

# OXFORD ECONOMICS

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## **Economic and competitiveness gains from the adoption of best practices in intermodal maritime and road transport in the Americas**

### **The TIR system as an example of a best practice**

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A report prepared by for



Inter-American  
Committee on Ports



Organization of  
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## Executive Summary

Both road and maritime transport modes have grown substantially in recent years, a likely product of globalization and the rapid development of emerging markets. Over 80 percent of goods marketed worldwide are transported by sea.<sup>1</sup> More than 99 percent of trade by weight (except for bulks) is carried via ocean cargo, with a nine-fold surge in tonnages traded since 1960.<sup>2</sup> Furthermore, developing countries are making up an ever larger share of the seaborne trade, responsible for 60 percent of world goods loaded and 58 percent unloaded.<sup>3</sup> The world's road network comprises over 40 million paved lane km. In the period 2000-2009, the global road network length increased by approximately 12 million lane-km with China and India accounting for more than 50 percent of paved lane-km additions during that time. Paved roadway length in Latin America also recorded substantial growth over that time. Within South America specifically, trucks account for some 35 percent of intra-regional trade by volume (with maritime transport some 61 percent) and 42 percent of trade by value (maritime 46 percent). Latin American and Caribbean (LAC) countries accounted for some 15.3 million trucks and vans in 2006 – roughly 8 percent of the global fleet total of 196.5 million in that year.

Some key maritime developments in recent years include containerization, the increasing capacity of ports and shipping vessels, and improvements in port logistics. Containerized trade, one of the most profitable activities for ports, has been the fastest growing segment of the shipping market, making up more than 16 percent of the global shipping trade by volume in 2012 and more than 50 percent of the trade by value.<sup>4</sup> Container traffic in Latin America has more than doubled in the past ten years, from 17 million twenty-foot equivalent units (TEUs) in 2000 to 40 million TEUs in 2010, with an average annual growth rate of 10 percent.<sup>5</sup> A second key maritime development, related to the increase in containerization, is the expansion in capacity of ports and shipping vessels to take advantage of the economies of scale offered by larger vessels and to keep up with the increasingly larger volumes of goods traded. The average size of container ships has grown 80 percent since 2005.<sup>6</sup> A third key maritime issue is port logistics, which includes tracking goods and relieving port congestion. The

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<sup>1</sup>Sida, K. (2009) *Trade Facilitation and Maritime Transport: The Development Agenda*. National Board of Trade, and Swedish Maritime Administration

<sup>2</sup> Hummels, D. (2006) *Global Trends in Trade and Transportation: Benefiting from Globalization: Transport sector contribution and policy challenges*. Berlin: 17<sup>th</sup> International Symposium on Transport Economics and Policy.

<sup>3</sup> *United Nations Conference on Trade and Development* (UNCTAD) (2013) 'Review of Maritime Transport'

<sup>4</sup> *ibid*

<sup>5</sup> Sarriera, M. (2013) *Benchmarking Container Port Technical Efficiency in Latin America and the Caribbean*. IDB Working Paper Series No. IDB-WP-474.

<sup>6</sup> UNCTAD (2013) 'Review of Maritime Transport'

savings associated with monitoring the movement of goods are estimated at 4 percent.<sup>7</sup> A study on East Asian ports found that the net benefits from a reduction in congestion are greater than the net benefits of expanding ports in the region.<sup>8</sup> Furthermore, the study found that cutting port congestion by 10 percent could lower transport costs in East Asia by up to 3 percent, or the equivalent of a 0.3 to 0.5 percent tariff cut.<sup>9</sup>

Traditionally road freight has suffered from limited abilities to achieve the economies of scale enjoyed by rail transport, as governments have imposed size constraints and also due to technical limits. The productivity of road transport has improved, however, with the introduction of larger articulated trucks. The use of such longer vehicles allows for exploitation of economies of scale. Higher capacity vehicles can improve fuel efficiency and reduce pollution, once limits on wheelbases, axle loads, spacing and weight are relaxed. For example, a government trial in New Zealand during 2008-09 found that 50 tonne vehicles could allow for 10-20 percent increases in productivity, a fall in trip numbers by 16 percent and a fall in fuel use by 20 percent.<sup>10</sup>

In order to move cargo large distances to its destination, much of the world's freight uses multiple forms of transport. This intermodal freight is often seen in the form of shipping containers, which can be transferred between different forms of transport, including road, rail and seaborne trade. Coordination between these different modes of transport is an important part of improving global haulage networks. However, inland bottlenecks in the rail and road transport systems impede port cargo flows.

Trade costs encompass distance-related transport costs, port efficiency, and regulatory burdens, and other factors. In addition to financial costs, trade costs also encompass the cost of time it takes to move goods. Both factors affect the competitiveness of trading and high trade costs can impose barriers to trade. Not only do they lower volumes traded, but they can prevent other products from being traded. For example, Dennis and Shepherd (2007) show that a 10 percent reduction in internal trade costs increases the number of products exported by 2.5 percent.<sup>11</sup> For the majority of countries, however, logistics costs are a bigger component of total trade costs than tariff barriers. Poor logistics means that firms have to hold more inventory. Holding more inventory ties up capital, leading to

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<sup>7</sup> Febré, G. and Pérez Salas, G. (2012) 'Intelligent transport systems in Latin American sea port logistics', *Facilitation of Transport and Trade in Latin America and the Caribbean*. ( Issue No. 305) UN ECLAC.

<sup>8</sup> World Bank Development Research Group (2009) *Weathering the Storm: Investing in Port Infrastructure to Lower Trade Costs in East Asia*. Policy Research Working Paper 4911.

<sup>9</sup> *ibid*

<sup>10</sup> Australian Productivity Commission (2006) *Road and Rail Freight Infrastructure Pricing*: Road transport Forum New Zealand. (Report no. 41) Available at: [http://www.rtfnz.co.nz/cms\\_show\\_download.php?id=267](http://www.rtfnz.co.nz/cms_show_download.php?id=267)

<sup>11</sup> Dennis, A. and Shepherd, B. (2007) *Barriers to Entry, Trade Costs and Export Diversification in Developing Countries*. World Bank Working Paper.

increased unit costs and lower productivity levels for firms. Using an interest rate of 15-20 percent, having to hold additional inventory due to poor logistics cost Latin American economies more than 2 percent of GDP.<sup>12</sup>

Information and communications improvements are increasingly important for richer countries. The cost for customs compliance and clearance has been estimated to be as high as 15 percent of the value of the good in parts of the world and a one-day reduction in customs clearance time would equal a 0.8 percent reduction in ad valorem tariffs. Furthermore, a 2004 study by Dollar et al showed that customs clearance is a key criterion for companies seeking to invest in developing countries. A World Bank trade simulation showed that customs improvements would result in a 0.9 percent increase in exports, with the largest monetary export gain for Brazil at \$0.53 billion.<sup>13</sup>

As suggested above, forms of customs automation and streamlining hold the potential to generate substantial benefits. One such approach to automation and streamlining is the 'Transports Internationaux Routiers' or 'International Road Transports' (TIR) system. TIR is an international customs transit system aimed at facilitating trade and transport, enabling transport operators to transport goods through third countries with customs control recognition along the supply chain. No LAC country currently implements TIR for land or intermodal services. However, the adoption of such systems could yield substantial benefits for LAC nations. Broad-based preliminary estimates suggest implementation of TIR could boost exports in Argentina, Brazil and Mexico by \$1-\$5 billion per annum, depending on the country, for a total of \$9 billion per annum for all three countries. In the case of Argentina and Brazil most of the boost occurs through intermodal trade, while in Mexico's case it occurs through road transport.<sup>14</sup>

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<sup>12</sup> Gonzalez, A., Guasch, L. and Serebrisky, T. (2008) *Improving Logistics Costs for Transportation and Trade Facilitation*. World Bank Policy Research Working Paper 4558.

<sup>13</sup> Wilson, John S., Mann, Catherine L. and Otsuki, T. (2004) *Assessing the Potential Benefit of Trade Facilitation: A Global Perspective*. World Bank Policy Research Working Paper 3224

<sup>14</sup> These figures are indicative and may be conservative as they consider only time benefits of TIR and not the reduction in the costs to shippers and/or end customers.

# 1 Introduction

The General Secretariat of the Organization of American States (OAS), which serves as the secretariat for the Inter-American Committee on Ports (CIP/OAS) and the International Road Transport Union (IRU) have commissioned Oxford Economics to carry out a study of the economic and competitiveness gains from the development of best practices in intermodal, maritime and road transport in the Americas, with the Transports Internationaux Routiers (TIR) system as an example of a best practice.

The Organization of American States is the world's oldest regional organization, dating back to the First International Conference of American States, held in Washington, D.C., from October 1889 to April 1890. Today, the OAS brings together the 35 independent states of the Americas and constitutes the main political, juridical, and social governmental forum in the Hemisphere. In addition, it has granted permanent observer status to 69 states, as well as to the European Union (EU). The Organization uses a four-pronged approach to effectively implement its essential purposes, based on its main pillars: democracy, human rights, security, and development.

The inter-American Committee on Ports (CIP) is the permanent Inter-American forum and advisory body of the OAS member states that promotes hemispheric development and cooperation at the highest government level in the port sector, with the active participation and collaboration of the private sector.

The CIP has the following six thematic priorities, each with a Technical Advisory Group (TAGs), to support the needs for development of its members on port issues:

- Logistics, Innovation and Competitiveness
- Sustainable Port Management and Environmental Protection
- Port Protection and Safety
- Public Policy, Legislation and Regulation
- Tourism, Inland Ports and Waterways, Ship Services and Navigation Safety
- Corporate Social Responsibility and Women in Ports

Founded in Geneva in 1948, the International Road Transport Union (IRU) is the world road transport organization, which upholds the interests of bus, coach, taxi and truck operators to ensure economic growth and prosperity via the sustainable mobility of people and goods by road worldwide. A global industry federation of national Member Associations and Associate Members in 75 countries on the 5 continents, the IRU today represents the interests of bus, coach, taxi and truck operators worldwide, from large fleets to individual owner-operators.

The IRU manages the TIR System under the mandate of the United Nations. The TIR “Transports Internationaux Routiers”, meaning International Road

Transport System, was created shortly after World War II to facilitate trade and transport while implementing an international harmonized system of customs control that effectively protects the revenue of each country through which goods are carried. The TIR convention has provided for intermodal transport operations since 1975. While some countries in the Western Hemisphere (Canada, Chile, the United States, and Uruguay) are contracting parties to, or have expressed interest in joining the TIR Convention, the TIR system has not yet been implemented in the hemisphere.

The study consists of three sections:

- An overview of maritime and road transport systems in international transport, with key developments in both;
- A review of maritime and road transport systems along with intermodal transport, with focus on trade facilitation and the potential for improvements in trade systems in Argentina, Brazil and Mexico with implementation of the TIR system; and
- A discussion of potential and actual challenges in the adoption of the TIR system.



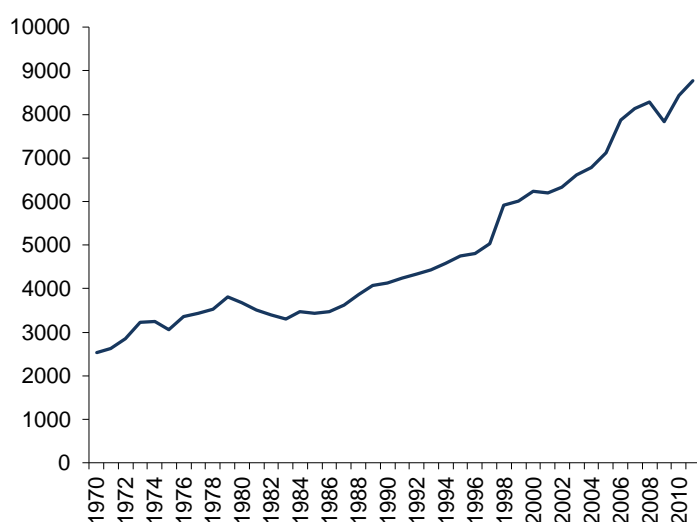
## 2 Maritime and road transport systems in international transport

### 2.1 Growth in shipping and road transport

#### 2.1.1 Maritime Transport

Over recent decades international merchant trade has grown steadily, a likely product of globalization and the rapid development of emerging markets. Over 80 percent of goods by volume marketed worldwide are transported by sea.<sup>15</sup> More than 99 percent of goods by weight (except for bulks) is carried via ocean cargo, with a nine-fold surge in tonnages traded since 1960.<sup>16</sup> In 1970, goods carried by sea amounted to 2.5 billion metric tons globally, increasing to 6.2 billion by 2000 and 8.8 billion in 2011.

