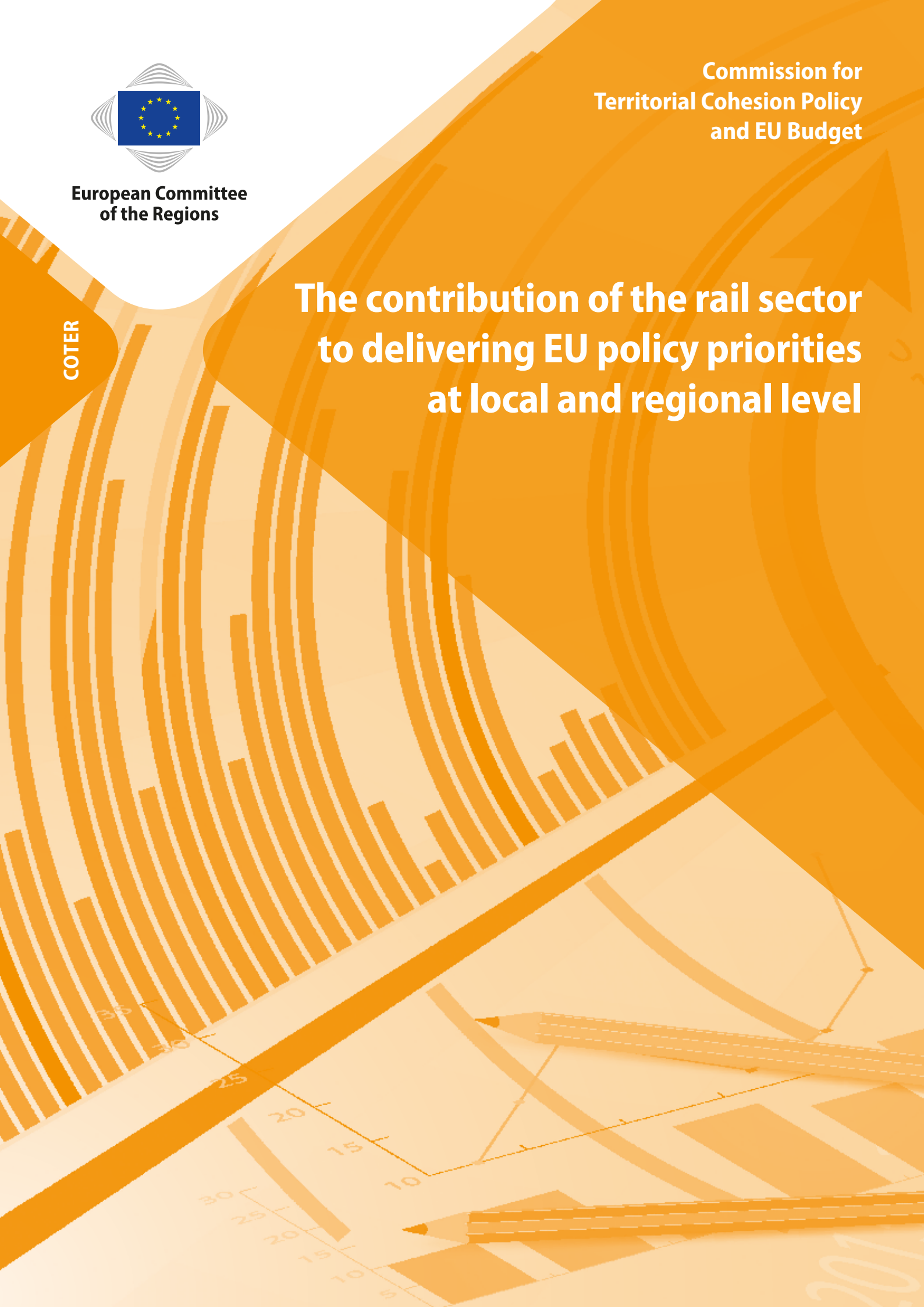
European Committee of the Regions

Commission for Territorial Cohesion Policy and EU Budget

COTER

The contribution of the rail sector to delivering EU policy priorities at local and regional level



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Glossary of terms

BEUR	Billion Euro
CEEC	Central and Eastern European Countries
CER	Community of European Railway and Infrastructure Companies
CEF	Connecting Europe Facility
CF	Cohesion Funds
CoR	Committee of the Regions
DB	Deutsche Bahn (German Rail)
DTI	Danish Technological Institute
EC	European Commission
EIM	European Rail Infrastructure Managers
EP	European Parliament
ERDF	European Regional Development Fund
ERRAC	European Rail Research Advisory Council
ERTMS	European Rail Traffic Management System
ESIF	European Structural and Investment Funds
ETCS	European Train Control System
EU-13	The 13 "new" EU Member States; i.e. BG, CZ, CY, EE, HR, HU, LT, LV, MT, PL, RO, SI, SK
EU-15	The 15 "old" EU Member States; i.e. AT, BE, DE, DK, EL, ES, FR, IE, IT, LU, NL, PT, SE, UK
ICT	Information and communication technologies
LRA	Local and Regional Authorities
MEUR	Million Euro
MLG	Multi-level Governance
MS	Member States
ÖBB	Österreichische Bundesbahnen (Austrian Federal Railways)
OECD	Organisation for Economic Co-operation and Development
PSC	Public service contract
PSO	Public service obligations
RTDI	Research, Technological Development and Innovation
SME	Small and medium-sized enterprises
ToR	Terms of Reference
UIC	Union internationale des chemins de fer (International Union of Railways)
UNIFE	Union des Industries Ferroviaires Européennes (Association of the European Rail Industry)

The abbreviations for the EU Member States follow the two-letter country codes[1].

[1] http://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Country_codes

Executive summary

Employment

The European rail sector employs ca. 1.8 million people[2]. A major challenge is the low percentage of women in the sector. In general, the percentage of female staff is between 8% (AT) and 49% (EE), with just 4 MS more than 30%[3]. Since the restructuring of the past 25 years was usually carried out via non-replacement of retirements, railway staff tends to be either in their fifties and sixties (37.4% in 2016[4]) or relatively young (from recent recruitment). In addition to skills shortages, skill requirements in the rail sector are rapidly changing

Territorial cohesion

Although significant efforts have been made to create a Single European Railway Area, lack of technical and administrative cross-border interoperability in rail transport still poses a challenge. In terms of network infrastructure development the European focus in rail transport is on the TEN-T core network that is meant to link major cities (capitals) across Europe but cannot serve larger territories without feeder lines. EU cohesion policy (in particular the ERDF) is open for investment into rail transport and intermodal hubs, meaning also an investment in regional rail networks. Regional railways account for 89% of the total number of rail passengers and 50% of total passenger kilometres in Europe[5]. A 2012 cost-benefit analysis for the TEN-T Baltic-Adriatic Core Corridor predicted aggregate value added of 0.1 to 0.6 % for the respective Austrian and Slovenian border regions from the corridor investment[6].

Energy efficiency

Urban, suburban and regional rail is the most effective means of public transport, not only in terms of greenhouse gas emissions, but also in terms of land use, capacity and safety. Rail is the only mode of transport that actually lowered its greenhouse gas emissions in the past 20 years, despite growing transports.

[2] UNIFE 2018b.
[3] EC 2019e, Table 87.
[4] EC 2019e, Table 88.
[5] Perchel 2015.
[6] Schwarzbauer 2012.

Competition

According to Regulation (EC) 1370/2007[7], regional passenger rail transport has to be carried out and subsidised via public service contracts (PSC), either directly awarded or on the basis of competitive tendering. From the perspective of LRAs the underlying quite sophisticated regulatory framework for PSC/PSO demonstrates the clear need to encourage the perception of local and regional rail transport as a task which would benefit from strong elements of MLG. The obvious first step is pro-active and transparent information to all stakeholders on available options in order to develop and promote fair and transparent solutions to incentivise such transport including cost-efficient approaches to the operation. In most MS this would be a task for authorities and infrastructure providers at national level.

The interdicted fusion of the rail branches of the two largest European manufacturers of railway equipment, Siemens and Alstom, produced divergent opinions. The EC feared a reduction of suppliers, loss of competition and market dominance in the EU market with the new Siemens-Alstom entity being three times larger than their closest competitor. The example of a declined merger in rail industry points at a wider question for Europe as to whether:

- Further de-industrialisation is desirable.
- Maintaining major European industries or even fostering re-industrialisation is possible without protective steps in a global economic environment where trade regimes tend to become more volatile and disrupted by geopolitical considerations

Support

Table 1. Tentative summary of the assessment on EU funding opportunities post 2020

Funding option	Considerations
ERDF	The major opportunity for LRAs to fund rail infrastructure on secondary lines. Commission has a major say in the approval of Operational or Regional Programmes (OP) on transport Shift of attention from road and TEN-T rail corridors to secondary rail connections will require 'nudging' in the coming months
CF, CEF	Focussed on TEN-T. But integrating a wider perspective on feeder lines as pre-condition for CEF-projects could be a lever to support a revival of secondary railway lines

[7] Regulation (EC) No 1370/2007 of the European Parliament and of the Council of 23 October 2007 on public passenger transport services by rail and by road and repealing Council Regulations (EEC) Nos 1191/69 and 1107/70 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:02007R1370-20171224

Funding option	Considerations
Horizon Europe	In general Horizon Europe has suffered from comparatively low participation of LRAs – this is a major policy point which should be addressed prominently when debates on the actual programming for Horizon Europe starts. One can expect major RDTI activities but there is an obvious risk that – given the political weight of automotive industries in the EU - certain types of transport (such as Automated Mobility meaning largely the automated car) might be disproportionally favoured. Thus, it is essential to position rail transport also in other key EU policy fields such as the EU Urban Agenda.

Source: own considerations.

Conclusions and recommendations

Fostering rail transport as important contributor to EU policy priorities means to focus on the following points:

- Rail is by far the most energy-efficient climate-friendly transport mode for peri-urban and urban mobility; in combination with walking and cycling it is the smart urban mobility triple.
- Smart transport by rail requires smart and supportive planning frameworks.
- Rail mobility requires a solid trunk network and secondary feeder lines.
- Economic challenge calls for cost-effective operation and new as well as broader approaches to financing.
- Regionalisation of railways could be a promising approach provided that LRAs are empowered to become partners in the development of rail transport next to infrastructure managers and railway undertakings.
- Promoting rail transport requires an increasing focus on Mobility as a Service (MaaS), passenger comfort and smart last-mile solutions.
- Rail industries will continue to perform as a solid employer with good growth prospects – provided that supportive policy frameworks are maintained or put in place.

Introduction

The present Study deals with the question of how railway transport can support ambitious EU environmental goals. Since transport is the main energy consumer and the main GHG emitter in the EU, rail as the most environmentally friendly land transport mode plays a key role for a future transport system that efficiently connects Europe while protecting its resources.

At the same time, the railway sector is an important employer providing jobs for ca. 1.8 million EU citizens[8]. A growth in rail-related employment might help to offset the job losses in the automotive industry expected from electrification.

Rail industries from rails over track equipment to rolling stock are important technology clusters spread across many Member States (MS). For example, Alstom has 12 production sites in FR (8,500 employees; including supply partners: 27,000), Škoda transportation Group in CZ (with its main seat in Plzeň, employing about 5,600 persons) or Siemens Mobility – a global player having 28,000 employees spread across the globe but with several key production sites spread across DE[9] and AT[10].

Rail depends on public financing. The European rail industry incurs 110 B EUR of cost, 30% of which comes from public subsidy[11].

A major part of rail transport in the EU happens at a local and regional level. Regional railways account for 89% of the total number of rail passengers and 50% of total passenger kilometres in Europe. Single wagonload freight transport still makes up 27% of rail transport in the 13 most important EU railway systems.

In this way, LRA are at the heart of the challenges and solutions facing the European transport system in the decades to come.

[8] UNIFE 2018b.
[9] E.g. Erlangen, Krefeld-Uerdingen, Nürnberg but also as a global player owing further production sites in U.S and India.
[10] Vienna, Graz.
[11] SDG 2015.

1 Contribution of the rail sector to delivering current EU policy priorities at local and regional level

Transport policy is a key lever to many other policies such as cohesion, environmental, education, social, urban or land-use policies. From the perspective of LRAs rail transport is more closely linked to public transport and less to freight transport – the latter being mostly in hands of rail freight operators and the infrastructure mostly being in the hands of national infrastructure managers.

When discussing public transport on rail cities and agglomeration areas are in a specific position since their infrastructure endowments often include streetcar or underground systems. The focus of this study is rather on the rail systems which are often part of the urban mass transit systems or closely interlocked with it.

Local and regional authorities (LRAs) have responsibility for designing and implementing public transport services in their territories. The role of LRAs differs across the EU depending on the political-administrative systems of the respective country. There are major differences between federal states such as Italy, Germany and Austria as compared to centralised countries such as for example SI and SK. Obviously the essential point is the financing capacity of LRAs, i.e. the budgetary arrangement or the respective mechanisms for tax redistribution on public transport – it defines if the LRA acts as contracting authority or is rather in the position of a 'recipient'.

LRAs have an increasing role in environmental policies – investment in more energy-efficient transport modes is an overarching concern in order to foster decarbonisation of transport and it is a very concrete task in urban agglomeration areas as a major contribution to noise and emission abatement. Rail transport offers the opportunity to be among the most energy-efficient transport modes next to walking and cycling provided that public transport is used by people. This makes rail transport a key lever to mitigate the environmental impact of transport and contribute to EU climate objectives.

Territorial cohesion is a major concern for all levels of governance in particular to avoid decoupling of more remote or sparsely populated areas but also to develop strategies to contain urban sprawl and excessive growth of certain agglomeration areas. Efficient and attractive public rail transport is among those factors which are essential to make a secondary city an attractive place to work and live or which are essential for the social agenda of LRAs in less favoured

areas in order to maintain fair levels of accessibility to schools and health care for elderly or disadvantaged persons.

The urban agenda, meaning prudent development policies to support smart and sustainable urbanisation is a rising concern since the number of urban residents will continue to grow in the EU. Urban rail transport is the means of transport best suited to meet transport requirements during peak hours and provide safe and reliable transport without major externalities.

1.1 Contribution of the rail sector to the EU labour market

Railways are important employers. They provide a wide range[12] of relatively well-paid and safe jobs; well-paid since they require mostly either skilled workers or academics and safe since most railway markets are dominated by state-owned monopolies or by oligopolies relying on public procurement.

Essentially, the jobs created by the sector can be divided into:

- Railway companies:
  - Railway undertakings (train operators);
  - Infrastructure Managers.

- Railway supply industry

- Public authorities:
  - Ministries;
  - Competent Authorities, at national or at LRA level;
  - Railway bodies (regulatory body, national safety authority etc.);
  - European Railway Agency.

- Financing industry (leasing companies);

- Other related jobs like security, catering, shops and restaurants at railway stations etc.

