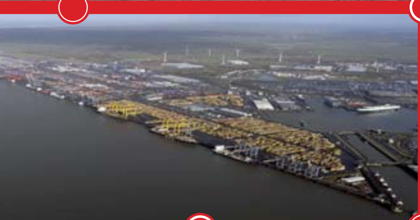
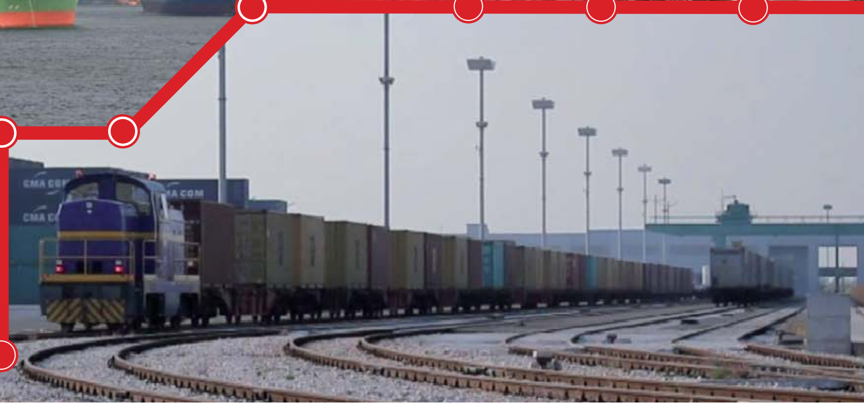
TIGER

THE CO-MODAL ROLE IN INDUSTRIALISING THE MARITIME TRAFFIC HINTERLAND DISTRIBUTION

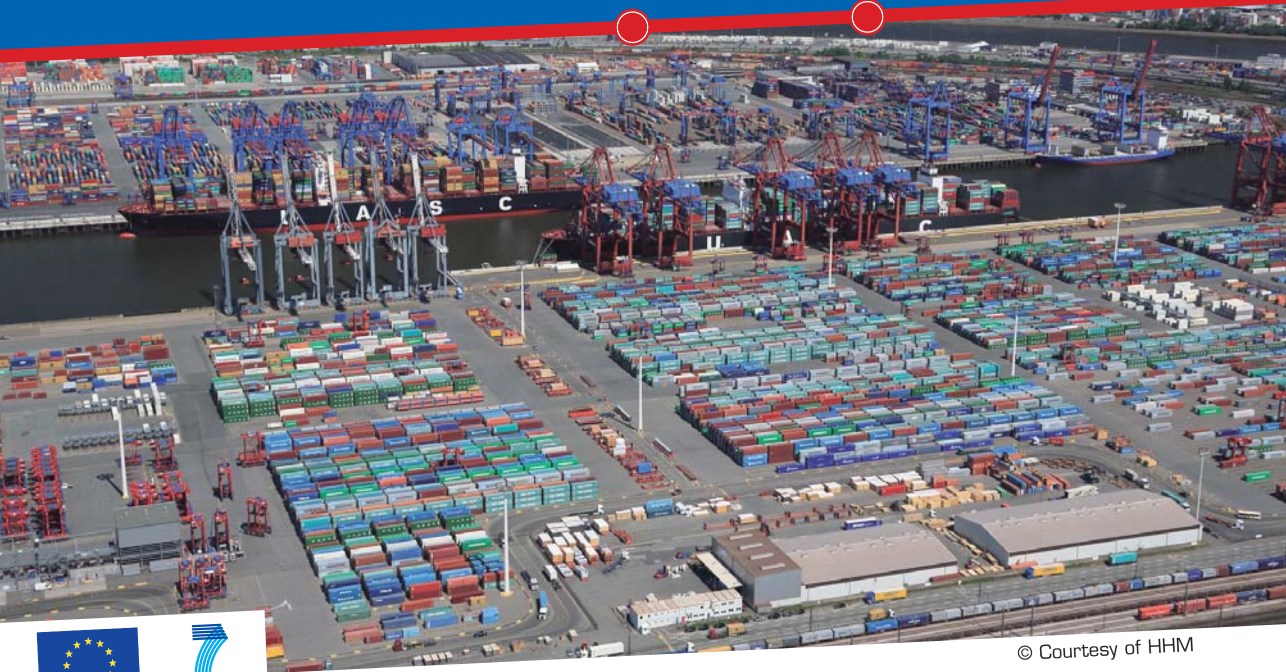




SEVENTH FRAMEWORK PROGRAMME

New OPERA

FINAL REPORT



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SEVENTH FRAMEWORK PROGRAMME

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TIGER IS A TRANSPORT RESEARCH PROJECT FINANCED BY THE EUROPEAN COMMISSION UNDER THE FP7 FRAMEWORK PROGRAM. THE PROJECT HAS BEEN DEVELOPED BY A MARKET DRIVEN CONSORTIUM LED BY NEWOPERA AISBL DURING A PERIOD OF 36 MONTHS UNDER THE SCIENTIFIC SUPERVISION OF DG MOVE. **TIGER** IS THE ACRONYM OF **T**RANSIT VIA **I**NNOVATIVE **G**ATEWAY CONCEPTS SOLVING **E**UROPEAN – INTERMODAL **R**AIL NEEDS

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THIS **TIGER** REPORT BOOK IS NOT ISSUED FOR COMMERCIAL USE OR COMMERCIAL DISTRIBUTION. IT IS INTENDED AS A TOOL FOR THE **TIGER** PROJECT DISSEMINATION. THIS REPORT BOOK IS PRINTED IN ONE ONLY EDITION. EACH BOOK WILL BE DISTRIBUTED FREE OF CHARGE TO ANY INTERESTED STAKEHOLDERS UP TO WHEN AVAILABLE.

1 . FOREWORD

Modal shift and GHG emissions reductions are vital components of the European Commission White Paper objectives towards a more sustainable Freight mobility. The White Paper objectives of reducing 60% the GHG emissions by 2050 minimizing the dependency from fossil fuels can be achieved through a better use of the existing infrastructures, reduction of energy consumption and the adoption of environment friendly transport means.
Such ambitious results cannot be fulfilled unless a long term planning view is taken from now to 2050 on the whole European mobility system involving both passengers and freight. The drivers for change amongst others are: efficient, clean and safe vehicles, better use of existing infrastructures, seamless mobility services, bottlenecks elimination, technology evolution, transport industrialisation, cooperative approach between the actors involved, European network of dry ports on the International rail corridors as traffic bundlers for economy of scale generation and last mile distribution from there.
The **TIGER** Large scale collaborative project which the European Commission has contributed to funding under the 7th Framework Program for Research and Development has involved numerous key European market actors who totally convinced of the correctness of these policies have decided to make very substantial investments in Ports and dry ports infrastructures, rail infrastructures, equipment, ICT and hardware technologies, intelligent management systems for translating these policies into concrete market uptake industrial opportunities.

This book which summarises the most important **TIGER** research and achievements is intended for a wider audience beyond the project's borders for encouraging other key actors engaged in different operating theatres to implement the best practices discovered during the **TIGER Project** development exception made for local geographical or morphological differences.

TIGER Project discoveries and on the field applications are pushing towards the progressive creation of a network of European Rail corridors where Freight transportation is enjoying higher degree of priority compared to present days. This approach is supporting the creation of a "European Rail Network for Competitive Freight" which will be indispensable for the achievement of the 2050 above mentioned White Paper objectives.

TIGER Project has provided a concrete proof that innovative Freight mobility solutions can be implemented as from now and this book is addressed to all those wanting to overcome challenges in their Transport and Logistic activities for a more efficient and sustainable cargo mobility policies in Europe.

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The **TIGER** "Read Thread" objective is to provide a synthetic explanation of the **TIGER** Rationale which is instrumental for a better understanding of this Final Report.

This book represents the conclusive document of the **TIGER Project** summing up its initial conception, its planning, the changing Market Environment, the Infrastructures adaptation, the equipment, the management systems, the tools, the Pilots, the applied solutions, the best practices, the impacts evaluation resulting from works and Research Innovations which lasted continuously for three years. The challenges to be overcome during the Project lifetime were very many having to resolve complexities in four separate geographical and social environments. The peculiarities of these four separate dimensions provided a considerable Value for **TIGER**. It became apparent right from the start that the findings, solutions, best practices applied during the **TIGER** development were sufficiently representatives for being exploited in other parts of Europe, exception made for geographical and morphological differences. Therefore in order to perceive the correct Value of the **TIGER Project** and its future influence on the European Freight mobility evolution, it is necessary to appreciate not only the improvements achieved in the four **TIGER** Demonstrators but also the benefits deriving from the replica application of the identified innovative solutions. In order to make visible this Value Added, it is necessary to explain the whole Project Development from its conception up to the Project conclusion.

The TIGER Project origin and its emerging structure. **TIGER** originated from the Rationale of the FP6 NEWOPERA Project which introduced in Europe the concept of the Rail Freight dedicated lines. This concept was further refined and elaborated by the European Institutions resulting in the final approval by the EU Parliament of the "European Rail Network for Competitive Freight" legislation. The implementation of such "Rail Network for Competitive Freight" entails the adoption of major European Corridors where Freight Transportation can be carried out with a greater degree of intensity compared to existing practices and above all in an industrial scale. The elaboration of this Transport concept, very innovative for Europe, coincided also with an increased congestion of the European Ports where it became apparent that the Economy of Scale generated at Sea by the new gigantic vessels, could not find any similar development on land. The Sea Ports were indeed capable of handling these new giant CTS vessels of 14,000 TEUs capacity through investments in lifting gears and equipment, only to discover that the crisis point had moved one step along the line in the Sea Terminal/Hinterland distribution area. The World Maritime Traffic doubled in six years between the Year 2000 to 2006 with the overland Infrastructures basically unchanged, be them road, rail or inland waterways. Starting from these basic premises a group of leading European Operators, Port Authorities, Infrastructure Managers, Service Providers, Engineering Companies and Research Organisations took the initiative for constituting the **TIGER** consortium having the objectives of industrialising the traffic from the Sea Ports to Inland Dry Ports bringing the vessels nearer to the points of origin and destination of the maritime cargoes. The **TIGER** Partners Consortium realised that the Sea Ports had within themselves the Economy of Scale necessary for feeding continuously intermodal trains capable of dislocating CTS in an industrial way to Dry Ports, Freight Villages, Mega Hubs located in the Hinterland traffic attraction zones. The Rail lines linking the Sea Ports with these Dry Ports, Freight Villages, Mega Hubs would be the corridors of the "European Rail Network for Competitive Freight".

The **TIGER Project**, born on these concepts, is totally market driven. The **TIGER** partners understood that the continued development of the Maritime Transport Industry, including the Sea Ports, could only take place through a major step change in the Rail Freight industrialisation process between the Sea Ports, Dry Ports, Freight Villages, Mega Hubs to the Hinterland destinations. The **TIGER** Partners seized these new market opportunities by using the three years of the recent recession for making investments in Infrastructure, bottlenecks elimination, Rail sidings, innovating equipment and management systems and getting ready for the additional traffic volumes forecasted from now to 2020.

The **TIGER** Partners identified these market opportunities in four geographical areas of Europe. Each one of these areas, having a traffic attraction zone based on one or more Sea Ports, constituted the operating theatre of a selected demonstrator to which a specific name was attributed as follows:

- GFC - Genoa Fast Corridor centred around Genoa Port and the Dry Port of Rivalta Terminal Europe;
- MARIPLAT - Maritime Platform centred around the transhipment Ports of Gioia Tauro and Taranto, the Ionian Rail line to Bari and the Adriatic Rail line from there to the Bologna Dry Port;
- iPORT - Innovative Port & Inland operations centred around the Ports of Hamburg, Bremerhaven and Wilhelmshaven and two Dry Ports in Germany introducing the "close to the Ports and close to the customers distribution approach".
- MEGA HUB - Intermodal Network 2015 centred around the Mega Hubs of Lehrte and Munich Riem where economies of scale are achieved combining maritime and continental traffic introducing new "train to train" production concepts.

The **TIGER** concepts attracted private investments both in Italy and Germany for hundreds of millions of Euros demonstrating that for projects, having sound economic fundamentals coupled with realistic market possibilities, the financial resources are made available by the market place.
During the **TIGER Project** development several dimensions have been planned, researched and developed. These dimensions are the object of this **TIGER** Final Report Book.

1. Market Assessment and potential targeted at 2020. This Work Package is constituted by two separate researches. The first one having assessed the Maritime CTS Traffic outlook with projection from now to 2020. In order to obtain the researched data based on sound foundations, three separate scenarios were envisaged. The CAGR scenario projecting up to 2020 the CAGR percentage of the last ten years incorporating also the recent recession. The GNP scenario projecting up to 2020 the average GNP as indicated by IMF with a multiplying factor as emerged in the last ten years. The NESTEAR scenario extracted from EUFRANET and EUROSTAT COMEXT database projected to 2020 according to mathematical modelling. For each research the minimum, maximum and average scenario was extracted with the purpose of obtaining a traffic projection cone on which each **TIGER** Port could identify itself for forecasting its own realistic performance.

   The second research, starting from the 2020 CTS traffic projections as above assigned these traffic volumes to the overland network according to the origin/destination matrix. This assignment had the objective to verify whether the forecasted volumes 2020 could be handled consistently and efficiently by the overland modalities either by road, rail or inland waterways.

2. Logistics concepts. For each demonstrator a complete survey of the existing Infrastructures, Terminals, equipment, procedures and processes has been accomplished. New designs, production layouts and re-engineered solutions have been applied in order to arrive for each

demonstrator at identifying the most effective and efficient solutions keeping into consideration both the geographical location, the natural barriers, the morphology of the territory and the operational constraints dictated by bottlenecks or other local Infrastructural impediments.

3. Tools and Means. Descending from the Logistics concept, each demonstrator identified the necessary Tools and Means capable of fulfilling the desired objectives. These tools and means had to alleviate or overcome the historic difficulties limiting the seamless execution of the maritime transport chain from ships to the hinterland destinations. They were by definition different for each demonstrator given the operational peculiarities characterizing the four geographical theatres. These Tools and Means varied between Infrastructure investments, bottlenecks corrections and adaptations, ICT and intelligent management systems, signaling, production management and control, Logistics chain optimization processes, integrated systems implementation, different organizational layouts, systems re-engineering, new intermodal chains, new booking systems, new equipment, just to mention the most relevant signifying the variety of the applicative fields.

4. Training for implementation. Considering the different actions introduced by each demonstrator it was apparent from the very beginning that specific training sessions had to be undertaken with all the personnel layers involved in these re-engineering processes. The training and re-training activities had the objective of enlarging and upgrading the required know how and competencies for a proper execution in the fields of the innovations introduced in the whole production chain from ship to terminals or trains and up to destination/origin the inland Dry Ports. In some cases it was necessary to implement an operational training on the job, in other cases it was necessary to train a selected number of trainers for subsequent and progressive rolling out of the new technologies and procedures. This aspect has proven to be very relevant during the whole **TIGER Project** execution. It involved complex processes of technological upgrading, more sophisticated job descriptions and contents, completely new professional figures, change management having ricocheting effects on labour and societal relationship. Such training paths, although positive for the development and enhancement of human skills, are challenging since it is typical of the human nature to be diffident towards any innovative changes from the status quo.

5. Pilots implementation. The implementation of Pilots in each operating theatre was the ultimate achieved result of the whole **TIGER Project**. Each Pilot was constituted by either the management of trains and transportation of CTS for a period of time testing the new production processes, or the introduction of new transport chains along different routings or testing new Terminals and Rail networks. Again the pilots implementation involved new Terminal production processes for achieving a number of optimisations in costs, transit time, congestion avoidance, quicker customs clearance through e-customs and e-seals and/or safer transport means through the application of new management and control systems.

6. Evaluation of Impacts. Towards the Project conclusion the research concentrated on dealing with the Cost Benefit Analysis enlarged to encompass the socio economic, environmental and energy relevant dimensions. Any Evaluation of Impacts entails the adoption of criteria and indicators capable of providing different forms of measurements. To this effect this Work Package prepared a tool based on the existing state of the art populated by Key Performance Indicators capable of expressing quantitatively the performance associated to each criteria. This implementation tool supported by a user friendly interface is capable of examining the results

for each demonstrator by comparing the basic measurement with the achieved improvement. The final objective of this research is the production of a report on Evaluation of Impacts summarizing the result of each demonstrator.

7. Internationalisation of Best Practices and Dissemination. The Internationalisation of Best Practices achieved by the **TIGER Project** and the dissemination activity are two facets of the same coin. While the dissemination activity started and continued through the Project lifetime using the classical tools for dissemination such as newsletters, internet, conferences, presentations, seminars, articles on the press, circulars, debates, etc., the Internationalisation of Best Practices was managed as an activity of its own. Various European Ports, Dry Ports, Freight Villages were selected in several parts of Europe as likely candidates for the replica application of the Best Practices identified in the **TIGER Project**. These identified Best Practices were presented during dedicated Workshops to the candidate organisations together with a checklist tools capable of putting in evidence the territorial differences. The candidate organisations targeted for the replica application were therefore capable of appreciating the value of the Best Practices and the modifications to be introduced because of the geographical operational context. It is then left to these organisations to incorporate such Best Practises into their production and distribution transport chain.

Conclusions. Most of the European Sea Ports, both in North Europe and in the Mediterranean, are confronted by a number of important challenges. The race by the shipping lines to seek their competitive advantage in ever bigger giant CTS vessels will not stop. Orders for 18,000 TEUs new buildings are in course of execution and designs for 23,000 TEUs ships have been submitted. These developments impose on Sea Ports two major challenges. The first for receiving and handling these vessels, the second for avoiding the Ports congestion resulting thereof. Infrastructures investments in further Ports developments are excessively expensive with not so attractive return in the long term combined with a very long time to market. Therefore the only viable avenue is to make a better use of the existing Infrastructures by industrialising the Ports distribution process to and from hinterland destinations. The Sea Ports are likely to reach their technical capacity intake by 2020 and therefore the actions necessary for keeping the traffic moving through the Ports are very urgent. All overland transport modes, be them road, rail or inland waterways, must produce far better performances if the Sea Ports are to regain their original mission of linking the Sea with Land. Rail intermodality, in particular together with inland waterways, is a mode capable of producing transport industrialisation compatible with the Economies of scale generated at Sea.
The **TIGER Project** had the ambition to demonstrate that such transport industrialisation from the Sea Ports to/from the hinterland Dry Ports, is not only possible but necessary. Such demonstration has been proven successful in two very representative operational theatre of Europe, one involving the North European Ports of Hamburg, Bremerhaven, Jade-Weser, the second involving the Mediterranean Ports of Genoa, Gioia Tauro and Taranto. The achieved results of this transport industrialisation can be applied elsewhere in Europe.

Franco Castagnetti
The Editor

3. INTRODUCTION & AKNOWLEDGEMENTS

The main drivers leading to **TIGER Project** originated from the European Commission efforts to achieve sustainable mobility through environment friendly transport means with particular attention to energy saving solutions and GHG reductions. Such efforts culminated in the adoption of a new legislation passed though the EU Parliament called "The European Rail Network for Competitive Freight" and a new European Commission White Paper on Transport, setting up very ambitious objective on a 2050 mobility scenario. Around these two basic pillars a number of other initiatives pointing in the same direction have been adopted or are in course of execution, such as the Core Network, the TEN-T Network, the ERTMS Corridors and the new importance attributed to Sea Ports, Dry Ports, Mega Hubs, Freight Villages, Stations, Terminals, Nodes capable of realising in practice the co-modal approach. The connectivity, the interfacing, the technological evolution are the tools capable of realizing the synchromobility which is the new buzz-word signifying the need of making a better use of the existing infrastructures having Europe realised that this is the only way to increase the system productivity at competitive costs. Budget constraints constitute colossal obstacles for dreaming about new Infrastructures which due to their long time to market do not constitute a realistic recipe for overcoming the competitive gap with other leading world market players. The other driver spearheaded from the FP6 NEWOPERA Project which provided unchallenged evidence that the European Rail Network has to produce a far better performance in Rail Freight. To this effect a number of preferential corridors must be identified for Rail Freight and Intermodality in order to produce better services at lower costs. It is necessary therefore to industrialise the Rail Freight intermodal transport chain and this operation is possible where Economies of scale are already existing and/or can be generated by traffic attraction zones. Such zones exist already, represented by the Sea Ports and by the Dry Ports/Freight Villages/Mega Hubs which are feeding industrial and urban agglomerates. Many local and central Governments of Europe have tended to forget that their cities are Urban Hubs for passengers and for people mobility but at the same time are also Hubs for Freight because of the consumables to be transported in the proximity shops and high street markets as well as for the disposal of the Urban waste produced as a result. New urbanization has not taken into consideration Logistics requirements and no planning activities have dealt with the emerging challenges of people mobility, cargo mobility and City Logistics. Each transport mode has found its own solutions lacking totally interconnections between themselves necessary for fulfilling comodality. A new planning awareness is therefore necessary for implementing and complementing the interfaces between transport modes in a combination of interchanges where cargo mobility can be carried out in an industrial way. The Sea Ports, the Mega Hubs, the Dry Ports and the Freight Villages constitute integral parts of these nodes where long distance freight trains are capable of operating regular services becoming the feed stock for people and industries. The Economies of scale so generated allow the implementation of longer, heavier and faster trains running between these platforms reducing considerably the operating costs. These interfaces are linked to the Urban Hubs through lighter trains and fuel efficient or hybrid vehicles for City Logistics distribution, producing lower noise and GHG emissions. A proper integration of the time factor with the space factor is necessary for transport avoidance and for favouring zero mile solutions.

TIGER Project is dealing with all these dimensions having identified in the various demonstrators the Sea Ports, the Dry Ports, the Mega Hubs and the Freight Villages where transport industrialisation can be achieved providing a guidance for other parts of Europe. Through the Internationalization of the **TIGER** Best Practices other Sea Ports and Dry Ports can themselves extract the same benefits producing the domino effect which is necessary for changing people habits, perceptions and behaviours.

The European Commission, through the contribution of the FP7 Programme has provided the necessary incentive and European wide imaging for **TIGER Project**. However **TIGER** could not have seen the light without a number of leading European operators being convinced of the potential expressed by this Project. Very substantial private investments driven exclusively by the new market opportunities have been realised during the Project lifetime in a period of recession in order to be ready when the European Economy will enter into a new expansion cycle. Courage and determination have been ingredients necessary to bring **TIGER** to its conclusion by which time the benefits of the fulfilled innovations are becoming tangible and visible.

Partner No.	Company short name	Involved experts
1	TRAIN	Valerio Recagno, Sara Fozza, Maria Lelli e Gabriella Messina
2	HACON	Marian Gaidzik, Lars Deiterding, Miriam Mascolo, Renee Keppler, Jan Hildebrandt
3	NEWOPERA	Franco Castagnetti, Armand Toubol, Horst Kubek
4	RIVALTA TERMINAL EUROPA	Roberto Arghenini, Romano Giacchero
5	DUSS	Wolfgang Müller, Barbara Müller
6	ELOG	Andrea Migliuolo
7	EUROGATE	Benjamin Brügelmann
8	GENOA PORT AUTHORITY	Francesca Moglia, Emanuele Profice, Gian Battista Maccagno, Francesca Pino
9	HAFEN HAMBURG MARKETING	Sebastian Doderer, Stefan Breitenbach
10	HAMBURG PORT AUTHORITY	Sven Heidmeier
11	BOLOGNA INTERPORTO	Zeno D'Agostino, Angelo Aulicino, Chiara Lepori
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13	KOMBIVERKEHR	Rainer Mertel, Uwe Sondermann, Christoph Büchner
14	LIGURIA REGION	Riccardo Mollo
15	RETE FERROVIARIA ITALIANA	Diego Sciulli, Laura Bunicci, Giusi Spitale, Stefano Castro
16	SOGEMAR	Sebastiano Grasso, Stefano Lontano
17	TERMINAL SAN GIORGIO	Maurizio Anselmo
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19	TRENITALIA CARGO	Francesco del Vecchio
20	UNIFE	Giorgio Travaini, Helene Koepf, Lea Paties

The TIGER PROJECT for the Market Assessment, involving a complete research on Market projections targeted at Year 2020, accessed the competencies of Professor Chistian Reynaud of NESTEAR, Paris, specialized in mathematical modelling.

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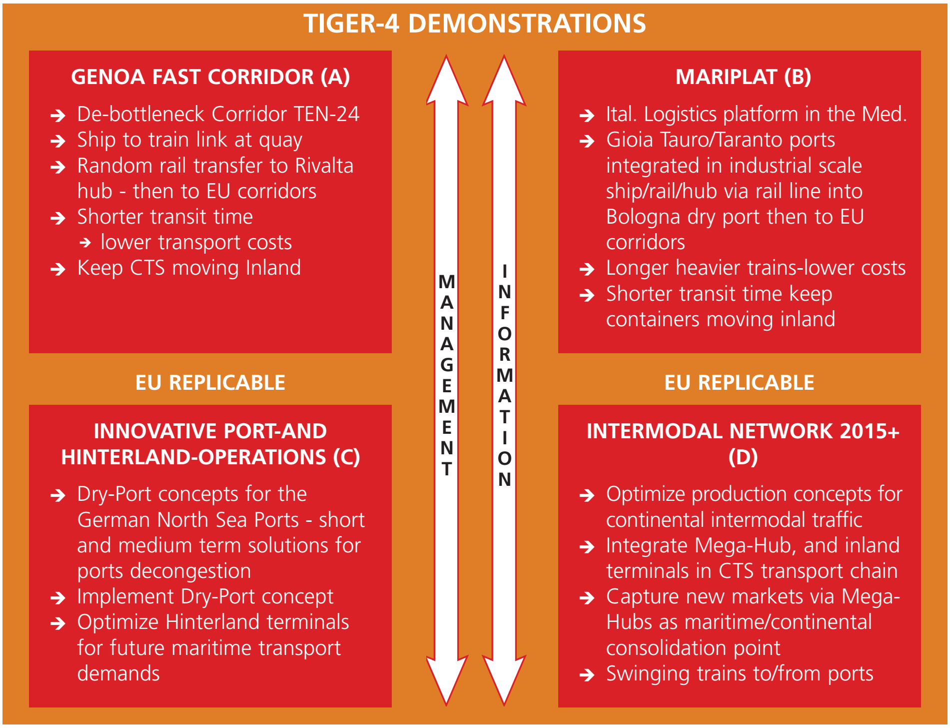
4. FRAMEWORK AND METHODOLOGIES

It has been established in previous research works that the generation of transport demand is growing between 2 to 3 times the European GNP. In particular the World CTS Traffic doubled between Year 2000 to 2006 from 240 to 450 MM TEUs. This colossal growth has generated a formidable development in ships evolution at Sea while the overland Infrastructures remained practically unchanged. This awareness is pointing decisively into the direction of a major re-engineering of the transport processes on land and particularly the Rail ones.

The **TIGER project** Rationale is driven by the European need of achieving a greater degree of effectiveness, efficiency and competitiveness on the Rail Freight Network. This is now perceived as being key for a more sustainable freight mobility. The reduction of road congestion, accidents, emission on the atmosphere and the negative effects on climate changes are leading to a safer and better environment for improving the quality of life of European citizens. In particular the recent breaks in trends in global trades brought about by EU enlargement and by the enormous traffic flows with the Far-East and South East Asia, have highlighted the impossibility of road modality of sustaining by its own the future European need of freight mobility. Port congestion has become a common feature both in the North and South of Europe to the extent that only a new distribution system to/from ports to inland destinations based on industrial intermodal shuttle trains represents the solution of this problem. The objectives of keeping the traffic moving through the European ports and increasing the market share of rail freight traffic improving the Rail Network productivity, are indeed the biggest challenges of our times.

The Project Framework has been built around the four demonstrators as indicated in the next figure (Figure 1).

→ Figure 1: The scheme representation of the Four **TIGER** Demonstrators

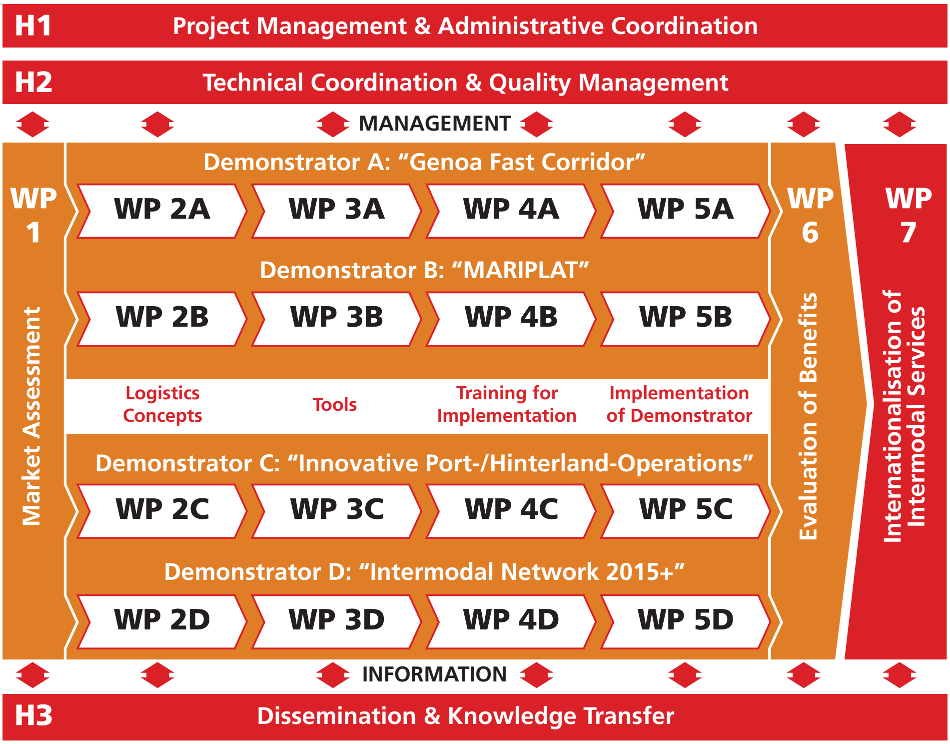


From the schematic representation of the four **TIGER** Demonstrators, it has been possible to imagine a Project methodology which could have a starting point from the market requirements, a development operational phase of the four Demonstrators incorporating all innovations up to personnel training to suit that market requirements and a conclusive phase encompassing the impacts evaluation, the applied best practices and their internationalization/dissemination. As a result of this Project development design it was possible to identify a sound methodology embracing the following steps:

- The market assessment
- The elaboration and planning of the different technical solutions for the 4 demonstrators
- The selection and implementation of the necessary hardware and software technologies
- The personnel training for each demonstrator implementation
- The Impacts evaluation including social, economic and environmental dimensions
- The Internationalization of Best Practices
- The dissemination activities during the whole Project lifetime

Having visualized the Project contour and the Project components it has been possible to give **TIGER** a proper structure assigning to each component Work Packages and Tasks capable of fulfilling the areas of intervention.

Figure 2: **TIGER Project** with Work Packages & Management Structure.
Source: **TIGER Project**



The **TIGER** Management, Administrative and Technical Coordination, together with Quality Assurance and Dissemination guided the Project to the complete fulfillment of its objectives.

4.1 THE **TIGER** PROJECT CHALLENGES

The **TIGER** project challenge is to provide a number of solutions to the EU Ports for eliminating or minimising Ports and road congestion. These identified solutions envisaged the reaching of the inland European destinations in an industrial way by Rail intermodality leading to a more sustainable mobility. The next table (Figure 3) represents the followed methodology indicating the area of **TIGER** interventions producing the desired results.

➔ Figure 3: **TIGER** interventions areas and actions

AREAS OF INTERVENTION	**TIGER** ACTIONS
Maritime Traffic Projections 2020	Research on 2020 Sea Ports technical capacity
Traffic assignment to demonstrator ports	Research on overland compatible Infrastructures
Co-modal Assessment	Research on actual co-modal solutions with extraction of best performances from each mode Sea- Rail- Road- Inland waterways
Logistics chains Assessment for each **TIGER** Port. Sea Ports natural traffic basins and accessible attraction zones via Dry Ports/Mega–Hubs intermodal services	The Four Project Demonstrators via Dry Ports/Mega Hubs: ➔ GFC - Genoa Fast Corridor ➔ MARIPLAT - Maritime Platform ➔ iPORT - Innovative Port & Inland operations ➔ MEGA HUB - Intermodal Network 2015
Physical and psychological barriers, service barriers, traditional production processes, traditional transport chains, fragmented interfaces, productivity gaps, non-standardized procedures	New Dry Ports and Mega Hubs for transport industrialisation and multiplication. New business models, innovative routings, new transport chain processes, space optimisation, traffic bundling, e-customs, e-freight, e-seals, e-security
Equipment gaps, technological gaps, training gaps	Management systems, intelligent systems, production control systems, hardware technologies, new interfaces, system compatibilities, equipment update, theoretical and on the field training
Bottlenecks identification	Bottlenecks corrections
Broken and inertia, service gaps	Shuttle service regularity, service quality
Rail lines capacity limitation	Longer, heavier and faster trains
Information availability and information flows	ICT technologies, track and trace, electronic readings/bar codes
Benchmarking	Identified best practices
Impact evaluation	Operational costs reduction, transit time reduction, rail freight market share increase, rail lines capacity increase, increase of commercial speed in rail corridors, energy saving, transport sustainability, GHG emission reduction, congestion reduction
Infrastructures, redundant productivity	Better use of the available resources through use of preferential corridors for freight
Train composition for Economy of scale	Traffic bundling through combination of different types of cargo
Habits, perceptions, behaviours	Quality of life value, noise reduction, carbon footprint reduction, human resources opportunities, environment as a limited resource
Open "free for all" mobility	2020 Freight Mobility Vision

4.2 THE WPS AND TASKS DEVELOPMENT TO SUIT THE OBJECTIVES

Here below are indicated the Work Packages which characterized the Project development together with the specific Tasks that each WP was called to research, elaborate and develop.

H1 PROJECT MANAGEMENT AND ADMINISTRATIVE COORDINATION

This WP had the objective of controlling both the financial and administrative project procedures according to the contractual obligations undertaken with the European Commission.

H2 TECHNICAL COORDINATION

This Work Package had the objective of evaluating and monitoring the Project progresses according to the GANTT chart. The coordination efforts between the Demonstrators, the communication channels and the problem solving were part of this Work Package. The Technical Coordinator, supervised each Demonstrator Leaders, responsible for its own area of activity, making sure that the progress were consistent with the overall Project objectives.

H3 QUALITY MANAGEMENT

The Quality Management Work Package aimed at ensuring that proper quality was achieved by the Project and that performances were improved during the project development. In parallel, it provided continuous assessment of the key criteria or requirements of the Project development. The emphasis was on achieving continuous improvement of performances, largely through addressing common causes of process variation.

H4 DISSEMINATION

This Work Package had the objective of disseminating the **TIGER Project** concepts and innovation through a variety of tools and channels. The Networking activities with other major transport and logistics actors as well as cross fertilization with other European co-funded Projects, were part of this Work Package.

WP1 MARKET ASSESSMENT

This Work Package had the objective of identifying seaborne CTS traffic attracted by the Demonstrators Ports with their traffic basins servicing the inland European destinations. This Task had to be fulfilled using a number of sources including EUFRANET, EUROSTAT, NEWOPERA, COMEXT as well as other commercial information. The core activity of this Work Package was the definition of the import/export CTS traffic volumes and future trends from now to 2020. Once the first part of this research was accomplished it was necessary to attribute to each **TIGER** Port the traffic volumes to be routed via the identified Dry Ports and Mega Hubs. At the same time it was necessary to verify if the Rail Infrastructures to and from these Dry Ports and Mega Hubs were coherent with the assigned traffic volumes for the same period of reference.

WP2 Genoa Fast Corridor
WP3 MARIPLAT
WP4 Innovative Port- and Hinterland-Operations
WP5 Intermodal Network 2015+

These Work Packages had the objective of defining, designing, engineering the Logistics concepts and operations for each Demonstrator, taking into account the local geographical, morphological and infrastructural situation of each **TIGER** Port and its traffic attraction zone.

Once the re-engineered Logistics operation had been planned, these Work Packages had to take care of the necessary equipment, technology, tools and means, production concepts, software, management systems as well as the innovative processes emerging thereof, encompassing the training for implementation up to the final Pilot test. For the detailed operational description of each Demonstrator, suiting the maritime transport chain of each **TIGER** Port, please refer to chapter 4 of this Final Report.

WP6 EVALUATION OF IMPACTS

This Work Package had to evaluate the impacts resulting from the application of the different solutions implemented in the four Demonstrators. This analysis was covered using an integrated approach capable of preparing suitable input for the WP "Internationalisation of Best practices", where the applicability of the **TIGER** solutions to other areas or corridors of Europe was assessed.

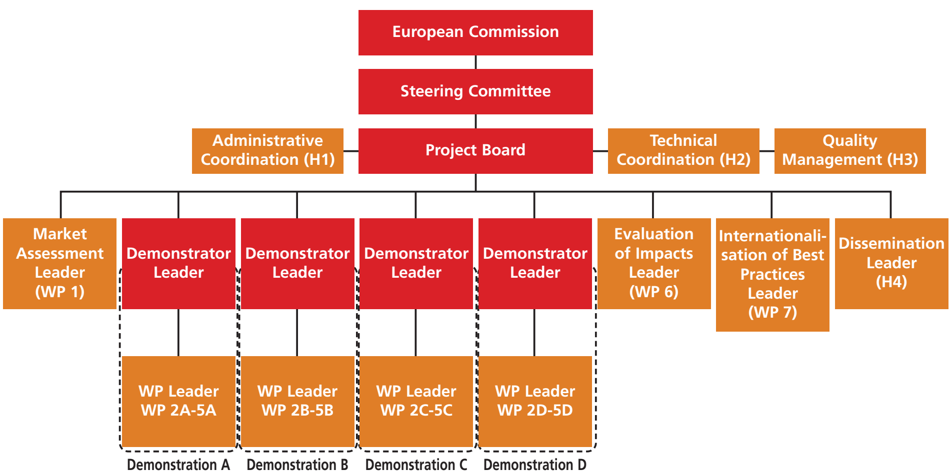
WP7 INTERNATIONALISATION OF BEST PRACTICIES

The new business models identified during the optimisation process of the four Demonstrators had the opportunity to test new production processes, equipment, services, links, trains, tools, management systems, technologies, corridors, which brought considerable innovations, costs savings, transit time savings to the whole maritime transport chain. Best practices were identified in each Demonstrator which could be suitable for replica application in other Ports, Dry Ports, Mega Hubs of Europe, exception made for local, geographical or Infrastructure differences. This Work Package had the objectives to bring these Best Practices to fruition in other European operating theatres.

4.3 THE PROJECT MANAGEMENT STRUCTURE

In order to secure the complete fulfilment of the **TIGER Project** objectives a proper management structure had to be put in place capable of coordinating the Demonstrators efforts and steering the necessary process for decision-making and any emerging corrective actions. The **TIGER** management Project structure operated according to the chart indicated in the figure (Figure 4) reproduced here below.

→ Figure 4: The Project Management Structure.
Source: **TIGER Project**



5. THE STATE OF THE ART AND THE TIGER PROJECT OB-JECTIVES

5.1 STATE OF THE ART

This **TIGER** Task is focusing on the European Import - Export Seaborne Traffic. All major European Ports experienced in 2009 either traffic reductions or at best stagnation after many years of relentless traffic expansion which brought the most successful ones to more than double their throughput in a relatively short period of time. Smaller or regional ports were no exception. Although these volume increases were driven by the trade explosion with China the Far East and South East Asia, other Continents trading with Europe such as the Americas and Africa achieved above average performances. Short sea trade and feeders benefited significantly from this traffic expansion. Vessels in short sea shipping became also bigger reflecting the general trend of the major World Shipping Lines. They rejuvenated their fleets with vessels exceeding 10.000 TEUs capacity. The strategic move towards giant CTS vessels was partially market driven and partially dictated by the competition game.

The maritime CTS traffic data for the Ports of **TIGER** interest and their geographical area of attraction have been researched. The database so obtained is projected to 2020 in order to make an intelligent assumption of throughput scenarios for each Port. The traffic projection for each Port is then compared with its theoretical throughput capacity allowing an immediate visualization of both its development or constrained possibilities. This market research is focused on the North Sea and Mediterranean Ports with particular reference to the six **TIGER** Demonstration Ports. These are Hamburg, Bremerhaven, Jade-Weser for the North Sea and Taranto, Gioia Tauro, Genova for the Mediterranean.

Relevant political and economic factors are also properly evaluated such as:

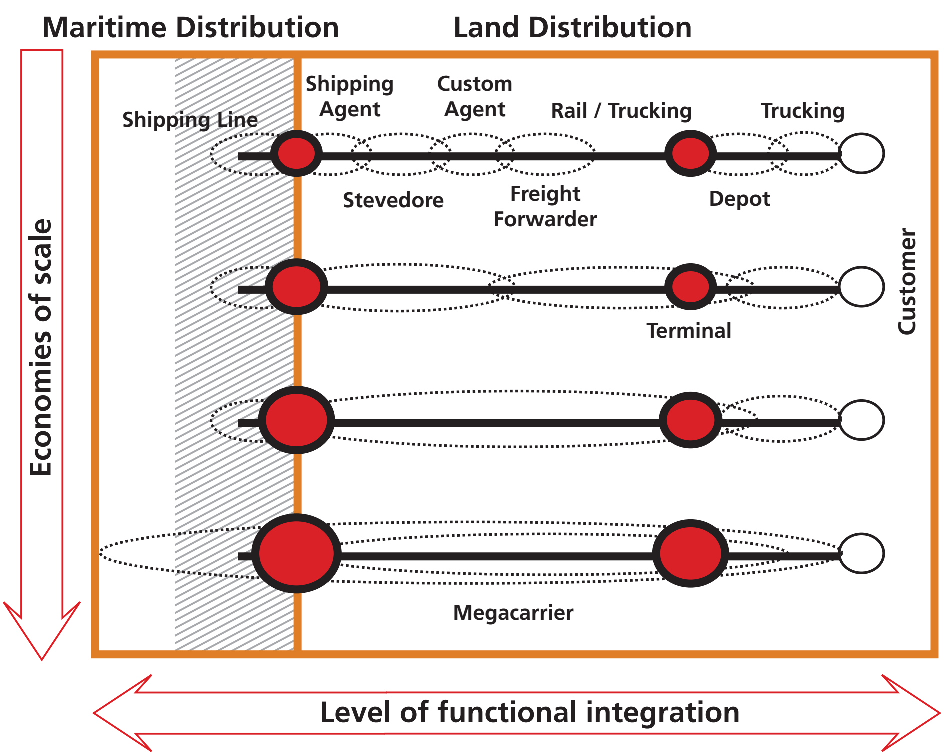
- The enlargement of the European Union towards the East;
- The New European Union neighbouring policy opened towards CIS/ Balkans countries as well as MEDA countries. The European Rail corridors will extend to these new neighbouring countries providing fresh business opportunities;
- The European integration with particular reference to the harmonization of a Common transport policy, the opening of the European Rail freight space to competition following the implementation of the three EU Rail Packages and the development of a European Rail Network for Competitive Freight;
- The constitution of the ERA European Rail Agency for the achievement of rail interoperability;
- The effective separation in each Member States between the rail operating companies and the infrastructure managers.

Demand and supply evolution are taken into consideration as well as evolving commercial or trade patterns. Environmental issues are also a relevant part of the scenario building. In previous research project such as **NEWOPERA** it emerged that traffic generation brought about by Trade Globalisation is averaging between two and three times the national GNP of the Country/Continent taken as reference. Some trading zones generated even higher traffic volumes; others less. The reasons for this transport multiplication are attributable both to manufacturing delocalisation for costs reasons and for products components brought to one point for final assembly and distribution to the consumer's markets. These mega trends could not be sustainable with the same pace for ever. A trading pause was to be expected as stated in the **NEWOPERA** Final Report.

The giant CTS vessels ordered during the traffic booming years have either been delivered or will be delivered during the coming months despite some shipping lines have been trying to postpone such deliveries. As a result yet another modification of the handling pattern Sea/Shore is taking place. The last generation CTS vessels call at a fewer number of ports. In the ports called, due to the vessels total capacity, the handling operations involve a larger number of movements. Such pattern entails a revision of Ports operations combined with adaptations in infrastructures and equipment upgrade. The Ports must be capable of receiving these giant CTS vessels at their berths reflecting both on the water depth as well as on the crane beams for the vessels' breath. At the same time each call is characterised by an increased number of movements impacting on the quay terminal space and on the traffic re-forwarding ability into the hinterland from the ports in an industrial way.

It is likely that fewer Port calls generate for the CTS a distance increase from the Ports to their final destination. Long distance transportation by Rail both on the National Rail Network and on the major European corridors is paramount both for service and cost competitiveness. Moreover one has to consider that Road modality has been in a position in the past to cope with traffic increases.

→ Figure 5: Functional Integration of Supply Chain (Adapted Model of Robinson)
Source: Naples Port Authority



With the introduction on major sea routes of this last generation CTS vessels exceeding 10.000 TEUs capacity it has become apparent that a Port distribution on a "one by one" delivery model, is no longer adequate.

The drive towards employing larger CTS vessels has affected all trades and services. Also the so called "pendulum services" from a trading zone to another and vice versa, have enlarged their tonnage. Less competitive CTS vessels both for inadequate capacity or high fuel consumption are being scrapped.

A new distribution plan to and from the Ports based on industrial shuttle trains operating between them and inland Dry Ports or Mega Hubs has been considered the only viable alternative. Such system allows the fast handling of a large number of CTS and their positioning near to the final customers in inland Terminals. Sea Terminals are thereby decongested.

The existing economic recession with the consequential Port traffic reduction with less congestion both inside the Ports and on roads, could induce many transport operators to imagine that problems have been resolved by themselves. Such contingent attitude could be very dangerous and detrimental to the future of European rail freight mobility scenario. This limited amount of time during which the congestion problems have not been so acute must be used for investing in the necessary operating adaptations to be ready when the traffic level is back to normal. One must not forget that overland infrastructures both road and rail are limited resources. They must be used at their optimum level and the overall transport system productivity must be increased. Investments in new technologies, equipment and management systems are necessary for achieving the desired productivity objectives. Investments in inland Dry Ports or Mega Hubs infrastructures to a scale compatible with the traffic volumes of the futures are the correct answer for facing these challenges.

Another dimension to be taken into consideration is the environment. The negative effects created by road congestion accidents and pollution, call for modal shift in favour of rail which is a more sustainable transport mode. The quality of life of the European citizens combined with the negative effects of climate changes are all relevant factors for policy makers. Any market produced solutions in favour of more sustainable freight mobility reducing the CO_2 carbon footprint, deliver better results compared to possible top down decisions likely to occur in case transport industry fails to achieve the required targets.

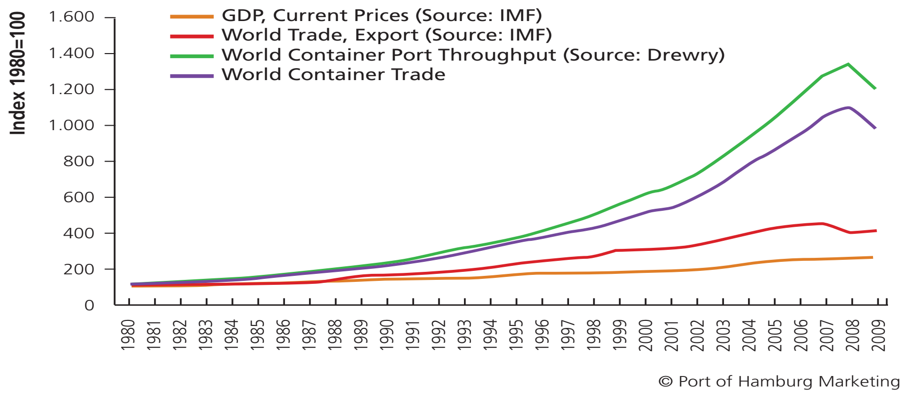
Trade is traditionally connected to GDP. Figure 6 illustrates the evolving relationship between world's export of goods and the growth in world's GDP as well as the relationship to the containers trade.

The international labour differences as well as the decentralisation of production processes are the main elements contributing to the world merchandise trade growth (since 1950 by a factor of 27). This yields a considerable increase of worlds GDP (since 1950 by a factor of 7.7). The seaborne trade is steadily growing due to the following reasons:

1) The production process decentralisation is taking place in distant economic areas from Europe such as China, the Far East, South East Asia, Central and South America.
2) Two/third of the Earth's surface is covered by water.
3) Sea going Vessels and Ports together constitute the most competitive transport mode. Both conventional and containers vessels are capable of covering great distances and are capable of carrying all types of cargo in an industrial way.

Since 1980 cargo transported by sea doubled to a figure of 8.023 billion tons in 2008 with an average yearly growth of 2.8%.

→ Figure 6: The Principle of Traffic Growth
Source: HHM 2010



In the 60ies containers were introduced in order to facilitate cargo shipping and forwarding and for reducing damages in transit. This system based on ISO standard use of containers, became very successful both at sea and on land. The containerization assumed a global coverage reaching also the underdeveloped countries. In 2008 the proportion of total cargo transported in containers has reached 65% of global transported cargo. As a result, the world container trade has grown as a mushroom. Since 1980 the average growth has been 7.9% per year to a figure of approximately 133.0 million TEUs in 2009.

The world containers port throughput has developed even faster with an average growth rate since 1980 of about 8.7% per year to a figure of 470.6 million TEUs in 2009. The difference between the container trade statistics and the container port throughput statistics is attributable to the containers transhipment traffic. The containers transhipment traffic is growing of importance for all ports with a trend that is likely to continue. In fact the giant container vessels exceeding 10.000 TEUs capacity calling at a fewer number of ports are likely to increase this transhipment traffic. Transhipped containers are handled at least twice. The first time when arriving with an ocean vessel the second time when loaded on a feeder vessel reaching their final destination port. The reverse operation is taking place for the contra flow. In addition empty containers are counted in containers port throughput statistics whereas they are not counted in world container trade statistics.

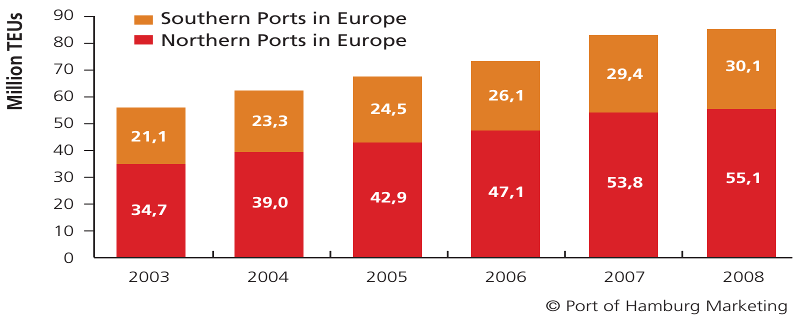
Due to the world economy slowdown as a consequence of the financial market crisis, global trade has suffered a sudden halt in its expansion trend. The lower confidence ricocheting from the financial markets affected the population at large, provoking a reduced level of economic activities. In 2009 the world's GDP decreased by -1.1 % from a +3.4 % . With the help of the concerted efforts operated by the various Governments, World economic activities are projected towards a gradual growth in 2010 picking up to about 3%.

5.2 THE CTS THROUGHPUT EVOLUTION IN EUROPE

To the effect of this research, the North European range and the Mediterranean range are of interest. Consequently out of this total picture, this research focused and made a proper survey of these two areas. Starting from the traffic volumes at disposal the immediate and future scenario evolution has been established for North Europe and the Mediterranean with particular reference to the **TIGER** ports.

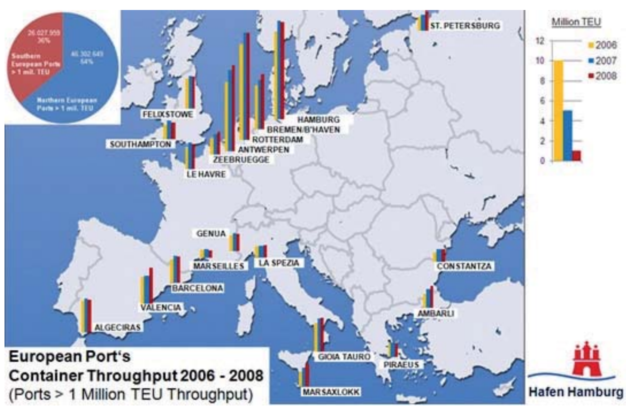
Since 2003 European ports traffic experienced a constant growth. While in 2003 approximately 55.8 million TEUs were handled through European ports the CTS traffic totalled in 2008, 85.3 million TEUs. This equates to an increase of 52.8%. Therefore Northern European ports have a share of 64.6% or 55.1 million TEUs while Southern European ports reached 35.4% or 30.14 million TEUs respectively (see Figure 7)

→ Figure 7: European ports container throughput 2003-2008
Source: HHM



The next figure (Figure 8) illustrates the geographical position of those ports having a turnover exceeding 1 million TEUs.

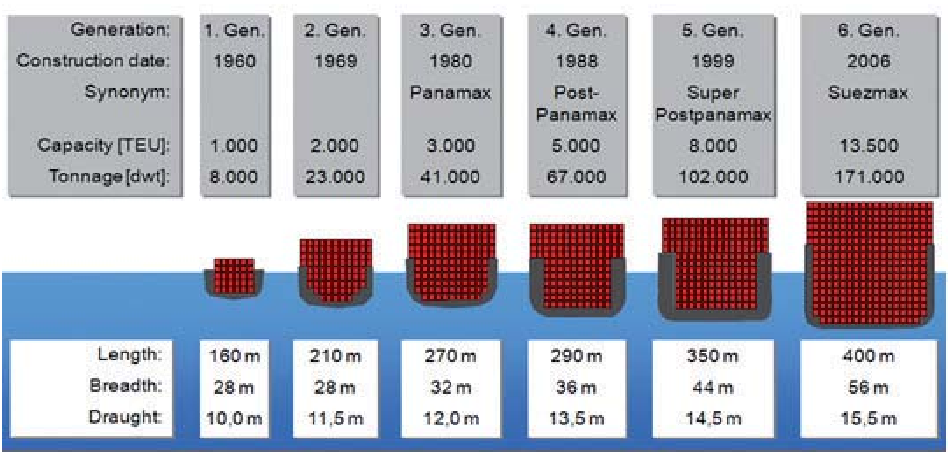
→ Figure 8: European Port's Container Throughput 2006-2008
Source: HHM, 2010



5.3 CONTAINER VESSEL SHIPBUILDING TRENDS

The container vessels dimensions have grown over the years providing increasing carrying transport capacity. The following figure (Figure 9) illustrates the development of new CTS ships as from 1960. The largest of these ships are capable of carrying today 13,000 TEUs or more.

