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The Impacts of Globalisation on International Road and Rail Freight Transport activity

Past trends and future perspectives

Allan Woodburn, Julian Allen, Michael Browne and Jacques Leonardi, Transport Studies Department, University of Westminster, London, UK

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FOREWORD

This paper was prepared by P Allan Woodburn, Julian Allen, Michael Browne and Jacques Leonardi,Transport Studies Department, University of Westminster, London, UK, as a contribution to the OECD/ITF *Global Forum on Transport and Environment in a Globalising World* that will be held 10-12 November 2008 in Guadalajara, Mexico. The paper discusses the impacts of increased globalisation on international road and rail freight activity – past trends and future perspectives.

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THE IMPACT OF GLOBALISATION ON INTERNATIONAL ROAD AND RAIL FREIGHT TRANSPORT ACTIVITY – PAST TRENDS AND FUTURE PERSPECTIVES

1. Introduction

1. This paper first establishes the recent trends in international trade volumes. It then aims to identify the main ways in which this trade growth has impacted on road and rail freight transport activity at the international level, and finally considers the likely future direction of international land-based transport movement. In this assessment, the 'international' focus is on cross-border road and rail transport, rather than on comparisons of trends and prospects across a range of different countries. However, there is huge variation in the types of trips that make up international freight in terms of their frequency, complexity, distance travelled and vehicle types used. For instance, international road freight trips between the Netherlands and Belgium take place on a very regular basis, are relatively simple (due to the lack of border controls in the EU), are very short distance (sometimes shorter than the average domestic trip), and do not necessarily use maximum weight articulated vehicles. However, by comparison, trips from Asia to Europe can be occasional, extremely long distance (thousands of kilometres), are very complex (due to numerous border crossings), and typically use maximum weight fully laden articulated vehicles in order to minimise unit costs of transport. Therefore in talking about international freight transport it is important to be aware of the diversity of trip types included, and the impact that the attributes of the trip described above can have on its organisation and cost.

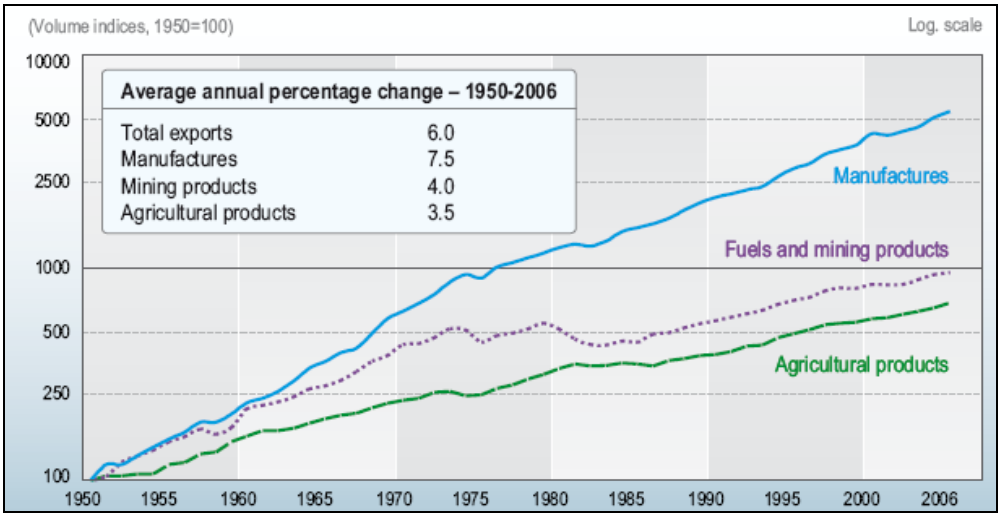
2. As far as possible, experience from around the world is identified and discussed, although the main focus is on cross-border flows between countries in Europe, Asia and North America since these three regions are where the majority of land-based international transport takes place and for which there is considerable published information. While the assessment is evidence-led where possible, there are limitations relating to differing definitions and measurement units, both spatially and temporally, and inadequate data relating specifically to cross-border freight transport activity.

3. The structure of the paper is as follows. The next section deals with recent trends in international trade activity since this is a driving force in the development of international transport. Section three discusses international trade and transport from a policy and economic perspective while section four notes the importance of customs clearance and border crossing together with the increased concerns about security in international transport. Section five outlines some features of recent trends in freight transport volumes by road and rail. This leads on to sections six and seven which are respectively a more detailed discussion of road and then rail within which aspects such as infrastructure issues, policy and regulation, operations and technology are reviewed. These sections are illustrated with a number of case studies. Future perspectives are discussed in section nine which concludes the paper.

2. Recent trends in international trade activity

4. The World Trade Organization (WTO) provides the most comprehensive data on trade volumes and trends. This section highlights some of the main aspects of world trade that affect freight transport activity and mode choice. Figure 1 reveals the long-term growth in international trade volumes in all product categories, but most notably in manufactures.

Figure 1. World merchandise trade volume by major product group, 1950-2006



Source: WTO (2007).

5. In general, trade growth has exceeded the increase in GDP over this time period; between 2000 and 2006, trade growth was approximately twice the GDP increase (WTO, 2007). Table 1 shows the key international trade flows between world regions and inside these main regions in 2006, in terms of the value of products. The top six flows involve just three regions, Europe, Asia and North America, with trade within and between these regions accounting for three-quarters of world trade value. Internal European flows alone make up almost one-third of all international trade. Six of the top 10 countries involved in international trade are European, with two each from North America and Asia.

Table 1. Intra- and inter-regional merchandise trade flows, 2006

Trade flow	Trade value (2006 $ bn)	% of 2006 trade value
Intra-Europe	3,651	31.4
Intra-Asia	1,638	14.1
Asia - North America	1,022	8.8
Asia - Europe	970	8.3
Intra-North America	905	7.8
Europe - North America	709	6.1
Asia - Middle East	451	3.9
CIS - Europe	388	3.3
Africa - Europe	268	2.3
Central/South America - North America	242	2.1

Source: WTO (2007).

6. Table 2 shows the average annual growth in trade to and from each of the world regions for the 2000-06 period. Globally, the value of goods traded increased by an average of 11% per annum. North America recorded lower than average growth, and those regions less involved in international trade experienced higher than average growth rates, but remain relatively insignificant in comparison to Europe, Asia and North America.

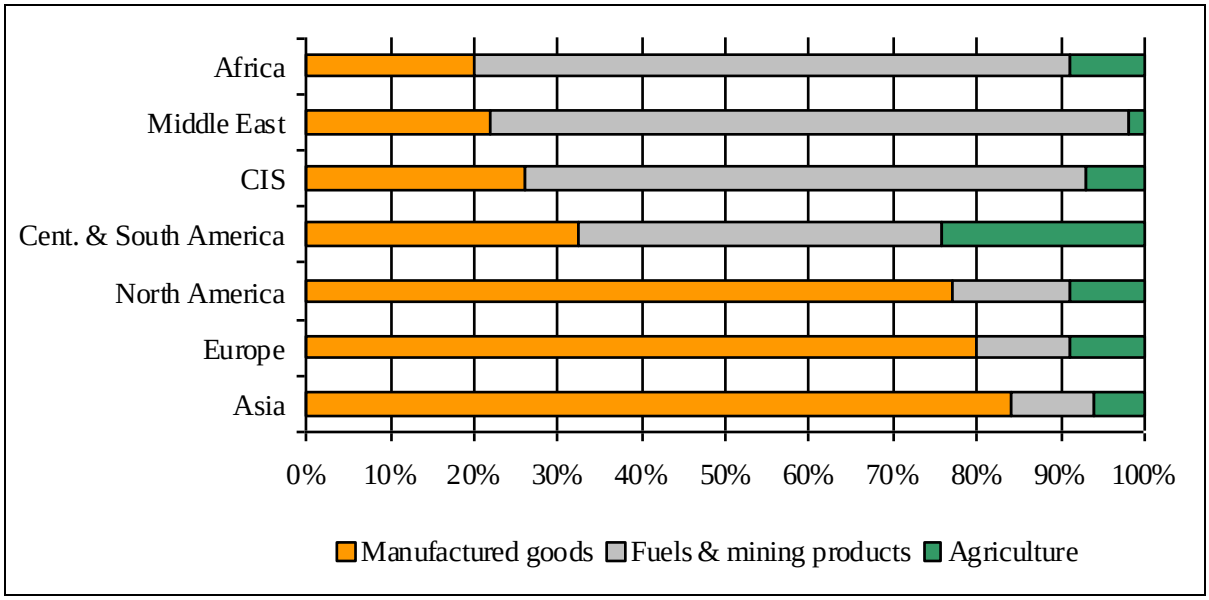
Table 2. Annual percentage change of value of goods in world merchandise trade by region, 2000-2006

Exports	Region	Imports
20	CIS	23
16	Middle East	15
16	Africa	14
14	South & Central America	10
12	Asia	12
11	Europe	11
11	**World**	**11**
5	North America	7

Source: adapted from WTO (2007).

7. Figure 2 reveals the regional differences in the composition of trade flows. For Africa, the Middle East and CIS, exports are dominated by fuels and mining products, while for Asia, Europe and North America manufactured products make up the overwhelming majority of exports. In Central and South America, there is a broadly equal distribution between the three product categories, giving this region by far the highest share of exports for agriculture products. Manufactures have been increasing their share of total trade value and now account for approximately 70% of the total, reflecting the dominance of the three main regions where manufactured goods represent the majority of trade value.

Figure 2. Sectoral structure of merchandise exports by region, 2006



Source: adapted from WTO (2007).

8. The introduction, and subsequent increased scope and/or geographical coverage, of regional trading blocs has been an important factor influencing international road and rail transport movements. Table 3 shows the major trading blocs involved in merchandise trade, with the two most significant by far being the European Union (EU) and the North American Free Trade Agreement (NAFTA). The EU has expanded geographically over time, taking in 27 countries by 2007, and has removed internal trade barriers while developing unified trade agreements for extra-EU trade. EU countries were involved in 38% of global merchandise trade by value in 2006. Of this, two-thirds was traded internally between EU countries (WTO, 2007). By contrast, trade between the three NAFTA countries (Canada, Mexico and USA)

comprised just over 40% of the total merchandise trade involving those countries, and in many of the other trading blocs the internal trade was a smaller proportion of the total involving member countries. In addition to Europe's role in global trade (shown in Table 1), the significance of the EU to trade within Europe is clearly very great, reflecting the large number of small countries that are now able to trade freely with each other.

Table 3. Involvement of major trading blocs in world merchandise trade

(as % of total world merchandise trade value), 2006

Exports	Trading bloc	Imports
37.5	European Union (EU)	38.3
13.9	North American Free Trade Agreement (NAFTA)	20.5
6.4	Association of Southeast Asian Nations (ASEAN)	5.5
3.9	Gulf Cooperation Council (GCC)	1.7
2.3	European Free Trade Association (EFTA)	1.7
1.6	Southern Common Market (Mercosur)	1.1
1.3	South Asian Preferential Trade Arrangement (SAPTA)	1.9
1.0	Southern African Development Community (SADC)	1.0
1.0	Common Market for Eastern & Southern Africa (COMESA)	1.0

Source: adapted from WTO (2007).

9. In their own right, road and rail modes are mainly dealing with intra-regional flows, given that two of the three main inter-regional flows (Asia - North America and Europe - North America) are not possible by land-based routes, so maritime transport dominates. For the third (Asia to/from Europe), land transport is possible though currently very limited, with the majority of goods again being moved by sea. Considerable use is made of road and rail as feeder modes for these inter-regional maritime services, connecting with inland flow origins and destinations and, in some cases, acting as land bridges.

10. At the intra-regional level, road and rail are more often used as the main transport modes in their own right, although shipping is also significant in some locations. As a consequence of the geographical distribution of this trade, much of the discussion in this paper relates to the three regions with significant intra-regional trade, these being Europe, Asia and North America.

3. International trade and transport: policy and economics

11. As noted by Kopp (2006) "there is widespread agreement that the reduction in long-distance transport and communications costs has been an important determinant of today's globalisation". For a long time it was believed that trade costs were of little importance for the structure and quantity of global trade; however it is now acknowledged that these costs are significant (Kopp, 2006).

12. Trade costs can be influenced by time and duration, or not (Deardorff, 2005). These are mainly:

- Non-time related costs:
    - Resource cost of transportation (the cost of transporting goods from one international location to another)
    - Insurance
    - Financial costs of exchange
    - Other (legal costs, charges for transit procedures, legal or illegal facilitation payments etc.)
- Time-related costs:
    - Interest
    - Storage
    - Depreciation

13. Trade costs (especially transport costs) can reduce the amount of international trade by making it unprofitable. In such a situation, countries rely more on their own resources and this deprives them of the gains that flow from international trade.

14. This is a problem that is often faced by landlocked, developing countries, which as a result of their geographical disadvantage face "specific challenges in their attempts to integrate into the global trading system, mainly because goods coming from or going to a landlocked country are subject to additional trade barriers such as lengthy border-crossing procedures. In addition, many landlocked developing countries suffer from weak legal and institutional arrangements, poor infrastructure, a lack of information technology, an underdeveloped logistics sector and a lack of cooperation with neighbouring transit countries. Finally, the distance to markets, as compared to countries with direct access to seaports, can also be a disadvantage in some cases" (UNCTAD, 2007). The economic growth of landlocked countries in the period 1992–2002 was 25 per cent lower than that of their transit neighbouring countries (UNCTAD, 2007).

15. The costs of transporting goods from one international location to another (the resource cost of transportation) is probably the most important cost of trade for most products. This cost varies with distance, weight and bulk density of the product, and its handling requirements in transit. Other costs of international trade include insurance (which is related to size and value), financing (which varies depending on the elapsed time between production and receipt of payment), and financial fees (resulting from trading across national borders and often using more than one currency) (Deardorff, 2005).

