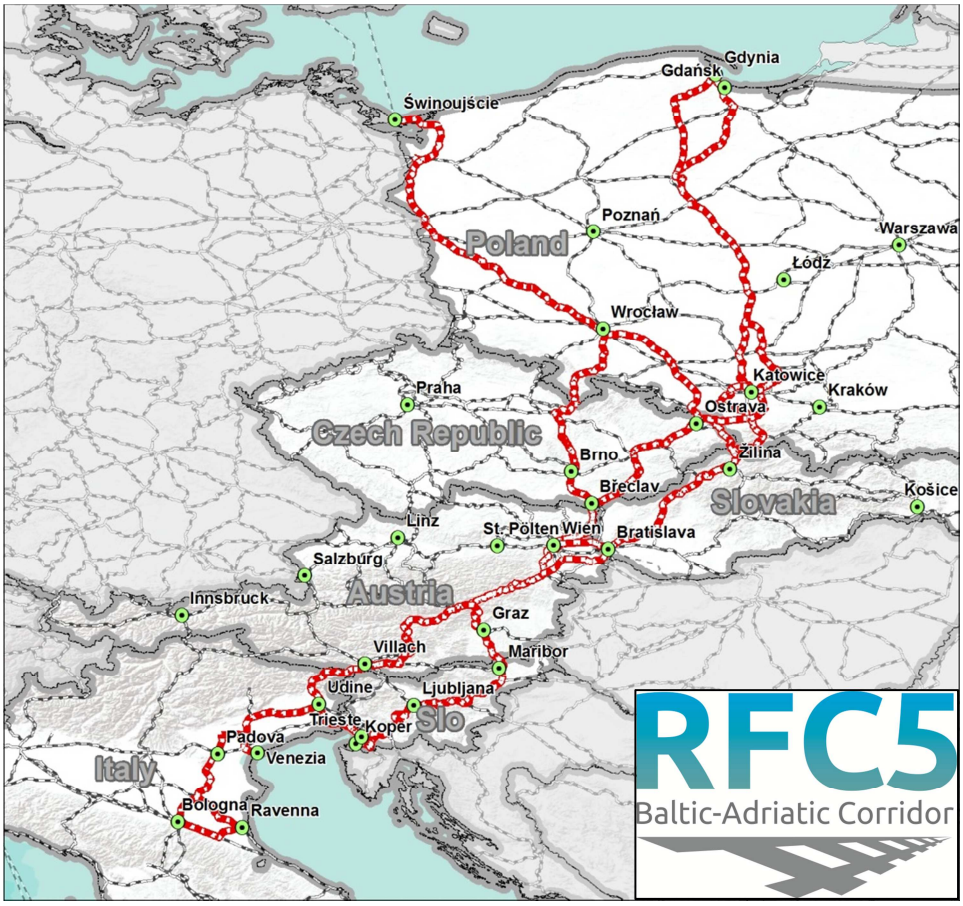
TRANSPORT MARKET STUDY ON EUROPEAN FREIGHT CORRIDOR 5

EXECUTIVE SUMMARY

January 2015



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AT ..... *Austria*
AŽP ..... *Public Agency of the Republic of Slovenia for Railway Transport*
BOKU (IVe) ..... *University of Natural Resources a. Life Sciences (Inst. for Transport Studies)*
CER ..... *Community of European Railway and Infrastructure Companies*
C-OSS ..... *Corridor One Stop Shop*
CZ ..... *Czech Republic*
EU ..... *European Union*
G ..... *Group*
GDP ..... *Gross domestic product*
IT ..... *Italia*
LPI ..... *Logistics Performance Index*
NUTS ..... *Nomenclature of Territorial Units for Statistics*
O/D ..... *Origin/Demand*
ÖBB ..... *Austrian State Railways*
OECD ..... *Organisation for Economic Co-operation and Development*
PAP ..... *Pre-arranged train paths*
PKP PLK S.A. ..... *Polish National Infrastructure Manager*
PL ..... *Poland*
PPS ..... *Purchasing Power Standard*
PRMTR ..... *World Bank's International Trade Department*
RFC ..... *Rail Freight Corridor*
RFI ..... *Italian State Railways*
RNE ..... *Rail Net Europe*
RP ..... *Revealed Preference*
RUs ..... *Railway undertakings*
SI ..... *Slovenia*
SK ..... *Slovakia*
SP ..... *Stated Preference*
SŽ ..... *Slovenian Railways*
SŽDC ..... *Railway Infrastructure Administration of Czech Republic*
T/P ..... *Terminal operators*
TEN-T ..... *Trans-European Transport Networks*
TMS ..... *Transport market study*
USD ..... *United States Dollar*
ŽSR ..... *Railways of the Slovak Republic*

1 Introduction

1.1 Background

In 2010 the European Parliament and the Council adopted EU Regulation 913/2010 concerning a European rail network for competitive freight. In this rail network, the EU has defined nine initial European freight corridors, which were complemented by EU Regulation 1316/2013. The European Freight Corridor 5, which is the topic in this paper, includes the railway connection between Świnoujście / Gdynia – Katowice – Ostrava / Žilina – Bratislava / Vienna / Klagenfurt – Udine – Venezia / Trieste / Bologna / Ravenna / Graz – Maribor – Ljubljana – Koper / Trieste.

The aim of the EU Regulation 913/2010 is:

- Improve the efficiency of rail freight transport relative to other modes of transport;
- Lay the groundwork for the provision of high-quality freight services meeting customer expectations;
- Develop the Rail Freight Corridors in terms of infrastructure capacity and performance in order to meet market demand both quantitatively and qualitatively.

In accordance with EU Regulation 913/2010, a Transport Market Study related to each freight corridor must be made.

The main objective of the Transport Market Study (TMS) for European Rail Freight Corridor 5 (RFC5) according to clients contract in 2013 is to provide a clear understanding of the current conditions of the multimodal freight market along the Corridor together with short- and long-term freight traffic forecasts consequent to the implementation of the Corridor at the end of year 2015, and also to propose a measurement of the expected modal shift from road to rail.

The TMS serves as the basis for the assessment of customer needs, through a corridor perspective. The TMS analyses and presents the main market elements of the RFC5 and contributes to the preparation of the Implementation Plan of the Corridor, pursuant to Art. 9 of the Regulation (EU) 913/2010.

The TMS is divided into three main parts, namely

- Phase I – Analysis of current situation
- Phase II – Survey
- Phase III – Short- and long-term forecasts.

1.2 Corridor overview and investigation area

Initial Rail Freight Corridor draft according to the EU Regulation No 913/2010 has been updated during the project. Additionally, requested from corridor countries, new branches were added: the axis Świnoujście – Wrocław – Międzylesie (border) on Poland site and from Międzylesie (border) to Břeclav on the Czech Republic site. Figure 1 shows the routing of Rail Freight Corridor 5 (RFC5) and the investigation area for modelling the effects of introducing RFC services.

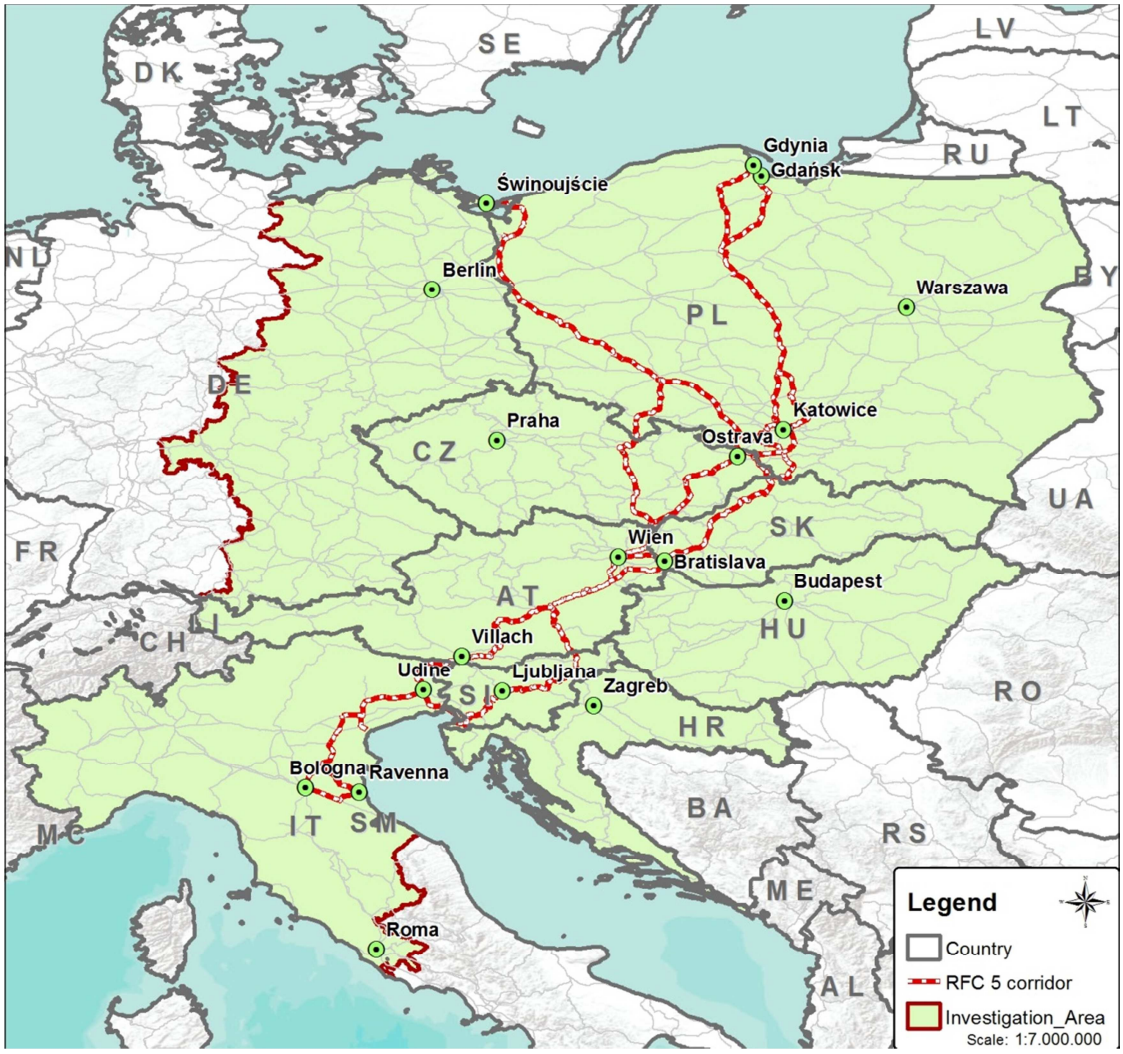

Figure 1: Routing of RFC5 and investigation area for modelling purposes

The investigation area in terms of main modelling area for the freight transport model includes all RFC5 countries inclusive the east part of Germany and whole Hungary as well as Croatia.

2 Phase I: Analysis of current situation

2.1 Socio-economic determinants and transport policies

The global interrelation of economic activity measured in Gross Domestic Product (GDP) and trade between 1970 and 2015 is depicted in Figure 2. Whereas the red line describes the development of trade growth[1], the blue line indicates changes in GDP[2]. It illustrates that trade has grown faster than GDP in the last 45 years.

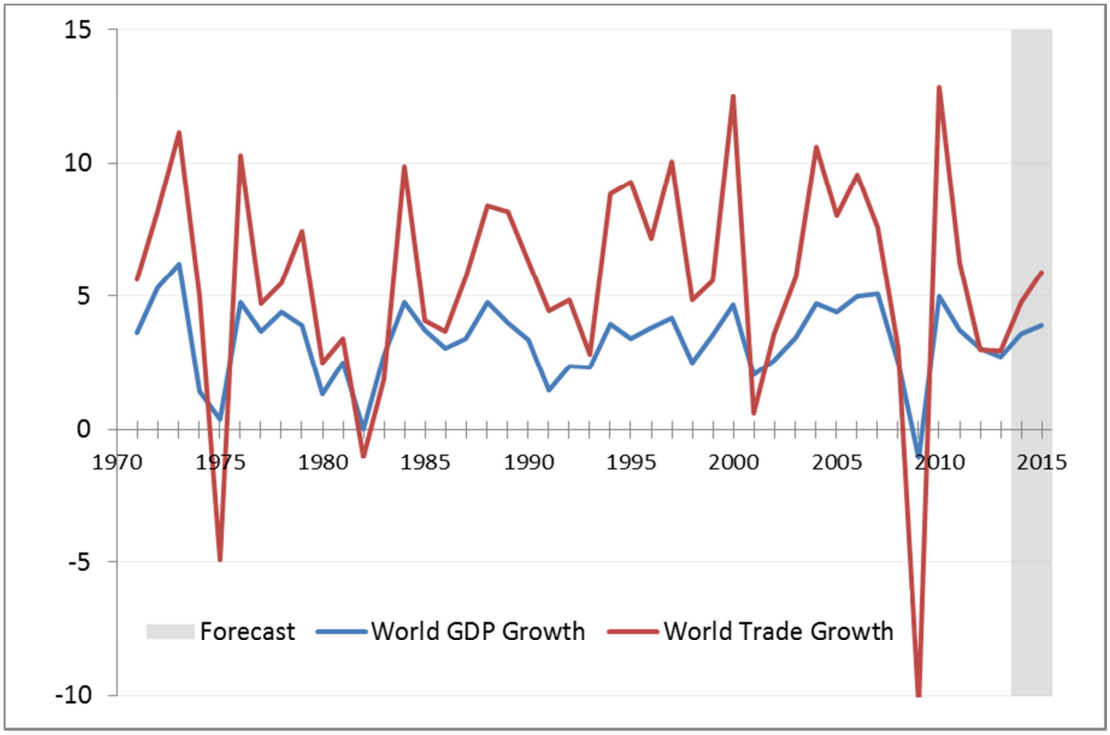

Figure 2: Development of GDP and world trade, 1970-2015

(Data source: OECD 2014).

When looking at long term developments it can be shown that the ratio of world trade growth and world GDP growth is roughly 2 to 1. However, the very recent figure for 2012 and 2013 do not reflect this relationship (they are almost equal). Reflecting the (slight) possibility that this 2:1 growth ratio represents a plateau phase and may decrease in the future[3], a lower trade to GDP growth ratio of 1:1 is used in the forecast scenarios in part 3 of this study.

[1] Trade in goods and services, 2005 USD at an annualized rate

[2] Volume or real GDP growth adjusted for price changes (inflation/deflation)

[3] Krugman, Paul (2013): Should slowing trade growth worry us? NY times blog entry, September 30, accessed 03.03.2014. http://krugman.blogs.nytimes.com/2013/09/30/should-slowing-trade-growth-worry-us/?_php=true&_type=blogs&_r=1

The analysis of trade flows shows that roughly three quarters of goods and services are traded within Europe. For this reason, an overview of the inner-EU trade relations with respect to the year 2012 is given in form of a so-called chord diagram. Country groups were generated where necessary – such as in the RFC5 case – in order to improve readability[4]. Figure 3 shows the pairwise trade relations of 2012 denominated in billion EUR in which trade flows are coloured according to colour of the country of origin. Germany clearly dominates the inner-European trade with export of 286 million tonnes (624 billion EUR) and imports of 382 million tonnes (593 billion EUR). The Netherlands are second, followed by the RFC5 country group with exports of 187 million tonnes (438 billion EUR) and imports of 197 million tonnes (435 billion EUR).

