



ETCS Migration and the Impacts on Railway Transport Markets

Dipl.-Wirtsch.-Ing. Miroslav Obrenovic



Deutsches Zentrum
für Luft- und Raumfahrt e.V.
in der Helmholtz-Gemeinschaft

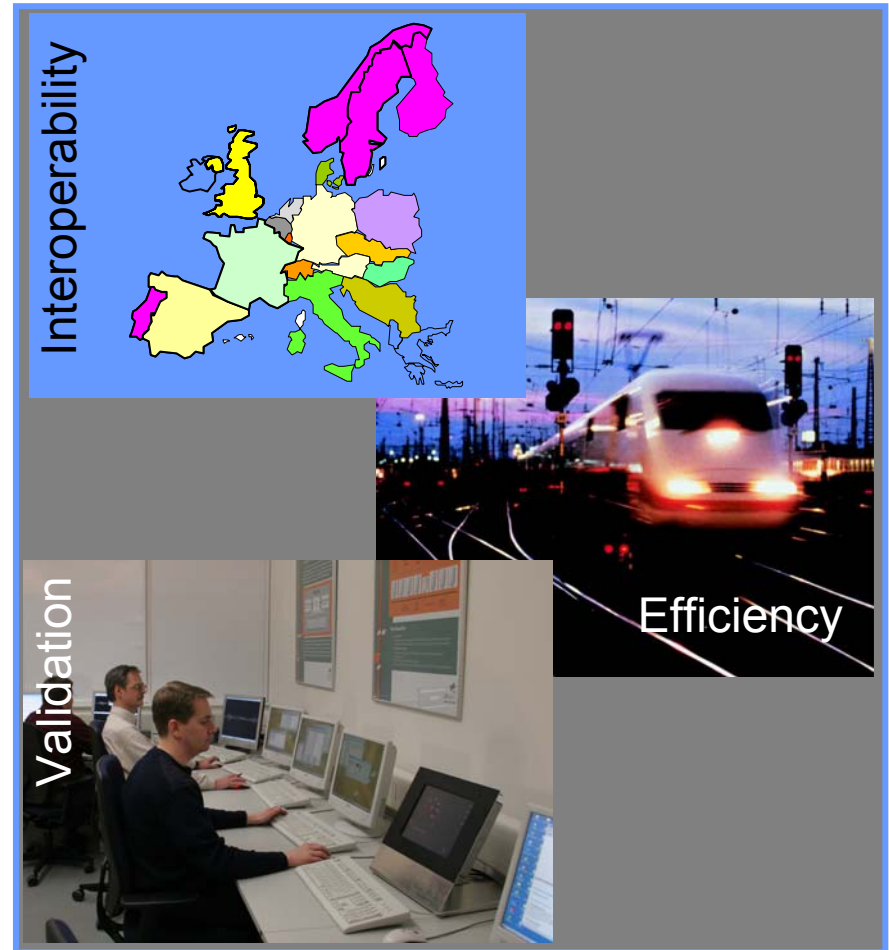


Content

- Railway research at the German Aerospace Center (DLR)
- Initial situation
- Opportunities and threats of ETCS migration
- Market considerations, macro-economic benefits
- LCC as crucial economic figure
- Development and evaluation of migration scenarios
- Conclusions

