

FOSTER RAIL

Future of Surface Transport Research Rail

Coordination and Support Action

Grant Agreement No 605734

Date of Annex I against which the assessment will be made: 23-05-2013

Deliverable D2.5

Rail Business Reference Scenario

WP	2	Rail Business Scenarios
Task	2.5	Definition of a rail business reference scenario

Dissemination level¹	PU
Nature²	R

Due delivery date	M15
Actual delivery date	M15

Deliverable lead beneficiary	1	Deliverable responsible person	Dennis Schut
Email	schut@uic.org		

Other contributors to the deliverable	Wuppertal Institut – Claus Seibt EURNEX – Wolfgang H. Steinicke, Lennart Senge Leeds University – Chris Nash, Marc Wardman A3PS – Reinhard Pfliegl UITP – Mihai Barcanescu, Yves Amsler
--	---

Document Version	Date	Author(s)
0.1	02/08/2014	Claus Seibt/ Wolfgang H. Steinicke/ Chris Nash
0.2	16/10/2014	Chris Nash/ Wolfgang Steinicke
0.3	25/10/2014	Claus Seibt/ Chris Nash/ Wolfgang Steinicke

¹ Dissemination level: **PU** = Public, **PP** = Restricted to other programme participants (including the JU), **RE** = Restricted to a group specified by the consortium (including the JU), **CO** = Confidential, only for members of the consortium (including the JU)

² Nature of the deliverable: **R** = Report, **P** = Prototype, **D** = Demonstrator, **O** = Other

Table of Content

1. Executive Summary	3
2. Description of the Deliverable.....	6
3. Rail Business Reference Scenario	7
3.1 Long-distance passenger rail.....	9
3.2 Long-distance rail freight	10
3.3 Regional and urban rail freight	11
3.4 Regional and local passenger rail	12
3.5 Urban Rail systems.....	12
4. Conclusion	13
5. References	14

1. Executive Summary

Deliverable 2.5 presents the first outline of the FosterRail business reference scenario. The scenario will serve to frame and support the further detailing of the roadmaps developed in FosterRail. Conversely, the drafting of and getting consent to the technology roadmaps is expected to bring up further input to be fed back into the reference scenario. With the approach to further develop and consolidate the business reference scenario half way through the FosterRail project, this feedback will be implemented.

The business reference scenario gained consent in the FosterRail Futures Forum in March 2014 in Brussels. The scenario is based on an explorative forward looking exercise involving a broad range of stakeholders and experts representing the European rail community: from rail industry, rail operators, rail infrastructure providers, rail research and academia, rail related public policy and civil society actors. The approach refers to the renewed principles of the European Technology Platforms (ETPs), currently in debate, to serve as deliberation platforms among multiple stakeholders to gain consent to shared routeways for research and to commit to joint innovation actions.

The business reference scenario outline was structured and consented in three sections: a) socio-economic framework futures b) generic storylines regarding European Rail Area futures c) expectations and visions for five selected rail business areas. The following paragraphs provide a short abstract of the business scenario outline in the main text:

European and worldwide economies are growing and transport demand is increasing. The 21st century is proclaimed as the century of global trade and the century of Green Growth with European policies at the forefront. Socio-economic transition is driven by climate change and public health concerns. The European internal market is expected to be growing at a moderate rate with a broad diversity of regional economic development. Young, well educated population is moving to growing metropolitan areas. Deprived population, the elderly and very old are left back in shrinking territories. Ageing society is fading out beyond 2050 with baby boomers life-span limits. Successful migration policy is expected to feed the economy with human capital. Pro-active labour market policies may come back to tackle unemployment.

European rail industries are expanding. Rail operating companies are converging into door-to-door mobility providers. Barriers regarding rail liberalisation are still challenging due to comparative market advantages of large rail operators. European Unions regulatory power stays related to the coordination of the rail technical system, while market exploitation is expected to remain at the national and regional level. Many rail passenger services stay as public services. They are seen as crucial for social cohesion and regional development and thus are expected to remain under the governing power of national and regional authorities, although often in the form of public-private partnership.