Furthermore, railways are important trainers of skilled staff. As an example, Austrian Federal Railways (ÖBB) are one of the most important apprenticeship masters in Austria, training 2.2 % of the apprentices in technical professions in Austria (two thirds of ICT electronics and one third of metal technology and

[12] An overview of professions in the railway sector can be found under http://www.railcareerpathways.net.au/a-z-of-rail-jobs or under https://www.railserve.com/Railroad_Employment_Jobs/railroad_occupations_wages.html.

mechanical engineering apprentices!) while offering 22 different apprenticeship professions[13]. 4.6 % of ÖBB staff are apprentices. About 50% of ÖBB apprentices switch to another company after the final exam, in many cases to SME. Therewith ÖBB plays a key role in avoiding youth unemployment and in securing skills supply for the Austrian industry as a whole[14].

The following overview focuses on the two most important aspects, railway companies and railway industry. 928 railway companies employ 496,400 persons in the EU-28 (2015). They turn over 74.113 BEUR p.a. [15].

Table 2. The EU-28 Member States with the largest rail sector 2015

MS	Population (million)	Turnover (BEUR)	Companies	Employees	Share of private freight railways (tonne-km)
AT	8.773 (15.)	3,433 (6.)	32 (8.)	23,600 (9.)	26.1% (14.)
BE	11.352 (9.)	**5.496 (5.)**	28 (12.)	35,600 (6.)	**48.6% (5.)**
CZ	10.579 (11.)	1,515 (11.)	30 (10.)	27,200 (7.)	34.9% (12.)
DE	**82.522 (1.)**	**11.626 (3.)**	**158 (2.)**	**47,700 (3.)**	45.5% (8.)
ES	**46.528 (5.)**	2.499 (9.)	16 (15.)	14,600 (11.)	29.5% (13.)
FR	**66.989 (2.)**	**14.506 (2.)**	42 (6.)	**47,500 (4.)**	41.0% (11.)
HU	9.798 (14.)	0.777 (14.)	30 (10.)	19,500 (10.)	42.1% (10.)
IT	**60.589 (4.)**	**6.866 (4.)**	26 (13.)	**38,700 (5.)**	**55.1% (2.)**
LV	1.950 (23.)	0.521 (16.)	31 (9.)	3,600 (21.)	25.5% (15.)
NL	17.082 (8.)	2.739 (7.)	34 (7.)	13,400 (12.)	45.0% (9.)
PL	37.973 (6.)	2.539 (8.)	**167 (1.)**	**49,800 (2.)**	**48.6% (5.)**
RO	19.644 (7.)	0.940 (13.)	**91 (4.)**	27,000 (8.)	**62.9% (1.)**
SE	9.995 (13.)	1.828 (10.)	**56 (5.)**	8,900 (16.)	46.0% (7.)
UK	**65.809 (3.)**	**14.701 (1.)**	**96 (3.)**	**77,400 (1.)**	**55.0% (3.)**
EU	*511.523*	*74.113*	*928*	*496,400*	-

Source: EU Transport in Figures 2018.

As can be seen from the Table, large countries have large rail sectors in terms of number of employees, also regarding turnover (DE, UK, FR, IT, PL, with the exception of peripheral parts of ES). EU-15 railways have relatively higher turnover than in EU-13, obviously connected with the higher salaries and higher productivity in the EU-15. The number of companies is especially high in MS that started early reforms in the rail sector: SE, UK, DE and in the large CEEC: RO, PL.

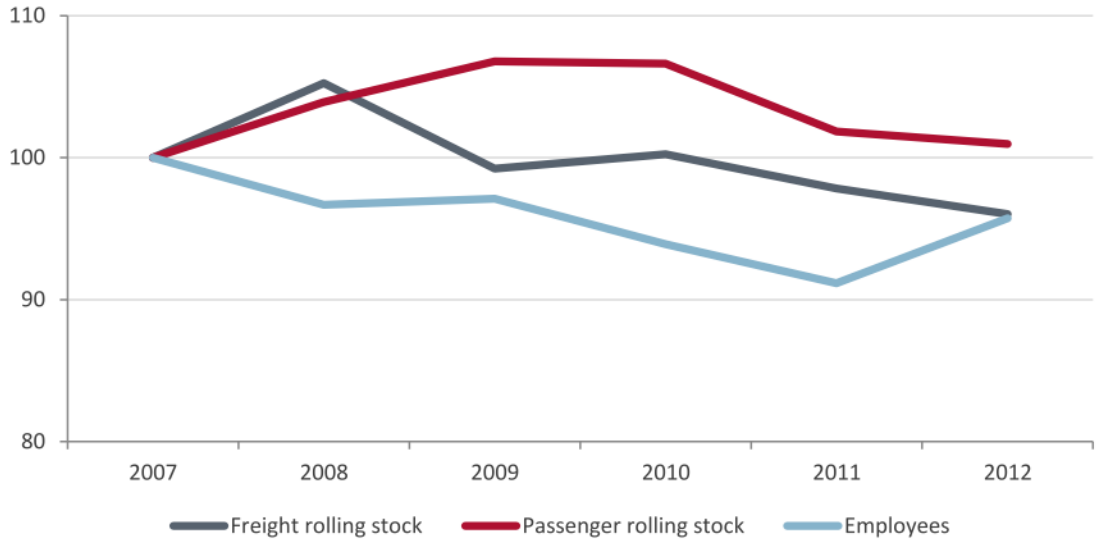
In a 2012 study, Eurofound points out the fact that railway employment shrank in the first decade of this century. According to Eurofound, the reason seems to lie in the rationalisation brought about by opening the sector to competition. This

[13] A detailed list of ÖBB apprenticeship professions including summaries of the curricula can be found in the Annex.
[14] ´Helmenstein 2013, p. 32-33.
[15] EC 2018a.

observation seems to be supported by the fact that the two EU pioneers of railway liberalisation in the 1990s, UK and SE, contrarily showed increasing employment (+23% resp. +45%) since they had undergone restructuring earlier and already adapted their workforce to a growing market. Eurofound also states that the separation and split-up of the former monolithic state railways resulted in outsourcing of non-core activities like maintenance or repair. Therefore and with the constant absolute growth of rail transport in the EU, it is to be expected that employment in the sector will continue to grow. Meanwhile, former civil servants in the state railways have mostly been replaced by employees under private law contracts[16].

A chart published in a 2015 study by Steer Davies Gleave on cost and contribution of the EU rail sector[17] shows the continuous trend towards rationalisation in rolling stock while employment starts to rise again.

Figure 1. Trends input indicators



Source: Steer Davies Gleave 2015.

Steer Davies Gleave see scope for productivity improvement in some EU-13 MS. If all MS could reach the level of the most successful, they would expect an increase of gross value added of 64 BEUR until 2030 (including upstream sectors) and about 3,200 additional direct and indirect jobs[18].

According to UNIFE, the worldwide rail supply market has a volume of about 163.2 BEUR, thereof 52.6 BEUR for rolling stock and 15.1 BEUR for train control systems. Growth is ca. 1.2% p.a. with Western Europe and Asia-pacific

[16] Eurofound 2012.
[17] SDG 2015.
[18] SDG 2015.

region as main drivers of demand. Further growth is forecasted[19]. The European rail supply industry employs ca. 400,000 people[20].

According to UNIFE and ERRAC, the European rail sector employs ca. 1.8 million people[21], 4 million when wider economic effects are taken into consideration[22]. A 2014 CER Study[23] breaks down the employment effects in the following way (2012):

- Train operations, infrastructure management (direct employment) – 1.06 million employees;
- Indirect employment caused by upstream supplier relations (e.g. financial services, accounting etc.) – 0.66 million employees;
- Indirect employment caused by infrastructure investment – 0.55 million employees;
- Indirect employment: manufacture of rolling stock – 0.1 million employees;
- Induced effects: economic effects from employees in the sector spending their income thus creating further value added and employment elsewhere in the economy – between 0.575 and 1.725 million employees (based on German and Swiss studies).

However, it has to be admitted that this is less than the 13.3 million employees reported for car industries.[24]

An Austrian study estimates that the employment multiplier of the railway industry is 1.52, i.e. one job in the railway industry secures 0.52 additional jobs in other Austrian companies. A 2013 study commissioned by the Federation of Austrian Industries estimates that rail infrastructure investment in Austria 2013-2020 induces ca. 24,000 jobs annually, two thirds in the construction industry and one third for suppliers. The SME share in the revenues induced by the Austrian rail infrastructure investment is 78 % as compared to 40-50 % in general production industry. SME-dominated sectors profiting from the investment are

[19] RB 2018.
[20] UNIFE 2018b.
[21] UNIFE 2018b.
[22] ERRAC 2017, p. 10.
[23] Molemaker 2014, p. 20-24.
[24] Car industry (2016); total employment manufacturing, services and construction 13.3 million (6.1% of total EU employment); source: ACEA Pocket Guide 2018/2019).

mainly production of cement and concrete, freelance services, wholesale trade, woodworks, metalworks, production of electrical equipment and plastics[25].

A major challenge is the low percentage of women in the sector. Women constitute only 22% of employees in the transport sector[26]. For railways, the situation tends to be worse. According to the recent Rail Market Monitoring Study, the percentage of female staff in the railway sector is between 8% (AT) and 49% (EE), with just 4 MS exceeding 30%[27]. According to Women in Rail, for example the UK railway sector has 16% female staff[28]. This is not only bad for women missing opportunities in a relatively safe and well-paying sector[29], but also bad for railway since the pool of potential staff is considerably diminished.

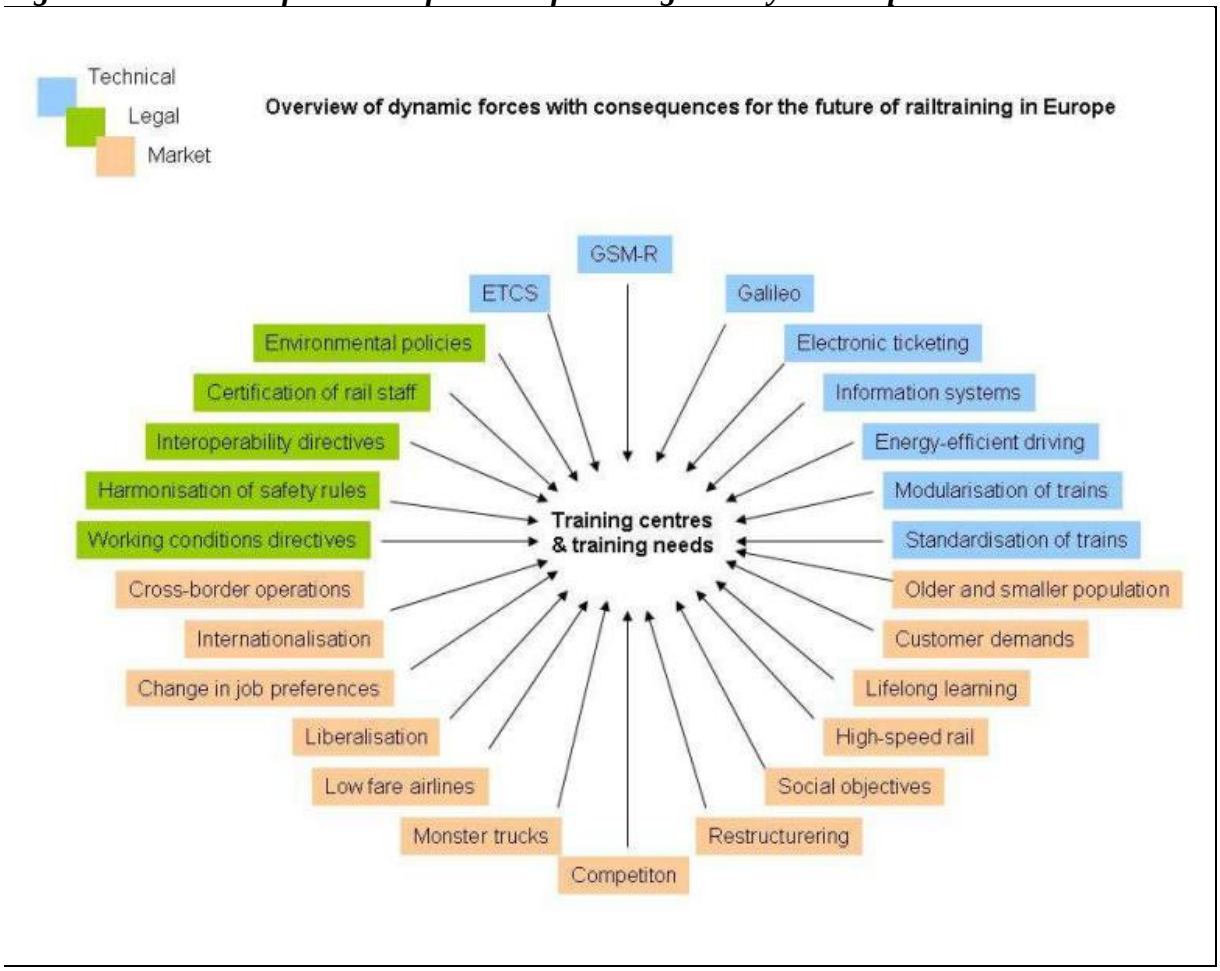
The workforce restructuring in the state railways has led to another serious diversity issue. Since the personnel reduction was usually carried out via non-replacement of retirees, railway staff tend to be either in their fifties and sixties (37.4% in 2016 according to the Rail Market Monitoring Study[30]) or relatively young (from recent recruitment). The age groups in between are largely missing.

Since, in addition to skills shortages, skill requirements in the rail sector are rapidly changing, 2007 scenario-based study by the Danish Technological Institute et al. tried to identify the main training and education needs in the railway sector until 2020. They list the following key drivers[31]:

- Liberalisation with competition between training centres;
- Internationalisation requiring language skills;
- Technical harmonisation, new technologies, interoperability requiring adapted training curricula;
- Demographic changes with an ageing population leading to recruitment challenges.

[25] Helmenstein 2013, p. 8 and 14-16.
[26] https://ec.europa.eu/transport/themes/social/women-transport-eu-platform-change_en
[27] EC 2019e, Table 87.
[28] WIR 2015.
[29] EC 2019e, Table 92, 93: Railways provide almost exclusively full-time jobs.
[30] EC 2019e, Table 88.
[31] Danish Technological Institute 2007, p. 115 ff.

Figure 2. Overview of the main factors influencing railway skill requirements



Source: Danish Technological Institute, CAS, Lloyds Register Rail Europe B.V.

The main areas for future digitalisation of the rail sector are listed in Chapter **Error! Reference source not found.**. Based on that, additional IT staff or o utsourced IT services could mainly be required for maintenance prediction, network usage, train control and AI for automated operations. Main fields requiring upskilling of non-IT employees seem to be cybersecurity, given the high damage potential of rail transport, as well as operations (automated driving) and new services (multimodal ticketing, e-freight-logistics). However, as a study pointed out, 85% of the jobs in the year 2030 have not been yet invented[32]. The figure seems exaggerated; however the emergence of new skills requirements unknown to us today is to be expected.