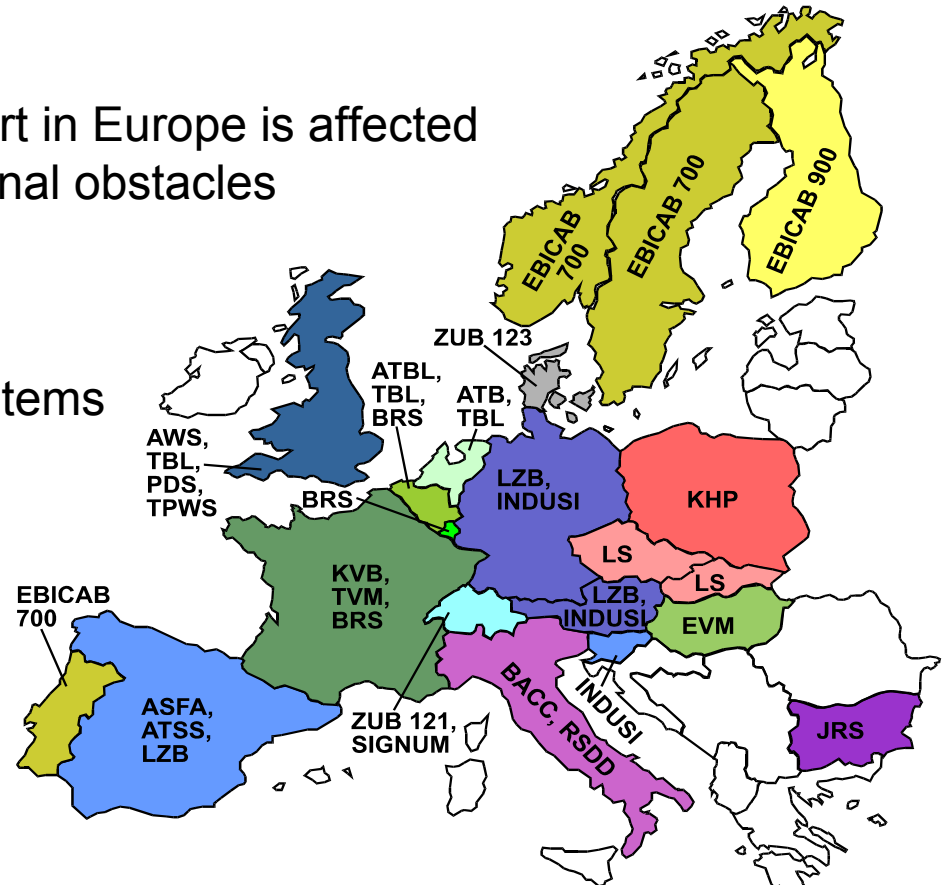
Holistic view on operational, economical and safety aspects of train automation

- Interoperability
- Safety
- Operating procedures and evaluation
- Economical evaluation, migration and LCC
- GALILEO applications
- Validation and testing



Initial situation regarding interoperability

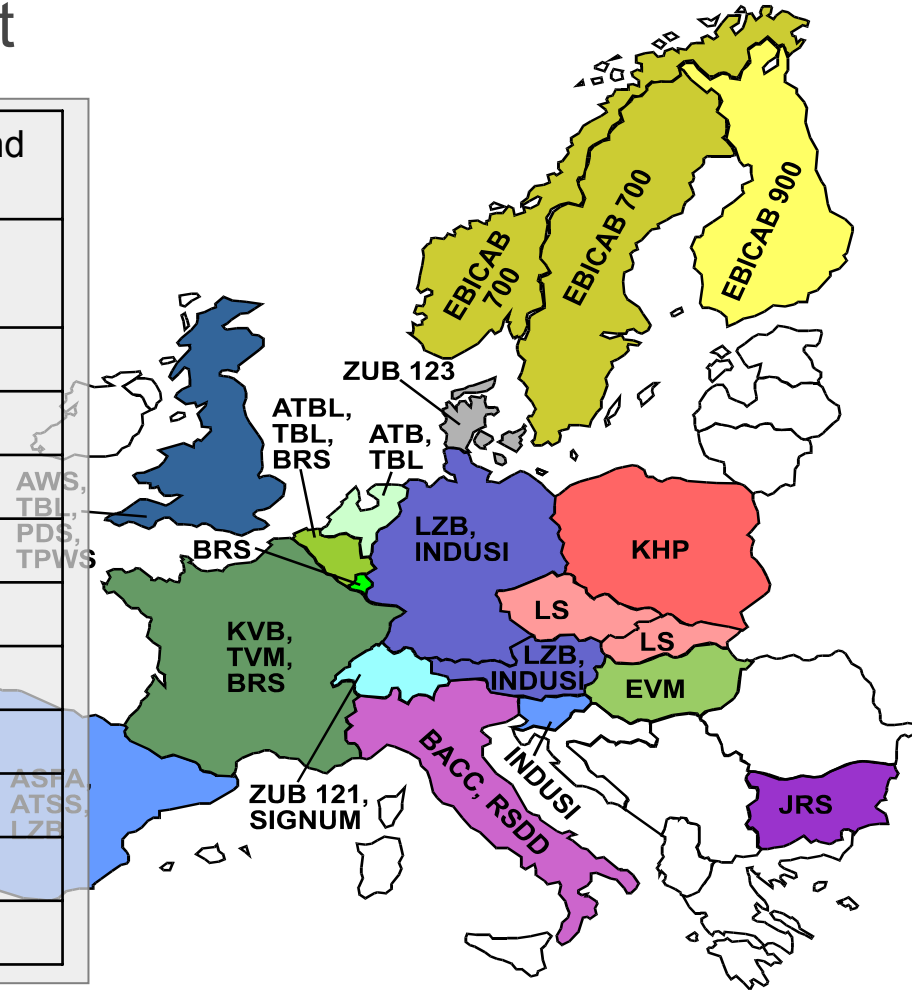
- Interoperability of railway transport in Europe is affected by several technical and operational obstacles
 - Track gauges
 - Braking curves
 - Electrical power supply systems
 - Height of station platforms
 - Maximum track gradients
 - Etc.



