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Challenges and Opportunities in the Downturn

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GLOBALISATION AND ITS IMPACTS ON INLAND AND INTERMODAL TRANSPORT

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SUMMARY

Globalisation is more than simply the opening of economies and the internationalisation of trade. It is a root and branch transformation of the relationships between firms and people brought about by a revolution in technology -- the "digital revolution", the full impact of which is yet to be felt -- which has changed the patterns of trade flows, shifting the economic centres of gravity and giving rise to new emerging countries, particularly in Asia .

Maritime transport has enabled and facilitated this development with the progress it has made in the operation of higher performance vessels, promoting the adaptation and modernisation of the major ports, which have become shipping "hubs" and continental "gateways" for world trade.

But globalisation is not just trade between the continental seaboards, even though the majority of the population and world economic activity clusters along these seaboards. As economies develop and diversify, trade also develops at regional level, further extending globalisation. The enlargement of the European Union and the recent increase in trade between the emerging countries of Asia are cases in point.

Of approximately 7.4 billion tonnes of products traded between countries, regional traffic accounts for around 47 % including 25 % for intra-European trade and 13 % for trade between Asian countries. This type of regionalisation is developing in a way that is still patchy from one part of the world to another and is setting new challenges for the inland transport sector in international trade

The globalisation of trade also means developing local links between countries, hinterland coverage and the creation of international inland infrastructure networks with the more direct involvement of state actors.

In the case of the European Union, the common transport policy opened up the transport sector and Trans-European networks (TENs) were developed. In this instance, another objective of the « regionalisation of trade » is « country integration », but in other parts of the world there may be some overlap between regional organisations with more political, economic or technical aims. The United Nations also conducts a major regional activity in the transport sector in Europe, Asia, the Middle East and Latin America and, to a lesser extent, in Africa where it is working on the identification of inland networks, trade facilitation and, often, the harmonisation of operating standards.

In this situation, road transport has often appeared to be the most dynamic mode with the initiatives taken by private operators.

In the rail sector, the development of international transport usually requires more extensive reform and has to be opened up to new operators capable of providing international services. For the development of international inland transport entails a more complex long-term investment policy for infrastructure, modernising operation and market regulation.

At any rate, inland intermodal transport combining the use of road, rail and waterway quite often appears to be an option that allows natural barriers to be crossed more easily, introduces some flexibility into the options and, with higher volume flows, generates economies.

Maritime transport using « loading units » is hence very pertinent for inland hauls using combined transport and « swap body » or « semi-trailer » techniques. The United States and transalpine examples show that this is a competitive model for main continental corridors. However, alongside that, logistics centres are required and rail has to be opened to competition in order to ensure that the services provided are competitive compared with road mode over distances of more than 500 to 600 km.

These issues led to the organisation of high volume inland transport services by rail or road. The most prominent examples of which are the introduction of « double stack » rail transport in the US and on certain lines in China and India, or waterway transport along the Rhine or the Yangtze. Most of the major European ports are planning a significant increase in their modal share of rail (or waterway) to serve continental intermodal hubs sited inland.

At « micro-economic » level, the aim is the integration of a steadily more complex logistics chain from production through to distribution, which has been made possible by new information and communications tools, but which will have to deal with the new challenges of road congestion and distribution in big cities.

A cost accounting approach to the different segments in the chain demonstrates that productivity gains are still possible on the main haul with higher flow volumes. However, it also demonstrates that the last link is accounting for a steadily larger share of the costs in the chain. The performance of maritime transport has « eliminated » the distance between continents, replacing inland transport as the key determinant in the performance of transport chains.

On the scale of world trade, another question is also whether inland and maritime transport complement or compete with each other, independently of the problem of pre- and post-carriage. Inland and maritime modes complement each other wherever inland transport ensures coverage of areas not easily accessible from the seaboard.

The creation of « land bridges » is a different situation which promises new maritime solutions in combination with inland modes and can cut distances: the best examples are the land bridges from coast to coast in North America, which avoid a sea leg via the Panama canal and could do so for other obligatory sea passages from one of the earth's seas to another.

Competition between sea and inland routes in intercontinental trade is largely dependent on geographical conditions, which may or may not facilitate the development of major inland corridors as national networks begin to interconnect.

This may be the case for routes between Europe and Asia and particularly China. There could be many more such examples in America or Southern Asia. In Africa, there is no real inland network except in Northern Africa and world trade is conducted via the coasts.

Competition may also come into play on a regional scale between inland and short sea shipping (SSS).

In all of the scenarios road transport would usually be the most responsive and the most flexible mode, but the performance of rail can also be extremely competitive as in the case of the US or Alpine routes in Europe. Between Europe and Asia, rail could be more competitive than maritime transport since it has the added advantage of shorter distances.

However, the problem does not always present itself in terms of complement or substitute and the broader vision of transport then becomes one of a more diversified network of global routes integrating all modes.

There is no reason why inland and maritime transport should be mutually exclusive in world trade and there is every reason to use both in integrating logistics chains, seeking to promote intermodal inland and maritime options. A more diversified range of services and routes would also make the global transport system less vulnerable.

Inevitably, these developments in globalisation make a forward-looking vision even more crucial if we are to be better able to manage the future.

In such a vision, a key scenario would be the continued globalisation of trade, which passes the point of no return accompanied by stronger regional links: but this scenario carries the risk of a " severe energy and environmental crisis » in the medium and long term, which calls for a sustainable development policy.

The main features of this scenario are:

- The globalisation of trade continues, boosted by the emerging countries along with the unprecedented revolution in digital technology, many effects of which have yet to make themselves felt. The bases for new growth are the same as at the start of the 21st century.
- The financial crisis should not jeopardise the fundamental economic development mechanism, even if it does have a major impact on the real economy in the short and medium term and leads to more moderate growth projections than forecast by the IMF and the World Bank a year ago.
- The centres of gravity of global economic activity shift to the most populated emerging countries of Asia and South America or Africa, proportionately reducing the role of the « Triad » countries, which dominated world trade in the second half of the 20th century. Demographic data and people's more direct access to knowledge play a key role in this shift.
- Under these circumstances, the diversification of the emerging economies affords new opportunities for local links, which encourage the development of regional trade: off shoring on a worldwide scale is accompanied by back shoring on a regional and local scale. Regionalisation drives the re-coverage of inland areas calling for the development of inland relations between neighbouring countries.
- That said, transport accounts for no more than 1 to 2 % of the total cost of manufactured products and is not really a brake on the high growth of trade in manufactured goods, which accounts for more than two-thirds of world trade in value terms; but such growth carries with it the seeds of an inevitable energy and environmental crisis twenty years or so from now unless sustainable development measures are adopted at international level.
- Another constraint is the availability of space for transport along the great coastal plains and around large cities where access is becoming increasingly difficult.

Actually, in the transport sector, technical progress continues to be made, enabling new operating performances and improved integration into logistics chains.

- Maritime transport is steadily increasing its volumes and its performance with the result that the focus is now on pre and post inland haulage and inland access to ports.
- This explains why inland transport is looking for options that call on modes other than road transport and consequently for ways of consolidating inland flows through inland hubs to eliminate road congestion problems terminals in the vicinity of ports and to reach more distant inland centres of activity.
- For inland flows between neighbouring countries, road is the most dynamic mode once border barriers come down; in the emerging counties, road transport is becoming more professional and is being modernised as inland trade becomes more international.
- This said, major productivity gains are possible with rail mode provided that reforms to open up the system are carried out and that higher volume flows are organised.
- In a large number of cases, combined road/rail, road/rail /waterway is already providing a very productive option where distances are quite long or there is a natural obstacle that has to be crossed, as is the case in North America or in Europe for crossing the Alps.

However, with respect to institutions, transport policies have become more complex to implement and require the definition of an « international governance » system for transport.

- The globalisation of trade has long been dominated by maritime transport between coastal cities, forming a true network of cities and ports across the world.
- Today, transport policy must:
  - incorporate a long-term policy for investment in inland transport infrastructure;
  - promote operating performance with the reform of the inland transport system, which is more directly subject to the control of administrations and to the weight of a country's history:
  - safeguard the environment, which is under threat from increased traffic, particularly in areas where traffic is heavy.
- As inland networks spread over the continent, new international « corridors » develop. These may complement or compete with sea routes where access to ports is difficult or where distances by land are shorter.
- Intermodal transport technologies applied to inland and maritime modes including short sea RoRo shipping enable route diversification, boost the more competitive options and at the same time reduce the vulnerability of the transport system.

Policies such as these call for forward looking programming and evaluation suggesting the following comments on methods.

- Know the issues, conduct periodic reviews and develop an information system that incorporates inland, maritime and air transport.
- Develop exchanges of experience between regional organisations aimed at the development of transport networks particularly in Europe and Asia (EU, EFTA ALENA, ASEAN and the UN).
- Monitor the performance of continental and intercontinental transport chains (ex: UN-ESCAP for land-locked countries) and identify best practices, notably for combined transport.
- Construct and quantify inland transport scenarios based on simulation and GIS tools.

This said, policies must go beyond the theory level and must also be supported by action among which the following initiatives warrant mention in the light of the foregoing analysis of the transport system:

- raising awareness of standards problems: physical standards for inland intermodal transport (and SSS), emissions standards and documentation standards for facilitation.
- facilitating the siting of intermodal logistics freight terminals, genuine gateways in the global transport system and hubs for organising point-to-point logistics chains.
- promoting experience with international intermodal maritime and inland corridors covering all aspects: infrastructure, operation and environmental impact
- setting ourselves an aim: world trade growth with a positive environmental outcome (reduction in nuisance and emissions).

In seeking solutions, there are of course measures that need to be taken to tackle a crisis that has a direct impact on transport, particularly maritime transport. This situation may have perverse effects leading to a choice of routes and transport modes that is less costly for shippers but more harmful to the environment. From this standpoint, solutions also have to be sustainable solutions, with a total rethink of the environmental performance of transport, and should not just be a short-term response to shore up the existing transport system, which is closely linked to the globalisation of trade and its methods of regulation.

INTRODUCTION

Globalisation is usually closely linked with growth in maritime container traffic. The inland aspects of international and global transport are more diversified and less well known.

Yet inland haulage will inevitably assume increasing importance as inland flows converge on large ports and as trade develops between countries within the new regional economic areas that are springing up in various parts of the world. In reality, globalisation is the combined development of trade between continents and between countries in the same economic area despite the fact that the focus is often on long-distance trade between continents.

In inland transport, there are problems with access to ports and with ensuring that transport logistics chains perform well from origin through to end destination as well as in terms of trade between countries on the same continent with the development of continental inland networks in Europe, America, Australia and, increasingly, in Asia and Africa.

Today, the logistics of maritime container transport is becoming more widespread at world and regional level for general cargo, i.e. cargo not transported in bulk. Alongside that, in the inland transport sector we are also seeing the development of transport using "loading units", i.e. ISO maritime containers, semi-trailers and swap bodies, although over longer distances, generally over 500 to 600 km and still in rather modest proportions: this is what is called intermodal transport or "combined" inland, road-rail and road-rail-waterway transport, which is faced with competition from a dynamic road transport sector. These intermodal techniques are becoming a credible inland transport alternative to "road only" for coping with the growth in international inland trade and better preserving the environment. Transport policy, infrastructure investment and methods of organisation and regulation must be redesigned to enable the development of these techniques and to satisfy the shippers' demands for logistic chain integration.

The aim of this report is to give an overview of past trends, current problems and the future outlook for inland international transport on a global scale and to show how it interfaces with global maritime container transport or provides alternative solutions.

The report is divided into five chapters:

- The first chapter reviews past trends in the internationalisation of trade and globalisation.
- The second chapter assesses the likely effects on inland transport from the standpoint of both access to ports and transport within regional areas.
- The third chapter focuses on the new transport demands of global firms for integrating logistics chains (microeconomic section).
- The fourth chapter focuses on diversification of major international trade routes, which are highly concentrated on a limited number of maritime routes.
- The fifth chapter outlines future trends in the economy and transport performance, closing with an examination of new modes of governance in global transport.

The conclusion of the report returns to transport trends on a global scale in relation to the development of inland transport, particularly international intermodal transport.