→ Figure 9: Containers vessel size groups
Source: HHM



The growth in dimensions is highlighted by comparing the first generation of container vessels established in 1960 with a total length of about 160m, a breadth of about 28m and a draught of about 10m with the last generation of containers vessels with a length up to 400m a width up to 56m and a draught up to 15.5m.

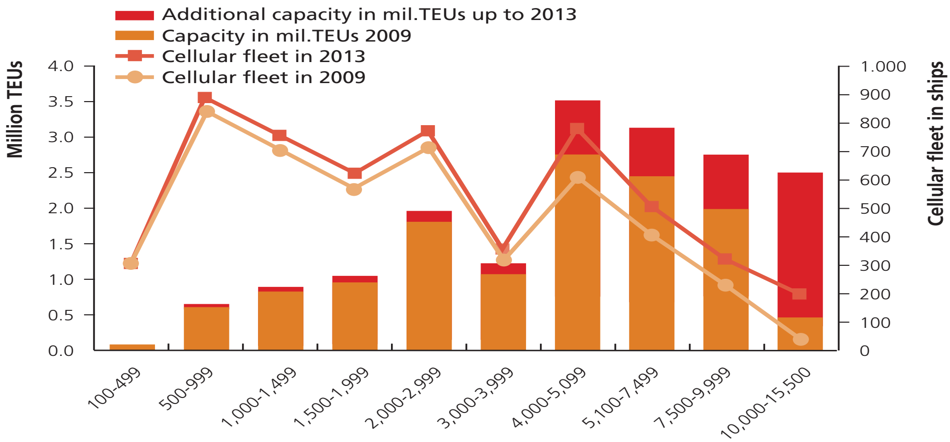
The steady capacity increase of container vessels is the continuous research of competitive advantages based on economy of scales and handling industrialization. The economies of scale applied to CTS vessels produce an average lower cost per slot proportional to the capacity increase.

This trend towards giant CTS vessels has been prompted by a steady transport demand generated by world trade globalization and development. During the last few years it appeared that the demand of shipping services could be endless. Vessels on the West bound leg towards Europe from the Far East were sailing full and shipping lines in order to provide a commercial/operative answer to this market trend, embarked themselves into a massive program of investments in new last generation tonnage.

5.4 CONTAINER VESSEL DELIVERY PROGRAM

According to AXS-Alphaliner the container vessel delivery program is highlighted in Figure 10. The scale on the left side expresses the nominal container capacity in ml. TEUs of cellular ships while the right side scale highlights the number of ships characterised as cellular fleet. The scale on the base line shows cellular ships subdivided by size groups. When observing the cellular ship size groups it becomes apparent that the additional nominal capacity is provided by cellular ships exceeding the 3,999 TEUs group. In particular one can note that an enormous share of that additional nominal capacity in TEUs will be provided in the market by ships of over 10,000 TEUs. On the other hand, it appears obvious that new constructions in the smallest ships group of up to 499 TEUs nominal capacity are discontinued. No single new order is placed for this kind of small vessels and the amount of ships existing in the market is indeed very low.

Figure 10: Cellular ship delivery program 2009-2013
Source: HHM, data: AXS-Alphaliner



The next figure (Figure 11) allows an even more detailed overview. In 2009 nominal capacity of cellular ships amounted in total to 13.1 ml. TEUs. This total is due to grow to 17.7 ml. TEUs in 2013 due to a further addition of 4.6 ml TEUs. New cellular ships for 757 new constructions have been ordered. The end result of this trend is that the orders of cellular ships above the 3,999 TEUs nominal capacity group is twice as high (511 vessels) as the amount of ordered ships below 4,000 TEUs nominal capacity group (246 vessels). Focusing the attention on the ships ordered above the 4,000 TEUs nominal capacity group, they provide 90% of the tonnage growth (4,167,931 TEUs) of which the ships above 10,000 TEUs provide themselves more than 43%.

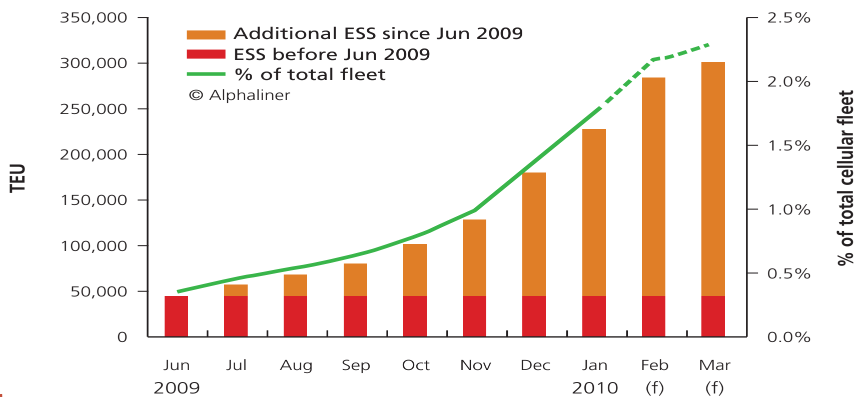
While in 2009 the share of cellular ships above 10,000 TEUs nominal capacity group compared to the total was below 4%, this percentage is due to rise to 14% in 2013 according to the data provided by AXS-Alphaliner.

→ Figure 11: Cellular fleet and their nominal capacity in mil TEUs in 2009 and 2013 subdivided by cellular fleet groups
Source: HHM, data: AXS-Alphaliner

	Asset 2009			Additional up to 2013			Projection 2013		
Ship size in TEU	Ships	TEUs	Share (TEU)	Ships	TEUs	Share (TEU)	Ships	TEUs	Share (TEU)
100-499	304	98,423	0,8%	0	0	0,0%	304	98,423	0,6%
500-999	833	613,523	4,7%	50	40,702	0,9%	883	654,225	3,7%
1,000-1,499	700	826,698	6,3%	53	60,005	1,3%	753	886,703	5,0%
1,500-1,999	567	960,320	7,4%	49	86,622	1,9%	616	1,046,942	5,9%
2,000-2,999	711	1,803,853	13,8%	58	150,200	3,2%	769	1,954,053	11,0%
3,000-3,999	318	1,083,299	8,3%	36	126,362	2,7%	354	1,209,661	6,8%
4,000-5,099	609	2,753,315	21,1%	167	748,873	16,2%	776	3,502,188	19,8%
5,100-7,499	404	2,452,116	18,8%	101	661,210	14,3%	505	3,113,326	17,6%
7,500-9,999	232	1,987,321	15,2%	86	744,470	16,1%	318	2,731,791	15,4%
10,000-15,500	40	477,982	3,7%	157	2,013,378	43,5%	197	2,491,360	14,1%
Grouped:									
100-3,999	3,433	5,386,116	41,3%	246	463,891%	10,0%	3,679	5,850,007	33,1%
4,000-15,500	1,285	7,670,734	58,7%	511	4,167,931	90,0%	1,796	11,838,665	66,9%
Total	**1,718**	**13,056,850**	**100%**	**757**	**4,631,822**	**100%**	**5,475**	**17,688,672**	**100%**

The shipping market in 2009 was characterized by overcapacity and by considerable drop in freight rates. The picture at the beginning of 2010 is still the same. However big efforts are made by ship owners in order to absorb at least part of the over capacity existing in the market place. One of the adopted measures is the "Extra Slow Steaming" (ESS) which has gathered momentum in liner operations when fuel prices reached the level of $350 per ton or more in June 2009. Since November last year, the ESS approach has been applied to almost 20 long haul loops. With the fuel price now reaching $500 per ton or more, this trend is expected to continue in the foreseeable future. By the end of January 2010, the ESS approach had already absorbed 230,000 TEUs of vessel capacity and this figure will rise to over 250,000 TEUs in February since more carriers slow down the speed of their deployed vessels to save fuel costs. The next figure (Figure 12) shows the pace by which the ESS approach is producing its effects of absorbing redundant carrying capacity. From the original baseline of about 45,000 TEUs of absorbed capacity in 2008, the figure is now close to 300,000 TEUs.

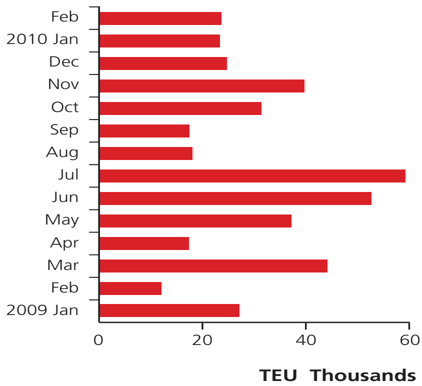
→ Figure 12: Capacity absorbed by Extra Slow Steaming (ESS)
Source: AXS-Alphaliner



The initiatives connected to the ESS approach kept in activity 47 vessels of between 3,000 and 13,000 TEUs, which otherwise would have been idle. The capacity kept active through the ESS approach equates to 2.3% of the total cellular fleet. With the bunker price at around $500 per ton, the ESS strategy generates 5-7% of savings in the total operating costs on long hauls. Such savings include the costs of the extra ships deployed on the journey and of the additional number of containers required to provide the service for longer transit times. The translation of the ESS strategy into annual savings allows for example to save $15-20 ml. for a typical Far East-Europe service which uses vessels in the size range of about 8,500 TEUs.

Another adopted measure for reducing over capacity is the tonnage scrapping. The following figure (Figure 13) illustrates the development of scrapping as from January 2009 and forecasts planned scrapping activities up to February 2010.

→ Figure 13: Scrapping 2009-2010 by month
Source: AXS-Alphaliner no. 09-2010, page 8



The basic conclusion of the above elaborations is that the order book up to 2013 is constituted by ship's over 10,000 TEUs and therefore the additional growth in nominal capacity is produced by these vessels. In more details:

- The growth is produced by ships above 3,999 TEUs nominal capacity group representing a share of 90%;
- A big share of this nominal capacity growth is provided by cellular ships of 10,000 TEUs or more (43.5%), representing the second largest amount of cellular ships on the order book (157 ships up to 2013).

5.5 REQUIREMENTS ON PORTS INFRASTRUCTURES

The CTS vessels size and technology evolution influenced the need of upgrading the ports infrastructures, their handling and moving equipment as well as their hinterland connections.

The port handling CTS equipment constituted by ships cranes, fork lifts, straddle carriers, port trailers, wagons, rail infrastructures had to be adapted to the new ships dimensions and capacity. The technology of ships handling equipment had to overcome important challenges caused by the considerable increase of ships breadth and the weight for CTS tandem lifting.

As already indicated in other part of this report, these giant CTS vessels call to a fewer number of ports basically for two reasons:

1. Not every port is capable of receiving them because of measurement restrictions such as restricted draught and/or height, width, ships length, combined with the availability of appropriate handling equipment.

2. These vessels produce the slot cost reduction while carrying the CTS on water.

As a direct consequence, the reduction of number of ports called during the journey is the result of this shipping lines strategy.

Another relevant technological revolution is affecting the World navigation canals such as Suez and Panama. When the shipping lines decided to invest massively in these giant CTS vessels, they had taken also the strategic decision to serve their markets by following different routes. They decided either circumnavigating South America or reaching the West Cost of the United States by Rail rather than crossing the Panama canal no longer capable of dealing with the new vessels size. As a direct consequence of this sea route modification strategy, the Panama Government decided to enlarge the Panama Canal in order to avoid being completely cut out from the World trade lanes. In fact the Panama Canal tolls provide substantial revenues to that Government.

The Suez Canal has the capability of dealing with the new vessels size but a new unplanned risk has developed in the Gulf of Aden. This new risk is represented by piracy. The costs of insurance for covering the piracy risk for these new giant CTS vessels combined with the Suez Canal toll, can move the balance of decision making in favour of circumnavigating Africa. This is even more likely in a time of shipping over tonnage.

5.6 OBJECTIVES

TIGER Project objectives embrace three dimensions: Strategic, Market, Technical.

The Strategic dimension deals with the adoption of co-modal logistics chains - the research for capacity increase-the choice of alternative routings-the solution of heavier and longer trains- the task of Ports decongestion- the insertion of Inland Terminals, dry ports and gateways as integrating nodes between land and sea-the introduction of an integrated industrial work process in the ports for inland distribution based on intermodality.

The Market dimension deals with the ability to give the customers a viable and long term sustainable transport choice-the achievement of punctuality and performance consistency/reliability through regular shuttle trains - the continuous improvements through a phased in work process - the placement on the market of an overland service product plugged on the maritime one - the industrial by pass of congested and expensive port zones - the delivery of a better service product at an inferior overall cost-the adoption of logistics solutions safer and more environment friendly. The use of best practices and benchmarks for leading KPIs, the International routing through the EU Ten T network.

The Technical dimension deals with the adoption of mixed diesel/electric traction for bridging electrification gaps cutting idle time - the introduction of last generation wagons for longer/heavier trains - the use of soft/hardware ICT technologies for logistics chain integration management and control- the implementation of E/Customs solutions and when applicable their transfer to the inland dry ports-the cross border control by electronic RFID means- the CTS random loading at ports to inland dry ports.

In more specific terms the **TIGER Project** objectives encompassing the above dimensions can be summarized as follows:

- Provide a step change solution for solving EU Sea Ports and road congestion.
- Drive modal shift to Rail or inland waterways through the envisaged solutions.
- Industrialise transport to/from inland destinations towards a more sustainable mobility.
- Introduce longer, heavier and faster trains on the existing Rail lines, multiplying transport productivity and at the same time generating additional capacity.
- Increase the Rail Network productivity through the transport industrialisation to/from the Sea Ports and the Dry Ports generating more capacity on Rail.
- Introduce traffic bundling on regular shuttle services operating between the Sea Ports and Dry Ports producing Economy of scale on land compatible to those at Sea.
- Select the nodal points of the European Rail Network for Competitive Freight such as Sea Ports/Dry Ports/Mega Hubs/Freight Villages where co-modal solutions are available.
- Route immediately the maritime traffic by Rail or inland waterways to hinterland destinations bringing the ships nearer to the customer factories or warehouses and reducing substantially the last mile distances.
- Identify and correct the Infrastructure bottlenecks interfering with all these objectives constituting obstacles for the implementation of maritime seamless transport chains.
- Deliver a high quality "door to door" service with a competitive cost $/TEU. This cost is inferior to the existing one and achieves the paradigm solution of "better service at lower cost".
- Reduce container transit time and dwell costs.
- Reduce external costs generated by less than optimal routings.
- Apply innovative software and hardware technologies to all Ports and inland distribution operations as well as ICT technologies to the planning, monitoring and management systems.
- Achieve through modal shift and synchro-mobility a better use of the existing Infrastructures for more sustainable and environment friendly mobility.

These challenges cannot be solved in the same way in various Sea Ports, Dry Ports or industrial districts of Europe because of different geographical barriers, operational circumstances and Infrastructures availability. Therefore **TIGER Project** took into consideration four separate Demonstrators theatres where a multitude of peculiarities provided a good operational pattern representing a European wide spectrum.

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The traffic attraction basin is not only established by the natural geography but also by the application of the virtual distances approach which is deriving from each **TIGER** Ports' ability in reaching at a given cost and within a standard time the customers located in the hinterland. The terminology "virtual distances" is determined by the principle through which far away locations from a given sea Port, can be served at competitive costs and with short transit time by means of regular shuttle trains capable of bringing the vessels nearer to the ultimate clients irrespective of physical distances. The application of this philosophy entails the industrial use of Rail service intermodality and the establishment of regular Rail connections either directly with the sea Ports or via Mega Hubs and Freight Villages called "Dry Ports".

This is the field were Rail service intermodality can extract the maximum advantage from the practical implementation of co-modality where the best performance from each transport mode is enhanced through the exploitation of its potential capability. The intermodal Rail service industrialisation when implemented efficiently can deliver the advantage of moving the traffic to several inland destinations in substantial volumes. Also the inland waterways transport mode has in itself such ability. However this is limited to the existence of a navigable river. The European Rail network is far more extended overcoming already the natural barriers which, since the origin of mankind, have been an obstacle to the circulation of people and goods. Therefore analysing the existing capability of all surface transport modes, Rail intermodality is the one offering the greatest opportunities for improvement. Some infrastructure investments in inland Dry Ports are necessary for the Rail network to extract and deliver its maximum productivity. The Dry Ports are the necessary links between the sea Ports and the inland destinations generating the step change needed to pass from occasional transportation to a standardised industrial transportation system.

The feeder services constituting and supplementing the shipping lines maritime network according to the hub and spoke approach have been and will continue to be successful in distributing containers in an industrial way from a hub port to regional ports. However this system is shifting the meeting point with the land further down the transport chain. In a given Sea Port the other three available transport modes have to become key players. These are:

- the road
- the inland waterways
- the Rail.

The Rail intermodality and inland waterways strong points have been already briefly indicated. Road modality in the last few decades supported by enormous Governments' investments in the creation of an extensive European motorways network has delivered a formidable and flexible performance. It has sustained the continuous development of the European economies and the citizens standard of living by keeping everything on the move. However such an achievement has been reached with a number of apparent and hidden costs for Society. These costs such as road congestion, pollution, noise, vibrations, safety hazards, accidents, casualties, fossil fuels, energy consumption have been relevant factors in the deterioration of European Citizens' quality of life. A debate which started several years ago on how to minimize these negative effects is currently being developed at the highest level of the European Institutions. Such costs for Society are not the only constraints for road modality. In more recent times road congestion on major motorways combined with the increase of fossil fuels and the need to limit $CO2$ emissions have generated into the public opinion the perception that investments in road infrastructures are also a limited resource. Therefore every effort must be made to optimize the use of road for the short and medium distances where it can offer the best advantages. It is not object of this Task to provide any comment or reflection on these topics. It is however a driving force of this Task the identification of a new business model coherent with the long term European implementation plan for a more sustainable and environmental friendly cargo mobility system. The **TIGER project** is totally fulfilling this objective.

In the last few years the key market players in the maritime transport field have realised that the Port infrastructures expansion is a limited resource. Such limitation is imposed by:

- natural constraints;
- substantial dimension of the required financial capitals;
- timing generating uncertainties on the market needs at fruition time.

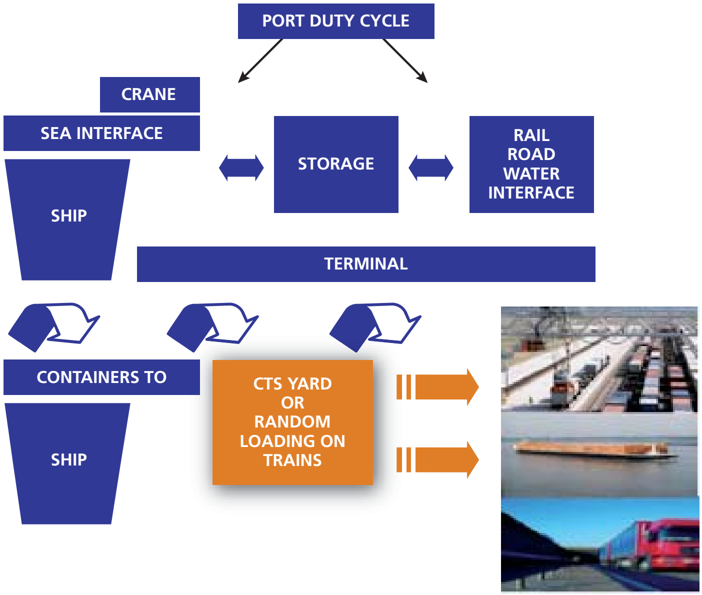
The above considerations are delivering the actors involved in this activity, the message that the most important challenge to be fulfilled is to extract the maximum available capacity from the existing infrastructures. This is even more opportune when considering that also the new infrastructures are likely to become saturated by the traffic development in the coming years when the application of a new business model must be in place and in full operation.

This new business model is the one envisaged by the **TIGER project** and encompassed in the **TIGER project** title acronym "**T**ransit via **I**nnovative **G**ateway concepts solving **E**uropean-intermodal **R**ail needs". The sea Ports must regain their original mission of linking the sea with the land by focusing the exploitation of their activities on the handling vessels operations. This objective is achieved by moving to inland destinations all the cargo ancillary operations that can be better exploited nearer to the ultimate customers.

In the following figure (Figure 14) a simple visual representation of the port duty cycle is reproduced. The giant CTS vessels having resolved the capacity challenge while on water, they have in fact moved the crisis point to the interface vessels/quay/storage forcing the sea ports to undertake substantial investments for bringing the port infrastructures to the required standards. This in itself is allowing the proper interface vessels/quay moving the crisis point to the next interface which is the storage area becoming congested. The result is the slowing down of the operations down the transport chain and the Sea Port congestion in the storage area. The answer to this problem cannot be the unlimited expansion of the storage area which in itself is constrained by land shortage. This port quay storage congestion can be more or less acute according to the geographic environment of each port. However the projections models stand to indicate that the capacity introduced at sea by the giant CTS vessels is so large that any new space will be filled in within a short period of time. Therefore the only possible solution lies in the ability of extending the sea port quays with Dry Ports infrastructures. These by definition are less expensive and less extended given that the volumes passing through the ports CTS parks storage areas, can be sub-divided according to the various places of traffic final destination. Such operation is reproducing on the overland surface the same hub and spoke principle adopted by the shipping lines themselves for their combination mother/feeder vessels. The sea ports according to this new business model are operating on the basis of mother quays/several extended inland quays. The industrial connection between the mother quays and the extended inland quays is supplied by industrial intermodal services and inland waterways when available. The road modality continues to serve the port for the destinations in the sea port vicinity and for all traffic originating to and from the inland Dry Ports (extended inland quays). By so doing the productivity of all the segments constituting the maritime transport chain is substantially increased. In fact the sea port storage area is decongested enhancing the original port mission of interfacing the land with the sea. The intermodal train shuttle services from the sea ports to the inland dry ports are managed in economy of scale producing transport connections at the lowest possible costs. The inland Dry Ports while receiving these additional traffic volumes originating from the sea ports, maximise their productivity round the clock and multiply the benefits also on their existing services which receive a new impetus from these additional traffic volumes. Most of the Dry Ports are already existing and the new maritime volumes integrate themselves with the existing overland volumes contributing to the filling up of redundant spaces both on the terminal and on the trains. Such innovative approach for increasing maritime traffic fluidity both at sea ports and in the hinterland entails a medium/long term vision. It is necessary to undertake at European and Governments' level initiatives for integrating Dry Ports, Mega Hubs and Freight Villages into a coordinated spatial planning in which urban areas are not only perceived as passengers hubs but also origin and destinations inner platform for cargo and city logistics.

It will not be before long that standardisation of length of freight trains to 750 metres will become operatives on the greater and denser part of the European Rail infrastructure. Such objective will be induced by the drive towards longer heavier and faster trains of up to 1.500 metres with double traction with one engine in the middle of the convoy opening up to the train modular concept. This drive is paramount for bundling together traffic volumes, generating on the Rail network the much needed capacity. The immediate effect is the substantial reduction of the unitized transport cost necessary for making Rail freight more attractive to a larger number of potential customers. The Dry Ports and Mega Hubs integral part of the **TIGER project**, capable of handling these longer heavier and faster trains in a modular composition originating from the sea ports, are a concrete response to the fulfilment of such vision.

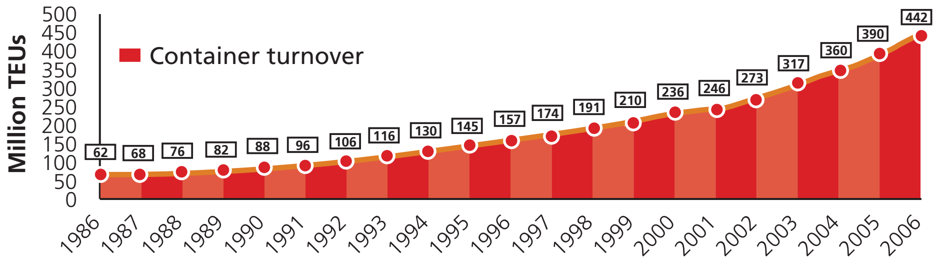
→ Figure 14: Port Duty Cycle graphic representation
Source: NEWOPERA



→ Figure 15: World CTS traffic volumes up to 2006
Source: **TIGER Project**

	Total TEU	Average TEU
2008	1.674.227	8.372
2005	1.301.581	6.543
2000	986.608	4.933
1995	733.155	3.666
1990	600.958	3.005

NO CHANGE IN THE OVERLAND INFRASTRUCTURES



© Port of Hamburg Marketing

The two figures indicated above (Figures 14 and 15) constitute the origin of the **TIGER Project** and the four **TIGER** Demonstrators. In fact the doubling of World CTS traffic volumes handled from Year 2000 to 2006 with further expansion in 2007, without any change in the overland Infrastructures anticipated the awareness that a new industrial business model had to be developed from the Sea Ports to the Dry Ports in order to avoid the total Ports congestion. To this effect four Demonstrators were selected reproducing four different geographical and Infrastructure situations. The full assessment of such geographical and Infrastructure situations are better described in chapters 5, 6 and 7 of this report, in direct relationship with the traffic forecasts 2020 assigned to these areas.

The **TIGER Project** is constituted by 4 Demonstrators:

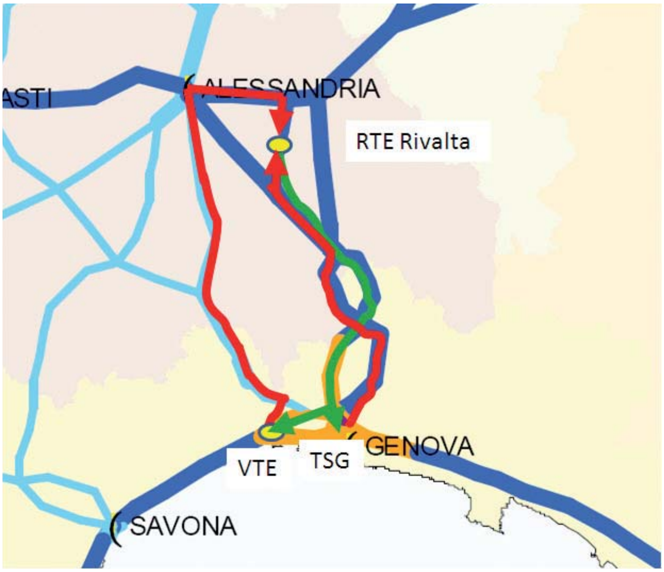
- → GENOA FAST CORRIDOR - GFC
- → MARITIME PLATFORM - MARIPLAT
- → iPORT & HINTERLAND OPERATIONS - iPORT
- → INTERMODAL NETWORK 2015 – MEGA HUB

The GENOA FAST CORRIDOR or GFC has the objective of transferring the CTS arriving both at Terminal San Giorgio and Genoa Voltri to Rivalta Terminal Europa, a new Dry Port immediately behind the Apennines mountains at a distance of about 75 Km from Genoa Port quays. Shuttle trains are operated joining together the San Giorgio and the Voltri traffic, adopting random loading from ships to trains speeding up operations in a total industrial way. The trains operations are designing a "loop" formed by using a secondary uphill Rail link returning to the Genoa Port via the main Rail line.

New technologies and management systems innovations as well as investments in ports infrastructures and signalling are introduced in order to make this innovative concept a viable operating commercial proposition. Mixed double traction, electric and diesel", is planned to be used in order to avoid idle time and manoeuvres at the Rivalta Terminal Europa.

Rivalta Terminal Europa is linked to the major Italian and European Rail network being directly located on the Genoa-Rotterdam European corridor. From Rivalta the connectivity to the rest of Italy and the rest of Europe is available having overcome the barriers and the bottlenecks represented by the Apennines mountains. Rivalta Terminal Europa is already today recognised as Genoa Sea Port Customs meaning that both security and Customs operations can be effected there without interference in Genoa Port while the CTS are in transit by Rail.

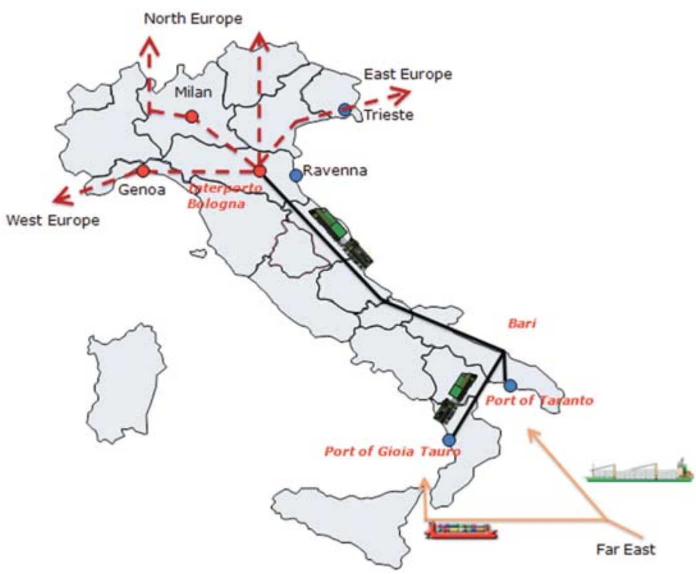
→ Figure 16: The Genoa Fast Corridor "LOOP" system
Source: TIGER Project



The Maritime Platform MARIPLAT "Y" concept is based on the concentration in Bari of CTS traffic destined to inland Italian and European destinations originating both from Gioia Tauro and Taranto ports. The Gioia Tauro traffic is transferred to Bari by "Antenna trains" using the Ionian Rail line which is almost free from traffic. Likewise the traffic from Taranto is shunted by Rail to Bari using the available Rail link which has recently been upgraded to double track. The traffic is then consolidated in Bari in one longer and heavier train operated between Bari and the Bologna Interporto freight village using the Adriatic Rail line. By so doing the bottleneck of the very congested Tyrrhenian Line passing through the cities of Naples, Rome and Florence is avoided. Likewise a better use of the terminal space is achieved in Bologna Interporto where capacity is immediately available.
Innovative technologies and management systems are applied in order to manage and monitor the

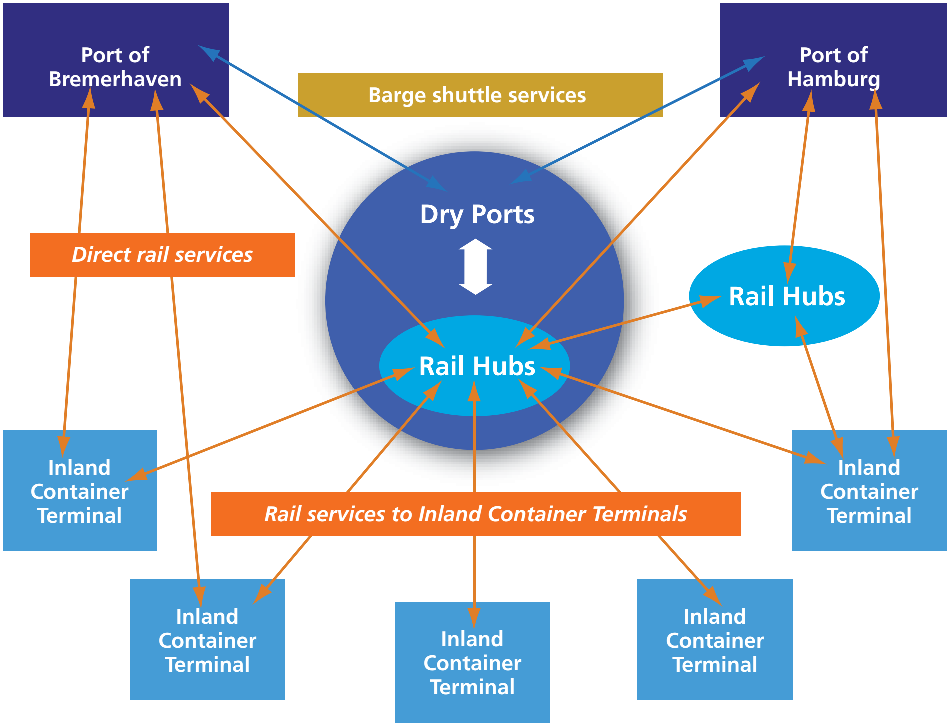
whole logistic chain. Bologna Interporto is located in an excellent geographical situation in the most important Italian nodal point accessing both road and Rail modalities. Through the doubling of the Rail line Bologna-Verona the Brenner Axe is de-bottlenecked towards Austria, Germany and the Northern Countries while the new high speed link Bologna-Milano has made available spare capacity on the traditional Rail line opening the access to the whole of Europe via the two Swiss Tunnels of Loetchberg and Gothard. Additionally the Bologna – Verona link is crossing with Corridor 5 towards Kiev accessing the Balkan Region, Hungary and the whole district of the eastern accessing Countries.

→ Figure 17: The MARIPLAT "Y" concept
Source: TIGER Project



The INNOVATIVE PORT & HINTERLAND OPERATIONS - iPORT or "WEB" concept has the objective of optimizing the hinterland CTS flows from the Ports of Hamburg, Bremerhaven and Jade-Weser to the hinterland. In this Demonstrator different approaches are evaluated. The "Close-to-the-port" and "Close-to-the-market" approaches are the two prevailing characteristics chosen for serving the market. The "close-to-the-port" approach entails the choice of a Dry Port where to route immediately the CTS to/from the Ports for subsequent re-launching to other Terminals of destination. The "close-to-the-market" approach entails the routing of the CTS trains directly from the Ports to the Terminals of final destination. Massive investments for expansions are being made in German Ports in order to secure their continuous development, having achieved above average expansion rates in the years immediately before the recent recession. The iPORT concept is planned to avoid future bottlenecks between the German CTS ports and the hinterland which are likely to occur failing corrective actions. The iPORT concept through the Dry Port strategy is set to achieve improved productivity along the maritime hinterland transport chain. The inland terminals and Dry Ports are important interfaces in this process. Their integration in the total logistic chain as well as their production efficiency are important factors for the success of the maritime intermodal hinterland traffic industrialization. The adoption of co-modal solutions allows production cycles in line with the expected volume increases in the three Ports of Hamburg, Bremerhaven and Jade-Weser. The new management technologies are set to improve the coordination and reorganization of the work processes and interfaces between the different actors.

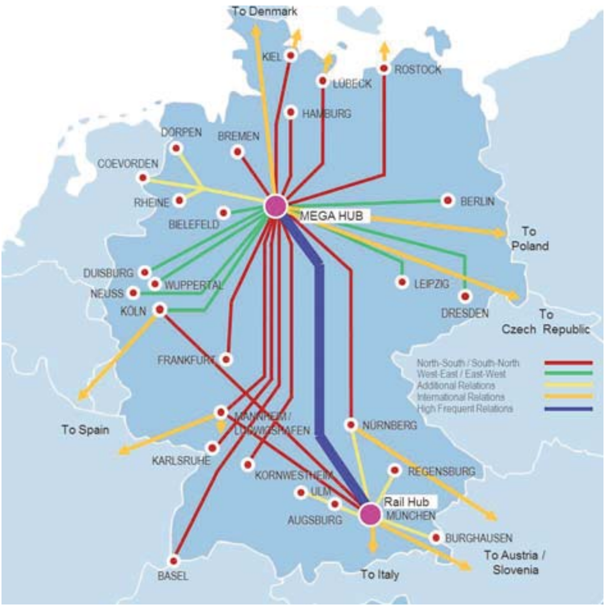
→ Figure 18: The INNOVATIVE PORT & HINTERLAND OPERATIONS "iPORT Web" concept
Source: TIGER Project



The INTERMODAL NETWORK 2015 - MEGA-HUB or "SPIDER" concept aims at making a further step change in the inland distribution by intermodal trains via the KombiVerkehr extensive shuttle service network. This step change is achieved through a major new investment in a Mega Hub which is being executed in Lehrte near Hanover and Munich Riem. While Munich Riem is ready to start operations, the Lehrte Mega Hub, although fully approved for constructions, will not be ready for operations during the Project lifetime. However the Lehrte investment was driven by the **TIGER Project** objectives. The new Lehrte Mega Hub is set to increase terminal productivity and efficiency both to and from the Sea Ports/inland waterway Ports and the national/ international inland destinations. The Lehrte and Munich Riem Mega Hubs are set to combine maritime as well as overland traffic achieving larger economies of scale. New production concepts based on train to train transfer are planned and implemented. Both Mega Hub facilities are designed and constructed with identical train operation concepts. Two production levels are planned: the first production level of larger scale is implemented with the direct shuttle services between major Sea Ports and inland Terminals/ Dry Ports, whereas the second production level is implemented for destinations having smaller volumes where direct daily services from Sea Ports cannot be secured. The Economy of scale obtained by concentrating the traffic in Munich Riem/Lehrte Mega Hub where both the maritime and overland domestic/international traffic is converging, allows the expansion of intermodal services by improving the frequencies. A the same time additional smaller terminals, where either the continental traffic or the maritime traffic individually do not have enough volumes for direct train links, can be connected with regular services.

The new technologies and management concepts support all these innovative processes.

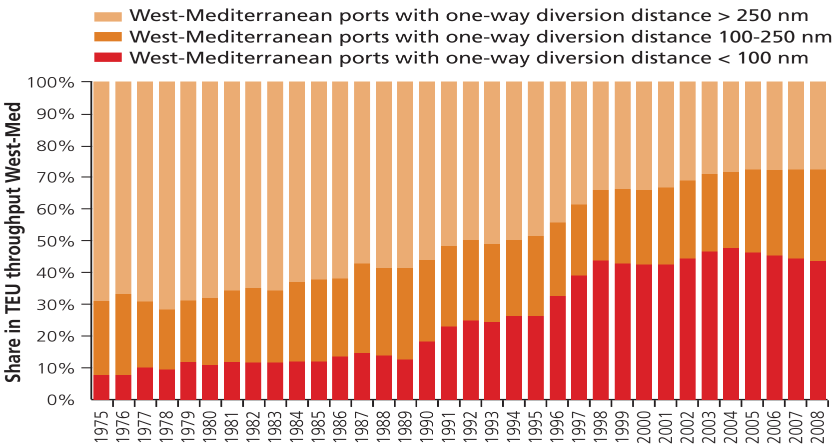
→ Figure 19: THE INTERMODAL NETWORK 2015 "MEGA-HUB SPIDER" concept
Source: TIGER Project



7.1 CTS THROUGHPUT EVOLUTION IN THE MEDITERRANEAN AND IN THE **TIGER** PORTS

In the Mediterranean, extensive hub-feeder container systems and short sea shipping networks emerged since the mid-1990s to cope with the increasing volumes and to connect other European port regions. Before that time, Mediterranean ports were typically bypassed by vessels operating on liner services between the Far East and Europe. Terminals at the transshipment hubs are owned, in whole or in part, by carriers which are efficiently using these facilities. Malta, Gioia Tauro, Cagliari and Taranto in Italy and Algeciras in Spain act as turntables in a growing sea-sea transshipment business in the region.

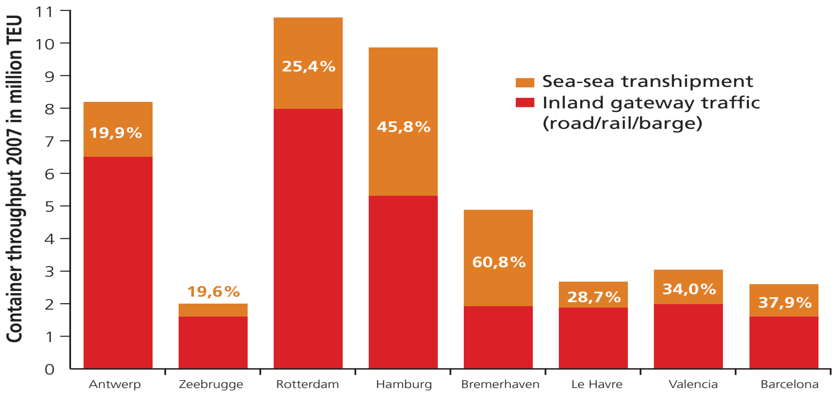
→ Figure 20: West Mediterranean CTS ports market shares. Ports grouped according to diversion distance from main shipping routes. 1975 - 2008
Source: ESPO



While quite a number of shipping lines still rely on the hub-and-spoke configuration in the Mediterranean, others decided to add new liner services calling at mainland ports directly. As a reaction Italian transshipment hubs have reoriented their focus by also serving Central and East Mediterranean regions. The net result of the above developments has been a slight decrease in the market share of the West Mediterranean hubs in recent years and a growth in the market share of mainland ports located between 100 and 250 nautical miles from the main maritime route (Figure 20). The transshipment business remains a highly footloose business. This has led some transshipment hubs such as Gioia Tauro, Taranto and Algeciras to develop inland rail services to capture and serve directly the economic centers in the hinterlands, while at the same time trying to attract logistics sites to the ports.

In Europe, hubs with a transshipment incidence of 85% to 95% can only be found in the Mediterranean. Northern Europe does not count any pure transshipment hub. Hamburg, the North-European leader in terms of sea-sea flows, had a transshipment incidence of about 45% in 2007, far below the elevated transshipment shares in the main south European transshipment hubs (Figure 21).

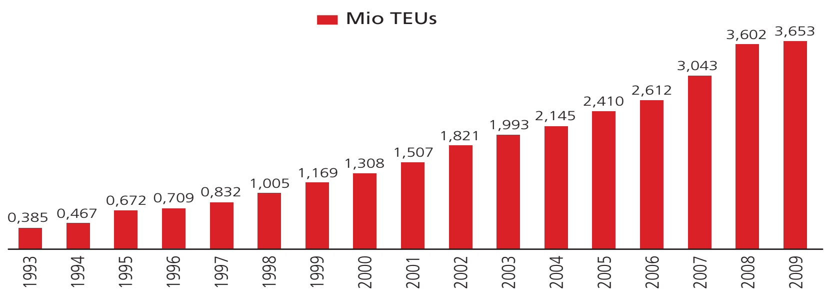
➔ Figure 21: Inland gateway traffic and sea-sea transhipment in selected ports having significant combined gateway-transhipment activities (data 2007)
Source: ESPO



Barcelona and Valencia due to their geographical locations close to the main production and consumption areas, are among the large Mediterranean ports combining an important gateway function with significant transshipment flows. Such transshipment flows reached 38.8% and 43.9% respectively in 2008. This is a further increase of the transshipment percentages from the 2007 figures indicated above (Figure 21).

This trend is further confirmed by the next figure (Figure 22) showing that the Port of Valencia has been in 2008/2009 the only major European port having experienced a traffic growth which was due entirely to the transhipment traffic. This traffic growth is attributable to MSC transhipment activity in its Mediterranean hub in Valencia.

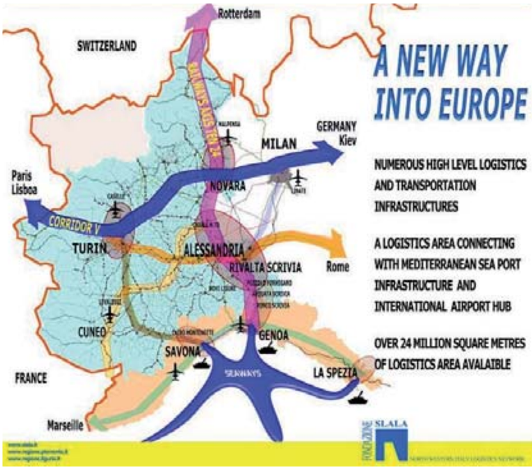
➔ Figure 22: Port of Valencia – Traffic Evolution from 1993 to 2009 – Including CTS transhipment
Source: Valencia Port Authority



PORT OF GENOA

The Port of Genoa is the crucial southern gateway of the TEN-T n. 24 corridor.
Together with the two other Liguria ports of La Spezia and Savona, the port of Genoa constitutes the pivot of the North Western Italy Logistic Network.

→ Figure 23: North Western Italy Logistic Network
Source: GPA



The port of Genoa develops its services through two main port basins: the Sampierdarena basin and the most recent Voltri port.

While the new Voltri port is specialized in CTS handling (VTE – Voltri Terminal Europa), the Sampierdarena port is composed by several terminals, some of them dedicated to CTS handling (SECH – South Europe Container Hub), some others dedicated to Multipurpose activities (including CTS handling) or dedicated to specific goods such as Fruit Terminal, Coal Terminal, Steel Terminal.

A global view of the port of Genoa is supplied by the following picture (Figure 24) where the older Sampierdarena port is pictured on the right side and the new Voltri port is pictured far on the left.

→ Figure 24: Port of Genoa global view
Source: Genoa Port Authority

The Next picture (Figure 25) shows the Genoa port general layout. In green the Voltri CTS Terminal, in pink the airport, in grey the Steel terminal, in brick-red the Messina Terminal followed by other 2 Multipurpose piers, 3 General Cargo piers and in violet the SECH CTS Terminal.

→ Figure 25: Port of Genoa layout
Source: GPA

The Port of Genoa origins go back to the 6th century BC. In the Middle Ages it was already a widely used port as per the following picture (Figure 26).

→ Figure 26: Genoa Port in 1481
Source: GPA

The next picture (Figure 27) stands to indicate the entry access to the port various quays. The access used for the CTS vessels are the "Bocca di Levante" and "Imboccatura Voltri".

Figure 27: Genoa Port entry accesses
Source: GPA

The Genoa Port is located on a naturally sheltered bay of the Ligurian Sea. Today the Port of Genoa features a 22 kilometre coastline which stretches seamlessly from the old port area westwards to the new port in Voltri and covers a total surface area of approximately 7 ml sqm. The draught is varying on average between 9m and 15m in Voltri. The Voltri draught allows to accommodate CTS vessels exceeding 10.000 TEUs capacity. The super tankers can take advantage of a water depth of up to 50m. The water depth is a natural advantage of the Genoa Port since the Apennines mountains fall steeply into the water. By contrast Genoa Port is scarce in land between the coastline and the mountains hence the need of by passing the Apennines by Rail or tunnels.

The Genoa Port is the natural gateway for one of the most industrialized areas of Europe including Piedmont and Lombardy with their capitals of Turin and Milan supported by other Liguria Region ports. The Genoa Port accessibility extend also to cities in Veneto such as Verona and Padua. Hence the Rail connections with Central Europe can be assured both via Switzerland and Via Brenner Tunnel through Verona. Genoa is a motorway nodal point sitting on a variety of motorways going East to West as well as North and South connecting the port to the whole of Italy and the rest of Europe.

Inside the Port area, the Red infrastructures indicate motorways, brown infrastructures indicate railway lines (see Figure 25).

The Genoa Port traffic has been fairly constant in the last few years indicating a traffic resilience also in difficult time. The total traffic volume in 2008 was 1,766 ml TEUs equating to 17% of the total CTS Italian throughput. In 2009 the traffic reduction was marginal despite the economic crisis. Further traffic expansion is expected to be promoted by the "extended Port concept" into the hinterland at Rivalta Terminal Europa (RTE) allowing the bypassing of the Apennines mountains which have constituted for centuries a natural barrier.

PORT OF GIOIA TAURO

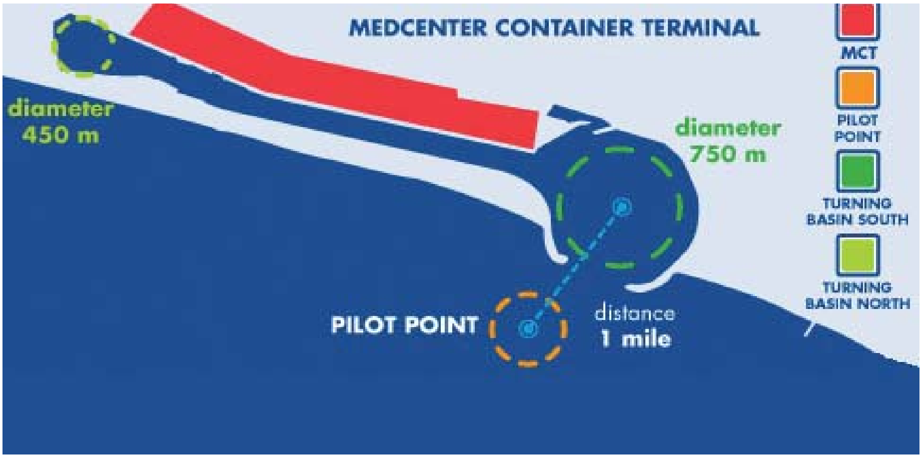
The Port of Gioia Tauro, located in the toe of Italy, has direct access to the open sea. Originally constructed to serve a major steel mill never built, was later transformed into a CTS transhipment port by the Contship Group. Gioia Tauro is the main maritime container terminal dedicated to transhipment operations in the South of Europe. One of its advantages is that the round the world shipping lines do not have to make any deviation from their planned journey. The port is located in the Italian main land and has a central position in the Mediterranean. These advantages have allowed Gioia Tauro to achieve in few years a leading position in transhipment sea-sea operations in the Mediterranean.

The port in addition of enjoying a very favourable geographic position for transhipment operations, is sitting on the motorway Salerno - Reggio Calabria and is rail connected through a dedicated port CTS terminal to the Italian rail network. The rail CTS terminal is equipped with 6 rail tracks of 500 metres length. The rail access has two possibilities. The first directly on the Tyrrhenian rail line and the second on the Adriatic line through the Ionian rail line to Bari almost dedicated to cargo. The seaport has seven docking berth with an extension of 4,646 meters. Medcenter Container Terminal and ICO-BLG Logistics Italia are the operators of the CTS and the car terminal respectively.

→ Figure 28: The port of Gioia Tauro
Source: MCT

The Medcenter Container Terminal (MCT)

→ Figure 29: Medcenter Container Terminal – nautical information
Source: MCT



The Medcenter Container Terminal (Figure 29) is extending for 1,6 ml. square meters and the available length of its quay is 3.395 meters. The draught vary from 12,5 to 18 meters, allowing to accommodate the super-Post Panamax CTS vessels of the last generation (13.000-15.000 TEUs of capacity).

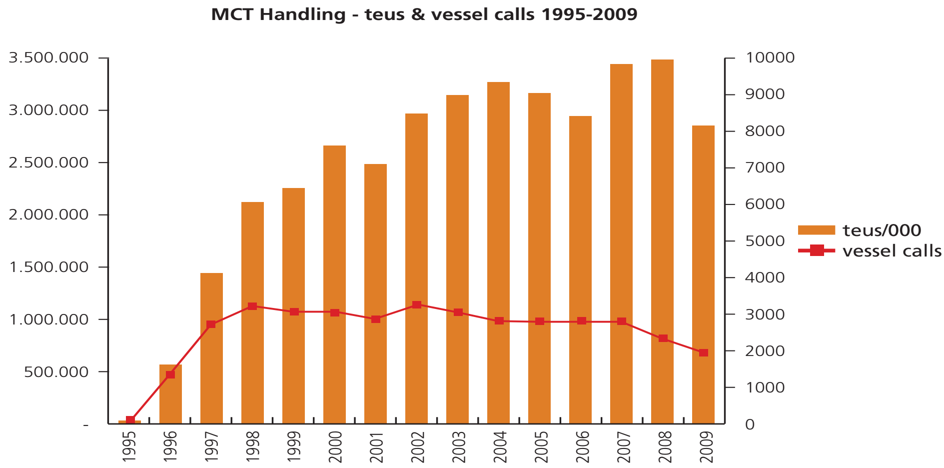
MCT can rely on a variety of equipments: 22 gantry cranes, 2 mobile cranes, 13 reach stackers, 120 straddle carriers.

→ Figure 30: Medcenter Container Terminal
Source: MCT

The port activity had a tremendous takeoff and development in a very short period of time. The port which started operations in 1995 with approximately 16.000 TEUs reached a total throughput in 2000, only five years later, of over 2,5 million TEUs. In recent times it reached a production of almost 3,5 million TEUs per year (Figure 31). The Medcenter Container Terminal is a subsidiary of Contship Italy, which owns the concession on the 1.6 million square meters of land at sea by the Italian Government.

In 2009, direct employees white and blue collars of Medcenter Container Terminal were 1.100. Recently, a study by Assologistica, the leading Italian Association of logistics companies and operators, estimated that in 2009 the indirect and induced labour force generated by Medcenter Container Terminal was 861 and 1.067 respectively. Therefore, the total labour force generated by Medcenter Container Terminal reached a figure of 3.038 units. This is a substantial development generated totally by private investments in a very depressed area of Italy where labour opportunities are very scarce.

Figure 31: MCT volumes in TEUs – from 1995 to 2009 and vessels calls
Source: MCT



MCT and its transhipment activities in the Gioia Tauro port are in direct competition with Malta, particularly for overseas traffic from/to the USA and from/to the Far East.

The total volume handled in the port in 2008 was 3,467 ml. TEUs which was the best performance since the operations' start. At that time such traffic level reached a saturation of about 80% of the total available capacity which is approximately 4,200 ml. TEUs. In 2009, due to the world economic recession and to the new competition localised in north Africa, such as Port Said and Tangeri, the throughput of Medcenter Container Terminal suffered a traffic reduction of 17,6%, to 2,857 ml. TEUs.

The reference market of Gioia Tauro port and of other Italian transhipment hubs is represented by the entire Mediterranean basin. Obviously this reference market includes the area of North Africa where meantime several transhipment hubs have come into operation. Moreover, in the coming years, the competition brought by North Africa countries is likely to increase due to several green field projects and other expansion port projects already planned or ongoing.

Such competition between the transhipment ports in the Mediterranean is influenced by at least three distortion factors in favour of North Africa ports. These have become even more determinant during the present economic recession. These are:

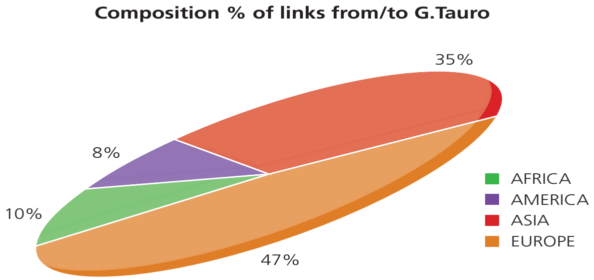
1) Labour cost
2) Non homogenous taxes such as anchorage and duties paid by the carriers
3) Excise duties on energy and fuel.