An increasing number of the elderly are using rail despite all progress in car driver assistance systems. Many of them need support regarding access in railway stations and for ticketing. The very old and disabled need personal attendance. The ageing rail workforce leads to changing requirements in organisation. Beyond 2050 the rail system may become driverless due to a need for increased capacity and improved service levels.

Technological progress is heading towards new technologies for rail traffic management. Next generation train signalling and control devices are expected to shift from fixed block to moving block technologies. New light-weight materials are adopted in railcar design. Regulatory governance is expected to be further reformed to allow more radical technological change. Multi-constellation satellite systems (based on Galileo) including supporting and innovative sensors in rolling stock and infrastructure are expected to become next generation train control systems to improve the capacity of rail.

Sustainable mobility and climate action plans are foreseeing drastically to reduce CO₂ emissions by phasing out conventionally fuelled cars in urban areas. This presupposes shifting a substantial part of daily travelling to rail transit, metro and tramtrain systems. Sustainable mobility is demanding alternatives to car travelling and ownership. Cars may be expected in the future to be parked at the cities' periphery with metro and tram access.

Due to decreasing public budgets, least-cost infrastructure planning and cost-effective operation in past years, it is expected to be even more crucial for budgetary decisions. Renovation and refurbishment of existing infrastructure and rolling stock is expected to be prioritized before investing into new construction. Civil society opposition against financial risks of large infrastructure spending may underline this public investment strategy.

Long-distance passenger rail systems such as high-speed-rail have evolved across the world. Huge investments were made with high benefits for European rail industries. The European rail industry is expected to strengthen its lead supplier role. A consolidation of European HSR industries with one or two large European system providers is expected.

Large European rail operators are foreseen to drive HSR services in Europe. With rising prosperity, increasing household budget shares are expected to be spent on high and premium rail travel. A diversification of HSR train services is in progress. HSR services are e.g. increasingly used travelling from "regional metropolises" to metropolitan centres.

In Europe, long distance passenger HSR networks have evolved with dedicated high speed intersections and shared sections with other rail services. Due to a continuous demand for network renovation and maintenance the average speed is lower than ideal expected. High speed passenger services today use both dedicated new routes and (at lower speeds) upgraded existing routes. On dedicated new routes, distances of up to 800km may be covered in less than 4 hours, and on mixed infrastructure in 5-6 hours.

Long-distance rail services are diversifying. Next to the premium rail segment, low-budget/low-cost train offers are serving the needs of population with lower income. A renaissance of over-night trains is still uncertain. Today these services are still running at a deficit for rail operators. With rising energy costs as well as improved service concepts these trains may serve as cost-efficient alternatives to long distance overnight bus services.

For long-distance rail freight transport a consequent shift to rail strategy in accordance with the white paper is expected to be rolled out up to 2050. Long-distance freight transport chains for distances above 300 kilometres (vs. 1000 kilometres today) are foreseen to be shifted to a large extent to rail and waterborne. Strong rail links to European Union's neighbourhood countries and Eurasian rail connections are expected to be implemented.

Capacity for rail freight is increased by longer and higher capacity trains, dedicated rail freight corridors and faster freight trains equipped with floating block applications including particular high speed rail freight (HSRF) lines. Cargo handling and shunting in large freight hubs, in particular ports and trimodal hubs, is expected to be fully autonomous. Several new port-to-hinterland rail links are established with new sea routes and ports.,

A combined road-rail strategy is crucial to achieve the white paper targets. Although infrastructure capacity for rail is expected to increase, it may be still not sufficient to absorb the growing freight transport demand. Public budget constraints and public enmity against new infrastructure projects may presuppose to count on existing infrastructures, making them more societal compliant while at the same time increasing their capacity.

Regional and local logistics centres are expected to be highly self-sufficient regarding energy and material use and embedded in a smart grid infrastructure. In urban areas dispersion on the first and last mile may be organized by cyclo-logistics or electrified delivery fleets to achieve targets for zero emission and CO₂ neutral urban freight logistics.

With the roll out of the white paper strategy, in particular regional and local rail freight has to be revitalized. Large interregional freight hubs have to be integrated with regional hubs and urban logistics centres. High-volume bulk transport (e.g. for on-site transport) is expected to be transported under this strategy at least partly again by rail transport.