The curricula of ÖBB apprenticeship professions listed in Annex 1 clearly illustrate the changing job profiles caused by the integration of ICT aspects. Where until 2010, generic electrical engineering and electronics training sufficed, new railway-specific branches of these professions or new professions have now been introduced – e.g. tracks used to be constructed mainly by unskilled workers;

[32] http://business-review.eu/news/analysis-how-digitalization-is-reshaping-the-jobs-of-the-future-167802

now with the use of increasingly sophisticated equipment (laser sensors etc.) a new apprenticeship profession "rail track construction technician" has been introduced[33].

1.2 Contribution to territorial cohesion

EU policy principles affecting rail transport
The Primary Law points out the role of the European transport system for territorial cohesion. Art. 170 TFEU requires special attention to *the need to link islands, landlocked and peripheral regions with the central regions of the Union*. However, immediately afterwards Art. 171.1 seems to contradict this when requiring that *the potential economic viability of the projects* shall be *taken into account*. This points out the main conflict behind the role of railways for territorial cohesion. In order to fulfil its role, the network needs capillaries. However, peripheral regions cannot, almost per definition, produce sufficient transport demand to justify the connections on strictly economic terms.

The EU regulation on public service obligations beginning with 1191/69/EEC in 1969 gradually led to a critical assessment of the closed lines. The notion of public service obligations turned the focus to the political component of "general interest" away from the purely commercial or economic feasibility that used to justify lines closure.

Although significant efforts have been made to create a Single European Railway Area, lack of technical and administrative cross-border interoperability in rail transport still poses a challenge. Technical interoperability challenges are train control systems, traction current, gauge (Russian and Iberian Broad Gauge) as well as different capacity limits of infrastructure such as loading gauge or limits to train length. In addition, there can be administrative issues such as mutual acceptance of locomotive drivers (language barriers) or lacking electronic data interchange.

In terms of network infrastructure development, the European focus in rail transport is on the TEN-T core network. European funding is and will be increasingly directed to the development of a high-grade trunk rail network across Europe[34]. The TEN-T core rail network should be the backbone of a Single European Railway area providing intermodal hubs and a high-speed network which is competitive to air transport across distances up to 500 km.

[33] Gluschitsch 2012.
[34] Connecting Europe Facility and Cohesion Fund (CF) are focussing on the TEN-T and TEN-E.

It is important to note that the TEN-T core network is meant to link major cities (capitals) across Europe but it cannot serve larger territories without feeder lines. EU cohesion policy (in particular the ERDF) is open for investment into rail transport and intermodal hubs, meaning also investment in regional rail networks.

Cutting the networks in the 60ies and 70ies

Decommissioning secondary railway lines started in Europe with the so-called "Beeching Axe" in the 1960s[35], closing 50% of the railway stations and 25% of the network in order to reduce the large losses of the incumbent state railway British Railways. Beeching had assumed that, after the closures, people would drive by car to the nearest railway station and then continue their journey onwards by train. He expected the same to happen with freight. But people started to use their cars for the whole journey, therefore road traffic levels grew significantly.[36]

Other state railways in Continental Europe then followed this example cutting networks, abandoning secondary lines which formerly served smaller towns in rural areas. This process is ongoing but – as examples show – the trend has also been reverted in a visible number of cases across Europe: A small number of the closed routes have since reopened or at least short sections have been preserved as heritage railways. In many cases rail infrastructure is lost: Sections have been incorporated into the National Cycle Network or used for road schemes. Some parts have been used for construction, reverted to farmland, or have remained derelict.

A network needs arteries – the importance of regional rails

Cutting the secondary networks and the investment focus on high-speed networks has changed the network size considerably. But still regional railways play a key role in the European railway system. In terms of passenger numbers, investment in regional rail infrastructure is more important than investment in the European high-speed network[37]. Regional railways account for 89% of the total number of rail passengers and 50% of total passenger kilometres in Europe. 80% of Austrian[38] and 98.7% of German rail trips are shorter than 100 km[39].

[35] In 1963 and 1965, Dr. Richard Beeching, Chairman of the then British Railway Board, published two reports: "The Reshaping of British Railways" and "The Development of Major Railway Trunk Routes".

[36] Another problem was that Beeching's reports made no stipulation for the handling of land after closures so that redundant structures from closed lines remained and caused maintenance cost without providing benefit. In conclusion it seems that the report often adopted a simplistic and short-sighted analysis of the economics of the routes in its attempt to eliminate British Railway's losses, which caused the belated recognition that railways also serve a social role which should be financially acknowledged.

[37] Ungerböck 2014.

[38] An average rail trip in Austria covers 30-50 km with an average speed of 42 km/h.

[39] Perchel 2015.

Serving different types of territories

When discussing rail networks, it is basically a system consisting of lines and nodes. The more people live in or nearby the nodes the bigger the potential market for rail transport. Evident key parameters are the population density and the density of railway lines which to some extent pre-define the potentialities related to rail transport. Already these parameters reveal significant differences across the MS ranging from 5,600 persons[40] per km track in NL over 4,400 in PT to 2,900 in ES, 2,400 in FR or 2,100 in DE to about 1,000 in LT.

Next to that rail opportunities will differ across types of territories.

Table 3. Potential impact, challenges and growth prospects or rail transport depending on type of region

Type of region	Potential impact of rail transport	Challenges & growth prospects
Less developed areas	Ensuring safe and reliable transport to public utilities in regional centres Could also be an interesting option for cheap transport of bulk goods provided that it is efficiently managed Role of railways as employer	Economic viability is the major challenge Obvious competitors are bus services which are more flexible – thus railways are challenged to develop attractive 'last mile' packages (cheap mobility service on demand, safe cycle stands etc.) (Heritage) tourism might be an impetus for growth Development of clever and attractive services in and around stations to raise passenger comfort
More developed rural areas	Quick transport to the centre of secondary or capital cities without congestion Development zones around railway stations in rural towns	
Urban areas	The area where all strengths of rail transport count: High energy-efficiency, low area consumption and high peak capacity in mass transport	Urban rail transport has in principle sound growth prospects An obvious challenge is passenger comfort and reliability during peak hours

One can expect that the trend towards urbanisation would favour growth and expansion of peri-urban and urban (light) rail systems. The trend towards urbanisation inherently fosters suburbanisation and thus growing agglomeration areas with substantial commuter flows[41]. Another market with growth prospects for rail transport is dedicated strategies to foster the development of secondary

[40] https://en.wikipedia.org/wiki/List_of_countries_by_rail_transport_network_size

[41] An interesting case are expanding settlement areas in river valleys in mountainous territories such as in AT or in FR – such settlement structures are particularly interesting to be served by rail. A recurring challenge of larger urban areas in mountainous territory is that quite often high-speed intercity connections and regional trains have to share tracks - at least partially; thus posing comparatively high requirements on train control in order to safeguard high safety levels.

cities in a polycentric European urban system – one of the obvious pre-conditions to strengthen a secondary city is the accessibility as an economic factor and as part of the quality of living which means inter alia high-grade rail connections to the capital cities. Such strategies might become increasingly interesting due to the steep rise of housing costs in major agglomerations.

It is important to stress that the future growth prospects for rail strongly depend on regulations set in other policy frameworks. Apparent elements are urban parking policies and road pricing as examples for short-term levers as well as land-use as the long-term policy lever in order to contain urban sprawl and support the development of settlement structures which can be efficiently served by rail – all elements mentioned are evident key elements of smart and sustainable urbanisation.

Stations and rail terminals as catalysts

Rail networks consist of lines and nodes and it is evident that the nodes, stations and rail freight terminals, have an important function as catalysts for economic development. And the numbers of stations as well as passenger numbers using them are quite impressive. As examples two large MS with a long tradition of industrialisation and rail development have been chosen:

- United Kingdom: The 30 most frequented stations show annual passenger numbers from 95 million (London, Waterloo) to 16 million (Liverpool, Lime Street), further 15 stations reported annual numbers over 10 million and further 55 stations from 5 to 10 million, 464 had reported passengers of 1 to 5 million[42].

- Germany has a system of categories which relates to the importance of train stations[43]; for example the 20 stations in Category 1 include Frankfurt/Main with about 168 million of passengers per year; but for the subject of the study it is more interesting to see that Category 3 includes 239 stations in medium-sized towns with passenger volumes ranging from 360,000 to 3.6 million persons per day.

Such figures point at crucial assets for economic development at various levels – be it directly in the station or in the surrounding area. In this way, real estate management has become an important aspect of rail infrastructure management. The potentialities of stations for real estate development depend on the exact location in the town, city or agglomeration area.

[42] https://en.wikipedia.org/wiki/List_of_busiest_railway_stations_in_Great_Britain

[43] The system has been subject to several reforms and is now built on multiple criteria such as No of platforms, No of trains stopping, No of passengers, barrier-free access and availability of services.

There are multiple ways how stations and terminals act as economic catalysts. The major asset in terms of cohesions is that rail networks usually spread across wide territories thus offering potentialities for development across a variety of different regions albeit at different scales.

Table 4. Stations and terminals as economic catalysts

Catalyst function	Annotation
Construction, refurbishment, maintenance of stations as investment programmes	Next to the refurbishment of stations and the adjustment of platforms, the easy access for disabled persons, park & ride as well as bike & ride facilities and the development of shopping areas in stations have been an investment focus by the national infrastructure managers in many MS. Given the high number of stations spread across the territories the aggregate leverage effect of these investment programmes is considerable. An interesting recent example is the 'greening' of train stations striving for low-carbon and high energy-efficiency. In DE the infrastructure manager[44] has invested in two pilot stations equipped with up-to-date energy-management, innovative lighting; the station building has been constructed with increased use of wood and other renewable resources.[45]
Stations as catalyst for city area development	More efficient train operation as well as separation of passenger and rail transport allow for more efficient use of rail network sites. Thus, railway stations often become the trigger point for larger city area developments. These major investment schemes usually focus on development of shopping malls, office and housing space but also improving the permeability of stations and the access to other parts of the city centres.[46] A good example is Katowice railway station (PL) that was renewed in 2009-2013 including retail, hotel, and other on-site facilities.
Stations contributing to local development	The smaller the city or town the less probable is the role of train stations as catalyst for major site development. But even in smaller towns the area around the train stations ranks among the most frequented parts. Owing to its all-year-round frequency of passengers it supports local development and provides an impetus for development of various small businesses.
Rail freight terminals as asset in business development	Environmentally friendly container and bulk freight transport should focus on rail. The combination of derelict former industrial areas plus unused rail areas which had been previously used for rail freight operations has been turned into attractive business locations in many MS.

[44] Deutsche Bahn (DB) Station & Service

[45] As pilot the station in Horrem was built in 2012, the second station (Wittenberg) was completed in 2016 (see https://www.deutschebahn.com/de/bahnwelt/bauen_bahn/Bauen_an_Personenbahnhoefen/Umwelt-Vorreiter_an_Bahnhoefen/Gruener_Bahnhof-1185278?contentId=1185350)

[46] Take the example of Linz (with about 15 million passengers per annum it ranks among the most frequented through stations in AT) which was rebuilt in 2004 and triggered a major development of office and service space in the city. An illustrative report on a major example in UK (Birmingham New Street) can be found in Rail Delivery Group, 2016, p. 5-9.

Catalyst function	Annotation
	A good example is Cargo Center Graz, the bimodal road/rail container terminal at Graz-Werndorf (AT), based on a PPP model that included the provincial LRA in the operating company for the first years. Evidently such terminals would profit from supportive legislation fostering rail freight transport.

Focus on cross-border links

Border regions are of specific interest for Europe. Seamless transport across borders is the major enabling function for European integration. Cross-border infrastructure allows for the better integration of markets and interconnection between communities that is crucial to EU territorial cohesion. Development of regional transport infrastructure however is largely undertaken by individual Member States and depends in each region on the national policy frameworks. In border regions, this means that policy frameworks in MS have relevance to the development of transport infrastructure in neighbouring countries. National ministries and rail infrastructure managers still focus on domestic corridors and tend to neglect border sections which have less traffic and where investment could rather benefit the neighbouring countries.

That means rather different prospects for the revitalisation or upgrading of border-crossing secondary lines depending on the location:

- Rural-peripheral border areas: The revitalisation of secondary lines - which are mainly in regional interest – will require even more convincing arguments than the revitalisation of lines within national borders. There are examples for the revitalisation of cross-border rail links in mountainous regions – in particular tourism development could provide an impetus to revitalisation plans.

- Urban areas: Taking the considerations on growing rail markets in agglomeration areas into account it is quite clear that border-crossing conurbations such as in the Eurometropolis Lille-Kortrijk-Tournai[47] might be very interesting showcases.

[47] The EGTC Eurometropolis is actively supporting mobility as focus area: *To erase borders, the "Mobility and accessibility" Working Group recommends joint management of public transport and motorway, rail and river networks. There are several areas of intervention. Firstly, efforts are being made to increase the frequency of public transport and homogenise its distribution, connection and pricing within the territory.* http://www.eurometropolis.eu/areas-focused-on/mobility.html

In the study on missing links[48] three types of challenged border zones have been identified:

- Densely populated areas with high commuter flows that may need additional border crossings due to their high demand, even when existing infrastructure is highly developed (usually EU15/EU15 borders). These are most interesting for public transport infrastructure investment, too.

- EU 13/EU 15 and EU 13/EU 13 borders, mainly because of investment backlog, scarcity of investment funds and low demand for many years.

- Borders with geographical obstacles like rivers or mountains with often low population density, where investment requirements for new border infrastructure are very high.

Consequently, the highest regional benefits from EU funding are to be expected in the cases of:

- high population density or high commuter flows when a high number of persons has reduced travel times and cost;

- poorly connected regions when the marginal utility of an additional cross-border connection is highest in terms of regional development.

Summary of main impacts of rail on territorial cohesion

The main impacts of rail transport in terms of territorial cohesion are:

- Accessibility of labour markets with rail being the best-suited mode for regional mass commuter transport.[49]

- Accessibility as part of the local and regional social agenda, safeguarding cheap and reliable transport to key public utilities such as schools or health care[50].

[48] See CoR 2016.

[49] When looking at the figures for annual passenger numbers of railway stations in the section on stations as catalysts (e,g, stations London Waterloo (95 million) or Frankfurt (168 million) or the fact that among the 20 stations in Category 1 in DE six of the stations are not the main station but commuter stations in agglomeration areas (such as Berlin or München) the role of rail transport for commuting is evident; And it should not be forgotten that regional railways account for 89% of the total number of rail passengers and 50% of total passenger kilometres in Europe.

[50] Demographic change and out-migration put a heavy pressure on LRAs in more peripheral areas and tend to trigger vicious cycles due to decreasing service levels for public services (since LRAs cannot afford to operate many facilities key facilities are then concentrated in larger cities); an obvious consequence is that availability

- Competitiveness of production depending on large in- and outputs; rail transport cannot easily be replaced for container hinterland transport and bulk transports for heavy industry if inland waterways are not available.