**Chart 2.1: Total goods unloaded globally**



Source: UNCTAD

The composition of this merchandise trade transported by sea has also changed, with the proportion accounted for by crude oil, petroleum and gas products falling from 55 percent in 2007 to 34 percent in 2011.<sup>17</sup> Meanwhile, the proportion of maritime trade in containers has increased, along with trade in five main bulk commodities: iron ore, coal, grain, bauxite and alumina, and

<sup>15</sup> UNCTAD (2008) 'Review of Maritime Transport.'

<sup>16</sup> Hummels, D. (2006), loc.cit.

<sup>17</sup> UNCTAD. 'World seaborne trade by types of cargo and country groups'.

phosphate rock.<sup>18</sup> Containerized cargo is mainly composed of manufactured goods and high-value bulk commodities such as time and temperature-sensitive agricultural products.<sup>19</sup>

The recession saw shipping fall slightly in 2009, however it continued to grow throughout 2010 and 2011. More and more, developing countries are making up a larger share of seaborne trade, responsible for 60 percent of world goods loaded and 58 percent unloaded<sup>20</sup> with developing countries in Asia responsible for 47 percent of world goods unloaded in 2011.<sup>21</sup> Since 2006, seaborne merchandise trade to and from developing economies in the Americas have risen more strongly, with export and import volumes rising by 22 percent and 32 percent respectively, compared to an 18 percent increase for both exports and imports in developed economies.<sup>22</sup>

The value of seaborne trade with major Latin American economies has also grown over recent years. For the Latin America and Caribbean (LAC) region in 2011, merchandise exports and imports reached US\$886 and US\$874 billion respectively, and 81 percent of these goods were transported via seaports.<sup>23</sup> However, this has happened at a time of volatile growth due to the financial crisis. While both Argentina and Brazil between 2006 and 2012 grew at or above the average annual growth rate for the LAC region, total imports have grown much more strongly than total exports. In contrast, Mexico's average annual GDP growth over the period has been lower than the LAC average, but both total imports and total exports grew at roughly the same pace. This is likely because Mexico's trade is more closely tied to trade with the United States.

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<sup>18</sup> UNCTAD. *Trade and Development Board, Trade and Development Commission* 'Recent developments and trends in international maritime transport affecting trade of developing countries' June 2013.

<sup>19</sup> *International Handbook of Maritime Economics*, pp. 17-18, Edward Elgar Publishing, 2011.

<sup>20</sup> *United Nations Conference on Trade and Development (UNCTAD)* (2013) 'Review of Maritime Transport'

<sup>21</sup> UNCTAD. 'World seaborne trade by types of cargo and country groups'.<sup>22</sup> *ibid*

<sup>22</sup> *ibid*

<sup>23</sup> Sarriera, M *et al.* (2013), *loc.cit.*

**Table 2.1: 2006-2012 per annum GDP, Total Import and Total Export Growth for LAC, Argentina, Brazil and Mexico**

2006-2012 p.a. growth (%)	
GDP: LAC	3.33%
GDP: Argentina	4.75%
GDP: Brazil	3.45%
GDP: Mexico	1.87%
Exports: Argentina	1.75%
Imports: Argentina	10.27%
Exports: Brazil	1.94%
Imports: Brazil	12.98%
Exports: Mexico	3.53%
Imports: Mexico	3.39%

Source: Oxford Economics.

With respect to modal shares for the shipment of goods, the mode of transportation used is affected by geography and the product. If the cost of transportation is a substantial portion of the final price, cost considerations drive the decisions behind mode of transport. On the other hand, if the cost of transportation is a small fraction of the final delivered price, other factors such as timeliness and reliability will drive the choice of mode of transport.

In Latin America, trade with land neighbors makes up roughly 10-20 percent of total trade.<sup>25</sup> In South America, much of the volume of goods traded is for trade external to the region. Between 2000 and 2010, the volumes of intra-regional transport rose by less than 7 percent, while it rose more than 5 times for volumes of extra-regional transport.<sup>26</sup> The table below shows the ten fastest growing maritime trade routes between South America and other world regions, which shows that the fastest growth is not only with North America and Central America/Caribbean, but also with other world regions such as Africa, Europe, the Far East and the Mediterranean.

<sup>25</sup> Hummels, D. (2006), loc.cit

<sup>26</sup> Wilmsmeier, G. and Guidry, L. (2013) 'The Evolution of Modal Split for Goods Transport in South America', *Facilitation of Transport and Trade in Latin America and the Caribbean* (Issue No 325) UN ECLAC.

**Table 2.2: Routes with fastest growing supply of TEU capacity between South America and the World**

Rank	Route	Index Supply Growth TEU Capacity Jun 2011 (Sept 2002=100)
1	West Africa - East coast South America	787.6
2	East coast North America - north coast South America	784.8
3	Europe - north coast South America	643
4	South Africa - East coast South America	502.4
5	Caribbean/Central America - East coast South America	399.1
6	Far East - East coast South America	366.6
7	Europe - west coast South America	362.4
8	Caribbean/Central America - North coast South America	355.2
9	Mediterranean - East coast South America	311.3
10	Caribbean/Central America - West coast South America	290.9

Source: CEPALStat.

This tendency has implications for modes of transport used and will be discussed further in the following sections.

### 2.1.2 Roads

The history of roads – and of road freight – is as old as the history of settled civilization. Once societies began to develop an agricultural surplus and unified states, roads became important for both military and commercial reasons. Particularly notable examples include the Persian Empire's Royal Road and the Inca Road network, the latter extending some 40,000 kilometers.<sup>27</sup>

Despite their necessity, ancient civilizations - particularly in Europe and China - often found sea or river transport more efficient than that of roads, a feature of life which persisted until the industrial revolution.<sup>28</sup>

A combination of developments – the increasing use of coal, the harnessing of steam power and the development of reliable rails and the consequent exploitation of the traction power of “wheel on steel” – resulted in the explosion of railway construction across the world during the 19<sup>th</sup> century, with roads being relegated to a supporting role in many respects. However a century later another series of developments – the internal combustion engine, pneumatic tyres, mass production and tarmac – all conspired to return roads to their dominant position in land transport and indeed ate into intra-national shipping in many cases.

Apart from the popularity of personal transport, roads offer a number of advantages for the movement of freight. While rail and sea transport retain some advantages for the movement of large amounts of goods over long distances, and for bulk transport, road transport offers flexibility and efficiency over shorter ones. Moreover, rail has always suffered one traditional disadvantage - goods transported by rail still require the use of roads to move goods from rail depots to

<sup>27</sup> Carballo, Volpe Martincus and Cusolito, A. (2013) "Routes, exports and employment in developing countries: Following the trace of the Inca Roads", *Inter-American Development Bank*, mimeo.

<sup>28</sup> A good illustration of the advantage of sea as a transport mode in ancient Europe is found at Stanford University's Orbis Geospatial Mapping website which charts the length of time taken to transport goods by sea or land in Roman times – see <http://orbis.stanford.edu/>

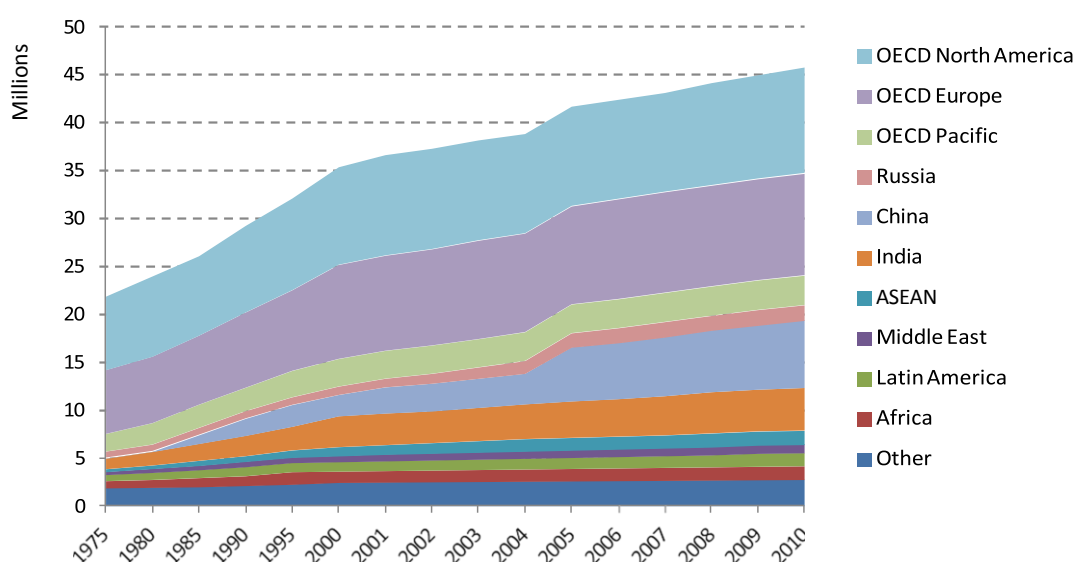
their final destination. In the 19<sup>th</sup> century this was an inconvenience but in the 20<sup>th</sup> many shippers elected not to bother with intermodal transfers at all but used roads for the entirety of the trip, helping to hasten rail's relative decline.

Like rail and sea transport, roads also benefited from the development of containerization, with trucks increasingly being designed around container dimensions and interfaces with rail and port facilities being improved to allow for easier loading and unloading of containers.

Moreover the development of road networks themselves has been an important facilitator in increasing the efficiency of road transport. The United States' Interstate Highway Network, Germany's Autobahns, and the gradual development of broader European motorway systems, among others, all represented examples of 20<sup>th</sup> century engineering which acted to further facilitate the use of road transport, helping to establish the predominance of trucks as a mode of land transport. In some cases, the development of such major highways has allowed road freight to mimic some of the efficiencies of the rail network – as exemplified by Europe's experiments with European Modular Systems (EMS) and Australia's B-doubles, B-triples and road trains.

The late 20<sup>th</sup> century and the early years of the 21<sup>st</sup> have seen emerging markets mimic past trends within the developed world. The advantages of road transport have been enhanced in recent years by the development of the global road transport network, particularly in China and India. The world's road network now comprises over 45 million paved lane km and has undergone substantial growth since 1975, as indicated by Chart 2.2 below.

**Chart 2.2: Paved roadway lane- -km growth 1975-2010<sup>29</sup>**



Sources: IEA analysis based on IRF (2012) and UIC (2012)

<sup>29</sup> As presented in International Energy Agency (2013) *Global transport infrastructure outlook to 2050* <http://www.internationaltransportforum.org/2013/pdf/koerner.pdf>

More specifically, in the period 2000-2009, global road network length increased by approximately 12 million lane-km (of which nearly 11 million lane-km was paved) with China and India accounting for more than 50 percent of paved lane-km additions during that time. Paved roadway length in Latin America also recorded growth in that period. Overall the proportion of paved lane-km rose from 53 percent of total global road lane-km in 2000 to nearly 60 percent by 2010. These developments have further boosted the salience of road freight, particularly given that global rail track length decreased by some 66,000 kilometers over the same period.<sup>30</sup>

The growth of global road transport infrastructure has allowed road freight to further strengthen its comparative advantage. The World Bank estimates that in low and middle-income countries over 70 percent of freight is now moved by trucks.<sup>31</sup>

Globally, calculations by the World Trade Organization (WTO) suggested that in 2007 road freight transport's global share of inland freight transport (measured in tonne kilometers) was 36 percent, with rail freight transport at 43 percent, pipelines at 16 percent and inland waterways at 5 percent.<sup>32</sup>

Between 1990 and 2007, the volume of freight (measured in tonne kilometers) transported by road in the 54 OECD International Transport Forum (ITF) member countries<sup>33</sup> nearly tripled. This outstripped the growth in volume of rail freight, which doubled over that period. The WTO suggests that the relative increase in the use of road freight reflects increasing complexity of production methods (with several plants involved in the manufacture of a single product) and the spread of "just-in-time" production, which has resulted in increasing demand for door-to-door services, smaller and more frequent freight deliveries and shorter delivery time windows. These issues are further examined below.<sup>34</sup>

The WTO also points to trucking's dominant role in many land transport tasks, especially shorter haul ones. In particular, it indicates that in the EU-27 about two-thirds of national freight (measured in tonnes moved) travelled less than 50

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<sup>30</sup> International Energy Agency (2013) *Global Land Transport Infrastructure Requirements: Estimating road and railway infrastructure capacity and costs to 2050*.