16. Time is another important factor in the cost of international trade (Deardorff, 2005). Time is required to transport the good from its origin to its destination, as well as to load and unload it, and to process the goods and the vehicle through customs clearance and border crossings. Given that it takes time to carry out international transport of goods, it is necessary for companies to hold stock. This stockholding incurs several costs in terms of warehousing costs, interest payments, and depreciation costs associated with physical deterioration or change in consumer tastes. These time-related costs will vary depending on the product in question, but make it important to minimise the time to market if one wants to minimise these costs. Therefore, in trying to minimise these time-related costs, it is important to choose the fastest possible means of transport (obviously taking into account the resource cost of each mode).

17. It has been noted that time delays and the variability of transit times are of greater concern to shippers than direct transport costs, as they affect companies' ability to meet agreed delivery schedules and therefore necessitate large stockholding (Hummels, 2001). Hummels (2001) has used the costs of different modes of transport to infer the costs of time from the amount that firms are prepared to pay to reduce it. His results suggest that a one-day delay in shipping leads to an average cost equivalent to a 0.8% tariff.

18. Trade costs are high. Broadly defined trade costs include all costs incurred in getting a good to a final user other than the marginal cost of producing the good itself. A rough estimate of the 'representative' tax equivalent of trade costs for industrialised countries is 170% of the 'original' value. This estimate includes 74% international trade and transport costs (made up of 21% transport costs, and 44% border-related trade barriers) and 55% local distribution costs. The international transport costs comprise direct freight transport costs as well as a 9% tax equivalent of the time value of goods (Anderson and Wincoop, 2004).

19. International manufacture is becoming increasingly common over time as companies seek out low wages and land costs to achieve low production costs (Rodrigue and Hesse, 2007). However, this results in the need for long-distance international transport. At the same time, consumer tastes are changing ever more rapidly, especially in relation to high-value and technology products. In such products it is

therefore becoming increasingly important for producers and retailers to get products to market as quickly as possible.

20. Technological innovations in transport and ICT are reducing the time to market for products. This is making it possible to manufacture products in distant locations from market and is also making trade in products possible where it had not been previously (*e.g.* air freighted cut flowers). High-quality, fast and reliable international freight transport systems, that have resource costs that are sufficiently low to ensure profitability, are essential in achieving this.

21. This is opening up new opportunities for international land (road and rail) transport. Traditionally for international goods movement, air transport has been used for products that are time-sensitive and valuable, and sea has been used for lower-value products that are less time sensitive. However, ever-longer international road and rail transport options are becoming viable as a result of infrastructure improvements and international agreements (which are resulting in increasing land-based international transport volumes). These land-based modes are likely to increase their modal share of international goods movements as they offer services that are cheaper (but slower) than airfreight and faster (but more expensive) than sea.

22. However, the quantity of goods transported internationally by land modes is still very small in comparison with domestic road and rail freight movements.

4. Other considerations in international trade of physical goods

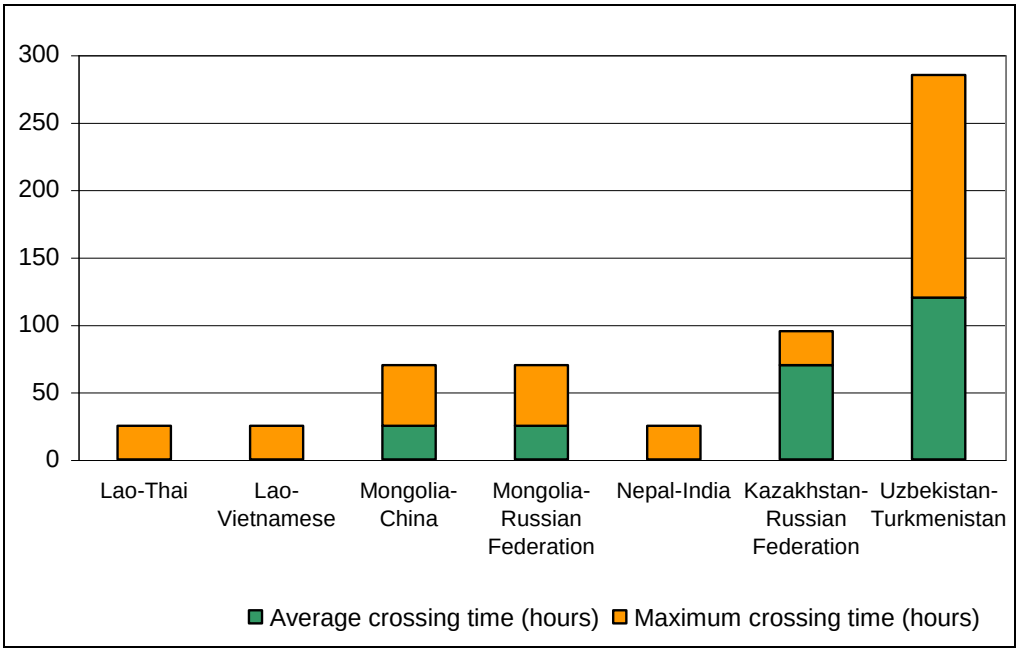
4.1 Customs clearance and border crossings

23. Time-consuming and complex customs clearance and border-crossing procedures can cause significant journey time-delays and poor journey time-reliability on international road movements. They can also impose additional costs both in terms of actual fees and charges for services provided, unofficial payments (*i.e.* bribes), and as a result of time-delays and unreliability in delivery. At worst, several days can be lost at these border points. As discussed in section 3, these costs increase the total costs of traded goods and can have a negative impact on competitiveness. One study mentions that the direct and indirect costs associated with border-crossings can be as much as one quarter of total transport costs (The Chamber of Commerce of the United States, 2006). These problems are particularly acute in some Central Asian countries, with suggestions that for road freight trips from Turkey to these countries can be as much up to 3 times as expensive and take up to twice as long as in an "Ideal situation" (*i.e.* with straightforward border crossings, low fees for border services, no visa difficulties and no unofficial payments) (The Chamber of Commerce of the United States, 2006).

24. Landlocked countries face particular difficulties in relation to border-crossing delays and costs. The ESCAP region (Asia and the Pacific) contains 12 of the world's 30 landlocked developing countries. For most countries in this region transit transport is "most heavily constrained by excessive delays and costs incurred at border crossings. Time-consuming border crossing and customs procedures, complicated non-standard documentation, poor organization and a lack of skills in the transport sector are some of the major contributory factors. Overlapping obligations brought about by several bilateral, trilateral and subregional agreements, the need for multiple bilateral agreements and the lack of a harmonized legal regime for transit transport, including arrangements for transit fees, further compound the complexity of the transit transport process" (UNESCAP, 2003). UNESCAP carried out a series of case studies in 2003 "to identify the common issues and concerns related to physical and non-physical barriers that characterize the transit transport systems of landlocked and transit developing countries in the ESCAP region" (UNESCAP, 2003). The case study countries represented least developed countries and economies in transition. Figure 3 shows a comparison of border-crossing times and Figure 4 a comparison of border-

crossing costs in these case studies. The results showed that time and costs associated with border-crossings ranged between 3 hours and 120 hours and US$ 100 to around US$ 650.

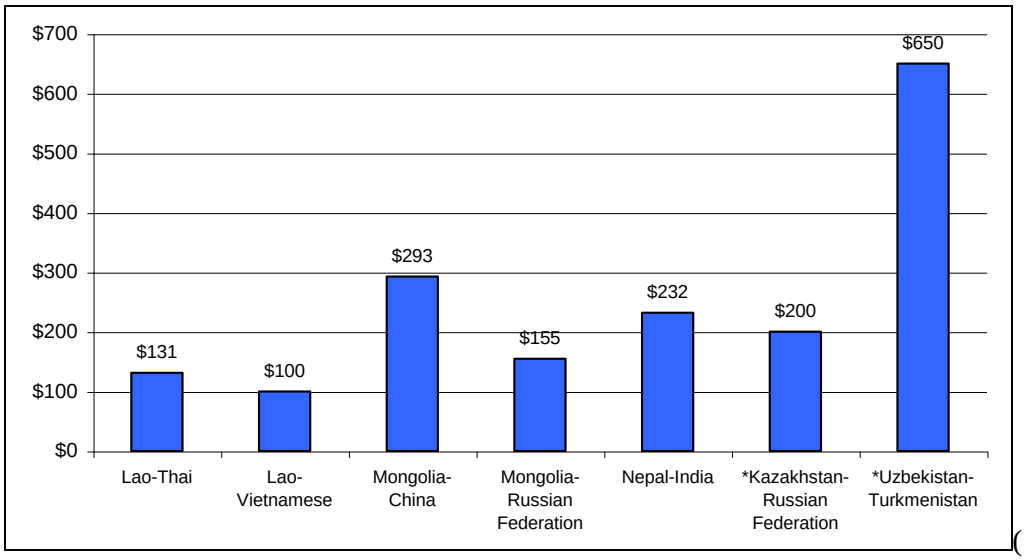
Figure 3. Comparison of selected border-crossing times for road and rail (hours)



Note: the results include border delays for road and rail crossings.
Source: UNESCAP (2003).

Figure 4. Comparison of selected border-crossing costs for road and rail

(Per TEU - Twenty-Foot-Equivalent Unit)



Note: * Border-crossing costs per 12-metre truck.
Source: UNESCAP (2003).

25. Despite the reforms that have taken place in some countries, and the growing use of international conventions to help reduce or overcome border crossing delays, it is still the case that clearing customs and border checking points is a cumbersome process in many countries. It can involve the following types of checks and controls (ECMT, 2000):

- Customs controls on the goods carried (which can involve checking relevant documentation and sometimes the product origin and destination);
- Inspections of goods (this can include sampling and testing);
- Vehicle checks (which can involve safety and environmental standards, and licensing);
- Immigration controls (including passport and visa checks, and possible vehicle searches for illegal immigrants);
- The collection of taxes, fees and duties associated with the above checks and controls.

Box 1. Border problems

The lack of a unified procedure in customs procedures and of a single document explaining all the necessary steps and payments required can worsen the problems experienced and increase the potential for the extortion of unofficial payments. Limited use of ICT in customs clearance can also cause delays at borders, as can visa policies. Recent examples include:

- "The Former Yugoslav Republic of Macedonia imposes a €100 payment for each tariff line inserted in the certificate of import for all imports of agricultural goods that benefit from tariff preferences.
- Local authorities in Romania have discretion to impose additional taxes, *e.g.* for environmental reasons. Such taxes are highly variable and non-transparent.
- In Uzbekistan, ten different documents, issued by various departments and ministries, are required for customs clearance, prolonging custom procedures for up to 2-3 months.
- In the Republic of Moldova, several government agencies are present at the border, each of them representing a different ministry and collecting fees.
- Truck drivers cannot obtain a visa for Bulgaria at the border.
- Strict visa requirements for business visitors including transport operators can cause significant delays for exports to Serbia."
- "Insufficient information technology equipment combined with inadequate training of custom staff delays customs clearance and traffic, throughout the region but especially in the Republic of Montenegro, Albania, Bosnia and Herzegovina".

The Logistics Performance Index survey has highlighted that "the rating for transparency of border processes consistently declines along with LPI scores: ..poor performers in the LPI were also poor performers on transparency of border processes". Only 10% of responses stated that solicitation of informal payments was common in high-income countries, whereas more than 50% of responses indicated that such informal payments were common in low-income countries.

Source: UNECE (2006); Arvis *et al.* (2007).

4.2 Security considerations and terrorism

26. As the UNECE (2008) has noted, transport systems are vulnerable to being used for or being the target of terrorism because they have not been designed to cope with security threats, and traditionally the focus has been on smooth, fast and reliable flows, while achieving certain safety rather than security standards. In addition, road transport infrastructure is easily accessible and often lacking surveillance (such as major roads, bridges and tunnels), and road goods vehicles are readily available and can be used as either a means of conveying weapons or as weapons themselves. Also, complexity presents major problems. Supply chains involving international road freight consist of thousands of companies and

national regulations often differ widely. Harmonizing national security standards across borders could help to prevent terrorists using roads and road freight, but is difficult to achieve.

27. The UNECE's Inland Transport Committee has reviewed issues that could benefit from further security considerations. In the field of land-based freight transport these include (UNECE, 2008):

- Vehicle regulations (concerning vehicle alarm and immobilization systems, and agreements on provisions for immobilising vehicles after unauthorised use, and the installation of positioning systems in vehicles to identify their location)

- Dangerous goods and special cargos (the need for security recommendations for transport of dangerous goods, and to consider updating training requirements for drivers and other personnel involved in the transport of dangerous goods to include security issues)

28. This Committee has identified that, unlike the protective measures that exist in ports and airports, inland transport would seem to be relatively under-protected and "appears to be the weakest link in today's supply chain". They have argued that vulnerable pieces of infrastructure (such as roads tunnels and bridges) are difficult to protect due to their public access and that therefore it is important to support research into new infrastructure protection technologies (such as control and detection systems, including vetting of the personnel working close to such critical infrastructure). They have also identified that there is no international body for land transport security (for goods and passengers), that is equivalent to bodies in maritime and air security. The existence of such organisations would make it easier to introduce international standards and rules (UNECE, 2008).

5. Recent trends in international freight transport volumes by road and rail

29. In the previous sections, the discussion of the growth in international trade was in terms of the value of the goods being traded, since this relates to the main purpose of the WTO. When considering modal trends, it is more common for the statistics to be weight-related, and as a consequence most of the discussion in this section is tonnage based.