Most significant lack of standardisation – more than 20 CC-Systems lead to fragmentation of the European railway landscape...

Automatic train protection National system deployment

Country	Share of not equipped track km and vehicles	
	Track km [%]	Vehicles [%]
Bulgaria	85	71
Poland	39	34
France	12	27
Germany	10	5
Luxemburg	5	12
Netherlands	4	0
Switzerland	0	0
Italy	63	5
Spain	11	20
UK	1	0

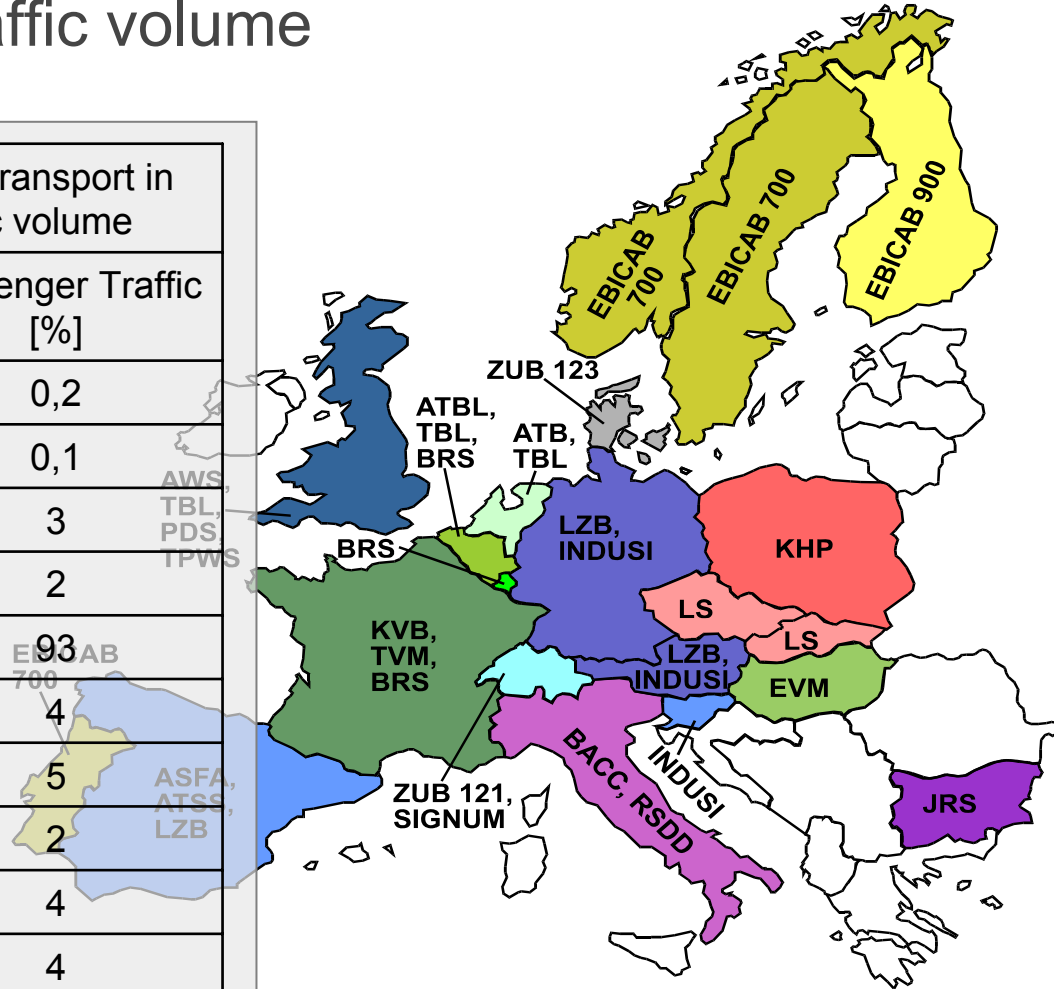


Source: UIC 2004

International rail transport

Share within overall traffic volume

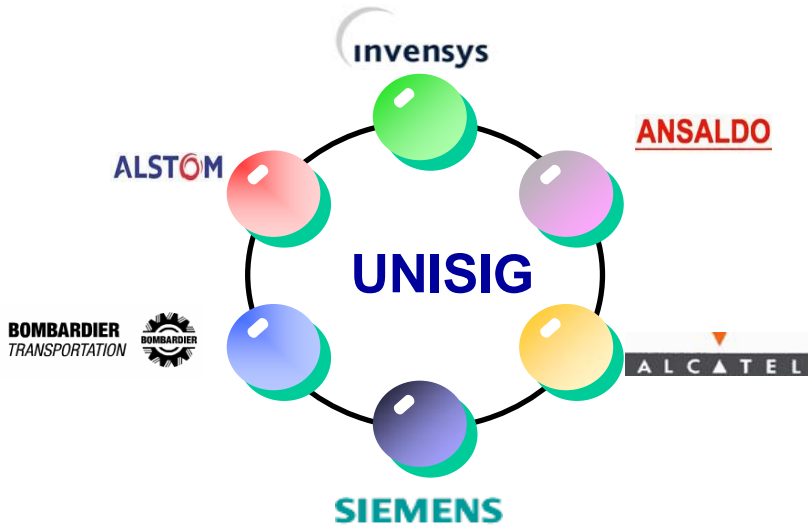
Country	Share of international transport in overall railway traffic volume	
	Freight Traffic [%]	Passenger Traffic [%]
Bulgaria	7	0,2
Poland	30	0,1
France	40	3
Germany	50	2
Luxemburg	73	93
Netherlands	78	4
Switzerland	28	5
Italy	23	2