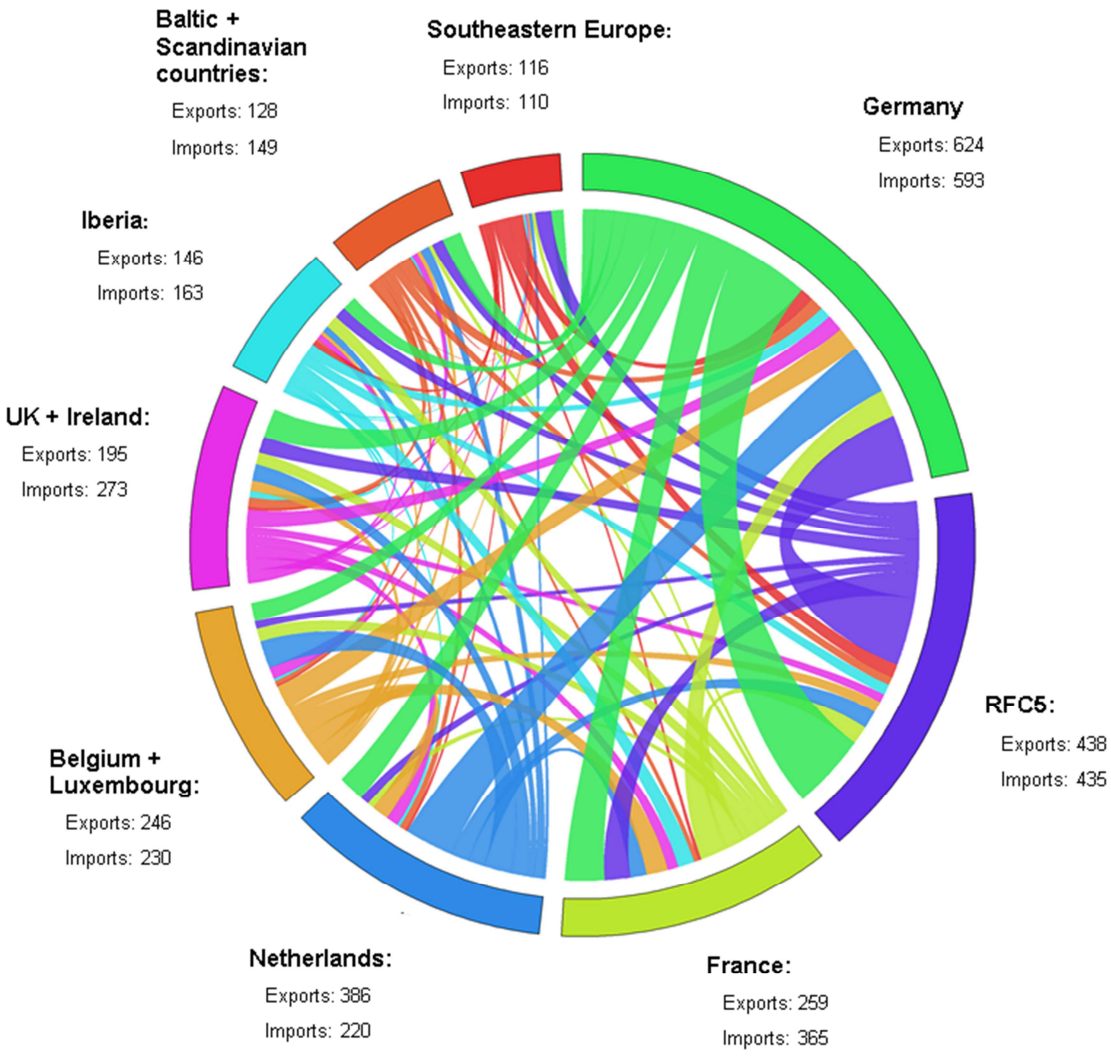

Figure 3: Intra-EU trade in Billion EUR, 2012.
Source: Comext Database, Note: Trade flows are coloured according to their country of origin.

[4] The following country groupings were formed: RFC5: CZ, IT, AT, PL, SI, SK; Southeastern Europe: BG, EL, HU, RO; Baltic and Scandinavian countries: EE, FI, LT, LV, SE; Iberia: ES, PT.

Transport can basically be interpreted as a downstream activity of trade which, in turn, is often explained by economic activity. The main indicator representing economic activity is the Gross Domestic Product (GDP). Another important measure of market demand is the purchasing power or GDP per capita, which indicates the per capita wealth of a region and acts as a demand or trade attracting factor (Figure 4). The following figure provides a geographical overview of GDP per capita.

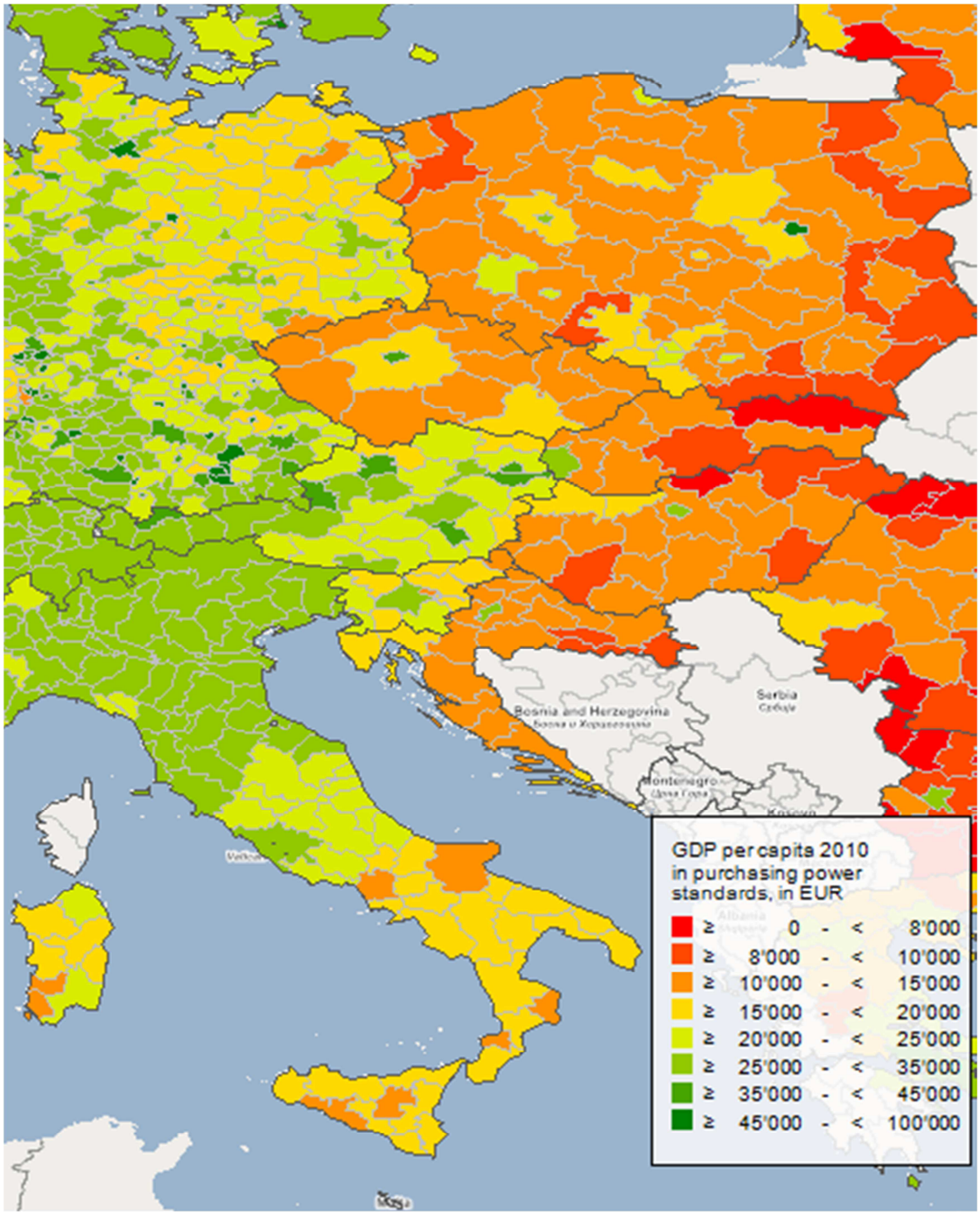

Figure 4: GDP per capita in purchasing power standards, 2010 in EUR
(Source: Eurostat)

Figure 4 shows the NUTS3 level distribution of regional GDP per capita in purchasing power standard (PPS). In general, cities and especially capitals including surrounding areas as well as ports have higher PPS-adjusted GDP per capita whereas some remote areas lie far below the EU average. Next to the historically inherited division of Eastern and Western European countries, the rather clear north-south divide in Italy is noticeable.

When analysing the development of GDP over the last 10 years, following conclusion can be derived: Especially Slovakia and Poland but as well Slovenia and the Czech Republic had GDP increases far above the European average. Whereas Italy shows a very weak economic performance. This supports the general picture that eastern European countries are economically catching up to western European countries and underlines efforts for strengthening infrastructure connections between those countries.

Finally, all socio-economic developments have to be considered in the light of policies. The topic of transport policies is regulated on various intersecting levels. Figure 5 gives an overview of the different policy levels influencing goods transport on both rail and road, and also emphasizes how these two areas complement and influence each other.

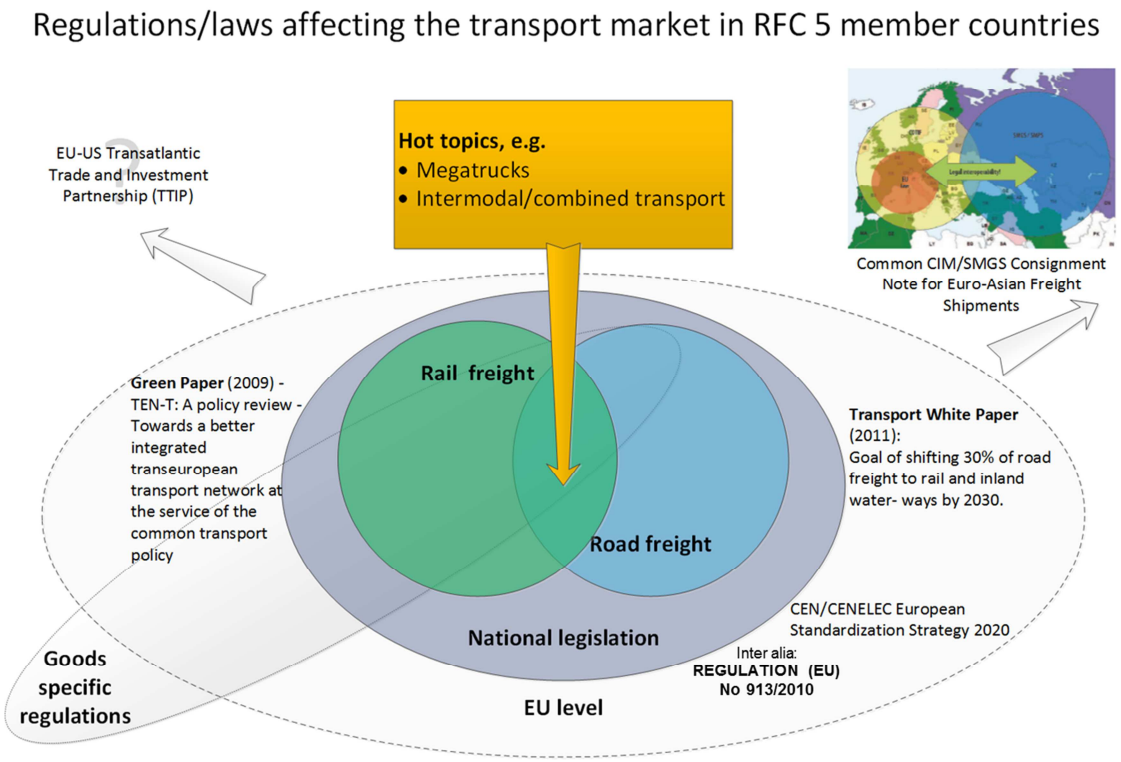

Figure 5: Overview of regulations and laws affecting the transport market in RFC5 member countries

Concluding on this, it is assumed that in the end costs will play a decisive role within the discussion of the future development of the European transport market. The most important cost factor in the future will be external effects and environmental considerations. Since these costs are usually not - or only partly - reflected in market prices, they should be subject to legislation. As rail transport generates the lowest specific CO2 emissions and is a more energy-efficient mode than road and air transport, future legal developments will most likely lead to significant cost advantages for rail, as external costs of transport become increasingly internalized.[5]

2.2 Transport market characteristics

In order to give an overview of the actual status of transport market characteristics the Logistics Performance Index (LPI) is used. The LPI is a rating compiled by the World Bank's International Trade Department (PRMTR). The assessment is performed by practitioners and a total of 155 countries are assessed by a weighted average of 6 different dimensions where every dimension can be scored from 1 (worst) to 5 (best)[6]. These are:

- Efficiency of the clearance process (i.e. speed, simplicity and predictability of formalities) by border control agencies, including Customs;
- Quality of trade and transport related infrastructure (e.g. ports, railroads, roads, information technology);
- Ease of arranging competitively priced shipments;
- Competence and quality of logistics services (e.g., transport operators, customs brokers);
- Ability to track and trace consignments;
- Timeliness of shipments in reaching destination within the scheduled or expected delivery time.

[5] CER - Community of European Railway and Infrastructure Companies (2013): Rail Freight Status Report 2013. Rail Freight after a decade of EU rail policy, April 2013, accessed 03.03.2014. http://www.cit-rail.org/files/public/Publications/FINAL_2__CER_Rail_Freight_Status_Report_2013.pdf?cid=388

[6] The World Bank (2012): Connecting to Compete 2012 - Trade Logistics in the Global Economy - The Logistics Performance Index and Its Indicators, Washington.

Table 1: LPI overall score and partial scores for 2012

Source: The World Bank, 2012[7]

Country	Overall Rank	Score	Scores					
			Customs	Infrastructure	Int. Shipment	Log. Quality	Tracking & Tracing	Timeliness
Austria	11	3.89	3.77	4.05	3.71	4.1	3.97	3.79
Italy	24	3.67	3.34	3.74	3.53	3.65	3.73	4.05
Poland	30	3.43	3.3	3.1	3.47	3.3	3.32	4.04
Slovenia	34	3.29	3.05	3.24	3.34	3.25	3.2	3.6
Czech Republic	44	3.14	2.95	2.96	3.01	3.34	3.17	3.4
Slovakia	51	3.03	2.88	2.99	2.84	3.07	2.84	3.57

In the Tables the countries are ordered by their overall rank and the best (green) and weakest (red) scores for the respective country are marked. What is striking for both reports is the fact that, except for Austria in 2012, all RFC5-Countries reach their highest scores in the dimension of Timeliness. The most common problematic factors identified are the customs procedures, where all countries score quite low results. Regarding the establishing of the RFC5 the weak Polish result for the infrastructure dimension in both years might be somewhat offset in the future[8].

Due to text efficiency no more detailed market analysis is given in the Executive Summary. If interested in further indicators on country level, a regional assessment of every national market and lists of most important terminals and relevant companies within the transport market, please refer to main report of TMS.

As a conclusion to transport market analysis of RFC5 region there are three major scenarios that will influence the transport flows significantly. These will be presented here in a condensed way.

- Sea shipping shift to Adriatic ports: Due to the investment and upgrading plans of most of the Adriatic ports, it can be assumed, that the quantity of goods that have to be transferred from and to them will significantly rise over the coming years. Therefore the hinterland connection and with it the RFC5 will become

[7] The World Bank (2012): Connecting to Compete 2012 - Trade Logistics in the Global Economy - The Logistics Performance Index and Its Indicators, Washington.

[8] The World Bank (2012): Connecting to Compete 2012 - Trade Logistics in the Global Economy - The Logistics Performance Index and Its Indicators, Washington.

increasingly important. Effects of these developments are explicitly covered in the freight transport model.

- Establishing of connection points to the Euro-Russian/Asian-Rail-System: This topic has been elaborated for a long time and many a study have been carried out to show the economic benefits of a link between the Russian broad gauge system and the central European rail system. Should these plans be realized, large amounts of rail bound goods would have to be distributed along the route of RFC5, as it will traverse the potential inbound and outbound lanes towards Russia and the whole Asian area. However due to the recent geopolitical developments involving Russia and the Ukraine, a completion of this project in the foreseeable future seems highly unlikely and therefore, effects were not included in the forecasts.
- Economic development of the Baltic ports and southern Poland: Mainly this point is an inner Polish matter, as the goods needed for the industrial production in the southern Polish regions will largely be imported through the North Sea and Baltic. However this will put pressure on the RFC5-Infrastructure to allow for larger amounts of goods being handled and transported along the now proposed lines. This topic is indirectly covered in the forecasts due to the inclusion of all relevant infrastructure investments along the RFC5.

2.3 Transport supply

The total length of the suggested RFC5 route is approximately 4400 km inclusive all side-branches. Most of the Rail Freight Corridor 5 is on the level of 2-tracks but around 15% of total Corridor length is only single track. Almost whole Corridor 5 route is electrified except west branch Gdynia – Bydgoszcz in Poland and Bratislava-Vienna via Marchegg, but there can be found three different electric systems along RFC5.

To give an impression of the rail transportation network in the investigation area, Figure 6 shows main rail network including RFC5 and all other relevant Rail Freight Corridors in this part of Europe.