<sup>31</sup> See <http://www.ppiaf.org/freighttoolkit/knowledge-map/road>. In addition, note Barbero J. (2010) *Freight Logistics in Latin America and the Caribbean: An Agenda to Improve Performance*. Inter-American Development Bank (Technical Note No. IDB-TN-103). Barbero cites 2007 work by Hine indicating that in developing countries trucks account for 70 percent of domestic freight task by volume and 80 percent by value.

<sup>32</sup> World Trade Organization (WTO) (2010) *Road Freight Transport Services Background Note by the Secretariat S/C/W/324*. These calculations were based on data provided by the 51 International Transport Forum (ITF) members in 2007

<sup>33</sup> In the Americas, members are Canada, Chile, Mexico and the United States.

<sup>34</sup> WTO (2010), loc.cit.

kilometers in 2007. Surface transport also dominates trade between neighbors. The WTO notes Fernandez (2008) calculations that 90 percent of the US-Mexican freight is transported by truck. In addition, road freight dominates domestic trading as well. For example, road freight transport accounted for 95 percent of the share of US domestic freight transport (measured by value) in 2008.<sup>35</sup>

Recent work has also begun to pinpoint the precise difference that road improvements and the related freight transport benefits in particular can make, some examples of which are discussed below.

Kerem Cosar and Demir (2014) examine Turkey's major investments in expressways in the 2000's, finding that road infrastructure development accounts for 15 percent of the increase in exports from the interior, with effects being particularly large for time sensitive/transport intensive industries.<sup>36</sup>

In Latin America, Volpe Martincus and Blyde (2013) use Chile's 2010 earthquake, which forced major re-routings of road freight transport, as a "natural experiment" to determine the impacts of the nation's road infrastructure. They find that in the short run (February 2010-February 2011) Chile's total industrial exports would have been 6.3 percent larger in the absence of those domestic road infrastructure re-routings.<sup>37</sup>

Carballo, Volpe Martincus and Cusolito (2013) examined the impact of the recent major expansion of the Peruvian road network between 2003 and 2010 on exports. They used the ancient Inca road network as an "instrumental variable" to control for the fact that exports may also have boosted infrastructure. They find that Peruvian exports would have been 20 percent smaller in 2010 without the road development program.<sup>38</sup>

LAC countries also experienced many of the broad international trends described above, with the 19th century rail boom giving way to the ascendancy of road transport. The increasing importance of trade to LAC countries (and particularly of exports for countries such as Argentina, Brazil, and Mexico), associated with globalization has only served to place more emphasis on the importance of roads as the dominant form of land transport and on the need for efficient intermodal facilities at ports in particular.

Within South America specifically, trucks transport some 35 percent of intra-regional merchandise trade by volume (with maritime 61 percent) and 42

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<sup>35</sup> *ibid*

<sup>36</sup> Kerem Cosar A., Demir B., "Domestic Road Infrastructure and International Trade: Evidence from Turkey", University of Chicago Booth School of Business. Available at: [http://faculty.chicagobooth.edu/kerem.cosar/research/cd\\_roadsandtrade\\_2014.pdf](http://faculty.chicagobooth.edu/kerem.cosar/research/cd_roadsandtrade_2014.pdf)

<sup>37</sup> Volpe Martincus C, Blyde, J (2013) "Shaky roads and trembling exports: Assessing the trade effects of domestic infrastructure using a natural experiment" *Journal of International Economics* 90 (2013) 148–161

<sup>38</sup> Carballo, Volpe Martincus and Cusolito, A. (2013) *New roads to export: Insights from the Inca roads*. Available at: <http://www.voxeu.org/article/new-roads-export-insights-inca-roads>



percent of such trade by value (maritime 46 percent). There have been some indications that there has been a modal shift in the volume of intraregional trade from seaborne to truck transport for countries such as Brazil and Argentina.<sup>39</sup>

LAC countries tend to have less dense road networks than is true of the world as a whole. Whereas the world average is 241 km of road network for every 1,000 km<sup>2</sup>, the equivalent LAC figure is 156 km. However, while road density is often linked to levels of economic development, this is not always a straightforward relationship with countries such as Canada having similar network density to LAC countries. LAC countries hold up well when compared to road network coverage per capita (5.7 km for every 1,000 inhabitants, vs the global average of 4.8. km per 1,000), though highly developed countries have values of around 15 per 1,000 people.<sup>40</sup>

However, length is only one dimension of road network measurement. In particular, while nearly 60 percent of the world's roads are paved (and nearly 100 percent in many developed countries), in LAC countries the equivalent figure is 16 percent, suggesting particularly poor road network quality. The proportion of paved roads in LAC countries is remarkably low even when set against other emerging markets, with 89 percent of China's roads paved, 78 percent of Malaysia's, 64 percent of India's and 58 percent of Indonesia's. Further, there is evidence that standards of road maintenance in LAC are below those of other regions in the developing as well as the developed world.<sup>41</sup>

More specifically, although Brazil possessed over 1.75 million km of roads in 2008, only some 5 percent of these were paved. For Mexico the equivalent figures were 0.36 million km and 50 percent.<sup>42</sup>

These issues are becoming more pressing as demand for road use has grown significantly in the last few years, driven by rapid growth and increasing motorization. This has placed strain not only on urban but also on rural highway links.

Concerns about infrastructure quality have hampered the development of LAC road and other transport - with LAC recording the lowest road infrastructure satisfaction ratings of any global region in a recent international survey.<sup>43</sup>

Recent work has sought to quantify the effects of poor road quality. While the papers of Volpe Martincus and Blyde (2013) and Carballo, Volpe Martincus and Cusolito (2013) cited above suggest that the extent of the road network is important. As a good road network can aid exports poor road quality may also

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<sup>39</sup> Wilmsmeier, G. and Guidry, L. (2013) 'The Evolution of Modal Split for Goods Transport in South America', *Facilitation of Transport and Trade in Latin America and the Caribbean* (Bulletin FAL Issue No 325, No.9) UN ECLAC.

<sup>40</sup> Barbero J. (2010), loc.cit.

<sup>41</sup> ibid

<sup>42</sup> U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics (2010) *Freight Transportation: Global Highlights 2010*

<sup>43</sup> World Bank (2014) *Connecting to Compete 2014 Trade Logistics in the Global Economy The Logistics Performance Index and Its Indicators*



act to hold such exports back, if it is not addressed. For example, Blyde and Iberti (2014) recently found that improvement in the quality of Chilean roads could generate a reduction in transport costs of 16 percent and increase average exports by 2 percent.<sup>44</sup>

## 2.2 Key maritime developments

Some key maritime developments in recent years include containerization, the increasing capacity of ports and shipping vessels, and improvements in port logistics. Containerization, a method of shipping whereby items are packaged into large standardized containers that can be transported via ship, truck, and rail, was invented and first commercially implemented in the US in the mid-1950s and adopted internationally in 1966.<sup>45</sup> Containerization dramatically reduced the total cost of shipping from the inland manufacturer to the inland customer by allowing goods to be packed once and shipped over long distances using a variety of modes of transport, reducing direct port costs for storage and stevedoring and indirect costs incurred during long port stops. Furthermore, the technology has continued to develop, with an increase in the types of goods that can be transported via containers (i.e. refrigerated containers to transport food).

The transport economics literature posits that containerization was the key innovation in 20th century transportation technology and the key driver of accelerated globalization from the 1960s. For example, it reduced the journey-time between Europe and Australia from 70 to 34 days between 1965 and 1970 and lowered insurance costs from an average of 24 pennies a ton to 4 pennies a ton on that route, thereby halving the capital cost of inventory for cargo.<sup>46</sup> An econometric study of the impact of containerization on trade found that the impact on the North-North trade over a 20-year period was larger than free trade agreements or the GATT [though the results were far weaker when the rest of world sample was added in].<sup>47</sup> Another study finds that doubling the proportion of cargo that is containerized results in a 13.4 percent reduction in shipping costs.<sup>48</sup>

Containerized trade, one of the most profitable activities for ports, has been the fastest growing segment of the shipping market, making up more than 16 percent of the global shipping trade by volume in 2012 and more than 50

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<sup>44</sup> Blyde J & Iberti G A (2014) "Better Pathway to Export: How the Quality of Road Infrastructure Affects Export Performance" *The International Trade Journal*, 28:1, 3-22

<sup>45</sup> Bernhofen, D., El-Sahli, Z. and Kneller, R. (2012) *Estimating the effects of the container revolution on world trade*.

<sup>46</sup> *ibid*

<sup>47</sup> *ibid*

<sup>48</sup> Hummels, D. (2009) 'Globalization and Freight Transport Costs in Maritime Shipping and Aviation' *International Transport Forum 2009* (Forum Paper 3) OECD.

percent of the trade by value.<sup>49</sup> Container traffic in Latin America has more than doubled in the past ten years, from 17 million twenty-foot equivalent units (TEUs) in 2000 to 40 million TEUs in 2010, with an average annual growth rate of 10 percent.<sup>50</sup> The capacity of container vessels serving Latin America doubled between 2000 and 2011, from approximately 2,000 TEUs to over 4,000 TEUs.<sup>51</sup> Within Latin America and the Caribbean, Brazil led in volume terms for container traffic, handling 19.1 percent of the regional share of container traffic in 2011, with Panama second (16 percent share) and Mexico third (10.2 percent share).<sup>52</sup> The table below shows, for Argentina, Brazil, and Mexico, the increase in container port throughput.

**Table 2.3: Container Port Throughput, 2008-2012**

TEUs	2008	2009	2010	2011	2012	5-Year Growth
Argentina	1,997,146	1,626,835	2,021,676	2,159,110	2,245,474	12.4%
Brazil	7,256,292	6,590,364	8,138,608	8,536,262	8,864,368	22.2%
Mexico	3,312,717	2,874,313	3,693,956	4,080,434	4,243,651	28.1%

Note: 2012 data are provisional estimates.

Source: UNCTAD, 2014.

A second key maritime development, related to the increase in containerization, is the expansion in capacity of ports and shipping vessels to take advantage of the economies of scale offered by larger vessels and to keep up with the increasingly larger volumes of goods traded. Containerization led to a dramatic decrease in a ship's average time at port, and thus investments in larger shipping capacity could be made profitable, as larger ships are less costly to run while they are steaming, but more costly when idle. The average size of container ships has grown 80 percent since 2005, the largest of which now carry over 18,000 TEUs.<sup>53</sup> The average capacity of a container vessel has almost doubled, increasing from 2,812 TEU in 2003 to 5,540 TEU by 2013.<sup>54</sup> Similarly, other types of shipping vessels have also increased in size. Ports must be able to accommodate these larger vessels to remain competitive by investing in deeper harbors, larger marine terminals, and modern cranes and yard equipment. The advantage of larger terminals is clear - container berths more than 14 meters deep can dock vessels with almost double the capacity of

<sup>49</sup> UNCTAD (2013) 'Review of Maritime Transport'

<sup>50</sup> Sarriera et al. (2013) *Benchmarking Container Port Technical Efficiency in Latin America and the Caribbean*. IDB Working Paper Series No. IDB-WP-474.

<sup>51</sup> *ibid*

<sup>52</sup> Pérez Salas, G. (2012) 'Port container traffic in Latin America and the Caribbean 2011', *Facilitation of Transport and Trade in Latin America and the Caribbean*. (Issue No. 307) UN ECLAC.

<sup>53</sup> UNCTAD (2013), 'Review of Maritime Transport'

<sup>54</sup> UNCTAD (2013), 'Review of Maritime Transport'

container berths 13 or fewer meters deep. In addition, the ongoing expansion of the Panama Canal (to be completed in 2015) will increase the maximum size of container ships going through the canal from 5,000 TEU to 13,000 TEU.<sup>55</sup> This expansion is motivating ports with shipping routes through the canal (the eastern US seaboard and the Caribbean) to improve their facilities to handle larger vessels. One of the questions that arise, however, in the light of ever larger ship and port developments is how sustainable these practices are. Larger shipping vessels place a greater strain on the environment and concentrate maritime shipping between ports with greater demand, thereby potentially putting smaller ports at a disadvantage.