5.1 European Union (EU)

30. For the 11 EU member states with consistent data, the proportion of tonne kilometres for international road haulage increased slightly from 22% in 1995 to 26% in 2005 (Eurostat, 2004, 2007a). This represented an increase of 52% in absolute terms, given the overall growth in road activity during this period. Of the cross-border volume for this sub-set of member countries, 90% in 2005 was between adjacent countries, so the incidence of cross-trade (*i.e.* transiting one or more intermediate countries) was low. For the EU-25 countries (excluding Greece and Malta), 30% of road freight volumes in 2005 were cross-border in nature, with 15% of the cross-border volume being cross-trade, representing the greater incidence of transit traffic in certain eastern European countries (Eurostat, 2007a). Of the cross-border flows, 94% of the volume in 2005 was between EU members and, of the remaining amount, most was to/from Switzerland, Norway and Russia.

31. By contrast, international flows are more significant in the rail market. 51% of rail freight volumes in the 25 EU countries in 2005 were cross-border in nature (Eurostat, 2007b). As with road, the vast majority of this volume was between adjacent countries, with just 20% of the total international volume transiting intermediate countries. While no consistent statistics over time exist at the European level, analysis of trends in individual countries reveals the growing share of international flows for national rail systems. For example, international rail freight increased from 37% of all rail freight in Germany in

1995 to 47% in 2005, in the Netherlands the increase was from 76% to 79% and in France the share went up from 30% to 33% (Eurostat, 2003, 2007b).

5.2 North America

32. Given its central position between Canada and Mexico, the USA is involved in all intra-North American trade flows. The North American Transport Statistics Database (NATSD) does not contain detailed and consistent time series data relating to intra-North American trade by transport mode; these data have been published only since 2004 (NATSD, 2007). Table 4 summarises the road and rail freight flows between the USA and Canada and Mexico in 2006. These two modes are more dominant for exports from the USA, where 60-65% of tonnage is by road or rail, whereas water transport and in the case of Canada, pipeline, are important modes for imports to the USA.

Table 4. USA trade with Canada and Mexico by road and rail, 2006

Exports from USA			Imports to USA	
Mode share (%)	Tonnes (m)		Tonnes (m)	Mode share (%)
		Canada		
42	59	Road	62	21
21	30	Rail	76	26
		Mexico		
38	31	Road	28	20
26	21	Rail	11	8

Source: adapted from NATSD (2007).

33. In 2002, international road freight accounted for just 2% of total road freight lifted to, from and within the USA. The corresponding figure for international rail was 6% (measured in tonnes lifted – freight delivered to a port will be counted as national rather than international for road and rail movements). In combination, road and rail represented 32% of international tonnes lifted to and from the USA (imports and exports combined) (Office of Freight Management and Operations, 2007).

5.3 Europe to/from Asia

34. Travel distances between Europe and Asia are generally far shorter by land than they are by sea. This is especially true if the origin and/or destination are inland. Rail services from China to Europe via Central Asia could be provided that take approximately 20 days, whereas this takes approximately 6 weeks by sea. It has been estimated that travelling from Europe to Asia by road would take approximately two weeks (ECMT, 2006).

35. At present the major trans-Asia land routes are rail routes, including the Trans-Siberian, the TRACECA corridor, and the southern route via Turkey and Iran. Road routes can be preferable to rail routes in Asia in terms of the denser coverage they provide to larger towns. In addition, the physical terrain in the south of the continent is often better suited to road than rail.

36. China is currently developing a countrywide network of road and rail infrastructure that will link up with connections to Kazakhstan, Mongolia and Russia.

37. Land transport between Europe and Asia is one of the oldest trade routes in the world (The Silk Route). However, over time long-distance freight flows on this route were largely replaced by maritime transport. The re-opening of the border between China and Kazakhstan for commercial trade has resulted in the recommencing of long-distance freight flows by (road and rail) land between the two continents.

However, volumes of intercontinental freight flows remain relatively small at present. These land routes are mostly used at present for the transport of commodities such as coal, agricultural products, iron and oil, and bulk goods. Only very limited quantities of containerised cargo is transported on these land routes. Table 5 shows the estimated modal split for containers between Europe and China. This reflects that maritime transport still dominates these container flows at present. Rail transport (especially the Trans-Siberian Railway) was estimated to account for approximately 3-4% of these containerised freight flows in 2005, and road freight was estimated to represent less than 1% of these containerised flows (The Chamber of Commerce of the United States, 2006).

38. It has been estimated by industry sources that in 2005, approximately 0.2 million tons of cargo (12,000 trips) crossed the China-Kazakhstan border on trucks. Freight volumes transported by road between China and Russia were estimated at 1.8 million tons (0.2 million truck trips) in 2005 (which represents an 80% increase over five years) (The Chamber of Commerce of the United States, 2006). These freight flows by road are likely to increase in the coming years as a result of infrastructure improvements, including improvements to roads, freight terminals and customs facilities.

Table 5. Estimated transport of full-load containers between Europe and China in 2005 (million full-load TEUs)

	Westbound	Eastbound	Total
Sea transport	4.5	2.5	7.0
Rail	< 0.2	< 0.1	< 0.3
Road (truck)	< 0.03	< 0.03	< 0.06

Source: The Chamber of Commerce of the United States (2006).

6. Factors influencing recent trends in international road freight transport

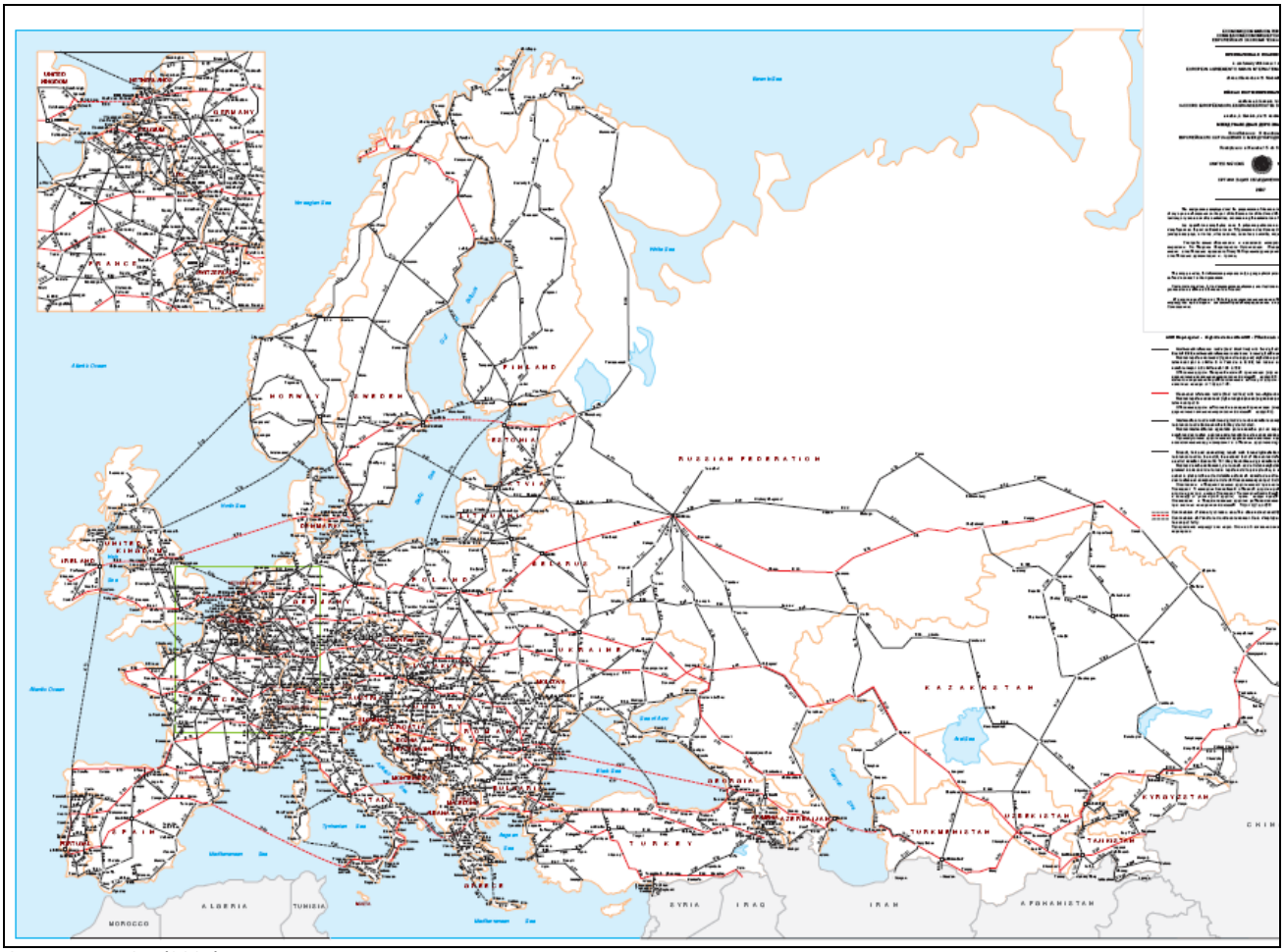
6.1 Infrastructure

39. The basic infrastructure for international road transport is available, but "missing links" constrain route choice. In addition insufficient capacity on some corridors and the poor quality of infrastructure add to the cost and time of road transport. There is also a general lack of infrastructure facilities, such as inland container depots, particularly at border-crossings, to support the consolidation and distribution of goods and trans-shipment between road and rail services (UNESCAP, 2003). Examples of international road infrastructure issues are highlighted below.

40. Figure 5 shows the latest version of the International E-road Network in Europe (E-road = a european road numbering system). It provides a geographical picture of the road routes followed by the traffic arteries defined in annex I to the European Agreement on Main International Traffic Arteries (AGR) signed at Geneva in November 1975 (UNECE, 2007). The AGR was extended in 2000 to include the E-road network for the then new UNECE member countries in the Caucasus and Central Asia. This resulted in the international road network in these countries, which extend right up to the borders with China, also being ascribed "E" numbers (see Figure 5). As well as establishing a coherent road network, the AGR sets in place minimum technical requirements to which E-roads should be constructed.

41. Asia also has a dense road network which links major cities, especially in the southern part of the continent (including India, Pakistan and the South-East Asian peninsula). Some of these road routes run parallel to East-West rail lines in the north of the continent. The Asian Highway (see Figure 6) provides road transport infrastructure linkages to and through the region. It is a network of 141,000 km of standardised roadways joining 32 Asian countries with linkages to Europe.

Figure 5. International E Road Network



Source: UNECE (2007).

Figure 6. Asian Highway Network Project

Source: UNESCAP (2008).

Box 2. The Trans-European Transport Networks "TEN-T"

The Trans-European Transport Network (TEN-T) was first established in 1993. It involves transport infrastructure projects to help put in place high-quality trans-european transport networks (unimodal, intermodal and multimodal) that contribute to the smooth functioning of the EU internal market, ensuring the sustainable mobility of persons and goods under the best possible social, environmental and safety conditions. It is intended to overcome problems associated with missing transport links and existing bottlenecks. Fourteen priority projects were established in the EU-15 in 1996, this was extended to 30 priority transnational axes in 2004 following the accession of new member states (EU-27). In 2007, discussions commenced on modifications to the major TENs axes to neighbouring countries. This involves TEN-T being redefined to include the EU's neighbours, towards the CIS and Central Asian countries along key transport corridors (as has previously been carried out for Central Europe and Mediterranean countries).

Road projects carried out as part of the priority infrastructure projects include: i) the Igoumenitsa/Patras–Athens–Sofia–Budapest Motorway axis, ii) the United Kingdom/Ireland/Benelux road axis, and iii) the Gdansk–Brno/Bratislava–Vienna Motorway axis.

In addition to these priority infrastructure projects, the TEN-T Network also involves horizontal measures to help:

- Speed-up border-crossing procedures
- Simplify and harmonise trade and transport related documentation (including the language regimes)
- Implement compatible new technologies
- Put in place measures to improve safety and security in all transport modes
- Enhance technical and administrative interoperability

Specific horizontal measures for roads include the designing and implementation of measures to improve road safety by addressing driver behaviour, vehicle safety, and road infrastructure safety; and the gradual upgrading of the road network along the major axes to take goods vehicles of up to 11.5 tonne axle weight and up to four metres high.

Source: ECMT (2006), Fontaine (2007), European Commission (2005).

42. Whilst the construction and improvement of road infrastructure is important in the development of international road freight, there are additional factors necessary in order to create a successful and efficient road network. This includes standardisation and harmonisation of many other factors besides the quality of the road construction, such as traffic regulations, vehicle regulations, and traffic technologies. Specific factors that need to be taken into account in standardising and harmonising the road network include:

- the systems adopted for traffic management (including the policies and technology used)
- border-crossing arrangements and dwell-time caused by customs and transport policies at these locations
- road signage and information including traffic conditions and roadworks
- emergency operations - calling a single number, minimum guarantee response time, etc.
- truck stop facilities (including eating and resting locations and services for drivers)
- emergency vehicle services (in case of vehicle breakdowns or other unexpected incidents)
- repair, maintenance and disaster management systems (including emergency service response to traffic accidents and adverse weather conditions, such as floods and earthquakes that may damage the road or make driving unsafe)

43. Several conventions concerning international road transport can help in the standardisation and harmonisation of international road networks. These include the Convention on Road Traffic that helps to harmonise road traffic rules, the Convention on Road Signs and Signals which has produced a large set of common signs and signals to use, and the TIR Convention that allows trucks loaded with goods to cross several borders without customs controls and without payment of duties or taxes.

6.2 Policy/regulation

6.2.1 Agreements between countries in international road freight transport

44. International road freight operations by definition involve goods vehicles moving between two or more countries as part of a delivery or collection. Some international trips can involve the vehicle or goods passing through (*i.e.* transiting) many different countries in order to get from the point of collection to the point of delivery. Different countries tend to have developed varying national rules governing goods vehicles, goods movement, and driver regulations, and have typically had differing views and approaches to international road freight. Over time, this has resulted in the establishment of conventions that govern international road freight operations, thereby allowing vehicles to pass between and through countries in carrying out their work.