- Generating and maintaining jobs; in particular in challenged regions with otherwise low prospects for economic activities.[51]

- Railways also play a direct role in job creation. Railways are usually one of the most important national employers, providing jobs for apprentices and skilled workers even in peripheral and border regions[52]. Next to that infrastructure managers are important due to large-scale investment programmes for stations and line refurbishment.

A 2013 Austrian study states that the availability of railway infrastructure increases the productivity of the economy as a whole. With rising foreign trade and more intermediate goods, this effect has intensified since 2000. Main regional effects are increased job opportunities outside areas of high population density, increased accessibility of tourist regions, larger sales markets and improved supply of labour (via increased labour mobility), energy and raw materials. Based on the assumption that a 1 % increase in permanent railway capital stock increases productivity by 0.1 % and therewith employment by 0.09 %, the study estimates that per EUR 68,300 invested into rail infrastructure, an additional job in Austria is created.[53]

Examples

There are a number of positive examples which show that the trend towards shrinking secondary rail networks can be stopped and even reverted. But it takes dedicated action and a lot of marketing efforts as well as a prudent pricing policy in order to strengthen the economic viability of secondary rails which are not part of peri-urban rail systems.

Title	**Regiobahn**[54]
MS, Region	DE, North-Rhine Westphalia
Key aspect	DE LRAs took over regional railway lines

of high-grade services means to commute and thus the quality of living in such areas increasingly depends on reliable and affordable public transport.

[51] As has been outlined before the rail networks of MS are usually widespread and consist of many lines and nodes; 239 stations in medium-sized cities and towns Category 3 in DE or 460 stations with 1 to 5 million passengers per year in UK offer jobs and potentialities for other micro-businesses across the country.

[52] E.g. the Austrian state railway ÖBB employs ca. 40,000 people and is the 7th largest Austrian employer.

[53] Helmenstein 2013, p. 18-19.

[54] The authors thank Mr. Christoph Kaupat (European Railway Agency) for the suggestion.

Key features	In 1998, a consortium of six LRAs and municipal transport operators took over operations and part of the infrastructure of a 33 km secondary line in North Rhine-Westphalia (DE) from incumbent state railway Deutsche Bahn. In 1998, the last year of DB operations, the part of the line that was still served had 512 passengers daily with a 60-minute interval. Now Regiobahn has 23,000 passengers daily with a 20-minute interval, 7.1 million passengers per year[55]. For comparison, the new high-speed connection Berlin-Munich is considered as very successful with 4.4 million passengers in its first year of operation, doubling the numbers and pushing rail modal share on the route from 23% to 46% while causing air modal share to plummet from 48% to 30%.[56]

Title	**Oloron - Bedous**
MS, Region	FR, ES Region Nouvelle-Aquitaine,
Key aspect	Partial reconstruction and reopening of a former cross-border railway link
Key features	24 km of railway line have been reinstated but the connection to ES is still missing. Passenger numbers are low and busses are competing with rail services.

Title	**Urban transport Gdańsk and Gdynia.**
MS, Region	PL, Pomorskie region
Key aspect	Urban rail connecting air and urban transport in the Polish tri-city area
Key features	In the area of the tri-city Gdańsk, Sopot and Gdynia 17 km of double track non-electrified peri-urban railway line is revitalised and brought to modern standards. The line connects the airport with urban transport in the tri-city area. Two stops (Gdynia Karwiny and Gdynia Station) are constructed and platforms are modernised.

Title	**Vinschgaubahn**
MS, Region	IT, Trentino Alto Adige
Key aspect	LRA took over a line from incumbent railway operator
Key features	An interesting example is the reopening of the Italian regional railway line Vinschgaubahn (IT). The line had been closed by the incumbent state railway Ferrovie dello Stato (FS) in 1990 after the train services had been replaced by buses in the late 1980s. In 1999, the line was taken over by the region South Tyrol (IT). The line was refurbished in the years 2000-2004 with a total investment of 116 MEUR (60 km, non-electrified) and reopened in 2005. Passenger numbers increased from 400,000 in 2005 to 2 million in 2013. The operational cost amounts to ca. 7 MEUR p.a.; cost coverage is 30-40 %[57]. Electrification of the line is intended to be completed in 2021.[58]

[55] https://regio-bahn.de/

[56] https://www.l-iz.de/wirtschaft/mobilitaet/2018/12/Die-Bahn-hat-ihre-Fahrgastzahlen-zwischen-Muenchen-und-Berlin-mehr-als-verdoppelt-247632

[57] http://www.vinschgauerbahn.it/de/news.asp; Legambiente, Rapporto Pendolaria 2013. (www.altreconomia.it/site/download.php?allegato=phpcbdjke8189.pdf); http://www.vinschger.com/vinschgerzug%201992%20bis%202005.htm; http://www.provinz.bz.it/de/downloads/PAB_partecipazioni_dirette_e_indirette_attuale1.pdf; http://www.vinschgerbahn.it/de/streckenfuehrung.asp; http://www.regionale-schienen.at/0_thema_200802.asp?mid=23; http://www.vinschger.com/vinschgerzug%20heute.htm

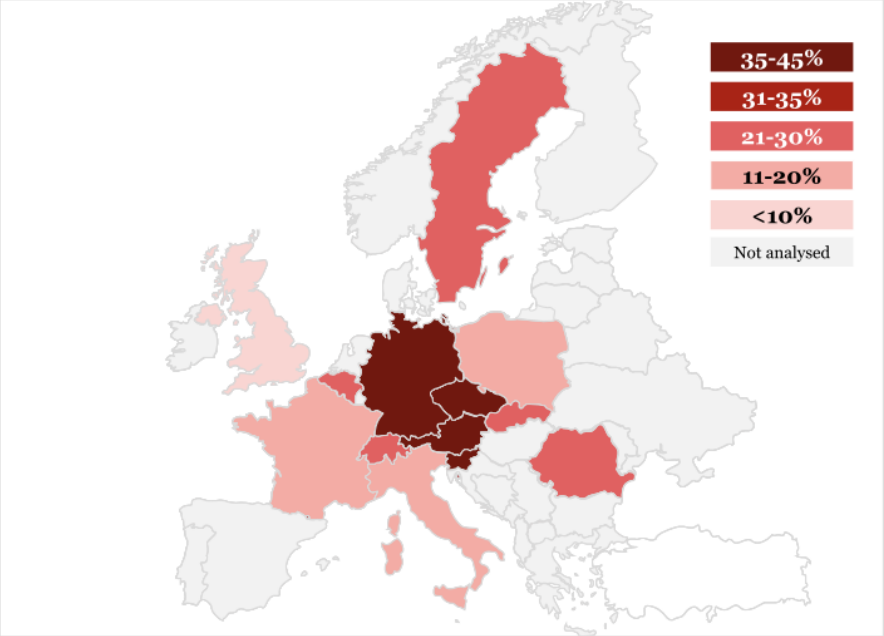
[58] See VCÖ, 2019, p. 21.

Freight transport

Despite the focus on passenger transport economic development in rather rural or even peripheral regions might benefit from rail infrastructure. Since the start of industrialisation railway lines have been arteries for supply and transport of fabricated goods. In some industrial regions these factors are still valid assets.

An interesting topic is single wagonload freight transport that still makes up 27% of rail transport in the 13 most important EU railway systems, although some important railway countries like UK, FR, PL or IT largely abandoned it. Single wagonload transport is important for certain goods like metals, chemicals or fuels that are important for regional economy. Two thirds of transport is international. Single wagonload transport faces severe challenges, i.e. volume reduction of affine goods, low profitability, lack of private competition to the state railways and competition from road[59].

Figure 3. Share of tonne-km transported via single wagonload traffic



Source: Pricewaterhouse Coopers 2015.

Title	**Freight transport on rail in Southern parts of Austria**
MS, Region	AT, Carinthia and Styria
Key aspect	Highlighting the added value of rail investment for regional growth LRA as catalyst for rail freight terminal investment
Key features	A 2013 Austrian study estimates that 28,000 jobs in the peripheral Austrian regions of Carinthia and Styria are directly and indirectly generated by the

[59] PwC 2015.

	wood and paper industry that depends on railway connections[60]. A 2012 cost-benefit analysis for the TEN-T Baltic-Adriatic Core Corridor predicted aggregate value added of 0.1 to 0.6 % for the respective Austrian and Slovenian border regions from the corridor investment[61]. An Austrian study estimates that 1 EUR investment in rail infrastructure construction or upgrade generates 2 EUR in taxes and social insurance payments while 1 BEUR railway investment creates 17,000 jobs[62]. Cargo Center Graz is a road/rail container terminal in Werndorf near Graz, opened in 2003. The car manufacturing industry in the area had long required a new terminal, however the incumbent Austrian Federal Railways were not interested. Upon initiative of local freight forwarders, the terminal was then implemented in an innovative PPP structure with 47% national state funding. Shareholders of the special purpose vehicle (operating company) that financed the other 53% were four local freight forwarders (50%), three local banks (25%) and the LRA (Province of Styria, 25%). The terminal was an economic success with construction cost and duration below and initial handling volumes above the estimates in the Business Plan. In the meanwhile, the Federal state of Styria has withdrawn from the operating company, as had been planned from the beginning[63].

When developing options how LRAs could promote rail freight transport one should look at the main network elements (lines, nodes) as well as the demand for rail freight services. Anchor points to promote rail freight traffic for LRAs are:

- Support to rail connection for business parks or rail terminal development: In particular in MS that are federations, regional government are often involved in the development of business parks and could thus influence rail-friendly site development.

- Feeder lines: Local railways can play an important role in connecting local industry to its suppliers and customers. E.g. province-owned Salzburger Lokalbahn transports ca. 90,000 tonnes p.a. (2009: 380,000 tonnes) on its own 1,000 V DC network (AT/ÖBB 15 kV 16.7 Hz AC). As a railway undertaking, it is also active on the national infrastructure with 2.5 million tonnes p.a., competing with incumbent ÖBB[64].

- Support to private sidings: Private sidings are closely linked to area-covering single wagonload transport. MS that try to keep up single

[60] Economica 2013, p. 34-42.
[61] Schwarzbauer 2012.
[62] Frohner 2015.
[63] http://www.cargo-center-graz.at/en/
[64] Scheinast 2017; https://www.salzburg-ag.at/bus-bahn/regionalverkehr/salzburger-lokalbahn/gueterverkehr.html; https://www.logistik-express.com/mehr-gueterverkehr-bei-der-salzburger-lokalbahn/

wagonload transport have support programmes for construction, upgrade and reactivation of private sidings in place[65].

- Act as exemplary user: In some cases, purchases and delivery or supply services for LRAs or groups of LRAs might allow the use of rail transport (e.g. in the field of waste management) – thus LRAs could actively develop logistics concepts favouring rail transport.

- Prudent and rail-friendly planning of land-use and public services: In a medium to long term perspective, it is vital that land use plans but also plans for certain public services are done in a 'rail-friendly' manner; this could become part of common strategy packages to mitigate the impact on climate whenever services involve container transport or bulk freight such as waste management or waste water treatment[66].

1.3 Contribution of the rail sector to energy efficiency and climate change mitigation objectives at local and regional level

The transport sector causes 27% of the greenhouse gas emissions in the EU[67]. Urban transport is responsible for 40% of CO_2 emissions from road transport[68]. The trend is driven by urbanisation. In the EU, 75% of the population live in cities, by 2050 it is estimated to reach 80%[69]. Therefore, urban transport is crucial for meeting the EU climate change mitigation objectives.

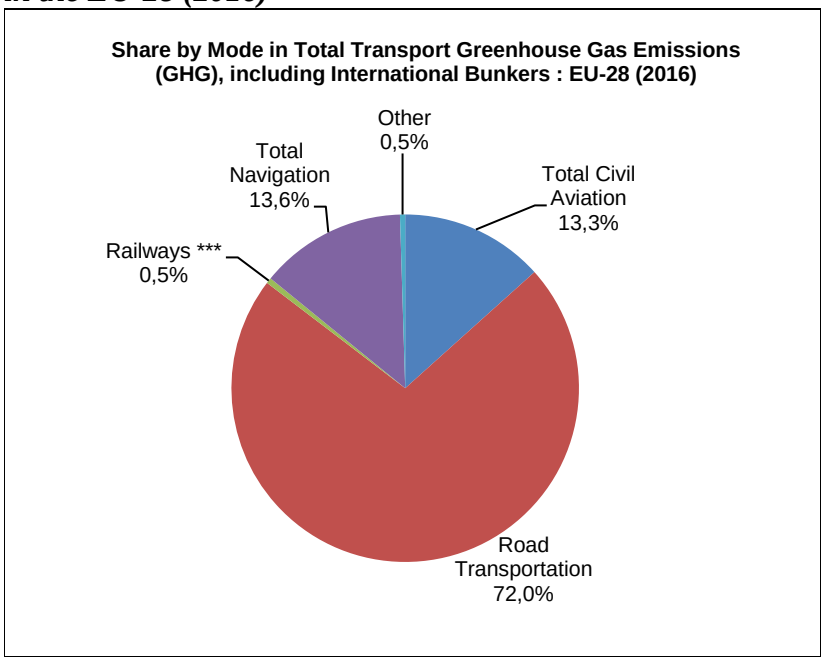
A new impetus to the discussion on the mitigation of energy policies is provided by the requirement for MS to present National Energy and Climate Plans (NECP) until the end of 2019. Transport is a cross-cutting issue across three of the five dimensions of the NECPs (decarbonisation, energy efficiency, and RDTI and competitiveness).

Urban, suburban and regional rail is the most effective means of public transport, not only in terms of greenhouse gas emissions, but also in terms of land use, capacity and safety. In order to reap the full benefits of the rail mode, it is important to electrify the network, at least as long as technologies like hydrogen

[65] E.g. AT https://www.schig.com/foerderungen-verkehrsfinanzierung/aktuell/foerderung-anschlussbahn-und-terminalfoerderung/, DE https://www.eba.bund.de/DE/Themen/Finanzierung/Gleisanschluesse/gleisanschluesse_inhalt.html
[66] Wastewater treatment produces significant quantities of sludge.
[67] EC 2019a.
[68] UNIFE 2019b.
[69] CER 2018.

power are not available for propulsion. 40% of the electricity used by EU railways comes from low-carbon sources, 20% from renewables[70]. The below illustration clearly shows the challenge posed by road transport emissions as well as the obvious solution, rail transport.

Figure 4. Share by mode of total greenhouse gas emissions in the EU-28 (2016)



Source: EU Transport in Figures 2018.

Lorries constitute 3% of vehicles and 15% of driven distance in the EU, however they are responsible for 25% of CO2 emissions from road transport. In the past 20 years, fuel efficiency of lorries has largely stagnated[71]. The below table shows that rail is the only mode of transport that actually lowered its greenhouse gas emissions in the past 20 years, despite growing transport volumes.