I - GLOBALISATION: TRANSPORT TRENDS AND CHALLENGES

The aim of this first chapter is to analyse past trends over the long-term that have led up to the current situation -- defined by the globalisation of trade and communications -- in order to gauge the challenges this poses for transport.

1. Internationalisation and globalisation

It is difficult to describe the stages in the worldwide phenomenon of globalisation, which has developed in different ways from one country to another and is still far from encompassing every region of the world uniformly, even if all regions are now concerned by it.

It is probably the result of action taken by governments to avoid a return to protectionism, which was one of the causes of the last global conflict leading to recommendations that economies should be opened up to world trade to better ensure peace and promote development.

Over the past fifty years, a combination of many political, economic and financial trends has given rise to globalisation as we now know it, which was made possible by one of the greatest revolutions in technology in the history of mankind, the "digital" revolution, which has completely transformed communication and trade, causing an unprecedented acceleration of change.

However, it is difficult to keep globalisation under control. After a long period of growth in trade, which culminated at the start of the 21st century, questions are increasingly being raised about the following issues:

- the future of energy resources including oil, which is the primary source of energy for transport and in particular for the transport of goods by sea, air and land;
- the environmental risks and climate changes to which current development patterns expose the planet and which are themselves closely linked to the consumption of fossil fuel, oil and coal, bearing in mind that the future of nuclear electric power generation remains a subject of debate.

At the end of 2008, a violent financial crisis, shocking in its suddenness, spread right across the world. Observers wonder what impact it will have on the real economy, production, consumption and trade.

While it is, of course, difficult to answer all these questions at the time this report is written, that makes it even more necessary to re-examine the long-term prospects of transport and to explore the possible scenarios.

For the analysis of past trends, a distinction is made between two major stages, namely the "internationalisation" of trade and a more widespread, global stage that would come to be known as "globalisation":

- An initial period from 1950 to 1973 which saw economies open to international trade.

While this period of opening up to international trade was a reaction to pre-war protectionist policies, it was nevertheless a period during which two blocks, West and East, confronted each other with tensions running very high at times, before a period of relative detente.

Furthermore, this period during which economies opened up to international trade primarily concerned western countries and Japan whereas developing countries remained relatively marginalized in terms of their shrinking share of international growth.

- A second period from 1973 to the present day, during which globalisation gained ground step by step.

Here, the term globalisation is used in the sense of "globalisation" involving not only countries, but people and hence companies in direct contact on a global scale.

From the economic standpoint, the production methods of companies were transformed with their activities being redistributed throughout the world. From the political standpoint, barriers between the Western and Eastern blocks came down after the fall of the Berlin Wall and economic relations between developed and underdeveloped countries gradually begin to see a shift as the emerging countries grew to become the real drivers of the global economy at the beginning of the 21st century.

The choice of the year 1973 for the end and beginning of these two major periods may seem arbitrary at first glance. It was the year of the first major oil crisis, which also revealed the changing balance of power between countries and the fundamental problem of the future long-term supply of energy, which has still not been resolved.

At the turn of the 21st century, the future outlook seemed to be for sustainable growth of the global economy on a new basis, with emerging economies having reached economic maturity, but also with new challenges for the environment and energy, caused by economic growth itself.

In just a few weeks, the financial crisis of the autumn of 2008 shook this outlook for global growth still being presented in IMF and World Bank reports on long-term prospects at the start of 2008. In the last section of this paper, the question to be asked is whether this crisis raises fundamental questions about the mechanisms of the global economy or whether it is a financial crisis that can be overcome, allowing the world economy get off to a new start.

1.1. Internationalisation, 1945 to 1973

By the end of the war, the aim of Western countries was to avoid the mistakes of the 1929 - 1930 crisis and the ensuing wave of protectionism, which resulted in decreased economic activity and unemployment and became one of the causes of the Second World War.

An international regulatory system was set up with the Bretton Woods agreements of 1944 to finance trade between countries, then the GATT agreements in 1947 to promote bilateral negotiations and gradually lower customs duties.

The successive rounds of GATT negotiations greatly reduced customs duties, by a factor of 3 on industrial products up to the early 60s, until the 5th "Kennedy Round" negotiations, which led to a further reduction in customs duties on industrial products: to only 8 % at the time for the European Union and 13.5 % for the United States.

During this whole period, governments played a leading role in promoting the internationalisation of trade and ensuring its funding through international institutions.

Throughout this period, growth in world trade was higher than that of GDP, which was about 5 %, reaching 6 % per year until just before the Kennedy Round and then 9 % from 1963 to 1973. Europe had become the world's leading exporter in 1961 with 25 % of trade, followed by the US and Canada with 19 %, and then Japan. These countries formed what was called the "Triad".

At the same time, this was also the period of the “cold war" when the clash of ideologies and the formation of political and economic "blocks", while the development of international trade took place mainly between the developed countries of the OECD.

From 1950 to 1973, the share of these latter countries in world trade increased from 63 % to 72 %, while the share of developing countries decreased from 31 % to 18 %, following a decline in the price of the commodities they exported relative to the price of manufactured goods.

The share in world trade of the block of centrally planned economies was estimated to be around 10 to 15 %, under state-managed trade within COMECOM, which was set up in 1949.

World trade was thus primarily trade between developed countries and trade between developed and under-developed countries characterised by:

- North-South trade in finished products from developed countries to less-developed countries;
- South-North trade in commodities from developing countries to developed countries.

However, there were some exceptions due to the fact that:

- some developed countries like the US, Australia, Canada and the Federal Republic of Germany were also countries producing raw materials;
- some developing countries adopted a strategy of exporting more sophisticated products very early on, as in the case of some Asian countries (Singapore, Hong Kong, Taiwan and South Korea), which ensured their rapid economic growth during this initial period.

Consequently, this period was marked by confrontation between the economic development models of market economies and planned economies and, furthermore, by criticism of “dependency on outsiders" in developing countries where there was a growing divide between export-led regions and other regions, which were stagnating.

1.2. Globalisation from the 1970s to the turn of the 21st century

Unlike the previous period, globalisation was less the intended result of countries and international organisations, even though they did play an active role in it, and more the result of profound changes in society brought about by advances in technology and the methods of production and consumption that accompanied them; businesses and individuals were direct actors in globalisation, which today calls for new regulation and governance methods.

Globalisation gradually gained ground from the end of the 20th century to become an inexorable reality by the start of the 21st century.

Several distinct stages in can also be identified, as follows.

(a) The 1970s saw the first oil crisis and the emergence of "global" companies, the Club of Rome raised questions about "zero" growth and there was a growing awareness of environmental risks, all of which were indicative of a challenge to the previous order.

(b) The 1980s saw the emergence of "triumphant liberalism" but also marked a period of difficult adjustment for many developing countries with what was called the "Washington Consensus" and the implementation of stringency measures for many countries.

(c) The 1990s saw countries with centrally planned economies open up, with a successful economic transition for most of them and the emergence in the world economy of large developing countries, such as Brazil, India, Russia, China (BRIC) and Mexico, which would profoundly change the face of global economics

A few details about the changing economic and institutional context of these periods are useful in gaining a better understanding of the basics of globalisation and transport, which is intimately related to it, as we enter the 21st century.

1.2.1. 1973, the global system in crisis

In 1973 came the first oil crisis, which occurred relatively suddenly although there had been many telltale signs of its likelihood since the creation of OPEC to foil the oil companies (the "majors") which dominated the market. However, this was also a period during which the industrial production system of western countries began to run out of steam and could no longer sustain the pace of productivity gains of past years.

In many countries, inflation was high and especially in Europe: this inflation was the result of rising labour costs which could no longer be absorbed by productivity gains. The international financial system based on the Bretton-Woods agreement also began to reach its limits and was terminated (convertibility of currency into gold) by the United States. Hence, there were economic difficulties at the macro-economic level in maintaining global balance and at the micro-economic level in ensuring that companies could maintain performance.

This accounted for the first "global crisis" with the hike in oil prices in 1973 and escalating political confrontations.

As such, the period from 1973 to 1980 effectively marked a turning point in global relations with industrial models being called into question and the first questions being raised about the aims of growth, in view of its impact on the environment and the depletion of natural resources, such as oil.

As a result, it prepared the way for future years when the major multinational companies would rethink their production processes on a global scale in order to contain labour costs: market penetration abroad was not just a consequence of the search for local demand in a market that was promising in the long run, but rather the consequence of a new concept of production/distribution on a global scale. It was during this period that locations in Asia became "workshops" in the literal sense of the term, part of the overall production line: trade between industries increased, which in turn increased growth in international trade in industrial products.

From the financial standpoint, this meant increasing international investment for new industrial facilities, first in Europe and then in countries in Asia, which became its main beneficiaries.

1.2.2. The liberal solution of the 1980s

On the economic front, growth in industrialised countries remained at a relatively low level as a result of the previous problems.

In policy terms, the period was one of "certainties" where open markets and competition were the foundations of economic regulation, and where equilibrium in the key areas of the economy had be restored in order to ensure market stability and government neutrality; this accounted for the stringency policies imposed on the most heavily indebted countries, and a general effort to restore equilibrium in key economic areas.

But this was also a period when some Eastern bloc countries began to open up to world trade and introduce market mechanisms into their economic systems.

1.2.3. 1989, economies in the East open up and new countries emerge in the global economy

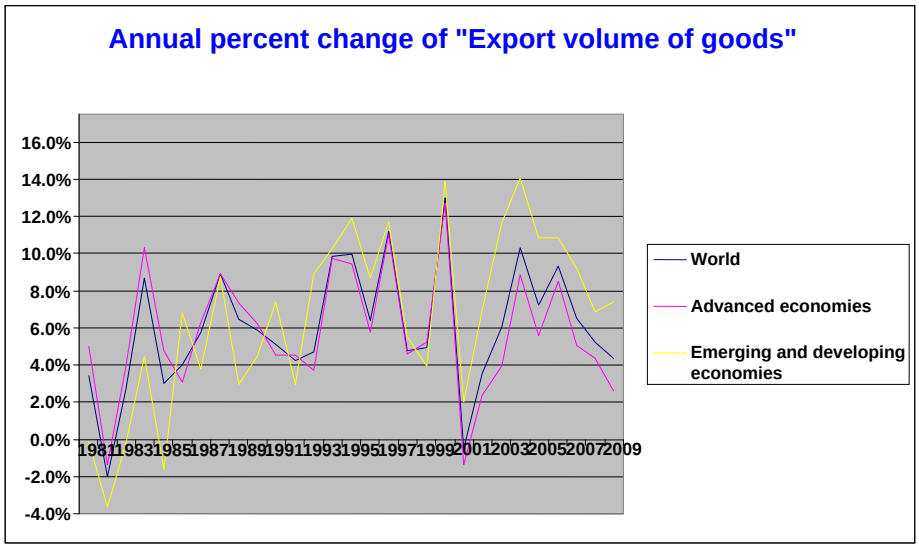
This period was marked by an increasing awareness of the globalisation that characterised the beginning of the 21st century.

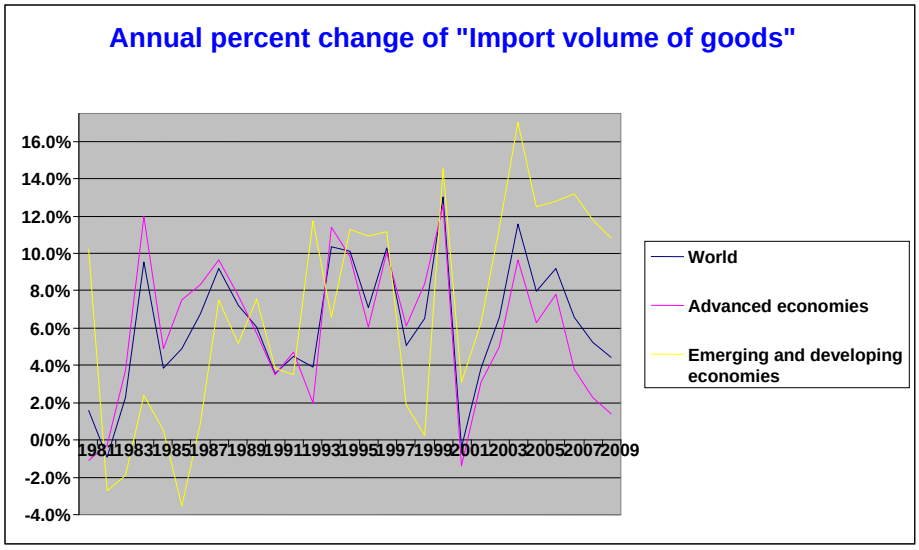
It began with the sudden opening up of the countries of Central Europe and Russia in 1989 and 1990, which led to the immediate collapse of COMECOM and the rapid redirection of trade in Europe.