45. The international community has, over the years, adopted several international legal instruments that contain provisions intended to assist international road freight operations including gaining access to seaports via transit traffic through neighbouring countries. The four main legal instruments addressing transit traffic and customs transit (UNCTAD, 2007):

- Convention and Statute on Freedom of Transit, 1921 (entry into force 31 October 1922; 50 parties);
- General Agreement on Tariffs and Trade (GATT), 1947, now part of GATT 1994 (provisional entry into force 1 January 1948; 150 members of the World Trade Organization (WTO));
- Convention on Transit Trade of Land-Locked States, 1965 (entry into force 9 June 1967; 38 States parties);
- United Nations Convention on the Law of the Sea, 1982 (entry into force 16 November 1994; 155 States parties).

46. In addition, the General Agreement on Trade in Services (GATS) extends the GATT's principles of freer and fairer trade in goods to services as well, which includes freight companies looking to do business abroad (Latrille, 2007).

47. Each of the above instruments is intended to address different issues concerning transit traffic and customs transit. This results in there being differences in the definitions of transit used in each. GATT, in its article V, and the Convention on Transit Trade of Land-Locked States only include goods (including baggage) in the definitions of transit. However, the Convention and Statute on Freedom of Transit and the United Nations Convention on the Law of the Sea also include passengers. These latter two agreements also include the concept of trans-shipment as a type of transit.

48. In addition there are many other international legal conventions and agreements that have been established by various intergovernmental bodies which aim to facilitate international road transport and transit traffic. Each of these conventions cover different themes in international transport operations, such as the transport of dangerous goods, the facilitation of crossing of borders, or the contract of carriage for road or rail transport. There are also other legal conventions that are mode-specific, addressing issues such as the harmonization of road signs and signals, or the transport of goods by rail.

49. International legal instruments are complementary to regional, corridor and bilateral transport and transit agreements and are often referred to in such agreements on transport as well as in those on infrastructure, storage and general trade terms (UNCTAD, 2007). Several regional cooperation organisations have established transit and/or transport agreements. Many countries have traditionally entered into bilateral agreements on particular aspects of cooperation. In road transport, such agreements have often been needed to allow a transport operator in one country to carry out bilateral transport

operations, third-country transport operations or transit transport operations through another country. A transit corridor agreement is an agreement concerning a designated route between two or more countries along which the corridor countries have agreed to apply specified procedures. These agreements tend to be very focused on the corridor and transit issues, such as infrastructure, customs, border crossings and vehicles. An example of this type of arrangement is the Walvis Bay Corridor Group which was established in 2000. This comprises public and private stakeholders along four transport corridors in southern Africa, all connecting with the port of Walvis Bay in Namibia.

50. One of the main issues for land-based transport systems that need to cross borders is clearly the complexity of international agreements and the time taken to achieve these agreements. This has the effect of inhibiting some of the potential developments and initiatives that could and would be taken from a commercial and operational perspective. As the following section notes, when transport regimes are liberalised, there are many more opportunities to provide services and the operations themselves can become more efficient.

6.2.2 Liberalisation of international road freight transport

51. The European Union provides an example of the total liberalisation of international road freight transport movements between member states. The origin of the liberalisation of trade and freight transport movements in the European Union was in the Treaty of Rome and the formation of the European Economic Community. This treaty provided for the establishment of a common transport policy, based on principles of free market economics, which was intended to remove obstacles to free competition between transport operators from different countries. Multilateral Community authorisations were introduced in 1969, which gradually replaced bilateral agreements between countries. The establishment of the Single European Market was the catalyst for full liberalisation in international road freight, with the removal of these multilateral authorisations and the introduction of European Community licences. Full liberalisation of international road freight was completed by 1998. Operators based in a member state only need to comply with two requirements to be able to carry goods between any EU countries: i) to be recognised as a professional road transport operator and ii) holding a European Community licence. To be recognised as a professional operator it is necessary to meet three qualitative criteria: good repute, financial standing and professional competence. Any operator who meets these requirements, and who meets any other national market access regulations, obtain a Community licence. This then allows them to carry out international transport operations in the entire geographical area of the EU (ECMT, 2005).

52. The European Commission has put in place harmonised social regulations to ensure that full liberalisation does not lead to competition distortions brought about by national differences in factors such as labour rates. These regulations cover issues such as working hours, driving time and rest periods for drivers, periodic technical inspection of motor vehicles and their trailers.

6.3 Operations

53. Growth in world trade together with road and rail infrastructure improvements have made the possibility of land-based international freight solutions easier over time. In the case of the EU, deregulation, the abolition of internal frontiers and harmonisation of fiscal and technical standards, together with the introduction of the Euro have also helped to boost internal international trade. In other countries and regions, better organised and faster border controls, together with trade and transport agreements, have facilitated growth in land-based international freight movements, albeit to a lesser extent. These changes have made it simpler for logistics service-providers to participate in international road and rail solutions.

54. One way in which logistics service-providers can enter into foreign markets is through the establishment of operating centres in other countries and gradually increasing their networks. However, rather than follow this evolutionary and somewhat slow route to growth in foreign markets, some firms prefer the prospect of mergers, takeovers or strategic trading alliances with operators based in other European countries as a means of becoming more international.

55. The growing internationalisation of business has forced companies providing logistics services to consider their own strategies to meet these new needs. Service-providers need to determine the extent to which they can meet all the service requirements of a European business or whether they can realistically only meet part of those needs. In many cases there remains at present a potential mismatch between the logistics demands of European companies and the ability of any single service-provider to meet these demands. This often results in disappointment when a manufacturer decides to rationalise their logistics network and seeks to reduce the number of service-providers they deal with at a European level. In many cases the manufacturer finds that there are few logistics service-providers that wish to take on the commitment of handling all their European activities (Distribution, 2002).

56. Providers of logistics services need to be concerned with two dimensions to their activities in the first instance: geographical scope and range of services. A consideration of these two dimensions highlights how challenging it really is for the logistics service company to be able to provide 'one-stop shopping' for a customer. Some companies already provide what can be described as European services, in the sense that they are the long-distance links in a network used by manufacturing companies. This provision of services is evident in the case of airlines, shipping lines, freight forwarders and integrators. It is clearly at the level of local and national distribution that internationalisation of service-provision has been slowest to develop.

57. A broad range of logistics activities can be provided by logistics service-providers. Freight transport and warehousing services have been widely available for many decades, together with documentation services to support the flow of these products (*e.g.* delivery and customs documentation). However, in recent years, logistics service-providers have begun to offer an ever-expanding range of services, such as final assembly of products, inventory management, product and package labelling, product tracking and tracing along the supply chain, order planning and processing, and reverse logistics systems (which tackle the collection and recovery of end-of-life products and used packaging in the supply chain).

58. Despite a period of uncertainty about the benefits of scale for logistics service-providers, there have been some important developments in the last few years. Larger logistics service-providers have grown mainly through merger and acquisition, and appear to be committed to developing more global capabilities.

59. The very different nature of global markets means that logistics providers wishing to provide for this growing demand for international services adopt suitable and appropriate approaches for different markets. International transport companies engaged in cross-border work already understand that strategies may need to be tailored to the particular country of operation.

60. In deciding how to take advantage of the new global opportunities, logistics service-providers need to be clear about which of the following strategies they wish to adopt:

- STRATEGY A (Global) - providing a world-wide service offering distribution both within and between a number of countries;

- STRATEGY B (Multi-domestics) - providing national services in several countries;

- STRATEGY C (Global-linkers) - providing a network (or part of a network) of mainly international services between major global markets.

61. Clearly the most ambitious strategy is the first - to provide a truly global service. Several major logistics service-providers are working towards achieving this, but it is a challenging goal. The foundations for the multi-domestic strategy appear to lie in the successful duplication of domestic services in other countries. The original services are, of course, adapted as required.

Box 3. The Beijing-Brussels International Truck Caravan

The 12,000 km caravan by goods vehicle took place in 2005. It started at the International Road Transport Union IRU Euro-Asian Road Transport Conference on 27 September and arrived in Brussels on 17 October. Road transport carriers from several countries participated in the project.

The aim of the project was to demonstrate that road transport is an effective means of shipping cargo by land between Europe and the countries of the Asia-Pacific region. It was initiated by KAZATO, IRU member association in Kazakhstan, and supported by governments, international institutions as well as road transport associations.

The Caravan started from Horgos in China (with loaded containers delivered by Chinese carriers) on 27 September 2005. The containers (under TIR carnets) then commenced their journeys on Kazakh, Latvian, Lithuanian, Polish and Russian trucks.

The IRU President Paul Laeremans said that the caravan had, "proven that freight can be efficiently transported from China to CIS countries and further to the EU within just one-third of the time it would take by sea. This caravan demonstrates that road transport, in an increasingly competitive globalised world economy, is no longer just a means of carriage, but rather an irreplaceable production tool for all companies and economies".

Peter-Hans Keilbach, Senior Representative of the U.S. Chamber of Commerce said that, "trade between the Asia-Pacific region and Europe exceeds $300 billion per year. American companies invested over $4 billion in China in 2004 and this number grows every year. Total U.S. assets in Europe are worth nearly $3.3 trillion. Currently, trade between Asia and Europe primarily involves sea transport as well as expensive freight handling ports. Road transport will significantly reduce transit time to less than 3 weeks, reduce costs, and allow for door-to-door delivery".

At the round-table on using Russian transit potential in road freight transport by road, held on the same day the truck caravan arrived in Moscow, Mr Rounov, IRU General Delegate to the CIS, referring to the caravan, emphasized the competitive advantages of road transport in terms of delivery speed and possibility of "door-to-door" delivery. Mr Sukhin, President of the Russian Association of International Carriers, reported that the average speed of freight delivery by road (16 km/hr) outperformed that of sea (4 km/hr) and rail (8 km/hr).

Source : IRU (2005).

6.3.1 Crime against road freight

62. International road freight drivers are prone to criminal attacks on their vehicles and the goods they carry as well as attacks on themselves. The fact that such operations are taking place in foreign countries, and sometimes in isolated locations, makes drivers more prone to such attacks than in domestic operations.

63. The IRU and ITF (formerly ECMT) carried out a study into attacks on international road freight drivers in 2005/6 (IRU, 2008). This research, involving a survey of drivers, transport companies and transport authorities in 35 European and Central-Asian countries was intended to better understand the type and scale of attacks on international good vehicle drivers operating across Europe and how governments are addressing this problem. The work included 1,300 face-to-face interviews and 700 replies to an Internet

questionnaire. Respondents were asked about their experiences over the period 2000 to 2005. The main findings included (IRU, 2008; Crass, 2007):

- 17% of all drivers interviewed have suffered an attack during the 5-year period
- 30% of attacked drivers have been attacked more than once
- 21% of drivers were physically assaulted
- 60 % of the attacks targeted the vehicle and its load, whilst the remaining 40% were related to the theft of the driver's personal belongings

6.4 Technology

64. This section discusses two aspects of technology that influence international road transport. Firstly, issues relating to vehicle technologies are outlined and then the rapid developments in information and communication technologies are noted. Clearly these latter developments have major implications for the efficiency and commercial possibilities of longer-distance international road freight operations.

6.4.1 Vehicle technology

65. The UNECE has developed two key agreements that relate to vehicle technology for international road freight trips; these are open to all UN member countries (Ferrer, 2005):

- the 'Agreement Concerning the Adoption of Uniform Technical Prescriptions for Wheeled Vehicles, Equipment, and Parts which can be Fitted and/or be used on Wheeled Vehicles and Conditions for Reciprocal Recognition of Approvals Granted on the Basis of these Prescriptions' (referred to as the '1958 Agreement').

- the 'Agreement Concerning the Establishment of Global Technical Regulations for Wheeled Vehicles, Equipment, and Parts which can be Fitted and/or be used on Wheeled Vehicles' (referred to as the '1998 Agreement'). This provides the legal framework for the establishment of global technical regulations for road vehicles. This Agreement was introduced largely to meet US concerns about the type-certification system included in the 1958 Agreement and a perceived loss of sovereignty.

66. These UNECE agreements provide the legal framework for the development of technical regulations to improve the safety and environmental performance of road vehicles, including goods vehicles. They help to remove non-tariff barriers caused by incompatible vehicle standards, and provide an easier process than countries attempting to harmonising their different domestic standards.

67. Within the EU rules exist governing engine emission standards (Euro standards) for new goods vehicles, aiming at limiting the amount of pollutants in the road freight sector. The introduction of this standard was leading to substantial improvement in air quality over Europe, mainly reducing air pollutants and particulates. In addition, member states have to accept goods vehicles within agreed maximum weight (gross weight and axle weight) and vehicle dimensions (length and height) limits from other member states. The maximum weight for road trains and for articulated vehicles with 2-3 axle trailers is 40 tonnes, and 44 tonnes for three-axle motor vehicles with 2 or 3-axle semi-trailer carrying a 40 foot ISO container. Member states may allow heavier and larger goods vehicles on their national roads if they wish.