Regional rail freight is expected to be revitalized *inter alia* by public financial support for rail freight business. Intelligent road user charging and access regulations will support shifting particular freight transport volumes from road to rail. However, how far this trend takes off depends on regional policy engagement and willingness at the European policy level to support, or on the contrary to block off such regional strategies.

Regional and local area passenger rail is expected to expand its role as the main transport mode in urban areas. Access restrictions and charging for individual car travel support this trend. Regional and local climate strategies are targeting the reduction of conventionally fuelled vehicles. The increase in light rail transit, tram and bus services is expected to be enormous with such aims. Cycling and walking are main options for the first and last mile. Sufficient entrainment options for bikes (bikes in trains), bicycle parking and bicycle sharing have to be provided. City walking has to be better taken into account.

Mass transit in metropolitan areas is expected to be fully intermodal, with main shares among light rail, metro, tram, bus services and cycling and walking. Technologies are converging with tram and train into tramtrain systems and light-rail at the many routes without sufficient traffic to support automated metro systems. However, in areas where basic rail infrastructure does not yet exist, bus rapid transit systems may be given priority.

Building up and financing metropolitan and urban rail infrastructure in the 21st century is expected to be based on a diversity of public and private sector investment. In some regions in Europe urban transport may be in future up to 100% funded by the public and offered at low charges to local citizens to politically support a shift to public transport. Due to public budget constraints it is expected that decreasing budget shares may limit investment in new infrastructure and rolling stock, and lead to more emphasis on the refurbishment and renovation of existing infrastructure and equipment.

2. Description of the Deliverable

Deliverable 2.5 presents the first outline of the FosterRail business reference scenario. The purpose of the business reference scenario is to frame the follow-up roadmapping exercises in FosterRail. The business reference scenario represents a consented and agreed vision among a dedicated group of rail stakeholders and experts for the European rail system up to 2050 beyond. The scenario was jointly sketched out in an explorative forward looking exercise involving a range of stakeholders and experts representing the European rail community: from rail industry, rail operators, rail infrastructure providers, rail research and academia, public policy actors like ERA, EC and invited civil society actors. The business reference scenario will serve as a first draft outline. It will be reviewed and further developed in the second half of the FosterRail project.

The business reference scenario, presented in the following paragraph, is the outcome of the FosterRail Futures Forum in March 2014 in Brussels. The scenario is based on a joint exploratory forward looking and visioning exercise and represents informed opinion among all the participating stakeholders and experts. Around 30 experts and stakeholders were participating. The approach refers to an actual European Commission innovation policy concept. This concept, called responsible research and innovation (RRI), explicitly asks for inclusion of a wide range of stakeholders, including civil society organisations, into research and innovation strategy and priority setting. Furthermore the approach refers to the state of debate regarding renewed principles for the European Technology Platforms (ETP) to serve as deliberative multi stakeholder platforms to agree on routeways for research and innovation and to commit to joint research and innovation actions.

To implement a robust multi-stakeholder dialogue in FosterRail an exploratory forward looking methodology was taken up in the Rail Futures Forum. In the morning session a portfolio of four different sketches of potential rail futures was presented and discussed. These four scenarios represented potential futures of the rail system in Europe against the background of different possible socio-economic framework scenarios. Varying socio-economic trends and policy drivers were taken up to differentiate the four framework scenarios. In the Futures Forum the four scenario stories were further discussed and further worked out with additional storylines. This exercise resulted in improving the four final scenarios which had been outlined in Deliverable 2.3.

In the afternoon session, now informed by a variety of potential rail future scenarios against the background of differential socio-economic futures, the participants started to outline most likely rail business area visions for Europe up to 2050 taking into account all main types of rail operation: the European high speed rail area, the long-distance freight area, the regional and urban freight area, the regional and local passenger rail area, as well as urban rail operations. The morning exploratory exercise was crucial to keep the business area visions based on realistic expert expectations rather than blue skies visions. This type of informed visioning and scenario building process was successful and resulted in a sound and robust business reference scenario pointing at a desirable, but at the same time realistic transition of the European rail system up to 2050. The reference scenario will be presented in the following chapter.