But other regions of the world also opened up with the rise of a whole series of countries which became known as the "emerging countries". The latter included China, Russia and other major countries in Latin America and Africa, all continental countries, which together represented the bulk of the world's population. This changed the scale of world trade.

For both imports and exports, the emerging countries have seen growth rates 2 to 4 points higher than the world average since the year 2000 and their GDP growth rates are often over 6 % while the rate in developed countries is around 2 %.

Faster growth in foreign trade in emerging economies
(Source: World Bank)





In this context, multinational relocation strategies were no longer confined just to setting up industrial production plants to benefit from lower labour costs. They also aimed to ensure the supply of raw materials and semi-finished products required to supply unprecedented global economic, industrial and agricultural growth; the "old economy was back" and markets for raw materials, industrial products such as steel products found fresh impetus in the globalisation of trade, providing new resources to countries producing raw materials, including the poorest countries.

In the transport field, a parallel trend was noted with networks opening up and liberalisation of the sector, although significant differences between maritime transport and inland transport, which changed more slowly should be pointed out.

Globalisation was accompanied by robust growth in maritime transport and in particular in the containerised transport of general cargo which made such growth possible by keeping freight rates low despite rising demand.

The maritime sector has always been more exposed to international competition while road and rail transport are more directly subject to complex and varied national legislation with the result that opening up the market and harmonisation take more time.

The internationalisation of road transport requires prior international agreements and legislative adjustments and, in many countries, considerable modernisation of a sector in which corporatism has always been strong, and regulations strict with price setting and quotas. On the North American continent, the sector was opened up to competition in the 1980s and in Europe in the 1990s, but has yet to take place in many countries.

International road transport which is more directly exposed to competition has been an impetus to the development of the sector: once measures facilitating movements between countries have been decided, adaptation to the needs of new markets has been swift and, in turn, provided further impetus for domestic markets.

Reforms took longer to implement for the rail sector, as it was a highly integrated system with specific statutes, and new market rules had to be defined to open up networks to competition and initiate an in-depth reform of companies. This called for work to define a new system of “railway regulation" ensuring both management and maintenance of infrastructure and securing free access to networks for new transport operators.

This reform, initiated in 1980 in the United States, then Canada, took longer in Europe, with its patchwork of different national rail systems, and has not yet been completed there.

For inland, road, rail and waterway transport, the organisation of international transport has depended on agreements between countries at regional level.

2. The challenges for inland transport

Several indicators are available to measure trends in international transport and, in particular, intermodal transport in terms of:

- the value of world trade, imports and exports
- the tonnage of international trade,
- and, finally, the number of containers transported or handled in ports, which gives an initial indication of inland intermodal transport, but which is limited to port activity.

As far as trends over time are concerned, all of these indicators are generally fairly well correlated with countries’ economic activity and especially with GDP or industrial output. However, these correlations also deserve a more in-depth explanation of the phenomena that occurred in a period of profound change in the patterns of trade in terms of products and geographical distribution.

As far as geographical distribution is concerned, a distinction has to be made between intercontinental transport between the major regions of the world -- primarily by sea (and on which little information is available regarding pre and post shipment inland carriage) -- and international inland transport between neighbouring countries over relatively shorter distances, but representing significant tonnages of trade.

As regards trade patterns for products, the analysis will focus on the transport of general cargo, as bulk transport is the remit of other types of logistics chains. These "miscellaneous" products are increasingly transported in "loading units" with the growth of what is referred to as "containerisation rates". The containerisation rate has now reached high levels close to saturation in long-distance maritime trade, between Europe and Asia for example. For continental trade, inland intermodal transport makes use of loading units other than maritime containers: swap bodies, semi-trailers, etc. This seems to be the technique best suited to competing with road transport, particularly for dispersed traffic, which is increasing rapidly as the market expands.

2.1. Measuring the challenge for transport in tonnage

Worldwide trade statistics are provided by the United Nations from the UN COMTRADE database on trade between countries by type of product at a very detailed level. These data are expressed in value terms (dollar).

The UN COMTRADE database was run to establish a matrix table showing trade between the major regions of the world, including intra-regional trade. Three major product groups were identified by separating out agricultural products, which may involve dedicated logistics chains and raw materials, which are usually transported in bulk.

In this breakdown, manufactured products with a higher added value tend to use intermodal transport.

In 2007, total trade amounted to USD 13.2 billion, 72 % of which in manufactured products.

The matrix table was then converted into tonnes to obtain a physical measurement indicator better suited to a transport analysis. For this purpose, a value per tonne was estimated by product, at a detailed classification level using the COMEXT database, which provides information in tonnes and in value of trade in the European Union. The results presented in the attached tables indicate trade of 7.4 billion tonnes, of which 22 % in manufactured goods, i.e. 1.6 billion tonnes.

The trade relations between regions were reproduced on world maps both for world “all products” international trade and for manufactured products only. The maps show that, in 2007, trade between the "Triad" countries was still the highest in terms of tonnage, including trade in manufactured goods, but that each region of the Triad was extending its trade relations to all of the regions in the world.

The concentration of trade between the Triad regions is still relatively higher for manufactured goods than for all products because of the high tonnage in world trade of heavy bulk goods coming from points of origin not concentrated in the Triad countries. The maps show that the growth of trade in raw materials and semi-finished products boosted world trade in all countries, including the least developed countries producing raw materials, particularly Latin American countries in recent years.

Finally, it should be noted that this analysis also shows the full scale of regional trade compared with trade between the major regions of the world, which can be correlated more directly with maritime container traffic.

2007 World Trade in goods, by product and by region

Source: WTO, Comext, units: '000 tonnes/year (estimated by NESTEAR)

Agricultural Products

Point of origin \destination	North America	South and Central America	Europe	CIS	Africa	Middle East	Asia	Total
North America	62 113	9 989	18 007	1 558	5 363	4 056	48 490	149 575
South and Central America	15 946	14 757	31 459	4 338	5 423	4 915	20 107	96 945
Europe	18 977	3 599	334 639	12 493	12 412	9 091	22 652	413 864
CIS	610	24	7 436	9 974	2 160	1 919	8 231	30 355
Africa	1 293	169	13 226	506	5 565	1 341	4 553	26 653
Middle East	297	56	2 433	667	1 116	8 673	1 349	14 591
Asia	19 916	2 756	27 698	3 473	7 166	9 214	96 593	166 816
Total	119 153	31 351	434 898	33 008	39 205	39 210	201 975	898 799

Fuels and extraction industry products

Point of origin \destination	North America	South and Central America	Europe	CIS	Africa	Middle East	Asia	Total
North America	304 046	31 981	85 489	432	3 808	2 162	91 913	519 831
South and Central America	148 307	80 928	82 999	437	5 616	2 940	130 131	451 358
Europe	87 636	6 356	850 146	8 182	27 516	14 849	50 867	1 045 552
CIS	29 919	4 224	433 035	69 489	1 186	11 393	63 691	612 937
Africa	152 225	24 454	199 706	130	26 547	3 298	117 156	523 514
Middle East	107 948	5 002	141 980	185	28 548	43 572	674 701	1 001 936
Asia	35 208	11 695	58 990	1 758	9 390	18 049	641 571	776 660
Total	865 288	164 640	1 852 344	80 614	102 611	96 263	1 770 028	4 931 788

Manufactured products								
Point of origin \destination	**North America**	**South and Central America**	**Europe**	**CIS**	**Africa**	**Middle East**	**Asia**	**Total**
North America	101 604	15 645	34 849	1 015	2 445	6 450	34 624	196 633
South and Central America	12 392	14 676	8 026	140	1 205	533	4 424	41 396
Europe	58 363	11 602	631 194	25 806	20 302	25 203	59 957	832 428
CIS	1 169	729	7 508	9 463	633	1 400	2 478	23 380
Africa	1 442	223	7 240	44	3 172	615	1 769	14 506
Middle East	4 515	231	4 838	674	1 917	10 427	5 246	27 846
Asia	75 917	10 991	80 163	9 005	12 528	25 579	225 384	439 567
Total	255 402	54 097	773 818	46 147	42 202	70 207	333 882	1 575 755

All products – '000 tonnes/year

Point of origin \destination	North America	South and Central America	Europe	CIS	Africa	Middle East	Asia	Total
North America	467 763	57 615	138 346	3 005	11 616	12 668	175 026	866 039
South and Central America	176 645	110 361	122 483	4 915	12 244	8 388	154 662	589 698
Europe	164 976	21 558	1 815 979	46 482	60 230	49 143	133 476	2 291 844
CIS	31 698	4 977	447 979	88 926	3 979	14 712	74 400	666 671
Africa	154 959	24 846	220 171	680	35 284	5 253	123 478	564 672
Middle East	112 760	5 289	149 251	1 526	31 581	62 672	681 296	1 044 374
Asia	131 041	25 442	166 851	14 236	29 083	52 843	963 547	1 383 044
Total	1 239 843	250 088	3 061 060	159 769	184 018	205 680	2 305 885	7 406 342

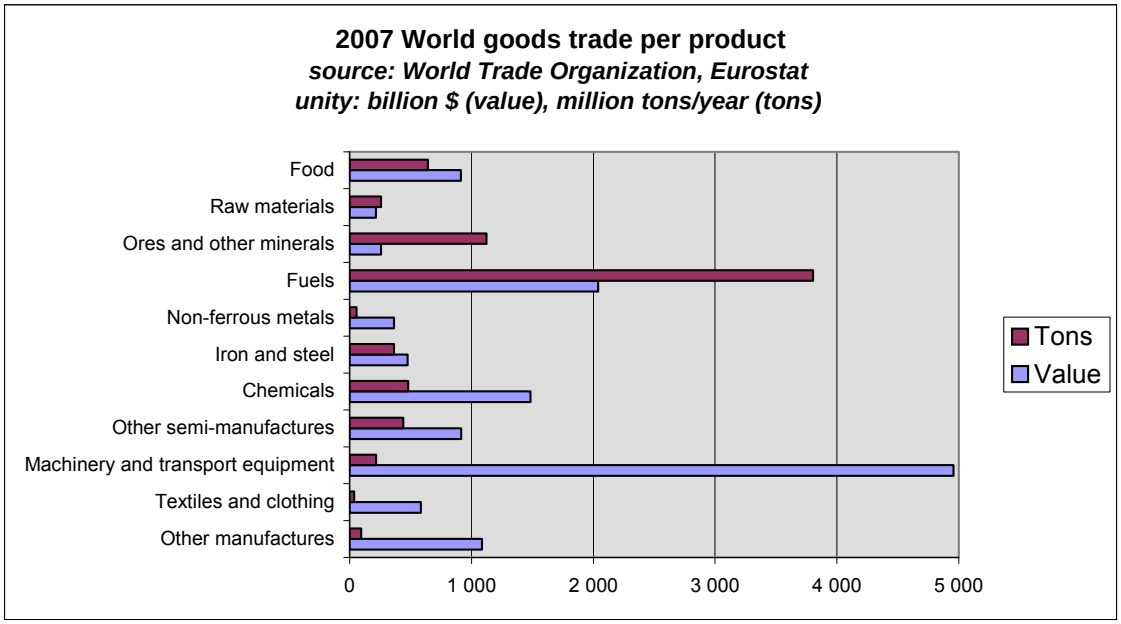
With this approach, it is also possible to obtain average values per tonne of product carried. This shows that for manufactured products valued at over USD 10 000 per tonne, the cost of transport, i.e. USD 2 000 to 3 000 for a TEU container containing 10 tonnes is rarely more than 2 to 3 % of the value of product delivered, and is often much lower for products with a value of over USD 20 to 30 000 per tonne. Transport costs of these orders are frequent for 20' containers as will be demonstrated below. For a 40' container, the percentage cost of transport per tonne is generally lower still.