6.4.2 Information and Communications Technology (ICT)

68. A wide range of ICT solutions are now commonly used in logistics and freight transport operations, and which have made international road freight operations more efficient, more secure and safer. These include:

- Vehicle and trailer tracking systems
- On-board communication systems
- Computerised Vehicle Routeing and Scheduling (CVRS)
- Satellite Navigation Systems
- Track and trace systems
- Paperless documentation and customs clearance

Vehicle and trailer tracking systems

69. Systems that can track a goods vehicle's movements have been available for many years. They can be used for tracking loads as well as vehicles and trailers. The hardware usually involves an on-board computer, a satellite signal (GPS) receiver and a communications module. These systems can help to deter and detect vehicle and load theft and thereby improve driver safety. Typical security applications can include: (i) panic buttons that allow the driver to raise a security alert so that the company can alert the police and the vehicle can be tracked, (ii) remote vehicle immobilisation that can be accompanied by door locking, flashing lights, and horn sounding, (iii) several vehicle tracking system providers offer vehicle tracking bureaux that can detect that a vehicle or trailer has moved outside a specified location or is operating outside its normal operating period.

On-board communication systems

70. Such systems can range from mobile and satellite telephones, to on-board text messaging and computing systems. These allow drivers to keep in touch with their company and other companies they are collecting and delivering from in the course of their operations. Drivers can be alerted of changes in their schedules and warned of problems in advance. In addition, drivers can contact supply chain partners, vehicle recovery services, and the police in case of emergency.

Computerised Vehicle Routeing and Scheduling (CVRS)

71. CVRS can be used to plan suitable vehicle routes and schedules to fulfil orders using digital maps and user-set parameters. The use of CVRS can help to improve customer service, planning time, reduce journey times and distances, and thereby reduce fuel costs.

Satellite Navigation Systems

72. Satellite Navigation Systems (SatNav) is used to provide drivers with instructions and mapping to reach their intended destination. This can be especially useful when the driver is making international deliveries in countries and cities that they are unfamiliar with, saving time spent deciding on a route and in selecting the wrong road. However, there can also be problems associated with using such technology. Such systems are capable of misrouting, resulting in a driver being directed a longer way when a shorter suitable route was available. In addition, drivers of heavy goods vehicles have frequently reported routeing problems caused by unsuitable routeings due to the computerised mapping software not containing constraints such as bridge heights, road widths, and weights restrictions (Freight Best Practice, 2006). There are frequently news reports in Europe of foreign goods vehicle drivers using Satellite Navigation

Systems that direct them onto inappropriate roads and becoming stuck for several days, and blocking the road in the process.

Track and trace systems

73. Track and trace systems can be used to track products throughout the supply chain. Such systems can provide visibility of the product at all stages and at all times. It is widely used in the parcels sector for worldwide operations. It helps companies to ensure safe, reliable and on-time delivery, and allows for improved planning. Such systems are also of great importance in locating products that have gone missing en route. Electronic seals and RFID[1] technologies are being increasingly used to track containers and other loads moved by road internationally.

Paperless documentation and customs clearance

74. Paperless documentation systems can be used to load manifest information electronically into a driver terminal at the beginning of the working day or throughout the day for greater working flexibility. Electronic proof of delivery can reduce delivery time and provide immediate proof of safe delivery and receipt of goods. Benefits of paperless systems can include reduced paperwork and administration costs, reduced delivery and invoicing errors, improved order status information and consignment tracking. This can result in lower operating costs and improved customer service.

75. Many customs authorities now use ICT applications in their work to help speed up processes and make them increasingly reliable, secure and resistant to fraud and corruption. It can also help to achieve customs revenue collection. ICT can also significantly reduce the number of physical inspections of goods required, and allow for pre-arrival clearance and risk analysis. It can be used to better plan the timing and location of physical inspections, thereby reducing the waiting-times for trucks and containers. An example of such a system is the UNCTAD Automated System for Customs Data (ASYCUDA) used to manage customs transit systems (UNCTAD, 2006). There are also plans to make some international road transport documentation electronic in future, such as TIR Carnets.

7. Factors influencing recent trends in international rail freight transport

76. Rail systems tend to be more heavily regulated than road operations and, in many cases, governments are directly involved in service provision in addition to their infrastructure-related responsibilities. The discussion that follows has been divided in four sections (infrastructure, policy/ regulation, operations and technology), but there are many inter-relationships between the issues raised in the specific sections.

7.1 Infrastructure

77. The most critical physical requirement to allow cross-border rail freight traffic is an active network connection. In some countries, rail networks are domestic in nature, and cross-border links have either never been constructed or have ceased operation. For example, in Latin America, links that previously existed between Colombia and Venezuela, and between Guatemala and El Salvador, are no longer present (ECLAC, 2003). In Europe, the various national railway networks are relatively well interconnected, although the quality of the international links can often be sub-standard compared to domestic corridors. Where a physical cross-border connection does exist, one of the biggest infrastructure constraints for international rail flows is the historical decision made by different countries to adopt a different track gauge (*i.e.* the distance between the two rails) when constructing their rail system. This is a

1 Radio-frequency identification.

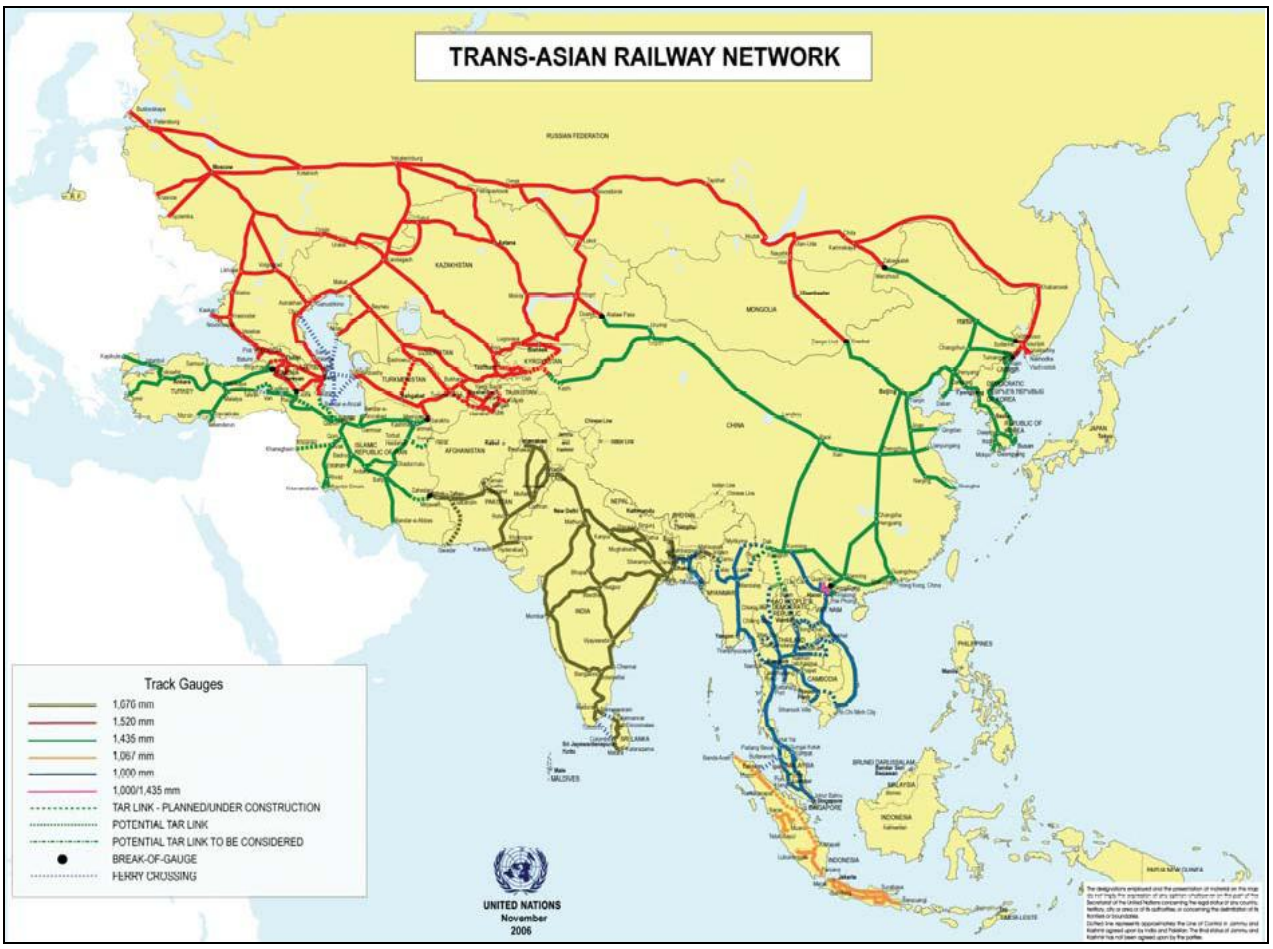
problem that persists within some countries, but is more particularly an issue at international borders. Two main gauges exist, metric (1,000mm) and standard (1,435mm), but there are others in certain parts of the world. Where different gauges are found, time and cost are added to the rail cross-border transfer since the goods themselves need to be transferred between rail wagons or the wagons need to have their axles changed for onward transport on the other gauge.

78. Examples where gauge differences exist at international borders include:

- Southern Brazil is metric gauge whereas Uruguay and Argentina have standard gauge networks; only the link to Bolivia is compatible with Brazil (ECLAC, 2003).
- France has standard gauge track, but traditional routes in Spain and Portugal have different gauges, 1,672mm in Spain and 1,664mm in Portugal; new high speed lines on the Iberian peninsula are being constructed to the standard gauge (European Commission, 2005), but freight will have to continue using the traditional routes where the difference in gauge will persist for the foreseeable future.
- In Asia, at least 5 different track gauges exist, ranging from metric in much of South East Asia up to 1,676mm in the Indian sub-continent; China has generally adopted standard gauge track, while Russia has a broader 1,520mm gauge (see Figure 7).

79. Another infrastructure-related issue is that of differing voltages on electrified lines, which has traditionally required a change of locomotive at border crossings where electric locomotives are used. This tends not to be as significant an obstacle as track gauge differences, though, since a locomotive change can be completed in a shorter period of time than regauging the wagons on an entire train. In many cases, diesel locomotives are used for cross-border services (even where systems are electrified) and, as identified in Section 7.4; multi-voltage electric locomotives have been introduced to operate internationally.

Figure 7. Trans-Asian Railway Network



Source: UNESCAP (2006).

80. A number of initiatives have been developed to try to better integrate domestic rail networks to provide higher quality long-distance corridors, notably in Europe where countries tend to be smaller and international rail freight activity more significant than elsewhere. RailNetEurope is one such initiative – see the accompanying case study box. Elsewhere, political alliances and/or disputes have had an influence on the continued use of existing cross-border infrastructure or the provision of new routes. For example, the break-up of the Soviet Union and subsequent unrest in much of the Caucasus region led to many of the rail routes linking Russia, Armenia, Georgia and Azerbaijan being abandoned and international rail freight volumes declining (Jackson, 2008). New links within this region are now proposed, together with external routes to Turkey and Iran which may eventually form part of strategic long-distance international corridors planned for the Asian continent. New routes are also planned within South East Asia, linking China to Thailand, Singapore and the Indian sub-continent (Briginshaw, 2007). Should the range of schemes currently proposed or under construction come to fruition, rail network connectivity across Asia will be significantly enhanced, opening up an array of new international journey opportunities.

Box 4. RailNetEurope (RNE)

RNE was established in 2004 and now has 31 rail infrastructure manager members from across the European Union. These members are responsible for a network covering approximately 230,000 km, and aim to develop a consistent European approach to cross-border rail traffic through greater harmonisation of systems and the removal of barriers.

RNE has four key objectives:

- To develop traffic on the European rail network
- To facilitate European rail infrastructure access
- To improve rail service quality
- To increase performance of the associated scheduling and operational procedures

An example of an initiative developed by RNE is the One-Stop-Shop concept, which aims to bring together the disparate rail networks along an international corridor and offer a single point of contact for potential service-providers who are keen to operate services using two or more infrastructure providers' networks. This should assist in reducing the barriers associated with national borders and simplify the process of establishing new international rail freight flows.

Source: RailNetEurope (2008).

7.2 Policy/regulation

81. In many parts of the world, railways are viewed as the responsibility of the public sector. Over time, though, many countries have initiated a process of liberalisation. Most noticeably, this occurred first in North America, but has also now taken place elsewhere, including Australasia, South America and Europe. There has been no standard method of liberalisation, but competition between rail freight companies is now prevalent in many countries. As Table 6 reveals, there are considerable differences in the processes implemented in North America and Europe. As a consequence, there remains a much greater role for the public sector in European rail provision. This may also result from the fragmented nature of the European market, rather than the more integrated North American situation where there are only three countries in a large land mass. Public policy remains an important issue regardless of the nature of the market.