3. Rail Business Reference Scenario

The following few paragraphs sketch out the expected socio-economic framework shaping European Rail up to 2050, agreed upon at the FosterRail Futures Forum.

European economies and economies worldwide are growing and thus transport demand is increasing up to 2050 and beyond. The 21st century is proclaimed as the century of global trade. Protectionism is expected to decrease multilateral trade policy coordination agreements. After the final negotiation of the free trade agreement with the US, negotiation regarding such agreements with other world regions like China and India are initiated.

Additionally, the 21st century is expected to be the century of Green Growth, with European policies and standards for environmental, climate, social and labour rights at the forefront. European ideas are governing sustainable development worldwide. The European knowledge economy is at the centre of this progress. Strict standards for carbon emission and internalisation of external costs drive technological progress and innovation.

European market integration is progressing. The European internal market is expected to grow in a moderate pace in the years until 2035 and beyond. But trade flows are increasingly dispersing across the world, with growing trade shares among other world regions and only moderately increasing trade shares toward Europe. The global and European socio-economic landscape is diverging into growing and shrinking regions: this re-regionalisation means wealthier and less wealthy districts and territories in Europe.

Re-regionalisation is opening another perspective. In a “Europe of regions” a broad diversity of regional economies is evolving. Priority is taken for self-sustaining and resilient regional and local economic structures. Regional economies of tomorrow are expected to be driven by a multiplicity of economic activities, not solely based on trade and commodities, but on sharing and barter economies, self provision and collective production and supply. Neighbourhood corporation, in particular in less wealthy regions, may operate energy supply and even public transport services.

Demographic change is affecting the social fabric in regions and districts. The young and well-educated population is moving to growing metropolitan areas where labour markets are still expanding. Deprived population, the elderly and very old are remaining in left back non-growing districts. A larger share of ageing population and population in general is expected to be healthier and more active. However, rising costs for social and health care for the very old are heavily stressing public and private household budgets.

Ageing society is fading out beyond 2050 with current baby boomer generation’s lifespan limits. This has to be taken into account, when reflecting demographic change and ageing. Successful migration policy and progressing education addressing life-long learning will be a main driver: feeding the economy with well educated human capital. Public policy at all governance levels may return to pro-active labour market policies to tackle unemployment.

Sustainable development goals are targeted at all European policy levels. Transition is driven by climate mitigation and adaptation, and increasing environmental impact and public health concerns interrelated to the transport system. Increasing oil and energy prices are putting a heavy burden on national economies as on individual households. Transaction

costs for transitions towards sustainability and climate mitigation and adaptation are high and thus respective policy, planning and deployment measures are only slowly taken up. To internalize external costs regulatory measures and pricing strategies are progressing. Infrastructure charging strategies are expected to be governed at the European level. Additional public and private sector cost burdens are expected with extreme weather events and subsequent environmental crises at a European and world wide scale.

Against the background of the above agreed socio-economic framework futures, the stakeholders and experts involved in the FosterRail Futures Forum started to sketch out rail related generic storylines to start drafting the initial rail business reference scenario.

European rail industries are expanding. Rail operating companies are converging into door-to-door mobility providers, not solely running mainline rail and rail transit, but a broad range of mobility services including last mile and integrated information and ticketing services. Rail operating companies are diversifying: new entrants, new services, innovative business ideas and concepts. Systemic barriers regarding rail liberalisation are still challenging: large incumbents have comparative advantages in European rail markets.

The European Union is further governing rail market integration by regulatory power, policy coordination and financial support for investment in rail infrastructure and research. The EU's regulatory power is mainly related to coordination of the technical side of the rail system. Institutional power regarding rail market up-take is, despite all European integration trends, expected to stay at the national and regional level. Rail passenger services are, as public services, crucial for social cohesion and regional economic growth and development, and thus are expected to remain genuinely governed by public-service contracts» with strong policy prioritisation (e.g. on quality standards) by public authorities.

Demographic change is showing up with an increasing number of elderly using rail services. Despite progress in autonomous driving and driver assistance systems for ambient driving, an increase in mainline rail passenger demand is expected. A growing number of elderly will need support in rail services, for example regarding access in railway stations and ticketing. Door-to-door services and support in interchanges will have a significant demand. The very old and disabled persons (all persons with reduced mobility) need personal assistance and attendance.