In contrast, the expansion of inland waterways (of which the Panama Canal is an example) is generally regarded as a positive development in terms of environmental sustainability because it is much more efficient than road or rail alternatives for inland transport. In the European Union, the energy consumption of transportation per ton-kilometer via inland waterways is one-sixth the consumption on roads and half the energy consumption of rail transport.<sup>56</sup> This efficiency also translates to lower costs of transport. In the US, the unit cost of transporting commodities via inland waterways is 2-3 times lower than other forms of transportation.<sup>57</sup> In South America, 90 percent of the southern cone's freight between Mercosur countries is moved via road and although shipments via the Paraguay-Paraná Hidrovía (HPP) increased by 13.4 percent per annum from 2002-2007, inland waterways in South America are far less developed than inland waterways in the United States and Europe.<sup>58</sup> The tonnage transported via the HPP increased from 2-2.5 million tons per year between 1990 and 1995 to over 15 million tons in 2008.<sup>59</sup> The Amazon Basin, the largest inland waterway network (by volume) in South America carries 21 million tons of freight per year.<sup>60</sup> In contrast, inland waterways in the US move almost 2.5 billion tons of cargo per annum.<sup>61</sup>

A third key maritime issue is port logistics. One aspect of port logistics involves the use of intelligent transport systems (ITS). Technological advances in ITS are mostly associated with freight, vehicle and infrastructure operations, but are less well-known for ports. They are particularly useful in coordinating intermodal

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<sup>55</sup> Canal de Panamá (2012) 'Panama Canal Expansion Program.'

<sup>56</sup> World Bank Sustainable Development Department, Latin America and Caribbean Region (March 2010) '*Southern Cone Inland Waterways Transportation Study- The Paraguay-Paraná Hidrovía: Its Role in the Regional Economy and Impact on Climate Change.*'

<sup>57</sup> *ibid*

<sup>58</sup> *ibid*

<sup>59</sup> World Bank Sustainable Development Department, Latin America and Caribbean Region (March 2010), *loc.cit.*

<sup>60</sup> World Bank Sustainable Development Department, Latin America and Caribbean Region (March 2010)

<sup>61</sup> *ibid*

transport, and are productivity-enhancing tools. Most of these systems are expanding to encompass the entire logistics chain, sharing standardized information more easily, reducing processing and inspection times in terminals, enhancing data accuracy, enhancing storage yard and vehicle efficiency, and decreasing paperwork. For example, the port of Valparaiso (Chile), granted a concession to one private technology operator that develops, implements, and operates a single window to coordinate information exchange with all public and private agents involved in the chain of imports/exports through the port.

One of the benefits of the use of ITS systems to enhance the traceability of goods through the logistics chain entails a reduction in company operating costs via lower fuel consumption. The savings associated with monitoring the movement of goods are estimated at 4 percent.<sup>62</sup> Many Latin American ports have implemented traceability using radio frequency identification (RFID), consisting of an electronic tag that sends radio signals to an interrogating antenna. At the Argentine port of Ingeniero White, RFID systems have been implemented to better manage the increase in trucks around the port due to the rise in cereal production. The tags used are readable at four to six meters passing at up to 20 km/hr and the data is subsequently transmitted via the internet to the exporter's unloading software to manage travel journey times and certify grain quality.<sup>63</sup> Within another category of ITS systems are automated guidance systems that run vehicles using remote control. These systems encompass the vehicle, the navigation and route selection system and automated controls. They move and stack containers, lowering the cost of operations involving many containers.

Another important port logistics issue is relieving port congestion, which can be an alternative to port expansion. A study on East Asian ports found that the net benefits from a reduction in congestion are greater than the net benefits of expanding ports in the region.<sup>64</sup> Furthermore, the study found that cutting port congestion by 10 percent could lower transport costs in East Asia by up to 3 percent, or the equivalent of a 0.3 to 0.5 percent tariff cut.<sup>65</sup> One method of reducing port congestion is the use of efficient rationing of port berths and instead of implementing a first-come-first-serve approach, rationing by the value of the cargo is more beneficial. This method of rationing places the priority first on containerized cargo, then on break bulk cargo, and bulk cargo last.

## 2.3 Key road transport developments

Traditionally road freight has suffered from limited abilities to achieve the economies of scale enjoyed by rail transport as governments have imposed size constraints and also due to technical limits. Limits on the traction capacities of

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<sup>62</sup> Febré, G., and Pérez Salas, G. (2012) , loc.cit.

<sup>63</sup> *ibid*

<sup>64</sup> World Bank Development Research Group (2009), loc.cit.

<sup>65</sup> *ibid*

trucks also restrict carrying capacities. However, some of these limits have gradually proved less restrictive in recent years (see below).

Road transport does possess significant advantages, including relatively low capital costs, and easy entry which helps ensure strong competition within the trucking industry. Low capital costs also ensure that innovations and new technologies can diffuse quickly through the industry. Other advantages of road transport include the high relative speed of vehicles, the flexibility of route choices, and door-to-door service for both passengers and freight. These multiple advantages have made cars and trucks the modes of choice for a great number of trip purposes, and have led to the market dominance of cars and trucks for short-distance trips.<sup>66</sup>

Authorities in countries with both short and long haul tasks (such as Australia) have noted that road freight offers greater flexibility in many cases than rail. Unlike rail access (where specialized equipment is required and access to the network is governed by allocation of train paths) road freight operators have relatively free access to the road network, and can reach points which are not served by rail networks, particularly smaller rural areas (for paved roads). In addition, pickup and delivery times can therefore more closely meet customer needs rather than being determined by less flexible rail timetables. Further, the ability to avoid transshipment (which is not available to rail transport) can reduce the risk of breakage and handling costs.<sup>67</sup>

Road freight is also especially well-suited for dealing with perishables and/or time-sensitive freight compared to rail. Along with improved truck communications, (which have helped reduce the need for intermediate warehousing in some cases) this flexibility has also helped make road freight increasingly efficient. This is especially true given increasing business adoption of just-in-time methods, which call for smaller inventories and reduced overheads. In addition, the growing popularity of door-to-door deliveries requires more frequent and generally smaller, shorter-haul deliveries.<sup>68</sup>

Consequently, in cases such as Australia, only 10-15 percent of the market is now contestable between road and rail services.<sup>69</sup> These advantages mean that road transport is often favored for many transport tasks, particularly within smaller countries such as Japan or jurisdictions containing several countries, such as the EU. However, rail transport remains important in certain very large countries, particularly where very large loads are involved – as indicated below.

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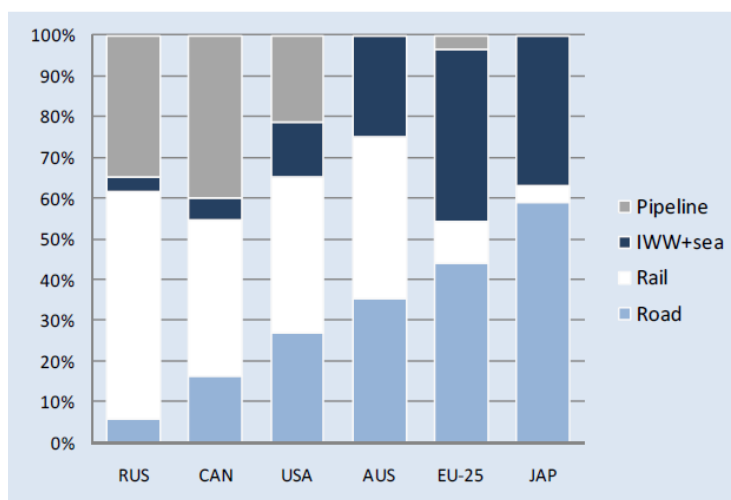
<sup>66</sup> Rodrigue, J. Comtois C. and Slack, B. (2006) *The Geography of Transport Systems*

<sup>67</sup> Australian Productivity Commission (2006), loc.cit.

<sup>68</sup> *ibid*

<sup>69</sup> *ibid*

**Chart 2.3: Modal distribution of inland surface freight transport – selected jurisdictions 2005 (tonne km)<sup>70</sup>**



Source: OECD

The productivity of road transport also has improved, with the introduction of larger articulated trucks. Australia allows the use of B-doubles (25m in length) and even B-triples (36m in length) on certain routes. Within the EU, maximum truck length is generally set at 18.75m. However, Sweden and Finland have been allowed to use trucks up to 25.25m in length and consideration is being given to the use of European Modular Systems (EMS) of this length (and weighting up to 60 tonnes) across the EU, with trials currently underway in Germany, Denmark and the Netherlands.<sup>71</sup>

The use of such longer vehicles allows for exploitation of economies of scale (thereby taking on some of the characteristics of trains in miniature form). Higher capacity vehicles have potential to improve fuel efficiency and reduce pollution once limits on wheelbases, axle loads, spacing and weight are relaxed. They can also result in a reduction in the number of vehicle kilometers for a given amount of freight, particularly in given that load volumes rather than weight can determine truck numbers. In addition, the use of modules (as per the Australian and European experiences) can allow for better load matching and help with intermodal transfers.<sup>72</sup>

A variety of past evidence has pointed to the efficiency gains of using longer and heavier vehicles:

Swedish studies found that moving to the smaller trucks used elsewhere in the EU would decrease cost per truck trip by 5-12 percent. However, the number of

<sup>70</sup> OECD (2011) *Moving Freight with Better Trucks: Improving Safety, Productivity and Sustainability*. Available at: <http://dx.doi.org/10.1787/9789282102961-en>

<sup>71</sup> EPRS (2014) 'Weights and dimensions of road vehicles in the EU' Available at: <http://eprthinktank.eu/2014/04/10/weights-and-dimensions-of-road-vehicles-in-the-eu/>

<sup>72</sup> OECD (2011) loc.cit.

trucks required for transport would increase by 35-50 percent, resulting in an overall truck transport cost increase of 24 percent.<sup>73</sup>

In Canada studies found that using single semitrailer configurations in Alberta rather than larger vehicles would result in an 80 percent increase in truck movements and a 40 percent cost increase for shippers.<sup>74</sup>

Australian estimates indicate that if B-Doubles had not been introduced in 1984 then the country would require an additional 15,000-20,000 trucks. B-Doubles are estimated to have reduced fuel use by the articulated trucks by 11 percent.<sup>75</sup>

Separate Australian work has also suggested that allowing larger trucks in specific areas could reduce truck trips to terminal and/or to ports by as much as 50 percent. Longer trailers alone are estimated to save 25 percent of trips. "SMART" trucks (with better designed steering, load and axle systems) could improve productivity by 37 percent and allow for a reduction in fleet numbers by up to 20 percent.<sup>76</sup>

A government trial in New Zealand during 2008-09 found that 50 tonne vehicles could allow for 10-20 percent increases in productivity, a fall in trip numbers by 16 percent and fuel use by 20 percent. This combined with the fact that road freight rates were 30 percent higher than in neighboring Australia, where B-doubles and triples were in use - facilitated a government decision to allow the use of vehicles up to 62 tonnes and 25m in length.<sup>77</sup>

Use of longer and heavier trucks could result in a modal shift from rail or other modes, though in some cases contestability is limited. Another impact may be an increase in the use of intermodal transport involving containers in particular. These could generate some gains to rail markets which offset the losses due to improved truck efficiency.<sup>78</sup>

At the same time border crossings have come to be recognized as major obstacles to international freight movement. The World Bank has helped to develop multimodal goods depots to which international goods can be consigned and delivered in bond before customs inspection and clearance in locations such as China, however as indicated below, the TIR system could constitute a viable global approach to such issues.

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<sup>73</sup> OECD (2011) loc.cit.

<sup>74</sup> ibid

<sup>75</sup> ibid

<sup>76</sup> Australian Productivity Commission (2006), loc.cit.

<sup>77</sup> ibid

<sup>78</sup> OECD (2011) Of course there is also potential for induced demand resulting from lower prices to offset reductions in vehicle kilometers due to larger and more efficient trucks. Studies of the introduction of 25.25m, 60 tonne trucks on European road networks found induced demand would be modest, with an initial 13 percent reduction in vkm reduced to 12 percent. However some UK work has suggested larger effects.



Nonetheless, the World Bank has also recognized that in recent decades, road transport has improved what it nominates as its “price-quality ratio” substantially through technical and logistical innovations. In the same period rail freight has lagged behind in such improvements. Moreover, the fact that growth in bulk transport—with a high market share for rail and water—has been lower than the growth in containers and packed goods - has added to road’s general increase in market share across the globe.<sup>79</sup>

Typical road freight issues in low and middle income countries cited by the World Bank include industry fragmentation, the use of older (e.g. 20 year old) vehicles and continued use of smaller, less efficient, rigid vehicles rather than the larger articulated vehicles which are increasingly being used in industrialized countries and a large proportion of empty backloads.<sup>80</sup>

LAC countries accounted for some 15.3 million trucks and vans in 2006 – roughly 8 percent of the global fleet total of 196.5 million in that year. Mexico alone accounted for some 6.9 million trucks, with Argentina accounting for some 0.27 million.<sup>81</sup> However, 85 percent of Mexican trucks in that year were classed as rigid (rather than articulated while the corresponding figure for Argentina was 80 percent. This suggests there is still some way to go in introducing larger and more efficient vehicles – and the attendant efficiency benefits noted above - within these states.

