The Potential of Pan European Rail Freight Service Using Hub and Spoke Model

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Abstract

An efficient, competitive and sustainable freight service is at the heart of European Commission's Transport Policy. There are many research and development initiatives at the national and European levels to achieve this policy. This paper is developed through research methods including in-depth state-of-the-art literature review, field surveys and interviews. This research adopted top-down and bottom-up analysis approach to identify the market potential and logistics requirements for a new pan European rail freight service. The bottom-up approach, based on interviews with potential users of the rail freight service, provides insights, characteristics, needs, requirements and the market potential within four market segments: dry and liquid bulk, specialized products, maritime containers and swap bodies. The analysis finds that there is sufficient demand for a new rail freight service along the proposed corridor. The bottom-up analysis supports the findings of the top-down modeling approach that there is enough market demand for running commercial rail freight services 2 to 8 times a week, provided diverse customer's requirements are met. However, the commercial requirement suggests that the network based operation rather than corridor based approach will be more attractive and viable.

Keywords: Potential, Pan European, Rail Freight, Hub-And-Spoke Model

1. Introduction

Factors such as economic liberalization, technological advancement, bigger domestic market environment and globalization have increased the volume of international trade tremendously (Dessouky, et al, 2008). The continuous extension of European Union (EU-10, 15, 25, and lastly 27) has added an 'extended domestics market' factor not only for freight transport but also for other economic inputs and outputs as well. An efficient freight transport system is crucial for economic com-

petitiveness for any country or region (Rushton, et al., 2000). The system must include all transport modes in a free and fair operating environment. The freight volume has increased from a total of 3060 million tonne-kilometres in 1995 to 4091 million tonne-kilometres in 2008 in Europe (on average annual 2.3% growth). Of this, rail freight has increased a total of only 14.7% (with annual growth of 1.1%) in contrast to road freight of 45.7% (with an annual growth of 2.9%) over the same period (EC, 2010). European transport policy focuses on sustainable but competitive economic model. Rail over road is generally is accepted as a more environmental sustainable mode. Increasingly many customers (in particular the bigger companies to respond to the social responsibility) consider sustainability as important selection criteria when selecting a freight transport service provider. Even being environmental friendly, rail could not be competitive due to failure in delivering key customer requirements: reliability, quality of service, a door-to-door service and cost (EC, 2001, 2006a and b). With the adoption of new 'Co-modal' transport policy, the EC policy focus has shifted from promoting non-road modes. The co-modal is an idea or notion introduced by in 2006 to define an approach of the global competitive approach of transport modes. It refers to an optimal and sustainable utilisation of resources. Thus there is an urgent need to reexamine, reinvent and/or explore the rail potential in a new market environment and to suggest key logistics requirements for rail freight services in a commercial, competitive, secure and sustainable fashion (EC, 2006c). The current research attempts to examine and report the pan European rail freight market potential using top-down and bottom-up analysis approach. In the following sections research methodology is discussed followed by findings of top-down and bottom-up approach.

2. Research Methodology

The current research adopted a combined methodology of top-down and bottom-up analysis approach. The top-down analysis approach performed the assessment of potential freight volume in the corridor using TRANS-TOOLS model (Transport Research Knowledge Centre, 2011), which utilised Origin-Destination (O-D) freight volume statistics for a corridor. Among others Eurostat (EUROSTAT, 2005) and TNO's (The Netherlands) own data bank were used for this analysis. The top-down methodology also conducted literature review in the field including recent EC funded projects including COMPETE (2006), INTERIM (2007), REORIENT (2007) and TREND (2006) that provided insights on shipper's requirements. The bottom-up approach included a survey among 330 shippers under the umbrella of REOREINT project (REOREINT, 2007) and 21 in-depth interviews, under the RETRACK (RETRACK, 2011) and REORIENT (REORIENT, 2007) projects, among the stakeholders consisting of eleven rail freight transport service providers and ten service users in different European countries around the RETRACK corridor between Constanta in Romania and Rotterdam in the Netherlands. The country-wise breakdown of 21 respondents is shown in Figure 1.