Demographic change regarding rail workforce leads to ageing human capital in the rail sector, with changing requirements regarding workforce organisation. Beyond 2050 the rail system may completely change towards driverless systems - due to a lack of human capital and to improve quality and frequency of service - at least for some workplace areas. Technological progress is heading towards novel technologies in intelligent transport systems (ITS) applications for rail traffic management. Next generation train signalling and control devices are expected to shift from fixed block to moving block technologies. Introduction of advanced so-called cooperative ITS systems (C-ITS) in the rail sector are heavily dependent on the diffusion of electrical braking in trains. New light materials adopted in railcar design may further enhance the next generation railways. Regulatory governance in the rail sector, e.g. regarding homologation of new technological systems, has to be further reformed to allow more radical changes in rail technologies and more radical technological innovation.

Technological progress is pushing the diffusion of the large technical system for rail traffic management ERTMS (ETCS Level 3) across Europe. The system was introduced to allow a fully interoperable European rail network. Galileo satellite navigation based train control and monitoring systems are expected to further support ERTMS. With the embedding of these applications (multi-constellation satellite systems, including supporting sensors in rolling stock and infrastructure) into ERTMS, these systems are expected to become the next generation train control and to strongly improve the capacity of rail.

Sustainable urban and regional mobility backbones are fully electrified rail transit, metro, tram and tramtrain systems. Sustainable mobility, regional and local climate action plans are foreseeing to drastically reduce CO₂ emissions in the mobility and transport sector by fading out conventionally fuelled vehicles in urban areas. This can only be based on a “shift to rail” strategy, shifting a significant part of daily travelling to rail mass transit, metro, tramtrain, bus services, and at first and last mile to walking and cycling. However, there is increasing civil society opposition against large infrastructure construction projects, not only due to environment and noise constraints, but in general against large public budget spending. Public participation and citizen involvement as democratic innovation is crucial for sustainable development with regards to appropriate rail infrastructure deployment.

Sustainable mobility demands alternatives to car travel and car ownership in urban areas. Alternatively fuelled and electrified vehicles are expected to be less restricted by the infrastructure to access urban areas in future. Conventional cars are expected to be parked at the cities’ periphery with good public metro and tram access to the parking sites. Smart and electrified systems will generally shape metropolitan areas (smart cities) of the future. However, due to investment in public transport and decreasing public budgets, cost-effective infrastructure planning and transport operations are expected to be even more crucial for budget decisions than today. Refurbishment of existing rolling stock and infrastructure is expected to be prioritized before constructing new infrastructure. Investing in renewable energy, e.g. with energy harvesting technologies along rail tracks and green power for the rail system of the future, is expected to be another priority area in rail.

In the afternoon, the scenario discussion was structured into five rail business areas: long-distance passenger rail area, long distance rail freight area, regional and urban rail freight area, regional and local passenger rail and metropolitan and inner city metro and tram area. For these five rail business areas the involved stakeholders and experts started to explore ideas (visioning) against the background of possible socio-economic- and European rail futures (generic storylines) explored in the morning session.

3.1 Long-distance passenger rail

Long-distance passenger rail systems such as high-speed-rail systems (HSR) have evolved across the world. Huge investments were taken into this economic sector with high benefits for European rail industries. The European rail industry in this business area is expected to further strengthen its global leadership in the rail supply market despite strong competition, in particular from Chinese, South-Korean and Japanese rail industries.

The consolidation of European HSR industries with one or two large European system providers, or the implementation of a “political lead market concept” with a single provider (“Airbus concept for HSR in Europe”), is expected for the years against a longer time horizon. In Asia, two or three large competitors are expected. HSR industries are organized as global innovation networks offering “all-inclusive, turn-key” solutions for infrastructure and rolling stock.