Spain	20	4
UK	6	4



Source: UIC 2004

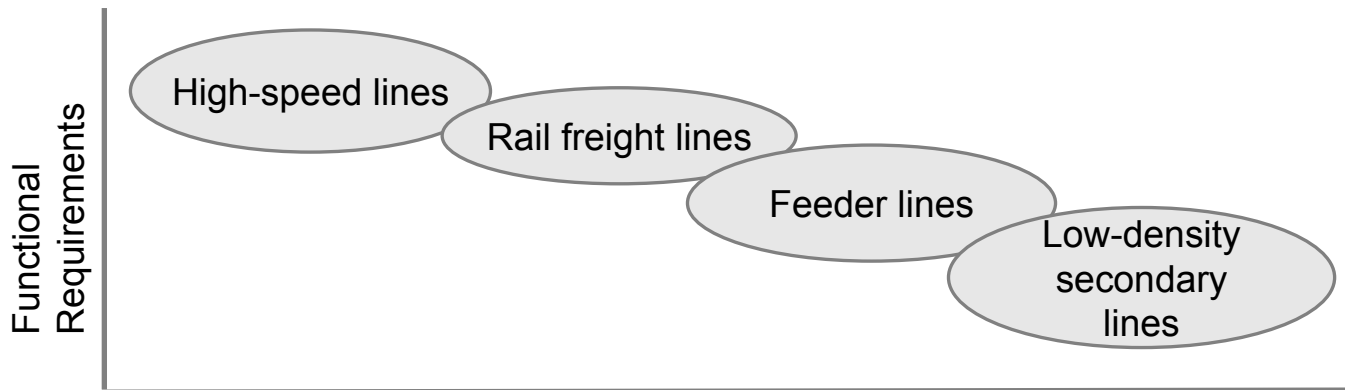
ETCS – different technical and functional levels

Providing technical interoperability



v supervision		Data transmission	
spot	cont.	spot	cont.
	✓	✓	
✓		✓	
	✓		✓
	✓		✓

Level 1
LS
Level 2
Level 3






Migration of ETCS – motivation and opportunities

- EU Directives 96/48/EG und 2001/16/EG
- Interoperability / impacts on railway operation and macroeconomics
 - Market for signalling systems
 - Harmonisation and standardisation of technologies
 - Barrier-free access to the European railway infrastructure
 - Seamless cross-boarder traffic
 - Decrease of transport time
- Operational performance of European railways
- RAMS aspects / increase and harmonisation of the safety level in Europe
- Microeconomic impacts, LCC