Overall, the Latin American experience with trucking industry structure is mixed. Barbero (2010) has pointed to the fact that the importance of road freight transportation is actually understated in LAC National Accounts, and much of the sector is typically highly fragmented, consisting of differentiated markets and characterized by small operators whose activities may not be fully recorded.<sup>82</sup>

In Mexico, for example, where trucks account for roughly 70 percent of the freight volume and 80 percent by value, 85 percent of trucking entities are small operators who own with 1-5 units with an average age of 20 years. Conversely a handful of larger companies have 100 or more units, on average 5-10 years old, but these account for some 65 percent of the national haulage. The World Bank has previously estimated that 30-40 percent of trips are “empty running” backloads.<sup>83</sup>

While the sector’s fragmented and privatized nature makes information collection difficult, similar productivity issues appear to occur elsewhere in the region. For example, in Colombia trucks typically travel 50,000-60,000km/year

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<sup>79</sup> Freight Transport for Development (2014) Available at:

<http://www.ppiaf.org/freighttoolkit/knowledge-map/road/intermodal-freight-systems>

<sup>80</sup> World Bank (2009) *Freight Transport for Development Toolkit: Road Freight*.

<sup>81</sup> Ibid. Figures for the following year (2007) indicate some 7.9 m trucks and vans in Mexico and 5.6m in Brazil. Not surprisingly this implies the great majority of the LAC truck and van fleet is in those two countries. See World Trade Organisation (WTO) (2010) *Road Freight Transport Services*, Background Note by the Secretariat S/C/W/324.

<sup>82</sup> Barbero J. (2010), loc. cit.

<sup>83</sup> World Bank (2009) *Freight Transport for Development Toolkit: Road Freight*.



and with 30 percent empty running. In developed economies these figures are typically some 200,000 km per year and empty running is typically around 25 percent.<sup>84</sup>

The Mercosur countries, however, tend to have better developed regulatory and competitive environments with clearer segmentation between companies that serve domestic and international cargo and long and short distances.<sup>85</sup>

The impacts of border crossings and associated customs delays along with the equivalent effects for sea freight will be considered more fully in the next chapter. However, given the size of its truck fleet and the salience of its road freight trade with the United States, customs related delays on the US-Mexican border are of particular interest. Cedillo-Campos et al<sup>86</sup> point to the importance of NAFTA with the value of trade between the USA and Mexico by all modes of transportation increasing from \$97 billion in 1995 to \$461 billion in 2011. Nonetheless narcotics and security concerns have frustrated many efforts to smooth the flow of goods at the two nations' land border entry points, with delays of several hours being common, particularly where physical inspections are required. The authors find typical delays to enter the US from Mexico of some 5.87 hours based on careful analysis of one crossing point.<sup>87</sup>

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<sup>84</sup> Barbero J. (2010), loc.cit.

<sup>85</sup> World Bank (2009) *Freight Transport for Development Toolkit: Road Freight*.

<sup>86</sup> Cedillo-Campos M., Sánchez-Ramírez, C., Vadali, S., Villa, J., Menezes, M. (2014) *Supply chain dynamics and the "cross-border effect": The U.S.–Mexican border's case*, *Computers and Industrial Engineering* Volume 72, June 2014, Pages 261.sci

<sup>87</sup> Extensive recent work has also been carried out in the trucking industry in Central America: - see World Bank (2012) *Five Explanations to High Costs of Service Provision, Road Freight in Central America*. Apart from pointing to many of the issues noted above, other things this work points to the long border crossing times as a significant issue – with border times ranging from 5-35 hours – or often 10-25 percent of the total trip time.

## 3 Maritime and road transport systems and intermodal transport

### 3.1 Intermodal transport

In order to move cargo large distances to its destination, much of the world's freight uses multiple forms of transport. This intermodal freight is often seen in the form of shipping containers, which can be transferred between different forms of transport, including road, rail and seaborne trade. Coordination between these different modes of transport is an important part of improving global haulage networks.

Monios and Wilmsmeir (2013) show that the organizational disconnection between different parts of the freight process, is because “spatial development is to a large degree an institutional problem, as intermodal corridors involve many actors that are integrated at different levels and managed by varying arrangements.” This creates a collective action problem, where coordination between different bodies is required to increase freight capacity. As a consequence, a number of investments require public sector support, especially in Europe where many rail operators receive public subsidies.<sup>88</sup>

Coordination failures in the planning, development, and maintenance of various forms of transport infrastructure can have serious impacts on the costs of trading. This is evident in cases like the one of Brazilian soybean exports. The Caramuru Group (manufacturer and exporter of soybean) estimated port costs at US\$7.00/ton in Santos (the largest exporter port of Brazilian soybean), the cost of exporting to China at US\$50/ton (each vessel holds sixty tons) along with various costs added due to inefficiency costs due to poor transport infrastructure. These trade costs are equivalent to 178.5 percent of the farm price. Soy has transportation costs above 30 percent of the final product cost in Brazil, much more than that of exporting from the US to Germany - at 19 percent of the final product cost.<sup>89</sup>

#### 3.1.1 Intermodal linkages

Whilst infrastructure plays an important role in improving shipping links, many forms of international trade require various modes of transport. For these forms of transport, one World Bank report argues that “the emphasis lies more on reducing the non-physical impediments to movement.” This highlights a need for improved information technology transfers, track and trace and delays associated with customs and crossing national borders.<sup>90</sup> The lack of

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<sup>88</sup> Monios, J. and Wilmsmeir, G. (2013) *The role of intermodal transport in port regionalization*.

<sup>89</sup> Moreira, M., Volpe, C. and Blyde, J. (2008) *Unclogging the Arteries: The Impact of Transport Costs on Latin American and Caribbean Trade*. Inter-American Development Bank.

<sup>90</sup> Gwilliam, K. *Multi-Modal Transport Networks and Logistics*. World Bank.

documentation of shippers and custom work inefficiencies, including duplicity of controls etc., are common problems faced in Latin America trade.<sup>91</sup>

A 2012 report by the World Bank considers a range of factors contributing to the high cost of road transport services in Central America. One key contributor is fuel costs, especially because the sector is quite inefficient and not technically advanced in the region; as well as this there are inefficiencies where a large number of return trips happen without cargo. On top of this, security costs are rising as crime increases and a combination of time consuming border crossings, road congestions, security concerns, inefficient custom procedures and infrastructure problems contribute to large wait times and higher transport costs.<sup>92</sup>

Furthermore, inland bottlenecks in the rail and road transport systems impede port cargo flows. The report argues that mechanisms such as joint-financing systems are required, as is better use of data in identifying bottlenecks and changing trade patterns. In Argentina, port access is a significant issue, as many of the ports are located in central city locations, so both rail and highway access must compete with normal city traffic when serving the port. This is particularly a concern for truck traffic, which for the Port of Buenos Aires carries 85 percent of the cargo going to and from the port.<sup>94</sup>

According to Notteboom (2008), terminals are integral to this process in Europe, both in seaports as well as inland ports, both of which will play an increasing role as capacity constraints grow. Alongside this, inland terminals play an important role in developing transport networks, with the author arguing that capacity constraints have gained less attention than in seaports.<sup>95</sup>

Suitable capacity in inland terminals can ease pressure on sea ports by allowing them to move cargo onwards more quickly, preventing congestion and waiting times on waterfronts. In larger countries such as the United States they are often found a significant distance inland and close to large population centers.<sup>96</sup> Much of these capacity and transport inefficiencies can be improved upon: the railway system in LAC countries carries 21 billion tons/km-year, compared to 2700 billion tons in the US and the average speed of trains for load transportation is 25 km/hour, compared to 64 km/hour in the US when transporting goods to

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<sup>91</sup> Moreira, M., Volpe, C. and Blyde, J. (2008) *Unclogging the Arteries: The Impact of Transport Costs on Latin American and Caribbean Trade*. Inter-American Development Bank.

<sup>92</sup> The World Bank (2012) *Road Freight in Central America, Five Explanations to High Costs of Service Provision*.

<sup>94</sup> Federal Highway Administration, U.S. Department of Transportation (2003) 'Scan Visits', in Larry, B. et al. (ed.) *Freight Transportation: The Latin American Market*. (pp. 21-59)

<sup>95</sup> Notteboom, T. (2008) *The relationship between seaports and the intermodal hinterland in light of global supply chains*. OECD

<sup>96</sup> LaSalle, J. (2011) 'The emergence of the inland port'.

ports. Moreover, a research study by the CNT in 2009 indicates that only 32 percent of roads are considered 'good to excellent'.<sup>97</sup>

### 3.2 Potential for improvements in trade facilitation

Economic research highlights a border effect in trade. For example, trade volumes are much higher between Canadian provinces compared to trade between Canada and US states, even though the border is relatively open and American and Canadian culture and institutions are comparable. This border effect is the result of a combination of trade barriers, trade costs, and the rate of substitution between domestic and foreign goods. Trade costs encompass distance-related transport costs, port efficiency, and regulatory burdens, and other factors. In addition to financial costs, trade costs also encompass the cost of time it takes to trade goods. Both factors affect the competitiveness of trading. High trade costs can impose barriers to trade. Not only do they lower volumes traded, but they can prevent other products from being traded. Dennis and Shepherd (2007) show that a 10 percent reduction in internal trade costs increases the number of products exported by 2.5 percent.<sup>102</sup>

For the majority of countries, however, logistics costs are a bigger component of total trade costs than tariff barriers. This is because many tariff barriers have been significantly reduced. For products from Argentina, logistics costs were found to make up 27 percent of the total product value, 26 percent for Brazil and 20 percent for Mexico, compared to 9 percent for the OECD average (data from 2004).<sup>103</sup> Poor logistics means that firms have to hold more inventory, because they are unable to operate just-in-time. Holding more inventory ties up capital, leading to increased unit costs and lower levels of productivity for firms. Using an interest rate of 15-20 percent, having to hold additional inventory due to poor logistics cost Latin American economies more than 2 percent of GDP.<sup>104</sup> In addition, extra time in shipping leads to uncertainty on delivery times, meaning that companies will then have to spend additional resources holding a safety margin of inventory.

The World Bank's Logistics Performance Index (LPI) allows for comparisons of logistics performance globally. The LPI is discussed in more detail below and results of the 2014 World Bank LPI for the top 5 countries, the United States, Canada, Argentina, Brazil and Mexico are in the below table along with a Latin America and Caribbean average.

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<sup>97</sup> Moreira, M., Volpe, C. and Blyde, J. (2008), loc.cit.

<sup>102</sup> Dennis, A. and Shepherd, B. (2007), loc.cit.

<sup>103</sup> Gonzalez, A., Guasch, L. and Serebrisky, T. (2008), loc.cit.

<sup>104</sup> *ibid*

Table 3.1: 2014 World Bank Logistics Performance Index\*

Entity	Overall	Overall LPI	Customs Infrastructure	International Shipments	Logistics Quality and Competence	Tracking and Tracing	Timeliness
	LPI Score	World Rank					
Germany	4.12	1	4.10	4.32	3.74	4.12	4.36
Netherlands	4.05	2	3.96	4.23	3.64	4.13	4.34
Belgium	4.04	3	3.80	4.10	3.80	4.11	4.39
United Kingdom	4.01	4	3.94	4.16	3.63	4.03	4.33
Singapore	4.00	5	4.01	4.28	3.70	3.97	4.25
United States	3.92	9	3.73	4.18	3.45	3.97	4.14
Canada	3.86	12	3.61	4.05	3.46	3.94	4.18
<b>Mexico</b>	<b>3.13</b>	<b>50</b>	<b>2.69</b>	<b>3.04</b>	<b>3.19</b>	<b>3.12</b>	<b>3.14</b>
<b>Argentina</b>	<b>2.99</b>	<b>60</b>	<b>2.55</b>	<b>2.83</b>	<b>2.96</b>	<b>2.93</b>	<b>3.15</b>
<b>Brazil</b>	<b>2.94</b>	<b>65</b>	<b>2.48</b>	<b>2.93</b>	<b>2.80</b>	<b>3.05</b>	<b>3.39</b>
<b>LAC Average</b>	<b>2.81</b>	<b>78.90</b>	<b>2.64</b>	<b>2.60</b>	<b>2.84</b>	<b>2.78</b>	<b>3.15</b>

\*Scores are out of a possible maximum of 5.00 with 5.00 best and 1.00 worst.