Regarding high-speed passenger rail, the large incumbent European rail operators are expected to drive European long-distance passenger rail. With rising prosperity, increasing household budget shares are expected to be spent on high and premium rail travel services. Rail users are expected to benefit from a wide range of comfortable and customized rail offers. A diversity of HSR train services are in trend: some of them not travelling to inner city centres but to hubs in the urban periphery, while others approaching inner city centres. HSR services are increasingly used by customers for travelling from “regional metropolises” to the metropolitan centres. Thus, high speed rail is broadening its functionalities as metropolitan express trains for daily commuting. In case of delay and disruption, provision for real time information and alternative routing for travelling in time is provided: smart and intelligent rail systems are embedded in “cyber-physical networks”, offering a simultaneous digital and physical connectedness.

In Europe, long distance passenger rail has evolved into a European-wide network with dedicated high speed intersections and shared sections with other rail services also connecting all core network airports preferably by high-speed rail. Due to this network character, attractive change options allow to reach more destinations. Due to a continuous demand for renovation and maintenance of the existing rail network and rail operation with a respectable number of train stops, the average speed is lower than at dedicated HSR infrastructure. Long distance, high speed rail in the European rail network allows travelling distances below 800 km in an average travelling time of 4-5-6 hours.

Long-distance rail services are diversifying. Novel services are offered by new entrants as well as by incumbents. Next to the premium rail segment, low-budget train services and an increasing number of bargain offers for rail services are serving the needs of population with lower income. A renaissance of over-night trains stays uncertain: today these services are in most cases loss making for operators, due to high personnel costs for operation. With rising fuel and energy prices as well as other concepts and regulations for over night train services they may get again economically feasible. Long distance bus services are already competing with rail services across Europe, are expected to progress in the future.

3.2 Long-distance rail freight

Regarding long-distance freight transport, a consequent shift to rail and waterborne strategy in accordance with the White Paper Transport is expected to be rolled out by 2050, supported by all relevant European stakeholders. Long-distance freight transport chains for distances above 300 kilometres (vs. 1000 kilometres today) are expected to be shifted to a large extent to rail and waterborne. Combined transport is established as the major freight transport mode for most logistics relations. Strong rail links to European Union’s neighbourhood countries and associated states (Russia, Turkey, Ukraine, etc.)

and some intercontinental Eurasian rail connections are expected to be implemented up to 2050. Several new port-to-hinterland railway links are established with new sea routes and ports, particularly in the very northern and south-eastern European territories. Capacity for rail freight is increased by longer and higher capacity trains, dedicated rail freight corridors at some European network intersections, faster freight trains equipped with moving block signalling – including some particular high speed rail freight (HSRF) – and fast rail freight services on some European rail freight corridors. Cargo handling and shunting in large freight hubs, in particular ports and trimodal hubs, is expected to be fully automated.

In parallel to the shift to rail strategy, road freight transport is still expected to grow. Alternative fuelling infrastructures for novel fuels based on natural gas, hydrogen and biofuels, and respective truck technologies (e.g. fuel cells, compressed hydrogen storage tanks) are expected to be available by 2050. Road freight transport progress is supported by smart road corridor and truck concepts (driver assistance systems, autonomous driving) as well as innovative types of loading units, fully interoperable with all other modes, e.g. new light container systems, swap bodies and cranable truck trailers.

A combined road-rail strategy, in particular on distances below 1000 kilometres, and appropriate integration among the road and rail networks, is crucial to achieve the white paper shift to rail and waterborne targets. Although infrastructure capacity for rail is expected to distinctly increase up to 2050, it may be still not sufficient to absorb the growing freight transport demand. Public budget constraints and public enmity and action against large infrastructure projects, due to environmental concerns and mistrust in large budget spending, may lead investments to be concentrated on existing infrastructures, making them more environmentally friendly and compliant to social and public health concerns – e.g. regarding noise and vibration –, while at the same time increasing their capacity (slot optimisation). Furthermore, it should be taken into account that, due to a range of potential reverse trends like upcoming trade protectionism, strongly increasing energy prices (peak oil), manufacturing and logistics' organisation may globally change. This may induce major transformations of production organisation and logistic chains. Driven by cyber-manufacturing (« fabricator »), re-regionalisation trends (« reshoring ») and local customized manufacturing concepts (« nearshoring ») transport demand may not grow as expected in today's economic growth prognoses.