The extensive feeder network (Figure 32) servicing Gioia Tauro, links weekly more than 60 ports in the whole Mediterranean Sea, the North Africa, the Tyrrhenian, the Aegean and the Black Sea.

→ Figure 32: The Gioia Tauro Feeder Network
Source: MCT

The next graph (Figure 33) is reproducing the percentage breakdown of the traffic involving the countries that had in 2009 active feeder links to/from Gioia Tauro. The represented result includes both the transhipment and the import/export traffic.

→ Figure 33: Traffic composition of the continents linked to Gioia Tauro
Source: MCT



Although the Medcenter Container Terminal core business is the maritime transshipment traffic, MCTl through its sister companies, Sogemar and Hannibal, who are specialized intermodal operators, is offering direct intermodal services to mainland Italian and European destinations.

The ICO-BLG Automotive Logistics Italia

The ICO-BLG is localized in the north part of the port. The car terminal has an area of 320.000 square meters and a capacity for 15.000 vehicles. The quay length is about 1.250 meters and the draught can accommodate modern deep sea car carriers. In the car terminal, vehicles are handled, warehoused, processed for ancillary operations and then delivered. A siding track, 3 head ramps and Ro/Ro pontoons are available for these operations.

Likewise for CTS also the Gioia Tauro cars handling activities are focalized on transshipment. In 2009 ICO-BLG handled about 150.000 cars, which unfortunately was 56,8% less than 2008 (best performance from start).

PORT OF TARANTO

From earliest times, between the eighth and the second centuries BC, Taranto emerged as one of the leading Greek colonies in Southern Italy as well as a centre of trade and maritime activities in the Mediterranean.

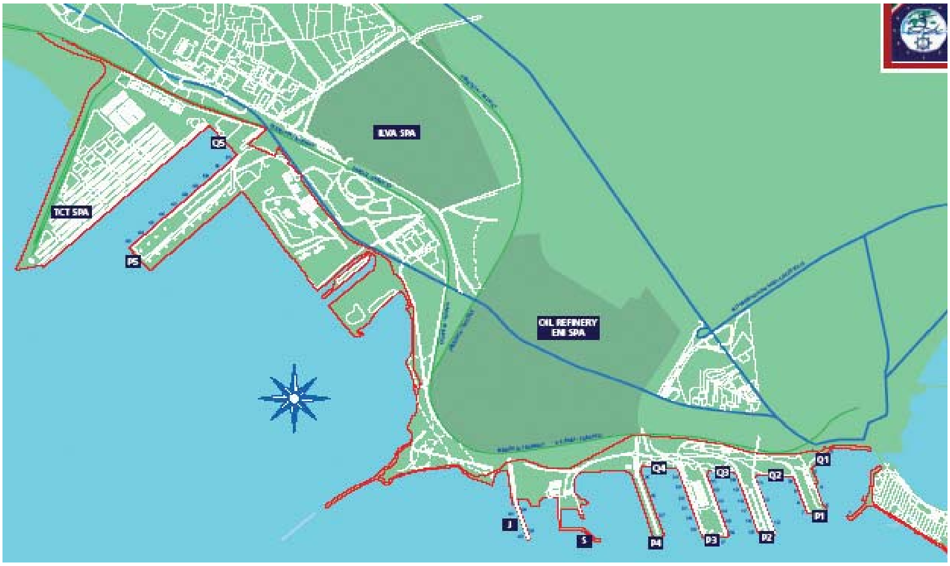
The port of Taranto, on the north coast of the Gulf of Taranto, is a natural harbour embracing a wide sheltered bay, Mar Grande, and a smaller inlet, Mar Piccolo. The commercial port and industrial port are situated on the north-west shore of Mar Grande, with the most recent facilities, the container terminal and Pier 5, just outside the western breakwater.

The port estate covers a total area of 3,43 ml sqm, of which 2,43 ml sqm is operational and 1 ml sqm on concession. The quays have a combined length of 9.995 meters, of which 1.310m is for common use and 8.685m on concession.

The activities developed under the port concession are relating to the handling of containers and are managed by TCT- Evergreen Marine Corporation of Taiwan. The loading and unloading activities of ferrous materials and steel products are managed by ILVA, while the loading and unloading operations of cement are managed by Cementir. There is also an important terminal for petroleum products managed by ENI.

The CTS terminal managed by TCT is equipped with 10 gantry cranes, 1 mobile crane, 22 rail-mounted gantry cranes, 3 reach stacker, 5 side loaders, 62 prime movers.

→ Figure 34: Full port layout
Source: Taranto Port Authority



→ Figure 35: The TCT container terminal in operation
Source: Taranto Port Authority

The CTS terminal covers an area of 1 ml. sqm and it is managed by TCT- Evergreen Marine Corporation of Taiwan. The throughput has grown steadily from 197.000 TEUs in 2001 to about 900.000 TEUs in 2006. During the existing recession volumes stabilized at around 786.000 TEUs in 2008. Further growth of terminal operations is dependent on a dredging programme that is required to increase the draught alongside the quay.

The terminal has a quay length of 1500m with a minimum draught of 15m allowing ships of up to 14.5m draught to berth. TCT' s facilities cover a total of 110 hectares with 25 hectares of yard space. There are 7,062 ground slots for containers with a total capacity of 35,310 TEUs. There is 45,000 TEUs of stacking capacity for empty containers and 900 reefer plugs.

While the lion's share of traffic through the TCT is generated by Evergreen and Italia Marittima (formerly Lloyd Triestino) – the Italian company that became part of the Evergreen group in 1998 – TCT is a common-user facility available to all liner operators. For example, ZIM and MSC made a number of ship calls in Taranto in 2005 and 2006.

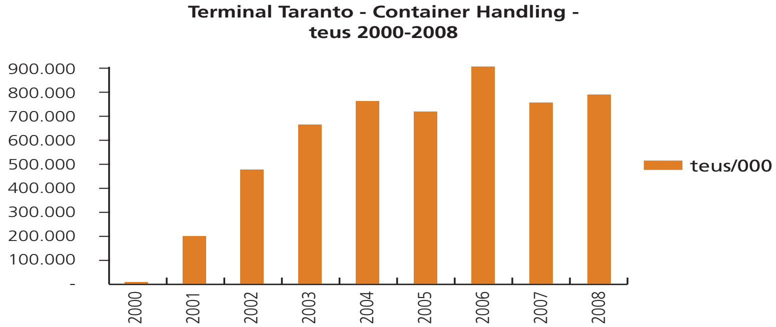
Taranto has still a huge potential to be exploited as a commercial hub port. This potential was unlocked in June 2001 with the opening of the container terminal – one of the most modern in the Mediterranean – having an annual handling capacity of over 2 million TEUs. This means that today TCT is using this capacity for about 40%. The port is capable of handling vessels of great capacity. In the above figure the available draught of over 15 m. is pictured.

The port is in a very favourable geographic position on the natural Gulf of the foot of Italy between its heel and its toe on the Ionian Sea. The port is well connected by road being linked to the Adriatic motorway and the Ionian highway. The rail connection is secured by the Bari-Bologna line together with the other main rail lines serving Potenza-Naples, Brindisi-Lecce and Reggio Calabria via the Ionian rail line. Intermodal shuttle services are operating between the CTS terminal and the Italian inland intermodal facilities at Nola, Bologna and Ancona. Likewise the port of Gioia Tauro, Taranto is mainly a transhipment port. In fact transhipment traffic accounts for nearly 90% of the terminal's business, while the remaining 10% is made up of import and export gateway traffic.

Taranto has moreover excellent Ro/Ro connections with Greece. This represents a key opportunity for Taranto because of the new plans to develop the road networks in the Balkans, such as the so-called Via Egnatia in Greece, with a terminal in the port of Igoumenitsa which is connected with regular ferry services with Taranto.

→ Figure 36: TCT CTS Terminal in operation
Source: Taranto Port Authority

Figure 37: Taranto TCT container handling
Source: Taranto Port Authority



Despite the steel industry is the Port of Taranto's biggest customer, this traffic is not the object of this research. Also the cement and the oil traffic are not considered.

7.2 CAPACITY OF MEDITERRANEAN **TIGER** PORTS

PORT OF GENOA

Expanded CTS Volumes at Voltri Terminal

The Voltri terminal with the entrance in operation of the 6th module, will complete its final CTS handling capacity at the end of 2012. In 2013 it is expected a CTS service volume of 1.2 million TEUs growing regularly along the following years up to 2 million TEUs in 2020. This is the forecast included in POT – Piano Operativo Triennale 2010 – 2012 made by Genoa Port Authority.

New Bettolo CTS Terminal

The in progress reclaiming activities at Bettolo Terminal are expected to be completed together with all the connected civil works in 2014 (Figure 38).

Figure 38: New Bettolo CTS terminal with new reclaimed extensions
Source: GPA

In 2015 an additional capacity of 800,000 TEUs will be offered to Shipping Companies connecting Europe to Far East, Middle East and African continent.

It is expected that Bettolo Terminal will attract new traffic and have a regular growth up to 2020 when it is planned that the 800,000 TEUs/year throughput of new import/export capacity are achieved and consolidated.

Expanded CTS Capacity in the Sampierdarena Basin
The other planned capacity expansion of 800,000 TEUs per year is provided by reclaiming from the sea an area between the Ronco and the Canepa piers. The new reorganized Multipurpose Terminal is planned to be operational in 2015 and the new CTS Terminal created by the above area reclamation between Ronco and Canepa piers is expected to be in operating profile by 2020 (Figure 39).

→ Figure 39: New Multipurpose final layout after area reclamation
Source: GPA

PORT OF GENOA FUTURE CAPACITY 2020

The new CTS Terminal capacity by 2020 allows Genoa port to handle a throughput of 4 million TEUs. This is to be considered a high volume scenario based on the successful reorganization of all the logistic chain components linking the Sea terminals to their inland railway dry ports expansions. To this effect the role of RTE and Alessandria Dry Ports is crucial. The opportunity for Genoa port of reaching in 2020 the 4 ml TEUs throughput is linked to the implementation of the "extended port" concept, allowing 1.5 ml TEUs to be moved by shuttle trains to RTE and Alessandria Dry Ports.

This 1.5 ml TEUs represent the maximum capacity of the 3 existing railway lines connecting Genoa with Ovada, Novi Ligure and Tortona beyond the Apennines. Also road distribution is planned to grow significantly for an additional 900.000 TEUs/year if this 4 ml TEUs target is to be reached. Such expansion of both rail and road distribution stands to indicate that the overland infrastructures will be under pressure up to the time when the new planned motorway bypass around the Genoa city will be operational in 2020. Likewise the third rail tunnel providing the much needed carrying capacity already planned and approved by RFI will not be available before 2018. Consequently to reach these goals from now up to 2020, the port of Genoa strategy focuses on the application of TIGER technological innovations to all Genoa port terminals and connected Dry Ports of RTE and Alessandria providing higher productivity, lower costs, faster transit time for the European users.

Because of the above considerations an average scenario of 3.5 million TEUs/year has been considered more realistic together with a lower scenario of 3 million TEUs/year. The lower scenario still provides a doubling of the existing throughput by 2020.

RTE (Rivalta Terminal Europa) Dry Port

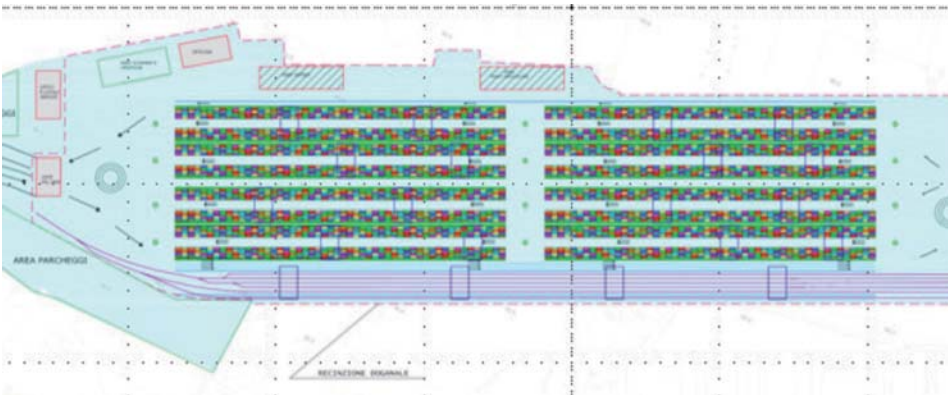
→ Figure 40: RTE Rail Dry Port Artistic Impression
Source: Rivalta Terminal Europa

RTE located at 75 km from the Port is the Genoa Port inland CTS terminal vital for the Port's expansion activity. RTE is already connected by a daily shuttle train to VTE Voltri Terminal. The rail connection is via RFI Rivalta Scrivia Station. The cargo customs clearance is made directly in RTE dry port being under the Genoa Customs Authority. The CTS are allowed to go to RTE without transit document using the cargo manifest. The shipping lines declare RTE as port of discharge.

The total surface covered by RTE is approximately 900.000 sqm. The RTE railway terminal is composed of five rail tracks of 900m length each able to host long trains. RTE includes 670.000 sqm of open stacking area of which 80.000 sqm are covered by warehouses and 8.000 sqm by workshops.

RTE capacity is estimated at about 500.000 TEUs/year by 2013 fed by 15 shuttle train couples per day from Genoa Port. By 2020 RTE throughput can increase up to 1 million TEUs/year linked to RFI rail tracks availability and capacity.

Figure 41: Alessandria Railway Dry Port layout
Source: Fondazione SLALA



The Alessandria railway Dry Port is directly connected to Alessandria RFI rail station. It is constituted by 5 per 650m long tracks under crane for a total of 3250m allowing train to train CTS handling. Alessandria dry port under development envisages an operational capacity of 500.000 TEUs/year in 2015 fed by 15 shuttle train couples per day from Genoa Port.

The Alessandria Dry Port increased capacity is linked to RFI rail tracks availability and capacity.

PORT OF GIOIA TAURO

In the surrounding areas of Gioia Tauro port there is great availability of land extending for about 1.500 hectares. This area is available for further developments.

The investment plan for Gioia Tauro in the next few years is based on the contents of "The three-year operational plan 2010-2012", issued by Gioia Tauro Port Authority which is the official Port document. The Gioia Tauro three-year strategic plan main objectives are :

- infrastructural adaptation and functional upgrade of the water basin to meet the last generation vessels' tonnage and draught requirements;
- safety of shipping port and port security;
- development of the links between the sea port, the CTS standage areas and terminals with the intermodal network both rail and road;
- development of industrial production activities associated with the port activities where the port activities can represent an added value.

Planned investment activities have been classified according to three categories as illustrated in the table here below (Figure 42)

Figure 42: Gioia Tauro Port planned investment activities & objectives
Source: Gioia Tauro Port Authority

ACTIVITY	TYPE OF INVESTMENT	OBJECTIVES
Port-required	Infrastructure investments to improve gate, yard and dock capacity	improving competitiveness increased efficiency improving in safety and port security
Port related	Logistics and Intermodality	improving the interoperability and the connections between sea and rail business development activity in the harbour area diversification of port operations
Safety and governance	Investments to improve safety and control within the port area	improving competitiveness and security immediate answers to the needs

In the Port's three-year strategic plan the following investments are described:

Port required :
- 5 investment projects are under construction: 4 dedicated to the increasing of gate capacity and 1 to the increasing of quay capacity;
- 4 investment projects are planned: 3 dedicated to increasing of yard capacity and 1 the increasing of quay capacity.

Port related :
- 2 investment operations are under construction ; both of them dedicated to logistics and intermodal development;
- 9 investment operations planned ; 6 dedicated to logistics and intermodal development and 3 dedicated to the alternative development of the port facility such as reefers and ancillaries services.

Security and Governance :
- 2 investment operations are under construction ; both of them dedicated to the improvement in safety and port security systems
- 6 investment operations planned ; 3 dedicated to the safety improvement and to the port security systems and 3 designed to perform the duties of control systems.

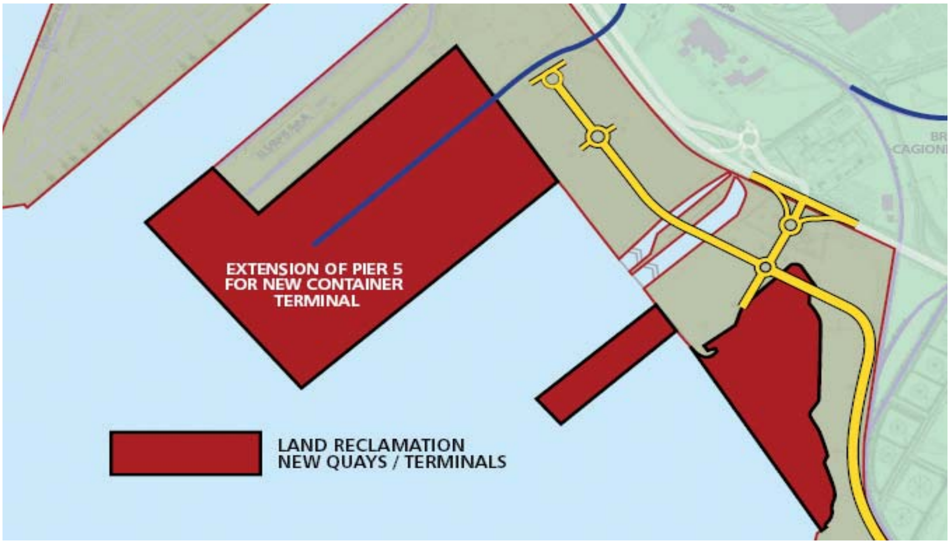
It is important to note that in 2009 the Gioia Tauro Med-Center Terminal throughput was 2,857 ml TEUs. The best performance was however achieved in 2007. The economic crisis reduced such very high level of performance during 2008 and 2009. International signs of optimism are signalled in various parts of the World and for this reasons MCT made relevant investments in order to increase yard and infrastructure capacity for future needs. By virtue of this the actual maximum capacity of the MCT Terminal is reaching 5ml TEUs, without the need for immediate further investments.

PORT OF TARANTO

In order to accommodate the latest generation of deep sea containerships, the Port Authority will dredge the seabed to increase the depth alongside the first 750 metres of quay and provide a draught of 16.5 metres. This will allow containerships of up to 12,500 TEUs capacity to berth.

Looking further ahead, there will be an extra 550 metres of berthing at the inner end of the Multipurpose Pier. So TCT will have a total quay length of 2,000 metres at its disposal increasing the TCT terminal throughput theoretical capacity by additional 750.000 TEUs.

→ Figure 43: Taranto CTS terminal planned extension
Source: Taranto Port Authority



→ Figure 44: Taranto logistics facility – Port extension
Source: Taranto Port Authority

The extension of Pier 5 (figure 43) is planned to accommodate traffic brought by new shipping lines customers as well as to provide transport and logistics services for the local economy, with opportunities to develop new manufacturing activities inside the port area. This could represent for these companies a logistics competitive advantage.

The Logistics Platform, on which construction work commenced in the first half of 2008, covers a total area of nearly 200,000 sqm Located within the port estate, close to Pier 4 (figure 44), it will act as an intermodal centre, allowing goods to be transferred between road, rail and sea, and will provide cargo services. The aim is to achieve a fully integrated operation based on ICT systems.

This Logistics Platform will have up to 22,500 sqm of warehousing and up to 6,000 sqm of cold storage as well as silos, sheds for logistics operations and a dedicated rail terminal linked with the national and European networks.

This new Taranto Logistics Platform could change the orientation of logistics networks throughout the Mediterranean by enhancing the role of southern Italy as a whole. Moreover, it will lay the groundwork for the creation of a Distripark, another facility that is needed to secure the development of logistics activities on site. A consortium set up for the Distripark Project has already completed the preliminary planning procedures as well as taking over the site, which covers about 750,000 square metres, immediately behind the port area, close to the container terminal. The consortium has also launched a promotional campaign to attract national and international investors, so that the Distripark can be set up through private venture capital under a project financing initiative.

Without these new facilities, containerised goods would remain on the terminal yards and produce no added value for the region’s economy. In addition to the new platform, the wider Port of Taranto Logistics Project, costing a total of Euros 156 million, will lead to the creation of other service facilities.

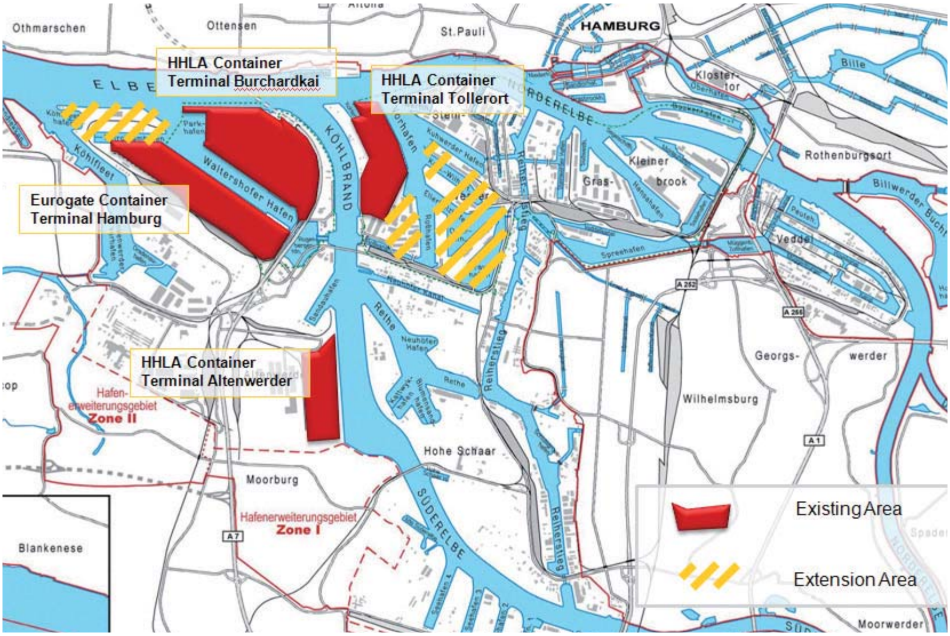
The rail connection to Bari has two bottlenecks before being totally operational on two rail tracks on the whole axe Taranto-Bari. The first bottleneck is constituted by the short leg Bitetto – Bari. This work is being tendered now from RFI. The second bottleneck is represented by the port connection Bellavista – Taranto. The works are already in progress. Consequently before too long the rail link from Taranto inner port to Bari will be operational on two rail tracks on the whole distance.

7.3 CTS THROUGHPUT EVOLUTION IN NORTH EUROPE - **TIGER** PORTS

PORT OF HAMBURG

The Port of Hamburg is Germany's biggest sea port. The port traffic production volume totaled 140.4 ml. tons in 2008. The biggest tonnage share is represented by the CTS throughput with 95.1 ml. tons equivalent to 67.7% of all handled traffic. Bulk cargo accounted for 42.5 ml. tons equal to 30.3%. In total 9,7 ml. TEUs were handled by the Port of Hamburg strengthening its position as Europe’s 2nd port and World’s 11th biggest container port.

→ Figure 45: CTS Terminals in the Port of Hamburg
Source: HHM



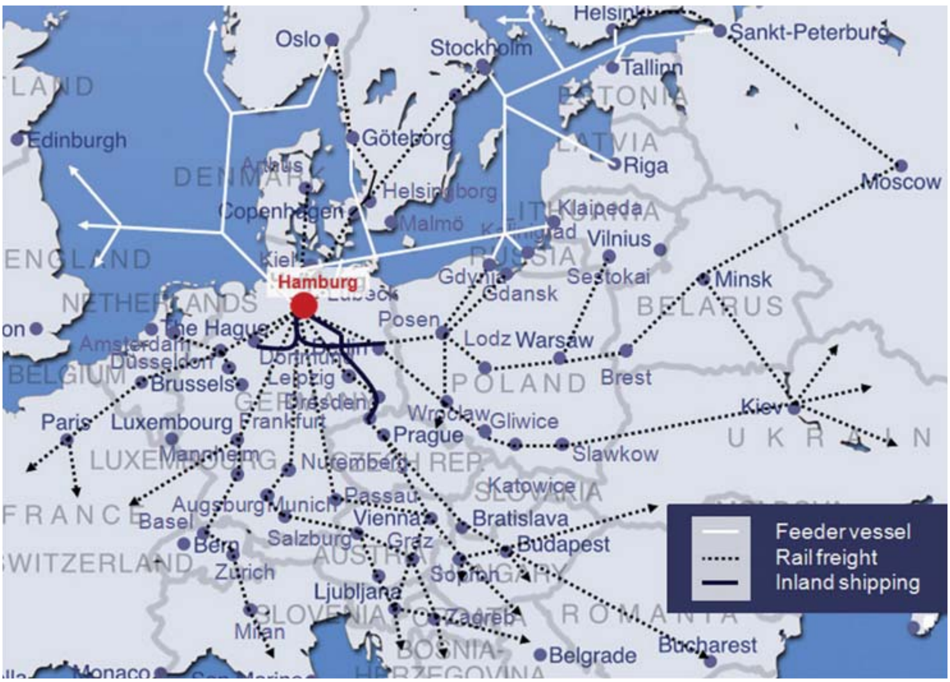
The port access through the traffic separation zones in the German Bight is controlled by a modern traffic management system. After about 70 nautical miles of Elbe estuary, past Cuxhaven, Brunsbüttel, Glückstadt and Stade, Hamburg 's port boundary is crossed at Wedel. With the high tide ships can reach the port of Hamburg with a maximum draught of 15.1m and can leave with a maximum draught of 13.8m. Without the tide influence, the total draught is restricted to 12.8m.

Two privately owned container operators, Hamburger Hafen & Logistik AG (HHLA) and Eurogate Container Terminal Hamburg GmbH (Eurogate), manage four terminals in the Port of Hamburg providing 7.3 km of quay side. Together the four CTS terminals handled 9.7 ml TEUs in 2008. The port infrastructures and all four CTS terminals allow the handling of last generation CTS ships. As described before the port access is restricted. As a result a further intervention on the river Elbe is necessary in order to allow ship’s calls to the port of Hamburg. The river Elbe in fact is the connection between the port of Hamburg and the North Sea and the new vessels generation require a deeper draught which today is restricted to 12,8m.

The port of Hamburg is serving a huge European area in addition to the whole of Germany. Many millions inhabitants living in the hinterland and in the Baltic Region are affected by the Hamburg port activities. Its position is strategic for being an ideal hub for CTS transshipment relating to traffic destined to and from the entire Baltic region. As many as 146 feeder CTS vessels departures per week of which 128 to the Baltic Region stand to indicate the extensive network port's competitive reach. Four out of six of the port's most important trade partners are in the Baltic Region. They are Russia, Finland, Sweden and Poland. The Baltic Region accounts for over a third of Europe's export volumes and 16% of world exports making it one of the most dynamic area in Europe. The Port of Hamburg being the most eastern port in the North Sea is the natural gateway for these markets. It is also known as their "Port of Entry".

The port of Hamburg is served also by an extensive inland waterways network. The river Elbe itself and the Elbe-Seiten-Canal provide the necessary connections within Germany and other European inland destinations. More than 15 weekly departures reach several inland river ports and central Germany destinations through the Mittellandkanal. Via the Upper Elbe river, inland waterways vessels serve directly other German and Czech ports, while Hannover and Braunschweig can be reached via an Elbe branch canal.

→ Figure 46: Hinterland Connections of the Port of Hamburg
Source: HHM



The city of Hamburg, the Hanseatic city, is located at the intersection of several motorways running North to South and East to West.

The port of Hamburg is accessed and supported by three major port railway stations. A 375 kilometers of tracks within the port area allow to dispatch more than 1.300 trains per week of which more than 750 are intermodal CTS trains. This substantial railways activity is one important key to the port of Hamburg success allowing the CTS to reach their final destination in an industrial way. The port of Hamburg has planned to double the traffic volumes handled by rail by 2015. Such ambitious plan is unrivalled in Europe making it by far the biggest existing Rail freight Hub.

BREMEN PORTS

The Bremen Ports include the port of Bremerhaven and the port of Bremen. Bremerhaven is situated 32 miles from the open sea. Ships with a draught of up to 12.8m can reach Bremer¬haven Port irrespective of the tide. Ships requiring a deeper draught are restricted to the tide.

The Port of Bremen is situated on the river Weser about 72 miles away from the North Sea. The water depth of 13.5m is available up to the mouth of river Geeste whereas a depth of 10.45m is available from there to Nordenham / Brake. A depth of 8.7m is available between Brake and Bremen. Vessels above LOA (Length All Out) of 190m or a draught over 7.6m are restricted by the tide. The parameters indicated above are clearly marking the Bremen port technical limitations. In addition in the city there are several fixed bridges with limited clearance.

In 2008 containers handling in the two Bremen Ports achieved an important growth factor. The number of boxes handled rose by 12.6% to 5.5 million TEUs. The great majority of containers were dispatched in the Port of Bremerhaven, accounting to 99.4% of total CTS traffic. One of the key features of Bremerhaven port is its 5 km "non-stop" containers quay. This is the longest quay within Europe. In the ports operate three major service companies: MSC Gate, NTB (North Sea Terminal Bremerhaven) and Eurogate. This means that the port of Bremen is mostly engaged in conventional traffic.

→ Figure 47: Container Terminal Bremerhaven
Source: Bremenports GmbH & Co.KG

Bremerhaven is Europe's leading Hub for new vehicles. The total new automobiles handled amounts to 2.08 million units in 2008.

Bremerhaven and Bremen can count on 240 kilometers of rail track inside the port. This extensive rail port system is connected with an excellent rail network reaching the large economic heart of Germany and the rest of Europe.

Road distribution is used from both ports for short and medium distances. Road transports are therefore the second largest transport mode for inland distribution.

Two waterways connections are available from Bremen to the national and European inland network. The first is the westwards connection via the Under Weser, the Hunte River, the Coastal Canal and the Dortmund-Ems Canal up to the Rhine. The second is the southwards connection via the Central Weser to the Middleland Canal.

7.4 NORTH EUROPE **TIGER** PORTS CAPACITY

In order to forecast future container throughput in the ports it is important to consider the ports theoretical capacity. This is necessary for calculating and planning the potential ports development. The ports extensions can be distinguished into "inner port" extensions and "outer port" extensions. While inner port extensions stand for the reconstruction and expansion of already existing harbor infrastructures, outer port extensions signify totally new investments in new port infrastructures developments.

PORT OF HAMBURG

In the port of Hamburg there are several "inner port" extension projects. The "Hamburger Hafen und Logistik AG" (HHLA), as biggest containers terminal operator is reconstructing all its three terminals in order to be able to handle up to 12 ml. TEUs per annum. Here below is highlighted the reconstruction of the three HHLA terminals.

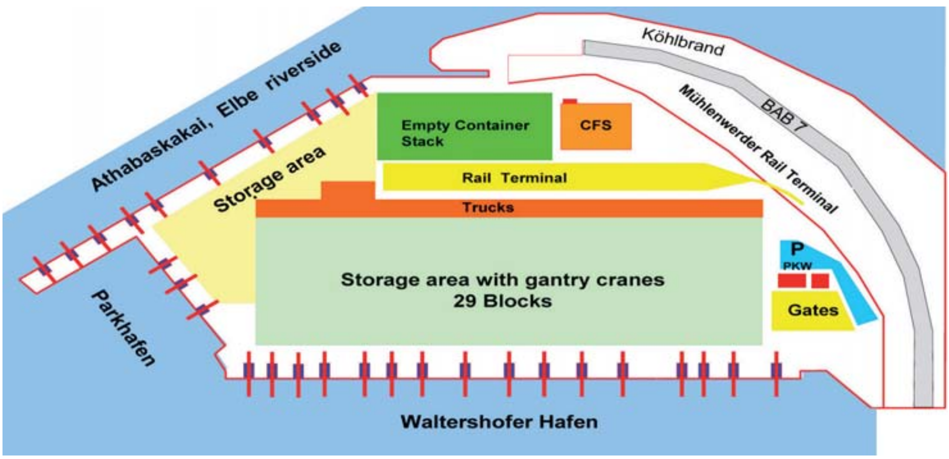
Container Terminal Altenwerder (CTA)

The CTA is located in the South part of the port at the Köhlbrand. The Northern extension of the existing quay is planned for a new 5th berth. The CTA has a target to reach a capacity of 4 ml. TEUs after the extension completion. The start of the work planned for this extension is not yet known.

Container Terminal Burchardkai (CTB)

The Burchardkai (CTB) is located directly on the river Elbe and it is the biggest container terminal together with the Waltershofer Hafen basin in the west of the port opposite to Eurogate's Container Terminal. In CTB a replacement of the operations system is taking place in order to reach an annual throughput capacity of 5.2 ml. TEUs. This equates to doubling the current capacity. The most relevant change is the reconstruction of the existing yard into a storage area of 29 blocks with gantry cranes.

→ Figure 48: Container Terminal Burchardkai
Source: Hamburg Port Authority 2009 / HHLA 2009



The oldest and smallest Container Terminal in Hamburg is Container Terminal Tollerort (CTT), located in the center of the port area on the river Elbe in the Vorhafen basin. By reclaiming parts of the Ellerholzhafen basin linked to the Vorhafen basin, an additional berth is being created. At the same time the Kohlenschiffhafen basin in the Northern part is being reclaimed and the new area will be dedicated to additional handling operations. After completing these investments the terminal's capacity will reach approximately 3.7 ml. TEUs. Completion date is planned for the near future.

The second CTS operator in the port of Hamburg is Eurogate GmbH & Co, KGaA, KG (Eurogate). Eurogate operates one container terminal where extensions are being planned.

→ Figure 49: Container Terminal Tollerort
Source: Hamburg Port Authority 2009

Container Terminal Hamburg (CTH)

The Container Terminal Hamburg (CTH) is located in the west part of the port opposite to HHLA's Container Terminal Burchardkai, in the Waltershofer Hafen basin.

In the 38 hectares terminal area and 1,059m new quay, two additional berths for ocean going vessels and one for smaller feeder vessels will be constructed. This project started in summer 2009 coinciding with the initiation of the approval procedure. At the time of writing this report, such approval procedure has not been completed yet. Assuming completion of such procedure in 2010, the Petroleumhafen basin will be reclaimed and the new quay will be built and delivered by the Hamburg Port Authority to Eurogate. After the completion of such work, the CTH will have a capacity of approximately 6 ml. TEUs.

Central Terminal Steinwerder (CTS)

The Hamburg Port Authority announced a further reconstruction project which started with a market consultation process in 2009. This process has the objective of implementing innovative concepts and identify new potential operators. In total an existing area of 125 hectares has been identified for port development. The existing terminals in this area such as BUSS Hansa Terminal, BUSS Roß Terminal, Leercontainer Zentrum Unikai and BUSS Kuhwerder Terminal will be relocated. A new terminal known as "Central Terminal Steinwerder" will be constructed. In September 2009 the second stage of this consultation process was opened. Twenty companies were selected for further participation and were provided with more detailed project information. The task for these companies was to develop their business plans and operating concepts for presentation to the HPA by the end of 2009. The process procedure provides that the best concepts are evaluated by a jury in the beginning of 2010 and awarded accordingly. It is still unknown how the development of these terminals will be shaped. However an additional containers terminal capacity is generated in this area in the region of around 3.5 ml. TEUs.

→ Figure 50: Container Terminal Hamburg
Source: Hamburg Port Authority 2009

→ Figure 51: Central Terminal Steinwerder
Source: Hamburg Port Authority 2009

BREMEN PORTS

The latest extension of the Port of Bremerhaven was the construction of Container Terminal IV, which was finished in 2008. The existing quay was enlarged by 1,681m featuring four new berths for containers ships. All together a 5 km "non-stop" container quay is now available which is the longest "non-stop" quay in Europe. Capacity was increased to approximately 8 ml. TEUs per annum.

NEW BUILDING PROJECT – JADE-WESER PORT

The Jade-Weser Port (JWP), the large Sea port project, is an over-regional co-operation between the two partners of Lower Saxony and Bremen Municipality. The construction work for this project, started at the beginning of 2008.[1] The first quay section, approximately 1,000 m in length, is scheduled to be ready for operations by the end of 2012. Ships with draught up to 16.5m can then be handled at the JWP. The Sea Terminal of 1,725m in length offering 120 hectares of working area, four berths, 16 container gantry cranes and intermodal rail facilities, is scheduled for completion in 2012/2013. It will have a cargo handling capacity of approximately 2,7 ml. TEUs after the final phase completion. The terminal will be jointly operated by Eurogate together with its partners APM Terminals and the Russian National Container Company. The total investment amounts to 950 million €. Almost 2/3rd of this amount will be spent on port and terminal basic infrastructures. The port operators themselves will be investing 350 million € in logistics infrastructures.[2] Through the close cooperation of the container terminal and cargo transportation centre (Güterverkehrszentrum) having direct accessibility to both rail, road and barges, a very efficient transport organizational system is being realized for the development of the Bremen economic activity.[3]

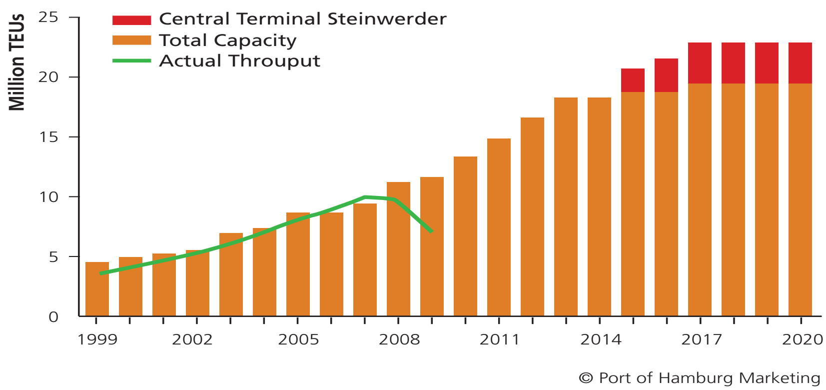
→ Figure 52: Jade-Weser Port
Source: Jade-Weser Port Realisierungs GmbH und Co.KG

1 Bremenports, in: http://www.bremenports.de/, 04.12.2009.
2 Ports Handbook Bremen & Bremerhaven, Page 47, Imprint: bremenports GmbH & Co.KG, 2008.
3 Bremenports, in: http://www.bremenports.de/, Date: 04.12.2009.

THE CHANGING BUSINESS ENVIRONMENT

All the investments indicated in the previous paragraphs will generate in the future a mushroom growth capacity of the Port of Hamburg. In 2008 capacity reached approximately 11-12 ml. TEUs while in 2017 it will increase up to 19-22 ml. TEUs. The 3 million TEUs variation in the plan is represented by the Central Terminal Steinwerder where a decision on its final destination has not been taken yet.

→ Figure 53: Total Capacity of the Port of Hamburg in Million TEU
Source: HHM



The Port of Bremerhaven capacity increased to approximately 8 ml. TEUs in 2008. Further plans to provide additional capacity have not been adopted.

The completion of the first 1.000m quay of the Jade-Weser Port (JWP) is planned in the first quarter of 2011. The JWP will start with a capacity of approximately 1.5 ml. TEUs and after completing the second part constituted by the remaining 725m quay in 2013 it will reach the final targeted capacity of approximately 2.7 ml. TEUs per annum.


TERMINAL BURCHARDKAI
TERMINAL BURCHARDKAI
CMA CGM

8.1 TRAFFIC VOLUMES MARKET ASSESSMENT

This chapter is necessary in order to develop the scenario building to be adopted for forecasting the traffic volumes for 2015/2020. The scenario to be adopted should emerge from a low/ average/ high methodology. Consequently all the following subchapter have to be developed and considered. The TIGER focus is on the research development of the TIGER Ports. The Project partners are key actors in identifying the traffic basin of Port attraction banking on their individual programs of investments and according to the technology initiatives and innovations put in place with the TIGER project.

8.1.1 DRIVING MARKET FORCES IMPACTING ON THE COSTS, THE QUALITY (BOTH PRODUCTS AND SERVICES) AND THE ACCESSIBILITY.

On Chapter 2 the World CTS traffic has been surveyed from which one can synthesise the market drivers as follows:

- The production process decentralization in distant countries from Europe and particularly in China, Far East and South East Asia for overall cost differentials.
- The modular production and production specialization of specific parts, pieces or components.
- The post-manufacturing activities in Europe integrated into the logistics process.
- The consolidation and products distribution into the market place in areas nearer to the consumer market.
- The ICT Software Technology allowing to manage in real time very complex and long supply chains.
- The high performance hardware equipment technologies capable of delivering greater productivities at lower costs.
- The giant CTS vessels capable of utilising the most extensive natural infrastructures represented by the water which is covering two third of the Earth's surface at no cost, therefor producing the most competitive transport mode.
- The European Ports capable with their infrastructures and technology evolution to keep pace with the CTS vessels development and by so doing maintaining the industrial scale in the ship to shore operations.
- The Inland distribution network coherent with the CTS vessels industrial scale and with the Sea Ports handling capabilities.

8.1.2 SCENARIO BASED ON LOW/AVERAGE/HIGH TRAFFIC EVOLUTION UP TO 2020

The maritime industrial structure "Shipping lines/ Ports" is characterized by four fundamental elements:

- The industrial scale.
- The very high number of operations measured in millions of TEUs.
- The service performance which is based on competitiveness.
- The value of the unfilled space both at sea and at shore which is equal to "zero" unlike any other industrial activity where the goods not sold have always a residual value.

Such an industrial structure forces the actors engaged in this business activity to research continuous improvements and achieve best practices. In this game the ability to read correctly the future market trends is vital since the investments in new tonnage and in Port infrastructures take years to be realised and even longer years to be amortised.

On the basis of the above concepts the **TIGER** Ports recognised the key strategic role of making reliable long term traffic projections developing possible scenarios based on different evolution concepts. Two methodologies have been adopted in this market research work. The CAGR methodology which is market driven and the GDP methodology which is driven by macro economic and statistic considerations.

This research has been supported by an ad hoc Excel Tool developed by HHM. Each **TIGER** Port has been asked to insert their throughput volumes from 1999 up to 2009, their transhipments traffic and local adjustment factors as explained in details in the following pages. The Excel Tool automatically calculates the traffic projections up to 2020 for the two CAGR and GDP methodologies. These data are automatically elaborated into graphical representations. The first picture represents the traffic volumes and projections by numbers in TEUs. The second graph shows a cone representation identifying a common overlapping area emerging from the two methodologies. This common area could be assumed as the most likely scenario if one was to exclude the high and low extremes.

Additionally a third methodology is provided based on the NESTEAR mathematical model. This further approach different from the previous two sourcing from O/D databases has the objective of measuring the scientific consistency of the whole research and the projections 2020 so extracted.

8.1.3 THE RESEARCH APPROACH OF THE CAGR METHODOLOGY

As a first step, Ports' throughput statistics have been surveyed and the compound annual growth rate (CAGR) has been calculated for total volumes taking into account the years 1999-2009. The CAGR methodology was applied to the base year 2009 up to 2020 with the integration of an adjustment factor agreed between the WP1 project partners in order to generate three scenarios:

- High Scenario: CAGR + 2.5 %
- Medium Scenario: CAGR +/- 0.0 %
- Low Scenario: CAGR - 2.5 %

At the same time, the CAGR methodology was applied also for calculating the hinterland total traffic moved by the various modes such as feeder vessel, barge, rail and road. Some specific circumstances were considered:

1. In any Port statistics the transhipment containers in TEUs are counted as volumes throughput. Such throughput is correct. However to the effect of this research the inland transportation traffic volumes are of particular importance since they will be the object of a specific research to be dealt with in WP1 Task 1.2. The projections dealt with in this chapter constitute the preparatory work and the direct connection with such Task 1.2. In order to extract such traffic volumes destined to the hinterland, one has to keep in mind that the transhipment containers are counted twice in Ports statistics. The first time when the container is arriving with an ocean vessel and is unloaded to the quay and the second time when loaded from the quay to a feeder vessel or vice versa. Therefore 50% of the total amount of feeder traffic must be deducted from the total Ports' turnover in order to clean the volumes from this double counting effect.

The data so extracted constitute the base for the research of the volumes to be distributed hinterland according to the various prosecution modes.

2. The development of feeder volumes from now to 2020, are also affected by the developments of the trade regions interlinked to the Port. For instance the Port of Hamburg total throughput is depending upon the development of the Scandinavian- and Baltic Regions. These are characterized by above average market growth rates set to produce projections with volumes higher than other Ports not enjoying the benefits from such favourable position. On the contrary on the Mediterranean region where the transhipment cargo is predominant in the Port of Gioia Tauro and Taranto, the new competitive environment generated by the North African Hubs could affect negatively the traffic volumes of those Ports. Therefore the CAGRs for feeder quantities for each scenario could be adjusted by a specific adjustment factor by each Port according to its prevailing economic circumstances and its competitive position. This adjustment factor is defined by each Port.

3. Furthermore each partner was given the opportunity to include individual adjustment factors to the forecasted volumes for each year according to the scenario taken as reference for peculiar situations or circumstances. These could be in relation to infrastructure investments, Ports developments, deepening of the draught allowing larger vessels to berth and/or the development of logistics areas providing facilities for inland distribution in an industrial way. The individual adjustment factors allows to adapt the traffic projections/forecasts to the additional Port capabilities and its increased competitive position.

The traffic forecasts and projections from now to 2020, allow each Port to put in direct correlation the expected traffic volumes in the years to come with its technical capacity limit. In case such expected traffic volumes should exceed the Ports capacity limit in a given year there is a situation of overhang. This shows how important is this research which enables the **TIGER** Ports to manage future situations that the day to day ordinary activity is unable to foresee. Eventually should one Port discover to find itself in technical overhang in one year, the traffic could be routed inland via Dry Ports or in extreme cases to be shared with other Ports in the area although this solution is likely to put the Ports in the risk of losing the traffic altogether.

8.1.4 THE RESEARCH APPROACH OF THE GDP METHODOLOGY

A second methodology for forecasting traffic volumes is based on the GDP methodology. The GDP methodology is based on the acceptance that an increase of GDP has a direct effect on the development of the traffic volumes. Because in this document it has been reported that Europe is an important trading Partner of China, the Far East countries and South East Asia, it is obvious that the European GDP growth rate is impacting on the volumes transported by sea. According to the prevailing perception, the relationship between GDP and the traffic generation is moving in a range between two and three times the national GDP of the Country/Continent taken as reference.

For this research of the traffic projections 2020 based on the GDP methodology the IMF[4] published GDP growth rate has been adopted. These published figures are unfortunately limited to the years 2010–2014. This time span however is sufficient enough to indicate a growing trend which could as well constitute a support for the years to come up to 2020.

4 IMF, in: World Economic Outlook, October 2009.

After comparing the growth rates of **TIGER** Ports between 1999 – 2009 with the growth rates of the GDP in Europe, it was decided to take for the GDP methodology a multiplying factor of 2,5 which appear to be coherent with historic data. The growth rate of the TIGER Ports' volumes for a given year is the result of the European GDP growth rate of that particular year multiplied by the above agreed factor (See Figure 54).

→ Figure 54: Example of Ports growth rates according to the GDP-methodology

	2010	2011	2012	2013	2014
GDP growth rates Europe	0.7%	2.0%	2.5%	2.8%	3.0%
Factor	2.5	2.5	2.5	2.5	2.5
Ports growth rates (GDP x Factor)	1.8%	5.0%	6.3%	7.0%	7.5%

Likewise for the CAGR methodology, the 2009 is considered as the base year for the volumes projections. In order to have coherent research data to be compared between the two methodologies, the identical mechanism for scenario building is adopted:

- High Scenario: GDP + 2.5 %
- Medium Scenario: GDP +/- 0.0 %
- Low Scenario: GDP - 2.5 %

The GDP methodology which is based more on assumed macro economic and statistic situations, does not include any individual adjustments factor by each Port.

8.1.5 THE NESTEAR RESEARCH APPROACH BASED ON MATHEMATICAL MODELLING

The two approaches described in the previous Chapters are supplemented by a scientific research carried out by NEWOPERA Aisbl using NESTEAR mathematical model. NESTEAR is a NEWOPERA Aisbl member who manages a well-known projection model for building future scenarios. The sources used by NESTEAR for this work are constituted by EUROSTAT and COMEXT O/D databases:

- EUROSTAT database provides traffic data in tons as well port exchanges with different countries of the World;
- COMEXT provides trade data per type of product between European countries and the rest of the World.

These data originating from the above historic sources must be re-elaborated in order to extract TEUs volumes using mathematical modelling allowing both conversion factors from Tons/volumes and their projections into the years up to 2020.

The results produced by the CAGR and GDP researches and the NESTEAR mathematical projections are compared. Such comparison allows a number of considerations and evaluations giving to the results achieved three important foundations:

1. Market Research Foundation;
2. Macro-Economic and Statistic Research Foundation;
3. Mathematical and Scientific Research Foundation between trade zones.

8.2 THE MEDITERRANEAN PORTS

8.2.1 GENOA PORT

The Port of Genoa CAGR methodology traffic projections are reproduced in Figure 55. Taking the traffic volumes throughput of 1,533 million TEUs of base year 2009, the following amounts (* 1,000 TEUs) are forecasted for 2015 and 2020:

→ Figure 55: CAGR-methodology traffic projections for the Genoa Port
in 1,000 TEUs

Scenario	2015	2020
High	2,234	4,000
Medium	2,135	3,500
Low	2,037	3,000

The Port of Genoa takes into consideration several positive factors:

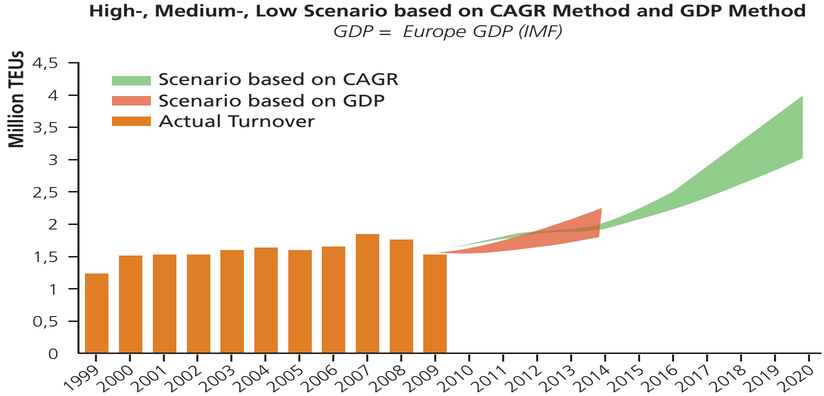
- The positive opportunity to recover traffic volumes generated by Emerging and Developing Economies
- At the beginning of 2010 Genoa port records an improved market share both versus West-Med competitors and versus the High Tyrrhenian Sea competitors showing an increased confidence by the operators
- All three scenarios of the Genoa Port are influenced by the profound restructuring of both the Port infrastructures, the Port internal operations and above all by the additional inland Dry Port facilities which have the objective of transferring the CTS beyond the Apennines mountains. The two Dry Ports of RTE (TIGER Partner) and Alessandria have an aggregate capacity of handling 1.5 ml TEUs by Rail from the Genoa Port. Both Dry Port infrastructures are on the EU Corridor 24. Road modality is planned to be capable of distributing additional 900.000 TEUs compared to the existing volumes.
- In 2015 and 2020 the Genoa Port will be totally different from the one it has been known in the past.
- The Low, Medium and High Scenarios take into consideration the above mentioned individual adjustment factors applying lower medium and higher percentages of success factors in the ability to make them fully operational and efficient during the considered timeframe.

  In the low scenario the CAGR starting from 2010 to 2020 is equivalent to 6,13%. In the medium scenario the CAGR starting from 2010 to 2020 is equivalent to 7,72% while in the high scenario it reaches 9,10%. The CAGR for the previous ten years from 1999 to 2009 was 2,20%.

  The high forecasted volumes resulting from the relatively high CAGR percentages are motivated by the positive circumstances which are making the Port of Genoa far more attractive and competitive than in the past. In the high scenario the Genoa Port's capacity limit is reached in 2020.

The GDP traffic projections with the IMF data available up to 2014 produces a cone supporting the CAGR traffic volumes forecast. However the GDP projections appear to indicate a more optimistic outlook for the short term and if one was to imagine the pink cone of Figure 56 continuing up to 2020, the CAGR and GDP methodology seem to be arriving at the same conclusive results. Also the GDP methodology seems to substantiate the fact that Genoa Port will reach its capacity saturation by 2020.

→ Figure 56: High/Medium/Low scenario based on CAGR and GDP for Genoa Port



8.2.2 GIOIA TAURO PORT`

The Gioia Tauro Port traffic volumes in 2009 reached 2,857 ml TEUs with a CAGR from 1999 to 2009 of 2,40%. This positive percentage has however been negatively impacted by the traffic drop in 2009. In fact in 2007 the traffic throughput was 3,445 ml TEUs. It is obvious that Gioia Tauro being a transhipment Hub, it has been more exposed to the World-wide reduction in maritime traffic and to the Mediterranean Countries negative economic situation. In the following Figure 57 the volumes situation is summed up.

→ Figure 57: CAGR-methodology traffic projections for Gioia Tauro Port
in 1,000 TEUs

Scenario	2015	2020
High	3,808	4,838
Medium	3,295	3,711
Low	2,841	2,827

One of the very positive characteristics of the Gioia Tauro Port is the space availability which is capable of delivering additional capacity with relatively small investments confined to the equipment gears. There appear to be adequate infrastructure capabilities up to 2020 and beyond. Consequently Gioia Tauro does not have a technical capacity constraint for the foreseeable future. Also the Rail facilities connecting into the Port are largely underutilized. The **TIGER project** moreover is launching a new Rail operation initiative using the largely underutilized Ionian Rail line to Bari opening up a non congested routing via the Adriatic line to Bologna Dry Port. This routing becomes indeed vital for the medium and high scenario traffic projections.