For textiles, for instance, with a value per tonne in the region of USD 3 000, transport costs are rarely more than 2 % and often much lower than 1 %. For clothing, the cost amounts to around 0.2 to 0.3 %. For transport equipment and machinery, the cost is usually much lower than 0.5 % and negligible as a percentage for office equipment and pharmaceutical products, which could easily absorb higher transport costs.

Prices of goods - Trade (imp+exp) between EU27 – World
Units: USD/tonnes Source: Comext 2007
Estimated by NESTEAR according to the WTO classification (SITC)
SITC: Standard International Trade Classification

WTO classification	USD/ton
Agricultural Products	**1 245**
Foodstuffs	1 390
Fish	4 786
Other foodstuffs	1 313
Raw materials	828
Fuels and extraction industry products	**540**
Ores and other minerals	229
Fuels	521
Non-ferrous metals	6 493
Manufactured products	**5 416**
Iron and steel	1 306
Chemical products	3 314
Pharmaceuticals	112 101
Other chemical products	2 318
Other semi-manufactured products	2 070
Transport equipment and machines	20 389
Office and telecommunications equipment	83 575
Transport equipment	16 791
Other machines	17 712
Textiles	8 862
Clothes	34 226
Other manufactured products	11 578

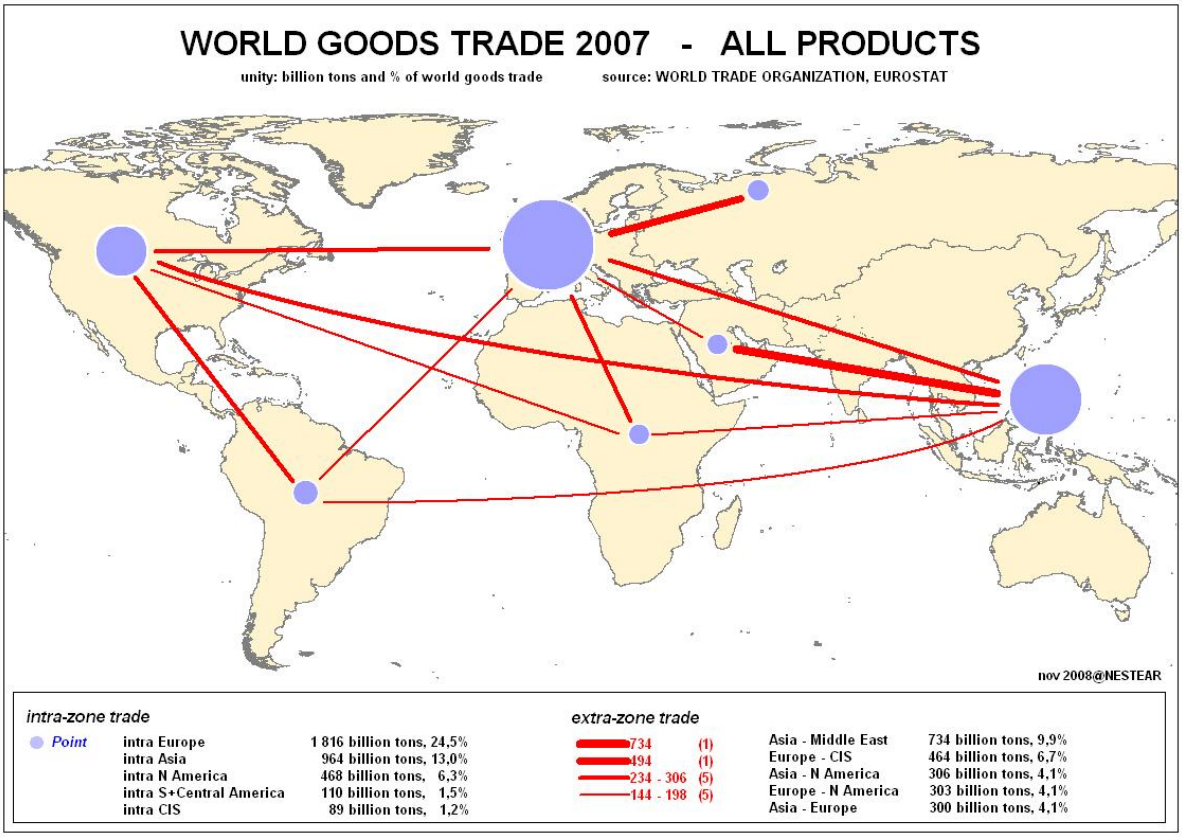
It is important to note that in terms of value, « manufactured products » account for over two-thirds of world trade and that the cost of transport has no significant impact on the value of these products delivered to market. It has an impact only on certain low value-added bulk products or on certain agricultural raw materials or foodstuffs.

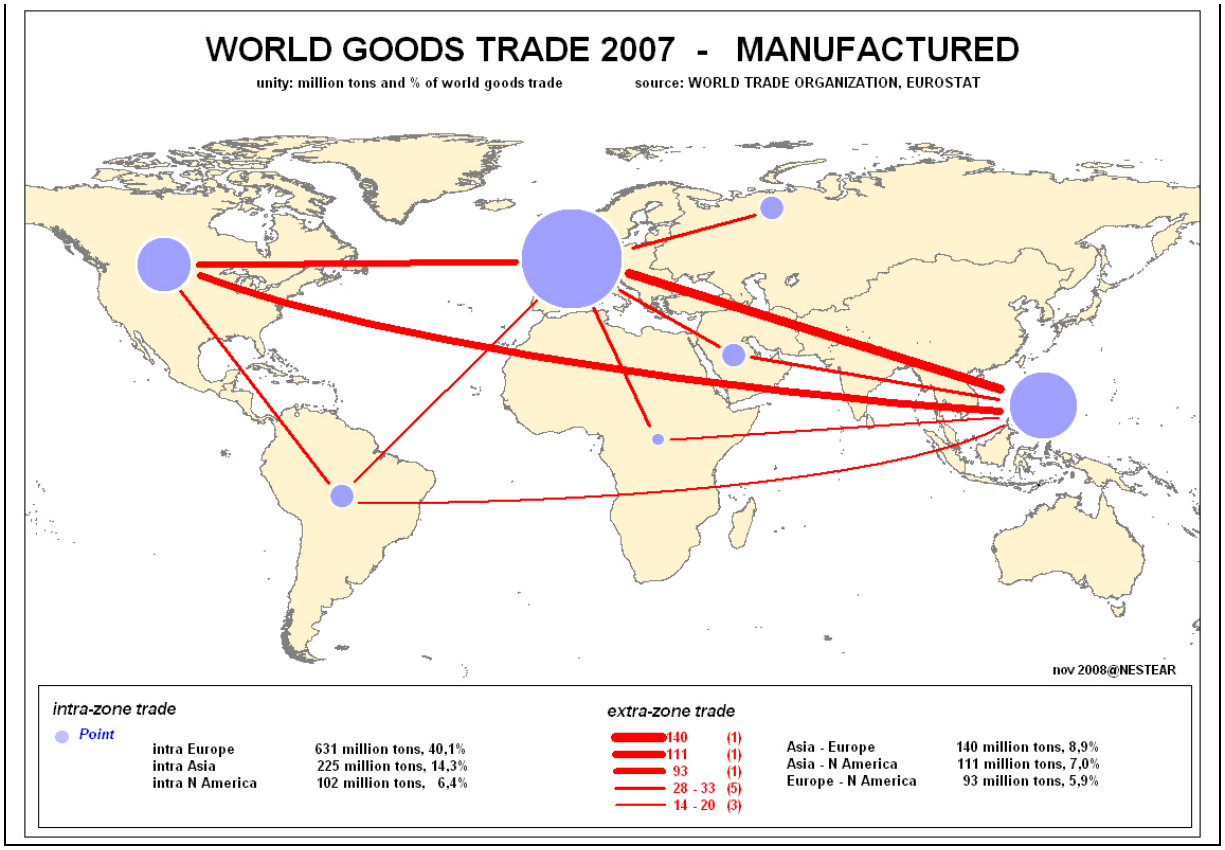


2007 World goods trade per product

Source: World Trade Organization, Eurostat
nomenclature of WTO: product groupings of SITC
unity: million tons per year (Estimate by NESTEAR)
Origin and Destination: Europe, North+Central+South America, Asia, Middle East, CIS, Africa

Products	billion $	million tons
Food	913	643
Raw materials	215	258
Agricultural products	**1 128**	**900**
Ores and other minerals	258	1 123
Fuels	2 038	3 804
Non-ferrous metals	362	56
Fuels and mining products	**2 659**	**4 983**
Iron and steel	474	362
Chemicals	1 483	481
Other semi-manufactures	915	440
Machinery and transport equipment	4 957	216
Textiles and clothing	583	37
Other manufactures	1 087	94
Manufactures	**9 500**	**1 629**
Total	**13 286**	**7 512**





2.2. Trends over time and growth in world trade

An initial approach is to analyse the correlations between global GDP and world trade, which provide a useful measure of the openness of economies and explain why growth in international transport is higher than growth in inland transport in the various countries.

In this type of analysis, particular attention may be given to the growth in international maritime trade for which there are also long-term trend indicators, but only for pre- and post-shipment carriage for inland trade.

2.2.1. Correlation between global GDP and world trade

Over the period from the end of World War II to 2008, international trade grew faster than world economic activity (world GDP).

Until the early 1970s, global trade increased by 7 % and world GDP increased by about 5 %, in other words, an average elasticity of 1.4 over the period.

Expressed in terms of value, world exports gradually rose from USD 28 billion in 1948 to USD 200 billion in 1967 before reaching USD 500 billion in 1973. Throughout this period from 1948 to 1973, the pace of increase in trade picked up from an annual growth rate of 6.5 % during the 1950s, to 9.2 % during the 1960s. However, this growth was stronger in developed market economies than in developing countries,

with growth of 7.1 % and 3.1 % respectively for both groups of countries in the 1950s, and 10 % and 7.2 % respectively in the 1960s: in other words, a difference of almost 3 % from 1950 to 1970.

From the end of the war, international trade was undeniably one of the drivers of growth with countries' share of exports rising from 9 % in 1950 to 15 % in 1973.

During subsequent periods from 1970 to 1990, which were periods of lower economic growth, international trade remained an impetus that supported economic activity, with growth rates still higher than those of economic activity.

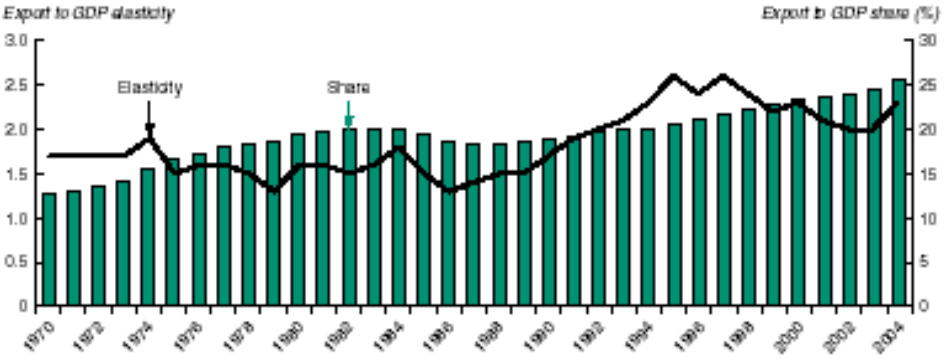
- A growth rate of 5 % compared with 4 % of GDP in the 1970s.
- A growth rate of 4 % for world trade compared with 3 % in the 1980s
- A growth rate of 6 % in world trade compared with 2 % of GDP in the 1990s, with sharp fluctuations in international trade for both developed countries and developing countries: however international trade reinforced its role in supporting economic activity with an average GDP elasticity of 3 over the period.
- Growth of 5 % in world trade compared with 3 % for world GDP in the early 2000s.

The elasticity of trade with respect to world GDP was thus above 2 or more from the early 1990s onwards, particularly for developed countries whose GDP growth slowed compared with world trade, which maintained its growth momentum.

The trend in elasticity can be seen clearly in the figure below, which covers the period 1970-2004 and shows a decline following a peak in 1973, then an upturn in the early 1990s to around or over 2, as has been the case in recent years, since 2004.