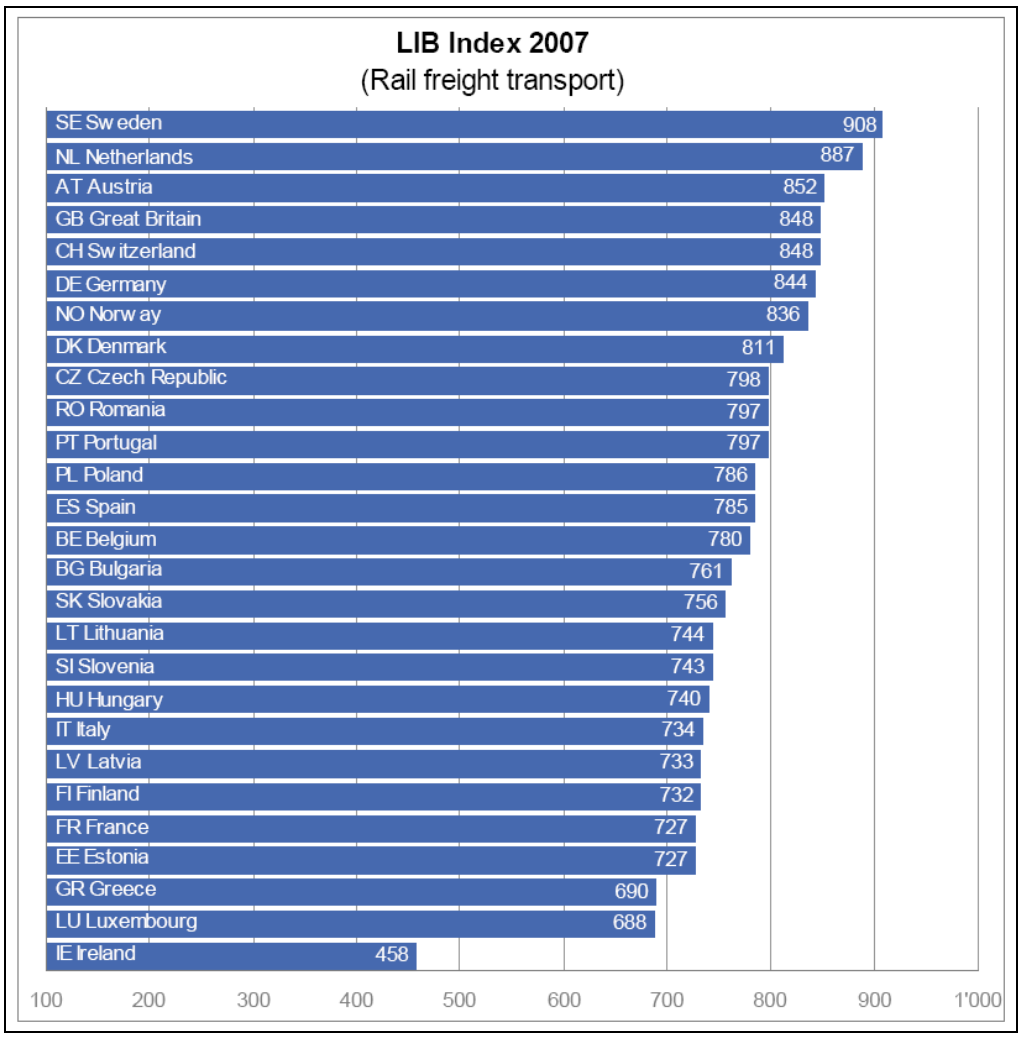
Table 6. Institutional differences between North America and Europe

	North America	**Europe**
Rail policy	Competition	Regulation
Rail competition	Parallel rail	On-rail
Infrastructure control	Operator	Regulator
Infrastructure funding	Private	Public

Source: Posner (2008).

82. The European Union sees the growth of international rail freight activity as a political objective, for economic, environmental and social reasons. Over the last decade, it has agreed a series of railway packages aimed at liberalising the rail freight market, particularly concerning cross-border traffic. Figure 8 shows that the extent to which specific European Union countries have liberalised their rail freight activity vary so far. Quite clearly there are differing experiences along the spectrum, with eight countries identified as being at an advanced stage. Just one, Ireland, falls in to the 'delayed' category. Under European law, international rail freight must now be liberalised, although certain countries have been less enthusiastic than others in allowing competitive service-provision to develop.

Figure 8. Liberalisation of rail freight transport in European countries



Key: 1,000-800 – Advanced; 799-600 – On schedule; 599-300 - Delayed
Source: IBM Global Business Services (2007).

7.3 Operations

83. There are various ways in which rail freight operations are being influenced by the internationalisation of transport activity. This section will highlight three of these to show the range of effects:

- Geographical expansion of operators
- New international services provided by co-operation between operators
- Landbridge corridors

84. With the liberalisation of access to provide services over rail networks in different parts of the world, formerly domestic rail freight operators have started to become more international in nature. An early example in the 1990s was the expansion of Wisconsin Central, a US railroad company that is now part of Canadian National, in to New Zealand, Canada, United Kingdom and Australia, often through the purchase of rail freight operations being privatised by governments (Canadian National, 2008). America

Latina Logistica (ALL), a private Brazilian operator has expanded its operations across the border in to northern Argentina (Kolodziejski, 2005). More recently, Railion Logistics has begun expanding rapidly across Europe – see the accompanying box for details.

Box 5. European Expansion of Railion Logistics

Railion is a division of Deutsche Bahn AG, the German national rail organisation which holds the majority of shares, with small percentages owned by the Dutch and Danish state railway organisations. In addition to its core German operations, Railion Deutschland, the company has direct rail operations in its established subsidiaries in the Netherlands, Denmark, Italy and Switzerland. Further expansion is occurring through acquisitions and partnerships, including the following during 2007:

- Joint venture established between Railion and Green Cargo, a Swedish operator, to improve service provision between Scandinavia and Central Europe
- Acquisition of EWS, Britain's largest rail freight operator that has also developed open access operations in France
- Purchase of the majority of shares in Transfesa, a Spanish logistics company with significant rail interests

As a consequence of this geographical expansion, which has occurred soon after the liberalisation of the European rail freight market, Railion is rapidly becoming a Europe-wide rail freight operator

Source: Railion (2007, 2008).

85. In addition to rail operators expanding their own territorial coverage, there have been developments in international services provided through co-operation between infrastructure and/or service operators, where two or more rail freight companies are responsible for the transit from origin to destination. For example, RZD, the Russian public rail company has been developing partnerships with a number of neighbouring countries, not least with the setting-up of the Eurasia Rail Logistics joint venture, which also includes Germany, Poland and Belarus (Lukov, 2008). A number of partnerships have developed in the European Union since the liberalisation process began, and service quality initiatives have subsequently been developed, building on the CER-UIC-CIT[2] Freight Quality Charter that was implemented in 2003 (CER, 2005). The Charter focuses mainly on train punctuality and the implementation of quality contracts between railways and customers. CER claims considerable success in improving service punctuality on international corridors, with steady improvement from 50% of trains arriving within one hour of schedule in 2001 to 72% in 2004. The impact of the Charter, which is being rapidly adopted to cover more and more services, is expected to lead to further improvement.

86. The third example can develop either as a result of one operator's expansion or the co-operation between a number of operators, demonstrating rail's abilities in providing a land-based link in international supply chains dominated by shipping, primarily for containers. The US land-bridge, where containers shipped across the Pacific from Asia are moved across to the East Coast is well-established, with international containers accounting for the majority of the 15 million (approx.) intermodal units moved by rail from the west to east of the US (Briginshaw, 2007). The growth in traffic between Asia and North America has led to rapid land-bridge growth for North American operators, such as Union Pacific, BNSF Railway, Canadian Pacific and Canadian National (Lustig, 2006). In South East Asia, there has been growth on the land-bridge route between Malaysia and Thailand, in competition with feeder ships (Abdullah, 2006). A similar land-bridge proposal is now being developed in Saudi Arabia, linking the Red

2 Community of European Railway and Infrastructure Companies (CER), Union Internationale des Chemins de Fer – International Union of Railways (UIC), Comité International du Transport Ferroviaire – International Railway Transport Committee (CIT).

Sea and the Gulf which will allow traffic from the key Jeddah Islamic Port on the Red Sea to move more directly to the Gulf region (Jackson, 2005).

87. More innovatively, plans are emerging for new long-distance services taking advantage of the network improvements and regulatory freedoms outlined earlier. For example, the accompanying case study box reveals details of a trial through container train service from China to Europe in early-2008, possibly marking the start of a concerted effort by rail companies to gain a share of the rapidly expanding market for freight transport between the Far East and the European Union.

Box 6. China-Germany container train trial

Responding to the increasing trade volumes between China and the European Union, a trial container train operated in January 2008 between Beijing and Hamburg conveying a range of consumer goods. The 10,000 kilometre journey through six countries (China, Mongolian Republic, Russia, Belarus, Poland and Germany) took 15 days, which is approximately half the duration by sea between the two cities. As a consequence of the successful trial, plans are being developed to commence regular operations on this corridor by 2010.

Source: Deutsche Bahn AG (2008).

7.4 Technology

88. Despite the greater potential benefits from adopting new technologies in a more fragmented continental market, European countries have tended to lag behind North America in their adoption of new technologies that assist in making rail freight more competitive. In general, the rail freight sector has typically not been very quick to develop and adopt new technologies. The combination of generally low-technology operations and, where technological solutions have been adopted, incompatibility between different national systems poses considerable challenges for cross-border rail movements.

89. The Americans have progressively modernised their systems, for example with the introduction of higher axleloads, automatic wagon tracking and wagon autocouplers, while European systems have tended to be slow to introduce new methods (Anon, 2008). This may reflect the commercial imperative of North American operators, who have seen the benefits of investment to improve rail's market position, compared to the state-controlled or state-influenced operations in Europe, where innovation has been much slower. The newly established European Railway Agency sees one of its main objectives being the development and introduction of new, standardised technologies and working practices to make rail freight more competitive with road, particularly for cross-border flows where interoperability is currently a significant obstacle (ERA, 2007). The accompanying box identifies a number of technologies that are being adopted or are under development in the European Union to help to overcome infrastructural differences and enhance the quality of cross-border rail freight services.

Box 7. Technologies to enhance interoperability in the European Union

Examples of technologies being implemented include:

- Multi-voltage electric locomotives: a number of new locomotive designs are being introduced that allow locomotives to work across international borders; for example, the Traxx locomotive has modules that allow it to operate on most of the electrified networks across Europe
- Signalling systems: a key component of European Rail Traffic Management System (ERTMS) is a new interoperable signalling system that is intended to reduce operating costs and enhance rail's competitiveness through the implementation of continent-wide standards that incorporate modern technology
- Gauge transfer: pending the full standardisation of track gauge across the European Union, new rapid gauge changing technologies have been developed to regauge wagons, reducing the length of time required at borders where track gauges differ on either side
- Train payloads: technological solutions to allow freight trains to be longer, larger and/or heavier, thus benefiting from economies of scale and reducing the unit cost of rail transport
- Information technology (*e.g.* consignment tracking): a technical specification for interoperability (TSI) has been developed relating to the adoption of standardised telematics applications, which will feed in to ERTMS

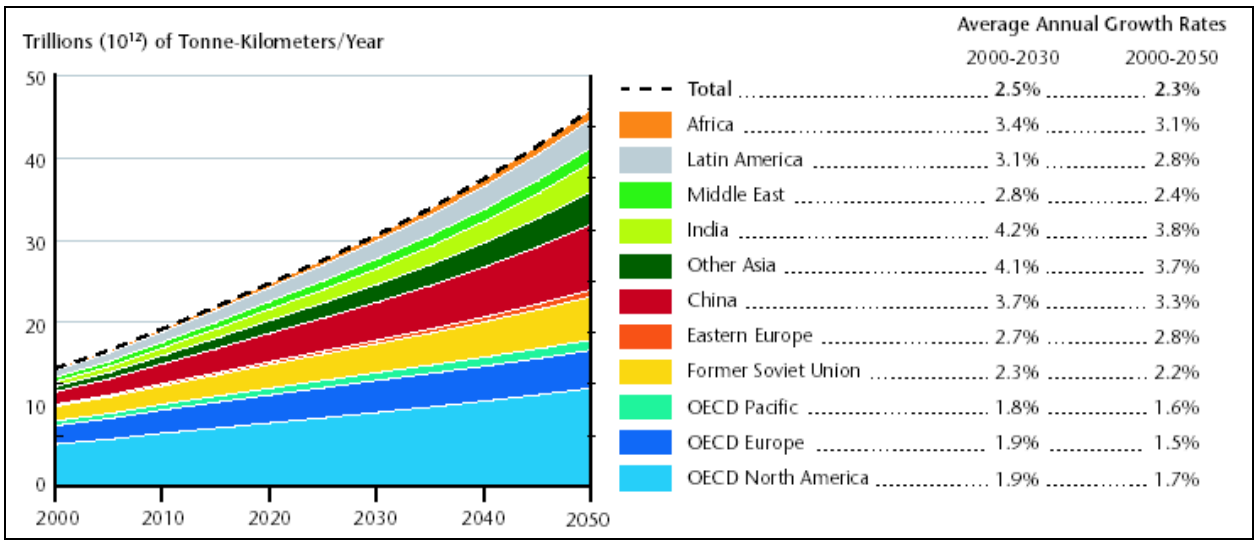
While some of these initiatives are starting to have an impact on reducing delays at border-crossings and improving the performance of international freight services, overall progress is relatively slow and full implementation of some measures (*e.g.* ERTMS) is likely to take many more years.

Source: CER (2007a), CER (2007b) and Vitins (2008).