3.3 Regional and urban rail freight

With the roll out of the EC Transport White Paper shift to rail and waterborne strategy, in particular regional and local rail freight has to be revitalized. This foresees, for example, to connect the large interregional freight hubs with regional hubs and urban logistics centres including the revitalisation of existing feeder lines to warehouses and company sites. Urban logistics centres are in the future expected to be fully embedded in regional logistics concepts. Even policy measures at the local level are expected shifting freight to rail. Single wagon and bulk freight are expected to increase. High-volume transport – e.g. on-site transport – is expected to be transported by rail and waterborne and not, like today, mostly by road. Swap bodies and containers will play a crucial role for these intermodal transport chains.

In a green economy regional and local logistics centres are expected to be highly self-sufficient regarding energy and material use (being at the same time sites for energy harvesting and recycling) and embedded in a smart grid infrastructure. In urban areas dispersion on the first and last mile may be organized by electrified delivery fleets and cyclo-logistics to achieve targets for zero emission and CO₂ neutral urban freight logistics.

Regional rail freight is expected to be revitalized *inter alia* by public support of rail freight operation, for example by introducing public service contracts (PSC) for regional rail freight operations as it is in some European member states already common to shift hazardous goods transport on rail. Intelligent road user charging and access regulations will additionally support to shift particular freight transport volumes from road to rail. However, how far this trend takes up depends on regional policy engagement and willingness at the European policy level to support or on the contrary to support such regional strategies. If fully unguided by public policy action, regional and local freight transport is expected to disintegrate into an « informal economy » with precariously employed shippers in a self-sustaining business environment and respective problems going along with this so called « mexicanisation of transport ».

3.4 Regional and local passenger rail

Regional and local area passenger rail is expected, like half a century ago before mass motorisation, to regain its role as the main transport mode not alone for daily commuting in metropolitan and wider urban areas. Access restrictions and charging for individual car travel in urban areas are supporting this trend. Regional and local climate strategies and actions are strongly targeting the reduction of conventionally fuelled vehicles. The increase in light rail transit, tram and bus services is expected to be enormous with such political targets. Cycling and walking are main options for the first and last mile. Sufficient entrainment options for bikes (bikes in trains), bicycle parking as bicycle sharing options have to be provided. City walking has to be better taken into account regarding station planning.

3.5 Urban rail systems

Mass transit in metropolitan areas is expected to be fully intermodal, with main shares among light rail, metro, tram, bus services and cycling and walking. Metropolitan and urban rail area systems are spreading all over the world. Technologies are converging with tram and train into tramtrain systems and light-rail with HSR to metropolitan express trains. Both systems are even converging with metro systems using underground networks in inner city areas. However, in areas where basic rail infrastructure is not already in place, bus rapid transit (BRT) systems may be considered potential before heavily investing in rail. Thus convergence with and integration of these different technologies and systems into an integrated transport network are expected for a next generation technology outlook. Building up and financing metropolitan and urban rail infrastructure in the 21st century will be based on a diversity of public and private sector financial investments. In some regions urban transport may be in the future heavily subsidised by the public and offered at very low charge to local citizens, to politically support a shift from individual to public transport.³

³ At this point expert opinion was strongly diverging, reflecting a multiplicity of opinion across Europe.

However, due to public budget constraints it is expected that in many cities and regions across Europe more emphasis will be given not investing in new infrastructure and rolling stock, but in the refurbishment and renovation of existing rolling stock and infrastructure. Life-cycle costs are expected to be most important for investment decisions: metro and tramway systems, being cost-efficient over their life-time and effective to maintain, are seen as one of the best available technology options for cost-effective public transport.

4. Conclusion

The above presented outline for the FosterRail rail business scenario is the outcome of the forward looking and visioning exercise in the FosterRail Futures Forum. Around 30 engaged stakeholders and experts of the European rail community participated and brought their knowledge together to jointly draft a first rail business reference scenario.. The worked out scenario is less a vision than experts' expectations and estimates of how the rail system in Europe may emerge and rail markets may develop up to 2050 and beyond. However, such a forward look based on experts' expectations remains uncertain.