One of the consequences of this has been, of course, that countries opened up at a faster pace, as measured by export/GDP ratio, import/ GDP ratio or import + export/ GDP ratio: worldwide, market openness, which was around 15 % in the early 1970s, rose to 20 % in 1990 and to close to 25 % in the early 2000s with, of course, significant differences between countries according to their industrial structure, history and size.

Figure 2.1 World trade has expanded dramatically...



Sources: World Bank Development Data Platform (DDP) and staff calculations.

Note: Elasticity is calculated as the percent change in real exports relative to the percent change in real GDP. The export share is calculated in nominal dollar terms. Data are smoothed using five-year moving averages.

For emerging countries, this phenomenon was even more dramatic: in the case of China, it should be noted that market openness, which stood at only 1 % in 1973, rose to 20 % in 1990 and then increased sharply to 45 % in 2004.

2.2.2. World trade and container traffic

For transport, three indicators of trends in world activity and global trade can be correlated/

- Trends in the tonnage of trade between major regions of the world, which is mostly by sea.
- Trends in container traffic, which is more directly related to trade in manufactured goods between major regions.
- Container throughput in ports: ports of origin, destination and transhipment.

However, the interpretation of these correlations calls for some comments on the organisation of maritime container transport and, in particular, on the concentration of traffic on major maritime hubs.

As a general rule, growth in container traffic is much higher than growth in world trade in volume terms. Over the past 20 years, growth in container trade has been about 10 % per year (9.8 %), reaching 1.1 billion tonnes transported out of a total of about 2 billion tonnes of general cargo (excluding bulk goods). In 2006, this tonnage represented 129 million TEU of traffic; a projection of 371 billion TEU in 2020 would represent an increase of 7.8 % per year (Drewry).

However, some of this growth was linked to what has been called the increase in the "containerisation rate", i.e. the increase in the proportion of products transported in containers. This phenomenon is now levelling off and the proportion of general goods transported as conventional cargo has declined considerably. Actually, in some areas such as the Mediterranean or the Black Sea, where conventional traffic has long remained active, the containerisation rate (percentage of products that can be placed in containers for transport) is becoming very high, even over shorter distances.

Another phenomenon has been the establishment of large hubs for routing over long distances with vessels increasing in size and proportionately increasing container handling and traffic compared with figures for exports or imports based on origin/destination links. Streamlining maritime operations thus introduces additional links.

Turning now to consider overall container throughput, data provided by ports gives a total of 440 million TEU for 2006, from which transhipment in hubs has to be subtracted to obtain the preceding figure for containers carried, given that there will always be at least two handling operations per shipment in the port of origin and final destination.

In a recent study carried out by MDS, a distinction was made between world trade carried by containers, the use of container ships and port transit activity.

The relationship between the number of international transport containers loaded, the transport of empty containers and the number of containers handled, was modelled over the period 1994-2006. The analysis shows that the container transport market has grown by about 7 % a year, to which should be added a 1.4 % increase in containerisation, 1 % for wider use of 40' containers (instead of 20' containers), and finally, almost 1 % for the increasing proportion of empty containers, thus giving a growth rate of 10 %.

Moreover, the increase in the proportion of empty containers is a major concern for maritime container operators in both the maritime and inland transport sectors when it comes to repositioning containers. Repositioning accounts for increasing costs and growing imbalances in traffic between Europe, Asia and

America. The management of the container fleet and the repositioning of containers probably account for over 25 % of the total cost of door-to-door container transport, a percentage comparable to pre- and post-shipment inland carriage and to the percentage for operating the vessel, for port transit around 20 %[1].

Port traffic and its components

	Total port handling	Port-to-port full	Port-to-port empty	Transhipment
1990	88.0	57.9	14.7	15.5
1995	145.5	93.1	21.0	31.5
2000	236.2	138.1	37.2	60.9
2006 (est)	441.9	255.5	66.2	120.2
2010 (est)	627.4	360.2	94.4	172.8
2006 *versus* 1995	+204%	+174%	+215%	+282%
2010 *versus* 2006	+42%	+41%	+43%	+44%

Source: Drewry Shipping Consultants (2006b)

2.3. Change in the patterns of global trade

This trend analysis should also be accompanied by an analysis of trade patterns by country type or product type.

- During the initial period, the share of developed countries in international trade increased to more than 70 % in the early 1970s with trade being concentrated between Triad countries (North America, Europe and Japan)
- By the end of the second period, in 2000, five countries in Asia already accounted for 25 % of total exports compared with only 7.9 % in 1980, reflecting a twofold phenomenon:
  - the opening up of trade between developed and emerging countries, with the momentum of trade now provided by emerging countries;
  - as well as an expansion of trade in each region of the Triad to their nearer hinterland, chiefly under regional agreements.

Turning, now to product type, the following is clear.

- A proportion of manufactured products has continued to rise, from 50 % in the early 1950s, to 63 % in 1973 and then to 75 % in terms of product value, due chiefly to the decline in agricultural products and, to a degree, in mining products.
  Among these manufactured products, a distinction can also be made between lower or higher value-added products in sectors such as textiles and steel, or sectors such as mechanical engineering and the motor-vehicle industry: the second category has tended to increase its relative share, at least in terms of value of trade.

- In addition, as a general rule, the proportion of industrial products in world trade is increasing, due to the economic growth of emerging countries, but also to the complete reorganisation of production on a global scale, with increased outsourcing and off shoring of activity.

These changes in industrial geography are taking place on both a worldwide and regional scale. The mechanisms involved are often complex with the result that trade among Asian countries themselves is

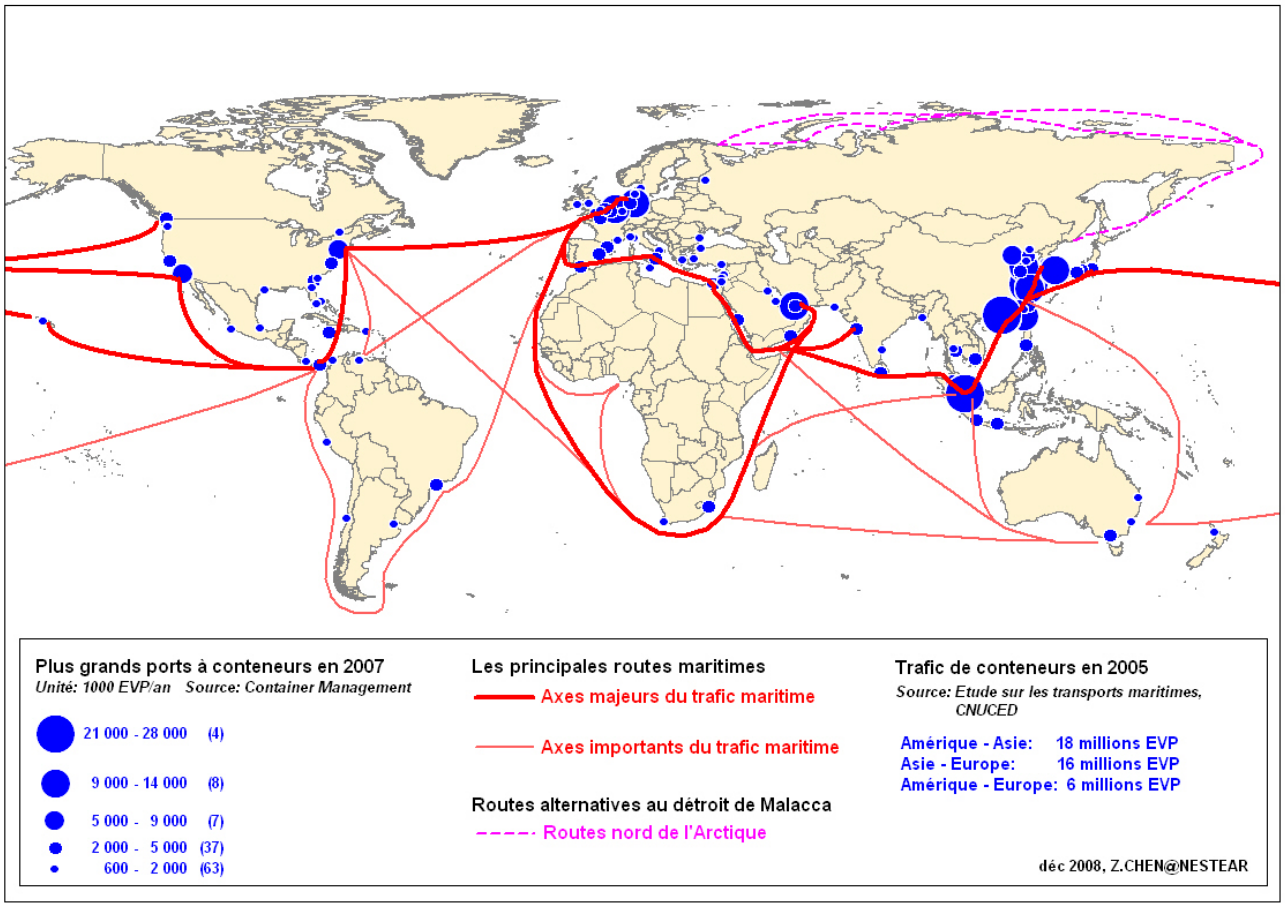
[1] Source INRETS according to Stopford 2002

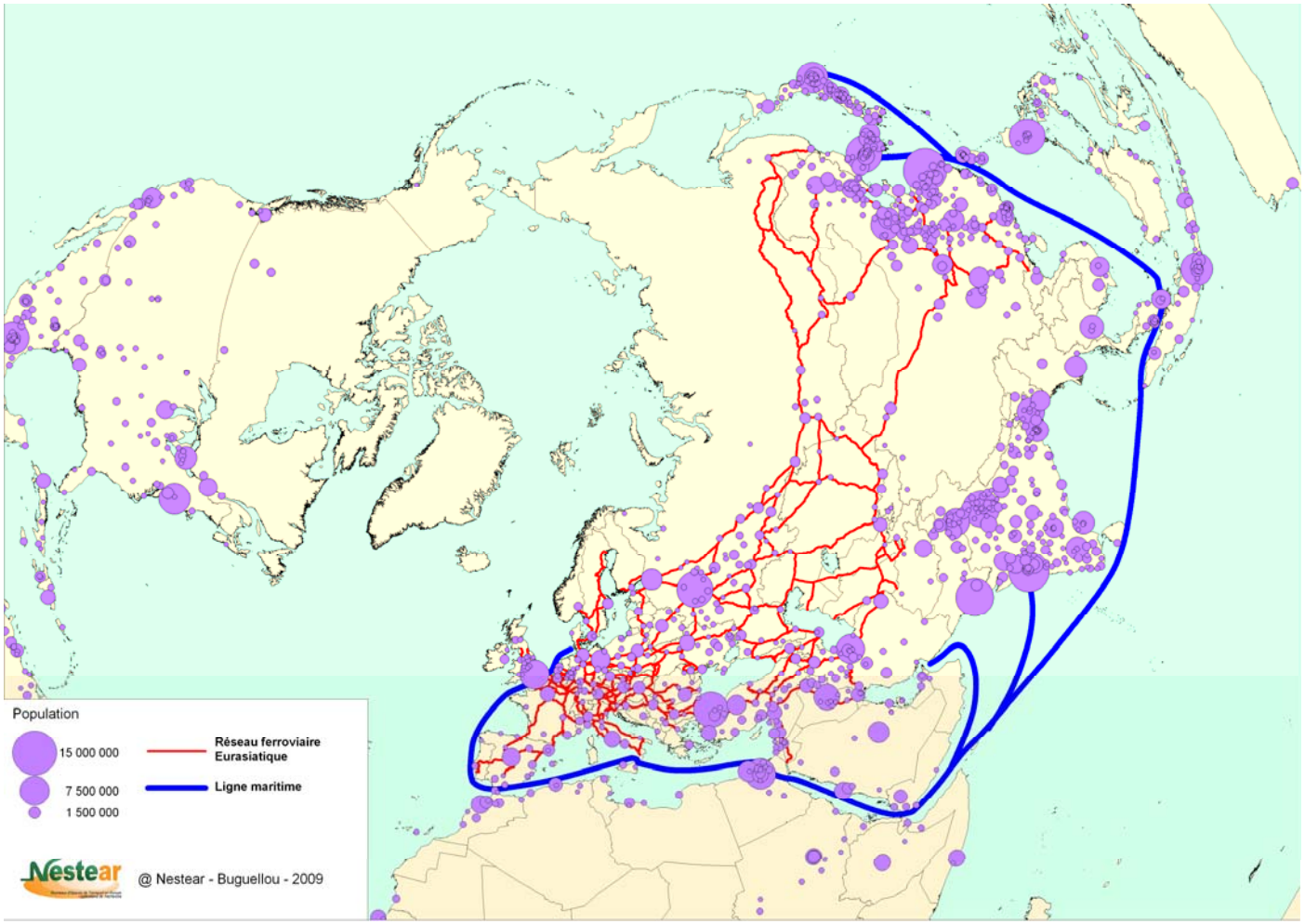
increasing faster than world trade. Half the exports from Asia to China consist of finished products going into the manufacturing of Chinese products for the US, European or even Japanese markets.

