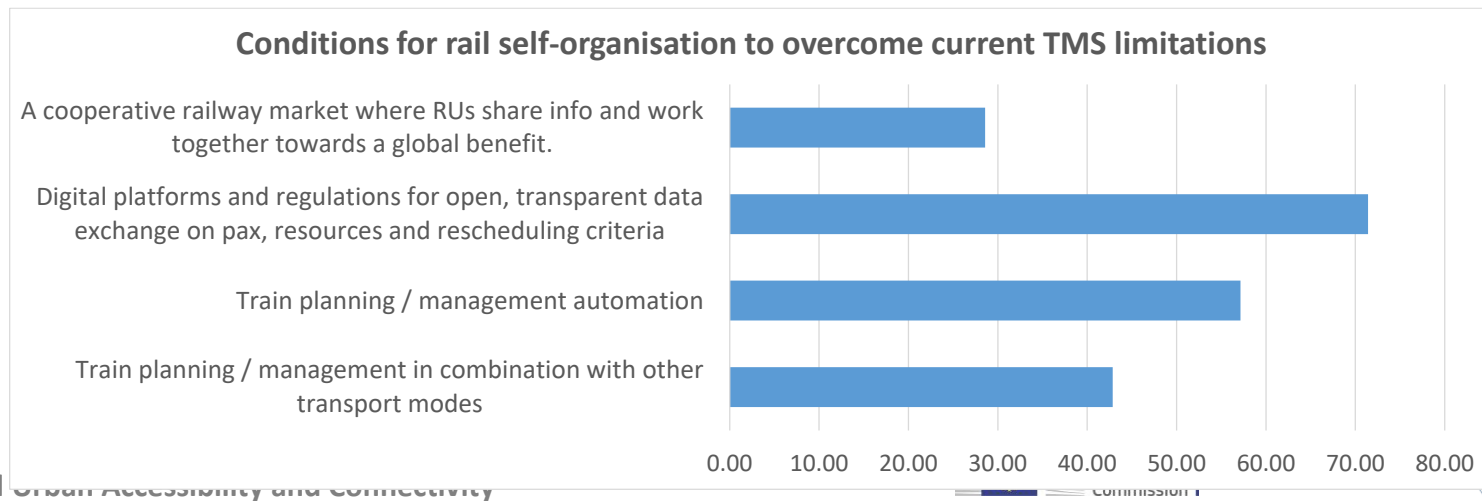
Current TMS limitations towards EC sustainability goals



Potentials of self-organisation towards EC's goals

Self-organisation can overcome current gaps only if it fosters / accelerates:

- Digital platforms and regulations for open data sharing
- Train (re)scheduling automation and integration with other modes
- Shift to a cooperative railway market / organisation



Strengths and Weaknesses of rail traffic self-organisation

Strengths	Weaknesses
Flexibility to demand trends and scalability to infra and traffic configurations	Limited in finding global optima and controlling effect of local strategies on whole network
Improved responsiveness to service disturbances	Train negotiation prone to bias from self-declared importance
Transparency in info sharing and decision-making while including individual train needs.	Train negotiation depending on effectiveness of train-to-train communication tech.

Opportunities and Threats of rail traffic self-organisation

Opportunities	Threats
Expand rail market by customer-oriented service, easier accessibility, multi-modal roles of IMs and RUs	Lack of industry and public acceptance of novel business models, processes, techs
Multimodal integration by synchronising train (re)scheduling with other modes	Complex regulatory approval for open data sharing and train negotiation rules
Reduce operational costs thanks to less personnel and wasted train-seat/km	Resistance to investments to install / maintain SO-enabling technologies
Balancing IM's and RU's roles for better planning-operations coordination	Risk of additional "system borders" and ambiguity in incidents' responsibilities
New R&D directions for SO approaches, extendible to other sectors	Pilot testing challenges / issues might limit research progress in the field.

Results: Migration to SO rail traffic 1

Step-changes enabling a SO rail traffic management

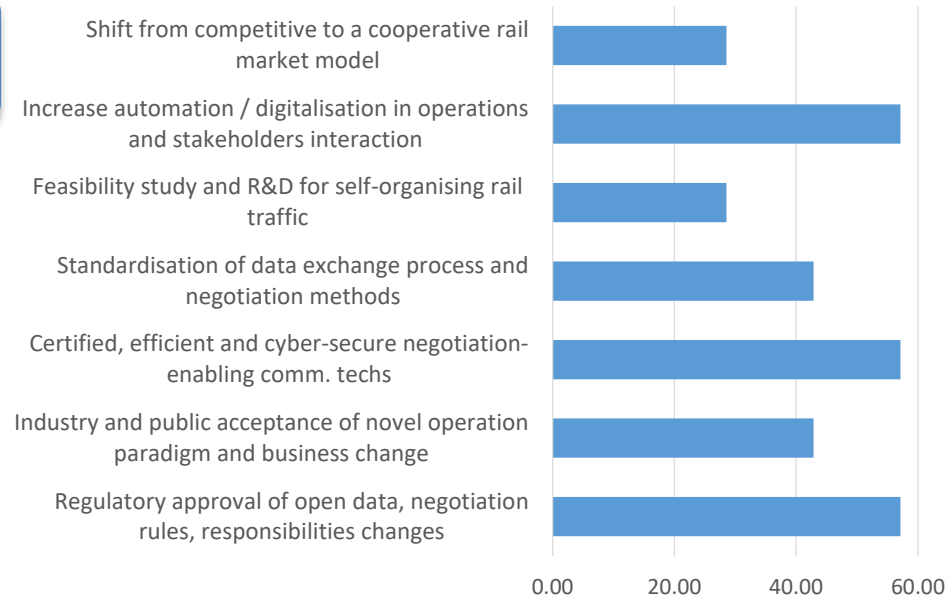
Feasibility study, acceptance of business change, cooperative market

Increased digitalisation in operations and stakeholders' interaction

Certified, cyber-secure SO-enabling communication techs

Regulatory approval of data sharing, negotiation rules, organisation changes

Key steps for migrating to self-organising rail traffic operations



Recommendations for migration to a SO paradigm

- Cost/benefit analysis of SO with impacts on technical and business performance
- Increase digitalisation of train (re)scheduling, operations and stakeholders' interaction
- Further R&D for effective train negotiation methods and enabling communication techs
- Integrate train (re) scheduling with customers' data and operations of other transport modes
- Round-tables and joined actions of transport sector to define enabling policies, plans, proof-of-concepts

A multi-target Delphi analysis has returned current TM gaps versus EC goals, rail traffic SO potentials and recommendations for migration

Current TM limitations are mainly in legal/tech barriers in data sharing, IM and RU separation and poor digitalisation

To bridge gaps SO traffic should not merely shift paradigm but foster digitalisation, open data policies and a cooperative organisation.

SO rail traffic can improve responsiveness to demand and disturbances, expand the market, but could find approval complexity / resistance

Migration to a SO traffic needs R&D on cost/benefit, negotiation methods and comm. techs as well as joined sector actions for enabling policies/rules

Thank you for your kind attention