In this ranking, a higher score indicates a better result. Out of 160 countries ranked on the index, LAC countries are ranked in the top half with Argentina, Brazil, and especially Mexico performing better than the LAC average. In fact, of the three countries, Mexico is the best performing on all the sub-indicators forming the index although there is a noticeable gap between them and the United States and Canada. Notably, Argentina and Brazil fall below the LAC average on customs and Brazil falls just under the LAC average on international shipments. These may indicate the key areas for improvement.

Logistics costs encompass time delays, which most research has found to have a greater effect on trade than direct costs. For example, Hummels (2001) found that one extra day in shipping time leads to a 1.5 percent decrease in the probability that a country will export manufactured goods to the US.<sup>105</sup> The cost of the time delay also depends on the type of good being shipped. Higher value added goods have higher values of time, so large time delays may discourage the trade of high value added goods. The table below shows the trade-weighted tariff equivalent of time savings per day for exports from High Income, Middle Income, and Low Income countries. It shows that time delays in transportation can affect product exports in much the same way that tariffs do.

<sup>105</sup> Nordas, Hildegunn K. (2006) 'Transport Time as a Trade Barrier', *Benefiting from Globalization: Transport sector contribution and policy challenges*. 17<sup>th</sup> International Symposium on Transport Economics and Policy.

**Table 3.2: Trade-weighted Average Tariff Equivalent of Time Savings per Day, by Product, for Exports (%)**

Sector	High Income	Middle Income	Low Income
Basic Agriculture			
Cereals, feeds, fibers	0	0	0
Live stock, meat and dairy	0.1	0	0.1
Other agriculture (oils, sugar, etc.)	0.2	0.1	0.3
Fresh and Processed Agriculture			
Vegetables, fruit and nuts	1.5	0.5	0
Processed food, beverages and tobacco	0.4	0.4	0.8
Natural Resource, Oil, Gas, Fuels and Coal			
Fish	0.1	0.3	0.1
Minerals and forestry	0.1	0.2	0.1
Oil, gas, fuels, and coal	0	0	0
Light, Medium and Heavy Manufactures			
Apparel	0.8	0.7	0.8
Light manufactures (wood prod, footwear, leather)	0.7	0.8	0.5
Textiles yarns and fabric	0.5	0.4	0.4
Chemicals	0.5	0.7	0.4
Iron and steel	0.9	0.7	0.1
Machinery and electric equipment	0.4	0.7	0.8
Mineral based products	0.6	1.5	1.3
Motor vehicles and transport	0.2	0.9	1
Processed nonferrous metals (e.g., gold, silver, platinum, aluminum)	2.4	8.9	1.1
Services			
Other services	0	0	0
Transport and communication	0	0	0
Utilities and construction	0	0	0

Source: Minor, Peter and Tsigas, Marinos, "Impacts of Better Trade Facilitation in Developing Countries," Nathan Associates, May 2008.

For high income countries, the highest value of time savings per day comes for processed nonferrous metals while for middle income countries, this value is 4 times as high. Goods with the highest value of time, such as precious metals, are most likely to be traded by plane.

Delays in exporting, in becoming a barrier to entry in trading activities, also affect the export market by restricting the types of products that can be exported. For time-sensitive goods, delays in trade procedures can make them uneconomical to export and if there is no domestic market for the good, it is unlikely that product will be produced at all.

A World Bank study shows that information and communications improvements are increasingly important for richer countries.<sup>106</sup> The cost for customs compliance and clearance has been estimated to be as high as 15 percent of

<sup>106</sup> Portugal-Perez, A. and Wilson, John S. (2010) *Export Performance and Trade Facilitation Reform*. World Bank Policy Research Working Paper 5261.

the value of the good in parts of the world<sup>107</sup> and a 2004 study by Dollar et al showed that customs clearance is a key criterion for companies seeking to invest in developing countries. According to recent research, a one-day reduction in customs clearance time would equal a 0.8 percent reduction in ad valorem tariffs.<sup>108</sup>

Transparent customs procedures also reduce corruption. A customs modernization in Mozambique increased customs revenues by 38.4 percent.<sup>109</sup> Single window systems have been implemented in many cases to facilitate customs procedures. In these systems, exporters file a unique export declaration to one entity (i.e. the national customs office). This system then transfers the data to the customs administrations of the importing countries, saving time with administrative processes and queues at the borders. E-customs platforms are a further way to facilitate cross-border trade as well as to ensure regulatory compliance. Such a system has been put into place in Europe. Single window systems are also being implemented in Latin American countries, with varying levels of advancement. A recent UNECE report showed that Colombia has the most complete experience with implementation of a single window system that includes digital certification of origin and digital signature.<sup>110</sup> Moreover, in 2011, Chile, Costa Rica, Ecuador, El Salvador and Peru were also making good progress in the implementation of these systems, with the capability to process e-documents.<sup>111</sup>

A World Bank trade simulation showed that customs improvements would result in a 0.9 percent increase in exports, with the largest monetary export gain for Brazil at \$0.53 billion.<sup>112</sup> Customs inefficiency and long border related delays on land routes within LAC countries in particular also continue to be regional problems. Past evidence suggests that delays in customs clearance in LAC as a whole increases transport costs by some 4-12 percent in LAC countries.<sup>113</sup>

For instance, Mexico is a major importer of cotton, most of which comes from the US. The American cotton is delivered to Nuevo Laredo and then taken to Central Mexico. The time to cover the distance from Nuevo Laredo takes on average 2-6 days, of which up to 84 percent of the time is spent on custom

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<sup>107</sup> Urciuoli, L., Hintsä, J., and Ahokas, J. (2013) *Drivers and barriers affecting usage of e-Customs — A global survey with customs administrations using multivariate analysis techniques*. Government Information, Quarterly 30 pp. 473–485.

<sup>108</sup> Behar, A., Manners, P. and Nelson, B. (2011) *Exports and International Logistics*. Working paper.

<sup>109</sup> Sida, K. (2009), loc.cit.

<sup>110</sup> United Nations Economic Commission for Europe (UNECE) (2013) *Connecting International Trade: Single Windows and Supply Chains in the Next Decade*.

<sup>111</sup> *ibid*

<sup>112</sup> Wilson, John S., Mann, Catherine L. and Otsuki, T. (2004) *Assessing the Potential Benefit of Trade Facilitation: A Global Perspective*. World Bank Policy Research Working Paper 3224.

<sup>113</sup> Guasch, J (2011) *Logistics as a Driver for Competitiveness in Latin America and the Caribbean*. Inter-American Development Bank (Discussion Paper No. IDP-DP-193) .



procedures. This elongated process increases the price of the product by 6 percent (caused by both freight expenditures and custom requirements), in turn hampering the consequent exports of Mexican textile.<sup>114</sup>

A variety of international studies have also sought to provide quantitative estimates of the benefits of trade facilitation and some of these also refer to LAC countries. For example, the OECD (2009) finds that reducing border trade transactions costs by 1 percentage point of the value of the traded goods would result in LAC countries' income increasing by between 5 -13 percent.<sup>115</sup>

In other work, the OECD (2013) finds measures to streamline border procedures and the use of automated processes and risk management would be of particular benefit to upper middle income countries (included in which are Argentina and Brazil), considering that these would reduce costs by 2.8 percent and 2.4 percent respectively. These effects would be additive.<sup>116</sup>

As already noted, commonly cited references in the trade facilitation literature include:

*World Bank Doing Business* project - This annual database and accompanying sets of reports includes a wide range of measures including the Trading Across Borders measure – which estimates, among other things, the time and cost (ex. tariffs) of exporting and importing a standardized cargo of goods by sea (excluding sea transport times and costs). The “Time to export” (or import) measure in particular, (separately) reports the time taken for inland transport, port and terminal handling, customs clearance and technical control and document preparation. The most recent data recorded in this publication relate to June 2013.<sup>117</sup>

*World Bank Connecting to Compete: Trade Logistics in the Global Economy (Logistics Performance Index (LPI))* – This has been referred to above and is also an annual publication. The LPI is based on a global survey of 1000 respondents at international logistics companies in 143 countries. The LPI itself is based on the factors noted above (customs, infrastructure, international shipments, logistics quality, tracking and tracing and timeliness). However, this publication also includes a variety of data including details on the “lead times” for sea/air and land transport (the latter including the total time taken from dispatch at the seller's factory to arrival at the buyer's warehouse). The current (2014) report is based on data collected from interviews in October-December 2013.<sup>118</sup>

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<sup>114</sup> Moreira, M., Volpe, C. and Blyde, J. (2008), loc.cit.

<sup>115</sup> OECD (2009) *Overcoming Border Bottlenecks – The Costs and Benefits of Trade Facilitation*

<sup>116</sup> OECD (2013) “The Potential Impact of Trade Facilitation Measures on Developing Countries Trade”, *Trade Policy Papers* No. 144

<sup>117</sup> World Bank (2013) *Doing business-Trading across borders*. Available at: <http://www.doingbusiness.org/data/exploretopics/trading-across-borders>

<sup>118</sup> World Bank (2014), loc.cit.



Trading Across Borders “Time to export” data from the most recent *Doing Business - Trading Across Borders* measure for Argentina, Brazil and Mexico are indicated below.<sup>119</sup>

**Table 3.3: Trading Across Borders – Time to export data for Argentina, Brazil and Mexico (June 2013)**

	Argentina		Brazil		Mexico	
	Duration (days)	Cost (\$US)	Duration (days)	Cost (\$US)	Duration (days)	Cost (\$US)
Documents preparation	6	450	6	325	5	200
Customs clearance and technical control	2	150	3	400	2	150
Ports and terminal handling	2	550	3	500	2	200
Inland transport and handling	2	500	1	990	2	900
<b>Total</b>	<b>12</b>	<b>1,650</b>	<b>13</b>	<b>2,215</b>	<b>11</b>	<b>1,450</b>

Source: World Bank

In addition the World Bank’s *Connecting to Compete* (2014), including the LPI, points to a variety of challenges facing LAC countries in terms of both infrastructure and customs-related issues, with respondents within LAC countries recently rating road infrastructure particularly poorly. In fact, out of all global regions, LAC recorded the smallest proportion of own region respondents rating road, rail and warehousing facilities as “high” or “very high” – see table below.

**Table 3.4: Connecting to Compete 2014 – Percentage of own region respondents rating quality of infrastructure types “High” or “Very high” (Oct-Dec 2013)**

	Ports	Airports	Roads	Rail	Warehousing and trans loading	ICT
East Asia and Pacific	24	29	16	6	20	23
Europe and Central Asia	10	27	10	4	22	32
<b>Latin America and Caribbean</b>	<b>20</b>	<b>20</b>	<b>7</b>	<b>1</b>	<b>7</b>	<b>24</b>
Middle East and North Africa	33	18	11	7	17	36
South Asia	28	28	27	7	24	58
Sub-Saharan Africa	23	20	19	3	22	34

Source: World Bank

It also notes that total import lead times in particular rise sharply (typically by a day or two) if physical inspection of goods is required (a procedure that best practice electronic methods such as TIR-EPD are designed to minimize –as discussed below).

Some LPI data have been reported above. LPI data on the land supply chain for Argentina, Brazil and Mexico are also noted below.

<sup>119</sup> This publication also includes equivalent import data.

**Table 3.5: Connecting to Compete 2014 - Land supply chain – export data for Argentina, Brazil and Mexico (Oct-Dec 2013)**

	Argentina	Brazil	Mexico
Distance (km)	535	322	1,300
Lead time (days)	4	2	4
Cost (US \$)	1,842	1,000	1,511

Source: World Bank

### 3.3 Potential for improvement in customs procedures – the example of TIR

#### 3.3.1 The TIR system

Consideration of these issues has given rise to ways in which to move up these international rankings so as to achieve some form of “best practice” or at least to achieve some form of substantive improvement. As suggested above, forms of customs automation and streamlining appear to be of particular interest and hold the potential to generate substantial benefits.

One such approach to automation and streamlining is the Transports Internationaux Routiers’ or ‘International Road Transports’ TIR system. The TIR system was first established shortly after World War II and is currently governed by a convention which came into place in 1975.

TIR is an international customs transit system aimed at facilitating trade and transport. It enables transport operators to transport goods through third countries with customs control recognition along the supply chain. This assists in minimizing administrative and financial burdens.