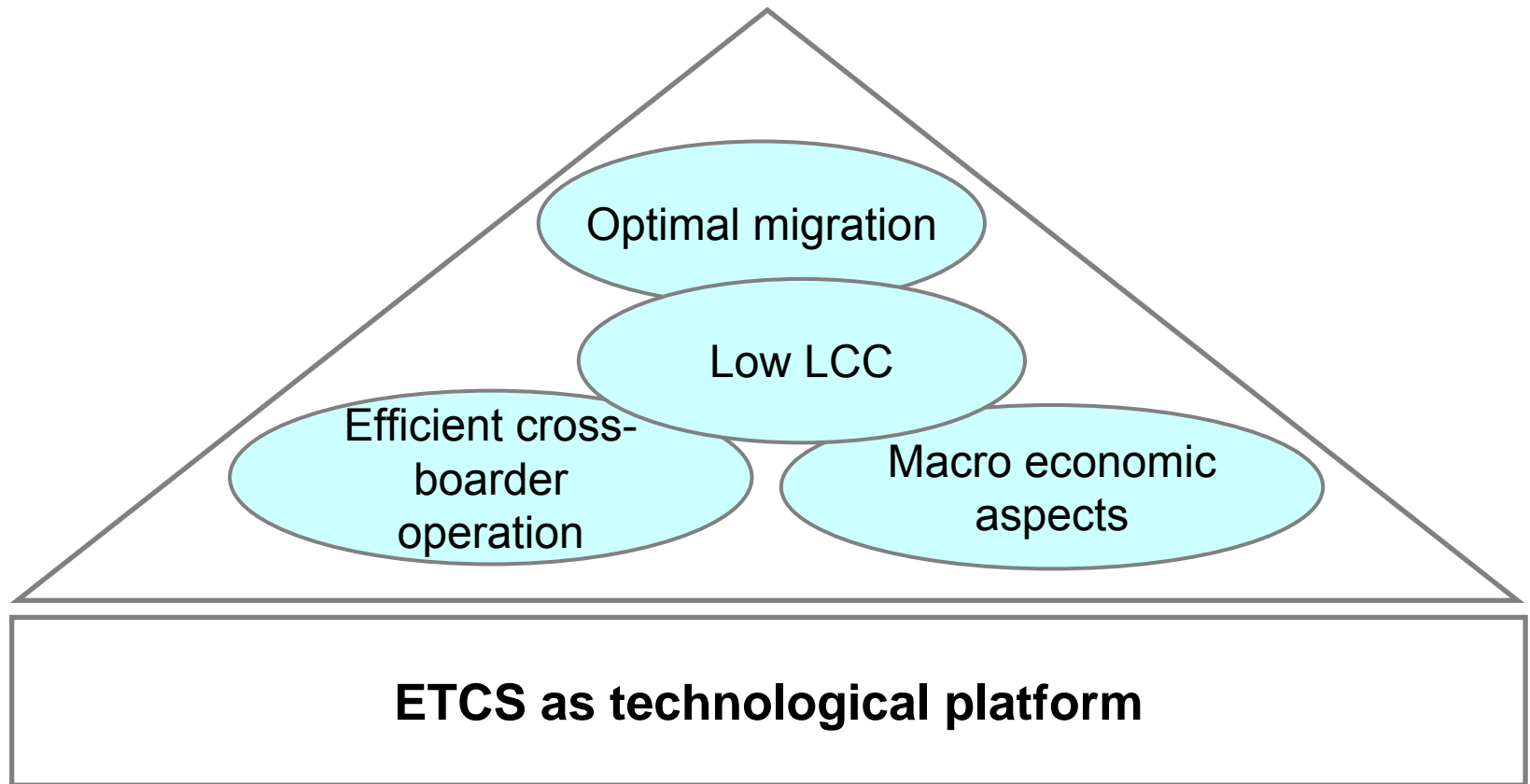
RAMS: Reliability, Availability, Maintainability, Safety

Migration of ETCS – barriers and threats

- High invests for the track and train-side ETCS equipment
 - Capable national CC-Systems (in some countries...)
 - Migration process – cost and time
 - National legacy systems with their long life cycles
 - Expensive parallel equipment during the migration period
 - Certification process – cross acceptance
 - Operational Interoperability
 - European subsidies for IM and TOC
 - Positive economical effects realised mostly in a long term period
- 