The first of the maps below illustrates the main intercontinental maritime routes for container traffic and shows how important the Asian ports are becoming in container traffic as a whole: trade with and among Asian ports accounted for 50 % of world import container traffic in 2005 and for 40 % of export container traffic; the projected percentages for 2015 are 62 % and 48 % respectively (UNESCAP), i.e.: more than half of world container traffic.

The second map gives another view of the world's main Europe-Asia inland and maritime routes using geo-positioning of the main cities, based on a different projection.

The main maritime routes and ports





II - INLAND TRANSPORT AND GLOBALISATION

1. Inland transport in the globalisation of trade

The internationalisation and globalisation of trade have been made possible or even stimulated by progress made in the transport field, from the technical, organisational and commercial standpoints alike; considerable increases in productivity have made it possible to meet the requirements of new demand in terms of volumes transported, service quality and reliability.

The most impressive progress no doubt occurred in long-distance maritime transport between the continents of Europe, Asia and America, in a context of more flexible regulations, with operators more open to changes in the global economy than in the case of inland transport, which is more restricted by national regulations and the availability of infrastructure.

This progress has resulted in the provision of container carriers of increasing size, and the maintenance of relatively low, stable freight rates, despite the growth in demand.

The advances in maritime container transport, achieved through a real process of "industrialising" container carrier services, has extended to port systems which have scaled up their facilities in parallel and made the required organisational changes, sometimes under more difficult conditions, but keener competition between ports made this upgrade necessary if they were to maintain their position in serving their hinterlands.

In the field of inland transport and international inland transport in particular, changes have generally been slower and more dependent on regional transport agreements: this applies equally to services to major ports for access to international maritime transport and to international inland transport.
Road transport has probably been the quickest to change, while rail transport has had to deal with technical, organisational and political rigidities, which are much more difficult to resolve, in order to open up to international transport and competition.

Therefore, the challenges facing inland international transport are not determined solely by trends in maritime container transport. All the more so because much of this international trade is conducted in a regional context between neighbouring countries, and this share is likely to increase significantly in many parts of the world, particularly in areas where foreign trade was concentrated on intercontinental links to date and where trade with neighbouring countries has been limited, as in Africa, Latin America and South Asia, for instance.

To cater for the growth in this traffic, intermodal inland transport solutions may also be developed, by combining inland modes, possibly including regional Short Sea Shipping (SSS).

In the previous table of world trade in tonnes, EU intra-Community traffic accounts for 24 % of overall global transport in tonnes. This percentage of intra-regional trade is much lower for other regions, including Asia, where regional transport accounts for only 13 % of world transport.

All products - %
Source: NESTEAR

Point of origin \destination	North America	South and Central America	Europe	CIS	Africa	Middle East	Asia	Total
North America	6.3 %	0.8 %	1.9 %	0.0 %	0.2 %	0.2 %	2.4 %	11.7 %
South and Central America	2.4 %	1.5 %	1.7 %	0.1 %	0.2 %	0.1 %	2.1 %	8.0 %
Europe	2.2 %	0.3 %	24.5 %	0.6 %	0.8 %	0.7 %	1.8 %	30.9 %
CIS	0.4 %	0.1 %	6.0 %	1.2 %	0.1 %	0.2 %	1.0 %	9.0 %
Africa	2.1 %	0.3 %	3.0 %	0.0 %	0.5 %	0.1 %	1.7 %	7.6 %
Middle East	1.5 %	0.1 %	2.0 %	0.0 %	0.4 %	0.8 %	9.2 %	14.1 %
Asia	1.8 %	0.3 %	2.3 %	0.2 %	0.4 %	0.7 %	13.0 %	18.7 %
Total	16.7 %	3.4 %	41.3 %	2.2 %	2.5 %	2.8 %	31.1 %	100.0 %

Manufactured products - %

Point of origin \destination	North America	South and Central America	Europe	CIS	Africa	Middle East	Asia	Total
North America	6.4 %	1.0 %	2.2 %	0.1 %	0.2 %	0.4 %	2.2 %	12.5 %
South and Central America	0.8 %	0.9 %	0.5 %	0.0 %	0.1 %	0.0 %	0.3 %	2.6 %
Europe	3.7 %	0.7 %	40.1 %	1.6 %	1.3 %	1.6 %	3.8 %	52.8 %
CIS	0.1 %	0.0 %	0.5 %	0.6 %	0.0 %	0.1 %	0.2 %	1.5 %
Africa	0.1 %	0.0 %	0.5 %	0.0 %	0.2 %	0.0 %	0.1 %	0.9 %
Middle East	0.3 %	0.0 %	0.3 %	0.0 %	0.1 %	0.7 %	0.3 %	1.8 %
Asia	4.8 %	0.7 %	5.1 %	0.6 %	0.8 %	1.6 %	14.3 %	27.9 %
Total	16.2 %	3.4 %	49.1 %	2.9 %	2.7 %	4.5 %	21.2 %	100.0 %

For inland transport, two questions arise as regards the development of regional traffic.

- To what extent is this regional traffic, which accounts for nearly half of world tonnage, likely to grow faster than transport between regions and reach or not reach levels comparable to those observed in Europe, where intra-regional transport accounts for around two-thirds of all European international traffic?
- To what extent should inland transport, particularly intermodal transport, contribute to the development of this regional transport, including Short Sea Shipping where appropriate.

The answers will almost certainly depend on where regional activities are in relation to coastlines.

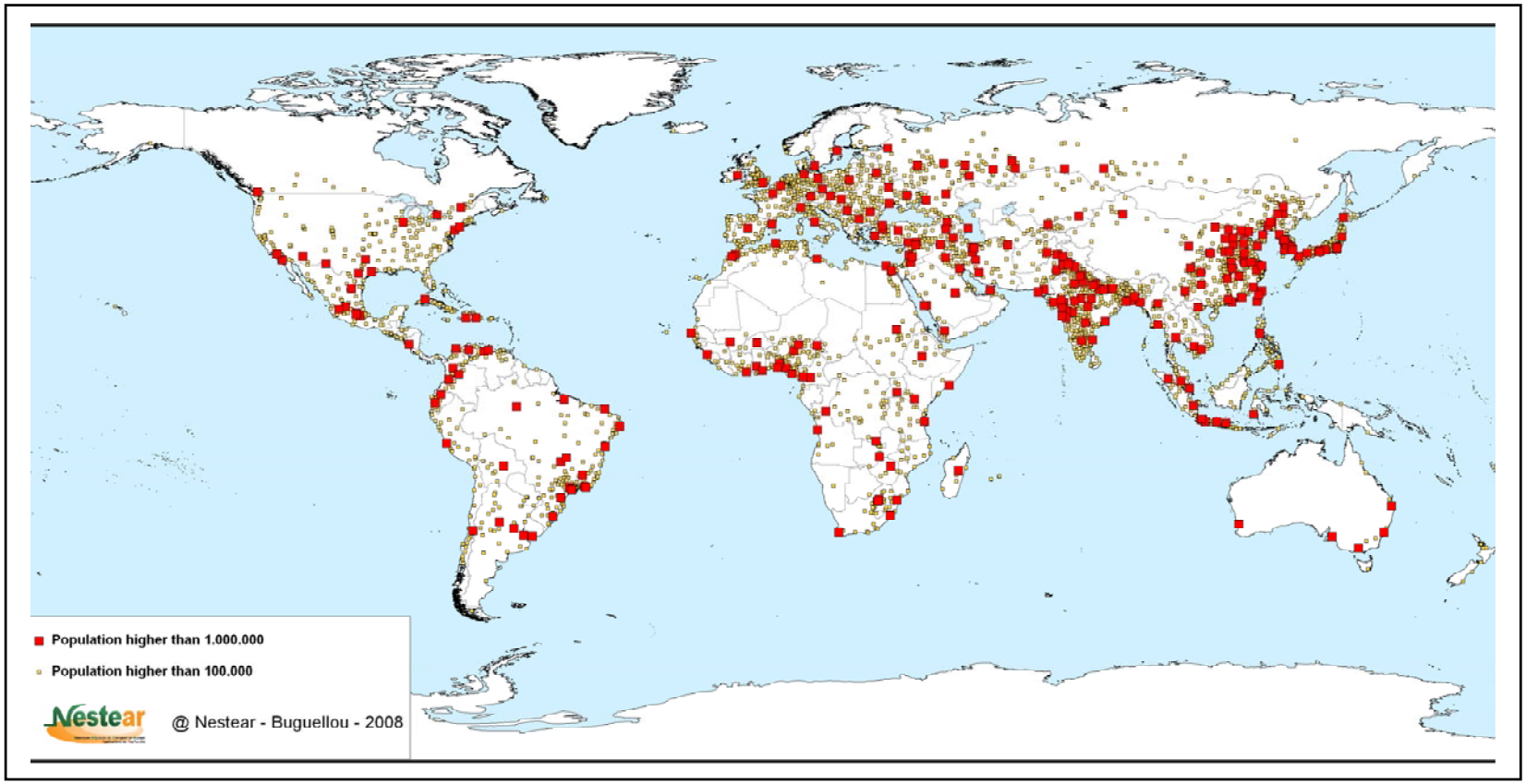
In the following maps, the main centres of activity have been mapped on the basis of urban population. They clearly show that much of the world's population has congregated along coastlines, especially in Latin America, and in many countries in East Asia and South-East Asia.

Hence, it is hardly surprising that globalisation first began with trade between seaboards, or rather between large metropolitan centres and centres of activity in coastal regions, along the networks that maritime transport had built between them. Among the exceptions that should probably be mentioned is the European Union, which seems to be one of the most integrated regional areas and, more recently, NAFTA.

These maps also show that in regions such as Europe, parts of Asia and North America, a large proportion of the population is also located inland. It is mainly in these parts of the world that inland regional transport should develop with stronger regionalisation of their economies.

For transport, the challenges are changing. From now the challenge will be to structure the territories of neighbouring countries – and co-operation between them can sometimes be more difficult – to make progress at local level in the knowledge that the major inland corridors can provide a useful framework for structuring such inland areas.

Coastal and inland towns with a population in excess of 1 million (comparison of coastal and inland populations)



In the inland transport sector, the main phenomenon in the past few decades has been the rapid growth in international road transport, which strengthened its position versus other modes of transport in agreements on conditions and licences negotiated between countries. These are bilateral and multilateral licences as was the case in Europe with ECMT licences from the 1960s onwards, while the regional organisation of the United Nations in Geneva was more directly responsible for technical standards on weights, sizes and infrastructure. Agreements that may sometimes be more political thus have to be combined with more technical agreements to facilitate international road transport.

In the rail sector, international transport was governed by co-operation agreements between large integrated national companies, which organised border crossings, but did not prove very flexible in adapting to the needs of new international markets, with costly and time wasting cross-border operations. In competition with road transport, rail transport was unable to take advantage of longer distance international transport insofar as they only added to its interoperability problems.

For waterways and short sea shipping (SSS), national transport rules exist alongside international transport rules. International regulations sometimes date back to very old agreements on movement between countries allowing varying degrees of openness to competition, while national transport is governed by specific national rules, which also change slowly depending on the influence of national corporatism.