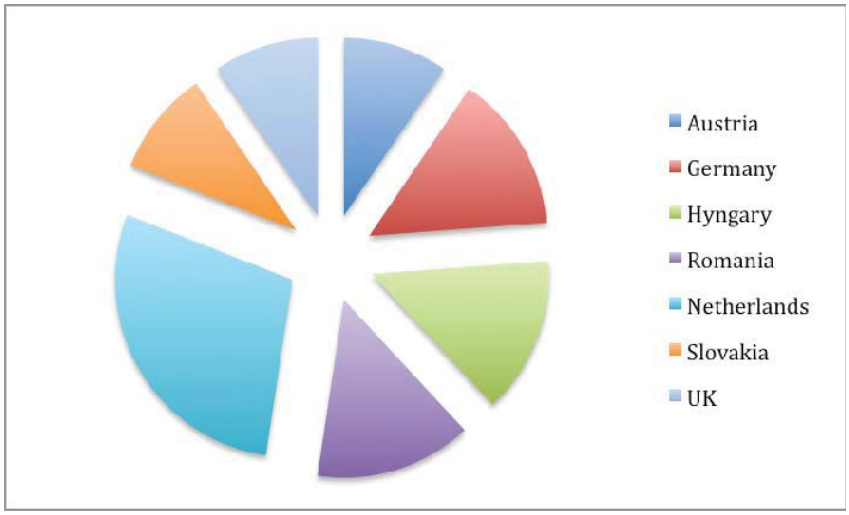

Figure 1 Country-Wise Breakdown of Interviewers

3. Findings

3.1 Findings Through Top-Down Approach

With the expansion of Europe Union the transport and logistics networks are changing, some are emerging or achieving more importance and others are losing importance. In this complex and changing market the main challenges for the transport chain partners are to manage these logistics networks in an efficient way and at the same time to satisfy the customer's requirements. Each transport mode has its own strength and weakness and the new co-modal transport policy of EC aims to exploit each mode's strength to achieve optimum solution (EC, 2006a and 6). For example, rail transport generally offers cheaper service in the long distance but depends on road for pick-up and delivery services, thus requires modal transfer at terminals. The modal transfers are subject to extra-cost and extra-time as well as uncertainly compared to unimodal through transport by road. Thus the rail service appears in some cases unreliable. On the other hand, its main competitor road transport is flexible and can offer tailor made service to customers. The service is generally cheaper in short hauls and offers higher customers satisfaction. However, the European road transport network is highly congested and may not be able to accommodate further freight transport growth. The weakness of road may offer an opportunity to rail freight service, provided they can meet customer requirements. This scenario can also offer an opportunity for rail intermodal (pick-up and delivery services within 200km from the terminal by road and the long haul by rail) freight transport in Europe. Thus road and rail freight service providers will compete and cooperate (i.e. co-petition) with each other (Nalebuff and Brandenburge, 2002) to prove commercial but environment friendly service. Figure 2 shows a typical rail-road intermodal freight service.

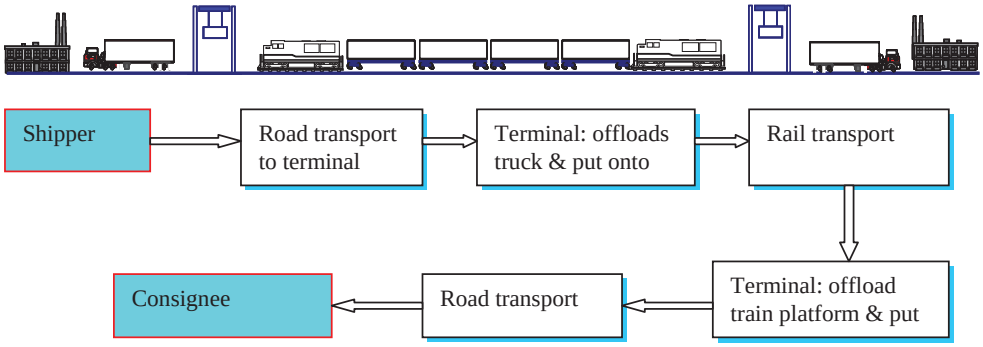

Figure 2 Road-Rail Intermodal Freight Services

The stakeholders of rail intermodal freight service include shippers/ consignees, service providers that include road/rail operators/ undertakings, terminal operators, freight forwarders, rail regulators. Each stakeholder has his or her own interests and needs, which makes cooperation as an essential requirement to develop a new rail intermodal freight service a real challenge. The reviews of recently implemented European Research and Development projects including COMPETE (2006), INTERIM (2007) PROTRANS (2002), RE-ORIENT (2007), TREND (2006) provide useful information on demand issues, like shipper's requirements and logistic needs in different sectors. The literature reviews finds that the most important shippers' requirements are: cost, reliability, service quality and security. For many shippers reliable transport is even more important than the transit time and/or cost. The findings of these projects suggest that intermodal rail transport is very competitive with road transport on long distances (for example more than 600 km). On distances up to 1500 km or more, the cost savings (using rail) can be achieved up to 10-15%, sometimes even higher.