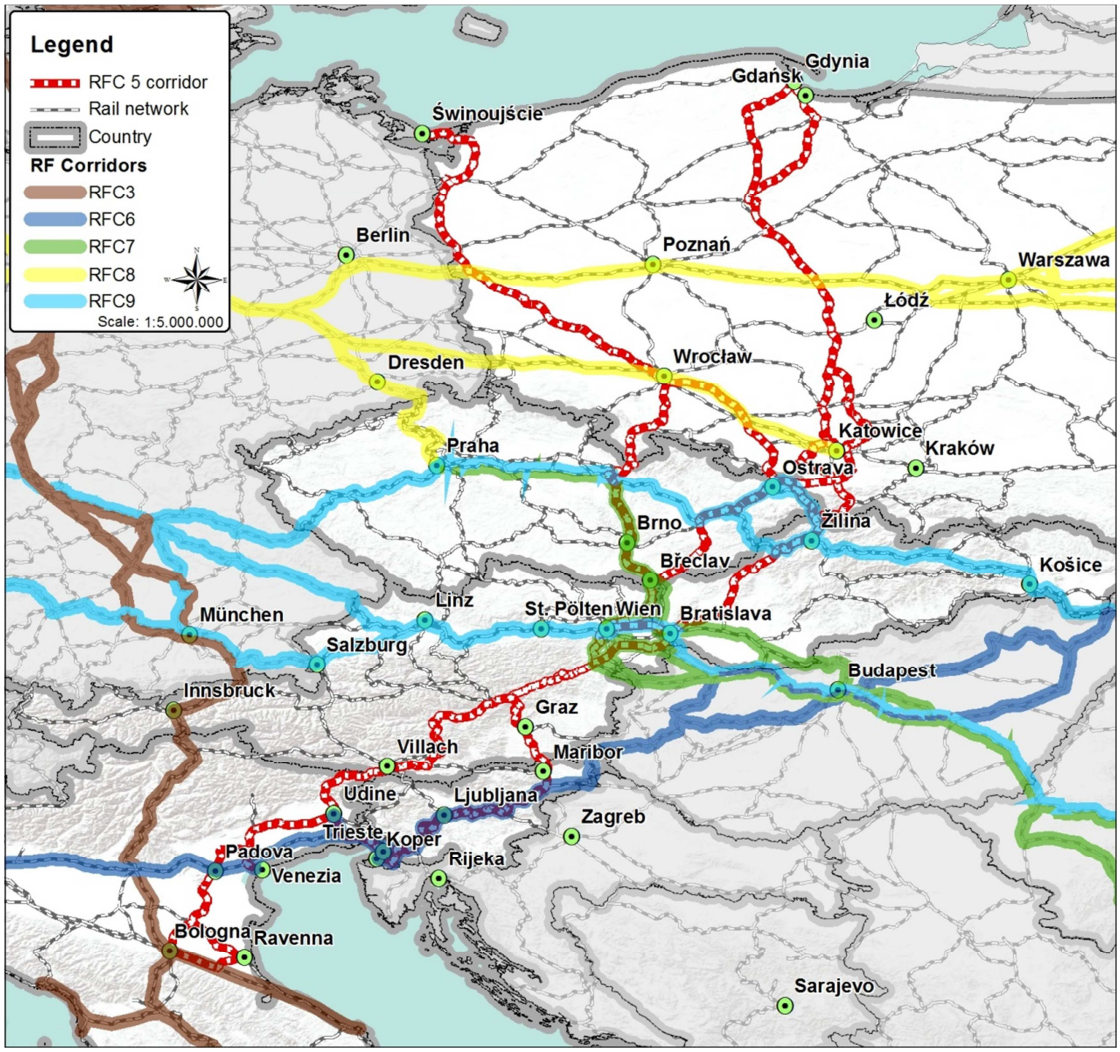

Figure 6: Rail Freight Corridor 5 (RFC5) and connections to other RFCs

Source: RNE, 2014

Main competing mode to rail transport on the RFC5 is road transport and therefore Figure 7 shows the comparison of road and rail network density for every RFC5 country in the year 2012. Since road statistics include only motorways, road density level is lower in all countries. Still it can be seen, that all countries have a quite well developed rail network. In Poland along RFC5 is A1 Motorway under construction and will be full developed until 2015. Along the other parts of Corridor 5 (Austria, Czech Republic, Slovakia, Slovenia and Italy), there can be found a good developed road network consisting of motorways with two or more lanes per direction.

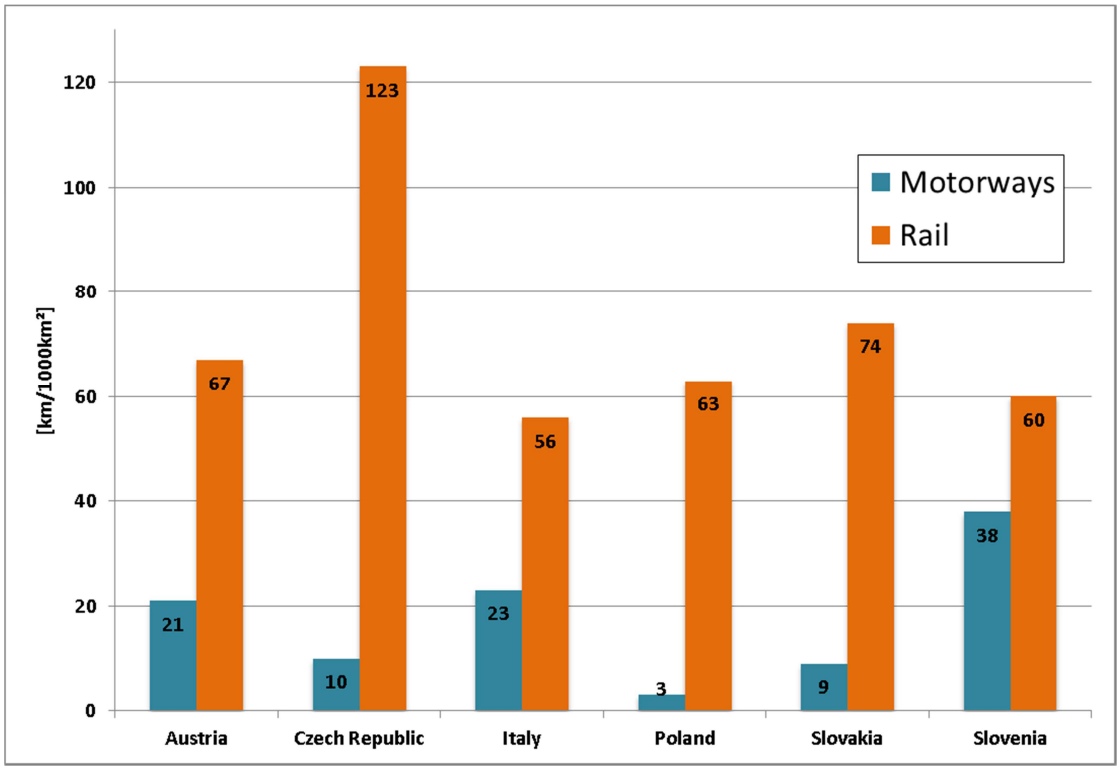

Figure 7: Road and rail network density per RFC5 country for 2012

Source: Eurostat table [tran_r_net]

Finally, Figure 8 shows a summary of the initial Corridor 5 rail route (state July 2014), with the main characteristics based on the RailNet Corridor 7, including important nodes (seaports, bigger cities and important terminals) and their multimodality and also Rail Freight Corridors that are crossing/connecting Corridor 5. Given transportation times between main nodes refer to block trains. New side branch Świnoujście – Wrocław – Międzylesie (border) in Poland and from Międzylesie (border) to Břeclav in the Czech Republic is not shown.

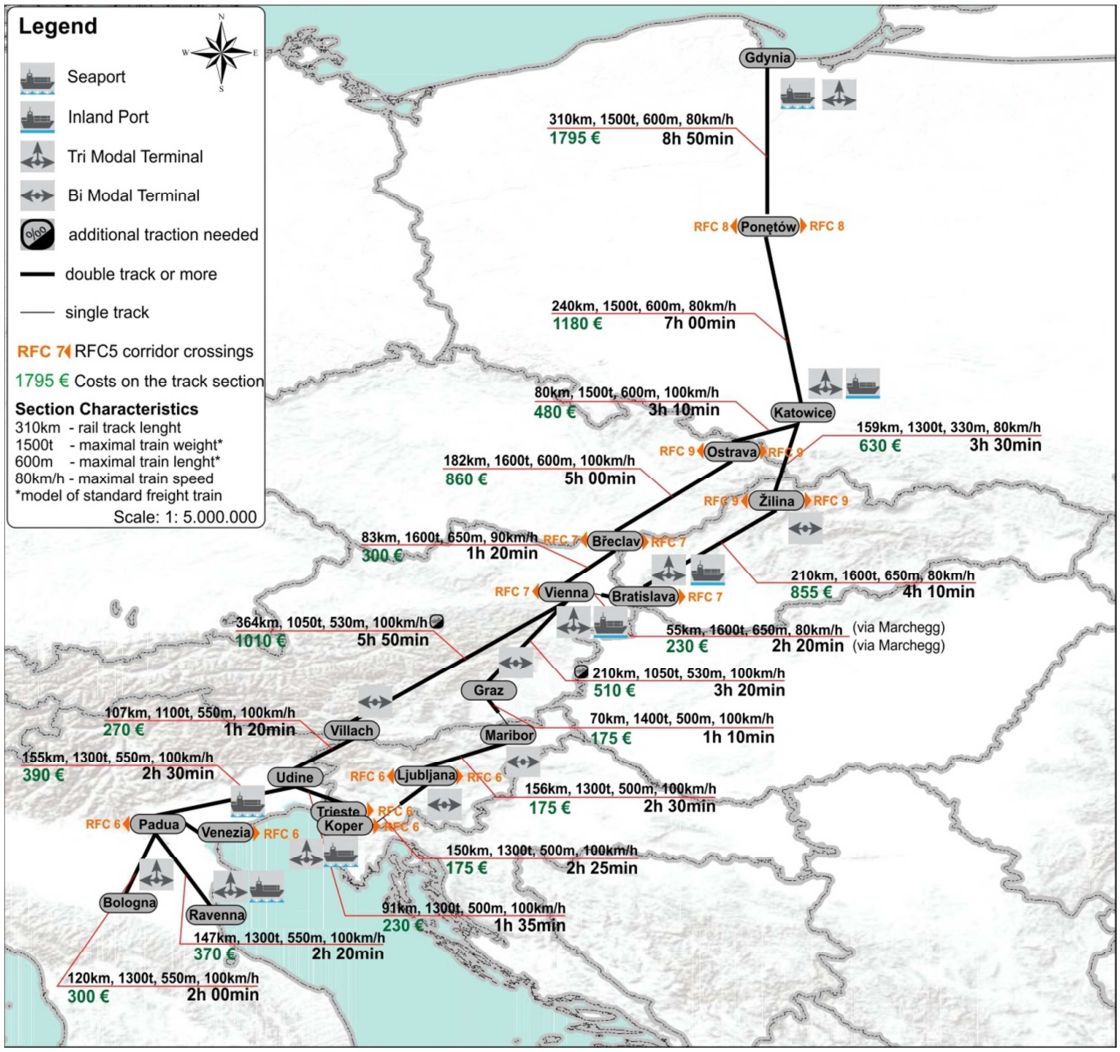

Figure 8: RNE07 route characteristics 2012

Source: RailNetEurope, http://www.rne.eu/

2.4 Freight demand

Freight transport demand is characterized in opposite to passenger transport through its large number of different goods to transport and their specific qualities as well as strong influences of different chaining of production processes for every branch of industry. Analysis of freight demand was differentiated in (i) market basics mainly covered by analysis of market characteristics and (ii) freight demand data and statistics as input for the transport model. Following figures show an overview of the freight demand development over the last years in RFC5 countries. More specific data and modelling results are given in part III (forecast) of the study.

As Figure 9 shows, rail freight demand development form the year 2003 to 2012 is strongly influenced by the effects of global economic crisis in the years of 2008/2009 and recovery period afterwards.

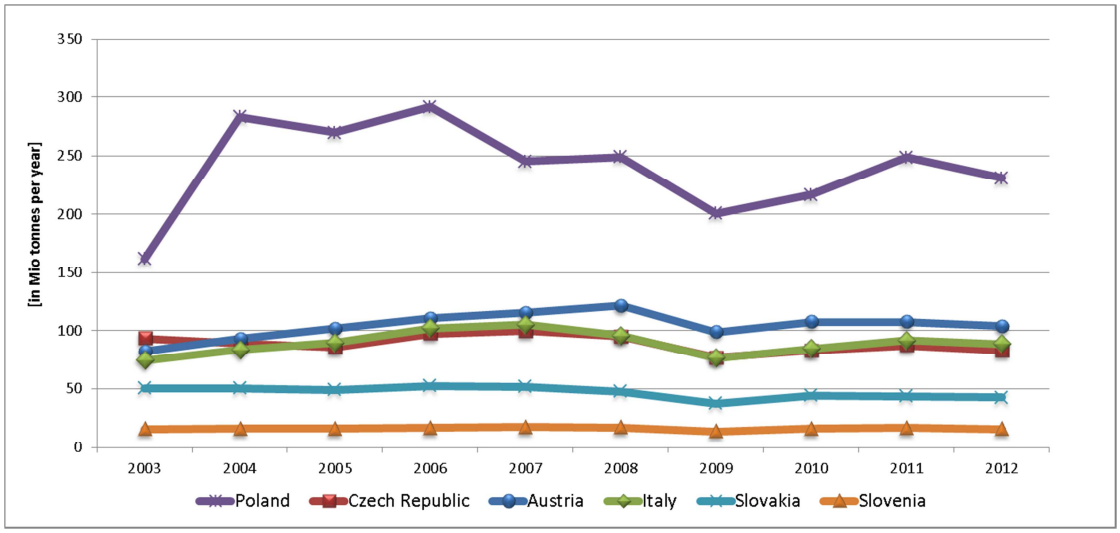

Figure 9: Development of rail freight transport 2003 – 2012; Total amount of transported goods of import/export/domestic/transit

Source: Eurostat table [rail_go_typeall]

By comparing development of rail (Figure 9) to road (Figure 10) freight demand, especially Poland shows a weak performance of rail transport demand. While road freight demand was strongly rising since 2004 continuously even during economic crisis, rail freight demand lost absolutely and relatively market shares and is still not at the level of the years 2004 to 2006.

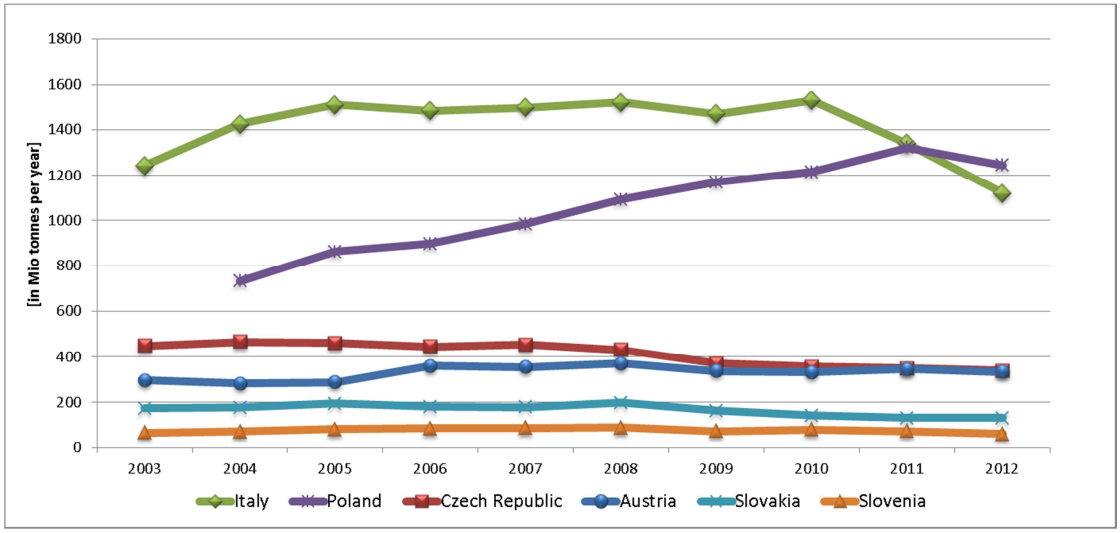

Figure 10: Development of road freight transport 2003 – 2012; Total amount of transported goods of import/export/domestic/transit

Source: Eurostat table [road_go_ta_tott]

As already mentioned, rail freight transport on RFC5 is strongly influenced by the performance of sea ports in the Adria and Baltic Sea. Figure 11 shows total of in- and outgoing transported volumes per year for the RFC5 ports.