8. Future perspectives

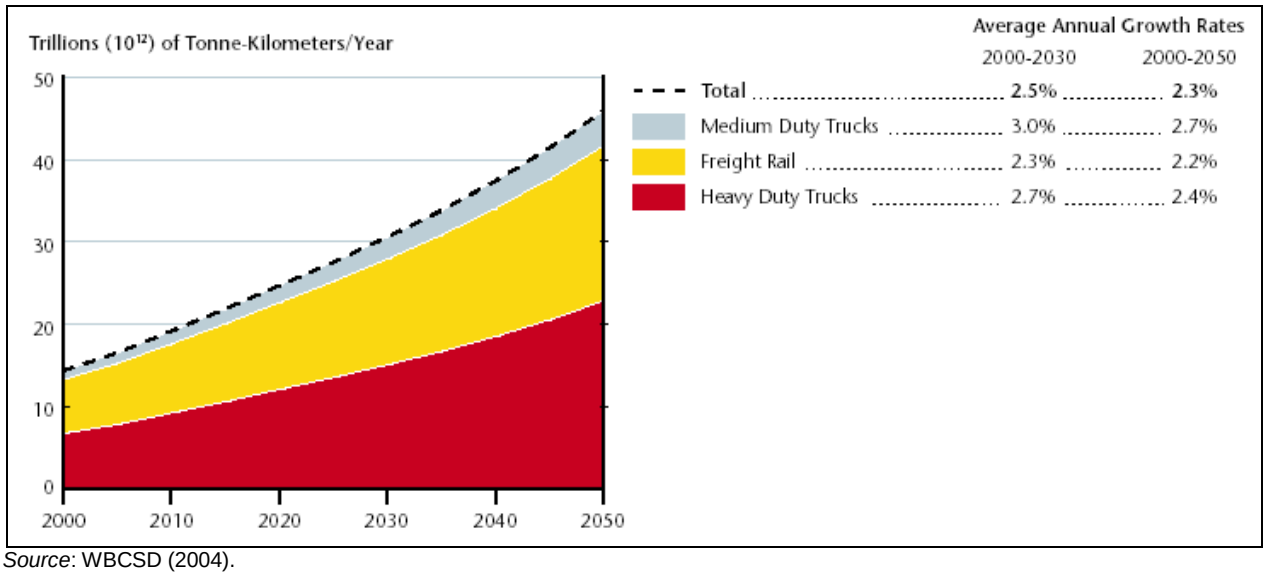
90. Projections of total road and rail freight activity (*i.e.* domestic and international) were produced as part of the Sustainable Mobility Project in 2004 (WBCSD, 2004). These projections indicate that road and rail freight transport activity will grow significantly over the period to 2050. Figure 9 shows the projections by region and Figure 10 shows the projections by mode (road – divided into medium and heavy trucks - and rail). In the USA, international freight is forecast to grow by 111% between 2002 and 2035, while domestic freight is expected to grow by 91%. International road and rail freight are expected to grow by 188% and 112% respectively over the same time period (Office of Freight Management and Operations, 2007).

Figure 9. Projected road and rail freight transport activity by region to 2050



Source: WBCSD (2004).

Figure 10. Projected road and rail freight transport activity by mode to 2050



Source: WBCSD (2004).

91. Growth in international movements are not shown separately – but if the broad trends above also occur in international road and rail transport, then there are some dramatic consequences in terms of the need for improved infrastructure and the removal of bottlenecks.

92. However, it is not simply a question of infrastructure. Recent work to develop a Logistics Performance Index (LPI) suggests "that policymakers should look beyond the traditional 'trade facilitation' agenda that focuses on road infrastructure and information technology in customs to also reform logistics services markets and reduce coordination failures, especially those of public agencies active in border control" (Arvis et al, 2007). The Logistics Performance Index is a benchmarking tool developed by the World Bank that measures performance along the logistics supply chain within a country. It is based on a

worldwide survey of global freight forwarders and express carriers, and allows comparisons across 150 countries. The index is intended to help countries identify challenges and opportunities and improve their logistics performance, in moving goods internationally rapidly, reliably, and cheaply (Arvis et al, 2007).

93. It is evident that many multinationals are rationalising the number of logistics service-providers they deal with - in much the same way as they have rationalised their production and warehousing operations (there is, of course, a link between these developments). This, together with the growth in intra-regional trade, is leading to greater demand for transport and logistics services. Political changes have opened up new geographical markets, both for production and consumption. Devising and implementing the right logistics strategies lies at the heart of successfully capitalising on these commercial opportunities available. Many of these changes are of significance to logistics service-providers, especially those concerned with international markets.

94. Road and rail are currently carrying relatively small quantities of products traded internationally compared with maritime shipping, especially in terms of product moving between economic regions. However, likely increases in the total quantity of international trade (as a result of manufacture continuing to grow in distant locations, facilitated by more reliable, and faster transport services, supported by improvements in technology) will increase the amount of goods that need to be transport internationally. In addition, the relative cost and speed advantages of land-based transport compared to water and air are likely to increase demand for international movements by these modes.

95. However, in order for international land-based transport to grow in this way, continued efforts must be made by governments to put in place measures and initiatives to enhance its efficiency. In many developing and landlocked countries and regions major improvements must be achieved to further reduce the costs and increase the speed of road and rail systems if they are to enjoy the benefits in trade growth resulting from globalisation. In countries already participating in large international trade flows, efforts will need to continue to reduce physical and non-physical barriers in order to maintain their competitive position. This will involve taking a range of initiatives which include:

- improving road and rail infrastructure to reduce bottlenecks and fill missing links
- harmonising road and rail networks internationally
- reducing time spent obtaining customs clearance and crossing borders
- reducing crime against drivers and loads in land-based transport safety
- reducing the level of corruption at border points

96. In order to achieve these improvements, countries will need to enter into international trade and transport agreements with neighbouring states. Greater use of international agreements will be more beneficial than bilateral and regional agreements. Where bilateral and regional agreements are chosen, these should make use of existing international conventions.

97. Manufacturers, retailers and logistics companies are becoming increasingly aware of the importance of time in the supply chain. It can result in additional costs due to the need for expensive stockholding. Also, shortening product life-cycles are making it increasingly important for producers and retailers to get products to market as quickly as possible. For land-based transport to play a growing role in international supply chains it must therefore be able to provide sufficiently rapid and reliable service levels to meet this demand.

98. ICT can help to bring about time-compression in land-based transport services and in customs and border services. ICT also has an important role in making customs and border systems more transparent and increasing the reliability and efficiency of transport services. It also improves safety and

security for drivers on international freight trips. Both the public and private sectors have important roles to play in ensuring that these technologies are embedded and used to their capacity.

99. Terrorism poses a particular threat to international road and rail transport. The infrastructure used by these modes is easily accessible and often lacks surveillance (such as major roads, bridges and tunnels). In addition, road goods vehicles are readily available and difficult to monitor for such use. It is therefore important that efforts are made at an international level to harmonise national security standards across borders to help prevent the risk of terrorist-related activity using road and rail.

100. The Logistics Performance Index (Arvis et al, 2007) suggests major differences in logistics performance across countries and regions, including differences between developing countries at similar levels of development. Those developing countries with relatively poor indices, and especially those that are landlocked, need to focus on the service level (in terms of cost, speed and reliability) provided by the road and rail services if they are to enjoy the benefits of trade-related globalisation in coming years. Their focus should not necessarily be on building road and rail infrastructure. Key factors are likely to include reducing land-based transport costs (domestically and in transit countries), and negotiations with transit countries to put in place suitable transport agreements and to work jointly to speed up customs and border processing. As Grigoriou (2007) has noted, "transit corridors are regional public goods and should be managed as such through international cooperation. International financial institutions can, and do, play a key role in this regard by providing assistance and coordination, as well as participating in policy dialogue".

101. If land-based transport services can achieve these efficiencies, it is likely that they will increase their share of international freight traffic over time. See the accompanying case studies for examples of how this could be achieved.

8.1 Projects to improve international freight transport in specific regions

102. This section contains examples of projects that are aiming to improve trade and international freight transport operations in specific regions.

Box 8. Trade and Transport Facilitation in Southeast Europe Program (TTFSE)

The World Bank, with the bilateral agencies of countries including the USA, the Netherlands, France and Austria, has supported a regional programme on trade and transport facilitation in Southeast Europe (TTFSE). The program, which started in 2001, includes eight countries: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, FYR Macedonia, Moldova, Romania, and Serbia and Montenegro.

The objective of the programme has been to encourage trade in the region by promoting more efficient and less costly trade flows across these countries, and improve customs operations to European Union standards. The program has sought to reduce non-tariff costs to trade and transport, to reduce smuggling and corruption at border-crossings, and to strengthen and modernize the customs administrations and other border control agencies. The primary emphasis in the early years of the programme was on road transport, but the focus has now been broadened to include other modes, primarily rail.

An important element in the programme has been the use of benchmarks and monitoring systems to track improved performance over the life of the program. Specific performance indicators were established on the basis of consultation with border-crossing agencies, and local project teams were established at border-crossing points to analyse the results and solve problems through inter-agency interaction at the local level. Validation of the progress, as well as the status of corruption, was also obtained through surveys of users.

The programme has achieved some notable success, with significant reductions (of up to 87%) in clearance-times reported for a number of the most important border-crossing points, and at inland terminals. In addition, there

has been an increase in trade volumes and in the revenue collected by Customs from duty and VAT.

Communications between the public and private sectors were formalized and improved with the establishment of public-private "Pro-Committees", which assisted with the dialogue between the parties and identified pragmatic solutions to the problems faced by forwarders and traders in the region. To further assist in the flow of information, a website was established (www.ttfse.org), together with the publication of an annual booklet on the harmonised procedures.

TTFSE is now moving into a second phase – TTFSE II, which will consolidate the achievements made under the original program while also replicating and scaling them up. TTFSE II has broader aims than TTFSE of embracing further aspects of trade facilitation by ensuring effective collaboration between all agencies active at border-crossings (Customs, road administration, border police, phyto-sanitary and veterinary controls), all modes of transport in the region (road, rail, inland waterway, and multimodal transport), and all border-crossings on the main TEN-T Corridors running through Southeast Europe and connecting the region with its neighbours.

Source: The World Bank (2005) and TTFSE (2008).

103. The European Union is continuing to focus on international rail freight, with a new policy document having emerged in late-2007 aimed at identifying a Europe-wide network of corridors where priority is to be given to freight flows (European Commission, 2007) – see the accompanying box for the key features of this proposal.

Box 9. Priority Rail Freight Network

Figure 11 shows the initial proposal for a priority rail freight network across the European Union. On this priority network, it is the intention that infrastructure and operations issues will be brought together to improve service quality to make rail more competitive against road haulage. Journey times, reliability and capacity are the key elements that will be addressed by this initiative. Specific actions that are proposed include:

- Determining the legal definition, and associated operating rules, of a priority freight corridor
- Encouraging infrastructure managers to coordinate their activities to promote corridors
- Identifying funds for corridor development
- Developing legislation to publish quality measures
- Examining steps taken by rail operators to improve service quality
- Coordinating technical improvements to make the most of capacity and to remove bottlenecks
- Improving international train paths through better coordination and priority for international trains (building on the RailNetEurope concept)
- Specifically, giving priority to international services at times of network disruption
- Ensuring that sufficient, good quality rail terminals and marshalling yards are provided

Source: European Commission (2007).

Figure 11. Indicative scope for a rail freight-oriented network

Source: European Commission (2007).

104. The accompanying case study box identifies a potential new land-bridge freight corridor across Asia and Scandinavia. Table 7 shows the distance savings that are offered by the two key rail routes across Asia when compared to the sea corridor; the land route is typically around half of the sea distance.

Box 10. The proposed Northern East West (N.E.W.) sea-rail freight corridor

UIC (International Union of Railways) has proposed the development of a new sea-rail corridor between China, Russia, the Nordic countries and North America. The rail leg would run from China to Norway, with a sea leg from there to North America. One of the key objectives of the proposed corridor is the provision of an alternative east-west route that would avoid major existing bottlenecks on the traditional more southerly routes. The rail link between China and Norway already exists, passing through Kazakhstan, Russia, Finland and Sweden, although it has a mix of broad and standard gauge tracks. Despite the technical and political obstacles associated with gauge changes and border crossings, UIR estimates that the through journey time from Urumchi (west China) and Halifax (Canada) by rail-sea could be as little as 15-16 days, representing a considerable time saving over current routings. It is recognised that considerable improvements would be required in the organisation of the railway operations, with far greater international co-operation and a streamlining of procedures.

Source: UIC (2004).

Table 7. Sea and rail distances between China and Rostock (Germany) (km)

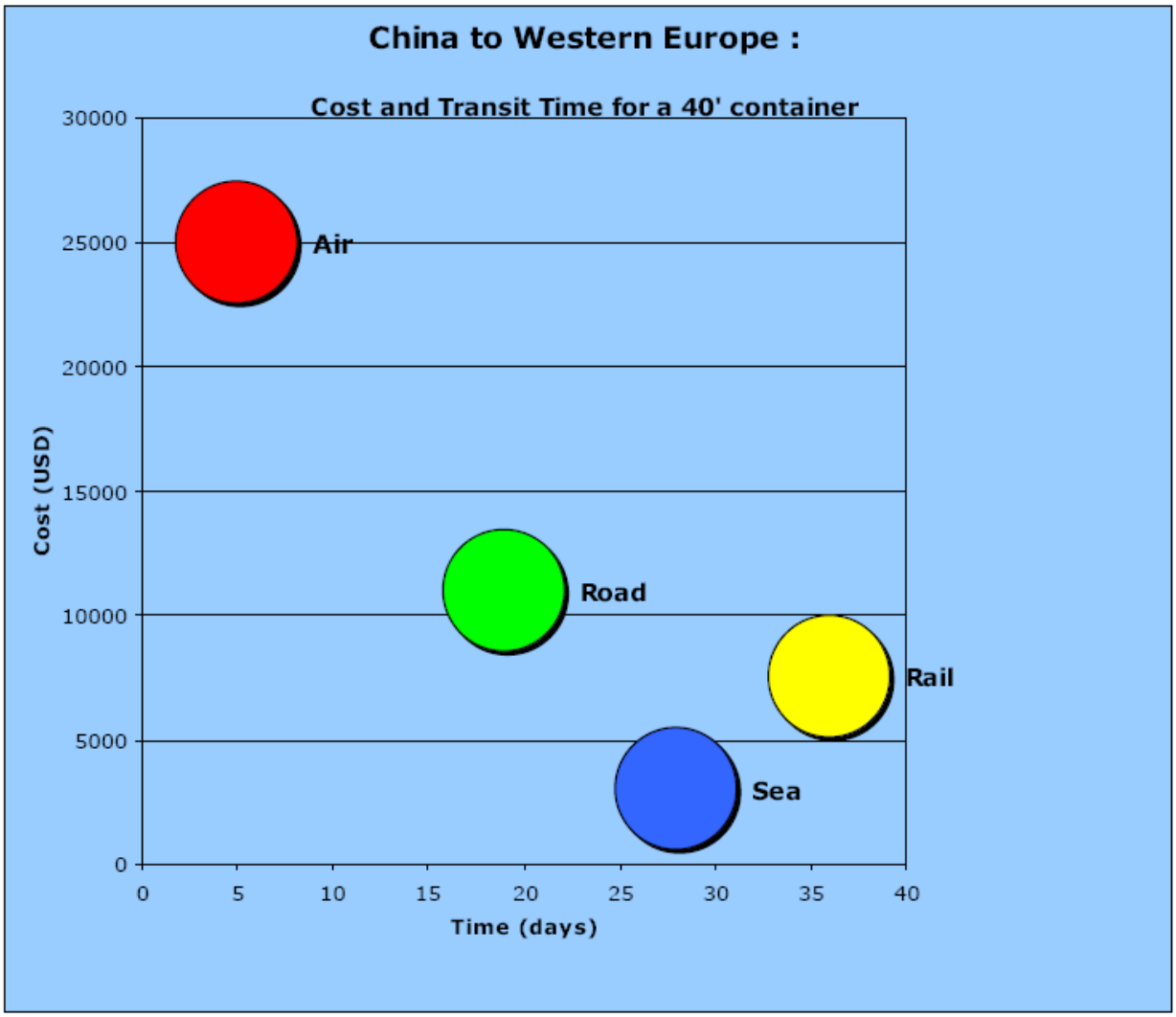
From	To	Rostock		
			By rail	
		By sea	Trans-Siberian	Euro-Asian
China port:	Tianjin	22,500	9,900	10,400
	Lianyungang	21,800	10,700	10,200
	Shanghai	21,200	11,100	10,600
Japan		22,800	13,300	12,700
Hong Kong		19,700	-	11,200

Source: UNESCAP (1995).