The top-down modeling approach using TRANS-TOOLS suggests that a network based rail freight service, we term it as RETRACK, (between Rotterdam, Netherlands to Constanta, Romania) can attract cargo from the following four target markets:

Current long distance rail transport: The East-West and West-East target volume is about 2 million tons. As a realistic estimate if this RETRACK rail service can attract 3% to 10% of the current volume, then it will gain 56.000 to187.000 ton per year.

Long distance road transport: The East-West and West-East target volume is 4.7 million tons. As a realistic estimate if the RETRACK rail freight service can attract 1.5% to5% of it, then it will gain 70.000 to234.000 ton per year.

Maritime transport North Sea – Black Sea: The maritime transport volume between North Sea and Black Sea ports equals 2.6 million tons. As a realistic estimate if the RETRACK rail freight service can attract 1% to 5% of the volume, then it will gain 26.000 to100.000 ton per year.

Import/export from TRACECA (an internationally recognised programme that aims at strengthening of economic relations, trade and transport communication in the regions of the Black Sea basin, South Caucasus and Central Asia owing to active work based on political will and common aspirations of all member-states that include Armenia, Azerbaijan, Bulgaria, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Romania, Tajikistan, Turkey, Ukraine, Uzbekistan) countries: Transport between European RETRACK countries (NL, DE, AT, HU, RO) and TRACECA equals about 15 million tons, mainly road or rail transport between Turkey and EU (7.5 million) and import from Ka-

zachstan (6.8 million). As a realistic estimate if the RETRACK rail freight service can attract anything from 0.5% to 2%, then it will gain 38.000 to150.000 ton per year.

The above estimation is calculated from a conservative approach, which suggests that the RETRACK rail freight service have potential of gaining up to 212.000 to 824.000 tons per year. This freight volume should be sufficient to inaugurate a new rail freight service in the current corridor with a frequency of 2 up to 8 times a week. The RETRACK rail freight service aims to reduce current transit time from approximately 120 hours to 80 hours. The number of frequency of freight rail operation is dependent on the total transit time. On the other hand, the total transit time largely is affected by some operational factors such as track interruption, train stop-time in terminal and number of stops on the corridor. The track interruption includes planned events (such as maintenance times, commercial stops) and unplanned events (such as train failures, broken rails). Such events take a track out of service and directly reduce the availability of tracks. The train stop-time in the terminal on a line directly increases the amount of transit time. Other factors to consider are: maximum trip time threshold and window (interval or unit of time) (Abril, et al., 2008).

3.2 Findings Through Bottom-Up Approach

The bottom-up analysis approach was performed through 330 surveys (under REORIENT project) and 21 in-depth interviews (jointly under REOIRNET and RETRACK projects) using interview protocol among the stakeholders of different European countries around the RETRACK network.

The bottom-up approach explored the insights of the characteristics, shippers' requirements and potential volume within the following four market segments.

Dry and liquid bulk segment: the transported volume by rail is usually large and predictable. For the larger volumes block trains are often used, but for new locations wagonloads can be an interesting market for RETRACK. Adequate safety and security is an important requirement in this market. More and more, larger chemical companies like BASF, Dow, Degussa, etc, are setting up manufacturing activities and finding new customers in Romania, Turkey, Ukraine, Russia and the Caucasus. This requires the transport of supplies to these sites, but also transport to Western Europe.

Oversized and special goods segment: the transported volume by rail is usually large and predictable (due to the manufacturing process). For the larger volumes block trains are used, but for new locations wagonloads can be an interesting market for RETRACK. The issue of safety and security is less important than in the dry and liquid bulk market segment, but reliability remains a major issue, especially for the automotive industry. The RETRACK rail freight service will get an opportunity offer services to the emerging Eastern European steel and automotive manufacturing to transport their finished goods to all over Europe. Especially there is an interest of using the RETRACK rail service in Slovakia. For this, a transshipment service will be essential in Budapest with a feeder link from Kosice or Bratislava.

The maritime containers market segment shows major growth in demand, especially to destinations in Eastern Europe. Rotterdam, Antwerp and Constanta will continue to grow in the next 5 to 10 years, and in all ports there is a policy objective of higher usage rail and inland waterway transport. Surveys and interviews in the current research suggest that logistics service providers and several shipping lines are interested in using the RETRACK rail service.