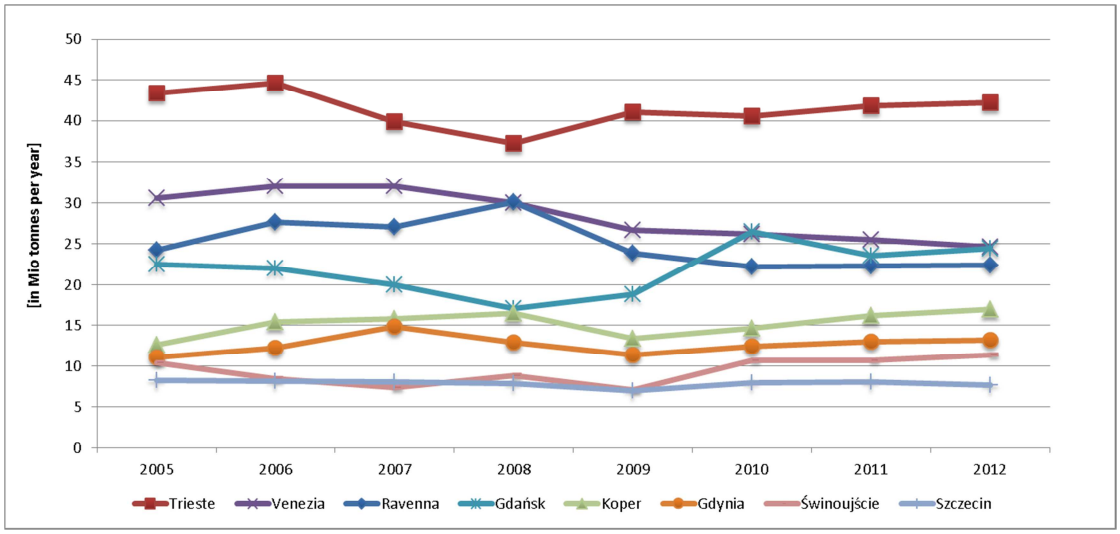

Figure 11: Maritime freight transport development 2005 – 2012; total sum in- and outgoing transported volumes per year

Source: Eurostat table [mar_go_aa]

Generally spoken, Italian ports excluding Trieste still struggle in reaching freight volumes before economic crisis while all other RFC5 ports show a strong development over the last years. By looking more deeply into statistics, especially container handling is growing rapidly almost at all ports and Trieste and Koper benefit strongly from growing world trade flows from e.g. China and South Korea in the last years.

3 Phase II: Survey

3.1 Objectives, procedure, target companies and response rate

The RFC5 will change the framework conditions for rail freight transports in Central Europe. Pre-arranged train paths will make the organisation and conduction of rail freight transports faster and easier, the flexibility of the overall rail transport system will be improved. Some of the aspects of the RFC5 – such as its rough routing – are already decided on, some other are still not determined. In order to provide a Rail Freight Corridor that meets the demands of its supposed users, a survey was conducted. It aims on identifying (i) how relevant companies assess the rail freight system in the RFC5 area, (ii) what they know about the RFC5, (iii) what their expect concerning the RFC5, (iv) how they will most likely react on the establishment of the RFC5 and (v) what requirements they have regarding the RFC5. Additionally, mode choice decisions were treated.

Four groups determine the success of the RFC5. These are

- shippers who order or receive freight transports (target number: 15 per country)
- logistic companies who organise or conduct shipments (15 per country)
- port and terminal operators as the entry points to the rail network(5 per country)
- railway undertakings operating trains (3 per country).

Companies from these four groups were the target group of the survey.

The survey had a two-stage approach: the first part included general questions on the RFC5. All participants were asked for

- characteristics describing their company (location, business field) and their tasks within their company (responsible for transport organisation, field of work),
- transport figures of their company (transport volume, modal split, origins and destinations),
- their assessment of the rail freight system in the RFC5 area,
- their knowledge and expectations concerning the RFC5,
- requirements and demands concerning the RFC5 as well as
- their most likely reactions in response to the implementations of the RFC5.

The second part addressed mode choice decisions of shippers and logistic companies including real-world decisions (Revealed Preferences) and a second part

containing hypothetic choice decisions (Stated Preferences); respondents were asked to describe two shipments they had recently conducted or ordered for which rail transport could have been used. Additionally, features of not used alternatives were recorded. Stated preference experiments treating mode choice decision were developed based on the attribute values of the reference shipments. Each experiment concerned a mode choice decision; whereby the respondents had to select the alternative they would most likely choose (Figure 12Figure 12). The alternatives were described by the attributes transport costs, transport time, percentage of delayed trips (more than 5% of transport time, at least 30 minutes) and percentage of damaged or lost goods. For the cost and time attribute, factors were selected according to an orthogonal design plan; they were multiplied with the attribute value of the reference shipment. For the delay and damage related attributes, fixed values were used according to the aforementioned design plan. Six experiments were conducted for each reference shipment each including a first and a second choice.

Experiment 2	Transport of 10 tons of x from x to x			
Main mode	**Train** 	**Truck** 	**Train** 	**None**
Transport costs (door-to-door)	1000 €	1150 €	850 €	
Scheduled transport time (door-to-door)	24 h	25.2 h	20.4 h	
Probability of a delay of more than 80 minutes	30 %	10 %	20 %	
Probability of 5% of goods lost/damaged	10 %	30 %	20 %	
What alternative would you prefer?	○	○	○	◉
What alternative would be your second choice?	○	○	○	◉

Figure 12: Example for a SP experiment

The survey started in April 2014 and was finished in September 2014. 288 companies participated to the survey, most of them by filling in the web-form. This also applies to terminal operators and railway undertakings that had access to all participation channels. The lowest number of participating companies was reached in Poland (40), the highest in Austria (65). 108 shippers, 81 logistic companies, 55 terminal operators and 44 railway undertakings participated to the survey. The target number was reached for all countries and target groups (Table 2). The participation rate – defined as the share of participants on those companies that could be reached by phone and who use rail transports at least sometimes – is 39% in average.

Table 2: Number of conducted interviews per country and group

	AT	CZ	IT	PL	SI	SK	Total number
Shipper (G1)	29	14	15	11	18	21	108
Log. Co. (G2)	15	11	14	12	21	8	81
T/P Op. (G3)	9	7	15	11	6	7	55
RUs (G4)	12	11	4	6	4	7	44
Total number	65	43	48	40	49	43	288

3.2 Assessment of the rail freight system in the RFC 5 area

In order to get an impression how the respondents assess the rail freight system, respondents were asked to rate the current status of several items related to rail freight transport and indicate if there is a need for improvements. The rating could either be done for a specific country or for the entire RFC5.

“Flexibility of train services”, “harmonisation of rules/processes” and “rail transport costs” were rated badly, “crossing of borders”, “contact to infrastructure operator”, “terminal access”, “risk of damages/goods lost/theft” and “safety systems” received above-average marks. However, respondents see many categories with a need for improvements – this includes those with a good rating: They consider improvements to be particularly important for hard factors such as “railway capacity”, “frequency of train services”, “flexibility of train services”, “punctuality/reliability of train services”, “rail transport costs”, “harmonisation of rules/processes”, “network access” and “total transport time (door-to-door)”. The highest need for improvements was stated in the categories “transport costs” and “flexibility”. A rather low need for improvements received only two categories: “risk of damages/goods lost/theft” and “contact to infrastructure operator”.

Figure 13 shows the result of the assessment of the item “harmonisation of rules”. The respondents were asked to rate the current status as “bad”, “rather bad”, “rather good” or “good” and the need for improvement as “high”, “rather high”, “rather low” or “low”. The following figure shows the share of all companies answering “rather good” or “good” on all valid answers for the current status and the share of companies stating a “high” or “rather high” need concerning the need for improvements. For the entire RFC5, the current situation regarding “harmonised rules” is considered to be bad; only 20% assess the status of this item to be good or rather good. The corresponding value for the needs for improvements is high. Thus, from the low level

of satisfaction with the current status evokes a high desire for improvements. This is also true for specific countries such as Italy and Poland, whereas the need for improvements is – based on a better evaluation of the current status – is lower for Austria, Slovakia and Slovenia. This might have two reasons: the companies might have already adapted their procedures to common standards why further improvements are not that important anymore or the same might refer to the systems of the countries.

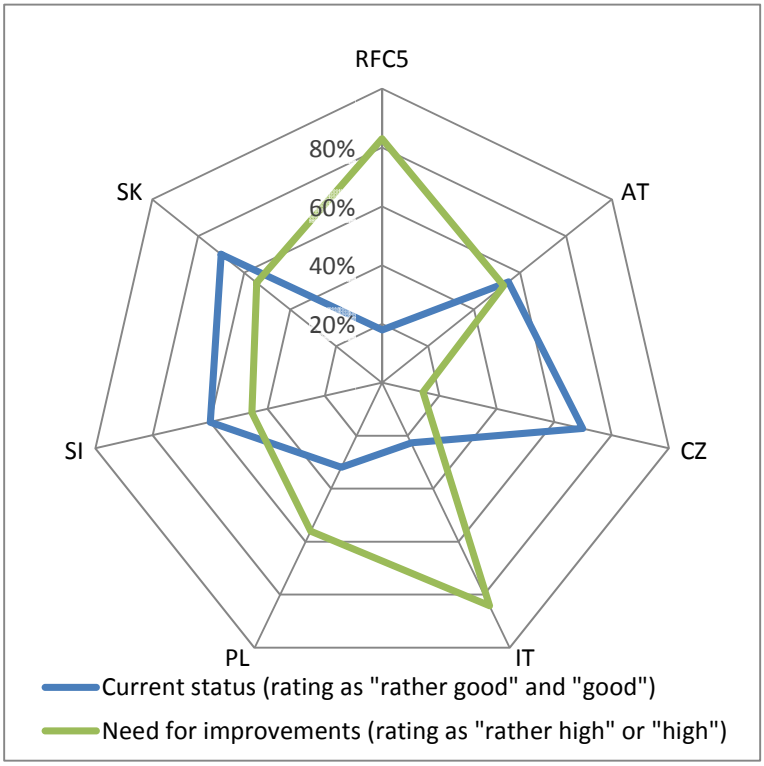

Figure 13: Harmonisation of rules (n=213)

3.3 Knowledge and expectations concerning the RFC5

A sound level of knowledge on the RFC5 is given among logistic companies, terminal and port operators and railway undertakings. The term “Baltic-Adriatic Corridor” is known as it is the rough route. Lacks of knowledge appear when more specialised questions are asked, in particular concerning the tools “authorised applicants” and “pre-arranged train paths”. From this follows that the brand RFC5 is well known but further efforts are needed in order to introduce the core concepts (C-OSS, authorised applicants, PAPs, reserve capacity) to the target groups.

Respondents expect a relevant success of the RFC5. One of the major shortcomings of the rail freight system is a lack of flexibility. The answering persons expect that the tools associated to the RFC5 – the PAPs and the reserve capacity – will help solving this problem by providing more flexible solutions. Thus, they expect the PAPs to be well received by the market (Figure 14).

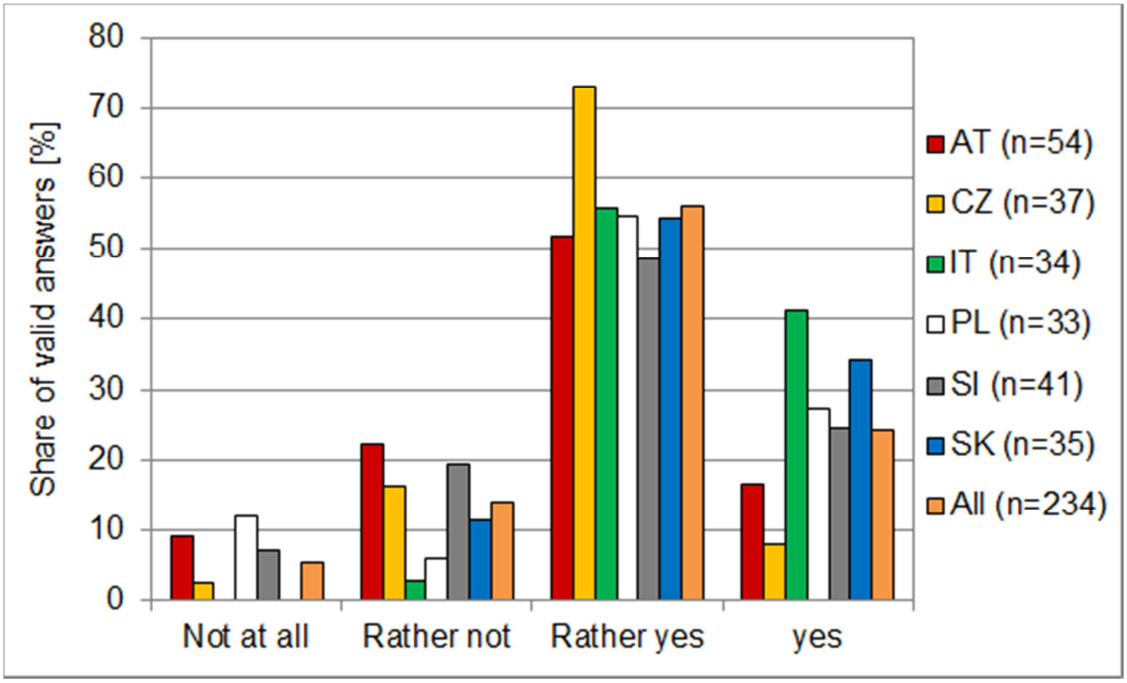

Figure 14: Will PAPs play a major role in the future by country?

Nearly all companies expect an increase of their transport volume or throughput capacity until 2020 – depicted for the example of shippers in Figure 15. The average expectations are above-average optimistic regarding the developments of rail transports including intermodal transports than for other modes. This refers to both, transports in the RFC5 area as well as the total transport volume. However, the expectations concerning the development of rail transports in the RFC5 area lay behind the corresponding expectations for the entire transport volumes.

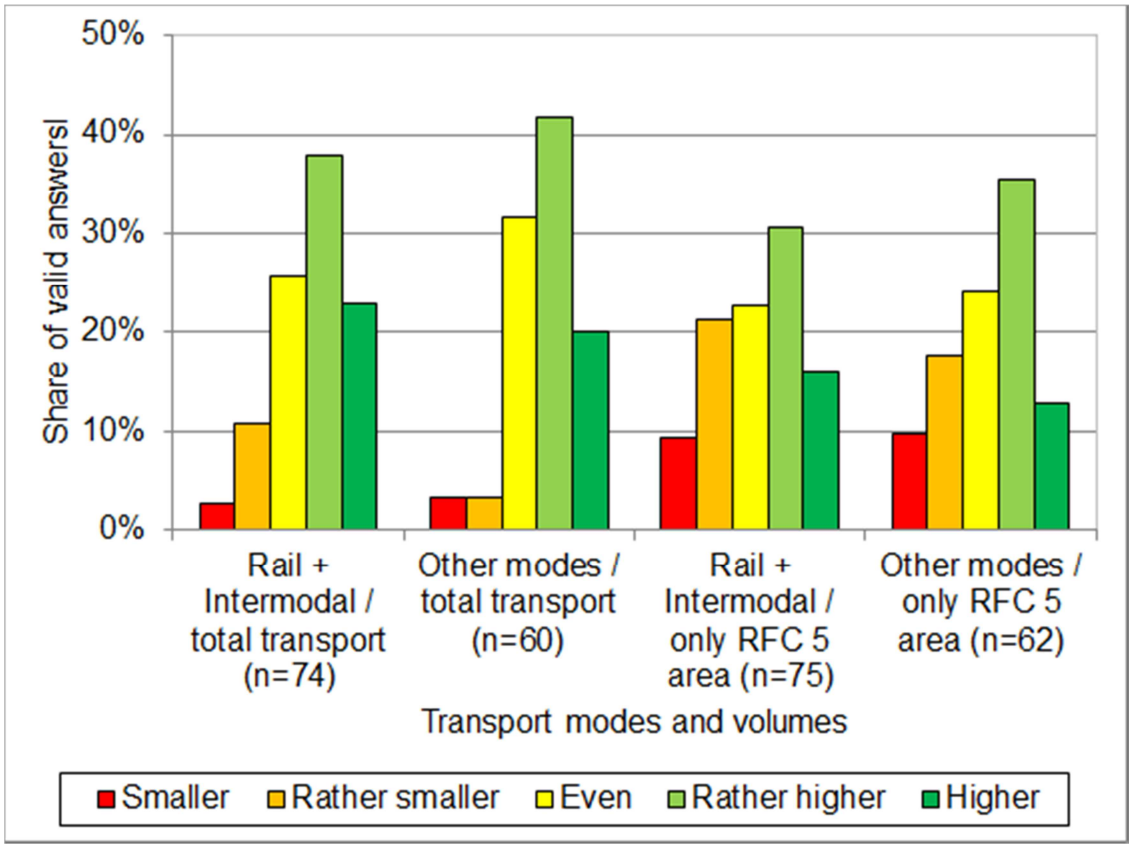

Figure 15: Expectations on the development of the modal split depending on the reference area of shippers (G1) until 2020

3.4 Most likely reactions on the establishment of the RFC5

The RFC5 might have impact companies in different ways. Many companies stated to develop new offers to their clients, use rail transports more often or invest in rail infrastructure or rolling stock. More than 50% of logistic companies and railway undertakings stated that they will likely or most likely change their services by providing other, more or new rail transports. This also applies to terminal and port operators. Every second railway undertaking and almost 40% of the logistic companies stated, that the RFC5 will have an influence on their investment decisions (Figure 16). The same refers to more than 65% of port and terminal operators who will invest into their railway infrastructure also due to the establishment of the RFC5.