8.2 Concluding remarks

105. The above sections clearly show that with developments to remove bottlenecks, combined with operational improvements, there is scope for considerable increases in the efficiency of international road and rail freight in many regions. Of course, it is not simply a question of transit time and reliability (although both these are highly important), it is also a question of cost. Figure 12 shows the results of a study comparing the total door-to-door transportation costs and transit (journey) times for a range of available transport solutions carrying containerised cargo from Asia to Europe. In the study, quotes were obtained from freight forwarders and transport operators for a specified list of transport services and destinations in order to produce these results.

Figure 12. Freight Costs and Transit Times for containerised freight between Asia and Europe



Note: The freight rate quotations on which these results are based were for a single 40' container loaded with 20 tons of cargo. The quotations include 100 km of trucking at both origin and destination. Insurance cost and other payments related to liabilities were not included. Transit times were provided by the freight forwarders/operators. The study was based on a relatively small sample size for each of the analyzed transport legs.
Source: The Chamber of Commerce of the United States (2006).

106. The results indicate that air transport has the highest cost and has a very short transit time. Sea transportation provides the lowest cost, but has a long transit time. Road freight results fall between air and sea both in terms of cost and transit time. The rail transport results had a very wide range of costs (4,000-10,000 USD) and transit times (14 to 45 days). The rail data showed major differences between the officially scheduled transit times and the transit times quoted by freight forwarders for complete door-to-door solutions (as did the rail freight rates quoted which were 30-60% higher than the listed rates). Transit times for rail transportation between Western China and Western Europe are quoted as 15-20 days in other studies so the rail results should be treated with caution.

107. Clearly, there are many developments that are difficult to predict with accuracy and certainty. Many past forecasts of improvements in transport technology and operations have been overtaken by events and in some cases, rather than transport becoming easier and faster, it has become more complex

and occasionally slower. Further consideration of Figure 12 highlights the way in which developments in the performance of one mode can have major implications for the use of the mode. Within the next 15 years, there seems to be limited opportunity to dramatically increase the speed of either ships or aircraft. Indeed, increased concern about CO_2 emissions could lead to changes in the view of the role of air freight within the supply chain. During the same period, there may even be calls for sea freight transport to operate at slower speeds (thereby lengthening transit times) in order to save fuel. Given these uncertainties, it is interesting to note the potential for rail movement in particular to offer opportunities for shorter transit times and possibly reduced costs. Road freight times may not have the scope to be reduced to the same extent as rail freight, but there are still many opportunities to improve road operations and thereby improve both the economic and environmental performance of road freight transport over long distances.

108. As noted in the introduction, international road and rail freight transport is extremely diverse. Thus the developments that have implications for short distance road freight are very different from those that affect long distance rail. It is evident from this review that there remain many opportunities to improve the efficiency and to reduce the environmental impact of both international road and rail freight transport. Many of these developments require government intervention in the form of changes in policy and regulation or improvements to infrastructure. This is a complex area when considered within one country – when it concerns international developments it is, of course, even more complicated. However, it is important when considering the developments that will happen in the next 15 years to note the growing role played in international transport of the major logistics companies. The consolidation that is evident means that single companies are now able to provide truly integrated services in a way that was not possible a few years ago. At the same time, the increased business focus on applying the supply chain approach is also evident – it is important for policy makers and regulators to take note of these developments, in order to maximise the opportunities for more efficient international road and rail freight transport, and in order to ensure that developments meet the much more demanding environmental constraints that the transport sector faces.

REFERENCES

Abdullah, D. (2006), "Malaysia plans five years of rail growth", *Railway Gazette*, 1 October.

Anderson, J. and Wincoop, E. van (2004), "Trade costs", *Journal of Economic Literature*, Vol. 42, pp. 691-751.

Anon (2008), "Freight standards need updating", *Railway Gazette*, 9 January.

Arvis, J-F., Mustra, M.A., Panzer, J., Ojala, L. and Naula, T. (2007), *Connecting to Compete - Trade Logistics in the Global Economy: The Logistics Performance Index and its Indicators*, The World Bank.

Briginshaw, D. (2007), "Asian railways rise to meet the growth challenge", *International Railway Journal*, 1 January.

Canadian National (2008), *The Wisconsin Central Story*, available on-line at: www.cn.ca/about/company_information/history/en_AboutWisconsinCentral.shtml (date accessed: 20/02/08).

CER (2005), *Rail freight quality: progress in a competitive market – Update Report on the CER-UIC-CIT Charter*, Community of European Railway and Infrastructure Companies (CER).

CER (2007a), *A new signalling system for Europe's trains*, Community of European Railway and Infrastructure Companies (CER).

CER (2007b), *Information interchange on rail freight: Improving customer service by innovative use of the telematic applications for freight regulation*, Community of European Railway and Infrastructure Companies (CER).

Crass, Mary (2007), Speech by Principal Administrator of the ECMT/International Transport Forum at the 4th IRU Euro-Asia Road Transport Conference, 14-15 June 2007, Warsaw.

Deardorff, A. (2005), "The Importance of the Cost and Time of Transport for International Trade", paper in ECMT (2005) *Time and Transport*, Round Table 127, ECMT.

Deutsche Bahn AG (2008), *Beijing-Hamburg container express manages 10,000 kilometres in only 15 days*, press release, 24 January.

ECLAC (2003), "The potential for more trade by rail between Brazil and its neighbours in the Southern Cone", *Facilitation of Trade and Transport in Latin America and the Caribbean Bulletin*, Issue 2005, September, ECLAC, United Nations.

ECMT (2000), *Integration of European Inland Transport Markets*, ECMT, Paris.

ECMT (2005), *International Road Freight Transport in Europe - Market Access and the Future of The Licence System*, Report of The Special Advisory Group, ECMT, Paris.

ECMT (2006), *Transport Links Between Europe and Asia*, ECMT, Paris.

ERA (2007), *Annual Report 2006*, European Railway Agency (ERA).

European Commission (2005), *Trans-European Transport Network: TEN-T Priority Axes and Projects 2005*, European Commission, Brussels.

European Commission (2007), *Towards a rail network giving priority to rail freight*, COM(2007)608, European Commission, Brussels.

Eurostat (2003), *Trends in rail goods transport 1990-2001*, Statistics in Focus Theme 7 – 9/2003.

Eurostat (2004), *Trends in road freight transport 1990-2002*, Statistics in Focus – 7/2004.

Eurostat (2007a), *Trends in road freight transport 1999-2005*, Statistics in Focus – 27/2007.

Eurostat (2007b), Railway transport – goods transported, by type of transport.

Ferrer, José Capel (2005), Speech by the Director of the UNECE Transport Division at 3rd IRU Euro-Asian Road Transport Conference, 26-27 September 2005, Beijing.

Fontaine, P. (2007), Speech by representative of the Directorate General for Energy and Transport, European Commission, at 4th IRU Euro-Asia Road Transport Conference, 14-15 June 2007, Warsaw.

Freight Best Practice (2006), *Wayfinding Research: Using Satellite Navigation to Improve Efficiency in the Road Freight Industry*, Research Report, Freight Best Practice Programme, UK.

Grigoriou, C. (2007), *Landlockedness, Infrastructure and Trade: New Estimates for Central Asian Countries*, Policy Research Working Paper 4335, The World Bank.

Hummels, D. (2001), *Time as a Trade Barrier*, GTAP Working Paper No. 18, Global Trade Analysis Project, Purdue University.

IBM Global Business Services (2007), *Rail Liberalisation Index 2007*.

IRU (2005), *IRU praises reopening of Silk Road*, Press release number: 807, November 2nd, 2005, IRU.

IRU (2006), "The Importance of the Euro-Asian Road Transport Connection Contribution from the EU", Annex 2, in ECMT (2006), *Transport Links Between Europe and Asia*, ECMT.

IRU (2008) *1 in 6 drivers attacked*, press release, 18 February 2008, IRU.

Jackson, C. (2005), "Saudi Landbridge ready to launch", *Railway Gazette*, 1 March.

Jackson, C. (2008), "Railways realign in troubled region", *Railway Gazette*, 16 January.

Kolodziejski, J. (2005), "Grain giant targets cross-border logistics", *Railway Gazette*, 1 June.

Kopp, A. (2006), "Summary of Discussions", in ECMT (2006), *Transport and International Trade*, Round Table 130, ECMT.

Latrille, P. (2007), "The Role of Market Structure in the Transport Sector on the Effects of Liberalization: The Case of the World Trade Organization", report in ECMT (ed). (2007), *Market Access, Trade in Transport Services and Trade Facilitation*, ECMT.

Lukov, B. (2008), "RZD adopts long-range development strategy", *Railway Gazette*, 22 January.

Lustig, D. (2006), "Railroads invest in extra capacity to move Asian import windfall", *Railway Gazette*, 1 August.

NATSD North American Transport Statistics Database (2007), available on-line at: http://nats.sct.gob.mx/

Office of Freight Management and Operations (2007), *Freight Facts and Figures 2006*, Federal Highway Administration, US Department of Transportation.

Posner, H. (2008), "Rail freight in the USA: lessons for Continental Europe", *CER Essay Series*, Community of European Railway and Infrastructure Companies (CER).

Railion (2007), Railion – The European Rail Freight Company.

Railion (2008), www.railion.com (date accessed: 21/02/08).

RailNetEurope (2008), www.railneteurope.com (date accessed: 08/02/08).

Rodrigue, J-P. and Hesse, M. (2007), "Globalized trade and logistics: North American perspectives", chapter in Leinbach, T. and Capineri, C. (eds.) *Globalized Freight Transport: Intermodality, E-Commerce, Logistics and Sustainability*, Edward Elgar, Cheltenham: UK.

The Chamber of Commerce of the United States (2006), *Land Transport Options between Europe and Asia: Commercial Feasibility Study*, The Chamber of Commerce of the United States.

The World Bank (2005), *Trade and Transport Facilitation in Central Asia: Reducing the Economic Distance to Markets*, Final Draft, The World Bank.

TTFSE Trade and Transport Facilitation in Southeast Europe Program (2008), TTFSE website, available at: www.seerecon.org/ttfse/

UIC International Union of Railways (2004), *The Northern East West (N.E.W.) Freight Corridor*, UIC.

UNCTAD United Nations Conference on Trade and Development (2006), *Report of the Expert Meeting on ICT Solutions to Facilitate Trade at Border Crossings and Ports*, TD/B/COM.3/EM.27/3, UNCTAD.

UNCTAD (2007), Note by the UNCTAD secretariat, for the Expert meeting on regional cooperation in transit transport: *Solutions for landlocked and transit developing countries*, 27-28 September 2007, Geneva, UNCTAD.

UNECE United Nations Economic Commission for Europe (2006), Extract from the UNECE Contribution to the UN Annual Report on Regional Integration, ECE/TRADE/C/NONE/2006/2, 29 May 2006, UNECE.

UNECE (2007), International E Road Network, UNECE.

UNECE (2008*), Multidisciplinary Group Of Experts On Inland Transport Security*, Final Report to be submitted to the Bureau of the Inland Transport Committee on 18 February 2008, Informal document AC.11 No. 1/Rev.1 (2008), UNECE.

UNESCAP United Nations Economic and Social Commission for Asia and the Pacific (1995), *Land Transport Linkages from Central Asia to Sea Ports in the South and the East*, UNESCAP.

UNESCAP (2003), *Transit Transport Issues in Landlocked and Transit Developing Countries*, Note by the secretariat, E/ESCAP/1282, UNESCAP.

UNESCAP (2006), *Integrated International Transport and Logistics System for North-East Asia*, UNESCAP.

UNESCAP (2008), *Asian Highway Route Map*, available at: www.unescap.org/TTDW/common/TIS/AH/maps/ah_map_2007.jpg

Vitins, J. (2008), "Traxx loco family meets European needs", *Railway Gazette*, 7 January.

WBCSD World Business Council for Sustainable Development (2004), *Mobility 2030: Meeting the challenges to sustainability*, The Sustainable Mobility Project, Full Report, WBCSD.

WTO World Trade Organization (2007), *International Trade Statistics 2007*.