The FosterRail Futures Forum was prepared by societal and economic trend analyses including a paragraph on transport demand prognoses and forecasts (« data referenced scenarios »), a paragraph on societal trends and drivers and an overview on other relevant scenario narratives and forward looking activities referring to the rail sector. These analyses resulted in deliverable 2.3. The deliverable was used in a short version as background paper to inform the discussion in the FosterRail Futures Forum. It was distributed to all invited stakeholders, who confirmed their participation in the Forum. The background paper served to structure the dialogue process during the Forum.

In futures research it is apparent that jointly discussing and drafting storylines and combining them to a coherent picture is not more than anticipating potential futures from a present perspective. The European experts and stakeholders in the Forum agreed a rather differentiated picture of the future. Public authority and budget spending for rail operation and infrastructure is for example expected to stay mainly at the national and regional level. European integration in the rail sector is mainly driving the technological sphere, e.g. by European regulatory governance and research funding. However, it is expected that European funding dedicated to rail infrastructure development may increase in the upcoming years to govern an integrated European rail network. Common opinion was that the European rail system is expected by 2050 being as federalist as the European Union: not a single, but a European rail system based on agreement and policy coordination.

The rail business reference scenario as outcome of the FosterRail Futures Forum will serve to frame and support the further detailing of the roadmaps developed in FosterRail. To work out roadmaps involves agreeing upon what public and private sector investments have to be taken up to successfully address a reference future. Thus the business reference scenario is expected to support the FosterRail roadmapping exercise. Conversely, drafting and agreeing the roadmaps may bring up further input to be fed back into the reference scenario as additional storylines. With the approach to further develop and consolidate the business reference scenario after halfway through FosterRail, this feedback will be taken up and implemented in the first round reference scenario.

5. References

Roadmap to a Single European Transport Area Towards a Competitive and Resource Efficient Transport System COM(2011) 144 final (European Commission, 2011)

Proposal for a Regulation of the European Parliament and of the Council on Union guidelines for the development of the trans-European transport network. COM/2011/0650 final/2 - 2011/0294 (COD) (European Commission, 2012)

Report on Transport Scenarios with a 20 and 40 Year Horizon (Tetraplan A/S, ITS University of Leeds et. al., 2009)

Europe 2020 - A strategy for smart, sustainable and inclusive growth COM(2010) 2020 final (European Commission, 2010)

White Paper 2011 - Roadmap to a Single European Transport Area - Towards a competitive and resource efficient transport system (European Commission, 2011)

4th Railway Package (European Commission, 2013)

ERRAC Roadmap Rail Business Scenarios (ERRAC Roadmap Consortium, 2012)

Rail Route 2050 – The sustainable backbone of the Single European Transport Area (ERRAC, 2012)

Challenge 2050 – The Rail Sector Vision (CER, EIM, UC, 2012)

Unife World Rail Market Study (Roland Berger, 2012)

UITP PTx2 (UITP, 2009)

DETRA D5.2 Optimised Pan-european Transport Research Work programme (2012)

Transport development in Asian Megacities (Morichi 2013)

The optimal setup of a rail system – Lessons learned from outside Europe (Roland Berger, 2012)

FORESEC D2.3 Global Trends and Actors Shaping European Security (2008)

Strategic Transport Infrastructure Needs to 2030 (OECD, 2011)

Krisen an Europas Grenzen (Hanns-Seidl-Stiftung, 2013)

The Academic Response to the Rail Technical Strategy 2012, Nov 2013

A sustainable transport vision for Germany (FHG ISI, 2011)

Rail Technical Strategy Europe (UIC, 2014)

Employment in the EU Transport Sector (European Commission, 2013)

We make it fly (Airbus Group, 2014)

A Vision for Railways in 2050 (OECD ITF, 2010)

Future Scenarios for the European Airline Industries (HHL, 2010)

European Foresight Platform ‘‘Smart Mobility 2050’’ Workshop paper Brussels June 2012

Think Railways Jose Viegas OECD ITF May 2014

FosterRail European Rail Futures 2050

(Rail Business Scenarios and Dialogue Forum Agenda (Working Paper), March 2014)

FosterRail D2.3 Report on Business Scenarios , May 2014