Two major forms of benefit arise under TIR:

- Using TIR avoids physical inspections in countries of transit (other than checking seals). This allows goods to be transported across national borders with minimum delays due to customs and/or border checks, reducing costs and transit times. In particular, TIR Electronic Pre-Declaration (TIR-EPD) is fully compliant with the World Customs Organization’s (WCO) SAFE Framework, reducing the time needed for customs procedures at borders by allowing TIR Carnet<sup>120</sup> holders to submit Electronic Pre-Declarations to customs offices.
- TIR provides security to transport operators and customs authorities. TIR establishes an international guarantee chain among contracting parties, which allows simple access to the required guarantee . A guaranteeing association in a particular country is authorized by the customs of that country, guarantees payment within that country of any duties and taxes which may become due. That is why transport operators avoid the need to deposit a guarantee covering duties and

<sup>120</sup> TIR carnets are harmonized control documents.

taxes at transit borders. This reduces operator risk and uncertainty and also serves to allow for reduced transit times.

In particular, the TIR Electronic Pre-Declaration (TIR-EPD) considerably reduces the time needed for customs procedures at borders by allowing TIR Carnet Holders to submit TIR Electronic Pre-Declarations to Customs offices of entry/departure in a simple, standardized way. TIR-EPD provides customs with all required TIR data well in advance of TIR truck arrival at border points, allowing for appropriate risk management in advance, increasing customs efficiency. Furthermore, the Real Time Safe TIR (RTS) mechanism enables automatic transmission of the data on the termination of the TIR operation and allows for prompt action to be taken if customs irregularities occurred.

The IRU in cooperation with the UN Economic Commission for Europe (UNECE) is currently working on the implementation of a fully computerized version of TIR system- eTIR , that would enable fully paperless exchange of all the information related to the TIR procedure.

The TIR System is currently operational in 58 countries. These include all European nations as well as several in North Africa and the Middle East. More than 35,000 operators are currently authorized to use the TIR system. Some 3 million TIR carnets were issued in 2013.

Historically, TIR has been connected with freight movements by road and due to such historical and geographical reasons, many of the users of the TIR system have been in Eurasia, where land routes are of paramount importance. However, TIR has recently expressed an interest in expanding into intermodal transport. The TIR Convention allows for such transport provided that at least one leg of the journey is carried out by road and transported goods are not reloaded from the sealed load compartment en route. TIR therefore holds the prospect of substantial intermodal benefits, with improved traffic flows in ports, secure transport and smoother customs procedures. The IRU has consequently developed a TIR Intermodal Program to facilitate intermodal traffic by identifying ways in which the road-sea interface could be better harmonized and by seeking to extend TIR to regions such as LAC.

Initial work examining the experience with Roll On-Roll-Off (RO-RO) ferries on the Turkey-Trieste/Toulon route suggests that the route was shortened by 1-2 days through use of TIR.<sup>121</sup> Other past work connected with TIR notes the following:

- The absence of harmonized procedures at borders can lead to up to 57 percent of transport time being lost at border crossings. This can also create an environment conducive to unofficial levies amounting to almost 38 percent of transport costs.<sup>122</sup>

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<sup>121</sup> Rojas, M. (2014) *TIR for Global Intermodal Trade Facilitation*.

<sup>122</sup> IRU (2014) 'IRU resolution on the WTO Bali Agreement'. Available at: [www.wto.org/english/forums\\_e/ngo\\_e/irubaligreement\\_e.pdf](http://www.wto.org/english/forums_e/ngo_e/irubaligreement_e.pdf)

- Usage of TIR-EPD saves up to 50 percent of border waiting times for transport operators, compared to border crossings without TIR-EPD.<sup>124</sup>
- The development of TIR-EPD Green Lanes – dedicated lanes on both sides of a given land border means that trucks in such lanes will be subject only to scanning and shipment of their TIR carnet. This allows customs to assess risks and determine which trucks should be subject to specific controls in advance, allowing for speedy customs controls. IRU estimates that this produces savings in transport time and costs of up to 40 percent.<sup>125</sup>
- Another approach to understanding the benefits of customs facilitation measures such as TIR is to compare them to the costs of infrastructure provision. IRU analysis of the Bishkek-Warsaw route suggests that for \$28 billion an additional two lanes could be added, cutting travel time by 3.9 days. However, if key UN customs facilitation methods were adopted and border wait times were typically closer to minimum (0.4 days) as opposed to maximum (4.5 days) than this would save 4.1 days.<sup>127</sup>

While the importance of appropriate infrastructure (globally and in LAC) is noted above, the cost of implementing such trade facilitation measures is likely to be far lower than infrastructure provision and, as this example suggests, has the potential to yield benefits which are as high or higher than infrastructure provision in some cases.

### 3.3.2 Quantification of potential for trade facilitation in LAC – TIR example

No LAC country currently implements TIR for land or intermodal services. However, the discussion above suggests that the adoption of such systems could yield substantial benefits for LAC nations.

The current report focuses on the potential for trade facilitation benefits for best practices in intermodal maritime and transport in Argentina, Brazil and Mexico, using TIR as an example of a best practice and some of the gains which might be made. The following approach was adopted in order to derive some indicative potential quantitative estimates of the adoption of a trade facilitation measure such as TIR:

- Path breaking work by Hummels (2001)<sup>128</sup> and Hummels and Schaur (2013)<sup>129</sup> has investigated the role of time as a trade barrier. Hummels and Schaur find that each day in transit is equivalent to an ad valorem tariff of 0.6 to 2.1 per cent. Likewise, using Doing Business – Trading

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<sup>124</sup> Communication with the IRU on 8 July 2014, using IRU data based on TIR-EPD Users' feedback.

<sup>125</sup> IRU, Implement TIR-EPD Green Lanes <http://www.iru.org/cms-filesystem-action/mix-publications/E-0303-1en.pdf>

<sup>127</sup> IRU (2013) *The role of road transport in the globalised economy*, Presentation in New York, 23 October 2013

<sup>128</sup> Hummels, D., (2001) "Time as a Trade Barrier", *American Economic Review* 103(7): 2935–2959.

<sup>129</sup> *ibid*

Across Borders and other data over a sample of 126 countries Djankov et al (2006) find that a 10 percent saving in time prior to export (e.g. due to improved trade facilitation measures) increases exports by about 4 percent – i.e. an elasticity of 0.4 (or using their precise estimate 0.38).<sup>130</sup> These analysts also find that for the median country in their survey, a one day saving in time prior to export would result in a 1.2 per cent increase in trade.

- The Doing Business-Trading Across Borders Data for days taken in port Customs clearance and technical control for Argentina (2 days), Brazil (3 days) and Mexico (2 days) were examined and compared to equivalent times in major European countries utilizing the TIR system (generally 1 day). The difference between these two figures (i.e. 1 - 2 days) was used as a rough indicator of the potential reduction in time the implementation of a TIR intermodal system could bring.
- For land transport, LPI data on land transport lead times for Argentina, Brazil and Mexico referred to above were utilized. Unlike the Trading Across Borders data these effectively include total travel times (including actual road transport). In order to estimate customs clearance times at land borders of Argentina and Brazil the World Bank (2010)<sup>131</sup> was used as a reference source. This cited work by Barbero (2008) indicating that average customs clearance times at Brazil-Argentinian and Argentinian-Chilean borders were in the order of 14-18 hours. The mid-point of these estimates (16 hours) was used.<sup>132</sup> Based on the TIR results presented above, it was assumed that use of TIR would cut these times by 50 percent.
- In the case of Mexico, recent detailed analysis by Cedillo-Campus et al (2014) suggests average US-Mexico border crossing times of 5.87 hours. This could be reduced to 3.40 hours if the truck used the electronic transmission of cargo manifests under the Free and Secure Trade (FAST) program. However, relatively few shipments are registered under this program.<sup>133</sup> The difference between these two was

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<sup>130</sup> Djankov, S., Freund, C., Pham C. "Trading on Time" (2006), *World Bank Policy Research Working Paper 3909*, May 2006 Note that consistent with this dataset, this effect measures the effect of trade facilitation on exports, as it is based on time taken to get from factory through customs to final export.

<sup>131</sup> World Bank (2010) *Uruguay Trade and Logistics: An Opportunity*. (Report no. 52303-UY)

<sup>132</sup> Note that this is close to the mid-point of land border clearance times (i.e. 20 hours) mentioned in World Bank (2012). Earlier (2003) work by CEPAL-ECLAC suggested that 65 percent of land cargo on the main Brazil-Argentina crossing point suffers delays of 30-36 hours (*Bulletin FAL "Border Crossings in Mercosur Countries: Obstacles and their Cost"*, Issue 199 March 2003).

<sup>133</sup> Registration into FAST works in conjunction with the Customs-Trade Partnership Against Terrorism (C-TPAT). It is necessary to be part of C-TPAT in order to utilize FAST. FAST shipments have dedicated lanes at the US-Mexico border and dedicated inspection booths. Their registration into C-TPAT means they are considered low risk and therefore unlikely to be subject to secondary inspection. FAST would therefore appear to share some of the characteristics of TIR-EPD. The percentage reduction in customs clearance times implied by these figures (43 percent) is also similar

used as the potential benefit of TIR, noting that the vast majority of Mexico's truck freight exports are over this border.

- Sea and road export values and volumes for Argentina, Brazil and Mexico were derived from ECLAC-CEPAL data on Modal splits in International transport for 2012.<sup>134</sup>
- While TIR technically covers bulk cargoes, in practice it would appear that usage of it in this context is limited. In addition, many bulk cargoes are transported to ports via rail rather than road. Accordingly, taking a conservative approach, volumes and values of exports were estimated by excluding crude materials, food and live animals estimates (which are less likely to be containerized).<sup>135</sup>
- The change in travel times in terms of days due to potential sea and land transport trade facilitation was then estimated in percentage terms relative to total export facilitation time. This percentage was then applied to the trade facilitation time elasticity of 0.38 estimated by Djankov et al, for both modes of transport. This allowed for estimation of a trade volume impact. The equivalent value of this effect was then determined with reference to the ECLAC-CEPAL data above.

Results of the analysis for the three countries are presented below in terms of \$US and as a percentage of total national exports.

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to those suggested for TIR above. However there has been little take-up of CTPAT and therefore of FAST to date.

<sup>134</sup> Wilmsmeier, G. and Hesse, M. (2014) *Argentina: Modal Split in International Transport – Year 2012*, CEPAL; Wilmsmeier, G. and Hesse, M. (2014) *Brazil: Modal Split in International Transport – Year 2012*, ECLAC; Wilmsmeier, G. and Hesse, M. (2014) *Mexico: Modal Split in International Transport – Year 2012*, ECLAC

Note that it has not been possible for this report to determine the modal share of road vs rail transport to ports in particular, although some broader literature suggests that usage of rail to serve ports in the relevant countries is patchy, particularly in Argentina, and it is likely that rail is mainly used to carry bulks which are not covered under TIR in any event. This may push the export benefits figures down somewhat as rail is not included under TIR. However, this effect is unlikely to be substantial and as indicated below the overall results are likely to be relatively conservative.

<sup>135</sup> According to the IRU, goods under TIR in an intermodal context are and can be transported not only in containers but also using roll-on/roll-off (ro-ro) technology. In ro-ro technology, a trailer with goods loaded is transported on to a ship from a country (A) to a country (B) without a truck. It is brought to the port of country A by one truck and continues its journey in country B with another truck after arrival at port. In such a case, food and crude materials can be transported in an intermodal context under TIR for non-containerized transport operations too.

**Table 3.7: Potential increase in exports from TIR implementation (\$ billion US, 2012 and percentage of total exports, 2012)**

	Argentina		Brazil		Mexico	
	Increase in value (\$US billion)	Percent increase in total export value (%)	Increase in value (\$US billion)	Percent increase in total export value (%)	Increase in value (\$US billion)	Percent increase in total export value (%)
<b>Total value/percent of national exports</b>	<b>1</b>	<b>1.6</b>	<b>5</b>	<b>2.7</b>	<b>3.3</b>	<b>1.1</b>
-Of which from use at sea ports (intermodal)	0.7		4.1		1.5	
-Of which from use in land (road) transport	0.3		0.8		1.8	

These figures suggest that implementation of TIR would boost exports in the three countries in question by \$1-\$5 billion for a total of \$9 billion. In the case of Argentina and Brazil most of the boost occurs through intermodal trade, while in Mexico's case it occurs through road transport (which is largely with the US).