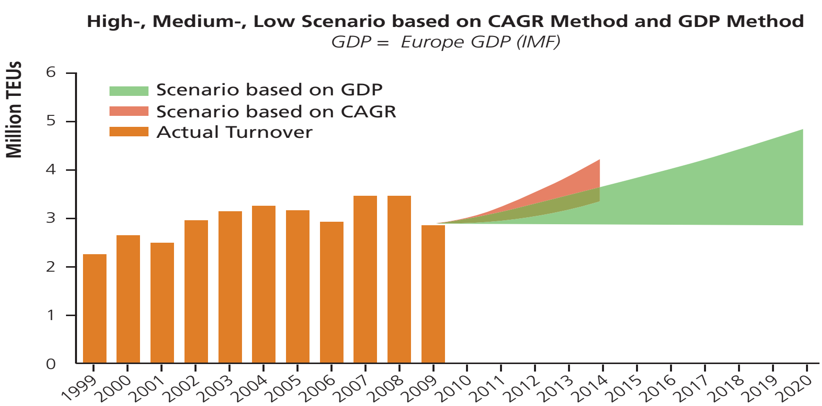
In the low scenario the CAGR starting from 2010 to 2020 is equivalent to -0,10%. In practice the low scenario is flat compared to the existing volumes. In this scenario the new competitive position of South Mediterranean Ports is taken into consideration. The new North African port facilities of Tanger, Port Said and the Sardinian Port of Cagliari will have to saturate their capacities therefore generating a negative impact on all existing Port facilities.

In the medium scenario the CAGR starting from 2010 to 2020 is equivalent to 2,40% which is the same percentage of the past ten years. This medium scenario appears to be very realistic since also in the past ten years new transhipment Hubs have come into the market and therefore one could consider that the future situation is not different from the past.

In the high scenario the CAGR reaches 4,90%. This scenario is also possible despite some favorable circumstances have to happen in the market place. Such positive factors coincide with a faster economic development not yet foreseen at the moment as well as a substantial pick up of maritime traffic volumes as a result. The other positive element to be considered in the high scenario is the impressive availability of giant CTS vessels already in operation and in case of economic development, the Gioia Tauro Port is capable of handling them as from now.

The GDP traffic projections as indicated in Figure 58 appear to offer a more optimistic outlook than the CAGR high scenario. This is no surprise since the GDP is the projection of a macro statistical data which does not take into consideration the negative circumstances incorporated into the Gioia Tauro Port market projections. However the GDP forecast delivers a very positive situation which could give substance to the CAGR high scenario and probably to overtake it.

→ Figure 58: High/Medium/Low scenario based on CAGR and GDP for Gioia Tauro Port



8.2.3 TARANTO PORT

The Taranto Port traffic volumes in 2009 reached 744.000 TEUs with a CAGR from 1999 to 2009 of 6,74%. This positive percentage has been however affected by the traffic drop which starting from 2007 impacted negatively on the Port traffic volumes development and future forecast. In fact in 2006 the traffic throughput was 859.000 TEUs. Taranto like Gioia Tauro being both transhipment Hubs have been more exposed to the World-wide reduction in maritime traffic and to the Mediterranean Countries negative economic situation. Moreover the competition from North African Hubs fighting for the same Mediterranean traffic has further eroded the volumes. For these reasons and for some other peculiar circumstances affecting Taranto Port, traffic volumes are seen very negative also in 2010 whereas other Ports are already experiencing a pickup of their activities. The traffic drop in 2010 is quite substantial and this is even more critical if one considers that both 2008 and 2009 have seen important volumes reductions. Amongst such peculiar circumstances one has to consider the organisational restructuring of the Port operations due to volumes reductions which affected negatively the Port's efficiency. Taranto Port forecasts a stabilization of its traffic throughput in 2011 and a positive evolution projected as from 2012. In the following Figure 59 the forecasted 2015 and 2020 traffic volumes (* 1,000 TEUs) are reproduced:

→ Figure 59: CAGR-methodology traffic projections for the Taranto Port
in 1,000 TEUs

Scenario	2015	2020
High	1,282	1,988
Medium	1,107	1,524
Low	935	1,159

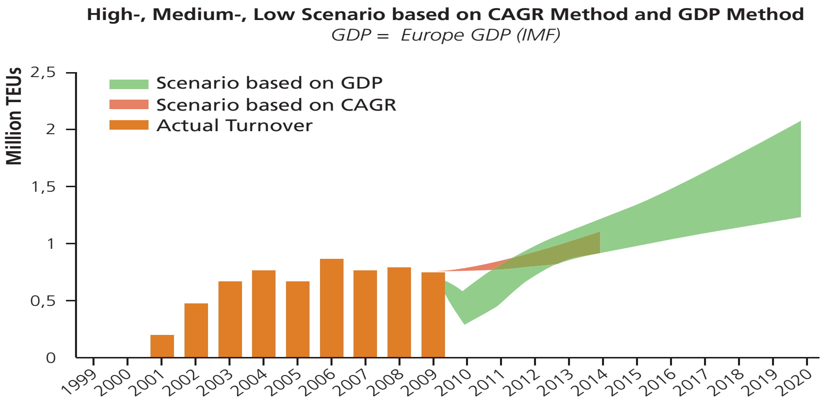
In the low scenario the CAGR starting from 2010 to 2020 is equivalent to 16,36%. This percentage appears to be exceptionally high but this is due to low level of traffic volumes forecasted in 2010 suffering from three consecutive years of traffic reduction.

In the medium scenario the CAGR starting from 2010 to 2020 is equivalent to 13,70% and again this percentage compared to the low scenario is due to a better forecasted traffic trend in the second semester of 2010. In the high scenario the CAGR reaches 12,93%.

Taranto Port in the Mediterranean situation has absorbed all the negative effects of the recession and the competition from North African and other Mediterranean Ports. The crisis has hit Taranto during its development phase and this situation has made the Port more vulnerable than others not having consolidated enough the relationship with its shipping lines customers.

The GDP traffic projections with the IMF data available up to 2014 produces a cone supporting the CAGR traffic volumes forecast. However the GDP projections appear to indicate a more optimistic outlook for 2010-2012 not taking into account the peculiar difficulties the Port as described above. The situation is reversed after 2012 but if one was to imagine the pink cone of Figure 60 continuing up to 2020, the CAGR and GDP methodology seem to be arriving at the same conclusive results.

→ Figure 60: High/Medium/Low scenario based on CAGR and GDP for Taranto Port



8.3 THE NORTH EUROPEAN PORTS

8.3.1 PORT OF HAMBURG

The Port of Hamburg CAGR methodology traffic projections are reproduced in Figure 61. Taking the traffic volumes throughput of 7.01 million TEUs of base year 2009, the following amounts (* 1,000 TEUs) are forecasted for 2015 and 2020:

→ Figure 61: CAGR-methodology traffic projections for the Port of Hamburg in 1,000 TEUs

Scenario	2015	2020
High	12,164	19,598
Medium	10,427	14,908
Low	8,579	10,771

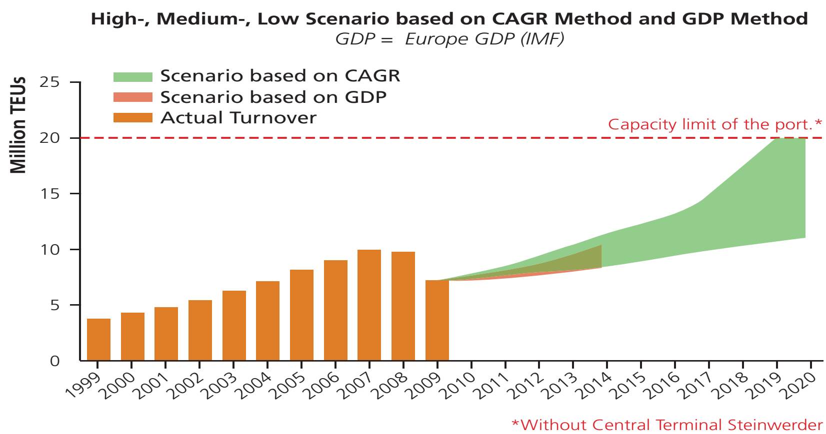
In the low scenario an individual adjustment factor was taken into consideration to cater for the slow recovery of the economy (2010-2012) as well as for the opening of Jade-Weser-Port (2013-2016). The result is a lower traffic volume growth for these years. The CAGR starting from 2010 to 2020 despite considering these adjustments is equivalent to 4.34%. The CAGR from 1999 to 2009 was 6,49%.

The medium scenario is also characterized by individual adjustments. There are some negative impacts again for the economy slow recovery in the years 2010-2012 compensated by positive effects generated by the adaptation of river Elbe (2013-2015). Additional positive considerations are connected to the entry of Russia into the WTO and the capacity limits being reached by the Port of Bremerhaven and Jade-Weser-Port by 2019-2020. The CAGR in the medium scenario, starting from 2010 to 2020 incorporating these considerations, reaches 7.39 %.

In the high scenario the same evaluations of the medium scenario are incorporated but giving a more optimistic outlook to the global and European economic recovery and a more positive effect to the investments made in the River Elbe in 2012-2015 generating additional receiving capabilities and improving the overall Port competitive position. According to these projections, the port of Hamburg will reach its capacity limit in 2020 but at this time additional capacity of the Central Terminal Steinwerder could come into play. The CAGR starting from 2010 to 2020 taking into account the above evaluations reaches 9.98%.

The GDP traffic projections are not possible up to 2020 due to the NON availability of IMF GDP estimates that far ahead but the low, medium, average scenarios up to 2014 produce a cone which is coherent with the CAGR volumes forecasts. In the following Figure 62, the GDP cone in pink indicates that both the lower and higher scenarios produce slightly lower figures than CAGR and seems to be mitigating the two extremes. If one was to project the GDP cone to 2020 with the same spectrum, it would appear that the Port of Hamburg would not saturate its capacity limit but still would achieve very substantial performances positioning its traffic volumes between 15 and 20 ml. TEUs in a position between the average and high CAGR scenario.

→ Figure 62: High/Medium/Low scenario based on CAGR and GDP for Port of Hamburg



8.3.2 PORT OF BREMERHAVEN

The Port of Bremerhaven CAGR methodology traffic projections are reproduced in Figure 63. Taking the traffic volumes throughput of 4.56 million TEU of base year 2009, the following amounts (* 1,000 TEUs) are forecasted for 2015 and 2020:

→ Figure 63: CAGR-methodology traffic projections for the Port of Bremerhaven in 1,000 TEUs

Scenario	2015	2020
High	7,906	8,500
Medium	6,443	8,500
Low	5,278	7,982

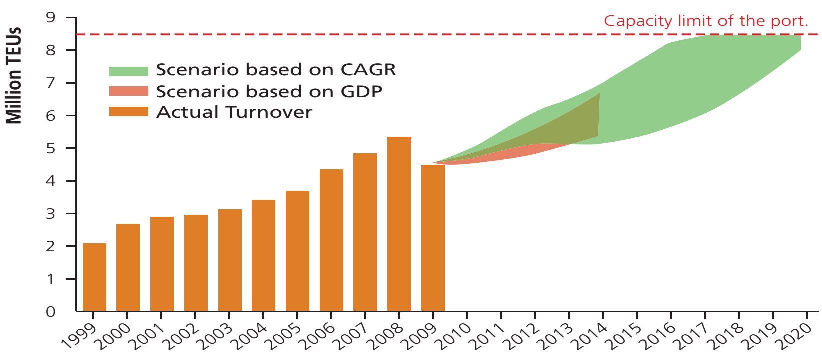
In the low scenario an individual adjustment factor was taken into consideration to cater for the slow recovery of the economy (2010-2012) as well as for the opening of Jade-Weser-Port (2013-2019). This results in a lower traffic volume growth for these years. The CAGR starting from 2010 to 2020 despite considering these adjustments is equivalent to 5.56%. The CAGR for the previous ten years from 1999 to 2009 was 7,57%.

The medium scenario is also characterized by some adjustments. There are some negative impacts again for the economy slow recovery in the years 2010-2012 but to an inferior level compared to the low scenario. Furthermore the time horizon of the Jade-Weser-Port opening is compressed to 2017 only. In this situation the Port of Bremerhaven reaches its capacity limit in 2018, pre-empting any further growth possibility thereafter. As a result of that the CAGR 2010 to 2020 incorporating the individual adjustments amounts to 5.82 %.

In the high scenario the same evaluations of the medium scenario are incorporated. The time horizon of the Jade-Weser-Port opening is compressed further to 2016. The economic outlook is more optimistic. In this situation the Port of Bremerhaven reaches its capacity limit in 2017 with zero development from this year to 2020. This means that in the high scenario the CAGR traffic development is lower than in the medium scenario due to the fact from 2018 to 2020 there is no possibility of traffic volumes expansion. The CAGR 2010 up to 2020 because of the above, is equivalent to 5.45 %.

The GDP traffic projections, which cannot go beyond 2014 for the reasons already explained for the Port of Hamburg, indicates that both the lower and higher scenarios produce slightly lower figures than CAGR and seems to be mitigating the two extremes. Likewise it was done for the Port of Hamburg, if one was to project the GDP cone to 2020 with the same spectrum, it would appear that the Port of Bremerhaven would indeed saturate its capacity limit by 2017/2018. This in itself is a very strong confirmation of the consistency of the two methodologies and confirm the credibility of the strong foundation on which this research is being carried out.

→ Figure 64: High/Medium/Low scenario based on CAGR and GDP for Bremerhaven Port



8.3.3 JADE-WESER-PORT

The Jade-Weser-Port is still under construction. Therefore it is not possible to apply CAGR methodology based on the percentages extracted from the years 1999-2009. Also the GDP methodology cannot be applied because the start of operations is planned at best in 2012. The following assumptions are taken into consideration:

- Operation increase in 2013 with an annual traffic volume of 1 Million TEUs.
- Annual traffic throughput to reach 1.5 Million TEUs in 2014. The maximum Port capacity is planned to reach 3.0 TEUs p.a.
- From 2014 onwards an annual growth rates of 5.0% (CAGR = 5.0 %) is applicable.
- The low, medium and high scenarios as for the other ports.

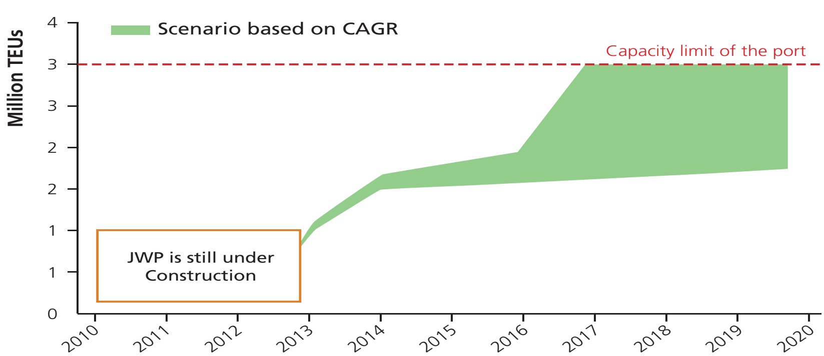
The traffic projections for the Jade-Weser-Port are visualized in Figure 65. Starting from the first year throughput of 1.0 ml. TEUs in 2013 the following traffic are forecasted (* 1,000 TEUs) in the years 2015 up to 2020:

Figure 65: CAGR-methodology traffic projections for the Jade-Weser-Port
in 1,000 TEUs

Scenario	2015	2020
High	1,819	3,000
Medium	1,615	3,000
Low	1,538	1,740

The following Figure 66 indicates the cone of the CAGR projections. According to the medium scenario capacity limit is reached in 2019 whereas on high scenario the capacity limit is reached in 2017. The strong growth rates in the high scenario for 2016/2017 are due to the Bremerhaven Port reaching its capacity limit with traffic shifted to the Jade-Weser-Port. The same effect takes place in the medium scenario in 2018 for the same reasons. In the low scenario full capacity is reached in 2020.

Figure 66: High/Medium/Low scenario based on CAGR methodology for the Jade-Weser-Port



8.4 THE NESTEAR RESEARCH

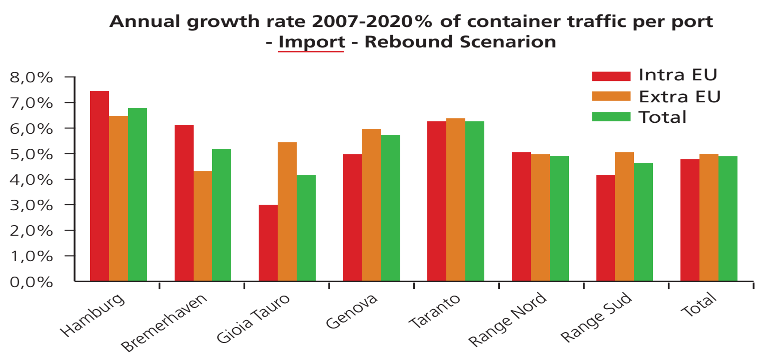
The NESTEAR research which has been conducted re-elaborating the COMEXT and EUROSTAT databases as indicated in another part of this paragraph, seems to confirm both the CAGR and GNP projections although positioning itself on the lower scenario. This lower forecast compared to both CAGR and GNP is motivated by the fact that the economic activity in Europe is forecasted at slightly lower level compared to the past decade. This research is very comprehensive and it is enclosed in the Annex I of WP1 Deliverable. The NESTEAR research is moreover of particular interest since is taking into consideration several dimensions of the European and World economic and trade activities. It encompasses in its findings variables such as:

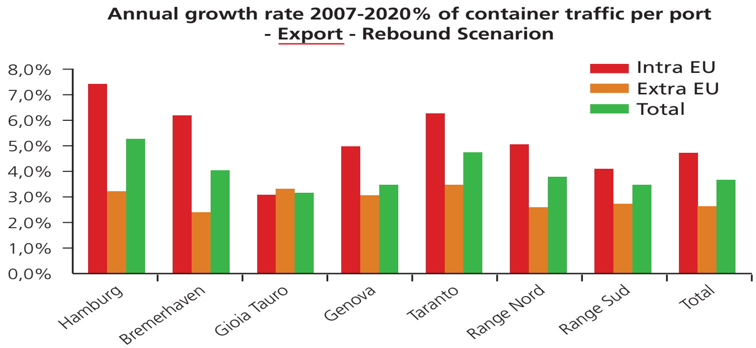
- European scenarios "permanent crisis, lost decade and rebound" as indicated by the European Authorities;
- The rate of containerisation of World trade;
- The Trade zones traffic breakdown and assignment to the Tiger Ports;
- The differences in trade reaction of the EU 15 and EU 12;
- The trade patterns affecting the Northern Port range and the Mediterranean;
- The trend of imbalances and its effects on transport variables and on the European trade development.

Therefore the NESTEAR research is affected by a number of considerations which could not be part of both the CAGR and the GNP methodologies. On the other hand the CAGR and the GNP methodologies having focused on the peculiarities of each TIGER ports, the ports competitive position, the individual investments programs and also the rail road barges connections with the hinterland, have incorporated into their projections considerations of commercial nature which could not be elaborated by the NESTEAR research.

Such different considerations motivate the slightly lower development in the rebound scenario trend compared to CAGR and GNP methodologies. The annual growth rate 2007/2020 are nonetheless very positive and give credit to the commercial and marketing considerations of CAGR and GNP forecasts (see Figure 67).

Figure 67: Annual growth rate graphs 2007-2020% (import & export)
Source: NESTEAR





One has to consider that the above rebound scenario trend is resulting to be lower than CAGR and GNP due also to the fact that the years considered are different. In fact the CAGR methodology calculates the CAGR percentages starting from year 1999 incorporating the strong development years from 2003 to 2007. The same applies to the GNP methodology. The NESTEAR research starts on the contrary from year 2007 up to 2020 and the percentage projections in the above reproduced rebound scenario is incorporating the dramatic drop in economic activities of 2008 and 2009. This drop produces a penalization greater than both CAGR and GNP. In addition the NESTEAR research starting from trade tonnage, does not incorporate the empty movements of containers which for each port constitute an important part of their volume throughput.

Considering all the above the NESTEAR research is used as a supporting evidence of both CAGR and GNP projections and is also an instrumental tool used by the individual **TIGER** ports in building up their future scenario keeping also into consideration the economic development taking place in the World trade zones captive to them.

8.5 SCENARIO FINDINGS

The results of all the above mentioned work is conducive towards answering the next subchapter which indeed represents the **TIGER** ports traffic projections up to 2015/2020. Considering the existing economic downturn a projection on a longer time span up to 2020 is more suitable for this research. This can be done applying to the adopted scenario a percentage traffic increase according to estimated European GNP and the GNP of the developing countries such as South East Asia, Far East and China.

Each **TIGER** Port has produced its own traffic projections incorporating in addition to CAGR, GNP and NESTEAR methodologies, an element of evaluation connected to its own captive market, traffic basins, reachable distances, infrastructure availability both at sea and land as well as the forecasted development of the trading partners economies. All three methodologies are incorporated into the traffic projections with the additional evaluation benefit of both their investment plans, their service rendering, their marketing and competitive factors.

WORLD ECONOMIC OUTLOOK (WEO)[5]

World growth is projected at about 4½ percent in 2010 and 4¼ percent in 2011. Relative to the April 2010 World Economic Outlook (WEO), this represents an upward revision of about ½ percentage point in 2010, reflecting stronger activity during the first half of the year. The forecast for 2011 is unchanged. At the same time, downside risks have risen sharply amid renewed financial turbulence. In this context, the new forecasts hinge on implementation of policies to rebuild confidence and stability particularly in the euro area. More generally, policy efforts in advanced economies should focus on credible fiscal consolidation notably measures that enhance medium-run growth prospects such as reforms to entitlement and tax systems. Supported by accommodative monetary conditions, fiscal actions should be complemented by financial sector and structural reforms enhancing growth and competitiveness. Policies in emerging economies should also help rebalance global demand, including through structural reforms and in some cases greater exchange rate flexibility.

The world economy expanded at an annualized rate of over 5 percent during the first quarter of 2010. This was better than expected in the April 2010 WEO, mostly due to robust growth in Asia. More broadly there were encouraging signs of growth in private demand. Global indicators of real economic activity were strong through April and stabilized at a high level in May. Industrial production and trade posted double-digit growth, consumer confidence continued to improve, and employment growth resumed in advanced economies. Overall, macroeconomic developments during much of the spring confirmed expectations of a modest but steady recovery in most advanced economies and strong growth in many emerging and developing economies.

Nevertheless, recent turbulence in financial markets—reflecting a drop in confidence about fiscal sustainability, policy responses, and future growth prospects—created a cloud over this positive outlook. Fiscal sustainability issues in advanced economies came to the fore during May fuelled by initial concerns over fiscal positions and competitiveness in Greece and other vulnerable European economies.

THE ECONOMIC RECOVERY IN CHINA:

The GDP growth of 11.9% in the 1st quarter 2010 compared to previous year's quarter stands for a very dynamic economy in China. The German Bank forecasted the annual growth rate of the GDP to 9.8%, China Academy of Social Science prognosticated to 9.9% and IMF to 10% (2009: 8.7).[6]

China's export booms in the first half-year because of the strong demand for low priced consumer goods. Between January and June 2010 the value of exported cargo increased by 35.2% in comparison to 2009 as per national customs authority of China. The annual comparison of the value of exported cargo within the month June shows an increase of 43.9% and of imported cargo 34.1%.[7]

The throughput of containerized cargo is booming too in Chinese ports. Chinese ports inform about highest ever measured turnover. To compare to previous month May in annual comparison the main ports turnover increased by 22%. Even more important is the plus of 17% compared to May 2008.

ECONOMIC RECOVERY OF THE USA:

Already in the 4th quarter of 2009 the GDP of the USA was growing by 5.6% compared to the previous quarter in the same year. The 1st quarter 2010 couldn't fulfil the expectations of a

5 International Monetary Fund, in: http://www.imf.org/external/pubs/ft/weo/2010/update/02/index.htm, date: 07.07.2010.

6 Germany Trade and Invest, Wirtschaftsdaten kompakt VR China. Jahresmitte 2010., page 3.

7 Süddeutsche Zeitung, Chinas Export boomt, 12.07.2010.

growth of 3.2% compared with the previous month but amounts to 3.0%. If the 1st quarter 2010 is compared with the 1st quarter 2009 a growth of 7.8% was reached. In total an annual GDP growth of 3.2% compared to the previous year is expected for 2010 after the decrease of -2.4% in 2009.[8]

Some economic experts are looking forward to a sustainable upturn in the USA with scepticism. The rate of unemployment is expected to remain static just under 10% at the end of 2010, so that private consumption could only offer a limited support to the economic recovery. The private consumption's share to the GDP amounts to 70% and is determining the economic recovery. Additionally consumers have to save money in order to amortize credits which they took in 2009. Debt conversion in new loans like in the past years is not possible because of more restrictive risk management of the banks.[9]

One has to consider the fact that the imports of the USA increase since June 2009 by a constant trend. In addition the Government of the USA passed a program in March 2010 to double exports within five years "National Export Initiative". Experts forecast a continuous growth of the total trade up to 2010.[10]

ECONOMIC RECOVERY IN GERMANY

Despite this was the deepest recession since the second world war, the employment ratio remained stable. Since October 2008 approximately 200 thousand jobs were lost but 1.2 million could be saved due to Governments reduced working hours program.[11]

In total an annual GDP growth of 1.4% (German Trade and Invest, May 2010) up to 1.9% (Rheinisch-Westfälische Institut für Wirtschaftsforschung, June 2010) compared to the previous year is expected for 2010 after the decrease of -5.0 % in 2009.[12]

Engine- and plant construction sectors recovered from the deep recession. In April 2010 orders increased by 36% compared to same month of previous year and in May by staggering 61%. The export markets in particular recovered very well. The same trend can be reported by the second important sector of the industry, the electronic, which registered an orders increase of 31% in April compared to the same month of the previous year.[13]

Consumers are able to buy more products manufactured in Germany. German companies delivered in total during May 2010 goods with a value of 77.5 billion Euros to foreign trade partners. This equates to a plus 9.2% compared to April and plus 28.8% compared to May 2009. This percentage jump achieved on the previous year was the biggest increase since 10 years. This

8 Germany Trade and Invest, Wirtschaftsdaten kompakt USA. Jahresmitte 2010, page3.
9 Germany Trade and Invest, Arbeitsmarkt bleibt die Schwachstelle des Aufschwungs, in: http://www.gtai.de/fdb-SE,MKT201006158010,Google.html, date: 16.06.2010.
10 Germany Trade and Invest, Wirtschaftstrends kompakt USA. Jahresmitte 2010, page 3-8.
11 Deutsche Bank Research (2010), Deutschland Beschäftigungswunder. Kurzarbeit, flexible Tarifverträge & gesunde Unternehmen. 27.04.2010.
12 Germany Trade and Invest, Business Briefing: Germany (May 2010), page 1.
13 Handelsblatt, in: Maschinenbau gewinnt 36 Prozent mehr Aufträge, in: http://www.handelsblatt.com/unternehmen/industrie/erholung-maschinenbau-gewinnt-36-prozent-mehr-auftraege;2591919, date: 31.05.2010. / Handelsblatt, in: Auftragsbestand steigt um 61 Prozent, in: http://www.handelsblatt.com/unternehmen/industrie/maschinenbau-auftragsbestand-steigt-um-61-prozent;2611240, date: 01.07.2010.

economic performance achieved in the last few months demonstrates that the country half year results will exceed the best expectations.[14]

The German export like in other European countries is taking advantage of the Euro currency devaluation compared to the USD $. There are many positive signs pointing towards the assumption for an economic recovery stronger and sooner than expected. Such considerations could have a positive impact on the traffic projections and on the most likely scenario affecting each German ports.

In particular China and the USA are playing an important role in the increased throughput of German ports in extra-EU trade. One has to report that the Port of Hamburg has closer trade relationships to Asia accounting for 59% of the total turnover than to America accounting for 10%. For the Port of Bremerhaven these percentages are 31% for Asia and 25% for America respectively.

ECONOMIC RECOVERY IN ITALY

ISTAT, the Italian official Government Statistical Agency, is forecasting a GNP growth of 1% or more for 2010 and similarly for 2011. However these projections are being monitored and adjourned monthly in order to incorporate the latest trends. These growth percentages are also supported by the international Agencies and by the European Institutions. In May the positive trend has gained momentum with orders to industries booming with a 26,6% increase on annual basis. One has to go back several years to find such an increase. Export in particular is driving these orders with a 49,2% increase but also the domestic market is producing new orders in double figures (+16%). Also the month of June seems to be confirming these positive trends with the extra EU export trade increasing 26,4% on yearly basis and with the import producing an even higher percentage of 37,4%. All industrial sectors seem to be positively affected. The very high import trade although having negative effect on the Italian balance of payments is seen as a very positive indicator. In fact Italy not having natural resources from its own territory is importing the raw materials from abroad. This means that industries are reconstructing their feedstock for their production cycles. There are definite signs that the recession might be over.

The above strong indicators both for import and export trade give substance for a more optimistic outlook of the traffic volume projections from now to 2020.

For additional information on the various trade zones peculiarities please refer to the NESTEAR research which is enclosed as Annex 1 to WP1 Deliverable.

[14] Hamburger Abendblatt, IWF erhöht Wachstumsprognose für die Weltwirtschaft, in: http://www.abendblatt.de/wirtschaft/article1561657/IWF-erhoeht-Wachstumsprognose-fuer-die-Weltwirtschaft.html, date: 09.09.2010.

8.6 PROJECTED TOTAL VOLUMES FOR THE MEDITERRANEAN & NORTH EUROPEAN **TIGER** PORTS UP TO 2020

8.6.1 GENOA PORT

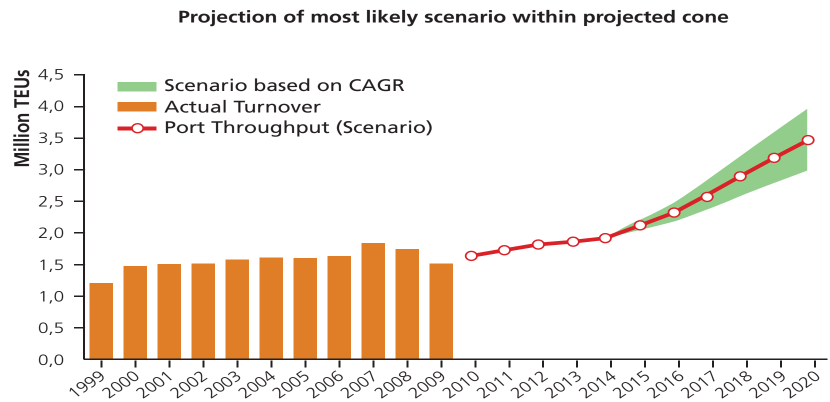
The Genoa traffic volumes have maintained themselves very constant in the last few years. The next chart (Figure 68) indicates marginal variations between the high and the low scenarios up to 2015. This is due to the fact that investments are presently on course and these gradually become operational in the next few years. A wider excursion in terms of traffic volumes is projected by 2020. In fact by 2015 and thereafter all the accomplished investments will be fully operational. In particular the Railways connection to Rivalta Terminal Europa and Alessandria Terminal will be capable of delivering their full capacity. These two huge Dry Ports with the organization of the inland Genoa Customs facilities allowing all Genoa customs operations inland without any transit formalities and with new production processes in the Port combined with Rail shuttle service connections are prerequisite for a step change in the Genoa Port productivity. For the above reasons the individual scenario chosen by Genoa Port is projecting the traffic volumes in 2020 to 3,5 ml TEUs which equates to double the existing traffic (Figure 69). The maximum throughput capacity of the Genoa Port will be 4ml TEUs by 2020. There will be still some scope for increasing the Port volumes after that date but not that much unless further investments are planned which are not being considered at the moment.

GENOA PORT HIGH LOW & INDIVIDUAL SCENARIO 2010/2015/2020

→ Figure 68: Genoa Port High Low & Individual scenario
Source: GPA

in 1,000 TEU	2010	2015	2020
High scenario	1.650	2.200	4.000
Low scenario	1.600	2.000	3.000
Individual scenario	1.650	2.100	3.500

→ Figure 69: Genoa Port individual scenario within projected cone
Source: GPA



8.6.2 GIOIA TAURO PORT

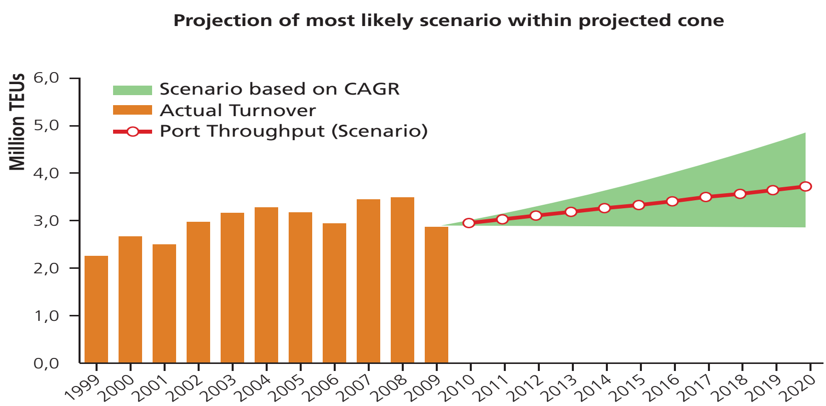
Gioia Tauro Port is substantiating the average scenario. The individual evaluation made by Med Centre CTS Terminal is crediting this average scenario given the more difficult competitive position in the Mediterranean basin generated by the North African ports as indicated in the first part of this document. The competitive position of Gioia Tauro both for its geographical location and for the availability of quay space remain strong but the important investments in port facilities in the North Africa countries will have some effects on the traffic traditionally attracted by Gioia Tauro. The Gioia Tauro Port Authority is realising investments to deepen the water in the port basin and in order to improve both the road and rail connections to the hinterland. Gioia Tauro will have still plenty of capacity available up to 2020 capable of attracting traffic well beyond that date. The Port on the individual scenario will be operating at about 70% capacity. There will be still an additional 25/30% capacity to be filled.

GIOIA TAURO PORT HIGH LOW & INDIVIDUAL SCENARIO 2010/2015/2020

→ Figure 70: Gioia Tauro Port High Low & Individual scenario
Source: Gioia Tauro Port Authority

in 1,000 TEU	2010	2015	2020
High scenario	3.000	3.800	4.840
Low scenario	2.850	2.840	2.830
Individual scenario	2.920	3.300	3.700

→ Figure 71: Gioia Tauro Port individual scenario within projected cone
Source: Gioia Tauro Port Authority



8.6.3 TARANTO PORT

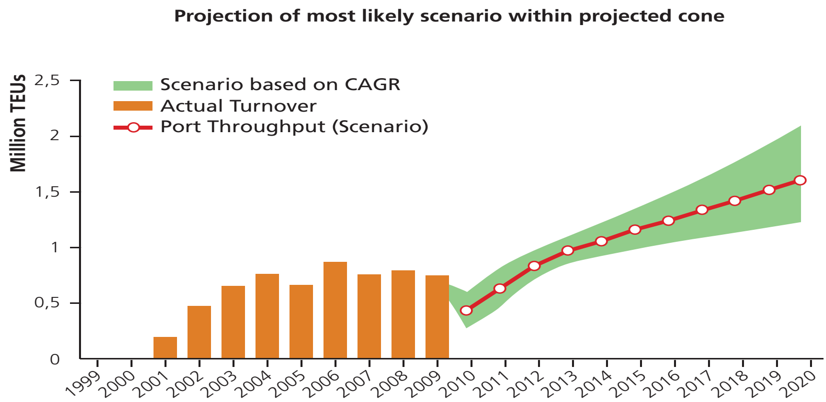
The Taranto Port having itself a characteristic of transhipment port is supporting an individual scenario close to the average scenario. The drop of traffic in 2009/2010 has been caused by specific circumstances such as labour unrest generating operational difficulties. Once that problem has been overcome the recovery of traffic activities in the port should continue the trend that was experienced before the economic recession. The individual scenario is projecting a volume of traffic in 2020 of 1,6 ml TEUs which is near to the port technical capabilities of 2 ml TEUs after which further investments will be necessary. Should this individual scenario found to be conservative Taranto Port has the space available for further investments in infrastructure for new capacity generation. It has already been indicated in the previous part of this document that further investments to be made on 550m quay side, will generate an additional capacity of 750.000 TEUs. So all systems and plans are in place to be activated in case of need.

TARANTO PORT HIGH LOW & INDIVIDUAL SCENARIO 2010/2015/2020

→ Figure 72: Taranto Port High Low & Individual scenario
Source: TCT

in 1,000 TEU	2010	2015	2020
High scenario	590	1.340	2.090
Low scenario	250	960	1.220
Individual scenario	420	1.150	1.600

→ Figure 73: Taranto Port individual scenario within projected cone
Source: TCT



8.6.4 PORT OF HAMBURG

China and the USA have very close commercial relationships with Germany accounting important figures for extra-EU trade. In 2009 China ranked 2nd and the USA 4th in the list of the most important countries delivering import cargo to Germany. Looking at German export markets, the USA ranked 3rd and China 11th. The majority of the cargos exchanged between these economies is transported by ocean vessels. The economic development of these two countries has a direct influence on the German ports throughput traffic volumes.[15]

The Asian continent containerized traffic accounted in 2009 for 59% of the total throughput at the port of Hamburg, followed by the European traffic 28% and the Americas' 10%. China including Hong Kong is the first trading partner. This situation has not changed for several years and the Chinese traffic represented in 2009 32% of the total Hamburg throughput in TEUs.[16]

Likewise the Bremen Ports main trade partners are Europe with 38%, Asia with 31% and the Americas with 25%. China including Hong Kong accounted for 16% of the containerized traffic volumes. The USA represented 15%.[17]

In the set of charts from Figures 68- 79 the comments made in the previous paragraph have been taken into consideration. The projected high/low scenarios built on CAGR and GNP methodologies described at length in other parts of this documents, are integrated with a red line which according to each TIGER port represents its own traffic projection up to 2020.

A fresh estimate of the traffic volumes according to the high and low scenario was made as per Figure 74. An individual Hamburg Port scenario close to the high scenario was adopted. This choice was supported by the above mentioned general economic tendencies for German international trade and also by the planned volumes recovery generated by the following factors:

- Close trade relations with Asia and especially with China;
- Six new or re-inserted liner services during 2010 to Asia. These are FES (PIL, Wan Hai), AEC-1 (UASC), Loop D (Grand Alliance), NE 5 (CHKY), AME (ZIM) and FAL 5 (CMA CGM);
- Expected deepening of the river Elbe in the medium-term opening new possibilities for giant containers vessels;
- Expected joining of Russia to the WTO organization. This will strengthen Hamburg' close existing trade relationships with Russia.

It is expected that the opening of the JadeWeserPort (JWP) will have an influence on the throughput of the Port of Hamburg slowing down the annual growth rate of its traffic volumes in 2014 and 2015. Nonetheless such impact is expected to be not so negative as it could be for istance for the Port of Bremerhaven. In fact Bremerhaven and JWP share the same operators A.P.

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15 Germany Trade and Invest, Wirtschaftsdaten Kompakt: Deutschland (05/2010), page 2-3.
16 Hafen Hamburg Marketing
17 Der Senator für Wirtschat und Häfen, Freie und Hansestadt Bremen, in: Die bremischen Häfen: Hafenspiegel `09, page 11.

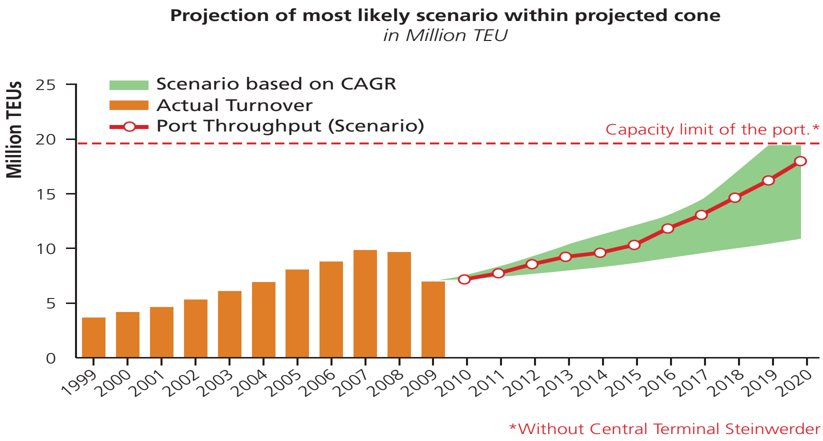
Møller Terminal & Eurogate. In addition the Maersk Liner services call at the Port of Bremerhaven and only smaller services call Hamburg. For these reasons the negative impact of the opening of JWP is forecasted to be not so negative in the short term (Figure 74) with the traffic volume improving considerably in the medium term (Figure 75).

HAMBURG PORT HIGH LOW & INDIVIDUAL SCENARIO 2010/2015/2020

→ Figure 74: Port of Hamburg High, Low and Individual Scenario (in 1,000 TEU)
Source: HHM

in 1,000 TEU	2010	2015	2020
High scenario	7,600	12,200	19,600
Low scenario	7,000	8,600	10,800
Individual scenario	7,200	12,200	17,000

→ Figure 75: Hamburg Port individual scenario within projected cone
Source: HHM



8.6.5 PORT OF BREMERHAVEN

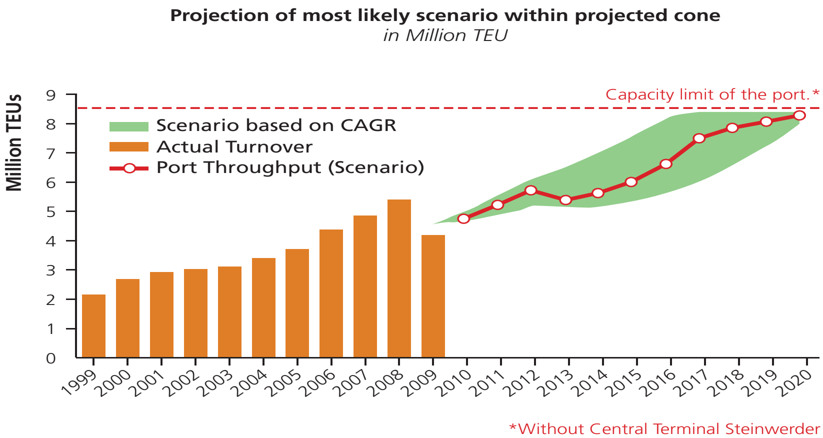
The Port of Bremerhaven gap betwenn high and low scenario is characterised by a smaller traffic variation (Figure 76). This is due to the lack of expansion areas which limit the total throughput capacity. Such capacity is today limited to 8.0 – 8.5 million TEUs. The calculated traffic volumes in the high scenario meet the total throughput terminal capacity in 2017 and in the medium scenario just one year later in 2018.

The individual scenario chosen by Bremerhaven Port is close to the high scenario up to 2012 considering the general tendencies of German TIGER Sea Ports forecasts. In 2013-2015 a decrease of this growth rate is planned due to the opening of the JWP. The years 2016 and 2017 are again characterized by an higher annual growth rates before reaching the limit of handling capacity by 2020 (Figure 77).

→ Figure 76: Port of Bremerhaven High Low & Individual scenario
Source: HHM

in 1,000 TEU	2010	2015	2020
High scenario	5,000	7,600	8,500
Low scenario	4,600	5,300	8,000
Individual scenario	4,700	6,000	8,300

→ Figure 77: Port of Bremerhaven individual scenario within projected cone
Source: HHM



8.6.6 JADE-WESER PORT

The JadeWeserPort opening has been rescheduled to the 5th August 2012 having reduced the speed of investments due to the economic recession. Also with this rescheduled opening the JWP will join a market which has sufficient available handling capacity provided collectively by the Hamburg and Bremerhaven Ports. This situation is confirmed also in the high scenario. Moreover the Rail infrastructure connection is also delayed due to uncertainty regarding financial matters and for technical plans approval. As a result the double track construction is expected only in 2015 instead of 2011/2012 and the electrification will not be completed before 2017.[17] Such rail connection is vital for linking the port to the hinterland destinations. This is even more so in presence of no inland waterways possibilities.

[18] Neue Presse, in: Späterer Bahnausbau für Hafen löst Streit aus, in: http://www.neuepresse.de/Nachrichten/Politik/Niedersachsen/Spaeterer-Bahnausbau-fuer-Hafen-loest-Streit-aus, date: 03.06.2010. / Deutsche Verkehrs Zeitung, in: Jade-Weser-Port bekommt erst 2014 einen zweigleisigen Bahnanschluss: in: https://www.dvz.de/news/politik/artikel/id/landtagsopposition-will-klarheit-ueber-jade-weser-port.html, date: 21.05.2010. / Verkehrsrundschau.de, in: SPD: Bahnanschluss für Jade-Weser-Port verzögert sich, in: http://www.verkehrsrundschau.de/spd-bahnanschluss-fuer-jade-weser-port-verzoegert-sich-941081.html, date: 07.05.2010.

Despite the above uncertainties the JWP is due to start its activities in 2012. In fact a cooperation contract concerning port interests have been signed between Lower Saxony (location of the JadeWeserPort) and the Chinese province Shandong (location of the Port of Qingdao). The JWP low and high scenario is affected by the Hamburg and Bremerhaven Ports reaching their capacity limit and JWP overland Rail infrastructure availability for hinterland connections.

The JWP individual scenario is incorporating all the above considerations up to 2016/2017 where the low scenario is prevailing (See Figure 78) After these years the annual traffic volumes growth rates should increase taking into account the fact that both Hamburg and Bremerhaven Ports draw near their capacity limits (See Figure 79).

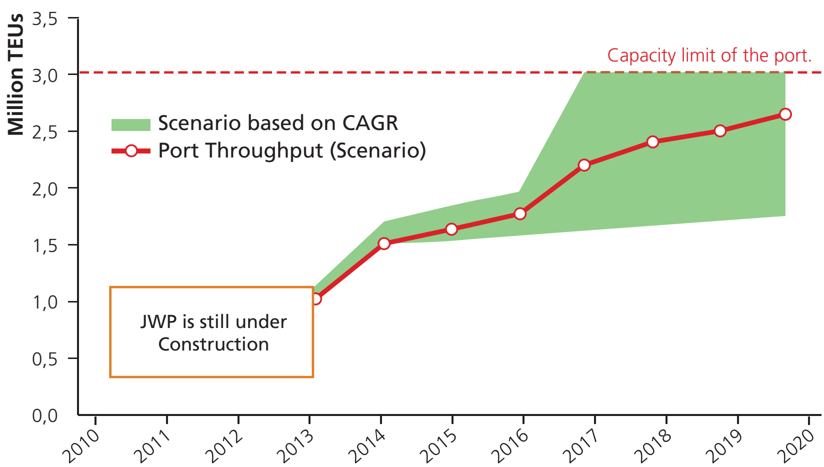
JADEWESERPORT HIGH LOW & INDIVIDUALSCENARIO 2010/2015/2020

→ Figure 78: JadeWeserPort High Low & Individual scenario
Source: HHM

in 1,000 TEU	2010	2015	2020
High scenario	not in service	1,800	3,000
Low scenario		1,500	1,700
Individual scenario		1,600	2,700

→ Figure 79: JadeWeserPort individual scenario within projected cone
Source: HHM

Projection of most likely scenario within projected cone
in Million TEU



9.1 THE MODAL SPLIT OF EACH TIGER PORT HINTERLAND TRAFFIC – THE RAIL DIMENSION.

In the previous chapter the traffic volumes were defined.

Each **TIGER** Port has produced its own traffic projections incorporating in addition to CAGR, GNP and NESTEAR methodologies, an element of evaluation connected to its own captive market, traffic basin, reachable distances, infrastructure availability both at sea and land as well as the forecasted development of the trading partners economies. All three methodologies are incorporated into the traffic projections with the additional evaluation benefit of both their investment plans, their service rendering, their marketing and competitive factors.

From each individual scenario, each TIGER Port has estimated a projected modal split of its traffic destined to the hinterland:

- Road;
- Rail;
- Barge.

The following graphs (Figure 80 - 91) are reproducing the **TIGER** Ports situation for their modal split according to the chosen individual scenarios.

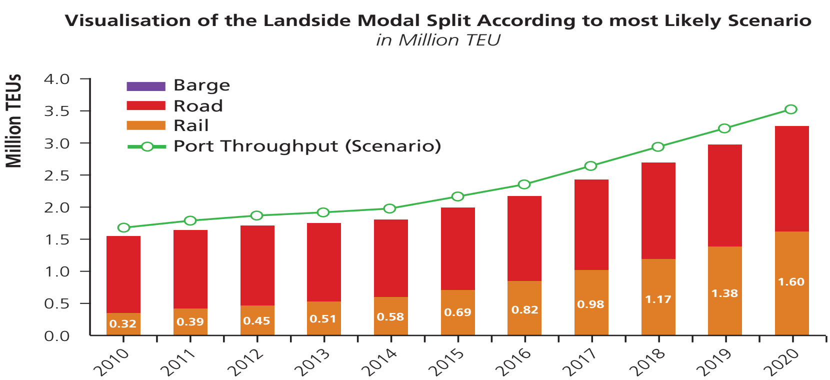
GENOA PORT

Genoa Port modal split in ml TEUs

→ Figure 80: Genoa Port Landside Modal Split according to individual scenario
Source: GPA

in 1,000 TEU	2010	2015	2020
Barge	-	-	-
Road	1.200	1.300	1.700
Rail	300	700	1.600

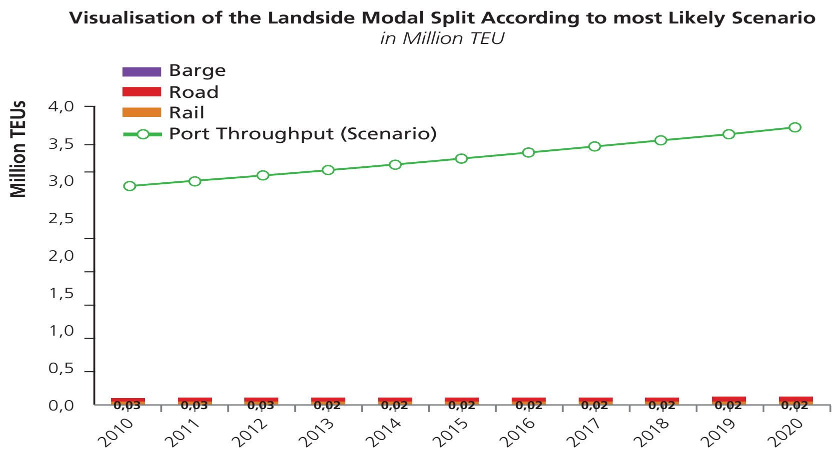
→ Figure 81: Genoa Port Landside Modal Split Visualization according to indi-vidual scenario
Source: GPA



→ Figure 82 - Gioia Tauro Port Landside Modal Split according to individual scenario
Source: Gioia Tauro Port Authority

in 1,000 TEU	2010	2015	2020
Barge	-	-	-
Road	67	86	105
Rail	27	21	15

→ Figure 83: Gioia Tauro Port Landside Modal Split Visualization according to individual scenario
Source: Gioia Tauro Port Authority



TARANTO
Taranto Port modal split in ml TEUs

→ Figure 84: Taranto Port Landside Modal Split according to individual scenario
Source: TCT

in 1,000 TEU	2010	2015	2020
Barge	-	-	-
Road	42	114	160
Rail	8	38	107

→ Figure 85: Taranto Port Landside Modal Split Visualization according to indi-vidual scenario
Source: TCT

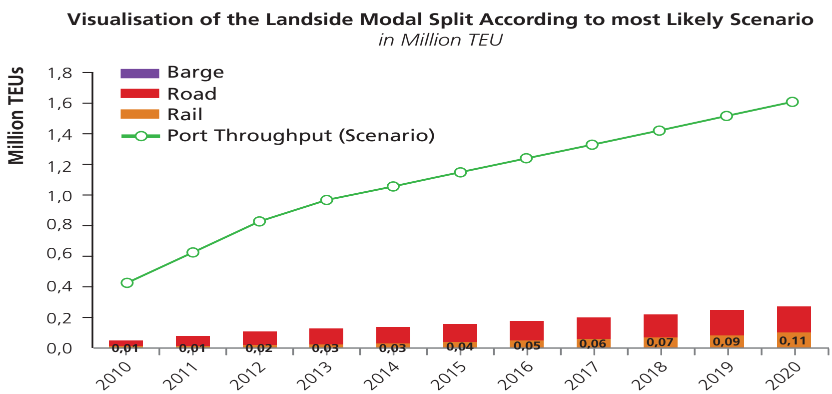
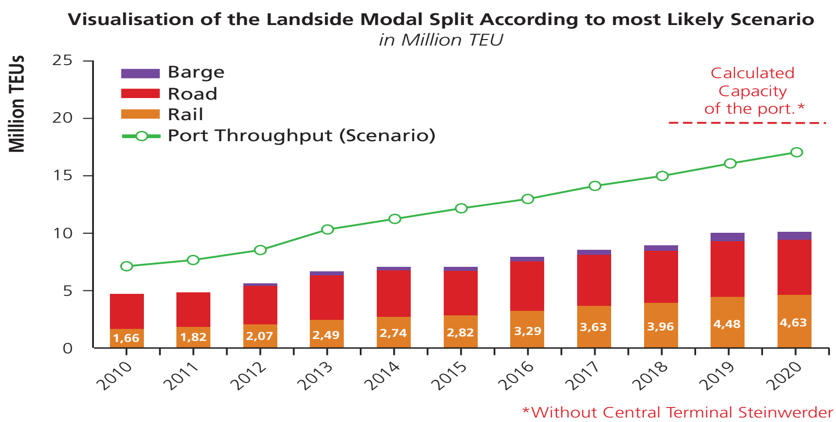


Figure 86: Hamburg Port Landside Modal Split according to individual scenario
Source: HHM

in 1,000 TEU	2010	2015	2020
Barge	110	280	710
Road	3.000	3.900	4.800
Rail	1.700	2.800	4.600

Figure 87: Hamburg Port Landside Modal Split Visualization according to in-dividual scenario
Source: HHM



BREMERHAVEN PORT
Port of Bremerhaven modal split in ml TEUs

→ Figure 88: Bremerhaven Port Landside Modal according to individual scenario
Source: HHM

in 1,000 TEU	2010	2015	2020
Barge	60	80	100
Road	900	1.000	1.200
Rail	800	1.000	1.500

→ Figure 89: Bremerhaven Port Landside Modal Split Visualization according to individual scenario
Source: HHM

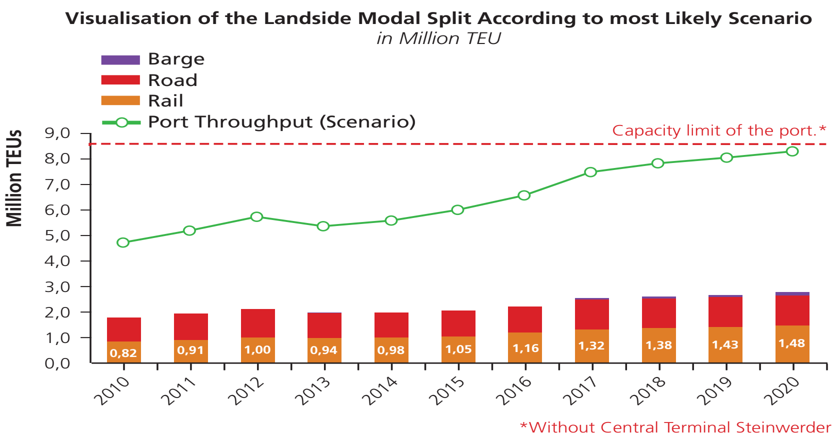
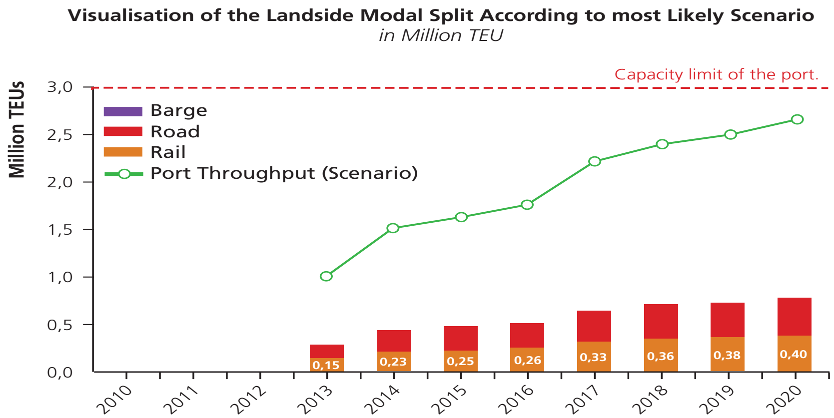


Figure 90: JadeWeserPort Landside Modal Split according to individual scenario
Source: HHM

in 1,000 TEU	2010	2015	2020
Barge	not in service	0	0
Road		250	400
Rail		250	400

Figure 91: Jadeweserport Landside Modal Split Visualization according to in-dividual scenario
Source: HHM



9.2 THE PORT INTERNAL RAIL NETWORK INFRASTRUCTURE, HANDLING FACILITIES AND INVESTMENTS PROGRAM.

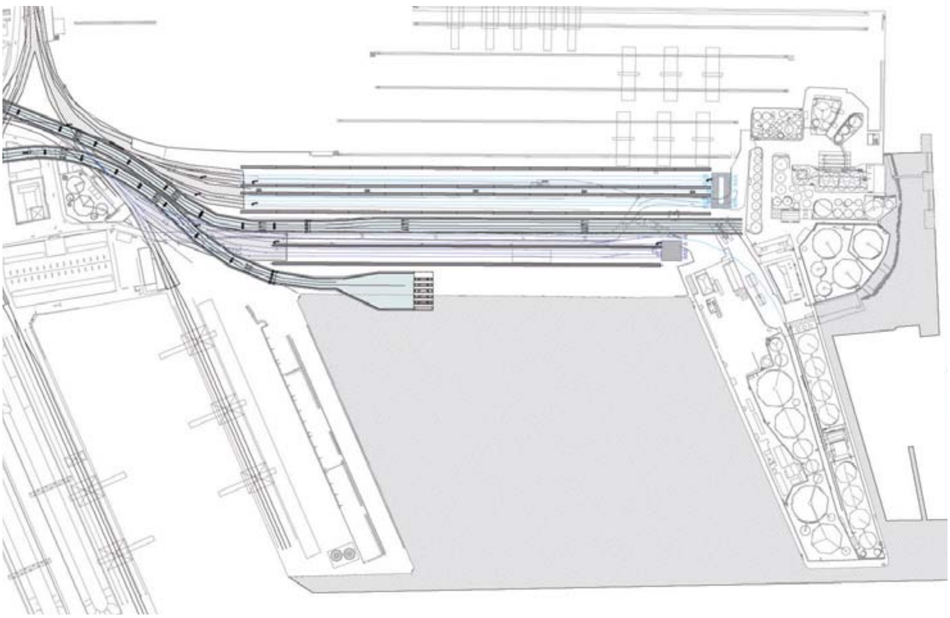
9.2.1 Genoa Port Railway Master Plan

The following information are reported on the main projects under execution included in the Port of Genoa Railway restructuring Master Plan.