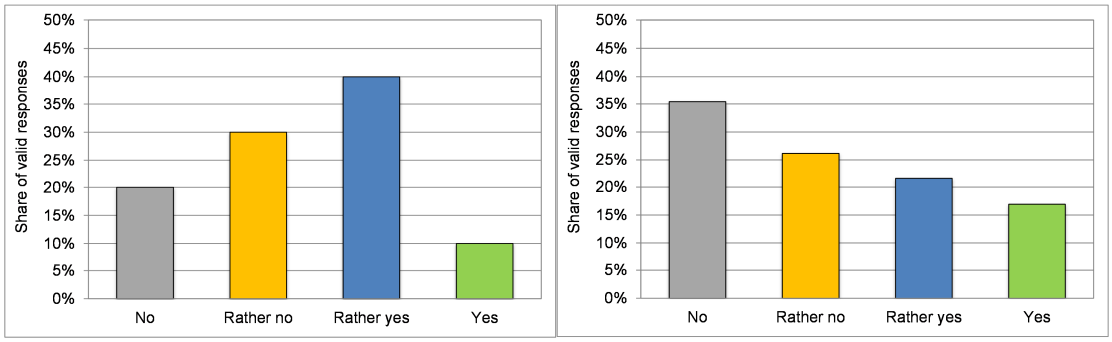

Figure 16: Influence of the RFC 5 on investment decisions (left: railway undertakings (n=40), right: logistic companies (n=65))

Several companies consider the opportunity to get an authorised applicant as promising. This mainly refers to Czech and Italian companies but also to Polish and Slovenian enterprises (Figure 17). Nearly no interest exists among Austrian companies. The level of interest in becoming an authorised applicant is also limited for shippers and among logistic companies (only 25% will rather and 5% certainly become authorised applicant). Contrary, port and terminal operators and particularly railway undertakings will act as authorised applicants (Figure 18). This corresponds to experiences gathered from operating RFCs.

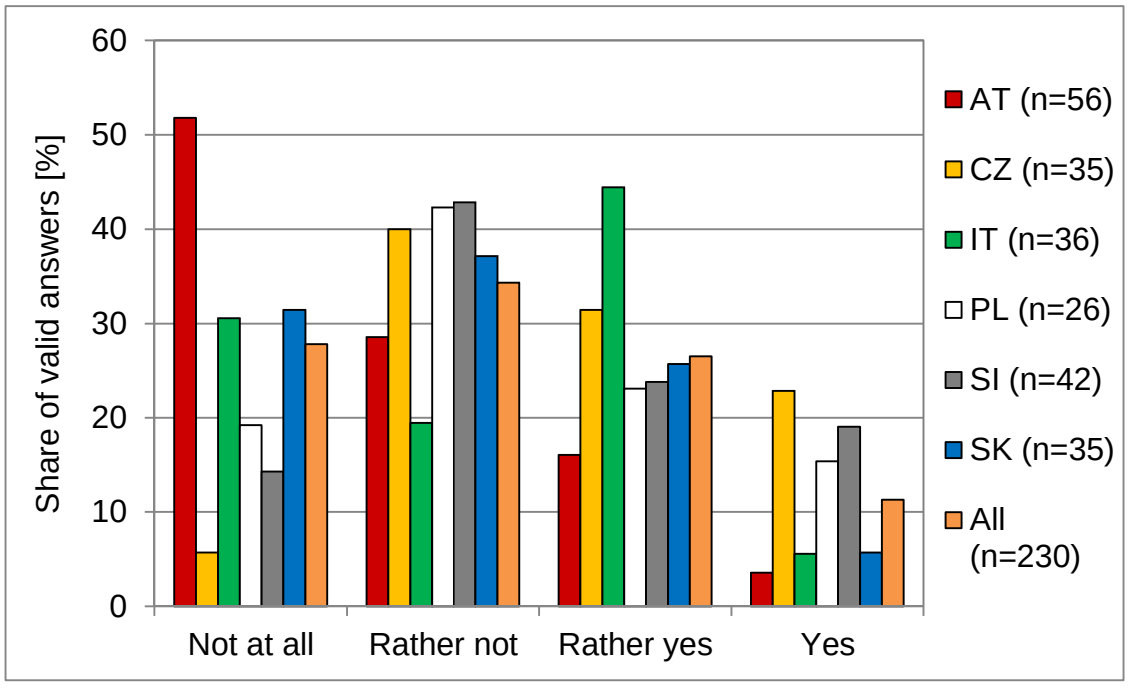

Figure 17: Intention to act as authorised applicant by country (n=230)

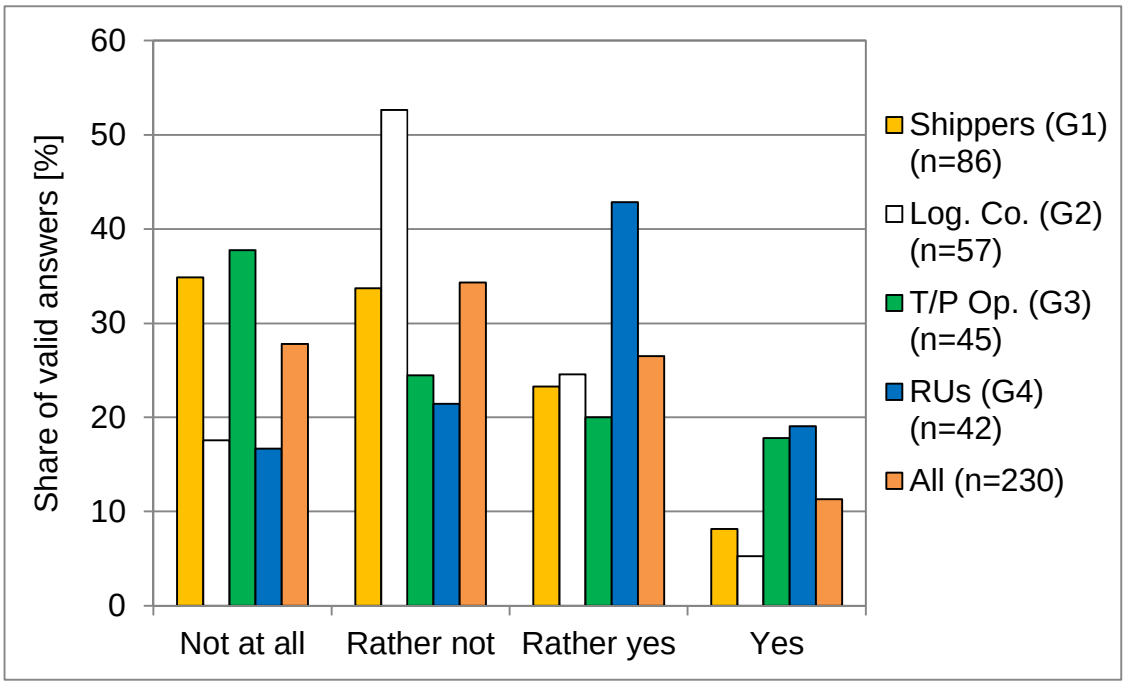

Figure 18: Intention to act as authorised applicant by target group (n=230)

Companies intending to act as authorised applicants will apply for all kinds of train paths without clear tendency; reserve capacity – as the tool providing the highest flexibility – is asked for most often, but the differences to the demand for PAPs are only small. Shippers and companies from Slovenia and the Czech Republic are particular interested in applying for PAPs, while railway undertakings, Austrian, Slovakian, Italian and Polish companies expect that they will more often apply for reserve capacity.

3.5 Requirements concerning the RFC5

The respondents were invited to express their requirements concerning the RFC5 in terms of the arrangement of the RFC5. With regard to the routing of the RFC5, there is a high level of satisfaction with the preliminary suggestion (Figure 19). All most frequently mentioned cities and border crossings that should belong to a Baltic-Adriatic corridor are part of the preliminary route of the RFC5; frequently mentioned areas to be included into the RFC5 or to be connected to the RFC5 were the industrial area of Upper Austria, Warszawa, Praha or Germany.

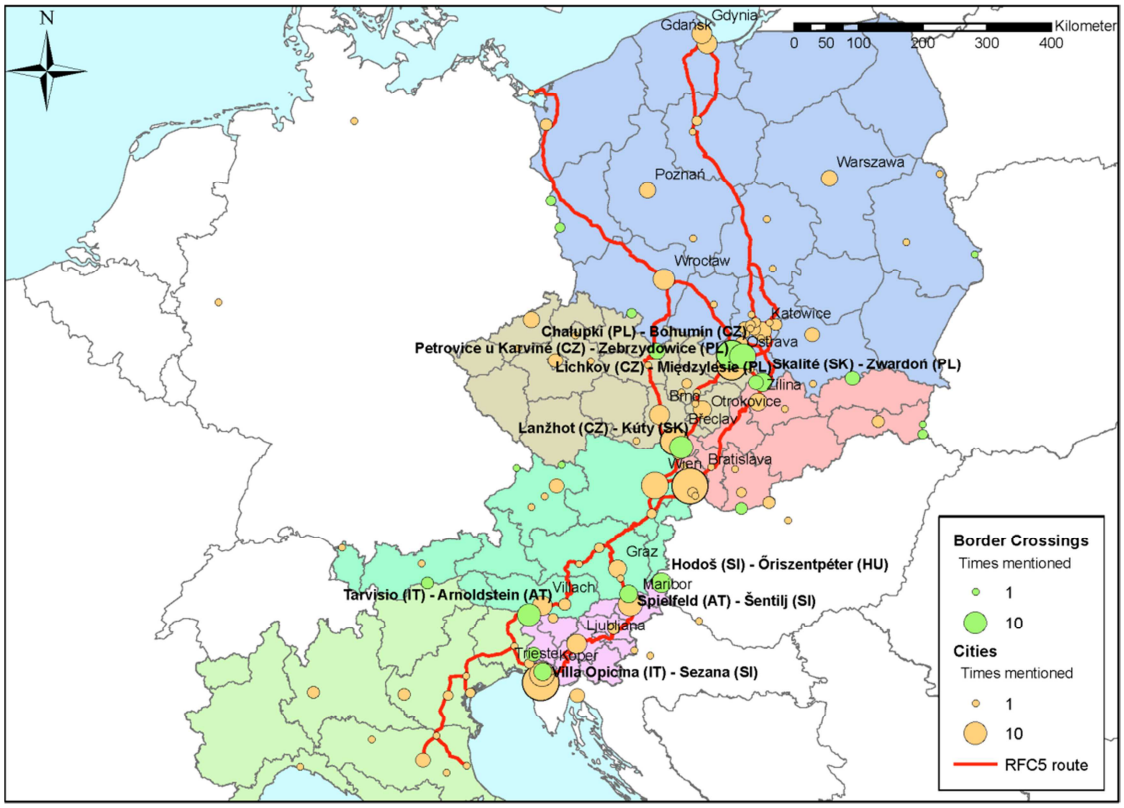

Figure 19: Cities to be included into a Baltic-Adriatic corridor

According to the respondents, the C-OSS has to act as a real single contact point offering all organisational services needed in terms of the preparation and conduction or shipments. The tracks offered should be flexible, the services costumer friendly. This includes the provision of information referring to both, the process of applying for tracks and shipments on the track. There is a particular demand for quick and short-term allocation of requested paths meaning that both, the time needed to decide about a request for a train path as well as the time period between the last possible application and the conduction of the shipment should be short. All additional efforts compared to the existing system of applying for train paths should be avoided.

The statements on minimum requirements concerning the RFC5 can be summarised in three main groups – infrastructure, services and quality indicators. The latter refer to a general demand for quick and cheap rail freight transports allowing enhancing the competitiveness of the rail system. Infrastructural demands can be summarised as a realisation of the TEN-T-specifications on the entire RFC 5. This includes electrification, double tracks, sufficient capacity, train length of 740 meters and the use of heavier and larger vehicles. Particularly vehicle size and train length were mentioned often.

3.6 Mode choice decisions

The stated preferences survey allows calculating utility functions describing mode choice decisions of shippers and logistic companies based on the decision whether to use rail or road transports for a given shipment. The finally selected utility function is based on the "1-Choice"-dataset, meaning that only the first choice of the respondents was taken into account. This model includes all attributes presented to the respondents (transport costs, transport time, probability of delays, and probability of damaged/lost goods) as well as the fact if the good transported is rail affine and the total distance covered. The transport costs account for 64% of the explanatory power of the attributes, thus it is by far the most important aspect whereas the probability of delays is of less importance.

The attributes enter the final model by means of normalised factors; the term "factor" refers to the fact, that not absolute numbers (costs in Euros), but relative changes are taken into account (relative differences between the values of the modes), "normalised" means, that the factors of both alternatives are divided by the factor of the road alternative. Thus, the attribute value of the road alternative has always a value of "1"; the value of the corresponding alternative of the rail transport shows relative differences to this value. Almost 75% of the decisions made by the respondents can be explained using this model; the adjusted rho-square is 0.234 which is a very satisfying result.

The resulting choice model allows forecasting the development of the modal split by applying a so-called multinomial logit approach. Based on this model, also the impacts of the RFC5 can be analysed.

4 Phase III: Forecast

4.1 Methodical approach

Objective of phase III is to comprehensibly estimate future freight transport demand along the RFC5 for the years of forecast 2015, 2020 and 2030. As shown in Figure 20, based on the analysis of current situation and results of revealed and stated preference survey a freight demand model for the base year of 2012 for whole investigation area was compiled. Main working steps were the updating of road and rail network elements and generating freight demand Origin/Destination (O/D) matrices on NUTS3-level based on data from Eurostat and detailed national statistics by using own modelling techniques (see main report of TMS).

By using examinations of national infrastructure managers concerning cross-border traffic on the network level, freight demand model and assignment model including a rail freight constraint function were calibrated to create plausible network loads for rail traffic. Another modelling part was the implementation of a mode choice model based on the stated preference survey. Therefore, different utility functions of a multinomial logit discrete choice model were statistically tested and with the chosen model direct effects of implementing RFC5 services in terms of a new rail supply quality on the Corridor could be modelled.