Table 5. GHG emissions (million tonnes CO2 equivalent) and billion tonne-km and passenger-km per mode 1995/2016

Mode	GHG emissions 1995	Tonne-km Pass.-km 1995	GHG emissions 2016	Tonne-km Pass.-km 2016
Rail	11.2	388 350 (424)	6.4	412 450 (556)
Road	781.8	1,289 4,532	883.2	1,804 5,507
Aviation	100.6	2 348	163.7	3 713
Navigation	141.5	1,052 31	167.2	1,328 25

Source: EU Transport in Figures 2018. Note. The figures in brackets include tram/metro.

[70] CER 2018.
[71] TE 2013.

It may be interesting to see a ranking of the MS with the highest modal share in freight railways (modal share in passenger transport is much lower, average 7.6% and differences are less marked).

Table 6. Rail modal share in land freight transport: EU Top 10 and DE/FR/UK/IT (2016)

Rank	MS	Modal share of rail
1	LV	71.4%
2	LT	63.8%
3	EE	42.9%
4	SI	33.3%
5	RO	29.5%
6	SE	29.4%
7	SK	28.8%
8	AT	28.4%
9	FI	26.8%
	HU	26.8%
12.	DE	18.2%
16.	IT	13.8%
18.	FR	10.5%
19.	UK	8%
-	*EU*	*16.6%*

Source: EU Transport in Figures 2018.

Countries with the highest rail modal share are:

- Small coastal CEEC (rank 1-4),
- RO (rank 5), also a CEEC with seaports,
- Large-area Nordic countries (SE-6, FI-9),
- Landlocked Central European transit countries (SK-7, AT-8, HU-9).

A major challenge is that the four largest EU economies all have a rail modal share at or below EU average. The high rail modal share of CEEC (7 of the top 10) might be due to a combination of Communist heavy-industry heritage, reindustrialisation and port hinterland transport.

2 Possible future ways to promote increased use of rail services

2.1 Transport pricing

As "neighbourhood effects", transport cause negative externalities, costs that the transport user does not cover. These external costs include[72]:

- accidents,
- noise,
- air pollution,
- climate change,
- effects on nature and landscape, water and soil,
- specific costs in urban areas (e.g. separation costs for pedestrians, costs of scarcity for non-motorised traffic),
- congestion (road) resp. scarcity (scheduled transport like rail).

The EC started the discussion on the internalisation of external cost in the transport sector in the mid-nineties[73]. Between 2006 and 2008 a strategy on estimating external cost was developed. The discussion on internalisation of external cost received new impetus with a recently published Study on Sustainable Transport Infrastructure Charging and Internalisation of Transport Externalities, commissioned by DG MOVE[74]. In this paper, overall external cost of transport in Europe is estimated at 987 BEUR p.a. (ca. 7% of GDP)[75]. A 2008 estimation had come to 510 BEUR excluding congestion and 660-760 BEUR including congestion, i.e. 4% of GDP without and 5-6% of GDP with congestion cost[76].

External cost per passenger-kilometre for electrified passenger rail transport is five times lower than for private cars and 40% lower than for bus transport. External cost per tonne-kilometre for transport with heavy duty road vehicles is about four times higher than for freight trains with electric traction. In 2016, road transport caused 83% of total EU external cost of transportation, rail transport 2%[77].

[72] Gibson 2014, p. 8-9.
[73] EC 1995.
[74] https://ec.europa.eu/transport/themes/sustainable-transport/internalisation-transport-external-costs_en
[75] Schroten 2019; EC 2019a.
[76] CER 2015.
[77] Schroten 2016, Executive Summary.

Figure 5. Average external cost of transport in the EU-27 2016

Vehicle category	Total external costs	Average external costs
Passenger transport modes	**Billion €**	**€-cent/pkm**
Passenger car	565	12.0
Bus/coach	19	3.6
Motorcycle	41	24.5
High speed train	1	1.3
Electric passenger train	11	2.6
Diesel passenger train		3.9
Aircraft	48[a]	3.4
Light commercial vehicles	**Billion €**	**€-cent/vkm**
Light Commercial vehicle	118	24.7
Freight transport modes	**Billion €**	**€-cent/tkm**
Heavy Goods Vehicle	78	4.2
Electric freight train	5	1.1
Diesel freight train		1.8
IWT vessel	3	1.9
Maritime vessel	98[a]	0.7

Source: Schroten 2019.

In competition with road, rail is at a serious disadvantage since it covers the major part of cost it causes, whereas road profits from large external cost unpaid-for by it. The tax revenues from passenger trains cover "overpay" their external cost (passenger cars 45%), freight trains with taxes cover half of their external cost via taxes, lorries just one third[78]. A similar point applies to air transport that also profits from tax-exempted fuel. "User-pays" and "polluter-pays" principles are an obvious approach towards a level playing field between the transport modes. They require however an exact or at least widely accepted method of monetising external cost and benefits[79]. The new DG MOVE Study mentioned above strongly advocates introduction resp. wider application of environmentally differentiated infrastructure charges for all transport modes[80], a policy that would favour rail transport.

A well-known example is the Swiss LSVA (Leistungsabhängige Schwerverkehrsabgabe; redevance poids lourds liée aux prestations - RPLP). It is a road toll system for heavy-duty vehicles covering all types of roads that were introduced in 2001. The external cost was included into the calculation; in 2008 calculatory external cost of 1,479 MCHF was almost matched by net revenues of 1,441 MCHF. The system is compliant with EU regulations since it is non-discriminatory. Two-thirds of the revenues go to the national level the major part of which is used for funding the large Alps-crossing rail tunnel projects. With a rail modal split of 60% in the Alps-crossing freight traffic, the Swiss approach is much more successful than those of the EU MS AT (29%) and FR (18%)[81].

[78] Schroten 2019, Executive Summary.
[79] Christopherson 2015, p. 8.
[80] Schroten 2019, Executive Summary.
[81] ARE 2015.

2.2 Suitability of the competition policy framework

Two aspects of competition policy shall be dealt with in this Chapter:

- Competitive award of public service contracts,
- European rail manufacturer champions in competition with China.

Public service contracts

According to Regulation (EC) 1370/2007[82], regional passenger rail transport has to be carried out and subsidised via public service contracts (PSC) that the competent authorities[83] conclude with railway undertakings. These contracts define public service obligations (PSO), compensation payments including exact calculation method resp. exclusive rights granted and how costs and income from ticket sales are distributed. Overcompensation is not allowed.

The Regulation also prescribes the awarding procedures. According to the amendments by Regulation (EU) 2016/2338 of 14.12.2016 (in force since 24.12.2017), PSC may on the one hand side be directly awarded to an internal operator in case of the competent authority being an LRA and the geographical scope being an urban agglomeration or a rural area. Direct awarding is also possible under certain circumstances like small transport volumes or temporary emergency measures. It is also allowed if the decision can be justified vis-à-vis the EC in terms of structural or geographical characteristics, quality or cost-efficiency. Directly awarded contracts have to be published and their validity may not exceed ten years[84].

In addition, unconditional direct awarding according to the previous version of Regulation 1370/2007 (Art. 5.6) is still generally allowed until 25.12.2023. Together with the maximum duration of ten years, this essentially means that de facto, direct awarding of rail passenger services PSC is still allowed for the next fourteen years[85].

The alternative foreseen in Regulation (EC) 1370/2007 (and clearly favoured by the EC) is non-discriminatory public tendering. However, especially concerning

[82] Regulation (EC) No 1370/2007 of the European Parliament and of the Council of 23 October 2007 on public passenger transport services by rail and by road and repealing Council Regulations (EEC) Nos 1191/69 and 1107/70 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:02007R1370-20171224

[83] "*any public authority or group of public authorities of a Member State or Member States which has the power to intervene in public passenger transport in a given geographical area or any body vested with such authority" (Regulation (EC) 1370/2007, Art. 1b)*).

[84] https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=LEGISSUM:l24488&from=EN

[85] The authors would like to thank Mr. Klaus Gstettenbauer (ERA, Austrian Ministry of Transport) for clarifications.

provision of rolling stock, new entrants are usually at a disadvantage vis-à-vis the incumbent that, as a state company, profits from the favourable financing conditions of the state and, as larger buyers from cheaper prices by the manufacturers. In order to provide a level playing field for new entrants, the competent authority is required to carry out a market study on the availability of rolling stock. It is possible for the competent authority to take measures like purchase of rolling stock and setting up a vehicle pool for the awarded railway undertaking, giving financial guarantees to the operator, guarantee a certain residual value after contract expiry or cooperate with other competent authorities[86].

It is important to note that, according to the Commission Guidelines on State aid for railway undertakings[87], it is very problematic for an IFI to subsidise the purchase of rolling stock. The rolling stock may only be used for urban, suburban or regional transport in a certain region and must be part of a coherent regional development strategy[88]. The vehicle pools mentioned in Regulation (EC) 1370/2007 provide a possibility for support of regional transport without distorting competition.

Public transport by tram or metro is not regulated by Regulation (EC) 1370/2007 but by Directive 2014/25/EU[89]. The latter essentially says that above a certain threshold these services must have a contractual basis. If the public authority issues a call for tender, it may not discriminate among the applicants[90]. There is, however, no obligation for public tendering.

Services under PSO make up about two thirds of the EU rail passenger market (ca. 280 billion passenger-kilometres of 424 billion passenger-kilometres in 2013). It is a growing market, despite competition from passenger cars and buses[91].

The PSO system has two inherent challenges. With its exclusive rights, it tends to produce monopolies, and with the high share of public funding, the logical focus of marketing activities can be more with the competent authority and less with the transport users.

[86] https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=LEGISSUM:l24488&from=EN
[87] Communication from the Commission - Community guidelines on State aid for railway undertakings (2008/C 184/07).
[88] https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=LEGISSUM:tr0004&from=EN
[89] Directive 2014/25/EU on procurement by entities operating in the water, energy, transport and postal services sectors.
[90] https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=LEGISSUM:240602_2&from=EN.
[91] SDG 2016.

Even if the liberalisation and market opening of EU railways already started in 1991 with Directive 91/440[92], the MS railway markets are still dominated by the incumbents, especially the passenger markets. In 13 of the 26 railway MS, non-incumbent railway undertakings have 0% market share in PSO transports, in another 7 less than 12%. Only in PL, PT, SE and UK non-incumbents have more than 50% market share[93]. In a 2016 Study on passenger rail traffic, Steer Davies Gleave point out that it is difficult to find evidence for the effects of competition in the rail market. However, it seems that often fares are lowered.[94]

A 2018 Eurobarometer survey showed that 66% are satisfied with the frequency of trains and 59% with punctuality and reliability. 80% are train users, mostly of suburban trains (67%). Only 22% use international trains[95], showing again the importance of regional railways. All in all, the results show that there is still room for improvement in the quality of European rail services.

From the perspective of LRAs the underlying quite sophisticated regulatory framework for PSC/PSO demonstrates the clear need to encourage the perception of local and regional rail transport as a task which would benefit from strong elements of MLG. The obvious first step is pro-active and transparent information to all stakeholders on available options in order to develop and promote fair and transparent solutions to incentivise such transport including cost-efficient approaches to the operation. In most MS this would be a task for authorities and infrastructure providers at national level.

Competition in railway manufacturing

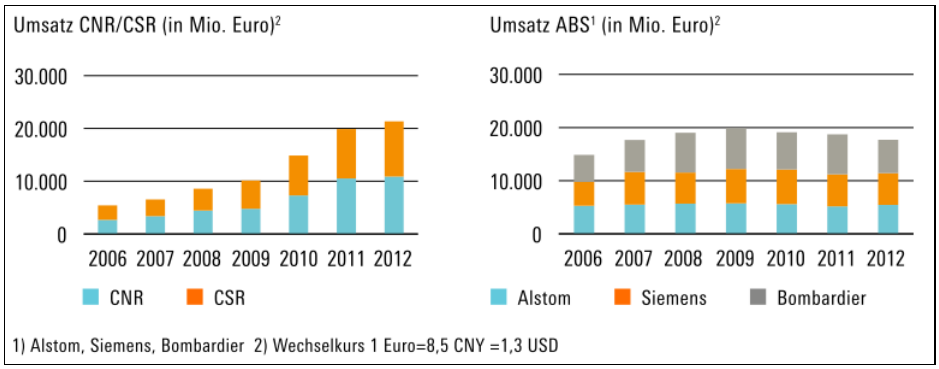
The planned fusion of the rail branches of the two largest European manufacturers of railway equipment, Siemens and Alstom, recently led to a diverse debate.

After notification on 08.06.2018, the European Commission, Competition Commissioner Margrethe Vestager, started an in-depth investigation of the planned acquisition of Alstom by Siemens in July 2018[96]. The two companies used to be the second and third largest supplier of rolling stock and signalling systems in the world (behind Canadian Bombardier). However, since 2010 the rapidly expanding Chinese competitors CNR and CSR had both overtaken the

[92] Now replaced by Directive 2012/34/EU of the European Parliament and of the Council of 21 November 2012 establishing a single European railway area https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1559906770578&uri=CELEX:02012L0034-20190101
[93] EC 2018a.
[94] SDG 2016.
[95] https://ec.europa.eu/transport/modes/rail/news/2018-09-18-eurobarometer-rail-satisfaction-europeans-increasingly-satisfied_en
[96] EC 2018b.

former Western market leaders, mainly relying on their home market[97]. In 2015, they merged to form CRRC Corporation Limited[98].

Figure 6. Revenues of the world's leading railway manufacturers in MEUR



Source: Lars Neumann - Walter Krippendorf 2016.

The EC feared a reduction of suppliers, loss of competition and market dominance in the EU market with the new Siemens-Alstom entity being three times larger than their closest competitor in the respective rolling stock and signalling equipment markets[99]. The two companies offered remedies[100].

- Concerning mainline signalling systems, the companies proposed a mix of assets, however in the opinion of the EC not offering an independent, stand-alone business entity that would have provided effective competition against the new merger on the market;

- Concerning very high-speed rolling stock, the companies proposed divesting the Pendolino (Alstom) or a restricted licence of Valero (Siemens) which the EC did not see as effective competition.

Since these proposed remedies were considered as insufficient, the EC decided on 06.02.2019 to prohibit the merger under the under the EU Merger Regulation. The EC stated that CRRC is not present in the EEA signalling market, and that is improbable new Chinese entrants into the European highspeed rolling stock market will put a serious competitive constraint on the incumbent suppliers[101].

However, rail industry lobbying organisation UNIFE pointed out that a consortium led by the Chinese state company China Road and Bridge Corporation

[97] Zimmermann 2016, p. 156.
[98] https://www.reuters.com/article/csr-corp-china-cnr-ma/chinas-trainmakers-complete-merger-adopt-crrc-as-new-name-idUSL5N0YN1WU20150601
[99] Zimmermann 2016, p. 156.
[100] EC 2019c.
[101] EC 2019d.

(CRBC) had recently won the 85%-EU-financed project to build Peljesac Bridge in Croatia[102]. UNIFE reminds of Art. 85.2 of the EU Procurement Directive 2014/25/EU allowing the rejection of bids if more than 50% of the value of products originates outside EU and Art. 86.5 according to which the EC can propose an implementing act to suspend third countries access to EU service contracts in case of unfair practices[103].