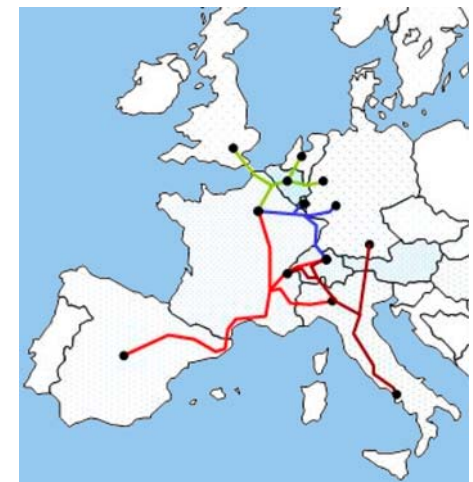
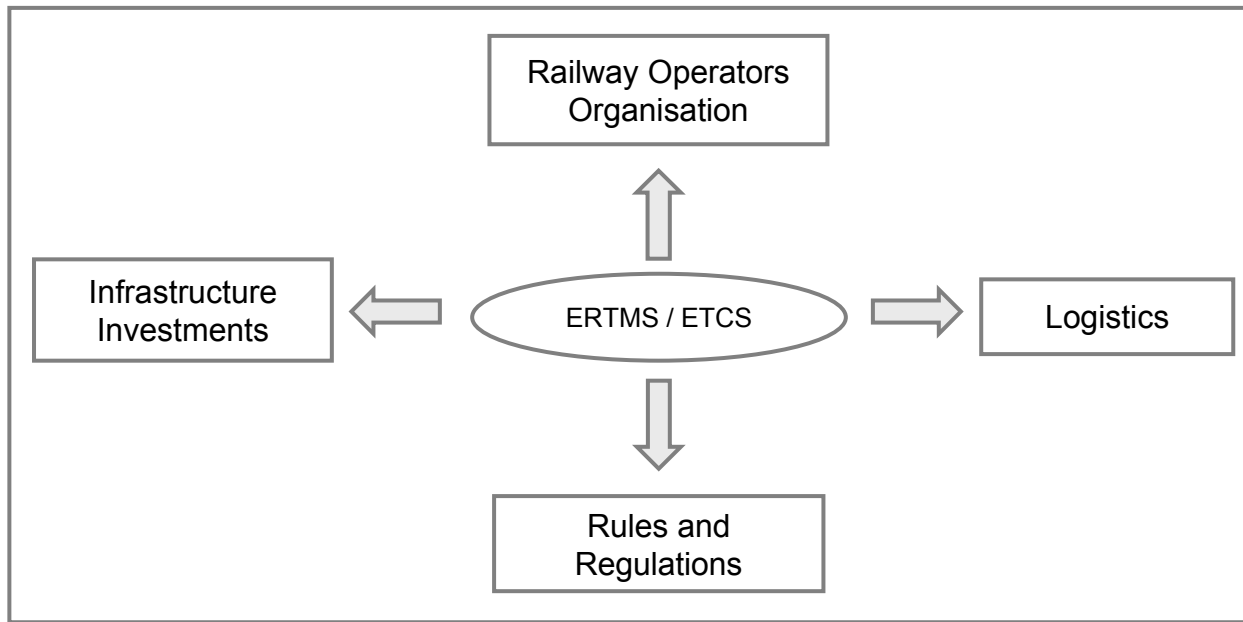
RAMS: Reliability, Availability, Maintainability, Safety

ETCS - main conditions for the success

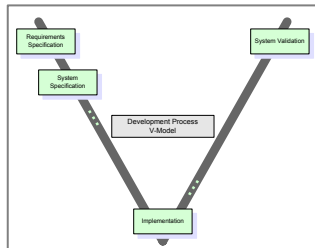
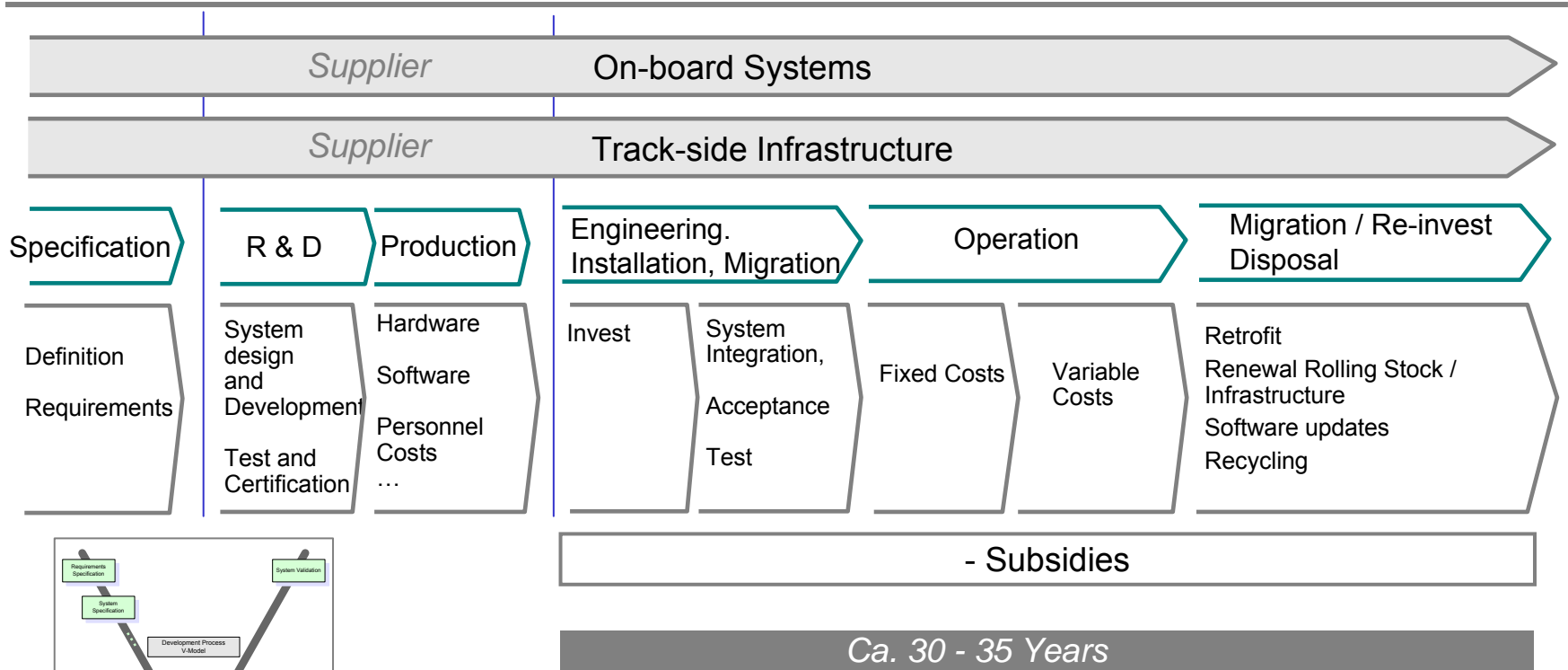