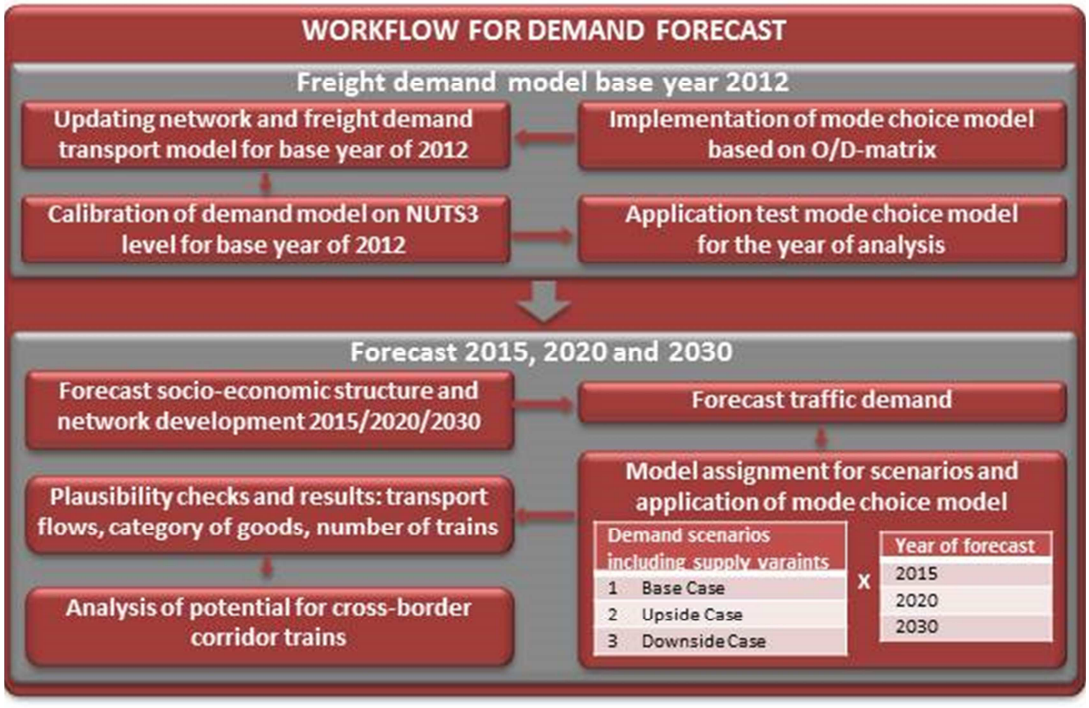

Figure 20: Work flow of demand forecast

Forecasts started by defining future scenarios for the years of 2012, 2020 and 2030. The freight demand forecast itself is based on the forecast of socio-economic structure, mainly the Gross Domestic Product (GDP). Future traffic demand was derived on the level of O/D matrices by using GDP-growth factors and a simplified overall elasticity within the model. Afterwards, future freight transport demand could be assigned and rail network loads for the whole RFC5 investigation area lay the base for analysing future potential of corridor trains and possible pre-arranged train paths'.

In the following text, only main results of the modelling process are given on Corridor level. For more detailed information concerning underlying assumptions, the modelling process and detailed results (e.g. capacity analysis, rough estimate of passenger trains, detailed network loads on national level) please refer to main report of TMS.

4.2 Freight demand model for base year 2012

In order to show actual state of transported goods between RFC5 countries, Figure 21 comprises a visualisation of transport flows between these countries. Transport volumes for the year 2102 are given in Million net-tonnes per year but excludes import/exports from RFC5 ports. Figure 22 shows same visualisation for road transport volumes between the RFC5 countries for the year 2012.

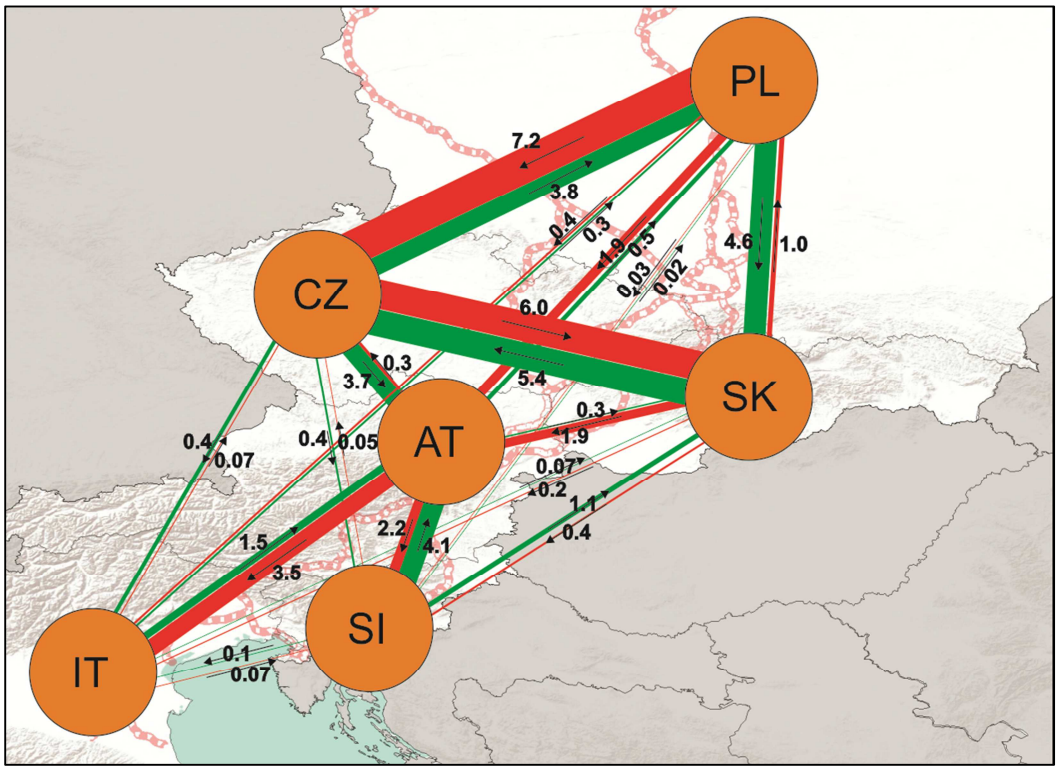

Figure 21: Rail freight transport year 2012 - Import/export between RFC5 countries from model O/D matrices in Million net-tonnes per year exclusive RFC5 ports

Source: Eurostat table [rail_go_typeall]

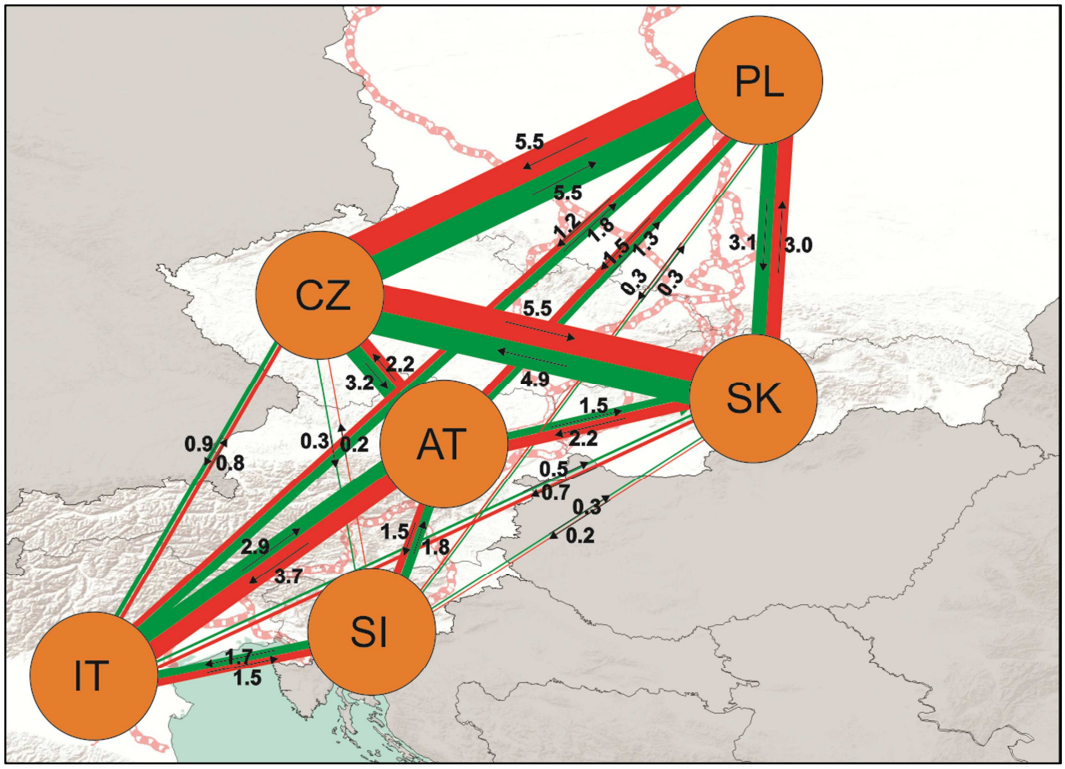

Figure 22: Road freight transport year 2012 - Import/export between RFC5 countries from model O/D matrices in Million tonnes per year exclusive RFC5 ports

Source: Eurostat table [road_go_ta_tott]

Finally, Figure 23 shows cross-border rail freight transportation in Million net-tonnes for the year 2012 on the network level. The given data was directly taken from national infrastructure managers, but needed some harmonisation due to differences in the national statistics of two sides of the same border crossing.

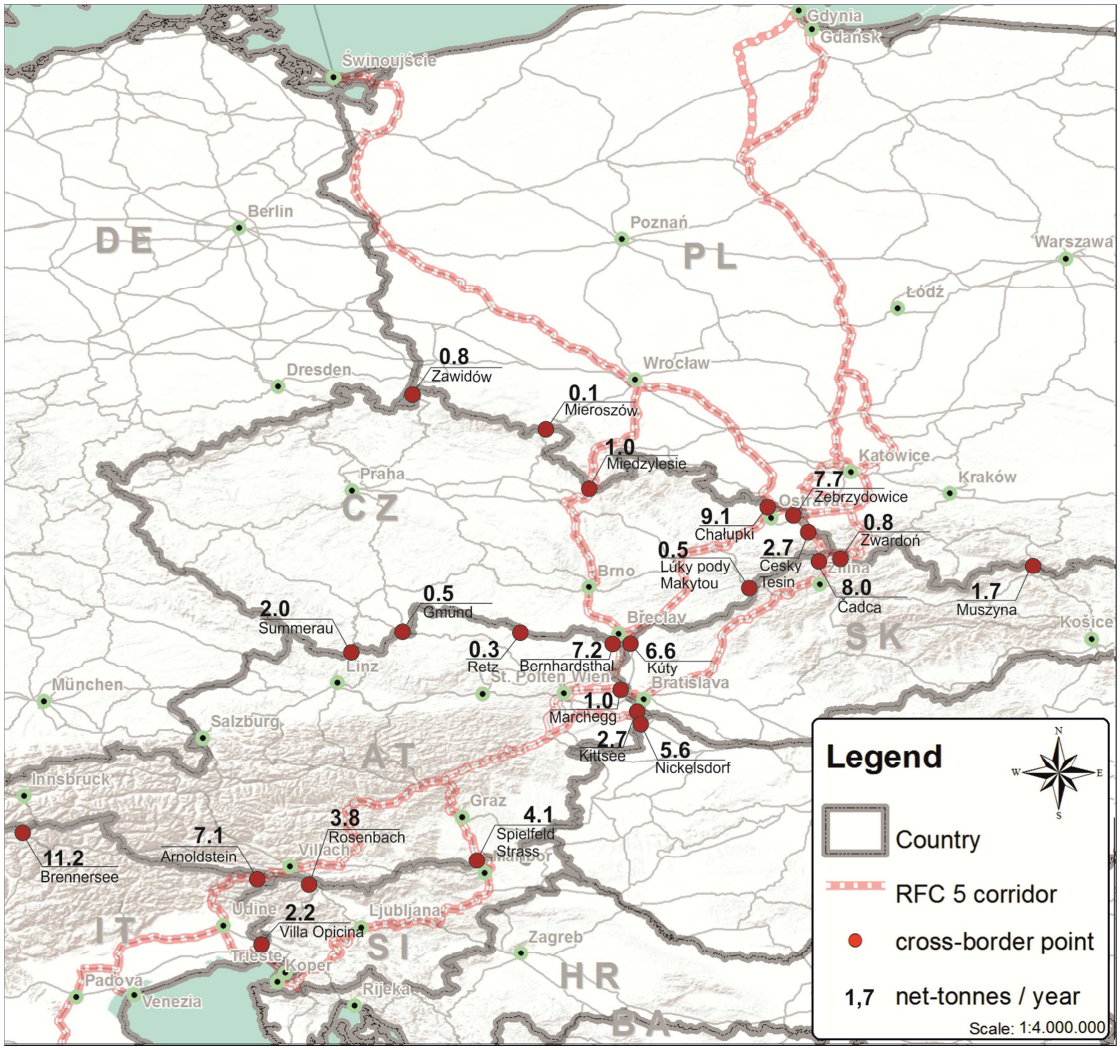

Figure 23: Cross-border rail freight transportation in million net-tonnes in the year 2012

Source: all RFC5 infrastructure managers, 2014

4.3 Forecast 2015 / 2020 / 2030

4.3.1 Definition of scenarios and GDP-forecasts

Freight transport demand is ultimately derived from economic activity which is measured by GDP (Gross Domestic Product) of every country. Short and medium term GDP-growth projections until the year 2020 have been calculated by the Institute for Advanced Studies. Long-term projections until the year 2030 were adjusted to meet those of the OECD.

Using scenario techniques is a proper tool for coping with different uncertainties when estimating future demand. For the TMS of RFC5 three different scenarios have been defined: one base-case scenario, one up-case and one down-case scenario.

In Table 3 the base-case scenario GDP forecasts for all RFC5 countries are summarized, using the most recent information available from October 2014[9]. For the years after 2015 only average yearly growth rates for three different 5-year intervals are provided.

Table 3: GDP forecasts for RFC5 countries base-case scenario

YEAR	2010	2011	2012	2013	2014	2015	2015-2020	2020-2025	2025-2030
Italy	1.7%	0.4%	-2.4%	-1.9%	-0.3%	0.3%	1.3%	1.4%	1.5%
Austria	1.8%	2.8%	0.9%	0.3%	0.8%	1.5%	1.9%	1.8%	1.9%
Poland	3.9%	4.5%	2,0%	1.6%	3.2%	3.2%	3.1%	2.5%	2.5%
Czech Republic	2.5%	1.8%	-1,0%	-0.9%	2.4%	2.2%	2.8%	2.4%	2.9%
Slovakia	4.4%	3,0%	1.8%	0.9%	2.4%	2.5%	3.1%	2.8%	2.6%
Slovenia	1.3%	0.7%	-2.5%	-1.1%	1.8%	1.4%	2.2%	2.2%	1.8%

In terms of sensitivity analysis, following assumptions have been made for the down- and up-case scenarios for both EU countries and world regions outside EU:

- Down-case scenario: half (½) GDP growth factors of base-case
- Up-case scenario: GDP growth factors of base-case +0.5% points per year

As shown by the elasticity analysis (see main report of TMS), statistical data from Europe of the last decade generate in parts statistically insignificant product elasticities which is mainly owed to the very volatile years during the economic crisis.

[9] As described above regional forecasts on a NUTS3 level were carried out and are included in the transport demand model. The factors presented here represent only a summary on a national level.

Therefore, a simplified approach by taking GDP-growth factors directly to project O/D matrices was used and varying assumptions of GDP-growth factors in the down- and up-case scenario should cope for this simplified approach.

Furthermore, RFC5 ports have been modelled autonomous as extra traffic cell with their own forecasting model, depending on GDP development of most important trade partners of different world regions. Therefore, main trade partners were aggregated and their average growth forecast was used for estimating growth of trade flows of every single port. We use Koper as an example: In the year 2012, almost 22% of total imports can be allocated to Asia (China, South Korea), 21% to Africa (Algeria, Morocco, Egypt), 14% to South America (Brasilia, Columbia) and 10% to North America (USA, Canada). Corresponding GDP-growth forecasts are given in Table 4.

Table 4: Worldwide GDP forecast growth in average yearly per period

GDP Forecast	average yearly growth per period			
	2012-2015	2015-2020	2020-2025	2025-2030
Worldwide	2.8%	3.7%	3.2%	3.1%
European Union	0.8%	1.2%	1.1%	1.1%
Russia	0.9%	2.1%	3.0%	2.7%
USA	2.3%	2.7%	2.4%	2.4%
China	7.4%	6.2%	5.0%	5.0%
rest of the World	4.2%	4.5%	3.8%	3.2%

On the supply side, all relevant infrastructure investment plans for rail and road as well as for main terminals and the sea ports and the corresponding time schedules given by every RFC5 country were included as basic assumption in all scenarios. Figure 24 shows an overview of the planned rail infrastructure investments along the RFC5 which were used in the forecast model.