In a more general perspective, the example of a declined merger in rail industry points at a wider question for Europe as to whether:

- Further de-industrialisation is desirable.
- Maintaining major European industries or even fostering re-industrialisation is possible without protective steps in a global economic environment where trade regimes tend to become more volatile and disrupted by geopolitical considerations.

When looking at the map there is still quite a number of rail industries and manufacturers of equipment and rolling stock spread across Europe. In several countries these manufacturers rank among the remaining flagship industries but next to Siemens and Alstom these are much smaller and partly face obvious challenges to compete on a global market on their own. As has been mentioned the Procurement Directives leave some room to protect the European Market and there is a vivid political debate about trade practices between EU and China.

At this stage the Consultant cannot clearly say if the case of Siemens and Alstom is to the detriment of the European rail industry. It might also be an encouragement to deepen cooperation in certain fields and to go for smart specialisation in other fields. For competition on the global market strategic densely woven cooperation alliances might be an ancillary asset.

2.3 Key opportunities of digitalisation and automation

Since about two decades Information and Communication Technologies (ICT) are the key enabling technologies and have triggered also developments which are labelled as disruptive in some cases. Thus many ‘old industries’ such as rail or car manufacturing are confronted with a paradigm shift.

[102] UNIFE 2018ª.

[103] Directive 2014/25/EU of the European Parliament and of the Council of 26 February 2014on procurement by entities operating in the water, energy, transport and postal services sectors and repealing Directive 2004/17/EC. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02014L0025-20180101&from=EN

The European rail supply industry invests ca. 2.7% of its turnover into RTDI activities. The Shift2Rail initiative receives ca. 470 MEUR from the rail sector and 450 MEUR EU funding. The innovations mainly focus on[104]:

- Automatic obstacle detection
- Freight wagon bogies (track-friendly, silent, low-cost)
- Medium frequency traction transformers
- Energy storage technologies
- Improved regenerative braking
- Satellite-based positioning systems
- Hybrid and diesel electric technologies
- Lightweight materials

It is remarkable that only two of the eight innovation areas fall under the ICT category (Automatic obstacle detection and satellite-based positioning system). This might be an indicator of underdeveloped ICT in the rail sector. However, it also clearly shows that rail innovation policy should not exclusively focus on ICT.

The following table outlines the probable main areas for future digitalisation in the railway sector according to a recent vision paper of UNIFE[105].

Table 7. Probable main areas for future digitalisation

Area	Topics	Competences required
Data management[106]	▪ Traffic data management solutions (including ERTMS/ETCS) ▪ Asset data management solutions ▪ Energy data management solutions	▪ Increased importance of interlinked databases for asset and energy management leading to respective ICT skills requirements
Big data	▪ Maintenance prediction ▪ Network usage	▪ Increased importance of specialised ICT staff ▪ Changed maintenance and network planning has to be integrated in the curricula resp. training of maintenance staff
Cybersecurity	▪ Risk understanding by the staff ▪ Security-by-design Cybersecurity in the rail sector is vital given the enormous damage potential of a train.	▪ Has to be integrated in business processes with respective training of staff ▪ Dedicated cybersecurity departments

[104] UNIFE 2018b.
[105] UNIFE 2019a.
[106] UNIFE 2019b.

Area	Topics	Competences required
Artificial intelligence	▪ Train operations ▪ Autonomous driving (certified AI technologies for safety-critical applications) ▪ "Intelligent" maintenance concepts	▪ Increased importance of specialised ICT staff for the development of AI systems ▪ Has to be integrated in the curricula resp. training of train control staff ▪ Impact on train drivers should be monitored – decreasing attractiveness?
New mobility services	▪ Seamless door-to-door mobility based on integrated multimodal transport systems	▪ Cooperation of ICT, commercial and marketing departments
Digitalisation of freight logistics services	▪ Rail freight as part of a global digital logistics system (greater efficiency and lower costs)	▪ Cooperation of ICT, commercial and marketing departments

The table above as well as the reflections illustrate that the 'digital challenge' in the rail sector triggers similar developments respectively requires similar steps as in many other economic sectors:

- IT pervades all steps in production and service and acts as key enabling technology thus posing the need to establish IT departments at various levels – safety and reliability of IT services have turned into the key concern for operation thus requiring solid knowledge in-house or long-term relationships with reliable service providers.

- Job profiles in the rail sector have to follow these developments posing manifold new requirements; for railway companies it poses the key question which capacities should be developed in-house and which ones should be outsourced.

- Same as in all economic sectors the IT-related tasks are diverse and require a broad range of different skills ranging from the professional implementation of large–scale training for train conductors for the proficient use of new tools on-train to highly specialised works such the development of software for IT-supported maintenance monitoring and e-procurement in rail network management.

- User-friendliness is a key requirement since all age groups and all education levels are represented among the customers of rail services.

- In any case the competent rail IT manager/developer is a key job profile: such persons have to act as interlocutors between the different departments of the railway company and the software developers; such persons / experts need to understand the requirements of the department and at the same time have to 'translate' these requirements into the specifications for soft- and hardware development; when considering such key functions one could start reflecting on the development of an international curriculum for railway management thus also supporting cooperation among the educational facilities specialised on the rail sector.

A major difference to other sectors is that most probably the pace of the digitalisation can be 'governed 'to some extent owing to the fact that competition is less demanding. Developments which might happen at disruptive speed in other sectors – e.g. in automotive industries – might be subject of a more coordinated development in the rail sector.

From the perspective of LRAs the outline on the future focus of development points at the following aspects:

- LRAs being in charge of secondary railway lines the key interest in development of new technologies should be options to minimise operation cost and to maximise passenger or client[107] comfort for example through development of new mobility services – several of the areas mentioned in the table point at major potentialities in this regard.

- From the perspective of European rail manufacturing regions it is essential that producers partake in leading trends – LRAs might support this with an open-minded policy towards testing and introduction of new solutions on tracks which are under their management

2.4 Prudent land-use policies, smart urban development

Smart transport by rail requires smart and supportive planning frameworks. For the EU a growing number of residents in urban (agglomeration) areas is forecasted. Evidently urbanisation means growth of agglomeration areas.

Prudent development of secondary rail networks would depend on strong policy coordination in the fields of land-use and development of settlement areas. Foremost this is relevant in the fast expanding sub-urban potential commuter-catchment areas of larger cities. Servicing settlement areas by rail requires certain

[107] When considering freight transport.

density levels in housing, relatively short ways to the next stops and options to walk or cycle there in the best case.

It is essential that urban rail transport uses its proper position in policy debates on the EU Urban Agenda as well as in the discussion on Smart Urbanisation. Next to energy consumption of buildings, the energy consumption of transport and ICT are crucial elements to develop concepts and masterplans for smart cities.

2.5 Support of LRAs under the current legislative framework

European Regional Development Fund (ERDF) and Cohesion Fund (CF) are the main funding instruments. EU Cohesion Policy gives few overarching guidelines supporting a shift towards more sustainable (low carbon) transport. Setting the priorities as well as the implementation of Cohesion Policy is in hands of the Member States and corresponds mostly to national priorities. In particular in EU-13 the ERDF and CF are key instruments to finance transport infrastructure. Planning projects and providing access for LRAs to these funds is part of national government systems. The EU has introduced some supervisory levers in the programming process: The requirement for consistent transport strategies has been one of the ex-ante conditionalities set for the current period. Funding plans for the period 2014-20 still show a dominance of funding of road infrastructure (see table in Annex 2). Since transport projects – and in particular rail projects – take long periods to mature one cannot expect substantial changes to the use of the funds for the period 2014-20 in late 2019.

The Shift2Rail Joint Undertaking, established 2014, is a public-private partnership for the coordination of RTDI activities in the rail sector under Horizon 2020. Its initial budget was 920 MEUR (450 MEUR from Horizon 2020, 450 MEUR from the rail industry)[108]. It foresaw 1.513 BEUR for calls for proposals and tenders in 2019[109].

[108] https://ec.europa.eu/transport/modes/rail/shift2rail_en
[109] https://shift2rail.org/wp-content/uploads/2019/01/20181204-AWP-adotpted_Annex-Decision-19-2018.rev11012019.pdf

2.6 EU-funded investment opportunities post 2020

In 2016, the EC made a proposal for the new Multiannual Financing Framework 2021-2027. The volume of ERDF and CF – as the major options for rail transport projects under ESIF – will be most probably reduced: in case of CF from about 63.4 BEUR for the current period to 41 BEUR post 2020; in case of ERDF a reduction of 10% from the current level.[110]

ERDF will remain the key funding opportunity for investment into infrastructure to secondary railway lines – in particular in the EU-13 where own funding capacity of LRAs will remain limited.

Implicit support for rail transport will come from all levers for further 'greening' of ESIF. For this funding period minimum allocations to a low-carbon economy and sustainable urban development have been set. It is intended to continue having such overarching policy goals. Plans for the period 2021-207 promote 'thematic concentration'[111] – meaning a strong focus on RDTI and environment protection is proposed.

A key point is the interpretation of the proposed future Policy Objective (PO3) on transport (a More Connected Europe). In the context of secondary railways the most relevant Specific Objective is:

(iii) developing sustainable, climate resilient, intelligent and intermodal national, regional and local mobility, including improved access to TEN-T and cross-border mobility;

In the negotiations in programmes the Commission has a potential lever to direct the attention of MS to rail transport. Given the formulation of the Specific Objective it should be difficult for MS to argue a continuation of a dominance of funding for conventional road transport. Further targeted information on promising secondary lines in MS might be useful to prepare for the negotiations.

Funds for the Connecting Europe Facility (CEF, the funding programme for the implementation of the Trans-European Networks)[112] – as the funding facility relevant for transport directly managed by the Commission – is intended to be increased from 24 BEUR (for transport) to about 30 BEUR. The proposed

[110] About 200 BEUR.

[111] According to draft regulations for post 2020 for Policy Objectives 1 (RDTI) and 2 (environment protection) the proposal includes minimum shares according to GNI-based groups of MS whereas for Policy Objective 3 (transport) no such provisions have been included.

[112] http://www.europarl.europa.eu/legislative-train/theme-new-boost-for-jobs-growth-and-investment/file-mff-cef-2021-2027

nominal increase is challenged by interest groupings: UNIFE points out that the CEF budget is stagnating from the last period, where it was usually 2 to 6 times oversubscribed. It also mentions an estimation of railway investment requirements in Europe until 2030 of 430 BEUR[113]. According to EEA, average annual investment in rail infrastructure in Europe is ca. 35-40 BEUR or ca. 0.3% of GDP.

Horizon Europe should be the successor of Horizon 2020. Under Horizon Europe, 15 BEUR are foreseen under "Climate, Energy and Mobility"[114]. A new programme "Digital Europe" is foreseen with an allocated budget of 9.2 BEUR[115].

The only current major funding facility without a clear perspective for continuation is the European Fund for Strategic Investment (EFSI; Juncker Plan). Under EFSI a couple of projects related to rail transport have been implemented – an example is the purchase of energy-efficient commuter trains by ÖBB, the largest Austrian rail operator.

Table 8. Tentative summary of the assessment on EU funding opportunities post 2020

Funding option	Considerations
ERDF	The major opportunity for LRAs to fund rail infrastructure on secondary lines. EC has a major say in the approval of Operational or Regional Programmes (OP) on transport Shift of attention from road and TEN-T rail corridors to secondary rail connections will require 'nudging' in the coming months
CF, CEF	Focussed on TEN-T. But integrating a wider perspective on feeder lines as pre-condition for CEF-projects could be a lever to support a revival of secondary railway lines
Horizon Europe	In general Horizon Europe has suffered from comparatively low participation of LRAs – this is a major policy point which should be addressed prominently when debates on the actual programming for Horizon Europe starts. One can expect major RDTI activities but there is an obvious risk that – given the political weight of automotive industries in the EU - certain types of transport (such as Automated Mobility meaning largely the automated car) might be disproportionally favoured. Thus, it is essential to position rail transport also in other key EU policy fields such as the EU Urban Agenda.

Source: own considerations.

[113] UNIFE 2018a.
[114] FFG 2018.
[115] UNIFE 2019a.

2.7 Stimulating private investment

Essentially, private funds would be available. According to the "Christophersen-Bodewig-Secchi Report", European insurance and pension companies hold 12,000 BEUR of assets, more than 90 % of EU GDP. These institutions are interested in infrastructure debt since they are long-term and have a better yield than government or corporate bonds. This ideally matches long-term liabilities like pension or insurance pay-outs[116]. However, there are important challenges to raising private capital for the small-scale infrastructure that is usually needed for LRA.

Main instruments for private funding are concessions where interest and amortisation are paid by the state and the railways, cross-financing from project-related revenues resp. special taxes or public-private partnership (PPP). Main advantages of PPP are budgetary, efficiency-related or transactional (freeing capacity of the public partner), risks for the LRA are loss of control and rigidities in long-term contracts.

Rail projects generate revenues via the infrastructure charges stipulated in Directive 2012/34/EU. These fees are intended to cover *the cost that is directly incurred as a result of operating the train service* (Art. 31.3)[117] and may not be zero. PSC according to Regulation (EC) 1370/2007 allow for concession-type contracts including PSO-supported public transport operations.

PPP models do exist in the rail sector. One option are bi- or trimodal rail-road/water container transhipment terminals, generating not only the relatively low revenues from infrastructure charges, container lifts and logistics services, but also high revenues from renting out warehouses and logistics space. A pioneering example was the Cargo Center Graz in Southern Austria. Investment of ca. 210 MEUR (initially 65 MEUR) was co-financed by the Republic of Austria (47%) and the special purpose vehicle comprising local freight forwarders, local banks and the LRA Federal State of Styria (53%). A real estate developer constructed and financed the warehouses and leases them to the SPV[118].

[116] Christophersen 2015, p. 7.
[117] The concept is detailed in Commission Implementing Regulation (EU) 2015/909 of 12 June 2015 on the modalities for the calculation of the cost that is directly incurred as a result of operating the train service.
[118] www.cargo-center-graz.at/

Examples for railway lines include the Oresund link where revenues from road tolls cross-finance 95% of the rail investment (2.7 BEUR)[119] and the Ligne à grande vitesse (LGV) Tours-Bordeaux (7.8 BEUR, 48 % self-financing over a concession period of 50 years according to the underlying assumptions[120]).

However, regional rail projects on secondary lines carried out by LRA will usually generate low revenues because of limited demand. It is important to note that PPP structures may also be beneficiaries of ESIF (Regulation (EU) 1303/2013, Art. 63). Another challenge is that setting up PPP requires specialist skills that may not be available with all LRA. Especially a realistic risk assessment is required. The above-mentioned "Christophersen-Bodewig-Secchi Report" proposes technical assistance in this respect[121].

Since rail infrastructure projects have positive neighbourhood effects on the regional economy, special taxes based on these benefits can be levied[122]. Examples are the South Lake Union Streetcar in Seattle (56.4 MUSD), co-financed by a "Local improvement District" tax on real estate owners (25 MUSD)[123]. The Vienna "U-Bahn-Steuer" ("Subway tax") paid by the Viennese employers has been introduced in the 1970s to co-fund the extension of the metro network[124] (66.2 MEUR p.a. in 2014[125]).