Sampierdarena port projects
Rugna yard – Bettolo terminal – "Third track cluster"

This project relates to the revamping of the Railway yard currently serving the SECH Container Terminal. The restructuring has the objective of allowing the accessibility of the Rail line both to the SECH Terminal and to the new Calata Bettolo Container Terminal. This project includes the implementation of a cluster of 6 Rail tracks (Figure 92).

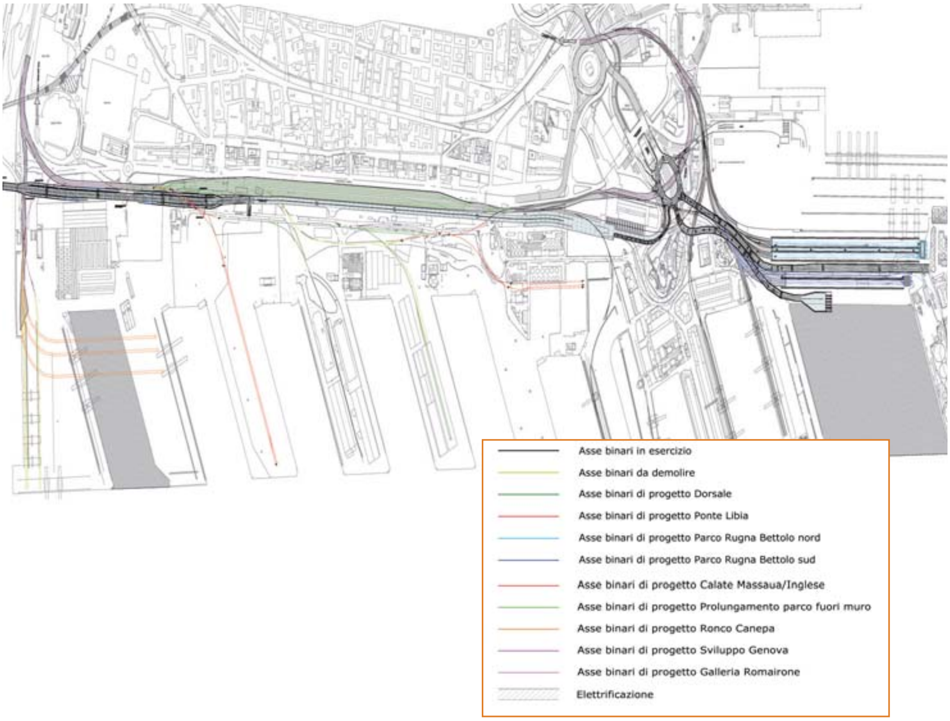
→ Figure 92: Sampierdarena basin railway Masterplan of Rugna – Bettolo
Source: GPA



This work relates to the revamping of the existing 350m tracks length transforming them in a module of 6 tracks of 500m length each. This module is served by a Rail track manoeuvring siding located at the cluster track head. The module is connected through a Rail line to the new Rail yard serving the oil terminal. An advanced S&C Signal and Control computerized system including switches automation at yard root will manage the trains traffic.

Figure 93: Sampierdarena basin (port of Genoa) railway Masterplan

Source: GPA



The Port New Railway Network & Interconnections

The Port new railway links are designed to avoid conflicts with road traffic and port internal activities. The project includes the realization of a railway corridor parallel to Viale Africa on which to channel the new railway tracks traffic of the Sampierdarena Basins various terminals achieving a more efficient and speedy cargo handling.

Massaua and Inglese quays - This project includes the realization of a cluster of 3 Rail tracks serving Massaua and Ignazio Inglese quays which today are not connected to the port Rail network. The new connection is approx 600m of length linking the West side to Calata Mogadisco Rail infrastructure and to the so called "Submerged" Rail line in the direction of the Sampierdarena gate. On the East side the new connection links towards the North directly to the "Campasso" Rail yard. On the South side the new line reaches the Ignazio Inglese quay terminals composed of 3 tracks of 250m each.

Ponte Libia Pier (including TSG Terminal San Giorgio) - The 2 new tracks of 450m each at the centre of Ponte Libia Pier are directly linked to the "Submerged" Rail line.

Ronco – Canepa Railway yard - This project relates to the creation of a Rail yard serving the terminal container Ronco and Canepa Piers. The new Rail cluster constituted of 6 tracks of 360m each is directly connected to the new Western railway link which is a priority project of "Sviluppo Genova".

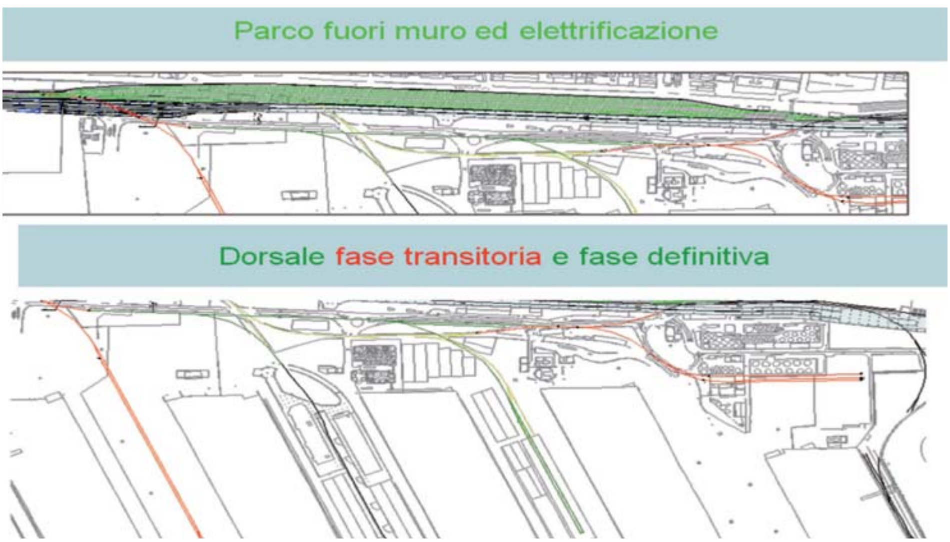
New Western railway link – "Sviluppo Genova" - This project relates to the realization of the Rail connection between the Sampierdarena Gate and the external RFI main line. This link allows the direct connection with the Ronco and Canepa Piers, the "Submerged" line and all other port of Genoa Rail lines to the RFI national and international network. "Sviluppo Genova" is also in charge of the realization of a new road at the Northern side of this new Railway network.

→ Figure 94: New Western link, Ronco–Canepa and Libia railway infrastructure
Source: GPA

Port of Sampierdarena basin: Projects in immediate execution phase

New Railway Network and Interconnections completion including additional works: The completion of this new Railway link includes the realization of all Rail lines serving each pier and any additional works necessary for avoiding conflicts between road and Rail transportation such as optic–acoustic signalling for Viale Africa Rail crossings and the relevant technological equipments. In the works to complete this Railway infrastructure is included the realisation of a duct parallel to the Rail tracks containing the cables for implementing the S&C Signal and Control, the switches automation and all connected underground services.

→ Figure 95: Transitory and final structure of the new port railway ridge
Source: GPA



Rugna yard – Bettolo terminal – "First and Second track clusters": This project relates to the works completing the railway yard serving Bettolo and SECH Terminals. These additional works refer to the creation of a new set of 7 Rail tracks of 500m length each located North of the new 6 tracks yard described in Figure 94. Also these new 7 Rail tracks are served by a Rail manoeuvring siding at the head of the track cluster. The new North Rugna yard is linked to the network already electrified and automated.

Electrification and automation: This project relates to the full electrification and automation of all the necessary switches serving the "Campasso", the Rugna/Bettolo Rail yards, the new Western Railway link, the Ronco Pier link as well as the "Submerged" line. These complex works include the complete substitution of the existing obsolete Rail lines implementing a new port of Genoa internal Rail network.

Fuori Muro yard revamping: This project relates to the revamping and full electrification of this vital sector. The existing Rail yard is composed of 9 tracks of 700m length each. This Fuori Muro infrastructure constitutes the main Railway Link connecting the internal port network to the RFI national and international network. This revamping is upgrading the whole infrastructure according to the most advanced technical and safety standards.

9.2.2 Gioia Tauro Port

The railway infrastructure within the port of Gioia Tauro is a private railway line and it is managed by MedCenter Container Terminal S.p.A. (MCT) which is part of the Contship Italia Group. This railway line assures the link from Gioia Tauro port to the S. Ferdinando Railway Station and from there to the RFI Rail network.

One must always consider to the effect of what is described in the following chapters that Gioia Tauro is an important transhipment port in the international maritime scenario. Therefore the great majority of its operations are for transferring cargo from one ship to another. In fact in 2009 only about 3% of the total import containers traffic handled in Gioia Tauro has been routed by land to the final destinations in the North of Italy or some other European terminals. Approximately the same percentage of traffic is transported overland to the port of Gioia Tauro for export by sea.

Therefore the Gioia Tauro port has a great scope for expanding its competitive reach by attracting larger volumes of traffic to be routed by land to inland destinations lowering both costs and above all transit times. This capability represents a big competitive advantage when comparing Gioia Tauro and also Taranto to the North African competition. The traffic landing in Gioia Tauro and Taranto is already on mainland Europe. An efficient Rail network coupled with effective intermodal services can make these two South Italian ports more attractive for gateway traffic in addition to the transshipment traffic.

What is described above explains the differences when comparing the hinterland performance of Gioia Tauro with Hamburg, Bremerhaven or other Northern European ports. In fact in 2009 only 93.413 TEUs were transported by land from/to Gioia Tauro port. According to the WP1 Task 1.1 projections, this volume is set to increase according to the medium scenario to 107.995 TEUs in 2015 and to 121.871 in 2020. If one concentrates on Rail transport mode alone, the volume transported is only 29.384 TEUs in 2009 including import and export and declining. The forecasted traffic variance for the medium scenario is resulting in 21.578 TEUs in 2015 and even in an inferior number of 16.683 TEUs in 2020. This Task 1.1 projection is influenced negatively by the declining traffic trend of recent years. In these last few years starting from 2007, the shipping lines confronted with a substantial reduction of their traffic flows in both East and West directions have restructured heavily their services and produced the biggest effort for reducing their operating fixed costs. On their long hauls they have introduced the ESS Extremely Slow Steaming approach whereas on their feeders services they have reduced their number of ships and at the same time maximised the loading factor of the remaining ones. Such policy has affected negatively the transhipment ports more than the gateway ports. In fact in the transhipment ports the shipping lines have reduced substantially the traffic going inland by offering their own sea alternative by feeder. This is even more so in the Mediterranean where all the Southern part of Europe is surrounded by sea. As soon as the economic development will contribute to restore the traffic to pre-recession times volumes, the shipping lines will no longer be in a position to transport containers by feeders at marginal costs and they will be compelled to manage the traffic according to its ideal and shortest route to/from final destination.

The MARIPLAT project positive approach is considering that there are almost 3 Million TEUs per year of import and export traffic which represents a potential basin on which to identify the containers destined to Italian and European destinations to be shifted from sea to land transportation and to Rail intermodal services in particular.

The Gioia Tauro Rail freight potentiality is represented in the following pictures (Figure 96-97). In particular the Gioia Tauro shunting area is here below reproduced (Figure 96).

→ Figure 96: Gioia Tauro Rail shunting area
Source: MCT

The railway infrastructures in Gioia Tauro Terminal is composed of six 500 metres tracks connected to the shunting area of the San Ferdinando Railway Station.

The following picture (Figure 97) shows all the tracks in the Terminal.

➔ Figure 97: Tracks in the Gioia Tauro Terminal
Source: MCT

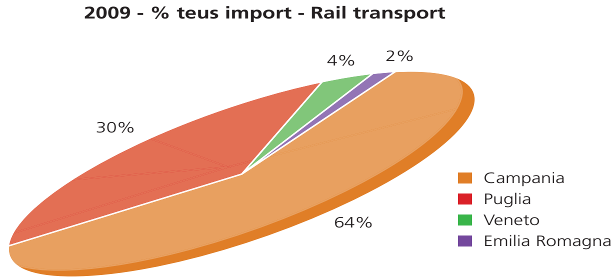
MedCenter Container Terminal is operating four reach-stackers for trains loading and unloading.

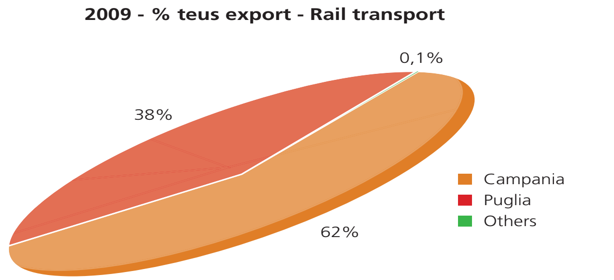
In the recent past until 2008 Sogemar through Trenitalia was operating 13 trains round trip per week to North and North/East of Italy as well as for other European destinations.

The situation is somewhat changed now due to the shipping lines companies using their feeders for reducing their fix costs as explained in the previous paragraph of this chapter. Currently train services are still operating to Puglia and Campania Regions. Through MARIPLAT demonstrator the objective is to improve the Gioia Tauro accessibility to North Italy and Europe via the Ionian line to Bari and from Bari to the North via the Adriatic Rail line.

The following graphics (Figure 98) shows the percentage distribution of rail traffic, divided into import and export.

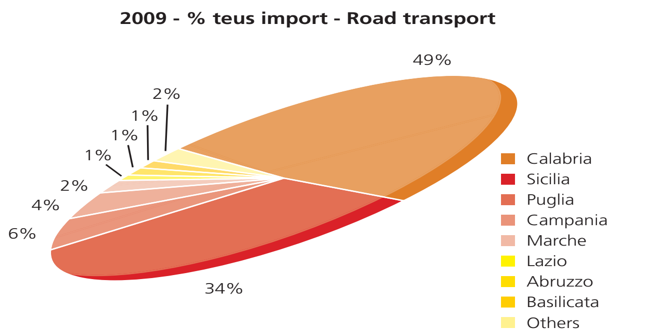
→ Figure 98: Rail traffic share percentages import and export by Regions
Source: MCT



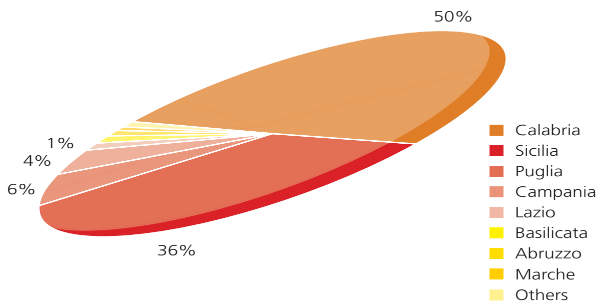


In 2009 as already indicated the rail traffic share amounted to 29.384 TEUs. However, the traffic carried by road is more substantial reaching 64.029 TEUs. The regions which are served by road are in the reachable vicinity of Gioia Tauro. Puglia, Calabria and Sicily are the regions served by truck services from Gioia Tauro. The following picture (Figure 99) is representing this situation.

→ Figure 99: Road traffic share percentages import and export by Regions
Source: MCT



2009 - % teus export - Road transport



The decision making process regarding the most suitable means of transport is in the hands of the shipping lines. This again explains the reduction in recent years of Rail traffic in favour of feeders.

Bottlenecks elimination on the National RFI Network

On the Railway line Gioia Tauro to Taranto and Bari several interventions are in the course of execution in order to improve the current railway performances. In particular on the line Gioia Tauro to Battipaglia on the Tyrrenian coast line, which is double track, the "CORECA" tunnel is being reconstructed in order to allow the transit of trains with gauge "C". At the same time improvements of electrical sub-stations at Vibo Pizzo have been completed to upgrade the power feeding to the line.

On the Ionian Railway line to Sibari – Metaponto –Taranto – Bari a number of upgrading measures have been already adopted to eliminate bottlenecks both in gauge "P/C 45" and train length, so that the same performance is uniformed along the line (Figure 100).

→ Figure 100: Gioia Tauro – Sibari - Taranto – Bari Rail line upgrading
Source: RFI

9.2.3 Taranto Port

As from December 20th 2010 Taranto Port Rail infrastructure has been upgraded by eliminating two major bottlenecks.

The first one on the line Taranto-Bari.

The second one on the line Taranto-Metaponto having beneficial effects on the traffic origination to/from Gioia Tauro via the Ionian Rail line.

The total investment of this important upgrading has reached € 48ml.

In practical terms two bypasses have been accomplished. The first one on the line Taranto-Bari connecting Bitetto with the Adriatic Line. The second one on the Ionian Line Taranto-Metaponto (Figure 102) by realising a completely new single track bypass of 6 km connecting in zone Bellavista, the Taranto-Bari line hence avoiding the Gioia Tauro freight trains to enter into Taranto city. Nearby in zone Cagioni there is also located the Rail movement yard for the trains to be either delivered or picked up by the Rail operators to/from the Taranto port. This investment is reproducing for the cargo the same beneficial effects that orbital motorways have achieved for road traffic avoiding the cargo to enter into city roads. In the next figure (Figure 101) the accomplished upgrade is marked in red. This is a great opportunity for the MARIPLAT project which involves both Gioia Tauro and Taranto intermodal traffic since these lines improvements allow to reduce substantially transit time and expensive costs of maneuvering as well as eliminating unnecessary complications. In addition further important environmental benefits are achieved by avoiding the dangerous cargo to enter into Taranto Rail station and by avoiding the intermodal trains originating from both ports of Taranto and Gioia Tauro to be mixed with the passengers traffic of the Taranto inner city. The noise abatement for the Taranto inhabitants is fulfilled particularly during the night hours busier with cargo than with passengers. This investment constitutes a substantial improvement for the development opportunities of Taranto port and its logistics district park infrastructure already described in WP1 Task 1.1 deliverable. The Bellavista bypass allows the direct connection of the Rail lines both to the district park as well as to the sea port Rail intermodal infrastructure which again is pictured here below (Figure 101).

→ Figure 101: Taranto CTS terminal planned extension and Taranto logistics facility Port extension
Source: Taranto Port Authority

These new lines are equipped with the most advanced technology regulating trains distances, SCMT (Sistema di Controllo Marcia Treno) and BCA (Blocco Conta Assi).

→ Figure 102: New lines marked in red eliminating two major bottlenecks on the Taranto-Bari and Taranto-Metaponto lines
Source: RFI

9.2.4 Port of Hamburg

Hamburg port railway is a public railway infrastructure provider responsible for operation, construction, maintenance and repair of the port railway network. It links the private rail infrastructure (side tracks) of the port industry with the Deutsche Bahn (DB) network. Its customers are licensed rail operators to whom it provides non-discriminating access-use and services such as train runs, shunting trips, marshalling, buffering, IT-communication, etc.

More than 70 different rail companies provide connections between the Port of Hamburg and the hinterland. Private rail transport companies are playing an important role as service providers for rail logistics and above all for transport of containers.

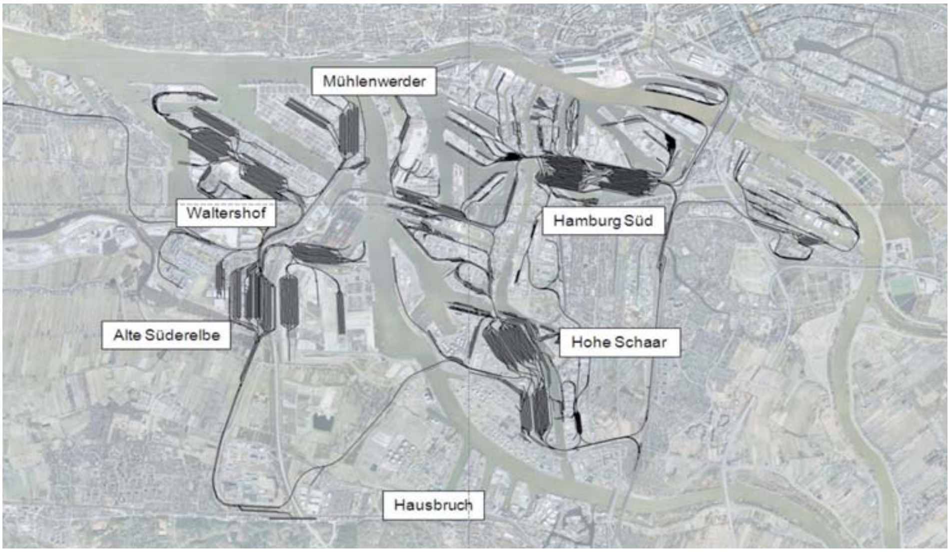
The Hamburg Port Railway manages efficiently huge amount of cargo. In 2009 the figures have been 1.6 million TEUs and 33.9 million tons. About 200 domestic and international trains serve the Hamburg port every day. They allow the containers discharged in the port during the weekend to reach overnight their inland destinations in order to be at customers disposal already at the beginning of the next week. The majority of these trains and up to 60% of them are direct block trains operating on the national network. Destinations such as Cologne, Rhine-Ruhr, Frankfurt, Munich, Stuttgart, Nuremberg are regularly served. On the international network the main Industrial and consumer traffic basins of Austria, Switzerland, Czech Republic, Poland, Hungary, Slovakia, Romania, Baltic Sea states and Eastern Europe are properly accessed. These trains do not carry only container traffic but they also carry regularly general cargo such as bulk, steel products, liquids, ore, coal, grains and others type of goods between the sea terminals and the hinterland destinations.

Together with very high service quality and high frequencies the Hamburg port is very watchful towards providing environmental friendly services to the European hinterland. For this reason a specific policy of developing industrially the rail modality has been adopted in the last few years and will continue to be adopted in the future. The tracks to the main European destinations run along flat gradients and also along rivers wherever possible trying to keep away from more fragile landscapes. Environmental considerations have been taken into account whenever new investments in rail infrastructure were necessary limiting to the maximum heavy interventions such as tunnels construction and bridges when these can be avoided. Rail routes having a slight gradient are already existing enabling the operators to exploit the rail system advantages. Additionally the great majority of the lines are electrified. This feature allows the suppliers of energy to introduce into the national electrical grid energy generated by renewable sources limiting the use of fossil fuels. This in the long term constitutes a significant contribution towards the limitation of the CO2 emissions.

Infrastructure

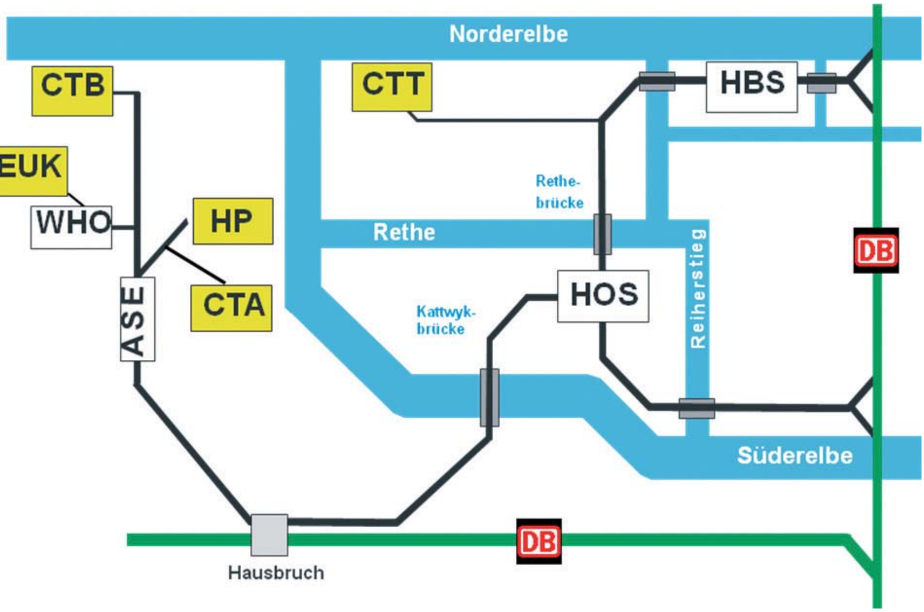
Hamburg Port Authority is owned by the Free and Hanseatic City of Hamburg. It manages Europe's largest port railway system offering a network of about 300 km track length and 100 km of catenaries as well as nine signal boxes and 55 railway bridges. The port internal network is linked to the Deutsche Bahn network via the connection points of Hausbruch, Veddel and Wilhelmsburg/Kornweide (Figure 104, 105).

→ Figure 103: Port of Hamburg Railway Network
Source: Hamburg Port Authority AöR



The port railway infrastructure contains several marshalling yards which are necessary for shunting, buffering and synchronizing rail freight traffic between the port and the hinterland network. These yards are Mühlenwerder, Waltershof (WHO) and Alte Süderelbe (ASE). They handle trains for the container terminals Burchardkai (CTB), Eurogate (EUK) and Altenwerder (CTA) in the western part of the port. Hansaport (HP) handles very heavy trains with iron and coal. Hamburg Süd (HBS) processes trains with containers as well as non-containerized cargo. Hohe Schaar (HOS) manages trains transporting grain, oil products and other bulk in the Eastern part of the port.

→ Figure 104: Hamburg Port Railway Layout
Source: Hamburg Port Authority AöR



The Western and Eastern parts of the port are linked by the Kattwyck bridge which is a combined road-rail vertical lifting bridge.

In order to achieve better efficiency in the transshipment and in rail port transport operations, the expanding container terminals are equipped with state-of-the-art rail cargo handling facilities. The most recent example is provided by the intermodal terminal of HHLA Container Terminal Tollerort (CTT). This is the first terminal facility in the world to be built on a curving track.

Planned Extensions

In order to cope with the future transport demand the "Port Railway 2015 Master Plan", which is the largest expansion project in the railway history of the port, was adopted in 2008. Such huge investment program requires the cooperation of all the actors involved. The HPA together with the terminal operators and DB Netz the German railway infrastructure manager, are planning to expand connections into the hinterland with the objective of achieving progressively modal shift in favour of transport of containers by rail.

The strong increase in rail traffic volumes requires further investments in rail tracks and signal technology. In addition the modernization and the extension of existing shunting yards as well as the laying down of new tracks in the port area and in the hinterland are a necessity. Also the introduction and upgrading of IT systems governing the whole network becomes paramount. In order to achieve efficiency and reliability of the rail freight movements, it is necessary a joint effort from all the key actors involved in the rail transport chain. The ultimate goal is to optimize the whole rail operation through the efficiency research of each component. The objective is to reduce substantially the dwelling time of wagons inside the port infrastructure from a current average of 36 hours to 18 hours.

A lot of project activities are being carried out with the aim of improving the infrastructure capacity. In Waltershof new tracks are being laid down, in Altenwerder an additional link is provided to connect into the DB Netz AG network. The construction of new railway bridges across the river Elbe is underway to replace the Kattwyk-bridge and Rethe-bridge. The Niedernfelder-bridges are also refurbished. Last but not least a comprehensive maintenance and repair program is being implemented in order to assure the maximum productivity and availability of the port railway network.

➔ Figure 105: New Rethe Bascule Bridge
Source: Hamburg Port Authority AöR

Bottlenecks

The majority of the rail traffic volumes is produced in the Western part of the port. Three of the four large container terminals are located in this area and therefore it is logic to expect that the biggest future traffic increase will occur there. Considering this expected traffic volume increase in the Western part of the port, the connection to the hinterland via the DB network combined with the link between the Western and the Eastern part of the port, there is a danger of a potential bottleneck generation. In order to reduce this risk the HPA is supporting the idea of implementing a second rail link between the Western port sector and the DB hinterland network. At the same time the HPA plans to renew the rail link between the Western and the Eastern port via the Kattwyk-Bridge.

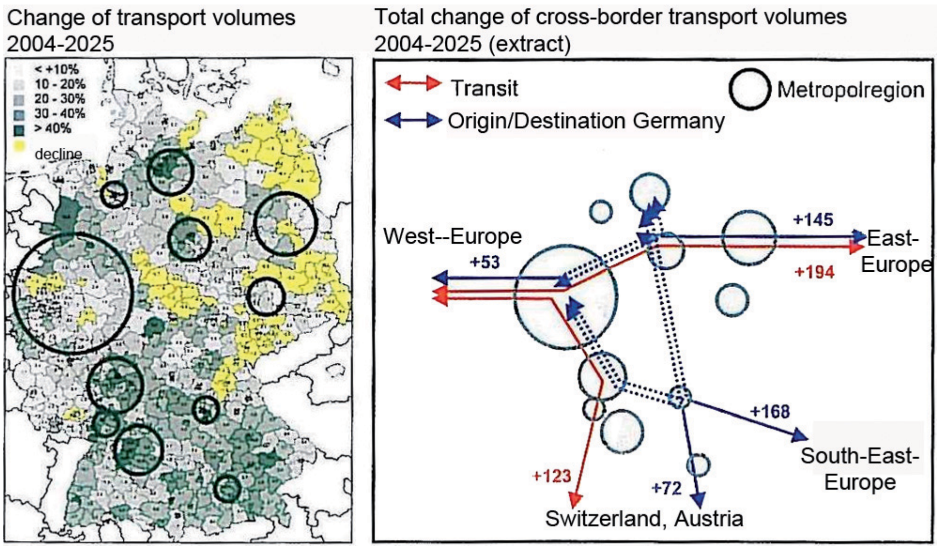
All these investments and initiatives inside the rail port infrastructures to make them more efficient and effective are by themselves not enough. It is necessary that all these measures are complemented and supplemented by similar initiatives on the hinterland rail network in order to make sure that sufficient capacity is available beyond the port for managing an increasing number of trains. This planning activity should include the rail infrastructure within the Hamburg city area as well as the rail links to the European hinterland network.

The major rail bottlenecks for Hamburg port are:

- Intersection Hamburg
- Track Hamburg - Hanover via Uelzen
- Track Hamburg Berlin via Uelzen or Büchen

As shown in Figure 106 a huge growth of traffic to Hamburg port is expected up to 2025. The highest traffic volume increase will occur in many important hinterland rail connections with Hamburg port. These are the corridors towards the East, the South-East of Europe and Austria. Such expected traffic volumes will exercise further pressures on the existing bottlenecks which situation needs to be addressed.

Figure 106: Expected Growth of Transport Volumes 2025
Source: Lesinski, Tobias: Konzept für mehr Schienenverkehr; Güterbahnen 3/2009, Alba Fachverlag

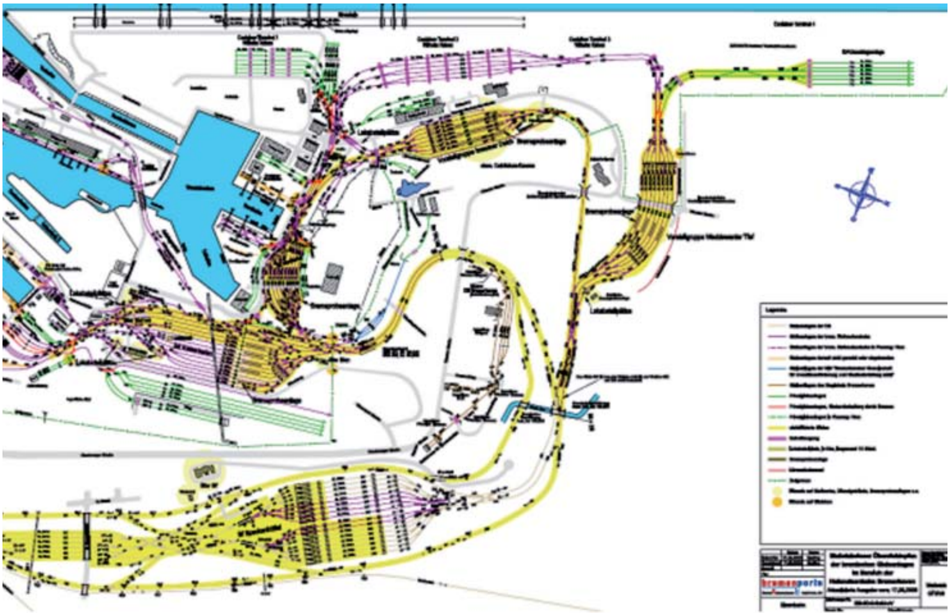


9.2.5 Port of Bremerhaven

The port railway network is a public railway infrastructure company. The company is represented by the Senate for Economics and Ports of the Free Hanseatic City of Bremen. The planning, maintenance and construction of the port railway facilities are carried out by the Bremenports GmbH & Co. KG on behalf of the Free Hanseatic City of Bremen. The inner rail port network is visualized in Figure 107.

The port is connected to the main DB-rail network via the Bremen – Bremerhaven – Cuxhaven shunting yard Speckenbüttel which is the port railway station.

Figure 107: Port of Bremerhaven Railway Network
Source: Bremenports GmbH & Co.KG



The Speckenbüttel port railway station offers a shunting hill as well as further shunting infrastructure. In particular are available 16 rail tracks with a length of 735m to 795m in the Northern part for buffering and trains consists organization. For the Southern part of the port Speckenbüttel offers six tracks with a length of 773m to 851m. The different groupings of Rail tracks are connected with each other.

Next to Speckenbüttel port railway station there are four additional railway stations in the "Überseehafen" port:

- Kaiserhafen station (16 tracks with a length of 180 m to 760 m, most of them 600 m)
- Nordhafen station (10 tracks with a length of max. 600 m each)
- Wedderwarder Tief station (8 tracks with a length of 642 m to 712 m)
- Imsumer Deich station (8 tracks with a length of 689 m to 723 m)

Overall figures of the railway port infrastructure are:

- Total Track length: 94 km
- Switch units: 351
- Signal boxes: Stf (SpDrS 60) / Bkf and Bkn E43
- Electrification: 26 km

All these stations can be reached by electric traction. They act as interfaces between the port railway network and the handling facilities of the automobile and container terminals. Incoming and outgoing trains are prepared there for further prosecution. Electric traction is changed at the stations to diesel traction in order to push or pull the trains on the different terminals in time.

As indicated in the map there are three container railway handling facilities in the container terminals. On the Southern part of the port and in the middle terminal, the rail tracks are located in the centre of the terminal between the quay and the container stacking area due to the terminal facilities having stepwise design due to the ground. The unloading/loading of the trains is done with straddle carriers.

For the new port container terminal CT4 where operation started in 2009 the train handling was optimized from operation start up. Adjacent to the terminal, a new trains handling facility was built. Because of the terminal modern planning, no interference between waterside and landside operation is occurring. The rail terminal offers state-of-the-art technology with six rail tracks each 700m and four rail mounted gantries.

Planned Extensions

The long-term traffic volumes is forecasting a substantial growth in rail freight activities. In particular the traffic expansion to and from the German seaports with the hinterland is requiring additional network capacity. A number of measures have been identified and will be developed in order to sustain this challenge. These measures will lead to an improved utilization of the existing network capacity:

- New junction platform at Bremen main station is planned in order to upgrade the connection of the track from Oldenburg to Bremen
- Elimination of platforms of equal height
- Shortening of the safety blocks between Bremen – Burg – Bremerhaven
- Consideration is being made for a potential 8 tracks shunting yard new building or changing the use of eight sorting rail sidings in Speckenbüttel.

Bottlenecks

Traffic analysis have indicated four major potential bottlenecks for the ports of Bremen and Bremerhaven. These are:

- Intersection in Bremen
- Intersection in Hamburg
- Track Hamburg - Hanover via Uelzen
- Track Bremen – Hanover via Nienburg

The two intersections are characterized by heavy use of freight and passenger traffic. The same applies to the two mentioned tracks which are equally affected by freight and passenger traffic coming / going to the intersections being located directly in the hinterland in the way of such intersections.

The following figure (Figure 108) shows the situation of these tracks and intersections. The yellow coloring implies a full utilization of the track and intersection whereas the red coloring implies a critical over utilization of these track and intersections.

→ Figure 108: Bottlenecks on Northern Railway Tracks
Source: Deutsches Zentrum für Luft- und Raumfahrt e.V.: Hafenhinterlandbindung – sinnvolle Koordination von Maßnahmen im Schienenverkehr zur Bewältigung des zu erwartenden Verkehrsaufkommens, 2008, page 3

The seaport of Bremerhaven is connected to the intersection Bremen via a double-track. This double line is supporting all freight rail traffic of the Bremerhaven port. In Bremen these trains are routed to Hamburg, Hanover and Osnabrück. The rail line to Hanover is the most utilized. Already today the rail line Bremen – Wunstorf – Hanover is heavily used both by passengers and freight traffic. This freight traffic is originated by seaport Bremerhaven. Luckily enough on this line there are many rail sidings allowing a smooth management of passenger and freight traffic. This line is already heavily utilized and a further increase of freight trains would put enormous pressure on the existing infrastructure with consequential negative effects for all users. The same applies for the intersection Bremen.

In order to ease this situation in the intersection Bremen, DB Netz AG is planning a double-track connection to / from Oldenburg. Despite this planned measure there will be a critical overutilization of the intersection Bremen in the long term. The further introduction of a 15 minutes cycle public transport local train between Bremen Central Station and Bremen Vegesack North of Bremen would make this situation even worse. Therefore additional infrastructure investments will be necessary in order to secure a reliable and high-quality rail connection to the seaport of Bremerhaven.

9.2.6 JadeWeserPort

Turning the view to rail infrastructure, bottlenecks occur while transporting cargo to East Germany since Bremen as well as Hamburg has to be passed. Bottlenecks of these regions are described in the previous chapters.

9.3 DRY PORTS/MEGA HUBS AS PART OF THE EXTENDED SEA PORT QUAY AND OTHER RAIL FREIGHT CONNECTED TERMINALS.

9.3.1 Existing Intermodal Terminals in Italy serving the intermodal traffic

Italy has an extensive intermodal terminals network serving the CTS traffic originated by the Italian Sea Ports.

→ Figure 109: Italian Sea Ports and Terminals
Source: Found on the Web network

9.3.2 Railway Network in Italy, Capacity and Bottlenecks

In Italy RFI has several works in progress to correct major bottlenecks. In particular on the Adriatic Railway line, which is the one serving both Taranto and Gioia Tauro ports of the TIGER project, the "Cattolica" tunnel is being accomplished. This tunnel of the overall length of 1100 m is allowing the transit of wagons with gauge "C". This gauge constitutes an upgrade for co-modal solutions for vehicles loaded on trains up to 4 m high and High cube CTS. This together with Galleria "Castellano" contributes to the whole Adriatic Railway line de-bottlenecking. The total investment is of Euro 32 million. (Figure 110).

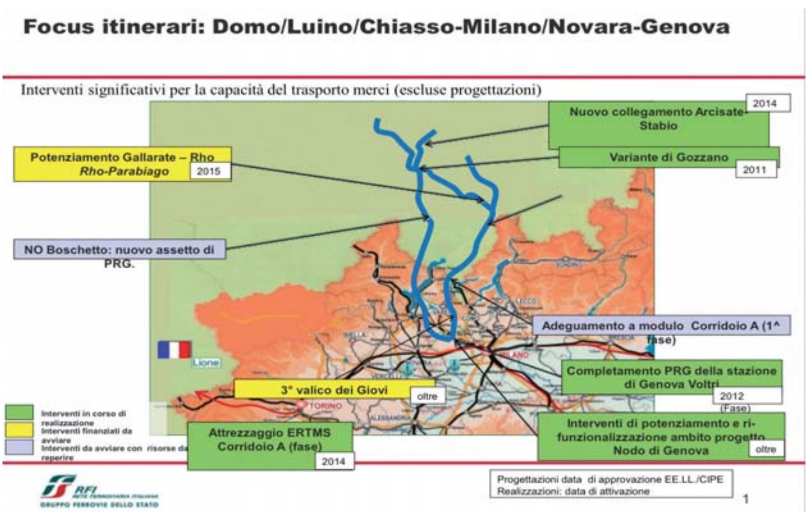
→ Figure 110: Tunnels "Cattolica" and "Castellano"
Source: RFI

The Tunnel "Cattolica" is expected to be opened for commercial use during Spring 2012. As a result of this upgrading both the connections to Taranto and Gioia Tauro ports, together with both the Adriatc and Tyrrenian Rail lines have been inserted into the Trans European Network for competitive freight. (Figure 111).

→ Figure 111: Italian portion of the Trans European Rail Network
Source: RFI

Moreover the Adriatic Rail line is being technologically upgraded in its total length from Bologna to Bari with the System of Command & Control (SCC) allowing the management of the trains circulation from one single point, which is located in Bari Lamasinata. From Bologna to the Brenner tunnel the de-bottlenecking has already taken place with the completion in 2009 of the Bologna – Verona doubling of the Rail track connecting in Verona also with Corridor 5 towards the East of Europe.

→ Figure 112 – Domo/Luino/Chiasso – Milano/Novara - Genoa
Source: RFI



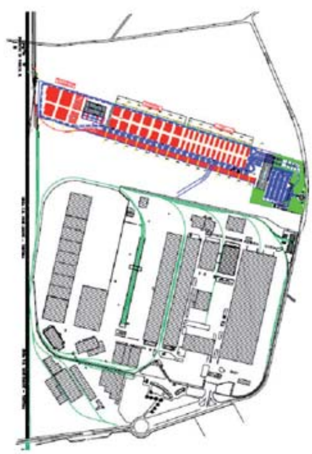
A major strategic investment is entering its realization phase in Genoa involving both freight and passenger services. The whole Railway system around Genoa is being completely restructured. In particular for the cargo the quadrupling of the Rail tracks between Genoa Voltri and Sampierdarena is of particular relevance de-bottlenecking the Rail sections directly connected to the port. Also the sextupling of the Track between Genoa Principe and Genoa Brignole is contributing to confine the passengers traffic with lesser interferences with the freight. All these works are complementing and supplementing the investments carried out by the Genoa Port Authority within the port area described in the following chapters for allowing the doubling of the Genoa port throughput as envisaged by the TIGER project. Other selected investments are being executed in other parts of the Italian RFI Network involving the international connections with Genoa (Figure 112).

9.3.3 Possible Locations for Dry Ports in Italy

The best dry ports locations for the Genoa port including Vado Ligure the other port of the Liguria Region were identified by RFI in Alessandria which is distant 78 km from the port of Genoa and Rivalta Terminal Europa which is at about the same distance. Both locations are positioned along the TEN-T Corridor n.24 and both of them are connected by RFI lines to the ports containers terminals of Vado Ligure, Genoa – Voltri and Genoa - Sampierdarena.

The dry port of RTE appears to be available for fast implementation of the "extended port" concept applying all the technological innovations planned in the TIGER project. The private owners of the RTE dry port which are Gruppo Gavio and Gruppo Fagioli, have planned the implementation of RTE as the biggest dry port in Italy with 1 million TEUs throughput per year. This operation has been planned in 2 phases. The first one to be accomplished within 2011 is constituted by the basic technological implementation of the dry port with the second phase achieving the full operational capacity between 2015 and 2020. The planned investments necessary to realize the RTE Rivalta Terminal Europa dry port exceed the amount of € 50 million. The Figure 113 shows the general RTE Rail yard layout and the Rail track connection to the outside RFI network.

→ Figure 113: RTE Railway Layout
Source: RTE



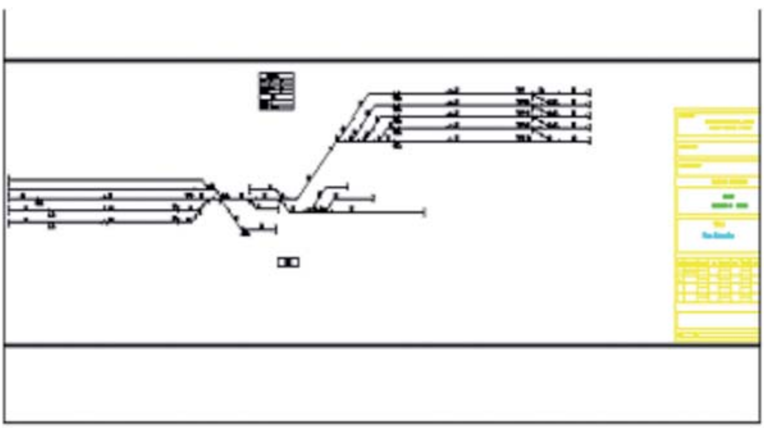
The tracks marked in green indicate the rail infrastructure currently in use represented by the lower part of the layout reproducing the existing Interporto di Rivalta. The tracks marked in red indicate the new Rail yard of RTE in its first phase of realisation already completed and already operational. The lines marked in blue indicate the roads for trucks and for accessing and servicing the Rail infrastructure.

At the end of the first year into the TIGER project lifetime up to September 30th 2010 the RTE rail terminal yard was nearly completed. In particular the work progress indicated that:

- The Rail tracks were laid down;
- The Rail links connecting RTE with Rivalta RFI Station were completed;
- The Rail connection for operational approval with RFI Rivalta Station was in progress;
- The signalling preparation work was accomplished including the raceways connecting the building hosting the central control pulpit and all Rail shunts and Rail track circuits.

The full works relevant to the completion of the RTE Rail yard, first phase, are to be fulfilled within January 2011 including the connection for full operation approval to RFI Rivalta Station. The Figure 114 shows the S&C Signal and Control functional scheme of RTE Rail yard, phase two, including 10 tracks of 900 m length each serving at least 30 couples of trains per day. The S&C system is planned to serve this volume of traffic. This scheme which is reproduced here below (Figure 114) shows all the dependencies to be controlled by the central computer and management pulpit to be installed at RTE.

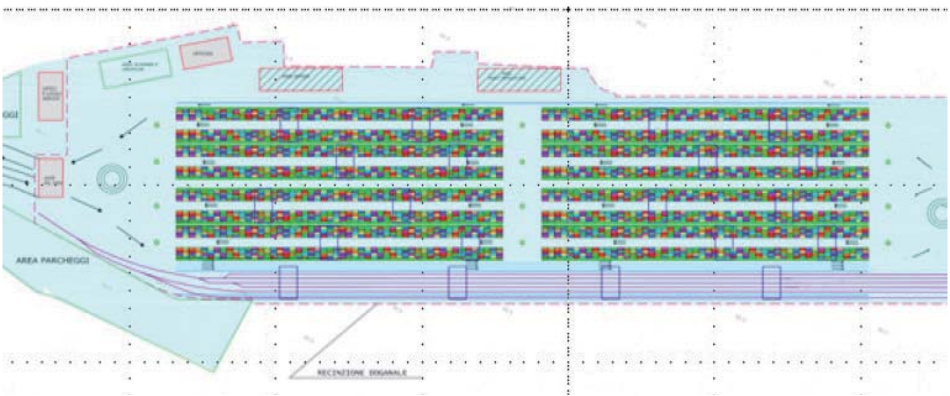
Figure 114: RTE rail yard (second phase) S&C functional scheme
Source: RTE



This S&C system will speed up the RTE trains entrance, the trains loading and unloading operations as well as the management of the standing trains while inside RTE. The same system will also manage the entrance and exit of trains along the Rail track connecting RTE to RFI external network. An automatic green signalling system will be based on real time information giving the necessary approval for operating trains between RTE and RFI Pozzolo Station S&C systems. This S&C system will be able to control a daily traffic volume of 30 couples of trains or 60 trains/day at an average of 50 TEUs per train which equates to 1 million TEUs per year approximately to be handled by RTE. The implementation of the other planned dry port of Alessandria is experiencing considerable delays. Public authorities and other institutions involved in its implementation including the Genoa Port Authority, the Alessandria Province, RFI, SLALA Association and others are facing financial difficulties which have brought the project to a halt.

The Alessandria dry port was planned to revitalize part of the existing Alessandria marshalling yard through the investment of approximately € 40 million. The necessary works for obtaining a new Rail terminal layout complete of innovative technologies capable of producing a total throughput of 500,000 TEUs per year, were planned over a 3 years period. This plan is reproduced here below in Figure 115.

→ Figure 115: Alessandria railway dry port layout
Source: SLALA



The Alessandria Railway Dry Port is directly connected to Alessandria RFI rail station. It is constituted by 5 per 650m long tracks under crane for a total of 3250m Rail track length allowing the train to train CTS handling. The Alessandria dry port development envisages an operational capacity of 500.000 TEUs per year in 2015 fed by 15 shuttle trains couples per day from Genoa Port.

As communicated by Genoa Port Authority to the European Commission " difficulties in raising financial resources to carry out infrastructural projects seem to push towards a greater involvement of private partners in public investments also in the case of the Alessandria Dry Port. If such an approach is confirmed, the Company in charge of implementing the Alessandria dry port would opt to open a call for tenders to carry out the infrastructure and the management of this dry port. Therefore, the financial original commitment of the Genoa Port Authority will be given up".

Under the above circumstances it appears evident that the realisation of RTE dry port and its introduction to full operation profile will be achieved much sooner than Alessandria dry port.

For the sake of completeness of this document, the port of La Spezia which is constituting together with Genoa and Vado Ligure the full port system of the Liguria Region, is also mentioned. The port of La Spezia had and still has in operation for some time the dry port of Santo Stefano Magra. This is located few miles in the hinterland of La Spezia at a crossing point of the two motorways Genoa-Rosignano and La Spezia-Parma connecting in Parma to the Milano-Naples motorway.

The Santo Stefano Magra dry port is on the Parma-La Spezia Rail line which is being expanded to double track. The implementation of this dry port on the immediate hinterland of the sea port has allowed La Spezia to achieve an exceptional throughput of 1 ml TEUs per year having available only 250.000 sqm of quay space. The La Spezia port development which is linked to the Santo Stefano Magra dry port will be positively influenced by the implementation of the "TYBRE" Rail corridor. This acronym means the Tyrrhenian – Brenner Railway corridor via Parma and Verona.

9.3.4 Existing Intermodal Terminals in Germany serving the intermodal traffic

In Germany a close network of intermodal transport terminals already exists. Besides bimodal terminals for road and railway traffic, some terminals are capable of tri modal operation being able to handle barge traffic as well as railway and road traffic.