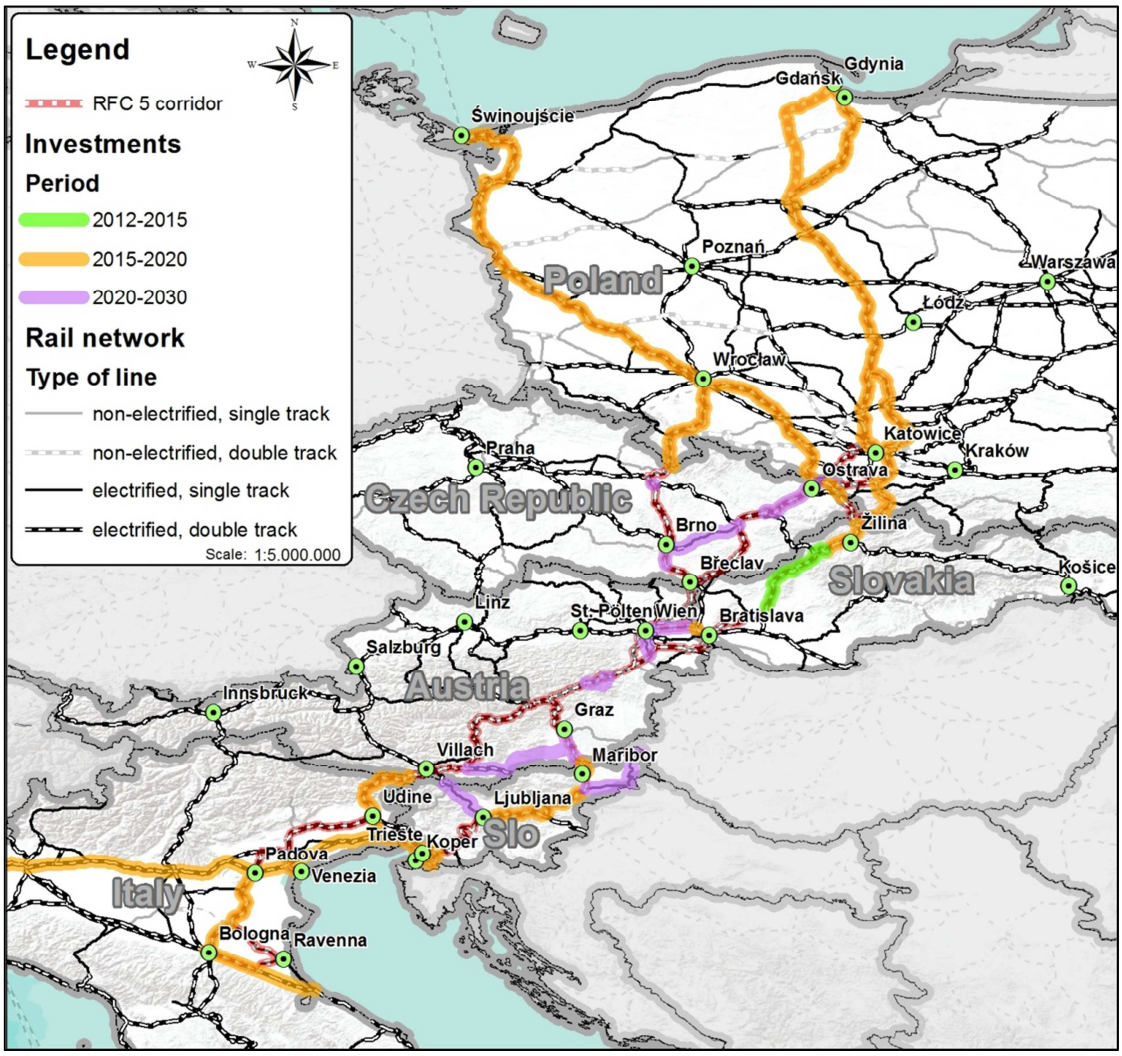

Figure 24: Rail infrastructure investments in RFC5 countries

At this point it has to be mentioned, that some of the planned infrastructure investments and corresponding time schedules seem to be very ambitious. Nevertheless, a good infrastructure is a key factor for economic development and therefore these plans were included without any changes. This has to be kept in mind when interpreting demand forecasts.

In respect to the implementation of RFC5 by the end of 2015, assumptions for the effects of starting RFC services on the transport supply side were explicitly taken into account for all relevant O/D relations:

- Transport costs change due to lower transaction costs and higher flexibility
- Transport time decreases due to preference track clearance for PAPs
- Punctuality increases due to preference track clearance for PAPs
- Waiting time at borders decreases

Table 5: Assumption for modelling modal split effects of RFC5

Parameter	Year 2020	Year 2030
Transport costs	-3%	-7%
Transport time	-3%	-7%
Punctuality	+3 percentage points	+7 percentage points
Waiting time per RFC5-border	-15 minutes each	-20 minutes each

Different assumptions for the year 2020 and 2030 reflect a learning effect of the rail transport system over the time.

Finally, only few scenarios were selected for presenting results. Figure 25 shows an overview of the basic assumptions.

Year	Supply	Demand		
		Base Case	Downside Case	Upside Case
2015	Infrastructure investments only	X		
	Infrastructure investments with RFC5 service			
2020	Infrastructure investments only	X		
	Infrastructure investments with RFC5 service	X		
2030	Infrastructure investments only	X	X	X
	Infrastructure investments with RFC5 service	X	X	X

Figure 25: Overview of selected scenarios and basic assumptions for forecasting

4.3.2 Transport demand forecast

All following results, tables and figures concerning freight transport demand are given for the base-case scenario including infrastructure investments and RFC service in operation. Variations of up-case and down-case scenarios are presented only in terms of selected results in the next chapter.

Figure 26 shows estimated development of total freight demand volumes (sum of rail and road) and rail freight demand volumes separately for the RFC5 countries excluding RFC5 ports and Figure 27 shows the same statistics for the RFC5 ports. This separate visualisation shows the high importance of sea ports especially for Slovenia: First, share of rail transport in Koper is very high and second, this rail freight traffic from Koper plays a major role for the total rail freight traffic volume in Slovenia. Therefore future development of Koper is crucial for Slovenian rail traffic while in other countries like Italy or Poland RFC5 ports play a less important role for the total rail freight volumes of each country.

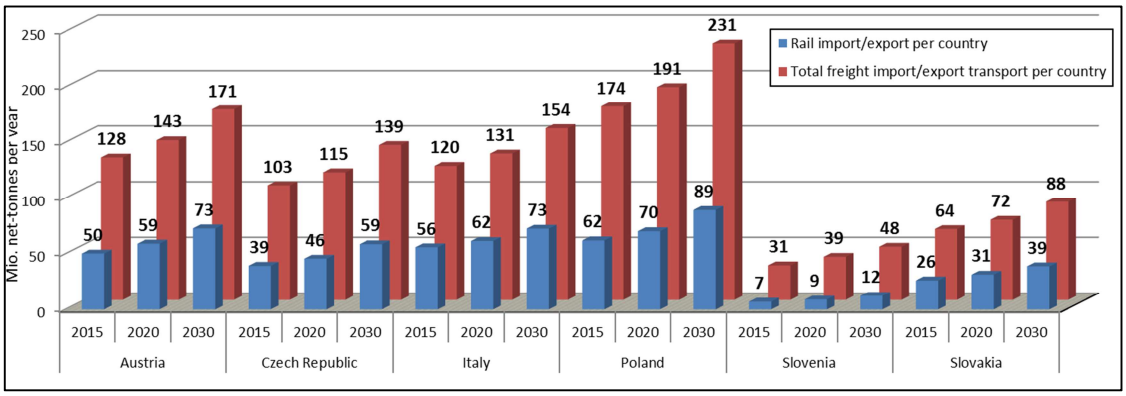

Figure 26: Sum of road and rail freight transport volumes: Import/export of RFC5 countries; base-case scenario with RFC service 2015, 2020 and 2030 without seaport traffic

Source: Eurostat tables [road_go_ta_tott], [rail_go_typeall], national statistics, IKK forecast base-case scenario

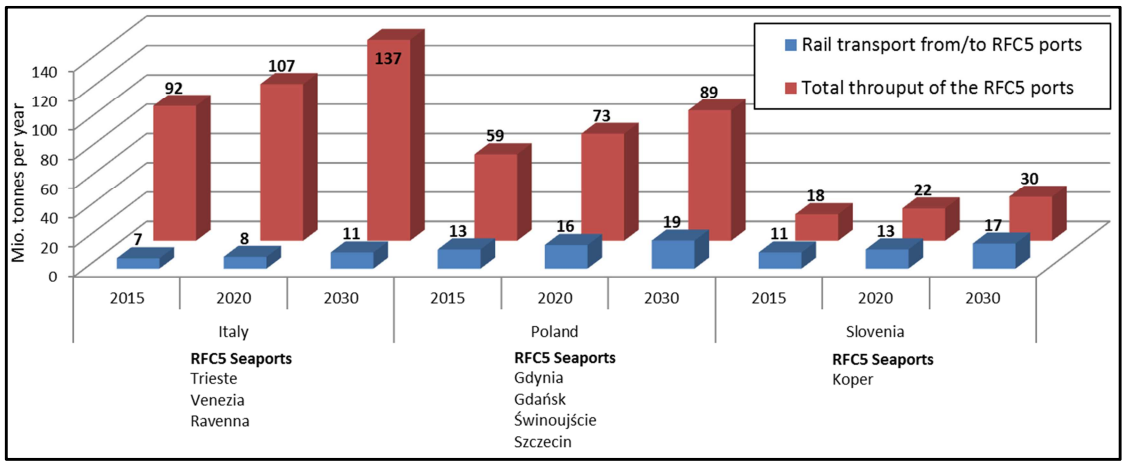

Figure 27: Total freight transport of RFC5 seaports and share of rail hinterland transport; base-case scenario with RFC5 service 2015, 2020 and 2030

Source: Eurostat table [mar_go_aa], national statistics, IKK forecast base-case scenario

The freight demand forecast points out a development without longer periods of recessions or other crisis like the Russian/Ukraine crisis and reflects relatively strong growth perspective of eastern European countries. By looking at estimated development of RFC5 seaports, even stronger growth can be expected due to strong dependencies of world economic growth outside of Europe. Additionally, it should be kept in mind that the scenarios include all infrastructure investments, which is probably a prerequisite so that enough capacities are available in the network to cope with the projected rail freight demand growth.

4.3.3 Assignment results: rail freight traffic network loads

In the transport model, freight demand is given in the form of O/D matrices which are all documented in the main report of TMS for RFC5. By assigning those O/D matrices on the network model by using route choice algorithm, freight traffic network loads can be presented. Figure 28 shows rail assignment results for base-case scenario including RFC service for the year 2030. Colours give a network load category and numbers represent network loads in million net-tonnes per year.

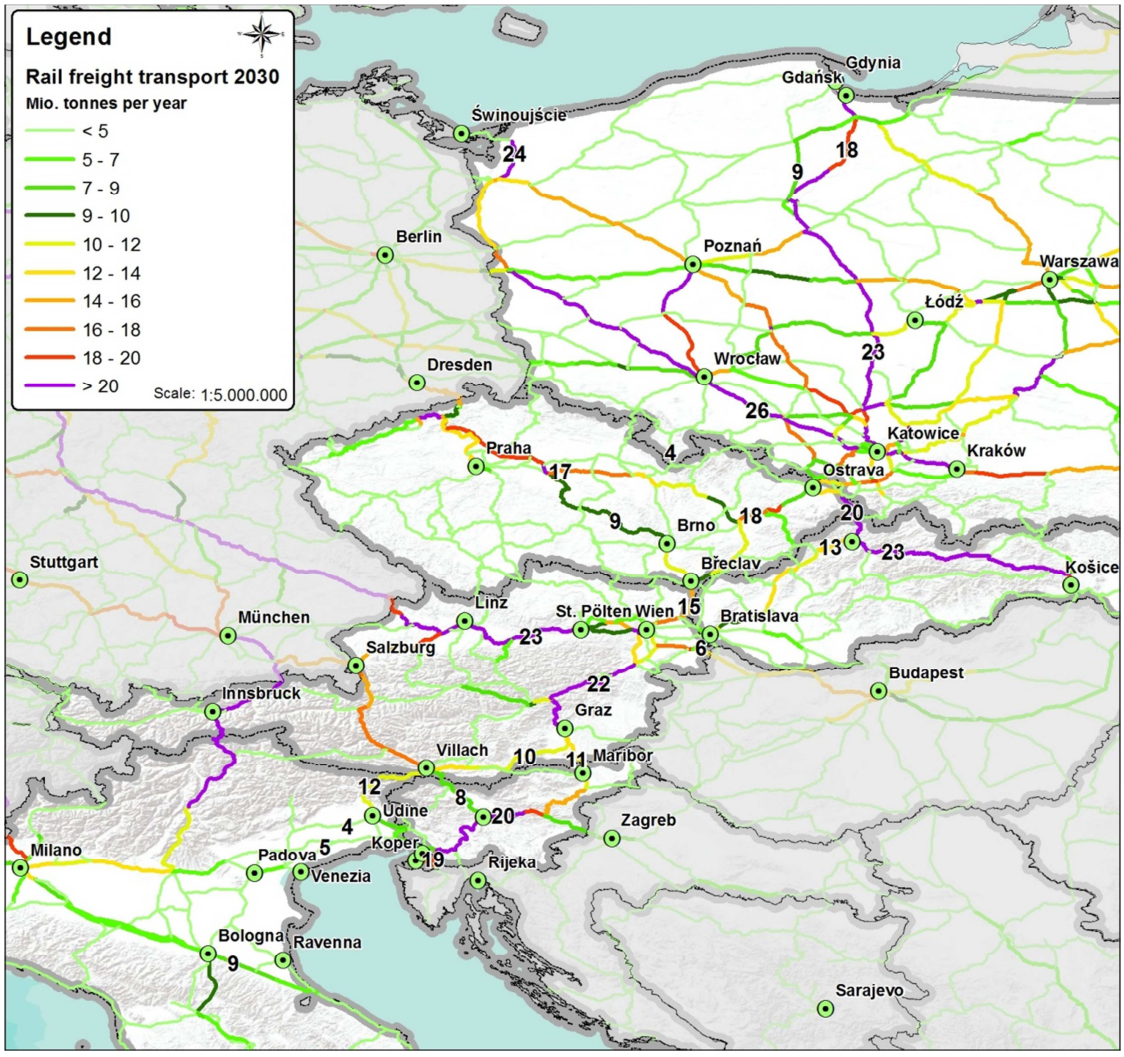

Figure 28: Rail freight traffic network loads, base-case scenario with RFC service for 2030

In comparison to network-loads of actual state in the year 2012 (Figure 23) forecast for 2030 (Figure 28) indicates strong growth along the whole RFC5. While on the southern parts between Slovenia/Italy and Austria the strong growth of Adriatic seaports overwrites weak economic growth, on the north-eastern part of RFC5 strong economic growth of Poland, Slovakia and the Czech Republic drives freight demand on the network.

To give an impression of the development over time, Figure 29 shows a part of the network model and the development of rail freight network loads in million net-tonnes per year for base-case scenario and the forecasting periods 2015, 2020 and 2030.