Waterways, which do not normally face as many interoperability problems as railways, have therefore largely contributed to the internationalisation of trade although with a number of limitations and restrictions:

- geographical limitations depending on whether or not there are natural waterways into continents, and in particular waterways as found in Europe, Asia and America with large rivers sometimes joining up with true inland seas (Great Lakes, Caspian Sea, Black Sea), and sometimes through the building of wide-gauge canals;
- limitations of the waterway market, which had long focused on a few bulk commodities (coal, minerals, oil, etc.) and has only more recently opened up to the transport of general cargo and containers.

Therefore, international intermodal inland transport has only seen minor development, other than in Europe, where volume for international inland transport is comparable with the volume for pre- and post-shipment container carriage, and in North America.

In this section, a distinction will thus be made between two aspects of inland transport as follows.

- Inland transport from ports that are continental gateways for world maritime transport
- International inland transport between continental countries.

2. The regional dynamic in globalisation

"Regionalisation" is one dimension of the globalisation of trade. It has its basis in a local approach and in agreements made between states within regional bodies to promote co-operation and trade. It most often has an impact on the development of cross-border international inland transport, although regional transport agreements and the importance given to them vary greatly from one region to another.

Initially, regionalisation might have been thought a factor that would counteract globalisation, allowing neighbouring states to forge special relationships that would protect them from global competition and better safeguard their national sovereignty. In actual fact, this has rarely been the case especially since the

World Trade Organisation was able to adapt to this de facto regionalisation by implementing the "most favoured nation" clause, creating synergies between regionalisation and globalisation of trade.

Since the Second World War, regional agreements for various purposes have proliferated, leading to forms of regional organisation that are integrated to varying degrees.

One of the most successful forms of integration has of course been the creation of "federations" or "unions", as was historically the case with the United States and the USSR, which enabled the integration of continent-wide transport networks which are now a valuable asset. However, such aims are now rarer, with the initial regional situation being more about neighbouring national networks.

In the case of the European Union, which is an example of the most successful integration since the end of the Second World War, the integration of transport networks was only specified in the Maastricht Treaty in 1993 -- more than thirty years after the Treaty of Rome -- which illustrates the scale of the difficulty in integrating national networks, which has now become a priority in EU policy at regional and global level (White Paper 2001).

In recent decades in different continents, such regional agreements include but are not limited to the following.

- The European Union, which has gradually been enlarged.
- The CIS, founded in 1991 after the demise of the USSR.
- ASEAN, founded in 1967 and then SAARC in 1985, an economic and policy organisation in South-east Asia and a regional co-operative association.
- NAFTA, which is a free trade agreement signed between the countries of North America in 1994.
- Regional agreements in Africa by major geographic areas with the ECOWAS for the development of West African States in 1975, SADC for the development of Southern Africa in 1980 and ECCAS (Economic Community of Central African States) in 1983.
- MERCOSUR, the South American Common Market founded in 1991 and the Andean Pact of 1969 replaced by the Andean Community in 1996, in Latin America.
- GCC (Gulf Cooperation Council) created in 1981 and AMU (Arab Maghreb Union) founded in 1989.

There are also other associations or agreements between Australia and New Zealand and between the countries around the Black Sea and the countries of Central Asia.

All of these regional groups have set more or less ambitious goals in terms of co-operation, customs agreements and development and refer to varying degrees to the integration of inland transport systems.

It has to be said that the share of regional trade in international trade is itself very inconsistent with the highest percentage achieved by Europe and NAFTA with over two-thirds of trade while this percentage is less than 25 or 30 % for other regions in the world, and even as low as 10 % in the Middle East and Africa.

In the matrix table for trade between geographic zones, intra-regional import trade accounts for:

- 66 % for European countries;
- 39 % for countries in East Asia and South-east Asia;
- 36 % for North America;
- 27 % for CIS countries;

- 26 % for South America;
- 8.5 % for the countries of the Middle East and the Maghreb, which is partly explained by the scale of world oil exports.

For exports, the corresponding percentages are as follows:

- 67 % for the European Union, which gives a relatively balanced structure of imports and exports;
- 55 % for North America, which is a percentage significantly higher than for imports;
- 32 % for the countries of East Asia and South-east Asia;
- 18 % for the CIS, which is lower than for imports and reflects the scale of world commodities exports;
- 24 % for South America, where the previous comment also partly applies;
- about 6 % for the countries of the Maghreb and the Middle East, which reflects the relative scale of world oil exports.

The above figures give a fairly mixed picture of the real situation with regional integration, which depends on the nature of the existing regional agreement, but also on specific regional economic factors, different levels of development and competitiveness for consumer products and capital equipment, given that commodities markets operate are set up on a global scale, not a regional scale.

Yet among all of these explanatory factors, there is also the performance of the inland transport or short sea shipping system, the feasibility of interconnecting national networks, etc.

Maritime transport promotes regional integration among the countries of South Asia and South-East Asia, wherever large areas of economic and industrial activity are still coastal regions. This may also be the case with trade between Latin and Central America, in Africa, and between Australia and its neighbours.

In these different areas, the development of global container transport and its organisation around « hubs » and « feeder » services has played a part in creating new links between countries in the same region.

This is also true in the Mediterranean area and in the Middle East, although the weakness in regional trade has persisted and can be explained by the convergence of other factors as follows.

- The predominant role of the EU in trade with the Mediterranean countries, which has also been reflected in the EU's policy of expanding transport to this region, in particular with the definition of priority "Euro-Mediterranean" corridors.
  The share of the EU in trade with Mediterranean countries, and with Western Mediterranean countries in particular, often exceeds 60 %, proportionately reducing the relative share of trade between countries in the area which do not belong to the EU.
- The economic structures of Southern Mediterranean countries, which have often remained fairly competitive, rather than complementary, in North-South relations.
- The share of commodity exports in the region that is directly dependent on a global market such as the oil market.
- Political problems between neighbouring countries limiting cross-border trade.

These remarks also show that regional agreements define geographical areas which may partially overlap -- as is the case in the Mediterranean region, the Middle East and Africa – and have different goals, although they always aim to increase links between neighbouring countries.

3. The development of international networks and the coverage of inland regions

As seen above, international inland transport has not changed as quickly as world maritime transport: its methods of organisation are much more demanding for technical operating reasons (interoperability) or statutory reasons (regulations drawn up at national level) in contexts where investment co-ordination requires a high degree of co-operation between countries.

Hence, inland areas are regions which it is more difficult for globalisation to penetrate even though there are some major inland routes, the main international “corridors”, along which international inland transport is organised via road, rail, or waterway.

Europe provides an example of a transport policy aimed at promoting regional integration through the development of trans-European networks (TEN) as part of a policy framed, fairly late on, in the early 1990s.

From this standpoint, the EU built on initiatives taken by other international organisations in the transport field and in particular the steps taken by the ECMT and the United Nations, which focused on the development of international inland transport from an earlier stage, laying emphasis either on the statutory aspects of licences or on the more technical aspects of network interconnections and harmonization (ECMT licence, AGC, AGR and AGTC networks).

Intermodal transport has always held a key position in all of these actions, with the definition of transhipment centres in AGTC networks for combined transport, specific authorisations for collection and distribution from these centres and the definition of a European intermodal transport network, focusing on infrastructure programming, operation and regulation.

Indeed, several aspects must enter into consideration when building international inland networks:

- the physical level of interconnection between national infrastructure networks and, at a later stage, investment programming investment along major international routes in order to meet demand;
- the operating level, which is much more stringent for rail than for road;
- harmonisation of regulatory systems so that transport operators can provide their services in different countries.

This means that the ideal vision of an "intermodal" inland network can only be a long-term goal; today, such networks exist only where they were established from the outset on a harmonized basis as was the case in the United States, the USSR, India and China and even in former colonies, although the quality standards required today are in a different category of sophistication.

At the current time, various types of organisations have different timeframes for reaching this long-term goal.

- The development of long-term frameworks for international networks as was the case for the AGR, AGC and AGTC networks in Europe, or the more recent UN-ESCAP networks for Asia and routes between Europe and Asia, or ESCWA networks in the Middle East, implemented by the regional representations of the United Nations.#
- Long-term objectives focusing on priority corridors, where co-operation between private and public stakeholders concerned is easier, such as between Europe and Central Asia (TRACECA), between the Maghreb countries (Trans-Maghreb) or between North America and South America.
- Short-term objectives for specific international interconnection projects, transit permits and facilitating cross-border operations including, for example, setting up cross-border freight terminals to facilitate border crossing from one country to another as is the case for road transport

between Turkey and Iran, or for rail transport between Central European countries where there is a change of track gauge.

Setting up trans-European networks then combines the long-term goals of covering the entire European area (concept of networks, territorial accessibility and single market uniformity) with shorter-term objectives for the selection of priority projects in priority corridors including transport to and from major intercontinental ports. On these priority corridors, co-ordinated infrastructure construction must be paralleled by improved operation (interoperability, regulation) along these corridors in order to optimize the use of infrastructure and to address congestion problems, where there is any conflict between local and international traffic.

In conclusion, it appears that while maritime transport has been able to respond to and even encourage demand for international transport by a considerable increase in productivity and reliability, the situation is more complex for inland transport and inland intermodal transport may be able to introduce greater flexibility.

Although the growth in international road transport has been rapid in North America, Europe and even Central Asia, this does not mean that continental road networks will be easy to establish as evidenced by the current efforts of regional bodies which sometimes have still made little progress in many parts of the world such as in South Asia or South-East Asia, or in Africa and Latin America. In many regions, the problems of vehicle weight, size and transit permits have yet to be resolved; this limits trade between neighbouring countries which are still reluctant to open up access to their transport systems.

Such an analysis suggests that inland transport may in fact have held back the development of international inland trade and is probably one of the reasons why trade between neighbouring countries has sometimes remained limited compared with long-distance trade by sea.

In establishing international inland networks, road transport has often proved to be the quickest mode to adapt when permitted by regulations. However, its facility in doing so should not jeopardize long-term railway solutions, which often make for higher productivity gains: intermodal transport will then look like one of the best options for reconciling short, medium and long-term goals.

The two maps below illustrate identified international inland networks between Europe and Asia and on the continent of Asia. They are the result of a whole series of initiatives taken mostly within the framework of the UN and its regional representations in Europe and Asia. These initiatives, too, take the « corridor » approach, defining ten or so road and rail corridors on which countries are co-operating to improve infrastructure, facilitate cross-border operations and operating procedures for both road and rail as well as inland waterway transport.

A similar approach is being developed for routes via the TRACECA corridor which links Europe and Central Asia, following the same type of « priority corridor approach » as adopted for the enlargement of the EU and, now, for links between the EU and its neighbouring countries in the Mediterranean, the Black Sea and the CIS.

In Southern Asia, within the SAARC (South Asian Association for Regional Cooperation), routes to provide access to the Gulf for the countries of Central Asia pose problems that are still difficult to resolve because of the difficult terrain and intertwining maritime and land routes.

Road links are generally in place, particularly between the countries of Central Asia and the Gulf ports via Bandar Abbas or Chinese ports by rail, for maritime access.

In these « corridor » approaches in Eurasia, the promotion of intermodal transport is usually included, in particular for maritime container transport.

At the same time, international rail (chiefly the OSJD and the UIC) or road (IRU and the silk roads) organisations are developing the same type of corridor concept, which enables them to better co-ordinate their efforts with those of international intermodal organisations.

III - INTEGRATION OF INTERMODAL TRANSPORT CHAINS

Globalisation can primarily be attributed to economic actors who found themselves thrust into a revolution in communications technology. Production and distribution processes became more complex in this new context, but more powerful tools for organising and managing information also became available. For any company, the key challenge is integration of the transport logistics chain and all of its component parts: transport, storage and flow management both upstream and downstream of production in order to reduce costs and strengthen its commercial presence.

1. The microeconomic approach to transport and globalisation

Industrial firms have long been based in countries other than their countries of origin, often to gain access to resources that were not available or not sufficient in their national territory.

However, such companies initially behaved more like "multidomestic" companies adapting to the local market, and maintaining special ties with their countries of origin. The aim in most cases was to circumvent any protectionist barriers and win new foreign markets.

During the 1970s, this phenomenon of locating companies abroad took a different turn.