Note that these figures are indicative but may be conservative as they consider only time benefits of TIR and not the reduction in the costs to shippers (and/or end customers) due to a reduced regulatory burden, risk, uncertainty and security related issues.<sup>136</sup> Further, TIR might also affect document preparation time for sea transport (a factor which was not taken into account above). The reduction in such costs and allowance for such factors might also be expected to result in an increase in exports, which would be in addition to that estimated above.

<sup>136</sup> Notwithstanding this, time costs are likely to be more significant than direct financial ones. Past APEC work based on Trading Across Borders data for containerized traffic suggests that costs of trading account for only 12 percent of trade transaction costs whereas the value of time to trade accounts for 88 percent of such costs.

Sohn (2013) 'The Impact of aid for trade on the cost and time to Trade: The case of Latin America and the Caribbean', *International Trade Series*. ECLAC.



## 4 Adoption of TIR system

### 4.1 Potential challenges to TIR implementation for LAC countries

Although Chile and Uruguay are contracting parties to the TIR Convention, no country in LAC (or the Americas as a whole) is currently an operational member of TIR for road or intermodal transport. Given the potential effects of TIR on the three sample countries, estimated above and the more general benefits of trade facilitation suggested by other studies, an obvious question is why LAC countries do not adopt the TIR system. To some extent, this encapsulates a broader question – why do LAC countries not adopt trade facilitation measures which would appear to offer them clear benefits?

Oxford Economics had originally planned to conduct interviews with contacts in Argentina, Brazil and Mexico to discuss this issue. However difficulties in contacting potential participants meant that the only direct interview was with Brazilian port officials. Additional written responses were obtained from the Brazilian port officials and from the Argentinian National Customs Office.

Nonetheless, it is possible to suggest several reasons as to why this is the case:

- *Lack of knowledge about TIR* – When questioned about this issue by Oxford Economics, the IRU itself has suggested that the major reason for the failure to take up TIR there is a lack of knowledge about the benefits of TIR in countries such as Brazil and Argentina.<sup>137</sup> Likewise, an interview with Brazilian port officials (and a subsequent written response) also suggested that information on TIR and its benefits had not been widely disseminated in this sector, despite recent interest shown in expanding TIR to international intermodal operations.<sup>138</sup> It is likely that both a lack of knowledge of TIR itself (and its historical contribution to road transport) as well as a lack of knowledge of TIR's potential application to intermodal transport (which has only received attention much more recently) are both issues here. It should be noted however that the Argentinian National Customs Office has indicated that it is aware of TIR and has studied the TIR system.
- *Historical/geographical reasons* – TIR has found its greater popularity in Eurasia where, for reasons of geography, land routes predominate. Within Europe itself it was likely assisted by the presence of borders within relatively short distances of major population and industrial centers (implying a more pressing need for trade facilitation) and development of the common market over a lengthy period after World

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<sup>137</sup> Communication with IRU (30 June 2014)

<sup>138</sup> Communication with José Newton Barbosa Gama, Assessor Especial Secretaria de Portos Brazil (28 July 2014)



War II.<sup>139</sup> However, while Mexico's trade is heavily dependent on road freight to and from the US, countries such as Argentina and Brazil are focused on sea trade with the outside world, with major population and production centers some distance from borders and with intra-LAC trade only becoming of more importance with the development of Mercosur after 1991.<sup>140</sup> Likewise, in the case of Mexico, NAFTA was only enacted in 1994. Accordingly, a system which developed through harmonization of road transport might have found less initial usage within such countries and intermodal applications may have been less immediately obvious. While there is now interest in promoting the intermodal benefits of TIR, in particular, given the historical "head start" to TIRs usage in pure road transport, and LAC trade patterns, it may not be surprising that there has been less take-up in LAC.

- *The existence of other reform programs/systems* – Regional trade agreements may have had an impact on interest in take-up of TIR, though such regional agreements may not be as effective as a TIR system which is standardized and international in scope. To the extent that NAFTA and MERCOSUR and/or internal country arrangements have facilitated such agreements, these may be seen as reducing the need for TIR. In the case of NAFTA in particular, Mexican trucks are allowed to make deliveries within the United States (although without long haul authority these deliveries are limited to a maximum of 25 miles within the United States).

The response from the Argentinian National Customs Office also made the following points:

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<sup>139</sup> ECLAC recently noted that overall intra-regional trade within South America (and indeed LAC) has always been of less importance than is the case of for example the EU. The share of South American trade (relative to total South American trade) doubled between the foundation of the Latin American Integration Association (1980) and 2000 to 26 percent. It has since fallen slightly to 23 percent in 2010. ECLAC (2013), "The Evolution of Modal Split for Goods Transport in South America," Bulletin FAL Issue No. 325, Number 9, 2013. South America's trade with the outside world has been the subject of extensive debate in past decades including the arguments of "dependency theorists". It is possible to speculate that the more recent increase in trade may be due to the impact of globalization and increasing trade with emerging markets such as China.

<sup>140</sup> Based on Wilmsmeier, G. and Hesse, M. (2014) 75 percent of Brazil's exports (by value) went to non-LAC countries in 2012, while for Argentina the proportion was 55 percent. Sea transport accounted for the vast majority of such transport. In the case of Mexico, 92 percent of its exports by value are outside LAC, though, of these, 69 percent go by road. The great majority of these non-LAC road exports are of course to the US. However, as the US likewise does not operate TIR, implementation would need to be mutual. As noted below alternative systems have also been developed for use along the US/Mexican border. Likewise it has been suggested that Chile's failure to move from contracting to implementation status has been due relatively fewer land borders than is the case with Eurasian countries. Communication with Aleksandra Zaronina, Project Manager TIR-EPD/Safe TIR IRU, 30 June 2014.

- Argentina has been a signatory since 1990 to the Agreement on International Land Transport (*Acuerdo sobre Transporte Internacional Terrestre* (ATIT)), under the Agreement of Partial Scope (*Acuerdo de Alcance Parcial*) within the framework of the Latin American Integration Association (*Asociación Latinoamericana de Integración* (ALADI)), whose other signatories are Bolivia, Brazil, Chile, Paraguay, Peru and Uruguay.
- In 1991, in the 18th Meeting of the Ministers of Public Works and Transportation of the Southern Cone countries (Argentina, Bolivia, Brazil, Chile, Paraguay, Peru and Uruguay) a customs agreement for trucking between countries was approved. This agreement is now under revision to perhaps provide other types of guarantees than those currently allowed for.
- In 2004, Argentina signed an agreement with other MERCOSUR countries to allow customs declarations to be transmitted electronically. This agreement would also apply to international transport via inland waterways. In 2009, they approved the International Customs Transit Computerized System (*Sistema Informático del Tránsito Internacional Aduanero* (SINTIA)), which is a customs information transmission mechanism as a pilot between Argentina, Chile, and Paraguay.
- Argentina has now expanded the SINTIA system to transport via land to destination countries party to the ATIT agreement. In fact, they feel that this system is satisfactory and they do not need to be signatories to TIR.
- The National Customs Office has stressed the importance of e-documentation to streamline the process.

It is worth noting however that the Argentinian response appears to suggest that the TIR Convention does not include an electronic customs declaration. Partly for that reason, it is not seen as suiting Argentina's goals in reducing the cost and time of customs transactions. TIR Electronic Pre-declarations (TIR-EPD) system enables TIR Carnet holders to submit TIR electronic pre-declarations to the customs offices en route. Furthermore, IRU is currently working on an eTIR international system that would enable fully paperless exchange of all the information related to TIR procedure. Given that TIR *does* indeed include electronic customs declaration, this suggests that there may be something of an information gap which has forestalled any further interest in TIR.

Likewise, an interview with Brazilian port officials (and a subsequent written response) indicated that the country was pursuing internal reform mechanisms such as its Paperless Ports program (*Porto sem Papel*) and Single Window for Foreign Trade (*Portal Único de Comercio Exterior*). Among other things, these initiatives are envisaged as allowing ships to send all port and customs-related documentation

through a single electronic point (the Paperless Port Information System). It is hoped that these and other reform measures might reduce the 13 days required for exports, cited above, to 8-10 days in the future. This target suggests even greater trade facilitation benefits than those (conservatively) modelled for TIR above, however full implementation of this program has yet to occur.<sup>142</sup>

While the evidence above suggests that there is still much to do to meet best practice and that TIR would nonetheless offer substantial benefits, what may also be of relevance is that such countries *perceive* that they should (or are) achieving such benefits through internal and/or regional reform rather than via arrangements which historically largely been of interest in Eurasia, such as TIR.

Further, electronic systems such as FAST, whose usage along the US/Mexican border is discussed above, appear to offer a local alternative to TIR-EPD despite their limited uptake to date. However, TIR-EPD also offers a guarantee system that is not offered by FAST. One of the IT risk management tools offered by the TIR system establishes an international guarantee chain among contracting parties and guarantees payment of any duties or taxes that may become due.

*Institutional constraints* – As part of the accession plan for the countries who are interested in becoming parties to the TIR Convention, it is recommended that such countries also ratify a package of other international conventions related to trade facilitation.<sup>143</sup> These include:

- *The Kyoto Convention*
- *The Revised Kyoto Convention*
- *The International Convention of the Harmonization of Frontier Controls of Goods; and*
- *The WCO SAFE framework of standards*

Subscribing to such conventions is recommended rather than required *per se* and the IRU works with accession countries<sup>144</sup>. Nonetheless, notes to articles 19 and 22 of the TIR Convention state the following:<sup>145</sup>

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<sup>142</sup> Interview with José Newton Barbosa Gama, Assessor Especial Secretaria de Portos Brazil (28 July 2014).

<sup>143</sup> Communication with Communication with IRU (17 July 2014).

<sup>144</sup> The IRU has found that implementing the TIR system and applying TIR IT risk management tools like TIR-EPD and SafeTIR, has enabled countries to meet the requirements of the above-mentioned Conventions.

<sup>145</sup> United Nations Economic Commission for Europe, The TIR Convention, 1975 (2013 Version) [http://www.unece.org/fileadmin/DAM/tir/handbook/english/newtirhand/TIR-6Rev10EN\\_Convention.pdf](http://www.unece.org/fileadmin/DAM/tir/handbook/english/newtirhand/TIR-6Rev10EN_Convention.pdf)

- *Specifications for Customs seals: The TIR Convention does not address the issue of standards and requirements for Customs seals' requirements for Customs seals. It only stipulates that, as a general rule, Contracting Parties must accept Customs seals affixed by other Contracting Parties. Thus, specification of Customs seals is left at the discretion of national Customs authorities. However, with a view to ensuring high security of Customs sealing, it is essential that Customs administrations use seals which conform to up-to-date international standards and requirements in this field. In this context, the attention of Customs authorities is drawn to the guidelines to Chapter 6 of the General Annex to the International Convention on the Simplification and Harmonization of Customs Procedures (revised Kyoto Convention) as well as to minimum requirements for Customs seals laid down in Specific Annex E, Chapter 1 of the said Convention elaborated under the auspices of the World Customs Organization (WCO). {TRANS/WP.30/216, paragraph 67 and Annex 2 and TRANS/WP.30/216/Corr.1; TRANS/WP.30/AC.2/77 paragraph 54 and Annex 3}*

While not a requirement, per se, membership of the Kyoto/revised Kyoto Conventions would therefore appear to make TIR accession easier. However the only countries in the Americas that are contracting parties are Canada, Cuba and the United States.<sup>146</sup> Factors such as these could represent additional barriers to accession.

More broadly a recent global survey found that issues of confidentiality and technical constraints and implementation costs were major barriers preventing more widespread implementation of e-customs systems. In particular, a lack of trust by traders that their information would be handled and stored securely, the existence of a wide variety of – and widely differing data - standards and the relatively high burden of implementation costs<sup>147</sup> in emerging economies were all cited by participants as important barriers.<sup>148</sup>

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<sup>146</sup> See [http://www.wcoomd.org/en/topics/facilitation/instrument-and-tools/conventions/pf\\_revised\\_kyoto\\_conv/instruments.aspx](http://www.wcoomd.org/en/topics/facilitation/instrument-and-tools/conventions/pf_revised_kyoto_conv/instruments.aspx)

<sup>147</sup> Implementation costs for the countries where the TIR system has already become operational have usually been jointly covered by the IRU and national customs authorities.

<sup>148</sup> Urciuoli, L., Hintsa, J., Ahokas, J., (2013) "Drivers and barriers affecting usage of e-Customs – A global survey of customs administrations using multivariate analysis techniques" *Government Information Quarterly* 30(2013) 473–485.

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