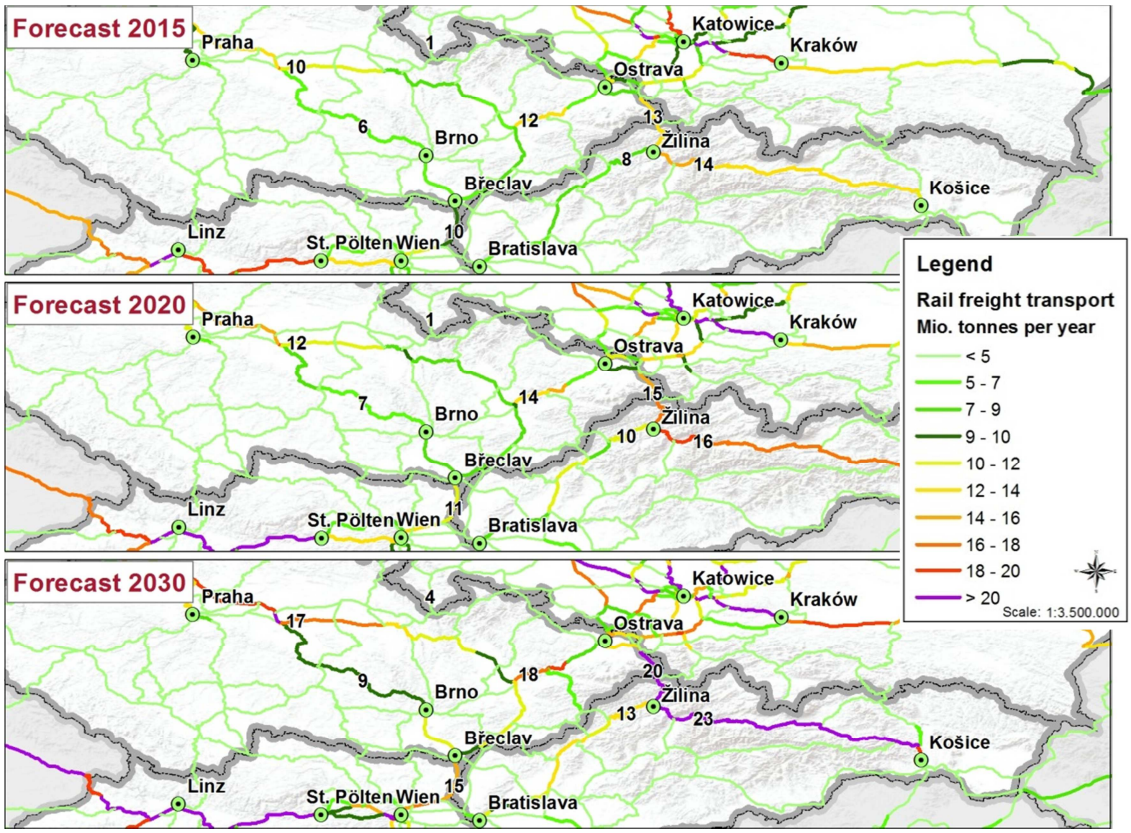

Figure 29: Rail freight traffic network loads, base-case scenarios with RFC service for 2015, 2020 and 2030

By comparing base-case scenario excluding and including RFC service, the direct effects of implementing Rail Freight Corridors can be estimated. Figure 30 shows the modal split effect in terms of shifting freight traffic from road to rail due to implementing RFC service. Again, colours give a network load category and numbers represent network loads in million net-tonnes per year. For correct interpretation of these results it has to be kept in mind, that modal split effects are a sort of “if - then” forecast: If introducing RFC service leads to a better rail supply in terms of lower costs, lower waiting times at borders and so on, then effects will be as shown in Figure 30.

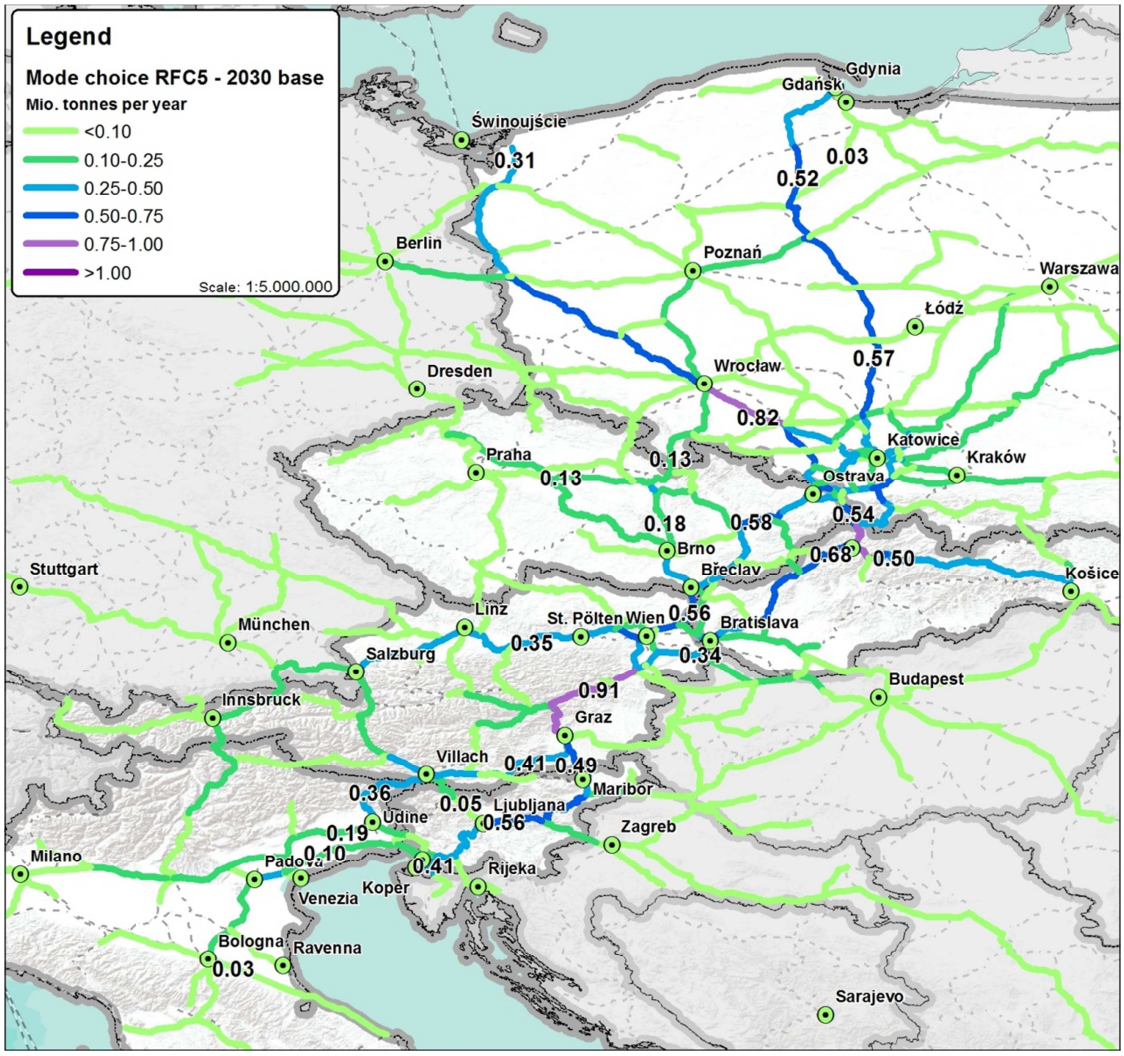

Figure 30: Rail freight traffic network loads, direct modal split effects of RFC5 service in the year 2030; base-case scenario

Finally, freight traffic network loads in net-tonnes per year can be converted into a potential for corridor trains. We use an average corridor train for the whole investigation area, which has a weight of 580 net-tonnes and runs 250 days a year. By using these assumptions, Figure 31 shows the potential for corridor trains in the base-case scenario with RFC service for the year 2020 and Figure 32 shows the same for base-case scenario in the year 2030. Blue colour marks corridor trains running on parts of RFC5 and green colour marks trains on the rest of the rail network.

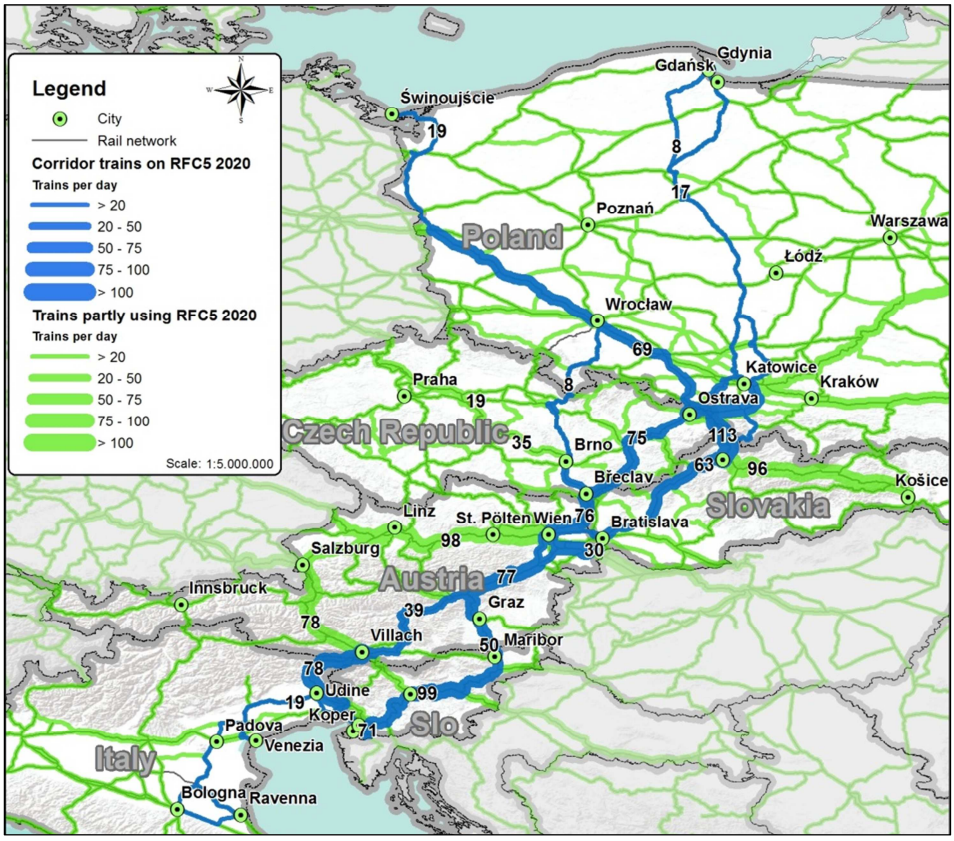

Figure 31: Potential of corridor trains 2020: possible number of daily border-crossing trains on RFC5; base-case scenario with RFC service

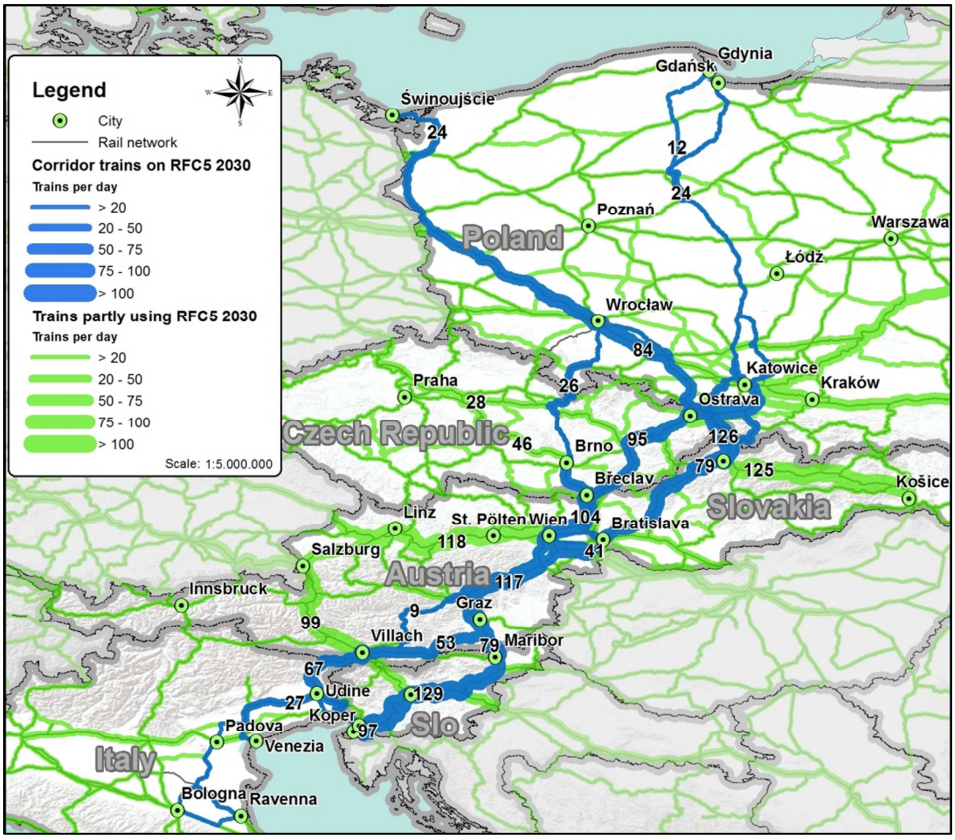

Figure 32: Potential of corridor trains 2030: possible number of daily border-crossing trains on RFC5; base-case scenario with RFC service

To give a better overview of modelling results for the different scenarios with their assumptions concerning future development, a summary of estimated rail freight traffic network loads at all border crossings along the RFC5 is given in Table 6.

Table 6: RFC5 cross-border rail freight traffic in million net-tonnes per year

Border crossing		base case			down-case	up-case
		2015	2020*	2030*	2030*	2030*
PL-CZ	Międzylesie - Lichkov	0,83	1,00	4,31	3,59	4,43
PL-CZ	Chałupki - Bohumin	10,35	11,53	14,36	11,32	14,94
PL-CZ	Zebrzydowice - Petrovice	7,84	8,44	11,52	8,40	12,18
PL-CZ	Zebrzydowice -Cesky Tesin	2,63	3,89	4,64	2,88	6,01
PL-SK	Zwardoń-Skalite	1,28	1,40	2,74	2,41	3,66
CZ-SK	Mosty und Jablunkova - Čadca	12,58	15,41	20,40	15,10	22,24
CZ-AT	Břeclav - Bernhardsthal	9,64	10,89	15,24	12,87	15,84
SK-AT	Devínska Nová Ves - Marchegg	1,86	2,12	2,66	2,25	2,76
SK-AT	Petržalka - Kittsee	3,61	4,40	5,85	5,51	7,18
AT-SI	Spiefeld Strass - Šentilj	5,35	7,71	11,30	9,19	12,27
AT-IT	Arnoldstein - Tarvisio Boscoverde	7,50	10,11	11,72	9,12	12,62

*years 2020 and 2030 inclusive RFC5 service

5 Conclusion

Socio-economic analysis shows, that Rail Freight Corridor 5 connects Italian industrial areas and Adria ports to the strong industrialised areas of Poland, Slovakia and Czech Republic. The connection to Poland ports in the North links those eastern European industrial centres to the Scandinavian countries as well as to world trade flows of Asia, Africa and America. Since freight transport volumes are dependent on trade flows and the latter are directly linked to economic development, RFC5 will serve as an infrastructure backbone and will support growing together of the connected economies.

Furthermore, sea shipping shift to Adria ports will significantly rise over the coming years and therefore the hinterland connection provided by RFC5 will become increasingly important. On the other hand, industrial production in the southern Polish regions are largely dependent on imports through the North Sea and Baltic ports and this will put pressure on the RFC5-infrastructure to allow for larger amounts of goods being handled and transported.

By conducting a comprehensive survey in all RFC5 countries, many interesting insights to the transport market could be derived. To state only one out of several results, requirements for the RFC service are summarised in keywords: C-OSS has to act as a real single contact point; offered tracks should be flexible; a customer friendly service should include information of the process of applying for tracks and shipments on the track; there is a particular demand for quick and short-term allocation of requested paths. In addition, the statements on minimum requirements for the RFC5 can be summarised in three main groups – infrastructure, services and quality indicators. The latter refer to a general demand for quick and cheap rail freight transports allowing enhancing the competitiveness of the rail system. Infrastructural demands can be summarised as a realisation of the TEN-T-specifications on the entire RFC5. This includes electrification, double tracks, sufficient capacity, train length of 740 meters and increase of axle load.

Based on the analysis of current situation and results of survey a freight demand model for the base year of 2012 was calibrated and forecasts for the years of 2015, 2020 and 2030 were compiled for different scenarios. Results of forecasts can be summarised as following:

Generally, base-case scenario reflects relatively strong growth projections for eastern European countries and rail infrastructure investments (which are a basic assumption for all scenarios) produce adequate capacities to cope with growth of rail freight traffic.

By looking at the down-case scenario, one can see much lower increase of rail freight traffic loads through the assumptions of lower GDP-growth. This could also be interpreted as a scenario, where GDP-growth keeps strong but effects on rail freight traffic are much lower due to lower GDP-to-trade elasticities. Nevertheless, as long as there will be no fundamental crisis, rail freight traffic should increase over the next century along RFC5.

Lower economic growth of Italy results in lower growth of rail freight traffic on Italian borders. Low share of rail concerning Italian ports gives a hint for possible future potential for shifting freight traffic from road to rail.

In contrast Slovenian borders show strong growth of rail freight traffic loads due to economic growth and much more due to very strong growth of in- and outgoing traffic of Koper. Especially for Slovenia, infrastructure investments are crucial to enable this development.

For Poland, Slovakia and Czech Republic strong economic growth leads to strong increase of freight demand. Especially in the last five to ten years, this growth was very much covered by road transportation. Rail infrastructure investments and strengthening efficiency of rail freight operation (e.g. through introducing Rail Freight Corridors) is very important to enable also growth of rail freight traffic as shown in the forecast of this study.

IKK, Boku, IHS, ZTL in January 2015