ETCS as a driver for global optimisation

- To increase performance and competitiveness compared to road, various issues are to be addressed on defined corridors



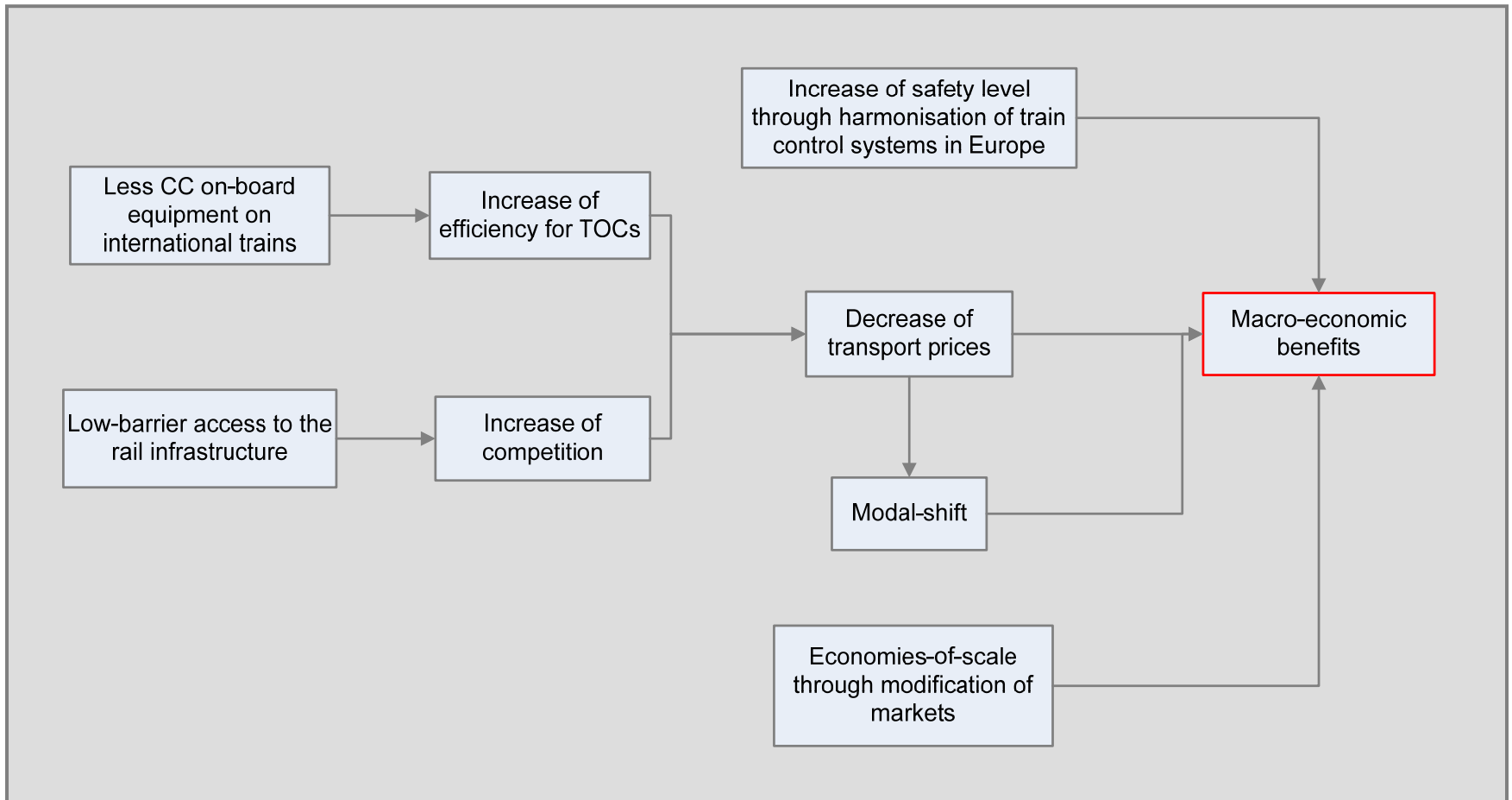
Simplified LC model for railway operations control