Continental swap bodies market segment shows a potential for major growth in demand, especially to destinations in Eastern Europe. The Austrian logistics service providers provide network services by e.g. collecting containers from Benelux, Germany and France and load them on a rail shuttle to e.g. Romania and vice versa. The RETRACK shuttle can offer services for large retailer groups with interests in Eastern Europe e.g. Carrefour and Tesco.

This bottom-up analysis supports the findings of aforesaid the top-down modeling approach that there is enough potential for a rail freight service in the corridor. However, the bottom-up analysis warned that the following crucial customer requirements must be met to run a commercial rail freight service in the corridor:

The intermodal rail transport costs have to be lower than the road transport to compensate for weaker performance on some other performance indicators; in some market Logistics market requirements for new rail freight services 10 segments the cost difference should be up to 10-15% to attract new customers. The top-down approach reveals that these cost advantages are realistic on several long distance door-to-door (D2D) connections in the network if the number of stops is limited. By introducing additional stops, the cost difference becomes smaller which might be in conflict with requirements of a specific group of potential users. On the other hand, including additional stops can also generate more traffic volume. It requires additional model analysis to analyse this trade-off in the particular corridor.

The intermodal rail transit time has to be competitive with road transport but above all reliable. The top-down modeling approach reveals that transit time is similar on distances of 600 to 800 km and shorter on longer distances, though this also depends on the number of transit stops. In intermodal rail transport there is often a lack of technical and administrative interoperability and coordination, thus increasing the chance of delay. Road transport is in general more reliable although increasing facing congestion problem resulting unreliability. A new rail service should be therefore be focusing particularly the interoperability and coordination issues in particular between countries.

From the above findings we can say that the RETRACK rail freight service will be able to offer a safe and secure way of transportation, reducing the risk of accidents, theft and damage. Security and accidents are of particular interest for transport of chemicals and dangerous goods whereas damage and theft are more relevant for transport of containers and swap bodies. However, we express the caution that the freight transport customers want flexibility in the logistics processes, so that they are able to meet any changes in demand. In general, road transport is very flexible; in contrast rail freight transport offers limited flexibility, for example, reserving capacity on a train. If it is not possible to reserve additional capacity, road transport can be used in addition to rail transport to provide this flexibility. In other words, the rail freight service providers will have to be dynamic to satisfy the customer demand.

4. Combined Approach

Both top-down (macro) and bottom-up (micro) approaches support the conclusion that there are good potential for a pan European rail freight service in the RETRACK corridor. The macro approach indicates enough potential for a frequent rail freight services, based on secondary materials/statistics on existing long distance transport hauls and assumptions on the share of relevant target markets that can be shifted towards rail freight transport. These assumptions are supported by the bottom-up approach (interviews with potential users of the rail freight service). In doing so, the approach brings together macro and microanalysis. The top-down modeling approach indicates signifi-

cant cargo potential in Germany, Austria, The Netherlands as well as Hungary and Romania, but the decision on the number of stops and the location of stops should be driven by customer demand and requirements.

5. Supply Side Developments

Market considerations and specific customer needs require a dynamic business model that is adaptable to changes in market developments and the customer base. These market considerations include the following:

Currently there are fierce competitions and an extensive service offering on the network between Rotterdam and Duisburg/Ludwigshafen.

Several operators already offer frequent services in this part of the corridor.

Demand from West Europe to/from Romania is fragmented over different regions (Rotterdam, Antwerp, Hamburg, Bremen, Le Havre) and consolidation of these volumes might improve the efficiency in the operation of a shuttle train service towards Romania.

Infrastructure quality in Romania needs improvements, in particular on the track between Bucharest and Constanta.

Some anchor customers (chemical cargo between Germany and Romania) will be required as base to launch a rail service.

6. Applying the Hub-and-Spoke Concept

The current rail freight operators (e.g. HUPAC and Raillink) in and around the RETRACK rail freight corridor already offer shuttle services between West European Ports and Ludwigshafen; where HUPAC operates from and to Rotterdam, Antwerp, Zeebrugge, Hamburg and Busto Arsizio; and Raillink operates from and to Lyon, Le Havre and Marseille. In particular the RETRACL rail; freight service must take into account of the high frequency existing rail shuttles between Rotterdam and Duisburg/Ludwigshafen. Considering the market considerations, discussed in previous section and the competition from the existing operators, the first phase in the business model can be built upon the idea of a hub-and-spoke network (see figure 3) in West Europe consolidating the cargo with the destinations to Budapest, Hungary, Bratislava, Slovakia and Romania. The hub-and-spoke concept is a system or network of connections in which freight can moves along the spokes connected to the hub at the center. The concept is widely used in transport and logistics services. Thus Ludwigshafen will therefore act as a consolidation hub and starting point for the RETRACK rail freight service. The RETRACK rail freight service towards Romania will offer strong competitions and complementarities to their existing networks and operators. The figure 3 shows these network complementarities.