Private transport project financing in the EU-28 amounted to 11.3 BEUR in 2014[126]. However, total transport infrastructure investment in Europe amounted to 101.7 BEUR in 2014[127] (EU-33 without Cyprus, Liechtenstein and Turkey). Although the sample slightly differs, the comparison hints at the proportions. Although considerable, private co-financing realistically cannot replace public infrastructure investment.

[119] https://www.oresundsbron.com/en/node/6738
[120] https://www.lisea.fr/
http://www.lefigaro.fr/societes/2015/03/12/20005-20150312ARTFIG00062-la-facture-tres-salee-de-tours-bordeaux-pour-la-sncf.php
http://france3-regions.blog.francetvinfo.fr/elus-et-citoyens/2016/02/07/lgv-tours-bordeaux-le-ppp-un-modele-economique-qui-deraille.html
[121] Christopherson 2015, p. 14.
[122] EY 2015, p. 12.
[123] https://www.fhwa.dot.gov/ipd/project_profiles/wa_slu_streetcar.aspx
Moudon 2007.
[124] Helml 2011.
[125] Rechnungshof 2017, p. 25.
[126] Makovšek 2018, p. 14.
[127] https://www.eea.europa.eu/data-and-maps/indicators/infrastructure-investments/assessment-3

From the current perspective, the financing of infrastructure for secondary railway lines appears to be the less prominent challenge compared to the long-term public subsidies required to fund operation. Incentives to attract private funding or PPP might be an option in specific cases of feeder lines for freight transport to better connect intermodal hubs such as ports or airports. To identify and define such projects requires a lot of expertise and LRAs will definitely require support and backing from authorities at national level to develop convincing 'bankable' projects. Still it would be worth an effort to do so.

3 Conclusion/recommendations

The major strength of secondary railway lines are: A full commuter train on an electrified track with electricity generated from reasonably sustainable sources is way more efficient than any average commuter car[128]. It is like that and will most probably remain so for the coming decades. None of the currently proposed future solutions of the automotive industries can come anyway near that levels of efficiency and effectiveness in peri-urban transport.

Rail as the energy-efficient climate-friendly transport mode for peri-urban and urban mobility

The fact that a growing number of EU residents lives in urban areas should be understood as one of the major opportunities to strengthen rail transport – given the major strength indicated above can be implemented as a result of prudent steps in several policy areas (see below).

There are visible trends which would favour a growing role of peri-urban and urban public rail transport:

- Rising cost of car ownership[129] and car usage[130] in urban areas;
- Rising cost of living (driven by rising cost for housing);
- Congestion problems in many EU cities (that realistically only the capacities provided by the rail transport can cover).

Players at all levels – meaning EU, national, regional and local policy-makers - are challenged to make clear statements on the fact that urban and peri-urban rail transport is one of the pillars of smart urban transport due to its outstanding features – to mention foremost energy-efficiency, low surface consumption and the capacity to handle peak hours.

Smart transport by rail requires smart and supportive planning frameworks

Urbanisation means growth of agglomeration areas. Prudent development of secondary rail networks would depend on strong policy coordination in the fields of land-use and development of settlement areas. Foremost this is relevant in the fast expanding sub-urban potential commuter-catchment areas of larger cities. Servicing settlement areas by rail requires certain density levels in housing,

[128] Average occupancy of cars according to EEA data: The most recent data for the average number of passengers per car (including the driver) for the countries sampled is approximately 1.45 passengers per vehicle (in the UK - 1.58; Germany - 1.42 and Netherlands - 1.38 passengers accordingly).
[129] Licensing, purchase (leasing), maintenance, insurance and taxation.
[130] Parking fees, tolled roads, fuel.

relatively short ways to the next stops and options to walk or cycle there in best case.

Rail mobility requires a solid trunk network and secondary feeder lines

The past decades have seen an investment focus on the construction of a high-speed or high-performance trunk networks of main lines – driven by national requirements but also by elements of the TEN-T. Next to this trunk network growing urban agglomerations as well as strengthening of secondary cities as regional growth poles offer sound growth prospects for peri-urban and regional rail.

For other types of secondary or tertiary rail connections the prospects are less clear. Bringing people 'from the road back to rail' would require dedicate action in many regions of the EU - it is an obvious challenge which requires comprehensive support. Evidently it would be a task best done in the frame of multi-level governance (MLG).

Even with ticket revenues rarely covering more than 30-40% of operations cost (and infrastructure fees covering even less), regional railway transport on secondary lines has many beneficial side-effects:

- Connectivity: cheap, efficient high-capacity connection with administrative centres, schools and hospitals, especially for pupils and elderly people;
- Job generation from construction and maintenance;
- Railways as one of the few employers in challenged rural areas;
- Industrial production benefits from, often requires rail connection for the transport of high volumes.

Economic challenge calls for cost-effective operation

The economic challenge inherent to secondary rail connections is:

- The low capacity of revenue-generation because of small demand resulting in few trains generating in turn low revenues from infrastructure fees
- The dominant position of the single or few railway operators and network providers and the inherent tendency to large-scale projects such as high-speed or high-capacity links which makes it difficult for LRAs to argue connections which are not part of main lines

Thus, it becomes evident that models supporting low operating costs are an essential pre-requirement to discuss the increased use or even the revitalisation of secondary railway lines. Funding of operations is mainly relevant for railway (and

sometimes bus) operations where Regulation (EC) No. 1370/2007 on PSO applies.

Regionalisation of railways

The importance of rail network arteries will look very different from a national as compared to a local or regional perspective. One of the factors favouring the revival of secondary railway lines could be the regionalisation of railways.

And this is less a discussion of infrastructure investment cost but rather of covering the operation cost in the long-run: The discussion of the re-use or upgrading or new construction of secondary railway has to focus on the coverage of operation cost as the cornerstone of an economically viable and sustainable connection.

Major points in favour of a regionalisation of railways are:

- A strong position of regions in the political-administrative system as well as in the market for railways services. The stronger their financing capacity and the better their position in the market for rail services the more political levers can be brought into the debate on the use of secondary lines.

- Fostering transparency in the cost of network management and services: seemingly it is a long pathway from former state monopolies to development of markets and alternative operators as well as fully transparent cost management of networks – LRA will often be in the position that guidance and advice from neutral third parties would be beneficial to decide on the best approach to cost-efficient solutions.

- Fostering options to reduce operating costs via regional vehicle pools, regional markets via tendering of concessions etc. Thus smaller and potentially more cost-efficient service providers might have a chance to enter the markets.

- For secondary lines it might be good to discuss some of the required technical standards: e.g. ERTMS requirements for regional railways operating on the secondary network are costly and more cost-efficient track control systems providing reasonable safety levels could be used.

From the perspective of LRAs the underlying quite sophisticated regulatory framework for PSC/PSO demonstrates the clear need to encourage the perception of local and regional rail transport as a task which would benefit from strong elements of MLG. The obvious first step is pro-active and transparent information

to all stakeholders on available options in order to develop and promote fair and transparent solutions to incentivise such transport including cost-efficient approaches to the operation. In most MS this would be a task for authorities and infrastructure providers at national level.

Financing

Across Europe rail transport is embedded in a difficult budgetary environment. In general one cannot expect that public budgets will offer increasing room for public investment. In most MS the rising cost for the social agenda limits any increase for spending on other public goods such as transportation. In transportation the investment in road networks still dominates.[131]

Pricing of motorised road transport is an important issue. Rail would benefit from the 'greening' of car and fuel taxation indirectly. As a second thought it is also evident that any additional revenues generated from 'environmental tax' on car and lorry traffic could be used to support investment and operation in public transport. The much lower external cost of rail transport justifies this kind of cross-subsidisation. But the decision to do so is up to the MS. Currently there are visible levers which would support such a debate.[132]However, motorised car transport is a sensitive political issue. This is mirrored by the very hesitant introduction of levies and taxes which would support a polluter-pays principle in motorised transport. To sum it up briefly: The potential options are manifold but up to now rather untested in practice.

From the existing EU policy and funding instruments, the best option for funding of secondary rail infrastructure projects is the ERDF as part of national operational programmes on transport or as part of ETC cross-border cooperation programmes: the Fund and the option to provide grants is by far the most attractive and currently the most realistic option for LRAs in particular in MS of the EU-13 where fiscal equalisation mechanisms hardly exist and thus investment capacity of LRAs is low. The situation from the current funding period will essentially not change for the period 2021-27 – except that a smaller budget has to be expected as a likely consequence of Brexit.

[131] Thus in future also rising budgets for road maintenance will be required.

[132] For example the Fridays for Future Movement across Europe or the fact that in large parts of Europe urban climate during spring and summer is marked by rising numbers of heat waves having major effect on the well-being of urban residents (and in case of urban climate the direct human influence on climate cannot be denied).

Mobility as a Service

Train operators have taken up the challenge and have made huge efforts towards developing customer-oriented services. The specificity of rail transport[133] is that it cannot provide the essential last mile. The obvious step is to start considering Mobility as a Service (MaaS) which is done to an increasing extent by all stakeholders. In these developments the role of LRAs is decisive. Just to give a few examples:

- Making train stations and stops attractive places offering amenities such as safe and easy parking for cycles and cars as well as WLAN and waiting zones.

- Either offering support to or developing environmentally friendly last mile offers for visitors (rail & bike, rail & taxi, rail & drive etc.).

- Cooperating with rail operators in the development of booking, ticketing and information packages (e.g. in tourism areas or secondary cities developing conference tourism etc.).

It is important to note that there is a plethora of comparatively cheap but important details which are decisive for passengers' perception on comfort.[134]

Rail industries as a solid employer with good growth prospects

In several MS rail industries rank among the industrial flagships. Estimated employment total is 1.8 million. On top of that railway operation employs in the EU about 500,000 persons working for railway operators. These are jobs which are usually spread throughout the territories thus being particularly valuable when it comes to less favoured areas.

On its own, the rail sector will probably not be able to make up for the expected job losses in the six times larger car industry. However, growth prospects of the sector are quite sound and skills requirements will increase in rail industries as well as in rail operation. But one cannot expect a leading role of LRAs in the area of Vocational Education and Training (VET) for the rail sector.

[133] In the sense rail transport is understood for this study, i.e. secondary railways which might also be part of peri-urban or urban railway systems.

[134] For example guidance to and in the stations for visitors, cleanliness if sanitary facilities, waiting zones and option to shop for daily needs, readability and audibility of train information etc.

Annexes

Annex 1: ÖBB apprenticeship professions

ÖBB offers apprenticeships for 22 professions that are listed below together with their descriptions.

Commercial apprenticeship

Office Assistant („Bürokaufmann/-frau“)

- Performance of activities related to incoming and outgoing mail
- Preparation of texts and documents on the basis of specifications in a correct and suitable form
- Procurement and inventory record keeping (such as office supplies, stationery, documents, and office equipment)
- Performance of tasks related to payment transactions
- Provision of information and support to customers
- Performance of administrative tasks using the company’s information and communication systems
- Cooperation in the company’s accounting and cost accounting
- Compilation, maintenance and evaluation of statistics, files and indexes
- Appropriate written and oral command of language and specialist terminology as well as use of job-related foreign language

Forwarding agent („Speditionskaufmann/-frau“)

- Provision, organisation and implementation of transport services, warehousing and ancillary forwarding services
- Selection and planning of the transport modes and main transport routes which are optimal in the respective case
- Cost accounting related to forwarding services (transport modes, customs, warehousing, insurance)
- Performance of job-related accounting tasks (cost accounting, cost-based pricing and controlling)
- Performance of customs formalities in global business transactions
- Organisation and implementation of goods traffic in the internal EU market
- Organisation and implementation of tasks related to storage management and logistic process control
- Customer advisory services and assistance
- Application of the company’s information and telecommunication technology equipment; work with PCs and networks

- Performance of tasks in compliance with relevant legal provisions (insurance, liability, modes of transport)
- Planning and control of workflows; assessment and documentation of rendered services; application of quality management systems
- Performance of simple tasks in logistics management
- Performance of administrative tasks using the company's information and communication systems
- Cooperation in the company's accounting and cost accounting
- Compilation, maintenance and evaluation of statistics, files and indexes
- Appropriate written and oral command of language and specialist terminology as well as use of job-related foreign language

Mobility Service („Mobilitätsservice")

- Provision of information and advisory services for customers on services provided by the company and its partner enterprises
- Customer and sales pitches, also in a foreign language
- Use of the company's marketing tools in the respective field; placement of products on the market (marketing)
- Performance of services or prompting of their performance
- Ability to plan, prepare, offer and sell the optimum transport services as the case requires
- Harmonisation of transport services with other enterprises
- Flexible response to disruption in service in accordance with customer requirements
- Performance of administrative tasks using the company's information and communication systems
- Cooperation in the company's accounting and cost accounting
- Compilation, maintenance and evaluation of statistics, files and indexes
- Appropriate written and oral command of language and specialist terminology as well as use of job-related foreign language

Technical apprenticeship

Electrical Engineering specialising in Plant and Industrial Engineering („Elektrotechnik – Anlagen- und Betriebstechnik“)

Basic and main module:

- Installation and commissioning of electrical machinery and devices and company-specific plants
- Servicing and maintenance of electrical machinery and devices, company-specific plants and systems related to building technology
- Search for and elimination of faults and defects of electrical machinery and devices, company-specific plants and systems related to building technology
- Installation, commissioning, testing, servicing and maintenance of systems of control and feedback control systems as well as search for and elimination of faults and defects of these systems
- Performance of the work taking into consideration relevant safety regulations, standards, environmental and quality standards
- Appropriate written and oral command of language and mode of expression as well as use of job-related foreign language

Training courses in one of the following special modules can be provided in addition to the basic and main module, with the aim of offering more in-depth know-how and specialisation.