The biggest operator of intermodal transport terminals infrastructure is DUSS (Deutsche Umschlaggesellschaft Schiene-Straße mbH). Their network is visualised in Figure 116. Shareholders for DUSS are: DB Netz AG (75 %), Kombiverkehr GmbH & Co KG (12.5 %) and DB Mobility Logistics AG (12.5 %). DUSS provides the handling of rail/road traffic, the deposit of loaded and empty units and the agency services for operators. They provide also supporting IT services as well as providing office rental to their customers. Altogether 53 gantry cranes and 10 reach stackers are in operation on 24 terminals.[19]

In addition to the DUSS network, many private owned terminals are existing and operating in Germany. Together they constitute the total terminal network as indicated in Figure 116. This figure illustrates the terminals capable of handling at least rail cargo as one of their modalities. These terminals are the essential interfaces for the switching of one mode of transport to another.

→ Figure 116: Locations of Intermodal Transport Terminals in Germany 2012
Source: DUSS

[19] DUSS, in: http://www.duss-terminal.de/index2.htm, 05.10.2010.

9.3.5 Railway Network in Germany, Capacity and Bottlenecks

The railway system of the German Federal Railway is the biggest and most complex in Europe. The railways net company DB NETZ a 100% subsidiary company of the German Federal Railway operates most of the German Rail infrastructure as independent infrastructure enterprise. This infrastructure is constituted by about 70,000 km of tracks predominantly used by both passengers and goods, by 5,700 stations 770 tunnels, over 69,000 switches 27,000 railway bridges and by about 4,400 of signal towers. The maintenance, the improvement, the conservation of this infrastructure in an efficient operational profile are the core business of this enterprise as well as being responsible for the slot assignment to the various operators which in the end constitutes the timetable production. The revenues of DB NETZ are constituted by the charges paid by the operators both passengers and freight for the network occupancy.

Capacity utilization

Capacity on a railway infrastructure can be defined in several ways. The overall definition focuses on practical available capacity which is a complex aggregate of individual measures. Capacity can then be expressed as a "measure of the ability to move a specific amount of traffic over a defined rail line with a given set of resources under a specific service plan". This leads directly to the fact that each track section between two nodes has its unique capacity. Within a microscopic approach this definition helps to define measures on how to overcome specific bottlenecks.[22] The capacity of a railway line depends very much on the spectrum of velocities of the different trains types using that track. The wider the spread of velocity the lower is usually the track capacity. Another reducing effect on the capacity is caused by regional trains which have a high number of stops.

According to Figure 117 a higher number of bottlenecks will materialise in Germany since the traffic is expected to grow significantly. In East Germany the forecasted volumes are not likely to exceed the capacity of the rail infrastructure. Only in the urban area some capacity deficit could occur.

The additional traffic flows might impact negatively on the capitals in Hungary and Romania due to their geographic location along one of the most important Trans-European corridor. This could become even more serious when considering the increasing commuter traffic.[21]

The following maps (Figure 117) show the existing bottlenecks for year 2008 and the ones still to remain in year 2030.

[20] Traffic flow: Scenario, Traffic Forecast and Analysis of Traffic on the TEN-T, Taking into Consideration the External Dimension of the Union-Final Report, December 2009, p.123.

[21] Traffic flow: Scenario, Traffic Forecast and Analysis of Traffic on the TEN-T, Taking into Consideration the External Dimension of the Union-Final Report, December 2009, p. 128.

→ Figure 117: Rail freight bottlenecks 2008 and 2030 [22]
Source: Traffic flow: Scenario, Traffic Forecast and Analysis of Traffic on the TEN-T, Taking into Consideration the External Dimension of the Union-Final Report, December 2009, p. 130

To date more than 60% of the trains production is achieved on less than 25% of the network length. A network capacity study made in 2005 with the support of the German Transport Ministry has reached the conclusion that only half of the German Railways network is currently used to its full capacity. Despite the other half of the network has still a lot of additional potential, there are considerable bottlenecks in several important corridors.[23]

The speed gap between high speed trains travelling at more than 200 km/h and regional/freight trains travelling at about 80-100 km/h reduces further the network capacity on mixed traffic lines. Critical bottlenecks exist on the North-South corridor and on South-East Europe links where it is difficult to accommodate the growing seaport hinterland traffic. Moreover the intercity express network has important sections with single tracks. This is a further cause of delays.

By contrast on major corridors such as the Rhine lines or the Lüneburg-Uelzen-Celle line there is available capacity. According to experts' reports the German railway network can sustain up to 20% additional traffic.[24] However considering the bottlenecks it will be difficult to expand the lines productivity without further infrastructure investments.[25]

The railway network is a complex and dynamic system which makes it hard to identify clearly the bottlenecks because of the interdependences between the infrastructure elements and the market.

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[22] Traffic flow: Scenario, Traffic Forecast and Analysis of Traffic on the TEN-T, Taking into Consideration the External Dimension of the Union-Final Report, December 2009, p. 130.
[23] Prof. Dr.-Ing. habil. Jürgen Siegmann, Technische Universität Berlin, Fachgebietsleiter Schienenfahrwege und Bahnbetrieb.
[24] Siegmann, J. Neue Netzstrategie für mehr Güter auf der Schiene erforderlich -Empfehlungen für eine neue Bahnpolitik - Berlin, Juni 2010.
[25] Neue Netzstrategie für mehr Güter auf der Schiene erforderlich -Empfehlungen für eine neue Bahnpolitik - Berlin, Juni 2010.

To identify the major sections where bottlenecks are likely to develop, three different approaches have been considered:

- The Siegmann approach which identifies a core-network for future Rail freight traffic
- The German Transport Ministry approach contained in the national infrastructure plan
- The Deutsche Bahn AG approach

Siegmann considers a core-network (Figure 118) which is consistent of 8 North-South and 6 East-West corridors included in the existing Rail network. These corridors are managed in a way that freight and fast passenger traffic trains are handled on separate tracks.

Figure 118: Grid net for Rail freight in Germany [26]

Source: Prof. Dr.-Ing. habil. Jürgen Siegmann, in: Neue Netzstrategie für mehr Güter auf der Schiene erforderlich -Empfehlungen für eine neue Bahnpolitik, p. 24 - Berlin, Juni 2010

Siegmann proposes a core-network with Rail freight traffic priority in Germany.

This network should have the following standards:

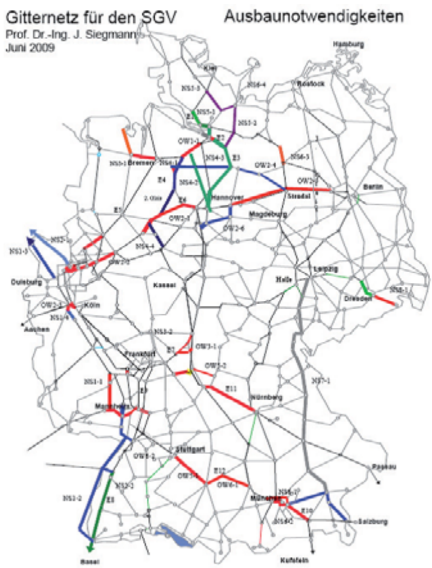
- G2 profile
- 750m of train length or more
- 2.500 tonnes/train
- Wagon axle weight increased up to 25 tonnes

These standards constitute a further step compared to those envisaged by the EU TEN-T network. The philosophy of this approach is to develop international freight traffic routes with more dignity to freight which means that sometimes passenger traffic could be affected.

[26] Traffic flow: Scenario, Traffic Forecast and Analysis of Traffic on the TEN-T, Taking into Consideration the External Dimension of the Union-Final Report, December 2009, p. 130.

In Figure 119 the most important suggested investments to achieve this efficient Rail freight network are put in evidence.

→ Figure 119: Expansion needs for the rail freight network [27]
Source: Prof. Dr.-Ing. habil. Jürgen Siegmann, in: Neue Netzstrategie für mehr Güter auf der Schiene erforderlich -Empfehlungen für eine neue Bahnpolitik, p. 24 - Berlin, Juni 2010



The lines most important for this Rail freight network are developed around Hamburg and Bremen, the East-West from Stuttgart to Munich and further to Salzburg and the Rhine-Line on the North-South section of Germany.

The approach of the National Infrastructure Plan

According to the National Infrastructure Plan, the first priority is represented by the East-West connection. In this sector there are construction projects described by the Federal Transport Infrastructure Plan back in 2003. The projects in the East and North East Germany should be completed by 2015. The routes in the regions of Leipzig, Hamburg, Frankfurt, Dresden and the route North-South Berlin – Munich axe are evidenced in the following figure (Figure 120).

[27] Neue Netzstrategie für mehr Güter auf der Schiene erforderlich -Empfehlungen für eine neue Bahnpolitik - Berlin, Juni 2010.

→ Figure 120 – The Infrastructure Needs marked in red and yellow. International projects in green. Rail links to be completed by 2015 in violet [28]
Source: Bundesverkehrswegeplan 2003, p. 72

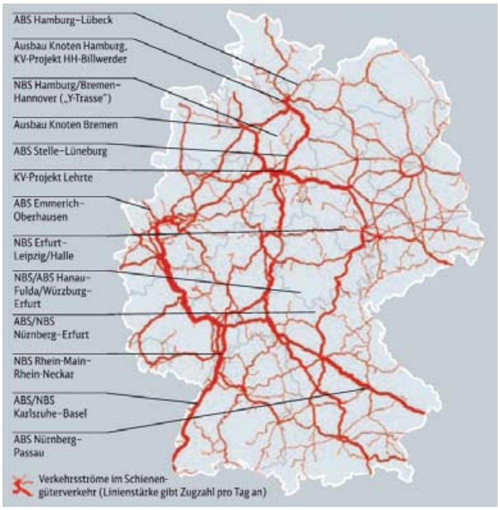
The following figure (Figure 121) shows the most important nodes in Germany. The hubs in Germany developing the majority of traffic are Hamburg, Hannover, Berlin, Dresden, Duisburg, Leipzig, Frankfurt, Mannheim, Nuremberg, Stuttgart and Munich. These hubs have the largest container terminals used both for maritime and continental containers traffic.

→ Figure 121: The most important nodes in Germany [29]
Source: Bundesverkehrswegeplan 2003, p. 72

[28] Bundesverkehrswegeplan 2003, p. 72.
[29] Bundesverkehrswegeplan 2003, p. 73.

The German Railways are working together with their partners on technology applications on intelligent EDP systems, on interfaces upgradings in order to improve the overall transport efficiency. These improvements will allow better customers services at reduced costs. The areas of safety and engineering are part of this effort. The following figure (Figure 121) shows the Expansion plans on existing lines for freight (ABS) and the New constructions (NBS).

→ Figure 122: Traffic flows on the rail freight [30]
Source: Masterplan Schiene – Hafen-Hinterland-Verkehr (Stand:27.08.2007), p. 11



Various measures have been defined in order to optimize the Rail infrastructure performance and the traffic fluidity on the German Rail system. Here below some important progress are described [31] :

- Progressive application of European standards and of the European Train Control System (ETCS) on German main corridors in order to optimize freight in transit.
- Combined transport developments by supporting financially transfer from road to Rail. Progressive separation of freight from passenger traffic.

The approach of DB Netz AG

DB Netz AG has produced an infrastructure enhancement plan in three steps:

- In the short term through the implementation of the "Sofortprogramm Seehafen-hinterlandverkehr" the bottlenecks will be eliminated.
- In the mid-term additional capacity in the Rail network will be generated by dedicated investments.
- In the long term further capacity improvement will be generated by building additional lines.

The so called "Sofortprogramm Seehafenhinterlandverkehr" will enhance the capacity of the existing Hinterland infrastructure with dedicated short-term measures.

30 Masterplan Schiene – Hafen-Hinterland-Verkehr (Stand:27.08.2007), p. 11.
31 Masterplan Güterverkehr und Logistik, September 2008, p. 33.

Figure 123: Short Term Action Program for Hinterland Rail Freight Transport

Source: Sofortprogramm Seehafen-Hinterlan-Verkehr: Eine Investition in die Zukunft, DB Netze (October 2008), p. 3

Maßnahmenübersicht aus dem Sofortpaket

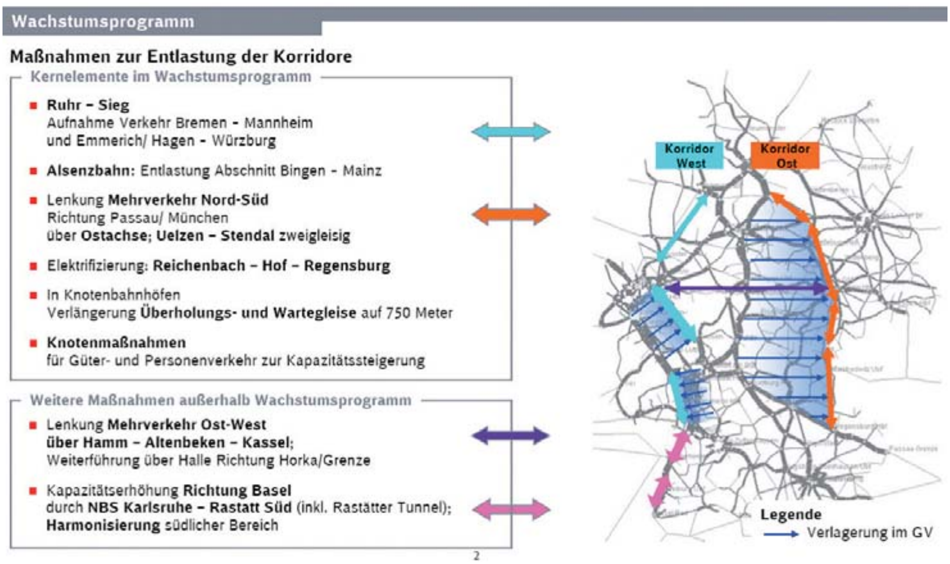
1	Knoten Bremen	Geänderte Anbindung der Gleise 1 bis 3 im Süd-Ost-Kopf Bremen Hbf
2	Knoten Bremen	Spurplanoptimierung Bremen Hbf für Mehrverkehr aus Richtung Vegesack
3	Bremerhaven-Bremen	Beseitigung höhengleicher Bahnsteigzugänge, Gv, Blockverdichtung
4	Knoten Hamburg	Zusätzliche Gleise, Blockverdichtung, parall. Fahrmöglichkeiten, Vk
5	Uelzen	Niveaufreie Einfädelung aus Richtung Stendal
6	Bremen-Hannover	Beseitigung schienengleicher Bahnsteigzugänge Bahnhof Eystrup
7	Bremen-Osnabrück	Zusätzliche Weichenverbindung Bahnhof Twistringen
8	Bebra-Fulda	Blockverdichtung, Verlängerung Überholungsgleise
9	Hamm-Kassel-Halle	Verbindungskurve, Spurplanverbesserung
10	Gießen-Friedberg	Verlängerung Überholungsgleise
11	Knoten Mainz	Kapazitive Optimierung Mainzer Tunnel und Mainz Hauptbahnhof
12	Knoten Wiesbaden	Verbindungskurve Wiesbaden Ost – Mainz Kostheim
13	Hamm	Ertüchtigung Knoten Hamm
14	Konzept. Westl. Ruhr I	Ertüchtigung Fahrstraßen, Neuanbindung Häfen
15	Hamburg-Berlin	Blockoptimierung, Verlängerung/Neubau 5 Überholungsgleise
16	Knoten Nürnberg	Anpassung Nürnberg-Stein
17	Nürnberg-Passau	Blockverdichtung Regensburg-Passau
18	Nürnberg-Passau	Bahnhöfe Parsberg und Undorf, Bau von seitenrichtigen Überholungsgleisen
19	München-Rosenheim	Erweiterung Überholungsbahnhof Ostermünchen
20	Nürnberg-Passau	Erhöhung Durchfahrtsgeschwindigkeit Hbf Regensburg > 40 km/h
21	Flieden-Gemünden	Errichtung einer zweiten Bahnsteigkante im Bahnhof Rieneck

22-24* Ubf Mannheimer Hafen, Ubf Kornwestheim, Ubf Ulm/Dornstadt in der Auflistung nicht berücksichtigt
Hbf – Hauptbahnhof, Gv – Gleisverlängerung, Vk – Verbindungskurve, Ubf – Umschlagbahnhof

As a mid-term action DB NETZ AG has elaborated a "Wachstumsprogramm" which will upgrade existing corridors to develop an alternative to the congested links. The Wachtumsprogramm will also contain capacity upgrade for congested knots in the rail infrastructure.

Figure 124: Mid-term action "Wachstumsprogramm" DB NETZ AG

Source: Weigand, Dr. Werner, Mehr Kapazität für den Schienenverkehr – reicht das bestehende Streckennetz aus?, in Eisenbahntechnische Rundschau ETR, Dezember 2009, page 722 ff, Frankfurt 2009



The short term action and the Mid term action are supplemented and complemented by the overall long term strategy made with the German Federal Infrastructure Plan. The latest periodic assessment of the Infrastructure Plan has put an extra focus on the Hinterland traffic needs originated from the sea ports. There are three major projects with high priority for seaports rail

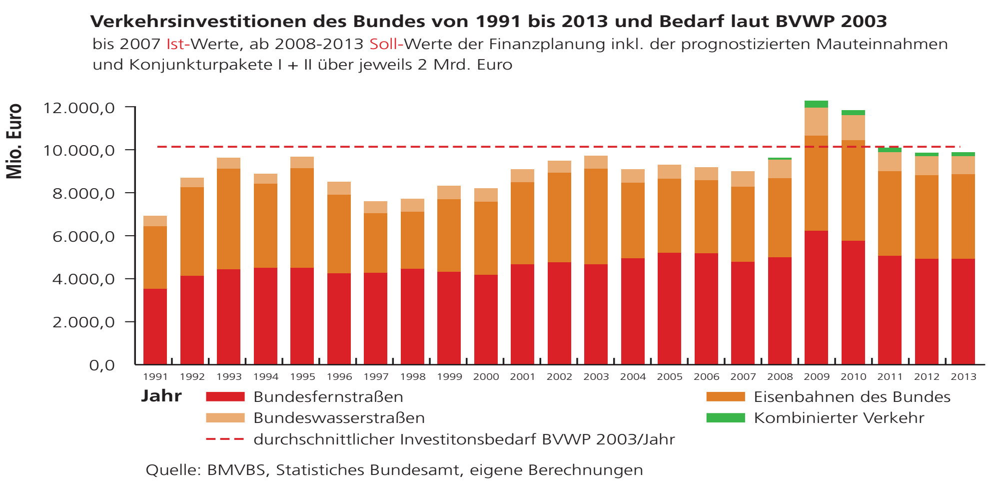
Hinterland traffic in the Federal Infrastructure plan: a new rail link between Bremen, Hamburg and Hannover ("Y-Trasse") and a capacity upgrade in the Hamburg and Bremen area. The Y-Trasse was originally planned as a 300 km/h high-speed passenger traffic line. Meanwhile it has been redesigned as a mixed passenger and freight line with reduced speed to cover the needs of the growing rail freight traffic of the seaports. The actual assessment of the Infrastructure Plan has now pointed out that the Y-Trasse should be re-rated again to find the best solution for Hinterland traffic originating from the seaports. One of the possibilities is that it should be considered as a dedicated freight infrastructure [BMVBS 2010].

The capacity upgrade in the Hamburg and Bremen area is not yet part of the Federal Infrastructure Plan. But it is mentioned in the actual assessment as an important measure.

These plans show the commitment taken at Federal level for the Hinterland traffic originating from the seaports. However past experiences indicate that the planning and building of new railways lines is a very long process. The Federal Infrastructure Plan is only the framework investment planning document not to be confused with the funding plan, which must go through a totally different process. In the described cases such as the "Y – Trasse", once the final planning is completed it is necessary to allocate the financial resources in the Federal budget. Such budgetary decision is taken at Government level and this procedures, because of funding constraints, is running behind when compared to the planned infrastructure investments indicated in the Federal Infrastructure document.

→ Figure 125: Annual investment budget vs planned budget in the Federal Infrastructure Investment Plan

Source: Eck, F.; Stark, S.: "Bundesverkehrswegeplan "20XX", Internationales Verkehrswesen I/2011, p. 26.



➔ Figure 126: Rail Freight Network 2025 containing Federal Infrastructure Plan
Source: BMVBS [2010]

Looking at the network which is planned in the Federal Infrastructure Plan and the forecasted freight traffic volumes for 2025 one must report that the main corridors serving the seaports hinterland traffic are at their capacity limit (black lines) or even overstretched (red lines) (Figure 118-119). As already indicated above the planned measures are still lacking the budget financial resource allocation. For this reason the final date of effective fruition of these declared improvements is very uncertain and it is doubtful that their completion will be realized by 2025. It is therefore imperative to find alternative solutions capable of de-congesting the rail infrastructures otherwise it will be difficult to have the necessary capacity capable of dealing with the traffic projections indicated in this deliverable.

In conclusion, analyzing the three situations described in the previous paragraph, it is likely that bottlenecks are going to occur in the hinterland corridors of the German Rail network in the near future when traffic increases are going to materialize. In particular these bottlenecks will affect the North-East corridor including the ARA-ports and the South-East directions. One has to note that the freight volumes in the seaports have grown steadily in the last few years. While traffic increases were moderate until the end of the last century, the growth occurred in the last 10 – 15 years was much higher than expected. The latest projection of the Federal German Ministry for Transport, indicates a growth of 65 % of the rail freight services demand up to 2025. In particular one has to report a disproportion between the continental rail traffic services demand and the sea ports hinterland rail traffic services demand. For the seaports rail freight services an increase of 168 % is forecasted. The rail CTS services are due to grow even more, and a percentage of 300%[32] has been quoted. Therefore one can see the enormous challenge lying ahead considering the long time-to-market necessary to bring any infrastructures investment to market fruition.

[32] BMVBS [2010].

9.3.6 Possible Locations for Dry Ports in Germany

The Figure 126 illustrates the main Hinterland destinations for rail cargo of the Hamburg and Bremerhaven German TIGER ports in 2009. In this figure accumulated data per region are visualised.

→ Figure 127: Main Hinterland Markets (Rail) of the German Tiger Ports Hamburg and Bremerhaven in Germany 2008
Source: HHM

Nine Regions having high traffic concentration, are distinguishable from North to South:

→ Hamburg	(federal State Hamburg)
→ Bremen	(federal State Bremen)
→ Hannover	(federal State Lower Saxony)
→ Berlin	(federal State Berlin)
→ Rhine-Ruhr Area	(federal State North-Rhine-Westphalia)
→ Frankfurt (Main)	(federal State Hesse)
→ Nurnberg	(federal State Bavaria)
→ Stuttgart	(federal State Baden Württemberg)
→ Munich	(federal State Bavaria)

These Regions have been in principle selected as areas of interest for a potential Dry Port location. They have to be reached via the rail network within acceptable time.

9.4 THE NOMINATED RAIL NETWORK FROM THE **TIGER** SEA PORTS TO THE DRY PORTS

9.4.1 ITALY

Genoa Port and Vado Ligure – As already indicated in many parts of this Work Package and on the **TIGER project** as a whole, the challenge for the Port of Genoa and also for the other Liguria Ports of Vado Ligure and La Spezia is to move the traffic beyond the Apennines given the shortage of space available in the sea front. The nominated Rail network infrastructure on which Genoa Port can rely on is represented by the two main RFI Rail lines crossing the Apennines named "Linea dei Giovi" and "Succursale dei Giovi". There is also a secondary RFI single track Rail line connecting Genoa Voltri, Ovada up to Alessandria. Additionally the port of Genoa can also use the RFI coastal line double track connecting South of Genoa to La Spezia and prosecuting towards the South of Italy on the Tyrrhenian cost line. On the West of Genoa the Rail line becomes single track and is providing the Rail connection with France. This important line is being upgraded to double track with a complete new line of tunnels and bridges. The works are in execution for some time (Figure 128).

→ Figure 128: Genoa- Ventimiglia Rail Line being upgraded to double track
Source: Liguria Region

The port of Savona is served by the above represented RFI coastal line connecting the port to the Italian Rail network. In addition the port of Savona can reach Corridor 24 in Alessandria or Rivalta by using the secondary RFI single track "Savona – San Giuseppe di Cairo – Alessandria". Additionally the port activities will be relieved by a new motorway connection bypassing the costal road (Figure 129).

The choice about which Rail infrastructure to be used for routing the port traffic volumes to the dry ports of RTE or Alessandria (when in use) or directly to a terminal of destination, is decided by the intermodal operators according to best route, shorter transit time, lower costs. The Rail Undertaking or the Intermodal Operator providing these intermodal services take the trains delivery from the RFI Rail head station of the port involved.

The port of Genoa is served by 3 Rail stations: "Genova – Campasso", "Genova Marittima Bacino" also called "Fuori Muro" collecting the traffic from all the container terminals of the Sampierdarena port and "Genova Voltri Mare" for the port of Voltri which includes the VTE terminal.

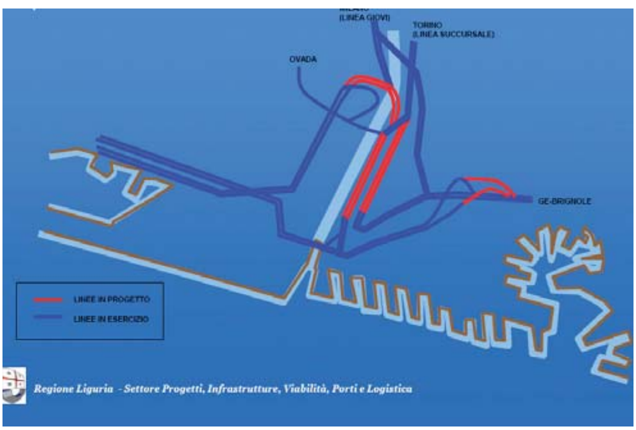
Figure 129: Motorway Bypass for heavy traffic
Source: Liguria Region

The port of Savona is served by the "Savona Parco Doria Station" serving the historic port area and by the Station of "Vado Zona Industriale" serving the port of Vado Ligure where the new Maersk Container Terminal is being realised.

The railway shunting operations for connecting the three terminals described above of "Genova – Campasso", "Genova Marittima Bacino/Fuori Muro" and "Genova Voltri Mare" with the port are performed by a unique Rail Undertaking called "FUORIMURO". A similar situation is occurring in Savona-Vado Ligure where the shunting services in "Parco Doria Station" and "Vado Zona Industriale Station" are performed by a unique Rail Undertaking called "SERFER".

The overall performance of the port of Genoa, in addition to the above indicated improvements to the port Rail network will be further enhanced by the overall restructuring and rationalisation of the Rail network within Genoa city itself involving the passengers traffic. Stations are being specialised according to a more rationale traffic distribution which will bring important benefits also to the cargo. The whole project to be completed by 2015-2016 has a budget of € 622 ml and has gone recently into execution (Figure 130).

Figure 130: Genoa Rail network rationalisation plan.
New Rail lines are marked in red
Source: Liguria Region

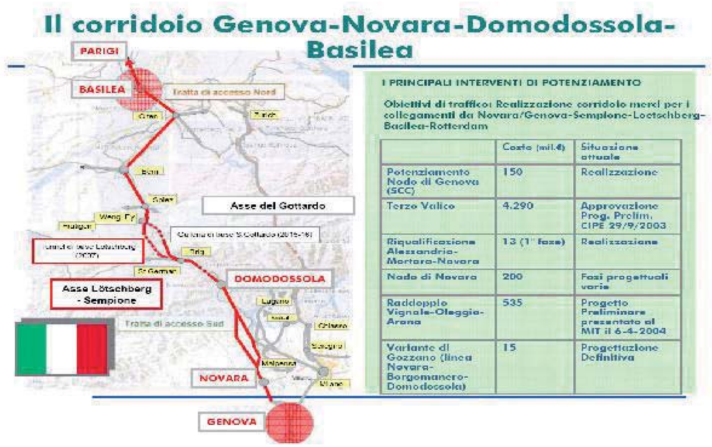


9.4.2 THE DRY PORTS CONNECTIONS

The Corridor 24 linking Genoa to Rotterdam needs considerable investments which are in course of execution or are being planned for completion by 2020. The situation is represented by the following Figures (Figures 131 and 132) which summarize the works to be carried out both on the Italian and Swiss part of the corridor.

Genoa – Loetchberg: The investments budgeted is € 5.2 billion of which € 4 billion allocated to a new Rail tunnel (the third Rail tunnel) crossing the Apennines. This new major rail connection is of 53 km length, the greatest part of which in tunnels. In addition there will be 14 km of connecting rail lines with the existing RFI Rail Network. The safety measures will be of the highest standards with signaling systems ERTMS/ETCS Level 2. The two Italian regions of Liguria and Piemonte are involved. The first lot for contracting the works execution has been approved by CIPE and financed for realization. This is a major multi – annual infrastructure investment for Italy and for Europe, correcting an important bottleneck of the European Rail Network. The completion of the Novara to Domodossola Rail track was scheduled for completion within 2010. The new third Rail tunnel crossing the Apennines although being approved has not seen yet the start of the works. The tunnel completion is planned for 2015-2016.

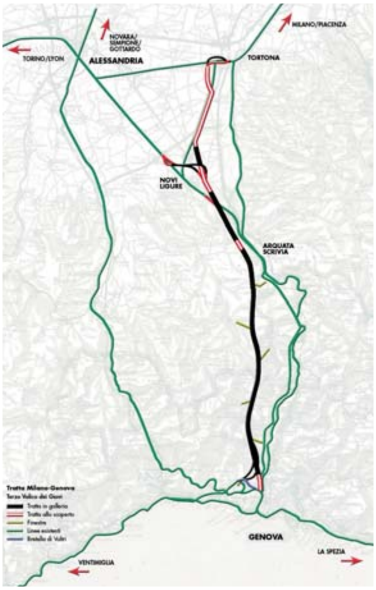
→ Figure 131: "Genoa – Novi Ligure – Novara – Lotschberg" works
Source: GPA



Genoa – Gothard: The Gothard tunnel in Switzerland itself is planned for completion in 2018. Still on the Swiss part further works are under execution on the Monte Olimpino tunnel and Monte Ceneri planned for completion in 2019. On the Italian part Rail lines upgrading are planned for execution on the Como-Chiasso where an existing bottleneck of a single track is being removed and on the quadrupling of the Monza-Como Rail line.

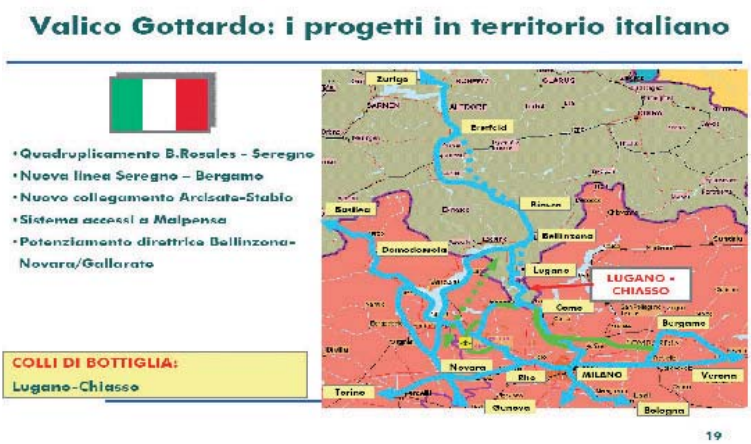
→ Figure 132: Third Tunnel from Genoa to Tortona. The Rail line inside the tunnel is marked in black

Source: Liguria Region



→ Figure 133: ALP Transit Sud network works

Source: Liguria Region



The third Genoa tunnel which is being constructed will improve the accessibility of the port of Genoa not only to Corridor 24 but also to Corridor 5 (Figure 134).

→ Figure 134: Genoa connections with Corridor 24 and Corridor 5
Source: Liguria Region

9.4.3 GERMANY

Germany offers the largest railway system in Europe. It's length amounts to 70,600 km and is used by approximately 350 railway operators. The competence for infrastructure management is in the hand of DB NETZ AG, the German Infrastructure manager. DB NETZ AG is part of the DB German Railway Group. The Rail slot assignment on the rail infrastructure to all rail operators including DB as well as to all other private operators against the payment of a price, is the core business of the DB Netze. All railway operators who have been assigned a given rail slot of occupancy at a given time on a declared stretch of the infrastructure from a location to another are entitled to run a train on that particular sector at the declared time.[33]

Any rail operators wanting to offer rail services between the sea ports and the dry ports must have a European rail operators' license together with a safety certificate as per European rules. Once in possession of this license they are authorized to apply for a rail infrastructure slot occupancy from DB Netze if they want to operate in Germany or from any other European Infrastructure manager if they want to operate elsewhere.

In Germany about 80 rail operators are able to offer their transport services to the customers of Hamburg and Bremerhaven ports to hinterland destinations in Germany and beyond. Germany is the country in Europe where the effective competition on the rail tracks has become a reality. Several operators are competing with each other and are competing with DB, the National incumbent offering to the customers a wide choice of services at competitive prices. The customers are able to chose their preferred rail operator.

[33] http://www.dbnetze.com/site/dbnetze/de/ueber_dbnetze/daten_fakten/daten_fakten.html, 05.10.2010.

9.4.4 THE DRY PORTS CONNECTIONS

In Germany the existing intermodal transport terminal and national railroad system is dense as illustrated in Figure 116: Locations of intermodal transport terminals in Germany 2009". Germany is ranked number one compared to other EU Member States with a total tracks length of 70,600 km. France is second with 49,600 km, Poland third with 38,900 km, Great Britain fourth with 31,100 km and Italy fifth with 23,400 km[34]. In Germany nearly all intermodal terminals are connected with the national Railway system and therefore to the international European network. Existing intermodal terminals are amongst the possible locations for dry ports as indicated in chapter 2.3.3. "Possible locations for dry ports in Germany". These terminals have the added advantage of being already integrated into the existing German Railways system opposed to completely new locations. It is obvious that in order to transform an existing intermodal terminal into a dry port it is necessary to make a deep survey on local conditions and capabilities in order to verify if the needed adaptations are practicable and with the effective desired results. In case such transformation are viable this solution could produce substantial costs advantages compared to green field projects which could have a longer time to market with uncertain results.

9.5 TRAFFIC VOLUMES ASSIGNMENT FROM EACH **TIGER** PORT TO ITS NOMINATED RAIL FREIGHT NETWORK AND HINTERLAND DISTRIBUTION INFRASTRUCTURE.

9.5.1 PORT OF GENOA

The most important gravity attraction areas for the traffic in origin/destination for the port of Genoa are: In Italy the Regions of Lombardy, Emilia Romagna, Veneto, Piedmont, Tuscany and South Regions of Germany, France, Switzerland, Austria as well as the Eastern Countries of the European Union.

The future demand traffic forecast elaborated in 2009 by Ocean Shipping Consultant for the port of Genoa have attributed in terms of O/D traffic 71.16% of the volumes to national sources whereas the remaining 28.84% was attributed to international sources.

For national Italian market the port of Genoa developed the following O/D traffic volumes[35] in percentages terms:

- 35% with Lombardy Region using the Arluno-Rho, Milano–Certosa, Milano–Rogoredo, Melzo terminals and Busto Arsizio dry ports;
- 32% with Emilia Romagna Region using the Modena, Rubiera and Piacenza terminals;
- 21% with Veneto Region using Verona and Padova dry ports;
- 5% with Tuscany Region using Arezzo dry port;
- 4% with Piedmont Region using Rivalta Scrivia, Casale Monferrato, Orbassano and Novara dry ports;
- 3% with other Italian Regions using several other terminals.

34 Eurostat, in table [rail_if_tracks], in:
http://appsso.eurostat.ec.europa.eu/nui/setupModifyTableLayout.do, Stand: 18.012011.
35 CIELI "Piano REgionale della Logistica della Regione Liguria" – 2008.

For the international market the port of Genoa developed the following O/D traffic volumes in percentages terms:

- 38.8% with Germany;
- 24.75% with France;
- 18.07% with Switzerland;
- 18.38% with Austria and East EU Countries.

If one analyses the modal split, in 2009 the final statistical results indicated a 18% of cargo routed by Rail and 82% of containerized cargo by road. For the traffic forecasts up to 2020 further projections are necessary in order to deal with the planned traffic increase which cannot be absorbed by road modality.

On the basis of 2009 throughput, the port of Genoa out of 1,426,273 TEUs has managed 1,014,930 TEUs for the national market of which 832,248 TEUs by truck and 182,688 by rail. The remaining 411,337 TEUs were for international O/D of which 159,743 TEUs with Germany, 101,836 TEUs with France, 74,166 TEUs with Switzerland and 75,592 TEUs with Austria and East EU Countries. The modal split has remained roughly the same.

According to the tool provided by HHM used for every TIGER ports this modal split has been applied to the three scenarios and the medium scenario has been chosen for the sake of this WP1 Task 1.2 exercise. The result are here below reproduced. These results give credit to the TIGER project approach since it becomes apparent that it will be impossible to achieve the planned traffic volumes increases maintaining the existing 2009 modal split. A far higher percentage of containerized intermodal traffic must be handled by Rail if the port of Genoa want to achieve its desired performance.

A total traffic of 1,985,962 TEUs not including feeder and transshipment, will be performed by port of Genoa in 2015 with about 40% of the traffic to be handled by rail and 60% by road. Out of this total amount 1,413,211 TEUs are planned to be destined to the Italian market and 572,751 to international markets.

The regional O/D volumes are the following:

- 494,624 TEUs with Lombardy;
- 452,227 TEUs with Emilia Romagna;
- 296,773 TEUs with Veneto;
- 70,661 TEUs with Tuscany;
- 56,529 TEUs with Piedmont;
- 42,396 TEUs with other Italian Regions.

The international O/D volumes will increase to:

- 222,428 TEUs with Germany;
- 141,798 TEUs with France;
- 103,270 TEUs with Switzerland;
- 205,255 TEUs with Austria and East EU Countries.

A total traffic of 3,255,223 TEUs not including feeder and transhipment, will be performed by the port of Genoa in 2020 with about 40% of the traffic handled by rail and 60% by road. Out of this total volume 2,316,417 TEUs are planned to be destined to the Italian market and 938,806 TEUs to international markets.

The regional O/D volumes are the following:

- 810,747 TEUs with Lombardy;
- 741,252 TEUs with Emilia Romagna;
- 486,446 TEUs with Veneto;
- 115,821 TEUs with Tuscany;
- 92,658 TEUs with Piedmont;
- 69,492 TEUs with other Italian Regions.

The international O/D volumes will increase to:

- 364,586 TEUs with Germany;
- 232,423 TEUs with France;
- 169,271 TEUs with Switzerland;
- 172,256 TEUs with Austria and East EU Countries;

From the above overall traffic projections divided by areas of distribution combining both road and Rail, the following table (Figure 135) is assigning the traffic volumes forecasts to the Rail intermodal service only for 2015 and 2020.

→ Figure 135: Rail traffic projections from Genoa to hinterland destinations and vice versa
Source: GPA

Comulated rail volumes by hinterland region	2010 Rail in TEU	2015 Rail in TEU	2020 Rail in TEU
Italy, therof:	229,091	423,963	694,917
Lombardy	80,182	148,387	243,221
Emilia Romagna	73,309	135,668	222,373
Veneto	48,108	89,032	145,932
Tuscany	11,455	21,198	34,746
Piedmont	9,163	6,959	27,797
Others	6,873	12,719	20,848
International, therof:	92,847	400,926	657,164
Germany	36,057	155,559	254,979
France	22,986	99,229	162,648
Switzerland	16,741	72,447	118,749
Austria + East	17,063	73,691	120,788
All hinterland regions	**321,938**	**824,889**	**1,352,081**

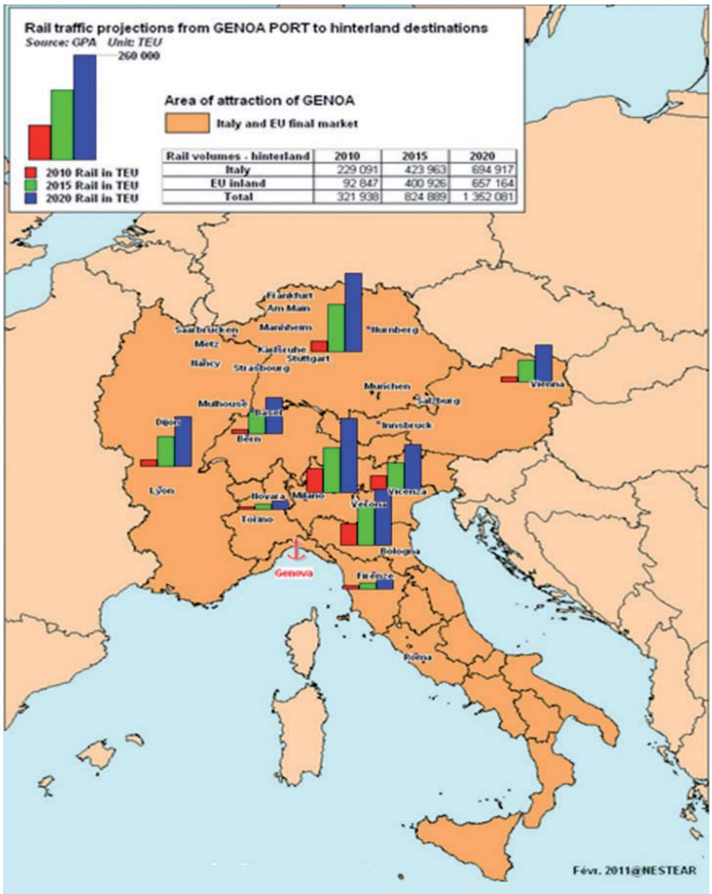
The traffic volumes projections assigned from the port of Genoa to the distribution by Rail intermodality via the dry ports or directly as per the above table together with the road distribution, constitute the total volumes forecasted by the port of Genoa in 2015 and 2020 as per table reproduced here below (Figure 136). This indeed is the total port throughput planned by the port following the introduction and implementation of all the investments and innovations in the productions cycles described in the previous chapters of this document.

→ Figure 136: Port of Genoa modal split 2015-2020
Source: GPA

Trasport modality "Port of Genoa - Final market"				
	2015		2020	
	Rail (TEUs)	Truck (TEUs)	Rail (TEUs)	Truck (TEUs)
Italy	423,963	989,248	694,917	1,621,500
EU inland market	400,926	171,825	657,164	281,642
Total per modality	**824,889**	**1,161,073**	**1,352,081**	**1,903,142**
Total throughput	**1,985,962**		**3,255,223**	

As a result the competitive reach of the Genoa Port is greatly improved (Figure 137).

→ Figure 137: Port of Genoa enlarged Area of competitive reach after **TIGER**
Source: **TIGER Project**



9.5.2 PORT OF GIOIA TAURO

The consolidated traffic volumes of 2010 compared to 2009 show a slight increase in the total port throughput. Although this traffic increase is only 4%, it stands to indicate that the traffic reduction experienced in the last two years has stopped. The traffic distributed by road has increased by 10% whereas the traffic distributed by rail has continued to decrease because of service problems.

The TIGER project plan is to improve the service via the Ionian Rail line to Bari in order to merge with the Taranto traffic. This new business approach should allow a service improvement increasing the frequency of the "Antenna" trains to Bari. This effort should allow an increase of the traffic moved by rail to the detriment of the road traffic and by so doing reversing the negative trend experienced by Rail distribution in recent years. According to this reverse trend a traffic projection 2015-2020 has been made as per Figures 138-139. The MARIPLAT, based on the Bologna dry port, inserted into the TIGER project has the objective of improving the accessibility of both Gioia Tauro and Taranto not only towards the North of Italy but to the Southern and Eastern parts of Europe. The combined intermodal volumes consolidated in Bari of both Taranto and Gioia Tauro ports have the objective of providing frequent services for attracting traffic which otherwise would go by feeder via North African ports. This is the reason why both ports of Gioia Tauro and Taranto are committed to TIGER project since their ability to distribute CTS overland represents a competitive advantage compared to North African ports.

→ Figure 138: Rail traffic projections from Gioia Tauro to hinterland destinations and vice versa
Source: SOGEMAR

Comulated rail volumes by hinterland region	2010 Rail in TEU	2015 Rail in TEU	2020 Rail in TEU
Italy:			
Campania	2,500	14,000	15,000
Puglia	8,000	36,500	50,000
Others			
All hinterland regions	**10,500**	**50,500**	**65,000**

Gioia Tauro Port modal split in TEUs

→ Figure 139: Gioia Tauro Port modal split
Source: SOGEMAR

in TEUs	2010	2015	2020
Feeder			
Road	71,200	57,600	57,000
Rail	10,500	50,500	65,000
Total	81,700	108,000	122,000

9.5.3 PORT OF TARANTO

At the time of writing this report the volume throughput for Taranto port is available for year 2010. Unfortunately for the port due to several problems experienced during the year the total throughput has stopped to 587.611 TEUs. Out of this total, the traffic distributed overland has reached 89.585 TEUs equating to 15% of which 11.312 TEUs in exports and 78.273 TEUs in import. The modal split is 84.224 TEUs by road and 5.361 TEUs by Rail mainly to Pomezia (Rome). Despite the substantial traffic reduction experienced during 2010, this reduction has been lower than originally anticipated. Such occurrence is to be taken as a good sign for 2011 volumes and thereafter.

Taranto Port modal split in TEUs

→ Figure 140: Taranto Port modal split
Source: Italcontainer

in TEUs	2010	2015	2020
Feeder	498.000	1.031.000	1.465.000
Road	84.000	80.000	75.000
Rail	5.000	39.000	60.000
Total	587.000	1.150.000	1.600.000

→ Figure 141: Rail traffic projections from Taranto to hinterland destinations and vice versa
Source: Italcontainer

Comulated rail volumes by hinterland region	2010 Rail in TEU	2015 Rail in TEU	2020 Rail in TEU
Italy:			
Lazio	5.361	14.000	18.000
Puglia		4.000	9.000
Emilia Romagna		13.000	20.000
Other regions		8.000	13.000
All hinterland regions	**5.361**	**39.000**	**60.000**

The immediate comment that one can draw from both Gioia Tauro and Taranto traffic projections is that the business model of the gateway ports is completely different from the one of the transhipment ports. The transhipment business model appears to be more vulnerable and exposed to the continuous research by the shipping lines of lower operating costs. At the same time one can say that both Gioia Tauro and Taranto being on the Italian mainland have the need to develop their hinterland distribution organization increasing the competitive reach of both ports using rail intermodal services. Their joint participation to TIGER project via MARIPLAT allows them to consolidate their hinterland volumes by adopting innovative co-modal solutions via Bari and Bologna. The full implementation of this hinterland distribution model can deliver them a substantial competitive advantage compared to the North African and Malta transhipment ports.

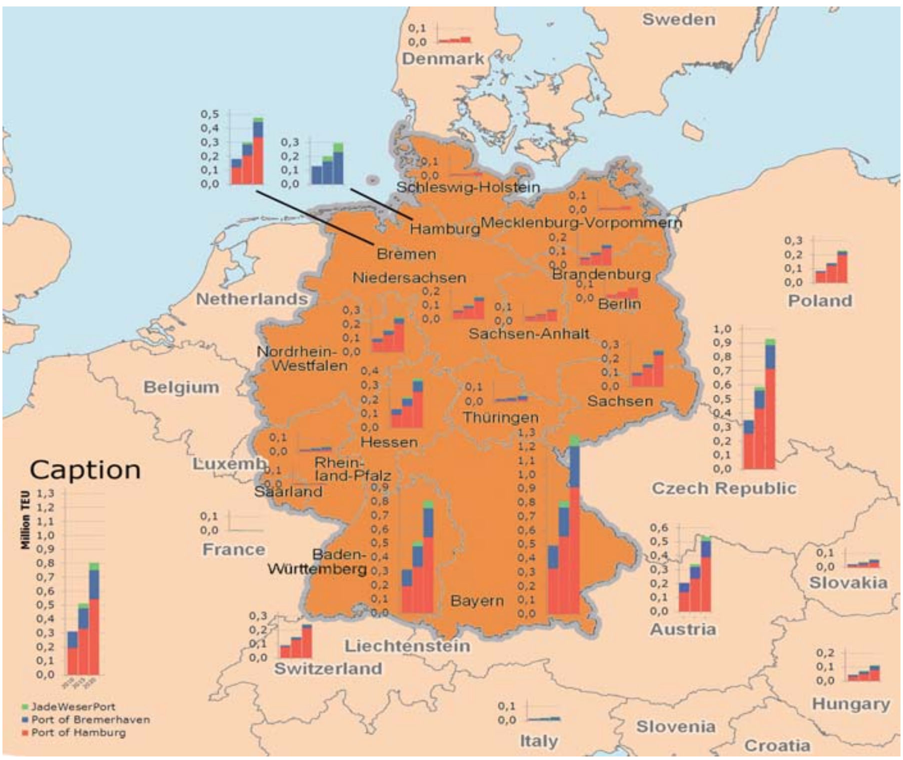
9.5.4 PORT OF HAMBURG, PORT OF BREMERHAVEN AND PORT OF JADE-WESER

All three ports, exception made for the internal and local sea port Rail infrastructure, are accessing the same Rail network for their hinterland containers and general cargo distribution. In fact being located geographically in the same range, the traffic developed by the three ports is funnelled through the same main Rail corridors. In the previous chapters of this document the bottlenecks corrections needed to improve the traffic liquidity have been identified and described.

The most interesting markets for Rail freight cargo in terms of volumes are represented by Southern Germany, the Czech Republic, Switzerland and Austria as per Figure 142 without neglecting farther destinations which are bound to become more and more serviceable following the deployment of the giant containers vessels calling at fewer number of ports.

Most of the cargo distributed by Rail is transported over distances exceeding 200 km. In intermodal terms this is a relatively short distance for Rail to be competitive since the common understanding is indicating in 500 km the distance above which Rail freight becomes really competitive. However for the North Germany ports range the relatively short distance of 200 km becomes interesting for Rail freight since the economy of scale provides the required incentives for industrialising the Rail transport chain moving containers in quantities.

→ Figure 142: Forecast of rail freight traffic in million TEUs from Northern TIGER Ports to their respective hinterland destinations and vice versa in 2012,2015 and 2020 (basis: individual scenario)
Source: HHM



The above figure (Figure 142) shows also the potential growth up to 2015 which can be expected to be routed by Rail.

The Figure 143 shows in detail the table of cumulated forecasted volumes assigned from the sea ports to the Federal States and to other international countries for the years 2010, 2015 and 2020.

→ Figure 143: Table of cumulated foracasted volumes assigned from Northern TIGER Ports to their respective hinterland destinations and vice versa in 2012,2015 and 2020 (basis: individual scenario)
Source: HHM

Comulated rail volumes by hinterland region	2010 Rail in TEU	2015 Rail in TEU	2020 Rail in TEU
Germany, therof:	1,660,210	2,755,099	4,331,332
Baden Wurttemberg	309,773	513,567	806,111
Bavaria	487,809	811,266	1,279,890
Berlin	27,214	46,399	76,115
Brandenburg	55,806	93,620	149,766
Bremen	181,877	302,389	476,840
Hamburg	128,310	202,626	292,180
Hesse	132,103	220,039	348,014
Mecklenburg-West Pomerania	9,264	15,792	25,897
Lower Saxony	59,362	99,733	159,922
North Rhine-Westphalia	94,327	158,150	252,767
Rhineland-Palatinate	15,285	24,795	37,521
Saarland	2,994	5,088	8,306
Saxony	97,795	164,589	264,639
Saxony-Anhalt	30,424	51,230	82,437
Schleswig Holstein	9,162	15,596	25,520
Thuringia	18,705	30,220	45,407
Austria	203,239	338,414	534,949
Belgium/Luxemburg	127	200	289
Czech Republic	350,455	585,449	930,304
Denmark	13,812	23,500	38,431
France	213	363	595
Hungary	43,098	71,607	112,796
Italy	11,690	18,458	26,609
Netherlands	0	0	0
other countries	493	792	1,178
Poland	84,316	142,070	228,852
Slovakia	22,882	37,717	58,641
Switzerland	88,571	149,491	241,434
All hinterland regions	**2,479,418**	**4,123,694**	**6,506,282**

10. THE TIGER PROJECT DEVELOPMENTS AND IMPLEMENTATION

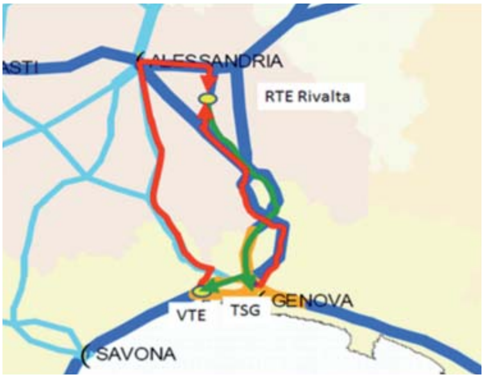
The previous chapters described the market evolution and traffic market projections up to 2020, the planning of the four **TIGER** Demonstrators together with the desired results after the Project completion. These Demonstrators have a common denominator for their achievements. They are the results of long and complex planning and implementation processes initiated back in 2007 when the **TIGER Project** was conceived. The first initiatives started at that time and continued relentlessly up to the Project end in September 2012 by undertaking investments in Infrastructures, equipment, technologies, tools, management systems, processes, training in order to fulfil the declared objectives. The **TIGER Project** innovative concepts have been the motor for changes in the maritime transport chain from Sea Ports to inland destinations. Private investors have seen through **TIGER Project** the opportunity of gaining a competitive advantage both on service efficiency and costs reductions and took the opportunity during the recent economic recession to re-engineer their operations. This was done in order to be fully ready when the economic cycle will enter into a new expansion phase. The amount of the total investments in the **TIGER Project** initiatives on all Sea Ports execution theatres both in Italy and Germany reached several hundred millions Euro. The co-financing provided by the EU Commission represents a minor part of these investments although very important. The official backing to the **TIGER** initiative by the EU Commission has provided the "steering force" for a snow ball effect and for the very important recognition of the Project at European level including the dissemination efforts embracing the whole of Europe and beyond.

It is not the purpose of this Report to undertake a detailed description of the intermediate phases which have characterized the Project development since they belong to the partners themselves who have adapted the technologies, equipment and process innovations to their own production cycles.