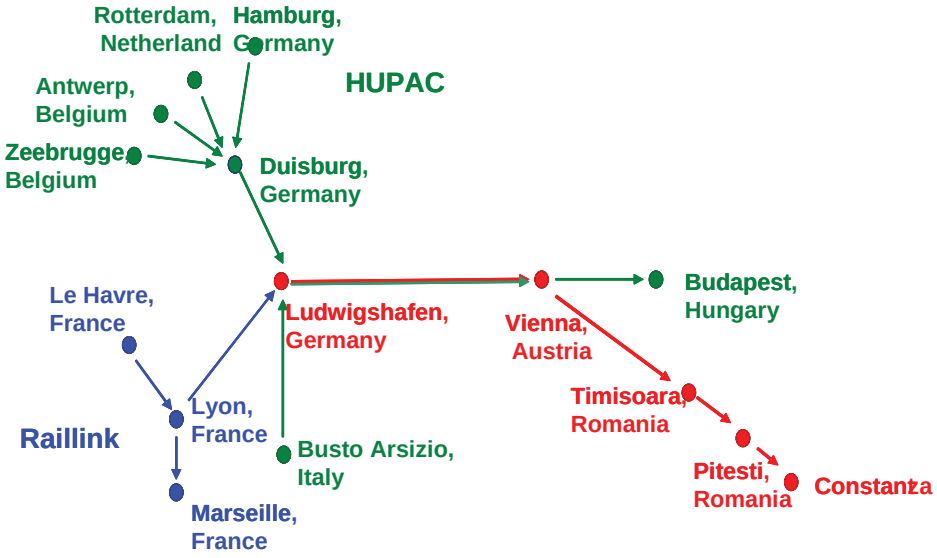

Figure 3 Hub-and-Spoke Model for Pan European Rail Freight

Non-electrified and single track (in eastern part of the corridor) results in a low average speed, which has consequences for the service offer in terms of lead-time. The Romanian rail network is being developed to allow an increase in train speed between Bucharest and Constanta. In addition significant infrastructure enhancements are being made in and around the terminals in Vienna, Budapest and Bucharest to allow additional trains to operate. These investments will enhance rail's competitive position. Given these planned improvements, the RETRACK rail freight service can start with a shuttle between Ludwigshafen (instead of Rotterdam), Germany and Pitesti, Romania (instead of Constanta). Later on, the service will be extended towards Constanta, offering a seamless intermodal corridor towards Turkey and connecting to the TRACECA corridor towards Central Asia.

Thus, in the first phase, the pan European rail freight service can be launched by offering three weekly departures in both directions between Ludwigshafen (Germany) and Pitesti (Romania). With a capacity of 24 wagons and 72 TEU and a roundtrip time of less then 6 days (less then 3 days per direction), the service offers significant improvements to existing rail freight services in the corridor.

7. Conclusion

The study finds that the RETRACK rail freight corridor has sufficient cargo to start a rail freight service in the corridor with a frequency of 2 to 8 times per week. The top-down modeling approach shows that the rail freight service on the corridor can attract cargo from four target markets: the existing long distance transport hauls, long distance road transport, maritime transport of North Sea-Black Sea and import/ export from TRACECA countries. The bottom-up approach emphasises on the fulfillment of customer's requirements: a) costs must be lower than road transport to compensate for weaker performance; b) transit time has to be competitive and reliable; c) the service has to offer safe and secure way services; and d) last but not least flexibility to enable the service users to meet changes in demand. The RETRACK rail freight service must not be complacent with the increasingly congested road.

At the first stage, the service may start between Ludwigshafen (instead of Rotterdam), Germany and Pitesti, Romania. When there will be a greater demand, the service can be extended between Rotterdam and Constanta and beyond. The number and location of transit stops should be driven by customer demand and requirements. In summary, a dynamic and flexible business approach will remain the main key to a successful long distance pan-European RETRACK rail freight service.

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