Special module "Electrical Engineering for Railways" (newly introduced, since 2010):

- Performance of recurrent testing of electrical engineering systems of railways (power engineering and traction energy)
- Compilation of error diagnoses of electrical engineering systems of railways
- Acceptance of failure reports and implementation of emergency measures
- Performance of the work by taking the special risks of railway operations into account

Special module "Rail Safety Technology" (newly introduced, since 2010):

- Performance of recurrent testing of safety installations (e.g. signals, switches, signal boxes etc.)
- Servicing and maintenance of safety installations
- Search for and elimination of faults and defects on safety installations

- Acceptance of failure reports and implementation of emergency measures
- Performance of the work taking the special risks of railway operations into account

Special module "Railway Vehicle Technology" (newly introduced, since 2010):

- Performance of testing, disassembly and assembly work on freight cars or railway carriages
- Servicing and maintenance of freight cars or railway carriages
- Search for and elimination of faults and defects on freight cars or railway carriages
- Performance of work taking the special risks of freight cars or railway carriages into account

Special module "Railway Transport Engineering" (newly introduced, since 2010):

- Operation of traction units (electrical or diesel traction units) when railway running operations are restricted locally
- Application and implementation of company-specific and technical regulations of standards
- Customer-oriented behaviour and customer-oriented communication
- Performance of the work taking the special risks of railway vehicle operations into account

Special module "Railway Vehicle Maintenance Technology" (newly introduced, since 2010):

- Performance of testing, disassembly and assembly work on railway vehicles
- Servicing and maintenance of railway vehicles
- Search for and elimination of faults and defects on railway vehicles
- Performance of the work taking the special risks of railway vehicle operations into account

Special module "Railway Operations Technology" (newly introduced, since 2010):

- Secure operation of mechanical, electrical and electronic signal control systems, company-specific communication facilities, railway power supply systems and company-specific safety systems if necessary

- Application and implementation of the company's regulations of standards to attain the highest security of action
- Customer-oriented behaviour and customer-oriented communication
- Performance of the work taking the special risks of railway operations into account

Electrical Engineering specialising in Electrical Engineering and Building Technology („Elektrotechnik – Elektro- und Gebäudetechnik")
Basic and main module:

- Setup and commissioning of installations for energy production, transmission and distribution as well as of electrical machinery and devices
- Servicing and maintenance of installations for energy production, transmission and distribution as well as of electrical machinery and devices
- Search for and elimination of faults and defects of installations for energy production, transmission and distribution as well as of electrical machinery and devices
- Installation, commissioning, testing, servicing and maintenance of systems of control and feedback control systems as well as search for and elimination of faults and defects of these systems
- Performance of the work taking into consideration relevant safety regulations, standards, environmental and quality standards
- Appropriate written and oral command of language and mode of expression as well as use of job-related foreign language
-

Training courses in one of the following special modules can be provided in addition to the basic and main module, with the aim of offering more in-depth know-how and specialisation.

Special module "Electrical Engineering for Railways" (newly introduced, since 2010):

- Performance of recurrent testing of electrical engineering systems of railways (power engineering and traction energy)
- Compilation of error diagnoses of electrical engineering systems of railways
- Acceptance of failure reports and implementation of emergency measures
- Performance of the work by taking the special risks of railway operations into account

Special module "Rail Safety Technology" (newly introduced, since 2010):

- Performance of recurrent testing of safety installations (e.g. signals, switches, signal boxes etc.)
- Servicing and maintenance of safety installations
- Search for and elimination of faults and defects on safety installations
- Acceptance of failure reports and implementation of emergency measures
- Performance of the work taking the special risks of railway operations into account

Special module "Railway Vehicle Technology" (newly introduced, since 2010):

- Performance of testing, disassembly and assembly work on freight cars or railway carriages
- Servicing and maintenance of freight cars or railway carriages
- Search for and elimination of faults and defects on freight cars or railway carriages
- Performance of work taking the special risks of freight cars or railway carriages into account

Special module "Railway Transport Engineering" (newly introduced, since 2010):

- Operation of traction units (electrical or diesel traction units) when railway running operations are restricted locally
- Application and implementation of company-specific and technical regulations of standards
- Customer-oriented behaviour and customer-oriented communication
- Performance of the work taking the special risks of railway vehicle operations into account

Special module "Railway Vehicle Maintenance Technology" (newly introduced, since 2010):

- Performance of testing, disassembly and assembly work on railway vehicles
- Servicing and maintenance of railway vehicles
- Search for and elimination of faults and defects on railway vehicles
- Performance of the work taking the special risks of railway vehicle operations into account

Special module "Railway Operations Technology" (newly introduced, since 2010):

- Secure operation of mechanical, electrical and electronic signal control systems, company-specific communication facilities, railway power supply systems and company-specific safety systems if necessary
- Application and implementation of the company's regulations of standards to attain the highest security of action
- Customer-oriented behaviour and customer-oriented communication
- Performance of the work taking the special risks of railway operations into account

Electronic Engineering specialising in Applied Electronics („Elektronik – Angewandte Elektronik")

Basic and main module:

- Installation, commissioning and testing of electric, electronic and electropneumatic controls
- Systematic search, localisation and elimination of faults, defects and failures on electric, electronic and electropneumatic controls
- Maintenance and servicing of electric, electronic and electropneumatic controls
- Assembly, mounting, commissioning and testing of electric, electromechanical and mechanical devices and equipment
- Systematic search, localisation and elimination of faults, defects and failures on electric, electromechanical and mechanical devices and equipment
- Maintenance and servicing of electric, electromechanical and mechanical devices and equipment
- Performance of all tasks taking into consideration relevant quality, safety and environmental standards
- Appropriate written and oral command of language and specialist terminology as well as use of job-related foreign language

Training courses in one of the following special modules can be provided in addition to the basic and main module, with the aim of offering more in-depth know-how and specialisation.

Special module in railway telecommunications technology (newly introduced, since 2010)

- Installation of workstations at hotbox detectors, video systems, loudspeaker systems, clock systems, automatic train destination displays, computer-based train monitoring
- Acceptance of failure reports, preparation of failure diagnostics and launching of immediate measures
- Systematic search for failure on systems of the railway telecommunications technology as well as localisation and remedying of these failures
- Implementation of periodic inspections on systems
- Operation of helpdesk systems and workflow systems to process customer orders

Electronic Engineering specialising in Information and Telecommunications Technology („Elektronik – Informations- und Telekommunikationstechnik“)

Basic and main module:

- Installation, commissioning, testing and shielding of systems of the information and telecommunications technology
- Systematic search, localisation and elimination of faults, defects and failures on systems of the information and telecommunications technology
- Maintenance and servicing of systems of the information and telecommunications technology
- Installation, commissioning, testing and shielding of analogue and digital communication systems and their components
- Systematic search, localisation and elimination of faults, defects and failures on analogue and digital communication systems and their components
- Maintenance and servicing of analogue and digital communication systems and their components
- Performance of all tasks taking into consideration relevant quality, safety and environmental standards
- Appropriate written and oral command of language and specialist terminology as well as use of job-related foreign language

Training courses in one of the following special modules can be provided in addition to the basic and main module, with the aim of offering more in-depth know-how and specialisation.

Special module in railway telecommunications technology (newly introduced, since 2010):

- Installation of workstations at hotbox detectors, video systems, loudspeaker systems, clock systems, automatic train destination displays, computer-based train monitoring
- Acceptance of failure reports, preparation of failure diagnostics and launching of immediate measures
- Systematic search for failure on systems of the railway telecommunications technology as well as localisation and remedying of these failures
- Implementation of periodic inspections on systems
- Operation of helpdesk systems and workflow systems to process customer orders

"Metal Technology specialising in Mechanical Engineering („Metalltechnik – Maschinenbautechnik")

Basic and main module:

- Manufacture of specialist workpieces and components taking the prescribed standards related to fits into account as well as of shaft connections to transmit torques
- Production of sketches, single part and assembly drawings by using CAD
- Programming and operation of computer-based (CNC) machine tools
- Production, assembly, fitting and mounting of components, machines, devices, equipment and structures according to instructions and plans, also in conjunction with mechanical, pneumatic and hydraulic systems
- Disassembly, maintenance and servicing of components, machines, devices, equipment and structures, also in conjunction with mechanical, pneumatic and hydraulic systems
- Systematic search, localisation and elimination of faults, defects and failure to components, machines, devices, equipment and structures, also in conjunction with mechanical, pneumatic and hydraulic systems
- Collection and documentation of technical data on the workflow and the results of work
- Performance of the work taking into consideration relevant safety regulations, standards, environmental and quality standards
- Appropriate written and oral command of language and specialist terminology as well as use of job-related foreign language

Training courses in one of the following special modules can be provided in addition to the basic and main module, with the aim of offering more in-depth know-how and specialisation.

Mechatronics („Mechatronik“)

- Ability to read and apply technical documents
- Specification of steps, work equipment and working methods
- Planning and control of workflows; assessment of final results/the results of work; application of quality management systems
- Manufacture, processing and treatment of mechatronic parts; assembly and adjustment of mechatronic sub-assemblies and components
- Assembly, fitting and installation of mechanical, electrical and electronic elements, sub-assemblies and components
- Measurement and testing of parameters related to mechanical engineering as well as of electric variables
- Fitting, installation and testing of mechatronic hardware and software components
- Establishment and testing of electrical, pneumatic and hydraulic controls
- Programming and testing of mechatronic systems
- Assembly, fitting, examination, and testing of machinery, plants and installations
- Installation, fitting, testing, adjustment, operation and commissioning of enterprise-specific systems in equipment, machinery, and installations
- Maintenance and servicing of mechatronic systems
- Localisation, diagnosis and clearing of faults, defects and failures of mechatronic systems
- Establishment, examination and documentation of protective measures to prevent damage to persons and damage to property
- Performance of the work taking into consideration relevant safety regulations, standards and relevant environmental standards
- Collection and documentation of technical data on workflow and work results
- Advisory services for customers on the use, application and servicing of mechatronic systems
- Appropriate written and oral command of language and mode of expression as well as use of job-related foreign language

Metalworks („Metallbearbeitung“)

- Production of relevant workpieces and construction components taking the prescribed standards of fits into account
- Production of drafts and simple technical drawings according to standards
- Production, assembly, attaching and mounting of construction components, machinery, devices, equipment and constructions according to instructions and plans, also in conjunction with mechanical and pneumatic systems

- Dismounting, maintenance and servicing of construction components, machinery, devices, equipment and constructions, also in conjunction with mechanical and pneumatic systems
- Collection and documentation of technical data on the workflow and work results/final products
- Performance of the work taking into consideration relevant safety regulations, standards, environmental and quality standards
- Appropriate written and oral command of language and specialist terminology as well as use of job-related foreign language

Rail Track Construction Technology („Gleisbautechnik")

- Performance of measuring and surveying tasks by using occupation-specific surveying and locating equipment
- Manual processing and machining of materials such as wood, metal, plastic and concrete
- Cooperation in the storage and transport of materials (including prefabricated parts, bulk goods, rail track panels and switch grate panels) taking damage prevention into account
- Digging of ditches and trenches as well as production of linings and supports
- Production of foundations, including for platform edges, and relocation of simple concrete and reinforced concrete elements
- Production of different surface attachments and their substructures
- Production of the rail system, such as laying of tracks and switches on the subgrade, and mounting of rail track endings and rail track extension devices
- Performance of maintenance, fault-clearing and servicing tasks on rail track systems (such as adjustment of track gauges, switch openings and expansion gaps) and on other rail installations
- Setting up of railway crossings and level crossings
- Performance of tasks by taking into consideration relevant safety regulations and environmental standards
- Appropriate written and oral command of language and specialist terminology as well as use of job-related foreign language

Vehicle body construction („Karosseriebautechnik")

- Reading and application of technical documentation and work drawings
- Specification of steps, work equipment and working methods
- Planning and control of workflows; assessment of the results of work; performance of quality controls

- Appropriate selection, procurement and examination of required and suitable material and auxiliary material
- Treatment and processing of material (metal, plastic, wood and glass) while taking into account relevant safety regulations, standards, safety and environmental standards
- Manufacture and rebuilding of superstructures and trailers for motor vehicles
- Servicing, maintenance and repair of vehicle bodies and chassis
- Mounting and dismounting of vehicle parts, equipment and accessories
- Appropriate performance of function tests and quality controls
- Application of primer and paint to preserve and embellish surfaces
- Collection and documentation of technical data on workflow and work results
- Customer-oriented behaviour and customer support and advice
- Application of foreign language technical terms and expressions

Vehicle technology/lorries and systems electronics („Kraftfahrzeugtechnik/Nutzfahrzeuge“/“Kraftfahrzeugtechnik/Nutzfahrzeuge & Systemelektronik“)

- Read and interpret technical documents (blueprints, schematics, etc.)
- Checking damages to the vehicle by checking the main parts and components (chassis, engine, body) by means of mechanical, electrical and electronic measuring and testing procedures, perform diagnostics
- Select and procure materials, spare parts, tools and accessories
- Check components of the chassis (z. B. bodywork, suspension, steering, brakes, wheels)
- Perform repair work on mechanical, electro mechanical and electrical parts of the vehicle
- Replace parts that are exposed to severe stress (eg. as spark plugs, air filter)
- Materials such as metal parts, sheet metal and plastic parts process: measuring, filing, sawing, drilling, reaming, tapping, welding, grinding and abrasive cutting
- Install, maintain and repair electrical and electronic equipment, such as heating and air conditioning, hi-fi and radio systems, navigation systems, hands-free systems and alarm systems
- Regular service work such including legally prescribed checks: engine, brakes, lighting systems, exhaust emissions, etc. at respective test facilities and with different devices, documenting results
- Perform testing, service and repair work on alternative drive (eg. as electric motors, hybrid drives, fuel cell drives) with appropriate special education
- Check and replace hydraulic fluids and other liquids

- Advise and inform customers on the handling and maintenance of the vehicles
- Perform work protocols, maintenance and service protocols, lists, folders, briefcases, customers card files

Cleaning technology („Reinigungstechnik“)

- Evaluate and document the surfaces ned and substrates to be treated (natural and artificial stone, textile covers, glass, wood, metal surfaces, etc.), determine purification process, mix detergent
- Select suitable cleaning and maintenance procedures and the necessary machinery and equipment, e.g. vacuum sweepers, single disc, dry / wet vacuum cleaners, pressure washers, low-pressure cleaners, sandblasters, shampooing devices, scouring and vacuuming devices
- Identify and fix faults on the devices
- Clean and maintain interior and exterior surfaces (walls) of buildings, monuments, as well e.g. light and weather protection systems, shopping and exhibition areas, transport and transport facilities, outdoor lighting, signalling and traffic systems, workshops, machinery and production (industrial and commercial cleaning)
- Disinfecting e.g. healing, spa, health care facilities and hospitals, kitchens, food processing plants, tourism and leisure facilities, as well as systems of communication engineering, z. B. telephone or computer equipment
- Treat surfaces cleaned with impregnation and protection products
- Install and remove ladders and platforms
- Advise customers and handle complaints
- Use personal protective equipment, e.g. breathing and skin protection, safety harness and comply with all necessary safety measures and environmental standards

Annex 2: Funding plans

Table 9. Intended achievements of ESIF in 2014-2020[135]

Network	Rail (km)	Road (km)	Inland Waterways (IWW)		Urban transport (tram/metro)	Member States with most substantial investment plans
TEN-T new	1,230	2,007	N/A		N/A	Rail: ES, GR Road: PL, RO, GR, HU
TEN-T reconstructed	3,706	770	N/A		N/A	Rail: ES, PL, RO, LV Road: LV, LT, EE
New	932	3,094	N/A		102	Rail: ES Road: PL, RO, GR Urban transport: HU, SK
Reconstructed	5,929	9,317	932			Rail: PL, ES, RO Road: PL, RO, CZ, BG IWW: FR, CR
Totals	**11,797**	**15,188**	**932**		**102**	

[135] https://cohesiondata.ec.europa.eu/themes/7#; Open Data Platform for ESIF.

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