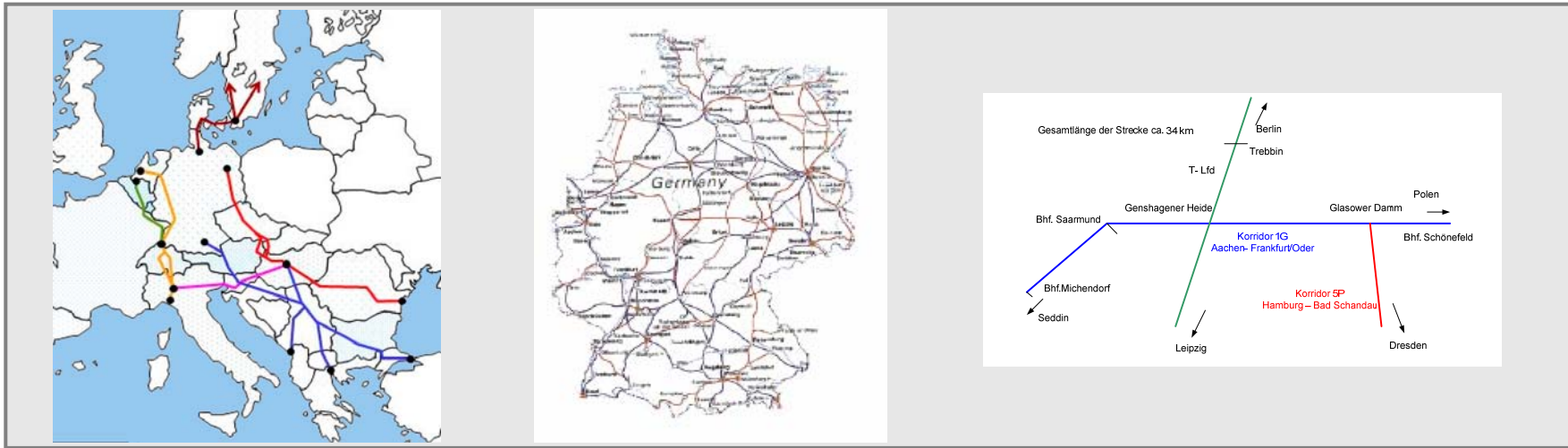
$$LCC = A_0 + \sum_{j=1}^n (M_j + O_j \times \frac{1}{(1+d)^j}) + D_n$$

ETCS implementation

Macro economic benefits



ETCS migration on strategic and operational level



Source: TSI CCS

Conclusions

- ETCS aims to provide technical interoperability of European railways
- Basis for operational interoperability still has to be carried out
- European and national subsidies are necessary to accelerate the deployment of the system
- In order to improve efficiency and competitiveness of the railway system, ETCS has to address following issues
 - Improvement of operational performance – ETCS as driver for global optimisation
 - Micro and macro economical benefits, sustainable decrease of LCC
 - Optimal migration strategies





For further information please contact:

Dipl.-Wirtsch.-Ing. Miroslav Obrenovic

German Aerospace Center (DLR)
Institute of Transportation Systems

Tel: +49 531 295 3424

E-Mail: *miroslav.obrenovic@dlr.de*