The objective of this chapter is dedicated to the execution and achievements of the four Project Demonstrators into the practical field of operations leading to full market uptake.

10.1 GENOA FAST CORRIDOR - GFC

→ Figure 144: The Genoa Fast Corridor "LOOP" system
Source: **TIGER**



The Genoa Fast Corridor re-engineering process involved the following components of the Genoa maritime CTS transport chain:

- Terminal San Giorgio – a multi purposes Terminal privately managed in the Genoa Port;

- Terminal Messina – a CTS Terminal in the Genoa Port managed by Ignazio Messina Shipping Line;
- Voltri Terminal Europa (VTE) – the new Port of Genoa modern facilities managed by PSA (Port of Singapore Authority);
- The Genoa Port internal and external Railway network Masterplan involving the restructuring of every connection to the various quays and the interconnections between themselves. This Masterplan goes through a transition phase up to a final structure layout of the Genoa Port Railways facilities with full electrification and automation of the various switches. In addition this plan involves the revamping of the "Fuori Muro" Rail Infrastructures which provides the Railway link between the full internal Port Railway system and the RFI (Rete Ferroviaria Italiana) National and International network.
- The wagons/trains manoeuvring inside the Genoa Port Rail sidings and the shuttle trains from the Genoa Terminals involving TSG, Ignazio Messina & C./Terminal San Giorgio (in RTI), VTE and Rivalta Terminal Europa (RTE). In this area a major change has taken place by entrusting to one unique operator the full responsibility of the train consists inside the Terminal, the shuttle trains to the Dry Port and the introduction of the train inside Rivalta Terminal Europa.
- The shuttle trains path agreed with RFI from Voltri Terminal and/or TSG and Messina Terminals to Rivalta Terminal Europa.
- The Rivalta Terminal Europa (RTE) Dry Port. This Dry Port is a complete green field new investment next to the old Rivalta Scrivia Terminal having a technical capacity of 1 Million TEUs throughput per year, the biggest in Italy. The area of development, once completed, is 1.2 Million square meters. This is a private managed Terminal owned by two operators Gruppo Gavio and Gruppo Fagioli. Gruppo Gavio is also the owner of Terminal San Giorgio. RTE is located at about 75 Km distance from Genoa Port. The first module of this substantial Infrastructure investment related to the RTE Dry Port has come into production in 2011 and has been involved in the GFC shuttle trains Pilot trials from Genoa Port to RTE.
- The Rivalta Terminal Europa (RTE) connection between the Terminal internal Rail sidings and the RFI station. In order to overcome the bureaucratic obstacles the Gavio and Fagioli Groups, owners of RTE, decided to buy the RFI Rail station avoiding this psychological and physical barrier, allowing the shuttle trains service to operate as planned.
- The National and International CTS freight trains from Rivalta to other Italian and International inland destinations together with the connecting activity of train path request with RFI. Completely new Rail freight accesses can be secured via Rivalta with connecting services to France, Germany, Switzerland, Austria, Slovenia, Croatia and Hungary.
- The introduction of a complete new system allowing seamless mobility combining together customs, security, documents through e-customs, e-seals, e-freight. A further step change is expected to take place when the joint operation between Genoa and the Port of Tianjin will be fully implemented. The electronic seals will guarantee the full coverage from origin to destination without any interference during transit. In order to make these electronic procedures to be fully operative it has been necessary to equip the gates of Genoa Port and of RTE with electronic reading devices capable of detecting through a "transponder" technology the passage of CTS while exiting and entering on the shuttle trains the Terminals involved. This electronic monitoring, together with the electronic seals, constitute the guarantee of CTS virgin condition.

- The hard/soft technologies equipment systems, controls, processes, management, training of personnel, governing the whole maritime CTS transport chain capable of reducing transit time, are producing better services at reduced costs.

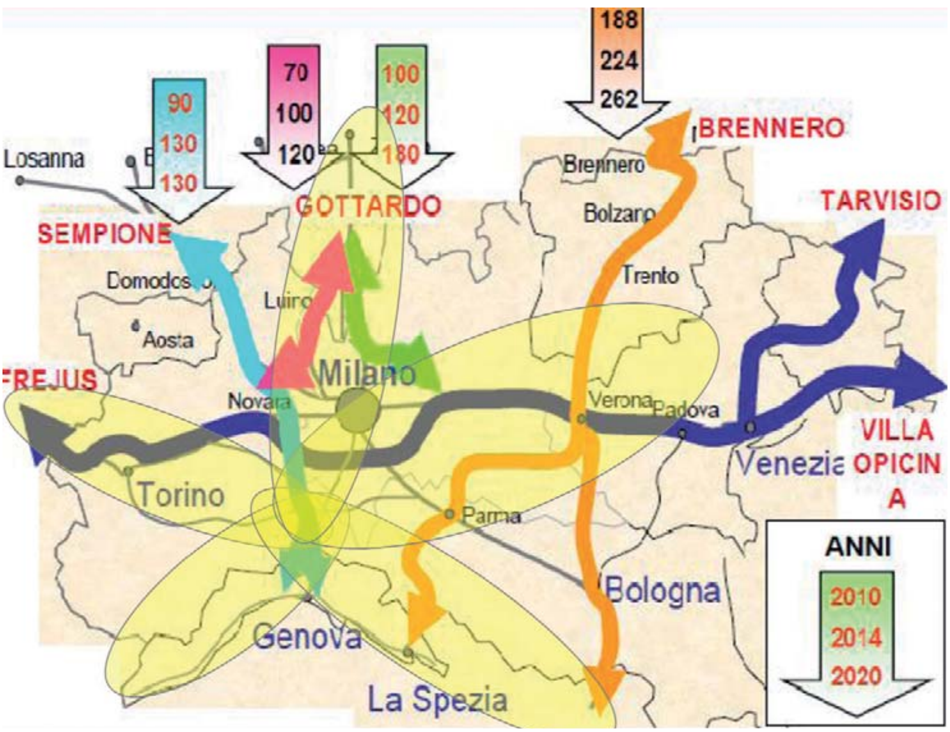
- The Rail monitoring and signaling system.

- The whole process is managed through intelligent Track & Trace systems overlooking and monitoring the position of the CTS before, during and after transportation. The full production cycle is under control.

The **TIGER** strategic relevance for Genoa Port is also represented by the fact that the innovations introduced in Genoa will be extended to the whole Liguria Region Port System constituted by Genoa itself, Vado Ligure and La Spezia. These three Ports have the same characteristics of high water on the Sea front and high mountains immediately behind with the emerging constraints of quays space and Terminal facilities shortage. Therefore the concept of extended quays approach through the Dry Ports of Rivalta Terminal Europa, Alessandria and Bocca di Magra (for La Spezia) is vital for securing future traffic development.

Here below this approach of "extended Port " and railways Dry Port totally supported by both the Genoa Port Authority, the Liguria Region and private operators, is reproduced in the following picture (Figure 145) which is showing also the International corridors connections.

- Figure 145: The extended Port and Railway Dry Port concept
Source: GFC

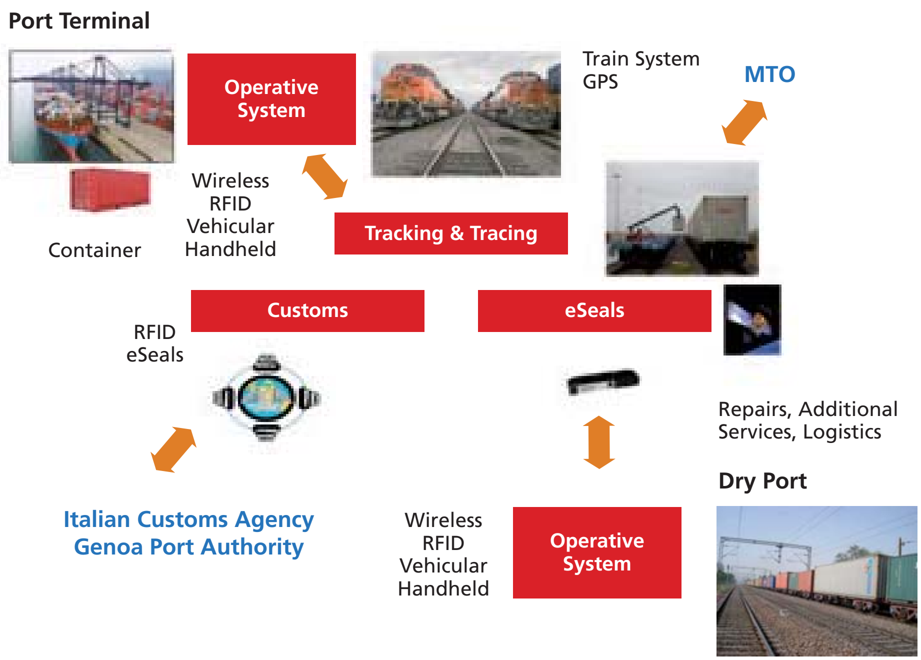


The operating scheme and the management system architecture embrace every aspect of CTS movements and operations between the Port Terminal up to the Dry Port, including all supportive activities such as wagons, trains, repairs, services and Logistics. A simplified graphic representation of the organizational set up is here below reproduced.

All intelligent systems governing this complex architecture have the capacity and power to manage and overview the whole maritime transport chain containing all functionalities both to feed the internal channels as well as the external connections.

The e-customs, e-seals, e-freight are major step changes towards the achievement of a seamless maritime transport chain without interruptions or outside interference. Here below the e-seal technology and its monitoring is reproduced (Figure 146).

→ Figure 146: Port Terminal/Dry Port management system architecture
Source: GFC for **TIGER**



The integrated information system, including all functionalities such as track and trace, e-seals, e-customs, e-freight, entails the installation of automatic reading devices based on transponder technologies at the various gates, be them exiting the Port or entering the Dry Port. In the next picture (Figure 147) there is a visual representation of such devices.

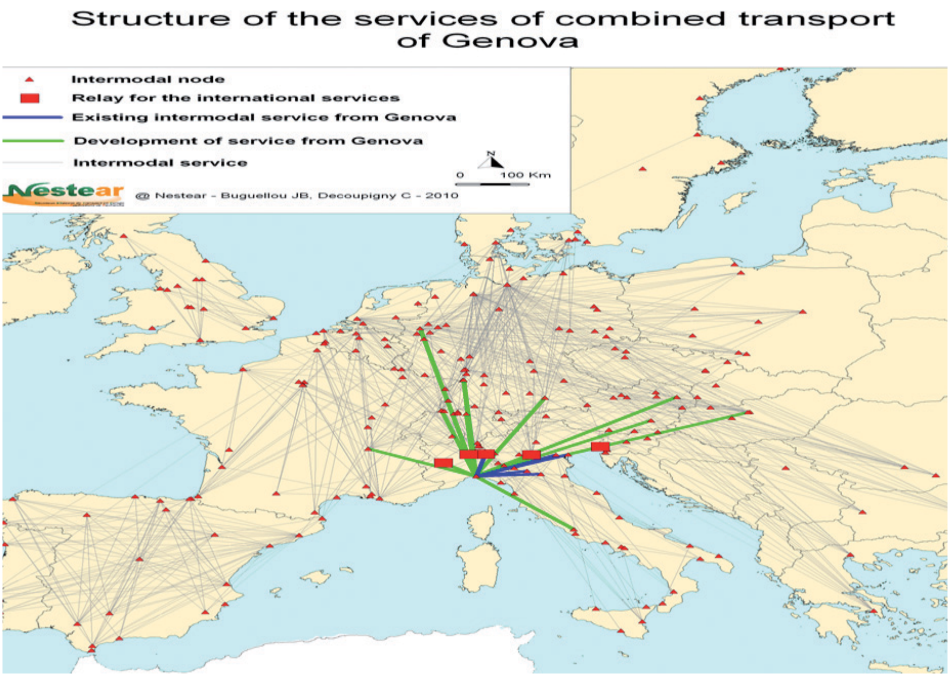
→ Figure 147: E-seals applied technology
Source: GFC for **TIGER**

→ Figure 148: Automatic reading devices allowing full electronic control and CTS management
Source: GFC for **TIGER**

At the time of writing this Final Report Book the various modules of the system both at operational and management level have been progressively implemented on the practical field of application through official Pilot tests. The Pilot test initially started with four couples shuttle trains per month being upgraded to eight couples of shuttle trains per month from Voltri Terminal Europe (VTE) to Rivalta Terminal Europe (RTE) involving a total throughput of 4 364 TEUs import and 3 437 TEUs export (Total 7 801 TEUs). The Pilot is planned to gain further momentum with the implementation of additional couples of trains and the introduction of service from TSG/Messina Terminals to RTE.

The results achieved so far are multifold. The most relevant, which were planned ever since the TIGER Project conception, are relating to the costs reduction of the transport chain coupled with better services and substantial reduction of transit time (reduction in dwell time, trains loading and shunting). Another very important benefit is the industrialization of the maritime transport chain via RTE combined with a longer and faster competitive reach of the Port of Genoa traffic as shown in the next picture (Figure 149). The achieved benefits will themselves become more visible with the progressive industrialization process of this maritime transport chain, the increased volumes moved to the dry Ports up to full economy of scale industrialization.

→ Figure 149: Port of Genoa Attraction zone and extended competitive reach via RTE
Source: Nestear for **TIGER**



To this effect a matrix has been prepared in order to control every dimension of the cost and service components. This is possible by reading at the crossing point of verticals and horizontal coordinates the KPI taken as a tool for measuring the achieved performances. The KPI evaluation is a separate chapter of this TIGER Final report Book.

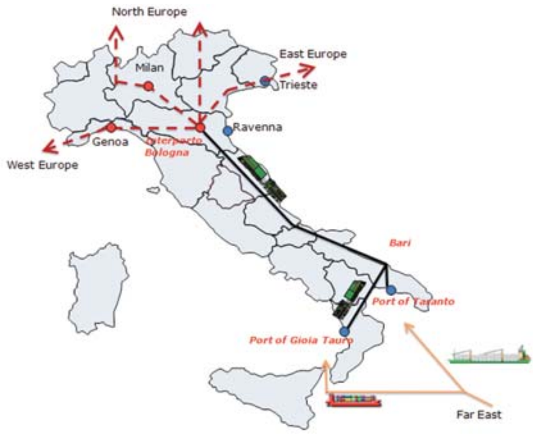
The most relevant results achieved are here below reproduced in the chart (Figure 150).

Figure 150: The main positive impacts achieved by the GFC innovations
Source: GFC for **TIGER**

GFC SOLUTIONS	REALISED BENEFITS/IMPACTS
INFRASTRUCTURE IMPROVEMENTS INVESTMENTS	→ Train length increase; → Transit time reduction; → Dwelling time reduction; → Operational costs reduction; → Service quality improvements and reliability.
SOFTWARE & HARDARE TECHNOLOGIES & ICT MANAGEMENT SYSTEMS	→ Integration of all GFC partners into the communication loop; → Improvement of information flows quality and reliability; → Data availability in real time; → E-customs, e-seals, e-freight technology for eliminating transit formalities from Genoa Port to RTE; → Intelligent systems for management processes-Track & Trace
LOGISTICS PROCESS RE-ENGINEERING	→ Operational costs reduction for seamless Logistics chain; → Tariffs reduction from Genoa to RTE and increased competitiveness on much wider traffic attraction zone; → Traffic bundling from Genoa Voltri, TSG, Messina on shuttle trains to RTE; → Terminal accessibility improvements and management control systems; → Planning activities improvement; → Integration with shipping lines, hinterland distribution strategies.
COOPERATIVE APPROACH BETEEN ACTORS OF THE GFC INTERMODAL CHAIN	→ Sharing of economic benefits between the partners; → Resources optimization; → Transport planning and operational visibility improvement; → Joint marketing and commercial efforts; → Reinforced and stronger foothold on the service by benefits and risks sharing; → Cooperative approach with far East Ports for total control of the transport chain from origin to final destination.
INNOVATIVE MARKETING STRATEGY	→ Stronger and more effective marketing by joint approach; → Multi-channel distribution; → Increased penetration for new accessible markets.

10.2 MARITIME PLATFORM - MARIPLAT

→ Figure 151: The Maritime Platform "Y" system
Source: **TIGER**



The MARIPLAT maritime Logistics chain encompasses a complete innovative routing and christened a new cooperative approach between two South of Italy Transshipment Sea Ports. The objective of this Demonstrator is to make Italy shorter from a Logistics stand point merging the overland Rail traffic volumes destined to Bologna Interporto. The "Y" system is a virtual design of the vessels coming from the Suez Canal, some of them berthing at Taranto and some of them berthing at Gioia Tauro in the "toe" of Italy. Both Ports traffic volumes are constituted by transshipment CTS arriving by Sea and departing from the same Ports by Sea loaded on smaller feeder vessels bound to other Mediterranean destinations. The percentage of the traffic to be distributed overland either by road or by Rail from Gioia Tauro Port or from Taranto Port is fairly small as it is apparent from figures in chapters 7.1 and 7.5.3. Therefore both Ports are lacking the overland volumes for developing an economy of scale industrialized distribution system to Northern destinations at competitive costs. However both Ports are aware of having a geographical advantageous position due to them being located in strategic mainland Europe. It is true that both Ports are vulnerable towards North African Hub Ports, however both political stability and the fact that they can reach North Italy and Central Europe by Rail in short time at competitive costs, play in their favor in the long term.

The MARIPLAT completely innovative Logistics engineering process involved the following components of the Gioia Tauro and Taranto maritime CTS transport chain.

- Gioia Tauro MedCenter CTS Terminal;
- Gioia Tauro Rail Terminal dedicated to MedCenter CTS Terminal;
- Gioia Tauro Rail shunting area up to San Ferdinando Railway Station;
- Antenna trains on the Ionian line Sibari – Metaponto –Taranto – Bari and vice versa where a number of upgrading measures have been undertaken or are in course of execution;

- Taranto Port and Taranto Rail Terminal on the Sea front. Nearby in zone Cagioni there is also located the Rail movement yard for the trains to be either delivered or picked up by the Rail operators to/from the Taranto port;

- The Taranto Rail city bypass recently completed. In practical terms two bypasses have been accomplished. The first one on the line Taranto-Bari connecting Bitetto with the Adriatic Line. The second one on the Ionian Line Taranto-Metaponto by realizing a completely new single track bypass of 6 km connecting in zone Bellavista, the Taranto-Bari line hence avoiding the Gioia Tauro freight trains to enter into Taranto city. These are major investments;

- The Antenna trains from Taranto Port to Bari Terminal and vice versa using the new Rail facilities indicated above.

- The train path of the Antenna trains from Gioia Tauro and from Taranto to Bari and vice versa with RFI;

- The Bari Lamasinata and Ferruccio rail plants, where bundling operations for trains coming from Gioia Tauro and Taranto Ports are performed in order to have a longer train running along the Adriatic line towards Bologna Interporto. The intervention with RFI and TRENITALIA for obtaining the authorization for longer, heavier trains adding one extra wagon up to 575 meters from the standard 550 meters for that area using new generation wagons;

- The Adriatic Rail line upgrading through the correction of two major bottlenecks in Cattolica and Castellano allowing trains with gauge "C", which is very important for maritime transport allowing transportation of 9' 6" high CTS. These are very substantial infrastructure investments;

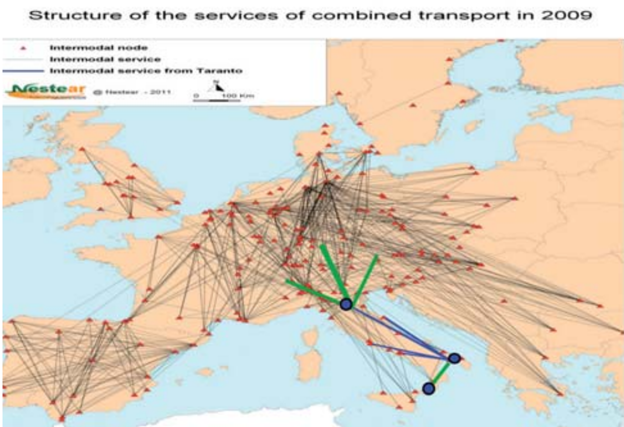
- The intermodal longer and heavier trains from Bari resulting from the bundling of the two Antenna trains to Bologna Interporto with the connected operation of train path insertion into the RFI timetable;

- The Bologna Interporto transport management processes involving planning, new tools, systems, track and trace, training of personnel for managing and controlling the whole maritime chain;

- From Bologna Interporto to other European overland destinations both North-South and East-West. The North-South connection can be effected via either the Brenner routing recently de-bottlenecked from Bologna to Verona and the Chiasso routing via Milano, also de-bottlenecked due to the new High Speed line. The East West connection is secured in Verona crossing Corridor 5. During the demonstration lifetime the Rail connection service to Germany is tested.

→ Figure 152: (left) Port of Gioia Tauro and Taranto attraction zone and extended competitive reach via IPBO
Source: Nestear for **TIGER**

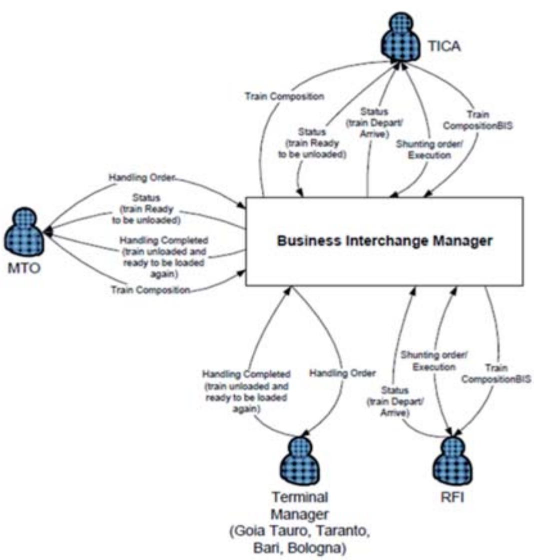
→ Figure 153: (Right) MARIPLAT logo and MARIPLAT leaflet
Source: MARIPLAT for **TIGER**



For the full market uptake implementation in an industrial scale, MARIPLAT prepared a MARIPLAT logo which is used for identifying the service and its characteristics. In the above chart (Figure 153) the MARIPLAT image effort is reproduced.

Here below the MARIPLAT Business Model scheme is reproduced with the interaction between the partners (Figure 154).

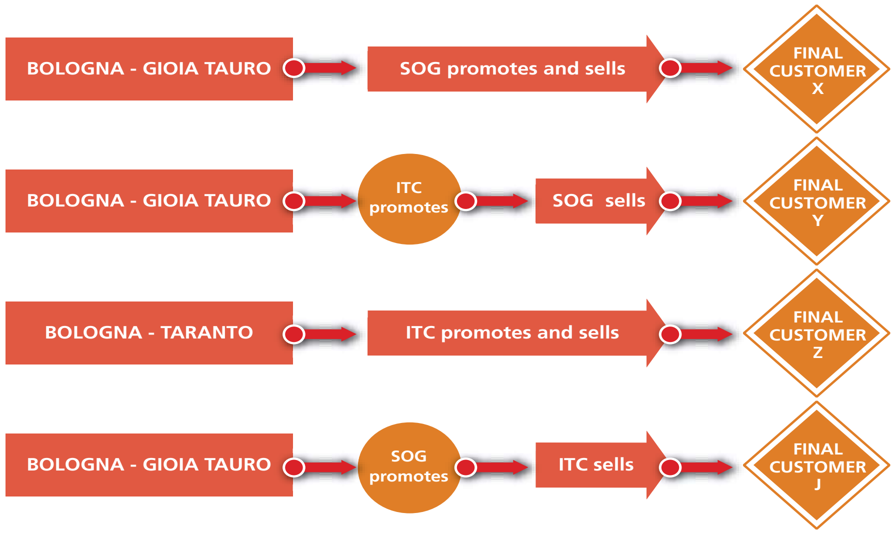
→ Figure 154: MARIPLAT Business Model Scheme & Partners interaction
Source: MARIPLAT for **TIGER**



The next picture (Figure 155) reproduces the MARIPLAT partners 'involvement towards the market place.

Figure 155: MARIPLAT partners 'involvement towards the market place

Source: MARIPLAT for TIGER



One of the key innovative MARIPLAT characteristics is represented by the efforts made by the Demonstrators partners to implement in the market place a cooperative approach and that such approach becomes visible through the MARIPLAT logo and service presentation leaflet. In fact the MARIPLAT Demonstrator is putting together under one marketing logo intermodal operators and Rail companies who, outside MARIPLAT, compete very hardly between themselves. However such competitive position has not become an obstacle for introducing a major service innovation where each partner has its own role. MARIPLAT would have had difficulties in seeing the light without the active participation of these partners who complement each other in various segments of the total intermodal chain between Gioia Tauro, Taranto, Bari and Bologna.

The next picture (Figure 156) is reproducing the number of wagons, trains, trains length, transport capacity fulfilled during the Demonstrator pilot phase.

Figure 156: MARIPLAT types of wagons and trains characterizing the Demonstrator in the pilot phase

Source: MARIPLAT for **TIGER**

Rail segment	Wagons		Maximum load per train [tons]	Number of TEUs per train	Train length [m]
	Type	Number per train			
Bari L.ta - Bologna Interporto	Sggmrss + Sgnss	14 Sggmrss + 7 Sgnss	1600	77	ca. 570 (with loco)
Taranto - Bari L.ta	Sggmrss + Sgnss	7 Sggmrss + 4 Sgnss	1300	40	ca. 307 (with loco)
Gioia Tauro - Bari L.ta	Sggmrss + Sgnss	7 Sggmrss + 4 Sgnss	1200	40	ca. 307 (with loco)

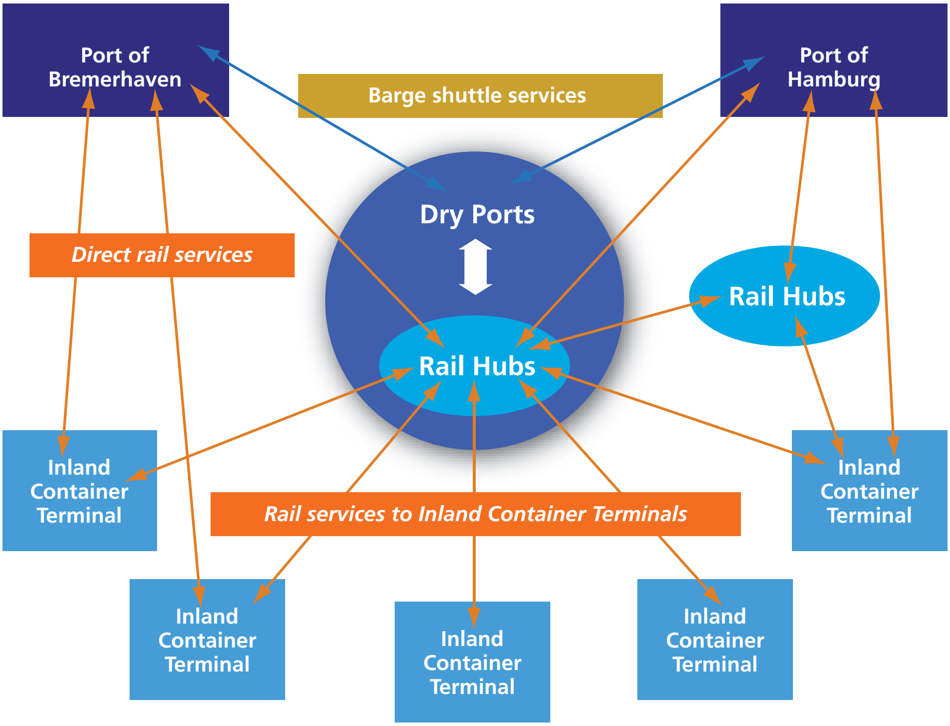
Likewise for GFC the results achieved so far by MARIPLAT are multifold. The most relevant are here below reproduced in the chart (Figure 157).

→ Figure 157: The main positive impacts achieved by the MARIPLAT innovations
Source: MARIPLAT for **TIGER**

MARIPLAT SOLUTION	REALISED BENEFITS/IMPACTS
INFRASTRUCTURE IMPROVEMENTS INVESTMENTS	→ Train length increase from 420 to 500 meters Gioia Tauro – Bari leg; → Transit time reduction up to 13% for Cagioni on Gioia Tauro – Bari leg; → Structure gauge upgrade due to new Cattolica tunnel allowing 9'6" CTS high on the Bari – Bologna corridor; → Operational costs reduction; → Service quality improvements and reliability.
SOFTWARE & HARDARE TECHNOLOGIES & ICT MANAGEMENT SYSTEMS	→ Integration of all MARIPLAT partners into the communication loop; → Improvement of information flows quality and reliability; → Data availability in real time; → New wagons technology for train length increase from 550 to 575 m on Bari to Bologna leg.
LOGISTICS PROCESS RE-ENGINEERING	→ Operational costs reduction for seamless Logistics chain; → Tariffs reduction all along the corridor up to 40% on the Antenna trains and 18% on the Bari – Bologna due to above improvements; → Traffic bundling for operating longer and heavier trains; → Terminal accessibility improvements and management control systems; → Planning activities improvement; → Integration with shipping lines, hinterland distribution strategies.
COOPERATIVE APPROACH BETWEEN ACTORS OF THE MARIPLAT INTERMODAL CHAIN	→ Sharing of economic benefits between the partners; → Resources optimization; → Transport planning and operational visibility improvement; → Joint marketing and commercial efforts; → Reinforced and stronger foothold on the service by benefits and risks sharing.
INNOVATIVE MARKETING STRATEGY	→ Stronger and more effective marketing by joint approach; → Multi-channel distribution; → Increased penetration for new accessible markets.

10.3 INNOVATIVE PORT & INLAND OPERATION - IPORT

→ Figure 158: Innovative Port & Inland operations "iPORT Web" concept
Source: **TIGER**



The Innovative Port and Hinterland operations involved several components of the Hamburg, Bremerhaven, Jade-Weser maritime CTS transport chain where the "Close to Port" and "Close to Market" approaches have been planned, introduced and implemented. The "Close to Port" approach stands to indicate the identification of a Terminal facility/shunting/marshaling yard to be utilized as immediate relief close to the Port for optimizing train loads originating to/from several other German Intermodal Terminals. The "Close to the Market" approach stands to indicate the identification of a distant Terminal from the above Ports capable of handling industrialized traffic in economy of scale close to the ultimate customers or where other intermodal regular services are available for routing CTS to/from their final destination.

In fact it became apparent during the congestion time just before the recent recession that the direct distribution from the Ports was no longer adequate to deal with the growing traffic volumes generated by the economy of scale developed at Sea by the giant CTS vessels. Therefore it was necessary to introduce management innovations and systems capable of optimizing these new traffic flows by identifying additional infrastructural nodes, Terminals, Dry Ports, Marshaling Yards, complementing and supplementing the direct distribution from the Sea Ports. To this effect three new facilities had been identified in order to execute this plan.

These facilities are: Nienburg rail yard for sorting and optimizing traffic, Munich Riem new Terminal/Dry Port facilities for traffic bundling and further distribution either to German inland or International destinations, Poznan new Terminal/Dry Port facilities for Polish traffic and International destinations towards the East of Europe.

The IPORT maritime innovative logistics engineering process involved the following components and actors of the maritime CTS Transport chain.

- Bremerhaven and Hamburg Eurogate privately managed Terminals;

- Jade-Weser (Wilhelmshaven) new Terminal facility, the first German Sea front Port entering into service in 2012. This new Port facility is road connected to the German motorway system and rail connected to the German intermodal network. The strong point of this new Sea front Port facility is the draught of 18 m capable of accommodating latest and future CTS vessel generations;

Figure 159: The Jade-Weser-Wilhelmshaven new Sea Port facilities
Source: EUROGATE

- The Bremerhaven and Hamburg internal and external Railway network where bottlenecks have been removed and bridges of higher capacity have been built;

Figure 160: Port of Bremerhaven 4,680 m long quay
Source: Bremenports GmbH & Co.KG

➔ Figure 161: The Port of Hamburg in full operation
Source: HHM

➔ The BoxXpress intermodal train operator, third party of Eurogate, integrated into the IPORT maritime transport chain for train management and train operations to/from the above Sea Ports;

➔ The Nienburg Rail shunting yard operated by BoxXpress for "Close to the Port" approach implementation strategy;

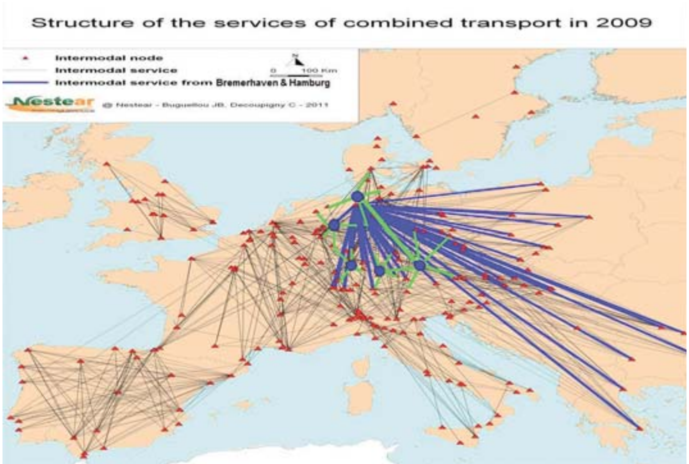
➔ The Munich Riem new intermodal facility module, completed and in operation, for the "Close to the Market" approach. It has been established during the Pilot trial operations that indeed Munich Riem is suiting perfectly the TIGER purposes since Munich Riem is a fully industrialized Terminal operating in economy of scale with a multitude of intermodal services to/from other German and International destinations such as Austria, Italy, Czech Republic, Slovenia and Hungary. In Munich Riem Eurogate organized their own facility for last-mile distribution, CTS repair yard and wagons repair facilities for full production cycle traffic optimization;

➔ The Munich Riem Terminal is operated by DUSS. Therefore DUSS was integrated into the Eurogate/BoxXpress hinterland network facilities;

➔ The Poznan Hub also for the "Close to the Market" approach with direct train connections to/from Hamburg, Bremerhaven and Jade-Weser, serving the Polish market as well as other eastern European Countries with intermodal services departing to/from this Terminal. Poznan Terminal has been planned and engineered by HHLA.

➔ The Poznan facility, which is a green field initiative, is operated by Polzug having direct train links with the three German Ports. As an example the transit time from Hamburg to Poznan has been cut from 18 to 12 hours;

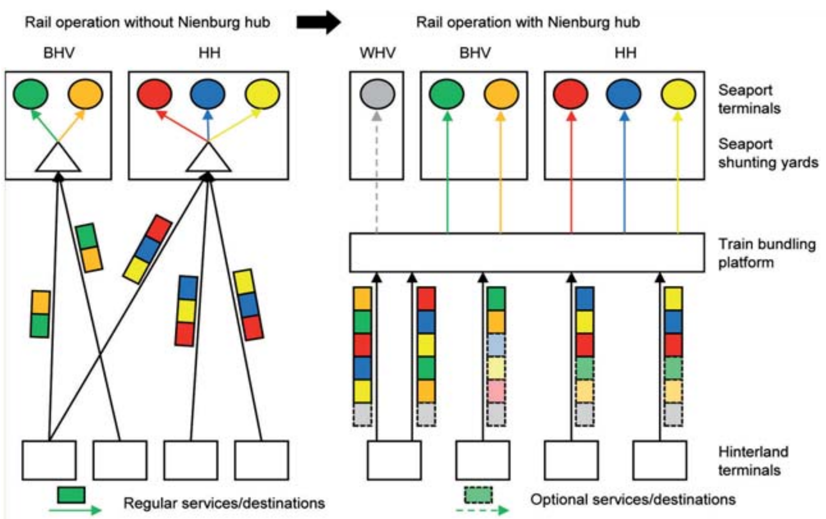
Figure 162: IPORT "close to Port"&"close to market" approaches
Source: Nestear for **TIGER**



- The shuttle trains path were managed by BoxXpress and Polzug for the respective destinations and for their insertion into the DB NETZ timetable;

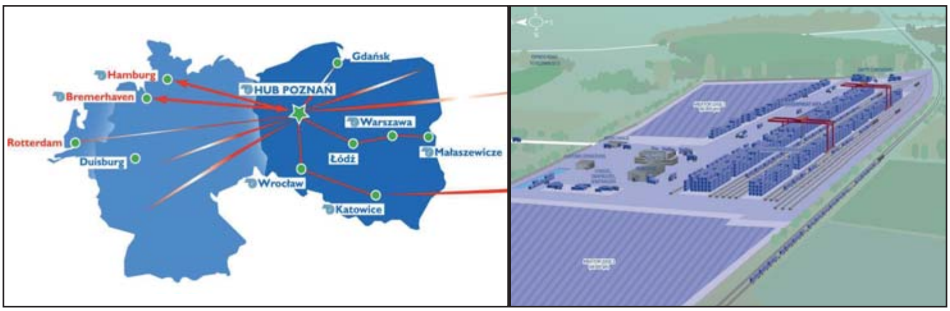
- The EUROGATE maritime transport management processes involving planning, tools, systems, track & trace, training of personnel for managing the whole downstream chain including the interfaces with the train and Terminal operators such as BoxXpress, KombiVerkehr, Polzug, DUSS and other supporting actors involved in last mile road distribution as well as wagons and CTS repairs.

Figure 163: Optimisation of hinterland processes via a "close-to-the-port" train bundling platform in Nienburg
Source: HACON



→ Figure 164: Nienburg "Close to Port" optimization platform
Source: EUROGATE

→ Figure 165: Poznan "Close to customer" Last Mile optimization
Source: HHLA intermodal



The service innovation operated by IPORT concept through the "close to Port" and "Close to customer" approaches are multifold. Some of the pictures indicated above (Figures 164-165 – Nienburg scheme, Nienburg and Poznan) are self-explanatory. The "Close to Port", through the sorting hub of Nienburg allows the flows optimization and their industrialization during the whole length of the transit. The CTS trains arriving at Nienburg Rail sorting hub in an industrial scale originating from several German inland terminals, are optimized according to the quays of final destination. By so doing the train in the last leg of its journey is transporting only CTS traffic destined to a given pier, with no further intervention or handling activities. Time savings of up to 90% have been achieved.

For the "Close to customers" approach a number of distant Rail intermodal terminals or hubs have been identified. The most important selected for the TIGER Project Pilots were Munich Riem and Poznan. Both places are characterized by completely new green field infrastructures which are both used either for terminals of destinations in case the CTS are already in their last mile distribution or as a departing Rail service station for reaching more distant places.

All these Terminal facilities are completely independent and self-sufficient production units containing services for Last Mile distribution, maneuvering and loading facilities, CTS and wagons repairs, all falling under the EUROGATE planning, management and track & trace control systems.

The most relevant results achieved are reproduced in the following chart.

→ Figure 166 The main positive impacts achieved by IPORT innovation
Source: EUROGATE

I-PORT SOLUTIONS	REALISED BENEFITS/IMPACTS
INFRASTRUCTURE IMPROVEMENTS INVESTMENTS	→ Dwell time reduction in Hamburg seaport → Decongestion of the rail network in Hamburg → Reduction of infrastructure usage fees → Increase of terminal slots' utilisation in Hamburg seaport → Re-usage of unemployed rail infrastructure in Nienburg rail hub → Close to the market facility in Poznan according to layout guidelines allowing for optimized maritime processes and services → External depot for maritime containers (Munich) → Increased efficiency of utilisation of existing rail infrastructure (Poznan) → Constant maximum train capacity (Poznan) → Transit time reduction (Poznan)
SOFTWARE & HARDWARE TECHNOLOGIES & ICT MANAGEMENT SYSTEMS	→ IT-Tool to support wagon dispatching and slot management → Finalisation of customs processes in the hinterland (Munich) → IT tool "BLU" for the optimisation of rail processes, transshipment and storage management implemented in the hinterland terminal → IT tool "BLU Opti" for the optimisation of crane movements (semi-automated crane control) and storage system in trial and testing period → Train monitoring with customer interface
LOGISTICS PROCESS RE-ENGINEERING	→ Innovative bundling schemes (terminal dedicated trains): No shunting in the seaport → Use of electric line locomotives for train composition purposes in Nienburg instead of diesel shunting in Hamburg leads to ecological and economic advantages → Increase of train utilisation by bundling maritime volumes of several seaports → Lean shunting concept by electric line locos → Reduction of operating effort for train formation → Higher punctuality rate → Centralised maintenance and repair concept → Combination of continental and maritime volumes → High frequent shuttle trains from/to the German North Sea ports (Munich) → Integration of external depot for maritime containers with associated shuttle service from/to the rail terminal (Munich) → Hub & shuttle concept (Poznan) → Advanced punctuality by avoiding shunting operations (Poznan) → Optimised utilisation of train capacity (Poznan) → Increase of rail performance efficiency
COOPERATIVE APPROACH BETWEEN ACTORS OF THE I-PORT INTERMODAL CHAIN	→ Multi-functional employment of operational staff in Nienburg due to dedicated training concept → Train consolidation plan: Definition of regular processes, regulations and guidelines for adjustment of rail service to daily changes of the situation in the seaports → Integrated wagon maintenance and repair concept → Optimised cooperation between long haul carrier and last mile rail operator in Hamburg seaport → Process optimisation along the hinterland transport chain (close collaboration sea terminal – shipping line/forwarder – intermodal operator – rail company – trucker – customer) → Joint specification of market requirements for layout and service parameters for maritime oriented inland terminals (Sea terminal operator, Port Authority, Intermodal Operator, Rail company, Shipping lines, Forwarders) → Interfaces for integrating IT solutions in existing data processing of all actors
INNOVATIVE MARKETING STRATEGY	→ Bundling of transport volumes not sufficient for direct / block trains between seaports and hinterland terminal

Applies (mostly) for "Close to the port" concept
Applies (mostly) for "Close to the market" concept
Applies for both concepts

10.4 INTERMODAL NETWORK 2015 – MEGA-HUB

→ Figure 167: INTERMODAL NETWORK 2015 – "MEGA-HUB SPIDER" concept
Source: **TIGER**

The **TIGER Project** original idea was based on a Mega Hub green field new investment in Lehrte near Hanover, where full integration could be achieved by combining both the continental/domestic and the maritime traffic. This traffic combination together with the introduction of innovative production system involving train to train operations, would allow the generation of larger economies of scale and the possibility of servicing with regular train links more remote areas where otherwise direct train services would not be possible. However it became apparent during the Project lifetime that the Lehrte facilities could not be ready on time before the Project closure to perform the Pilot tests. Therefore the Pilot tests were performed in Munich Riem where a complete new production module entered into service at the end of 2011 having exactly the same technical characteristics planned for Lehrte. At the time of writing this report the decision about the Lehrte green field construction was approved and taken so that the Lehrte Mega Hub is now under construction. One has to appreciate that DUSS constructed and managed Munich Riem and is responsible for the construction and management of the Lehrte Mega Hub. The contract for Lehrte Mega Hub construction has been signed with a total investment of € 130 Million.

The technical component and pre-requisite for the Mega Hub Intermodal system management are:

- The Rail Hub Terminal having industrial scale characteristics;
- The double sided electrified access for momentum operations;
- The high performance Gantry Crane servicing several Rail tracks;
- The Information and Communication technology;
- The technical management tool;
- The capacity management tool;
- The train monitoring.

They are instrumental for developing the intermodal industrial production concept, the management of the operations connecting the trains in the Rail Hub, the information and communication system for handling and managing the traffic via the Rail Hub, the integration of the Rail Hub and the regional satellite terminals into the existing intermodal network, the assessment of the Sea Port inland transport traffic complementing the overland one into the Rail Hub with the emerging synergies. All these activities are monitored in real time with the availability of the booking/capacity management, the information and communication systems providing pre-existing information as well as real time progressive production evolutions. The customers are supplied with the communication of their interests covering the entire transport chain. Then the train monitoring system, the capacity management and the Terminal Operation system are integrated into each other for providing a total network visibility.

Figure 168: Advantage of Entrance with Momentum
Source: Kombiverkehr

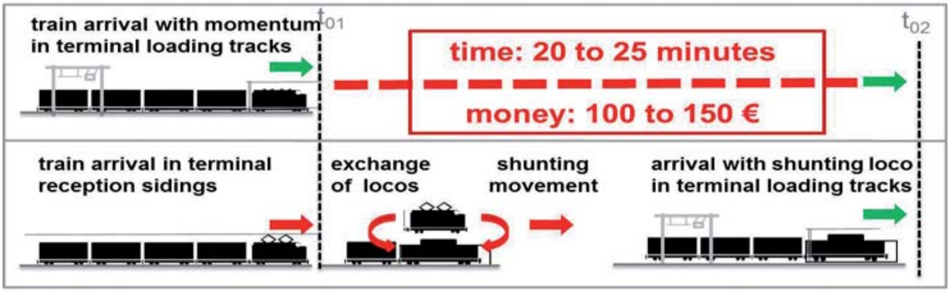


Figure 169: Entrance with Momentum and Direct Exit
Source: Kombiverkehr

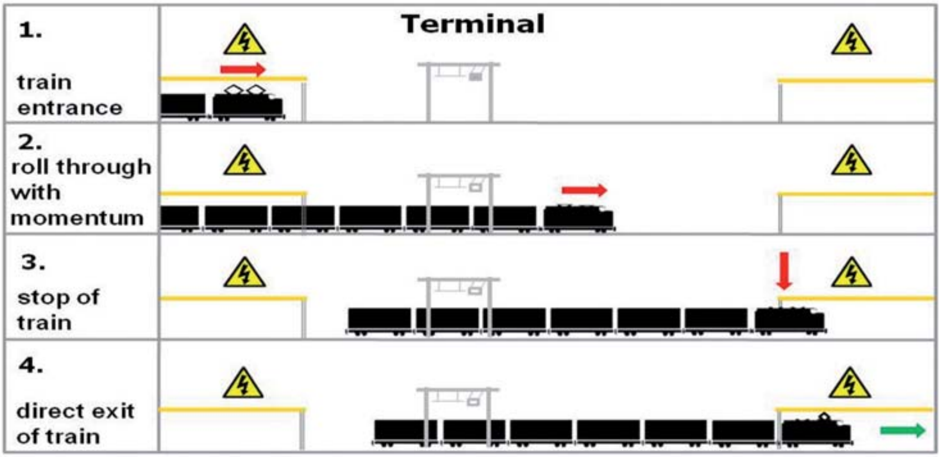
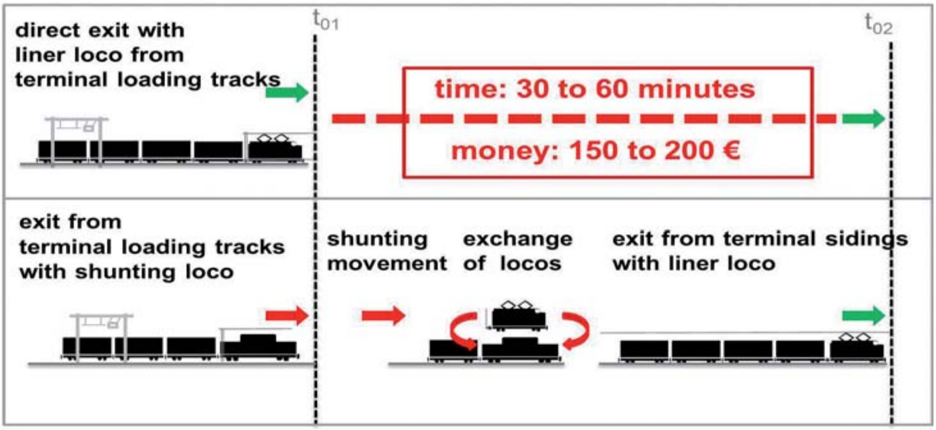


Figure 170: Advantage of Direct Exit
Source: Kombiverkehr

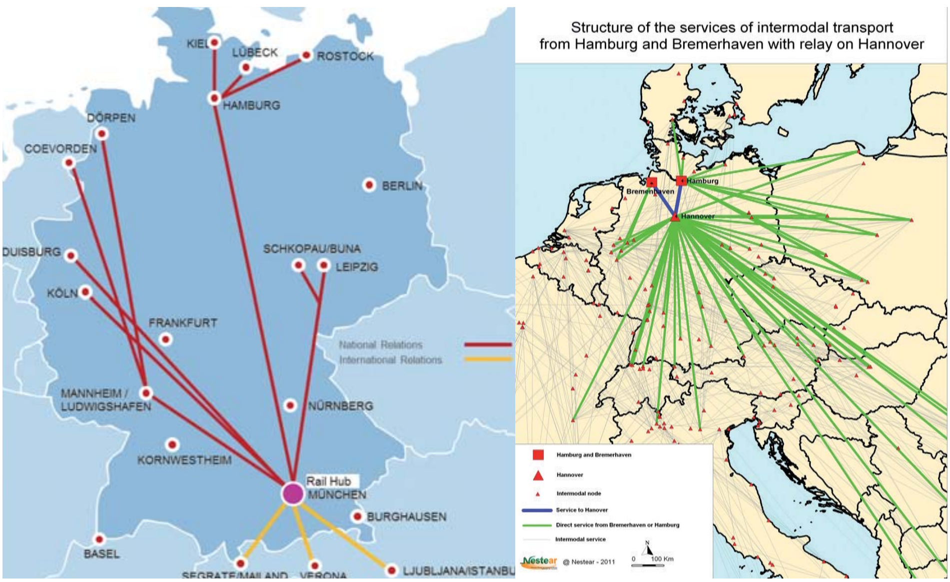


The ICT Technology is providing the timetabling, Track & Trace on the individual routes while the continuous through-booking provides alternative appropriate routings for the transportation request should the direct link not immediately available.

Once a routing has been agreed with the customer, the system automatically reserves capacity on the relevant routes for transporting the CTS to final destination. This capacity management is capable of giving immediately visualization of both the reserved and the free capacity on the various routings.

→ Figure 171: New Terminal module in Munich Riem in operation
Source: DUSS

→ Figure 172: Connection Hamburg-Munich Riem with satellite Terminals & connection Hamburg-Bremerhaven-Lehrte Mega Hub with new competitive reach from there
Source: **TIGER**



The most relevant results achieved are reproduced in the following chart:

→ Figure 173: The main positive impacts achieved by MEGAHUB innovation
Source: HACON

INTERMODAL NETWORK 2015+ SOLUTIONS	REALISED BENEFITS/IMPACTS
INFRASTRUCTURE IMPROVEMENTS INVESTMENTS	→ New infrastructure investments-Munich Riem and Lehrte; → Transit time reduction (origin/destination); → Dwelling time reduction (terminal); → Higher punctuality rate; → Operational costs reduction; → Service quality improvements and reliability → Improved connectivity
SOFTWARE & HARDWARE TECHNOLOGIES & ICT MANAGEMENT SYSTEMS	→ Information flows improvement quality and reliability through Real-time train monitoring with ETA-information, → IT-system management for terminal operation (including rail-rail) → IT-system for train capacity management (guarantee of hub connections) → Transshipment module facility management in München Riem Terminal → Infrastructure adaptation in terminal (direct train entrance and exit, crane collision protection)
LOGISTICS PROCESS RE-ENGINEERING	→ Operational costs reduction for seamless Logistics chain; → Introduction of hub concept with integration of medium and small size terminals in national and international networks → Costs reduction and increased competitiveness thanks to optimized train arrival and exit to/from terminal → Additional positive impacts in efficiency and sustainability in competition to truck service
COOPERATIVE APPROACH BETWEEN ACTORS OF THE INTERMODAL NETWORK 2015+ CHAIN	→ Close co-operation between railway undertaking, terminal operator and intermodal operator → Development and implementation of a Rail-Hub concept to improve and expand the continental and maritime intermodal network → Resources optimization; → Transport planning and operational visibility improvement;
INNOVATIVE MARKETING STRATEGY	→ Accesibility of new intermodal transport markets thanks to innovative marketing strategy

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11. THE IDENTIFIED BEST PRACTICES AND THEIR INTERNATIONALISATION

Several Best Practices have been identified and tested during the whole **TIGER Project** development. These Best Practices although having common denominators had to be adapted to the peculiarity of the different demonstration theatres where their application on the field was tested. In fact the **TIGER Project** involved Gateway Ports such as Genoa, Hamburg, Bremerhaven and Jade-Weser as well as transhipment Ports of Gioia Tauro and Taranto with uneven characteristics. In addition the geographical area of the North Sea Ports and the Mediterranean are featured by a diverse business environment posing several additional challenges for problem solving.

It was part of the contractual agreement with the European Commission that the identified Best Practices be disseminated internationally in order to allow other Sea Ports, Dry Ports and Rail/Intermodal Operators to apply them elsewhere in Europe although with the needed adaptations for local operational differences. Therefore it was decided to achieve this objective by organising four separate workshops taking place in Europe. The first one took place in Athens on the week from April 23rd to 26th 2012 during the Transport Research Arena (TRA 2012) International Event organised with the European Commission Support. This event attracted visitors from Greece and other Mediterranean Countries where the transhipment facilities are particularly relevant. The second workshop took place on June 13th 2012 in Antwerp at Transport Operations Conference 2012 (TOC Europe 2012). To this effect a cooperation agreement was made with the TOC organisers in order to have the workshop in the Conference theatre of the Exhibition floor. TOC is also an international event attracting Sea Ports, Terminals, Rail CTS operators. They represent the ideal target for the Internationalization of Best Practices: visitors and exhibitors originated from the Scandinavian Countries, England, France as well as the North European Port range Countries. TOC Europe in Antwerp proved to be a very effective tool for fulfilling the Internationalisation of Best Practices. The event is in fact very specialized attracting a lot of people from Europe and beyond. The Workshop took place in the conference theatre of the exhibition floor and was well attended. A public debate took place after the various presentations with questions and answers. The third event was organised specifically for Spain in Madrid on June 21st 2012 at the Residencia de Estudiantes with the Support of the Madrid Regional Government in order to involve the Spanish and Portuguese maritime Ports, Dry Ports and Terminals Communities for implementation of the Best Practices there. The Residencia de Estudiantes is a very historic place full of Spanish tradition. TTU the Spanish **TIGER** partner looked after the workshop organisation involving several Spanish Ports and inland terminals. Organisation support was provided by other Spanish operators. More than 60 delegates registered for this event which proved to be very successful. A lively session of questions and answers followed the presentations of the Demonstrators leaders. The fourth workshop was organized at Innotrans 2012 in Berlin from September 18th to 21st. Innotrans is attracting Operators from all over Europe and worldwide so that a workshop within the exhibition compound secured the maximum visibility. A special session was dedicated to this workshop. The workshop was very well attended and followed with maximum interest. For each one of the four planned workshops the **TIGER** leaders provided the delegates with dedicated documentation contained in a personalised **TIGER** folder. By so doing together with the fulfilment of the Best Practices Internationalisation the dissemination result was also achieved by spreading the **TIGER Project** results in very specialised and highly reputed Freight and logistics business environment.

The most important identified Best Practices were grouped in two categories:

- General Best Practices having common denominators shared by all four TIGER Demonstrators;
- Specific Best Practices applied to each individual Demonstrator incorporating the local operation peculiarities as well as their geographical territorial characteristics.

The **TIGER GENERAL BEST PRACTICES** are summarized (not exhaustive) in the following chart (Figure 174).

→ Figure 174: Major General TIGER Best Practices
Source: **TIGER**

GENERAL BEST PRACTICES	IMPACTS
1. Productivity maximisation of the existing infrastructures (*conditio sine qua non* to be competitive)	→ Shorter time to market at lower costs. Technologies are available
2. Adeguacy assessmnent of the Internal Rail Network of the Sea Port if compatible with 2020 and beyond traffic projections. If not, which adopted corrections	→ Maximisation of rail transport mode having the ability to move on land quantities compatible with those at sea → Bottlenecks corrections
3. Dry port/mega-hub nomination complementing the sea port infrastructures for transport industrialisation	→ Decongesting the sea port implementing the extended quay approach (cargo closer to customers)
4. Dry port/mega-hub capacity & technical equipment assessment for XY.000 teu handling throughput/year for transport industrialisation & investments emerging thereof	→ Reduce dwelling time in ports and existing demurrage costs. The sea port is the most expensive place where to keep traffic standing
5. Rail connections identification between the sea port & the dry port/mega-hub for implementing the transport industrialisation concept as above	→ Environmental benefits, energy saving & sustainable mobility in the long term implementing co-modality policy decisions
6. Bottlenecks correction on rail lines between sea port and the designated dry port/mega-hub such as: → Bridge construction in Hamburg; → New by pass rail line in Taranto; → New Cattolica tunnel for 9’6” high; → New rail set up in Genoa port.	→ Maximise capacity of existing infrastructures through sectorial limited investments → Accesible rail market enlargement → Traffic liquidity
7. Dry port/mega-hub location on the ten-t corridors constituting the future european network for competitive freight such as: RTE, Bologna, Lehrte, Munich Riem, Poznam.	→ Drive towards the objective of the european network for competitive freight maximising the productivity of the whole corridor through economy of scale
8. Longer, heavier & faster trains implementation on the existing infrastructures	→ Increase rail lines productivity & reduced operational costs per unit
9. Software & hardware technologies & ICT communication systems implementation for traffic & capacity management (e-seals, e-freight, e-customs, ict tools, capacity management.)	→ Reduce the overall transit time, improve service to the customers at reduced operating costs → Service and space guarantee → Barriers abatement
10. Cooperative approach adoption between transport actors for transport industrialisation	→ Economy of scale generation and trains capacity space optimization

The **TIGER SPECIFIC BEST PRACTICES** are related to each individual TIGER Demonstrator and they are reflecting the operating peculiarities, the Infrastructures and geographical situation of each Port connected to its Hinterland. They are summarized (not exhaustive) in the following chart (Figure 175).

→ Figure 175: GFC Identified Best Practices
Source: **TIGER**

SPECIFIC BEST PRACTICES APPLIED TO GENOA FAST CORRIDOR "GFC" DEMONSTRATOR	IMPACTS
1. Use of new routing "loop" via a secondary uphill rail line link to Rivalta Terminal Europe	→ Reduced congestion on main line → Increased capacity by rail → Transit time reduction → Rail services industrialisation → Environmental benefits & energy savings
2. Use of double traction diesel-electric	→ Avoid manouvers both inside the sea port rail network and inside RTE terminal network as well as providing additional traction on the uphill rail line
3. Contracted single rail operator both for manouvers inside Genoa port and RTE as well as train traction	→ Barriers abatement within ports operation → Seamless logistics chain → Interfaces simplification → Improved accountability
4. Services originally studied for terminal San Giorgio extended to other port operators such as Messina Lines and multi-users Voltri Terminal Europe	→ Economy of scale generation → Traffic bundling → Service frequency → Costs reduction → Port dwelling time reduction
5. Cooperative approach between actors of the GFC Intermodal Chain	→ Multi channel distribution approach → Maximisation of productivity for total transport chain efficiency → Partners integration into communication loop
6. Logistics process re-engineering of the entire production cycle	→ New production cycle on the quay from Vessel handling up to train loading including retraining of all involved personnel
7. Adopted customs single point of entry enabling RTE as recognised Genoa port customs point via rail : e-customs	→ Implementantion of extended quay concept & avoidance of transit formalities in Genoa port cutting dwelling time
8. Adopted innovative electronic "RFID" management traffic solutions for security & traffic fluidity such as e-seals, e-freight, track & trace	→ Security operations via x-ray moved to RTE using transponders and automatic reading devices via gate out-gate in CTS on train monitoring → Real time data monitoring
9. New intermodal rail service connection from RTE to the national and international network	→ Extended new Genoa port competitive reach South-north & West-east
10. Innovative marketing strategy for monitoring total transport chain from origin to RTE through e-seal tehnology	→ Global reach through agreements with other ports of origin/destination

Figure 176: MARIPLAT identified Best Practices

Source: **TIGER**

SPECIFIC BEST PRACTICES APPLIED TO MARITIME PLATFORM "MARIPLAT" DEMONSTRATOR	IMPACTS
1. Use of completely new routing "the Y Concept" from Gioia Tauro using the Ionian Rail Line to Bari, totally free from traffic, with Antenna Trains	→ Infrastructures optimisation → New service concept availability → Increased capacity by rail → Increased ports accessibility → Increased ports competitiveness versus North African ports
2. Use of new rail link from Taranto port to Bari Terminal with Antenna Trains	→ Infrastructures optimisation → New service concept availability → Increased capacity by rail → Increased ports accessibility → Increased ports competitiveness versus North African ports
3. Composition of the traffic of the two Antenna Trains from Taranto and Gioia Tauro in Bari on longer Intermodal Trains to Bologna using the Adriatic Rail Line	→ Traffic bundling → Services industrialisation → Service costs reduction → Use of less congested rail line compared to Tyrrenian Line
4. Integration of the maritime traffic of Gioia Tauro and Taranto in Bari with other overland traffic and traffic to/from Greece	→ Economy of scale generation → Service improvement → Costs reduction per unit
5. Longer, heavier Intermodal Shuttle Trains from Bari to Bologna	→ Economy of scale generation → Service regularity → Costs reduction per unit
6. Opening via Bologna to Gioia Tauro and Taranto maritime traffic to Central European market via Brenner & Chiasso Transit as well as on the East-west Axis via Verona Interchange	→ New competitive reach → New market opportunities → Transit time reduction → Transport sustainability → Support EU white paper policy
7. New wagons technology adoption	→ Allowing longer, heavier trains
8. Logistics process re-engineering & ICT technology track & trace and traffic management	→ New production cycle for traffic management , train monitoring → Track & trace in real time → Integration of all Mariplat Partners in the communication loop
9. Cooperative approach between operators competing in the market place	→ Multi channel distribution approach between competing operators for capacity management → Economy of scale generation → Sharing of economic benefits
10. Innovative marketing strategy	→ Stronger and more effective market penetration → Multi channel distribution → Integration with shipping lines services

Figure 177: IPORT identified Best Practices
Source: **TIGER**

SPECIFIC BEST PRACTICES APPLIED TO INNOVATIVE PORT & INLAND OPERATION "IPORT" DEMONSTRATOR	IMPACTS
1. Adoption of completely new maritime production cycle introducing the "close to the port" approach and "close to the market" approach	→ Infrastructures optimisation → New service concept availability → Increased capacity by rail → Increased ports accessibility → Increased ports competitiveness
2. Terminals/hubs identification for implementing such innovative production cycles. → brownfield approach: Nienburg → greenfield approach: Munich Riem, Poznan in operation & Teisendorf in planning stage	→ Traffic bundling → Fast responsiveness in sea ports → Increased train capacity utilization → Sorting hub for wagons according to sea ports operators → New service concepts availability → Increased ports accessibility
3. The Boxxpress Train operators'choice and terminal interface	→ Barriers abatement within ports operation → Seamless logistics chain → Interfaces simplification → Improved accountability
4. Operational perimeter definition for Nienburg: → Rail services to/from Nienburg → Wagons sorting & bundling → Re-matching of less-than-train load → Wagons repair → Import & export traffic	→ Service improvements → Elimination of ports congestion → Elimination of diesel traction in the port → Shunting elimination in ports → Centralisation of standard service and maintenance procedures → Costs and energy savings → Increased train numbers
5. Nienburg as hub for Hamburg, Bremerhaven and Jadeweser-Wilhelmshaven	→ Traffic bundling platform for connecting seaports → Handling/transfers avoidance & wagons manouvering in ports
6. Operational perimeter definition for Munich Riem & Poznan: → CTS loading/unloading → Trains formation → Wagons & CTS repair → Last mile distribution by road → Relay intermodal services for less-than-train load → CTS depot	→ Service improvements → Elimination of ports congestion → Elimination of diesel traction in the port → Reduction of shunting in ports → Centralisation of standard service and maintenance procedures → Costs and energy savings → Increased train numbers → Economy of scale generation
7. ICT technology track & trace and traffic management for close to the port and close to market approaches	→ New production cycle for traffic management, train monitoring → Track & trace in real time → Integration of all operators and Boxxpress in the communication system
8. Longer, heavier intermodal shuttle trains	→ Economy of scale generation → Service regularity → Costs reduction per unit
9. Logistics process re-engineering	→ New production cycle based on "close to port" and "close to market" approaches including retraining of all involved personnel
10. Innovative marketing strategy	→ Stronger and more effective market penetration → Multi channel distribution → Integration with shipping lines services

→ Figure 178: MEGA HUB identified Best Practices

Source: **TIGER**

SPECIFIC BEST PRACTICES APPLIED TO INTERMODAL NETWORK 2015 "MEGA-HUB SPIDER" DEMONSTRATOR	IMPACTS
1. Adoption of innovative intermodal production concept at Munich Riem & Lehrte under construction	→ Freight traffic optimisation → Infrastructures optimisation → New service concept availability → Increased capacity by rail → Increased ports competitiveness → Increased ports accessibility → Reduced costs → Environmental benefits
2. Integration of megahub into the sea ports/inland transport network for sinergies effect, accessing regional satellite terminals	→ Regular shuttle trains services with high frequencies → Economies of scale → Traffic bundling → Increased train capacity utilization → New service concepts availability → Multiplication of capacity by extended quay concept → Integration of peripheral terminals into the rail network → Extended competitive reach
3. Implementation of operational concepts connecting trains in the mega hub (trains to trains)	→ Industrial scale productivity → Seamless logistics chain → Interfaces simplification → Improved accountability
4. Implementation of double sided electrified frictionless rail access and high performances gantry cranes servicing several rail tracks	→ The train drives along the track by inertia momentum up to the next electrified contact avoiding additional manouvers → Shunting costs reduction → Time savings
5. ICT-intelligent technologies for terminal operations including rail-rail	→ Traffic bundling → Integration of maritime with overland traffic → Train space optimisation → Train to train operation → Terminal costs reduction
6. ICT-intelligent technologies for train capacity management including hub connections & traffic in transhipment	→ Services quality → Space automatic management up to final destination Irrespective of how many connections/transhipments are affected (airlines system)
7. ICT-intelligent technologies for real time train monitoring	→ Services quality → Effective trains performances
8. ICT-intelligent technologies for managing and supervising the overall intermodal traffic operations in the whole kombiverkehr network	→ Whole network optimisation providing alternative routings & alternative services in costs,days, transit times
9. Logistics process re-engineering	→ High productivity system → Capacity maximisation → Skills improvement through re-training & technology usage
10. Innovative marketing strategy	→ Stronger and more effective market penetration → Multi channel distribution → Cooperative approach

12. THE TIGER PROJECT CONCLUSIONS, RESULTS & RECOMMENDATIONS

This Report has the objective of summing up the **TIGER Project** process development including the market projections 2020, the facts, the figures and the challenges overcome during the project duration. In addition, during the Project lifetime the research had to survey the Infrastructures network availability, the technologies to be adopted, the presence of bottlenecks, the socio economic and the environmental aspects. A further element of complexity was represented by the economic recession which the partners, who are the key actors in **TIGER**, had to confront with from the very beginning of the Project start-up date in September 2009. This economic downturn has not exhausted its negative effects on the European Economies at the time of writing this report in 2012 which stands to indicate that **TIGER** was able to respect its contractual obligations and fulfil its achievements under unfavourable macro-economic circumstances.

Drawing towards the Project conclusion one can say that the **TIGER** management during the Project development had to deal with two choices having different impacts on the partners activities and on their future operational scenarios:

1. To consider delaying the strategic decision-making imposed by the Project challenges in order to take them in a more favourable economic climate and more steady business environment;
2. To take a more proactive and decisive optimistic outlook on the future economic recovery. This time of recession to be used as a respite with no pressure from traffic congestion in order to re-plan, re-engineer, re-organise the Sea Ports and Hinterland Logistics activities to be ready when the economic cycle enters into a new expansion phase.

The choice made by the **TIGER** partners was the second one for the following reasons:

- The first choice which appeared to be easier to be taken would have meant a deviation from the original Project objectives and would not have represented a positive sign of innovation towards fulfilling higher productivity of the existing system and networks. De facto the first choice would have been only a choice of delaying the decision making and would have been against the logic of market players acting in favour of the market rules in order to influence them positively.

- Moreover the European Commission through the adoption of the White Paper, the European Rail network for Competitive Freight and the Horizon 2020 was indicating the will and determination to pursue long term objectives towards a more efficient, environmentally friendly and sustainable freight mobility.

The **TIGER** Partners felt that they not only wanted to support this European Commission efforts but they wanted to take concrete actions driving towards the fulfilment of this objective.

- It has been apparent now for some time that major Infrastructure investments capable of resolving like a magic wand the traffic engulfment in Europe is a non-realistic dream far away from reality. Budget constraints imposed by individual Government spending reviews indicate that financial resources for major investments are scarce to the point that several already approved Infrastructure Projects had to be postponed. In addition even assuming that funds would be available, the very long time to market of any new Infrastructure investments, favours the choice of making a better use of the available resources. This in itself does not forego at all the need of investments in new Infrastructures to be encouraged anyway. With the choice of making a better use of the available infrastructures, the system at least provides the additional capacity required by the European commerce and industries to prosper and expand up to the time when such new Infrastructures will become available.

- **TIGER** is a market driven Project supported by key market actors. It is during periods of economic recession with activities downturn that the entrepreneurs find new ways of becoming more productive and competitive. Innovative solutions are found and implemented which in period of opulence are more difficult to be discovered. Economic troughs are cause of difficulties as well as many opportunities. Such opportunities were reinforced by the **TIGER** market Research projections 2020 elaborated by accessing three different methodologies: CAGR, GNP, NESTEAR. The three methodologies although with very slight differences pointed towards a decisive maritime traffic recovery. By 2020 many European Ports will reach their calculated technical handling capacity and for this reason the **TIGER** actions are absolutely vital in order to maintain the traffic fluidity between the Ports and their Hinterland destinations.

- The **TIGER** partners unanimously took the view that the Project had a very strong fundamental business opportunity orientation and that the contribution received from the European Commission under the Project lifetime represented an important driver for attracting private investments on the **TIGER** business rationale. Once the **TIGER** partners had taken the decision to participate to this Project and at the same time had allocated the investments for seizing new business opportunities, this process could not be stopped.

  TIGER attracted private investments for several hundred millions Euros in Dry Ports Infrastructures, Dry Ports upgrading, equipment, intelligent and management systems, new technologies, training activities for refining personnel competences and inspiring new ones. All of this to produce innovative services for the customers who are challenged themselves by evermore sophisticated Supply Chain needs. The **TIGER** partners through the Project fulfilment wanted to satisfy these new market needs.

CONCLUSIONS WITH MARKET & FREIGHT MOBILITY RELEVANCE

- The Research on Market Requirements conducted through the use of separate methodologies explained in details in other parts of this report, have concluded that by 2020 most of the traditional Gateway Ports of the North European range will reach their technical capacity throughput. The same situation would apply also to the Gateway Mediterranean Ports.

- The same Research reached opposite conclusions for the Mediterranean Hub transhipment Ports of Gioia Tauro and Taranto which operate with a more volatile Business Model. These Ports are and will be more vulnerable to the competition by the North African Ports capable of attracting transhipment traffic at lower handling costs. In this connection the **TIGER** Research has evidenced that the South Mediterranean transhipment Ports located on mainland Europe such as Gioia Tauro and Taranto have the advantage of attracting traffic destined to Hinterland destinations being connected to the European Rail Network and accessing many European destinations with much shorter transit times. This indeed is a considerable point of strength provided that these Ports, in combination with their Shipping Lines, are capable of organising regular and efficient Rail services for reaching at competitive costs several Hinterland destinations.

- The **TIGER** Research has evidenced that the Shipping Lines Business Model is driven by reduction of their Production costs achieved through the deployment of giant CTS vessels.

Most of them, in order not to be pre-emptied in the competition game by the more aggressive ones, have embarked in a colossal renewal of their fleets. At the time of writing this report about 150 new constructions have been delivered with capacity varying between 10 to 14.000 TEUs. A leading Shipping Line ordered to a Korean Shipyard four new CTS ships of 18.000 TEUs capacity and ships designs are already available for vessels having capacity of up to 23.000 TEUs. These giant vessels produce their competitive advantage while at Sea which entails that they are calling at a fewer number of Ports where they will be performing a higher number of movements. This race towards giant tonnage is bound to bring about further changes in Ports CTS handling as well as additional Hinterland industrial distribution requirements to/from these Ports.

- One has to say that the Economies of scale generated at Sea by these giant CTS vessels did not find the same compatibility when the CTS have been discharged on the Ports quay Terminals. Therefore the immediate challenge to be overcome is the generation on land, be the modality Road, Rail or Inland Waterways, of the Economies of scale compatible with those generated at Sea. Hence the Transport industrialisation, to/from Sea Ports to Hinterland destinations via Dry Ports connected through regular and multiple shuttle trains and when available barges for river navigation, becomes a priority. To this effect **TIGER Project** has proven to be a forward looking one since road modality which is prevailing in Europe does not seem to be particularly suitable for transport industrialisation. Additionally the need of energy and environment conservation are progressively driving towards modal shift and sustainable mobility.

- **TIGER Project** has proven the validity of the Sea Ports, Dry Ports, Mega Hubs and Freight Villages as freight bundling centres for Economies of scale generation. In particular these Infrastructures located on major European freight corridors (TEN-T Network or European rail Network for Competitive Freight) constitute the vital nodes where freight multiplication, freight optimisation and transport industrialisation can become effective. It is obvious that these Infrastructures must have capacity characteristics compatible with Economies of scale and transport industrialisation requirements.

- The presence and availability of such Dry Ports/Mega Hubs/ Freight Villages on major European corridors constitute integral part of the Rail Network for Competitive Freight. In fact it is through them that it is possible to connect the peripheral Terminals into the whole Rail intermodal network creating a capillary distribution system where co-modality can be exploited at its best with long hauls operated by trains or inland waterways and last mile distribution from peripheral Terminals operated by road.

- The **TIGER Project** assessment of the existing Infrastructures in the areas of interest, including local Rail network, Rail corridors, Dry Ports, Mega Hubs and Terminals has surfaced the need to correct a number of bottlenecks. Such need has been reinforced by the traffic projections 2020. Failing such correction the risk is represented by the inability to achieve the planned traffic optimisation and the full implementation of the co-modal productivity approach. Some of these bottlenecks have been identified on main Railways corridors involving decision making at National and International policy levels. The local and National Authorities of the Countries involved have been made aware of the necessity of removing such bottlenecks.

- Likewise the Shipping Lines Business Model is driven by the reduction of their slot costs achieved through the deployment of giant CTS vessels, the Overland Business Model promoted by **TIGER Project** is driven by the reduction of the unit costs transported through the implementation of transport industrialisation achieved through industrial shuttle trains operated between sea Ports, Dry Ports, Mega Hubs and Freight Villages.

- The strategic relevance of these nodes is capable of delivering an additional value to the European Network. In fact for decades the traffic development in Europe was concentrated on the axis North-South and vice versa. The expansion of the European Union towards the East and the development of the new accessing Countries having above average growth rate, materialized a greater need of freight exchanges in the West-East direction and vice versa. It is through the intersection of the nodes that the North-South corridors integrate with the West-East ones giving substance to the full integration of the various corridors into the European Network.

- It appears obvious that in these high capacity nodal points the production tools such as gantry cranes, reach stackers, lifting equipment, manoeuvring locos, etc., must allow state of the art loading/unloading and train to train operations compatible to the Economies of scale of a totally industrialised production process. To this effect also the rolling stock deployed on the shuttle trains must be of the latest technology allowing longer, heavier and faster trains to be operated between the serviced Sea Ports, Dry Ports or Mega Hubs. Needless to say that repair workshops for both rolling stocks and CTS are available facilities at the nodal point in order to secure a continuous operation during the 24 hours production cycle.

- The **TIGER Project** development process has proven that there is another productivity multiplicator in addition to Dry Ports, Mega Hubs, Freight Villages as nodal point of the network. This productivity multiplicator is represented by the implementation of innovative and intelligent technologies capable of managing production programs, shuttle trains, capacity optimization, subsequent bookings, alternative routings as well as track & trace and other ICT communication within the customers/users loops.

- One of the main **TIGER** common denominator through the completion of the four Pilots Demonstrators was represented by the need of having to re-engineer the production cycles and the business process. Profound modifications were necessary in order to secure a proper migration from the previously existing "status quo" to the new production or service levels. Extensive training and re-training activities were necessary for introducing and/or upgrading the management and personnel skills to the competent usage of the new tools be them software or hardware.

- Last but not least the **TIGER Project** highlighted the existence of a series of bureaucratic and psychological barriers needed to be overcome. Those encountered within the **TIGER Project** lifetime have been faced and resolved. However outside the Project boundaries both the operators and the competent Authorities have to make renewed efforts for improving the traffic fluidity. Reference is made to self-generated impediments, the "it cannot be done" syndrome, the customs, administrative and security regulation not always up to date with the use of innovative technologies. Manual, visual and physical interventions are still required in various phases of the transportation process also when new technologies, satellite communications, video cameras remote controls, RFID bar code Technologies, X-rays, E-seals, Transponders, pods and similar tools make them absolutely redundant, unnecessary, costly and therefore inefficient.

ACHIEVED RESULTS OF THE PILOT TESTS IN THE FOUR SEPARATE OPERATING THEATRES OF DEMONSTRATION

- The new gigantic dimension of modern maritime transportation, deploying vessels of up to 18,000 TEUs, dictate an operational pattern of a reduced number of port calls characterized by a higher number of movements. The **TIGER Project** contributed to maintain the Sea Ports free from congestion by re-forwarding the traffic to the Hinterland via the Dry Ports.

- The deployment of innovative technologies, both soft and hardware, have contributed to a considerable improvement in the service quality offered to the market place, transit time reduction and performance control through track & trace. Administrative and bureaucratic barriers have been abated through the implementation of E-freight, E-seals, E-customs. The introduction of intelligent management systems governing trains capacity, bookings, loading/unloading, service quality, traffic bundling and schedules improved considerably the trains productivity and the capacity optimization. Security controls have been largely simplified through the adoption of E-seals which can be checked electronically. The progressive extension of this technology to the customs points/ports of origin allows the full guaranteed control of the cargo in transit up to the customs point of arrival. This represents a major step change towards the problem solving of the physical cargo inspection which in the last ten years has been a major cause of additional costs and delays in Sea Ports.

- Selected investments inside the Terminals and the adjacent quays as well as in the Port areas Rail network correcting bottlenecks have proven to be very productive. Rail connections have been upgraded reducing dwelling time, transit time and costs.

- As a result of these selected investments, operated by the **TIGER** partners, the working cycle in the interfaces "Ship-to-Shore" and "Shore-to-Train" has been re-engineered and re-programmed eliminating idle time and interruptions. The duty cycle has become seamless. Several of these barriers have been eliminated favouring the adoption of one contractual interface capable of governing the entire process. This is a vital passage conducive towards transport industrialisation.

- The Dry Ports, Mega Hubs, Freight Villages have proven to be a vital ingredient not only for the maritime traffic but also as freight bundling point for transport industrialisation. Rivalta Terminal Europe, Munich Riem, Lehrte, Interporto di Bologna, Bari, Nienburg, Poznan and the new planned locations of Alessandria and Tiesendorf, have introduced a new strategic vocation to their mission increasing substantially the span of their business. They have become vital nodal points of the European Rail Network as catalyst of traffic attraction zones either for final hinterland distribution or for re-launching trains to other Terminals in the Network. In particular in the **TIGER Project** these Dry Ports have allowed the implementation of the extended quay concept and the traffic industrialization with their reference Sea Ports of Genoa, Hamburg, Bremerhaven, Jade-Weser, Taranto and Gioia Tauro.

- The identification of the Dry Ports, Mega Hubs, Freight Villages capable of handling Rail traffic in an industrial way, combined with the new seamless duty cycle in the Sea Terminals, have made possible the handling of multiple industrial shuttle trains operated between the Sea Ports and the Dry Ports. In particular for Genoa Port the recognition of Rivalta Terminal Europe as fully authorized Genoa customs point allowed the through-transit from the ships to Rivalta without formalities.

- The added result demonstrated by the **TIGER Project** is represented by private companies who have understood both the business development potentiality of the maritime traffic as certified by the projection 2020 and the business development emerging thereof by investing in Dry Ports and Mega Hubs facilities. The involvement of private initiatives in this field is relatively new and it could be taken as an example to be followed for obtaining financial resources for public private consortium in Infrastructures investments.

- The **TIGER Project** fully demonstrated the viability of the two approaches: "better use of the existing Infrastructures" and "transport more with the available resources" limiting the Infrastructures investments to the bottlenecks corrections. These approaches do not at all pre-empt the construction of new Rail Infrastructures but on the contrary they provide the extra time needed for any new investment to come to market.

- Within the domain of "better use of the existing Infrastructures" and "transport more with the available resources" the **TIGER Project** demonstration proved in practice that not necessarily the shortest distance between a Sea Port and a Dry Port represents the ideal solution. Today International trade exchanges are characterised by the principle of the "virtual distances". This means that the prices or costs charged are not proportionate to the physical distances. Virtual distances are common both in maritime and overland traffic. The driving force of virtual distances is the traffic imbalance between Countries and Continents. Similar situation applies when the shorter Rail corridor between two nodal points is totally congested or has to cross major cities where heavy passengers and commuters traffic represent an obstacle for freight trains. In this case alternative longer routes congestion-free represent a viable alternative both for costs and services. Within **TIGER** the use of the Ionian line from Gioia Tauro to Bari and the use of Munich Riem and Lehrte to relay traffic to other Terminals represent a practical example.
- The objective of achieving traffic industrialisation dictates the need to develop techniques of operational standardisation. This means that both physical handling as well as information flows through ICT technologies have to be repeated endless time during the production cycle in a "standard format". This approach goes hands in hands with the progressive standardisation worldwide of the vehicles, CTS, trucks and wagons 'sizes deployed on the International trade lanes.

RECOMMENDATIONS

- Within the **TIGER Project** Work Packages one in particular dealt with the "Internationalisation of Best Practices". Four separate workshops were organised in different part of Europe for disseminating the Best Practices implemented during the Project lifetime. These Workshops took place in Athens, Antwerp, Madrid and Berlin. Many Best Practices emerged during the **TIGER Project** implementation. The idea driving these workshops was the application of such Best Practices in Countries other than those involved in the **TIGER Project**. One of the recommendations is to make sure that the experiences, the improvements, the solutions adopted in **TIGER** could be progressively applied in other European Countries for improving the traffic fluidity through recognised efficient patterns of operations.

- During the **TIGER Project** lifetime the partners realized and experimented that the space in Europe is a limited resource. The freight mobility Infrastructures are also limited and because of this they are congested most of the time. The Ports Infrastructures cannot be expanded beyond their geographic limits and the costs of investments at sea are far more expensive and with longer return than investments on land. In addition the **TIGER** partners and the operators around the Ports realized that the Sea Terminals are the most expensive places to keep CTS on standage. The Ports should regain their original mission of connecting the Sea with Land and in order to make this happen the traffic should be kept moving in both directions. Only by working towards this traffic fluidity objective, the Sea Ports can increase substantially the productivity of their Infrastructures making a much more efficient and productive use of the existing resources. Therefore one recommendation emerged from the **TIGER Project** is the need to increase and improve the connectivity between the Ports and the Hinterland through selected investments in the inner Ports Rail/Road network, bridges upgrade, electronic switches, bottlenecks corrections, quay Rail interconnections, etc. In addition to the inner Ports network upgrading it is necessary to have inside the Port areas operating Rail terminals capable of handling traffic of multiple trains daily in an industrial way.

- In order to make realistic the traffic fluidity in the segment Ship to Shore and from quay CTS Terminals to Hinterland destinations it is necessary to avoid any congestion inside the Ports areas. This objective can be achieved only through the availability of Dry Ports, Mega Hubs, Freight Villages in the freight attraction zones capable of handling traffic in an industrial way. This is a pre-requisite for producing on land volumes compatible with those generated at Sea by the giant CTS vessels. One recommendation emerged during the **TIGER Project** and during the demonstration Pilots is the need to identify and make available these Dry Ports connected by Rail to the Sea Ports as vital nodes of the future European Rail Freight Network. In fact the European Rail Network for competitive Freight legislation approved by the European Parliament is a combination of Rail corridors and nodal points (Dry Ports, Mega hubs, Freight Villages, Terminals). They are the traffic multiplicators through bundling, relaying and last mile distribution.

- It has become apparent during the **TIGER Project** lifetime that the deployment of giant CTS vessels up to 18,000 TEUs in sizable numbers changed the traditional business model of road distribution from the Ports based on a one by one CTS or at best on a 2by2 20’ CTS distribution. Such Business model has encountered three major obstacles difficult to overcome:

  a. Every vessel is handling in each Port of call an increased number of movements both in Import and Export and the service frequencies operated by different Shipping Lines is generating calls in the major Ports nearly every day.

  b. The road vehicle fleet itself is not expandable having reached a limit of rigidity dictated by shortage of drivers and tariffs competiveness. The continuous increase in fuel costs have eroded profit margins for the transport companies hence force reducing the ability for new investments. The driver shortage has proved to be an insurmountable hurdle for those companies wanting to buy new trucks.

  c. The only mode of transport capable of handling CTS in an industrial way in addition to the feeder vessels and inland waterways is Rail intermodality which can be operated between the Sea Ports Terminals and the Dry Ports in the Hinterland. Moreover the giant CTS vessels calling at an inferior number of Ports, are handling traffic into these Ports with less optimised overland distances compared to the final destination/origin points. This process is generating a demand for longer distances transportation with an increased competitive penetration to the Hinterland to and from these Ports. Road distribution alone is no longer capable of dealing with this traffic demand for longer distances at competitive costs.

One recommendation which has been the driver of the **TIGER Project** itself is that Rail distribution must become central in any European Port competitive reach should the traffic fluidity be improved as from now and up to the years to come. The traffic projections 2020 clearly indicate that the expected traffic volumes can be handled only if the Rail performance from the Ports to the Hinterland is increased very substantially. Also road modality will have to increase its own throughput capability although at a slower pace than Rail.

- If the above recommendation of industrial transportation by Rail to/from Sea Ports to/from Dry Ports is implemented then a new recommendation is becoming apparent. The road productivity will be enhanced by concentrating on last mile distribution from Dry Ports, Mega Hubs, Freight Villages and Terminals to final destination. This is the so-called "last mile distribution". By implementing this business model, multiple deliveries can be performed in one day from the Dry Ports on short distances, fulfilling both the objective of productivity, equipment turn around, competitiveness, cost reduction as well as objectives of environment protection by extracting the best possible performance from road (co-modality).

- The individual European Government budgetary constraints dictate a much stricter selection of the investment priorities. Investments in new Mega-Infrastructural Projects are to be ruled out for the immediate future, which means that the limited resources are to be channelled towards Projects capable of accruing immediate results and quick capital return. The applicable principle is "maximizing the expected results with the least amount of investments". The **TIGER Project** has identified a number of bottlenecks encountered during the **TIGER** process lifetime on the Rail connection between the Sea Ports and the identified Dry Ports. One recommendation is to start immediately the work for correcting these bottlenecks which today represent a source of Rail congestion and an impediment towards Rail traffic industrialisation.

- The other major Freight multiplicator in addition to the Dry Ports, Mega Hubs, Freight Villages, which are vital for traffic bundling, is represented by the technology dimension. The technology innovation has many facets. During the **TIGER Project** lifetime two major technology families have been implemented: the ICT, intelligent management software technologies and the equipment, handling and rolling stock hardware technologies. These software and hardware technologies alone are capable of delivering the desired results when applied in the right place and at the right time. The TIGER Project has identified the nodal points in which these technologies are capable of impacting positively as freight multiplicators. In the **TIGER** Sea Ports, Mega Hubs, Dry Ports, Freight Villages these technologies have been applied and demonstrated. Intelligent systems such as trains management, capacity management, trains monitoring, service monitoring, track & trace, RFID, electronic transponders have been applied and rolled out for market users. Similarly ICT technologies using satellite communication have been adopted for complementing and supplementing the above intelligent systems. Other innovations such as E/seals, E/freight, E/customs have been identified as measures of success. One recommendation emerged from the **TIGER** Pilots demonstrations is that it is necessary to implement on the Rail transport chain a much higher degree of technology innovations capable of delivering immediate benefits in a relatively short period of time.

- Likewise a variety of hardware technologies have been identified, tested and implemented during the TIGER development process. Equipment, lifting gears, locomotors, train-to-train transloader, new technology wagons, have been used in the Pilot phase. Both the software and hardware technologies have been instrumental for re-engineering the work processes all along the transport chain simplifying the interfaces and shortening dwell time in the Ports, Dry Ports and transit time with evident costs saving benefits. One recommendation emerging thereof is to take as a permanent objective the progressive modernization of the hardware and software technologies which are instrumental for implementing the management and the monitoring of the service performances in real time and at reduced costs.

- The technological dimension has allowed to achieve and demonstrate in the **TIGER Project** how both the security and custom formalities can be grouped together in one seamless process through the adoption of E seals and E customs. The traditional way of managing both security and custom formalities is the physical stoppage and inspection of the vehicle in transit. Such old fashioned practice leaves itself open to personnel interpretation of the rules, very slow timing, transfer costs, manoeuvres, additional lifting, demurrages. All in all this equates to a cargo victimisation generating substantial extra costs, delays, lost orders, lost sales, damages, etc. Through the E/seals, E/customs, transponder technologies, RFID, the entire security and customs process can be controlled electronically through the entire transit. The E/seal applied by the customs at origin is capable of guaranteeing the integrity of the cargo up to the customs of arrival. If the customs of arrival is in a Dry Port in the hinterland, the loading on the train at the Port of arrival is accepted as a guarantee of journey continuation from the ship to the Dry Port of arrival. The customs authority with only one customs clearance at the Dry Port of arrival is eliminating the intermediate physical examination. The E/seal is controlled electronically and it offers a much higher reliability than any physical visual or manual control. One recommendation is to promote the extensive diffusion of such system since today the technological tools allow such security and customs control much safer than those operated by men.

- The Just in Time technique has contributed to divulge into the public perception the idea that shorter distances are synonymous of faster time. This is certainly a true assumption provided no external factors are interfering during transit. These external factors are beyond the control of the actors involved and therefore totally unpredictable. Moreover the elements of unpredictability become almost certain when the shorter routes are structurally congested. This applies to both Road, Rail and Air. The elements of unpredictability in inland waterways is dictated by the level of water in the rivers which could be either too much or too small. One must not forget moreover that our time is characterized by “virtual distances” were the idea of shorter distance is disconnected from two relevant dimensions such as costs and time either together or considered separately. These considerations emerging from the real Logistics world and the market place, conduce toward the concept that a longer routing could result in being more competitive in time and costs contradicting the prevailing perception that “shorter is cheaper”. One recommendation is to consider in Rail transportation between Sea Ports, Mega Hubs, Dry Ports, Freight Villages also secondary lines when the direct lines are congested. During the Project lifetime secondary lines have been used effectively in the Pilots demonstration.

- One of the major problems affecting Rail freight has been and still is the fragmentation of operations compared to a door to door service which can be offered by a road truck. Such fragmentation is originating from both historic and psychological barriers. Due to the continuous compression of the Supply Chain, the ultimate customers do not accept any longer that a component of their Supply Chain represented by Rail is having within its own perimeter elements of disruptions. Such disruptions are caused by operations, actors, intermediaries which today do not have cause to exist. Reference is made in particular to manoeuvres, handling operations, transhipment, stoppages, local rules, conflicts between governing bodies or Authorities, trade unions or private sidings consortium. In such a confused operating theatre, each intervening actor is claiming a right of authority and a right of claiming operational dues generating costs with no value for the ultimate customers. The end results for Rail are inefficient and costly operations with consequential traffic loss. All of this represents a negative heritage from the past which must be totally cancelled if Rail freight is to become competitive now and in the future. In **TIGER Project** similar situation have been encountered and resolved by nominating one unique interface capable of assembling together these interrupted operations into one unique work flow executed at competitive costs. One recommendation emerging from such an experience is to adopt measures during the planning phase of Rail freight or intermodal services capable of compacting the whole Rail process into one work flow supplied by one single operator accountable both for costs and services.

- During the **TIGER Project** Pilot demonstration of new services between Terminals, Dry Ports, Mega Hubs and Freight Villages the various operators involved in the intermodal transport chain had the opportunity to appreciate the availability of repair workshops both for rolling stock, CTS and swap bodies. In particular the efficient up-keeping of the rolling stock and the maintenance of the CTS/swap bodies is an indispensable element for equipment turn around and for preventing any train stoppages while in transit. Likewise the proper maintenance of the transported CTS is itself a pre-requisite for safe-loading on the ships and /or safe and punctual performance of the last mile deliveries from the inland Terminals, Dry Ports, Mega Hubs, Freight Villages. One recommendation is therefore the presence of such service facilities in the Dry Ports, Mega Hubs, freight Villages where regular shuttle trains are operating in an industrial way. By so doing the Rail traction company in charge of moving the train, is confident that the rolling stock deployed on the service is at the required standard for performing the traction in safe condition and according to the train schedule.

- At the time of writing this report it is known that a Project name "MARATHON" has the objective of testing on the operational field longer, commercially faster and heavier trains. This will be possible thanks to new radio communication technologies, innovations on rolling stock, double traction with a second "slave" locomotor in the middle of the convoy, innovative braking and signalling systems. Although such pilot is outside the **TIGER Project** scope, the **TIGER** partners recognized this to be a very relevant step change for promoting Rail freight transport industrialisation between the Sea Ports to the Dry Ports in the hinterland. This idea of longer, commercially faster and heavier trains has found support between the **TIGER Project** partners to the point that in the South of Italy where trains are shorter than in Central Europe, longer trains have been implemented using new wagons. Only by lengthening marginally the trains by one or two wagons transport costs are saved and additional capacity is generated at very marginal costs. One recommendation has emerged from this Best Practice that indeed longer, commercially faster and heavier trains must be implemented on the European network between Sea Ports to/from Dry Ports or between the Dry Ports, Mega Hubs, Freight Villages themselves situated in the hinterland whenever Economy of scale and traffic bundling possibilities are available.

- Another opportunity experimented positively during the **TIGER Project** lifetime is the cooperation amongst various actors of the Rail freight transport chain. In different geographical operational theatres several kind of cooperative approaches have been experimented with very successful results. In particular in the North European Ports of

Hamburg, Bremerhaven, Jade-Weser, the local Port Authorities and Terminal operators exercised a pivotal role with forwarding agents, Rail freight operators, traction companies and other key actors of the Port activities in order to optimise the Port system productivity. Problem solving and barriers abatement were the focus of discussions tending to eliminate administrative, bureaucratic and psychological barriers in the interest of efficiencies and costs reduction for the cargo owners. In the Genoa Port ships agents, train operators, Dry Port management, customs and security officials were involved in several dedicated workshops in order to streamline formalities, information flows, security and customs operations. New ideas of E/seal, E/custom, E/freight were tested with very positive outcome. These efforts were successful resulting in shorter dwell time, faster transit time, quicker equipment turn around and consequently lower costs. On the MARIPLAT demonstrator a further more sophisticated step forward was achieved. Intermodal operators who are competitors in the market place, joined forces in order to participating to the train loading in the interests of the train costs optimization. This cooperative approach is very common and largely implemented in other modes of transport. In the maritime field slot charter agreement are common place between competitors. A similar situation is applied since decades by the airline both in the passengers as well as in the freight traffic. Also competing organisations participate to the efficient co-loading of trucks in the LCL business. In Rail freight this practice is almost unknown. One recommendation emerging thereof is the need in Rail freight or intermodal traffic to adopt a much stricter cooperation amongst the key actors of the Rail transport chain which is necessary for modernising the sector. The cooperative approach is capable of managing more efficiently the available capacity and introducing new practices in the marketing and commercial organisation. The commercial approach must evolve from mono-channel to a multi-channel distribution Business Model capable of achieving an effective service segmentation and a much more efficient selling penetration.

➔ All the above recommendations equate to a major step change in the management of the Rail freight traffic. In order to implement these recommendations it is necessary to adopt a new business model based on transport industrialisation, economy of scale, traffic bundling and cooperative approach between the key actors of the Rail transport chain. The efficient loading of the trains, the capacity management, the ICT and intelligent system technologies are all ingredients for achieving seamless transportation to an industrial scale. The multi-channel distribution approach is capable of understanding much better the ultimate customers' needs for producing services, which are instrumental for the users' problem solving. Rail freight constitutes only a part of the entire customers' supply chain and regular industrialised shuttle services between Sea Ports, Dry Ports, mega Hubs, Freight Villages are capable of providing the necessary guarantee of regularity eliminating the uncertainties which have characterised Rail freight up to now. One recommendation is emerging from the **TIGER Project.** A new offer-driven Business Model is necessary compared to the old fashioned demand-driven. In the service industry, services must be available if one wants the customers to buy them. When services are not available, which is the prevailing situation in Rail freight, the customers are not in a position to purchase services that do not exist. In Rail freight it takes months to produce a new service being Rail freight a "closed system". During such lapse of time the customer is finding new solutions, new routings which do not consider Rail as a viable proposition. This still is and has been the prime cause of continuous Rail freight decline. In all other transport modes be them for passengers or freight, the prevailing Business Model is offer driven. It is almost impossible to understand while in Rail freight the European Rail system has adopted the long term losing Demand driven approach which is not responding to the customers' needs. Once the offer driven Business Model has been adopted the immediate consequence is the need to implement the "selling of capacity" through the multi-channel distribution approach and innovative marketing techniques capable of extracting from the services produced the differential value perceived by the customers. The Rail operators have within their own system a very evident example of their own creation. The passengers new high speed services are offer driven, high capacity services and sales segmented with outstanding market success. These services have eliminated the airlines on medium distances through fair and effective service competition. This Business Model must also be applied to freight.

- In all four **TIGER** demonstrators which were implemented in different European geographic theatres, new production processes, duty cycles have been adopted for achieving the Project objectives. New investments in equipment, ICT and intelligent tools, machinery, locomotors, transponders, electronic seals, management systems, computers, wagons, lifting gears, etc. required a lot of training and re-training activities involving both white collars as well as blue collars human resources. The roll out into the market place of such innovations involved trials, experiments, pilots, processes, commercial actions, agreements as Best Practices capable of bringing the desired results. All these activities entailed extensive training both in theory as well as in practice. Such activities lasted during the whole Project duration since the **TIGER** partners wanted the new work processes to become part of their company culture. One recommendation emerging from all the four **TIGER** Pilots is the absolute pre-requisite of investing resources on the human element. Specialized people capable of managing the tools at their disposal are key for success. People constitute the element that make the difference in the service Industry. They can produce either success or failure. Europe needs success and the people able to achieve it.

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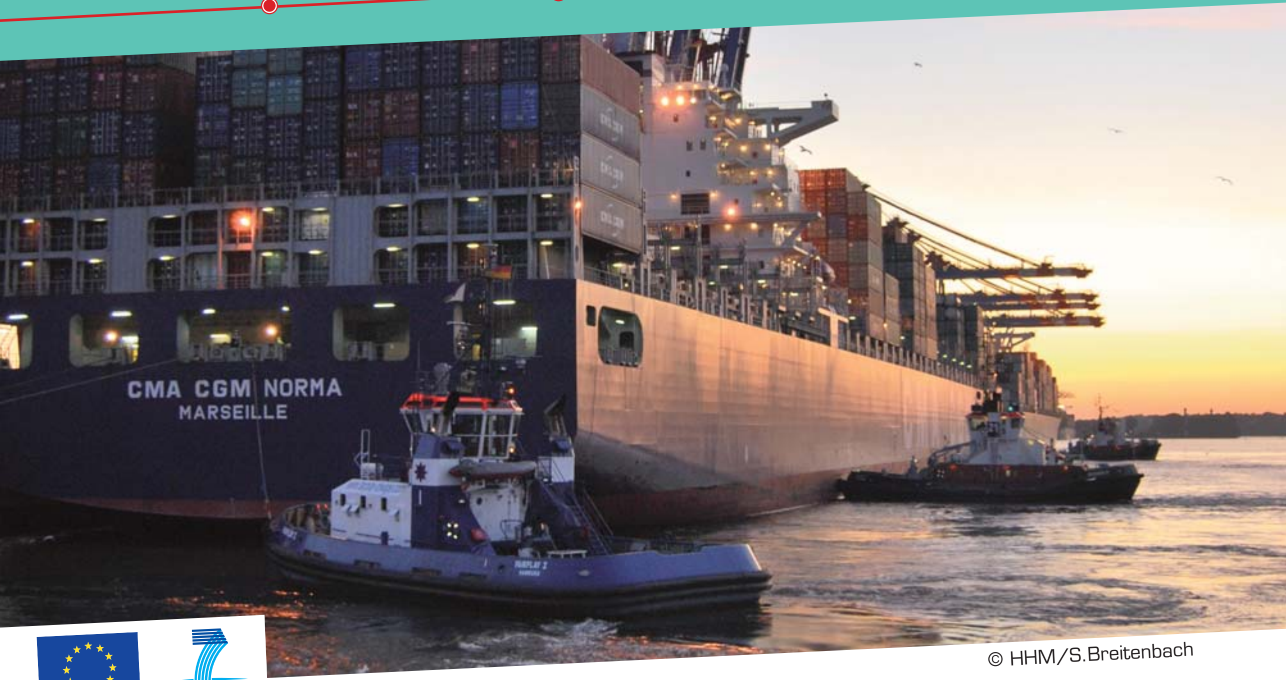

SEVENTH FRAMEWORK PROGRAMME

14. GLOSSARY

ABS	Ausbaustrecke (Upgrading of existing lines)
ARA Range	Antwerp – Rotterdam – Amsterdam range ports
ASE	Alte Süderelbe
BCA	Blocco Conta Assi (Axle count)
CAGR	Compound Annual Growth Rate
CIS	Commonwealth of Independent States
COMEXT	Community External Trade Statistics
CTA	Container Terminal Altenwerder
CTB	Container Terminal Burchardkai
CTS	Containers
CTT	Container Terminal Tollerort
DB	Deutsche Bahn
DBNetz AG	German Railway Infrastructure
DUSS	Deutsche Umschlaggesellschaft Schiene-Straße mbH
EDP	Electronic Data Processing
ERA	European Railway Agency
ESPO	European Sea Port Organization
ESS	Extra Slow Steaming
ETCS	European Train Control System
EUFRANET	European Research Study - European Freight RAIlway NETwork
EUK	Eurogate
EUROSTAT	Statistical Office of the European Communities
FP7	Framework Programme 7 (EU)
GDP	Gross Domestic Product
GFC	Genoa Fast Corridor
GNP	Gross National Product
GPA	Genoa Port Authority
HBS	Hamburg Süd
HHLA	Hamburg Hafen und Logistik AG
HHM	Hafen Hamburg Marketing
HOS	Hohe Schaar
HP	Hansaport
HPA	Hamburg Port Authority

IMF	International Monetary Fund
IPORT	INNOVATIVE PORT
ISO	International Standards Organization
JWP	Jade-Weser Port
LCL	Less than Cargo Load
LOA	Length All Out
MARIPLAT	Italian Logistics Platform in the Mediterranean Sea
MCT	MedCenter Container Terminal S.p.a.
MEDA	Mediterranean Countries
NBS	Neubaustrecke (New Rail Line)
NEWOPERA	New European Wish: Operating Project for a European Rail Network FP6 European Commission Project -
O/D	Origin/Destination
POT	Piano Operativo Triennale (Operational three year Plan)
RFI	Rete Ferroviaria Italiana
Ro/Ro	Roll On/Roll Off
RTE	Rivalta Terminal Europa
RTI	Raggruppamento Temporaneo di Imprese
S&C	Signal and Control
SCMT	Sistema di Controllo Marcia Treno (Train system control while running)
SECH	Terminal of Genoa Port
SERFER	Società Servizi Ferroviari
SLALA	Association in charge of Alessandria dry port project
SOGEMAR	Società Generale Magazzini Raccordati
TCT	Taranto Container Terminal
TEN-T	Trans European Transport Network
TEU	Twenty-foot equivalent unit
TGR	**TIGER project** code on the repository
TIGER	**T**ransit via **I**nnovative **G**ateway concepts solving **E**uropean intermodal **R**ail needs
TSG	Terminal San Giorgio
TYBRE corridor	Tyrrenian Brenner Railway corridor
WHO	Waltershof yard
WP	Work Package

15. FIGURES AND CHARTS DESCRIPTIONS

This **TIGER** FINAL DEMONSTRATORS REPORT BOOK is aiming at providing data, facts, figures, freight mobility researches, traffic projections, suggestions and recommendations for supporting European Institutions, Governments, Decision makers, Infrastructure managers, Operators, Port management, Port Authorities, Railway undertakings, Dry Ports and Service providers in making the correct choices towards the fulfillment of an efficient and effective European freight mobility policy. It is hoped that this objective has been achieved.

Franco Castagnetti
TIGER Project Leader

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NEWOPERA Aisbl President

Founder of NEWOPERA Aisbl, Founder of The European Freight & Logistics Leaders Forum, former Director of Procurement & Supply Chain Management of Polimeri Europa Milano (ENI Energy Group) former Managing Director and member of the board of CNM shipping line and several other companies in the European Intermodal industry. Former European then Middle East and America Far East Director of the Merzario Group of companies then former Director General of the same Group leader in containerization.

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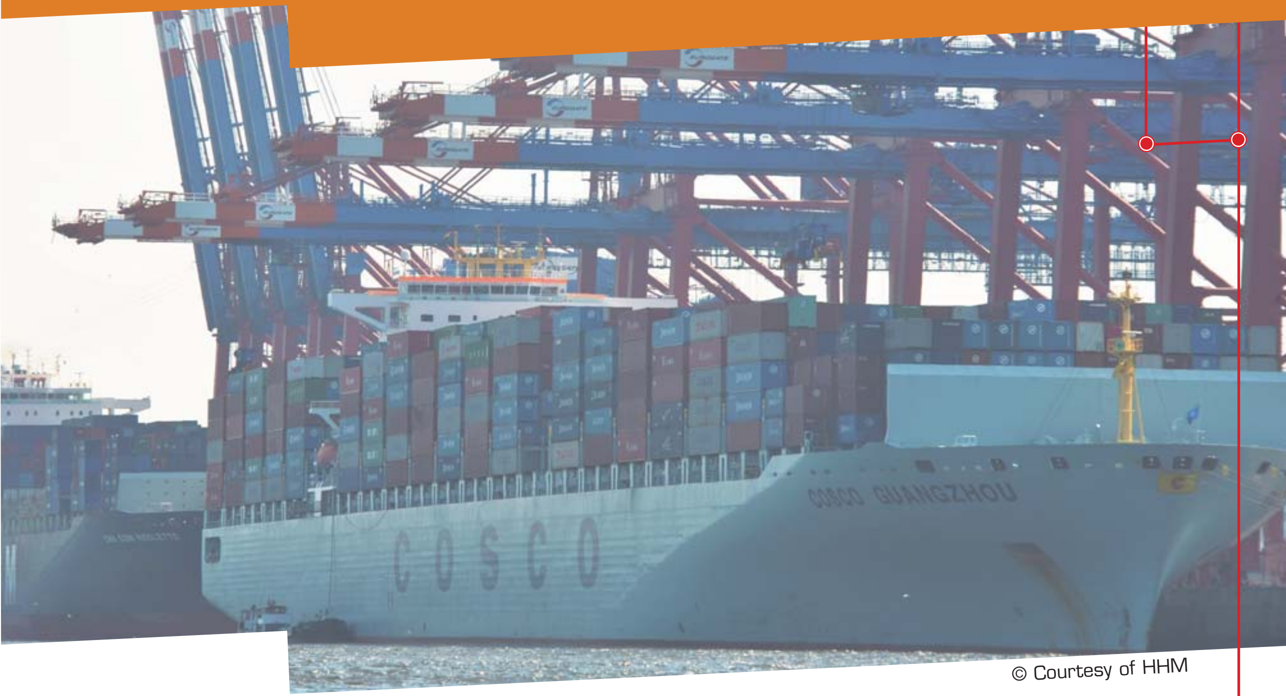

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NEWOPERA	UNIFE
E-LOG	Regione Liguria
Consorzio TRAIN	DB Netze
EUROGATE	Kombiverkehr
Autorità Portuale di Genova	Rivalta
HaCon	RFI
Hafen Hamburg Marketing	TRENITALIA
Hamburg Port Authority	SO.GE.MAR
Interporto Bologna	Terminal San Giorgio
Italcontainer	TT&U