Market opening and advances in technology enabled the global company -- the key player in globalisation -- to "dismantle" its production and distribution process and make better use of the manpower resources available worldwide, in particular in China, India and emerging countries in Europe.

This phenomenon, which led to a further increase in productivity, is now no longer confined to companies based in developed countries, since the major emerging countries, too, have now reached "economic maturity" by diversifying their exports and strengthening their domestic demand.

The main characteristics of integration of the production/distribution logistics chain are outlined below.

- **The extension of production processes and the development of trade within the company and within a given sector**

The aim is to take maximum advantage of local production conditions and achieve economies of scale, while at the same time meeting more diversified demand. These new production methods are being accompanied by an increase in trade between units and by increased outsourcing: these remain difficult to measure but are reflected in increased intra-firm and intra-sector traffic.

- **The development of distribution channels on a global scale**

Globalisation at company level is not confined solely to industrial production companies. It also involves large distribution companies which are taking an increasing role in organising the entire logistics chain on what is known as a demand-led basis to meet local market demand.

The growing importance of large companies in the distribution of commercial products, at the expense of traditional retailers, first became apparent in the most advanced countries of North America and Europe.

These companies very quickly developed their own supply networks on a global scale, so promoting international trade and growth in imports.

This development was accompanied by greater control over logistics chains sometimes requiring production rates and warehouse development on different scales to organize the movement of goods. Europe also witnessed the twin phenomena of flow consolidation with the creation of European Distribution Centres (EDC) and deconsolidation with local terminals being set up near consumer centres.

In recent years, these global distribution companies have developed and increased their locations in emerging countries around the world, not only to consolidate their supply chain but, increasingly, to organize distribution networks within the latter countries and to implement new logistics techniques suited to the international movement of products and to the increasing urbanisation of emerging countries. Indeed, the development of major cities in emerging countries calls for the urgent development of suitable distribution logistics and for streamlining the movement of goods in cities.

- **Integrating the logistics chain into a production/distribution process**

With the off shoring and proliferation of production centres on an international scale, and the more complex organisation of distribution networks, the integration of the logistics chain has become a major challenge in intermodal transport and introduces greater flexibility in the choice of routes and logistics operations.

Logistics chain integration in fact involves two major aspects:

- integration of the physical movement of goods;
- integration of information on the concentration of these physical flows.

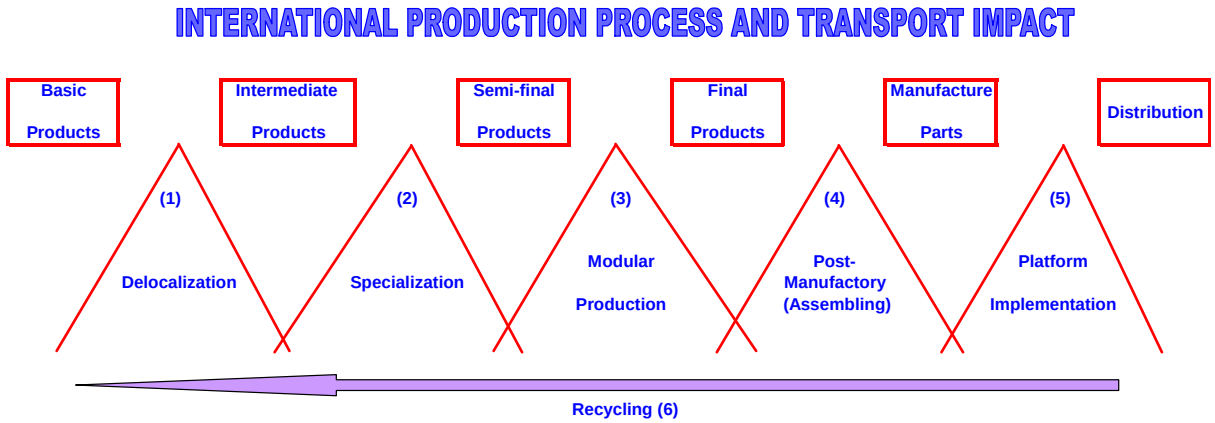
The first of these was made possible by the use of loading units and efforts to harmonise physical standards throughout transhipment and storage operations, inasmuch as a link is established between the identification of the loading unit and that of the products transported.

The second has benefited from the progress made in computerised data transfer, which facilitates administrative procedures, and more recently product traceability.

Clearly, integration has not yet been completed consistently across all countries and much progress is still to be made on operating and administrative procedures, especially in international road and rail transport. However, transport professionalization and logistics "know how" are rapidly making inroads in emerging countries, particularly in areas with close links to international trade, port areas and free zones often having advantages from this point of view.

Indeed, physical flows are integrated through transport logistic centres which bring together logistics, transport and land use planning actors and which then become key locations for the organisation of international logistics and locations for modernising the inland transport system.

The following diagram shows how changes in the organisation of logistics are likely to increase transport demand.



(1) possible decrease in transport (or of high value goods transport)
(2)(3) increase in number of trips between same-branche industries
(4) increase in number of trips between industry and the logistics hub
(5) increase in number of trips between logistics hubs
(6) increase in transport demand

2. Inland access to major ports

In recent decades, the development of major ports has been directly influenced by the internationalisation, then, globalisation of trade. The major ports have transformed their facilities, their functions and their methods of organisation within the trading system

Ports were initially major industrial port centres and primary locations for industries depending on foreign countries for imports of raw materials and exports, following the relocation of inland factories with a view

to promoting their competitiveness in a world market as in the case of the steel and chemistry industries and industries in the construction sector (cement makers).

These port areas then became prime areas for setting up industrial processing activities, particularly in developing countries after industries were off shored by developed countries. This was the case with the first exporting countries in Asia, which based their development on industrial processing and export strategies for the world market. The establishment of free zones near ports facilitated such development.

The major ports worldwide have now primarily become large logistics activity zones for the organisation of transport, closely in line with the development of maritime container transport: ports have become nodes in a global transport network, or "gateways" to continents.

However, the spread across continents has been very patchy from one region of the world to another, depending on the performance of inland transport. The huge productivity gains achieved in maritime transport have not always been matched in inland transport. The industrialisation of maritime transport seen in the case of bulk transport and container transport in particular has not occurred on a comparable level in inland transport. This has led to landside problems with accessibility and infrastructure capacity inland that are particularly difficult to resolve.

There are two different type of situation, as follows.

- Situations where port areas have from the outset had a limited hinterland; this is the extreme case of transhipment ports (hub-port) and ports where the hinterland is limited to a nearby activity and population centre.

- Situations where the port is a “hinterland port”, connected to an inland infrastructure network serving a whole range of inland regions or countries.

It should be borne in mind that access saturation and congestion problems may occur in both cases: in the first case, the problem is essentially one of local traffic in a dense coastal area while, in the second, the problem is with access to national and international inland networks.

The development of the world's major ports has thus often followed fairly comparable models, but for inland transport, the situations vary more.

For pre- and post-shipment inland freight carriage, the possible options are as follows.

- Either goods are stripped from containers in ports and then transported, most often by road.

Handling goods in the area near the port would be a variant on this option, which has long been facilitated by the increasing number of international distribution centres near ports.

- Or goods are transported directly in containers to an inland distribution hub near the final destination

For pre- and post-shipment inland carriage over distances of more than a few hundred kilometres (over 300 km in general), goods in containers tend to be transported by rail or waterway even though road transport is still largely the dominant mode for the landside transport of containers. The use of an alternative mode can reduce congestion on port access roads at a time when traffic exceeding 1 000 or 2 000 boxes may be generated each time a ship puts into port, making it more difficult to move them by road.

For these longer hauls, which may include a border crossing, the problem of port haulage overlaps with that of international continental transport.

3. Integrating land and sea links of maritime chains

"The sea battle is played out on land", maritime operators often heard to say.

The initial idea behind this expression is that the ship owner needs to become more involved in inland transport in order to make the whole maritime chain more efficient from point of origin through to final destination, given that the terminal haul accounts for an increasing share of the overall cost of the door-to-door chain.

That said, it is also strategic in that it allows operators greater commercial control over the whole transport chain and direct access to the logistics organisation of global companies, to become their key partners.

Among these operators are major port operators who have played a key role in the creation and development of new container ports. In recent years, new ports have jumped to the top of the list of world ports in only 4 or 5 years, whereas historically the global reputation of a port was built on several decades or even hundreds of years of activity.

Nevertheless, the development of landside transport to ports did not take place as quickly and landside services to ports are still largely by road provided by road operators which may be either SMEs or large companies.

The question is then whether the current performance of the terminal haul can be improved by other modes of organisation involving alternative modes, such as rail or waterway, which will enable higher volume inland access to cope with the growth in worldwide traffic and expand the hinterland of ports.

One major operator, Maersk, is already doing so. For 2006-2007 in Rotterdam, it reports a modal share of 32 % for rail, 42 % for inland waterway and only 25 % for road transport where it is in charge of transport arrangements (carrier haulage) compared with a share of 65 % for road mode where it is not in charge of arrangements (Merchant haulage). Grouping cargo at an inland terminal can limit individual container movements in ports and their immediate vicinity, which is frequently congested. A company like CMA - CGM points out that 37 % of every 1.8 million TEU carried by inland transport throughout the world are carried by rail.

Port operators such as DP World also aim to promote inland intermodal transport by offering a choice of intermodal services to maritime companies.

Against this backdrop, operators in the maritime world are able to draw upon their experience to develop landside services, particularly for rail and waterway transport, where they are positioned as new entrants.

For ship and port operators, there is also an opportunity for diversification in an inland market that may be less exposed than the global shipping market, where future competition in freight rates is likely to be particularly stiff given the number of orders for new container carriers exceeding 9 000 to 10 000 TEU in size, given that:

- the available capacity of ships has already been capable of coping with the tremendous growth in demand in recent years, with freight rates which have remained stable;
- a possible drop in demand in the next few years as a result of the financial crisis could bring a slowdown with catastrophic consequences for freight rates.

In just a few months, there has already been an unprecedented decline of around 80 % in maritime bulk freight transport, with the expected slowdown in growth in industrial production. Even if container transport is less volatile, operators who have already expanded their presence in ports and in inland networks will probably be in the best position to cope with this crisis.

The integration of port and sea links thus requires the integration of both port transit and inland terminal hauls.

3.1. Port transit

The different stages of port transit are:

- coming alongside
- stacking, in the port
- storage
- unstacking for transport to a road or rail terminal
- administrative or customs operations.

The relative share of the above items in total transit costs vary from port to port, or even with billing methods, given that coming alongside may be partially or wholly included in maritime freight.

In the same way, transit operations in the port may be more or less complex depending on port configuration and the location of storage areas in relation to berths and road and rail terminal facilities.

The cost of administrative and customs operations also varies, depending on the progress made with facilitating operations, the computerization of procedures, whether or not customs duties are maintained and inspection procedures. However, in many major ports that are in competition with other major ports, substantial productivity gains have been made on all of these operations through computerisation and/or the privatisation of port operations.

As a general rule, the costs of coming alongside and stacking, including storage, are now relatively well monitored for ports and are between USD 100 and USD 300 per loading unit. Administrative and customs costs are the items that vary most from one country to another.

An important issue would then be access conditions to a road or rail terminal within the precinct of the port for road, waterway and rail transport.

The issue of road access, which will still be possible for a few units, soon becomes a problem with ships putting into port and transhipping several hundreds or even thousands of units in a short period of time: 24 or 48 hours

This is why many maritime, port or inland operators aim to reserve road transport for short hauls and make wider use of alternative modes, such as rail and waterway over longer distances, which would allow higher volume flows.

For waterways, a useful solution is cross-docking, where possible, from the container ship directly onto the boat or barge. In this case, waterways can really extend the port precinct.

In Europe, barges currently have a capacity of up to 200 or 400 TEU. This is the advantage of using this mode even over relatively short distances to waterway logistics hubs from which a second distribution

stage can be organised via road or even rail. The “string’ of inland waterway logistics ports along the Rhine, especially the port of Duisburg in Germany, which has become one of the major rail hubs to Central Europe, is a good illustration of this type of organisation. China provides other examples with river transport from the Port of Shanghai along the Yangtze, over very long distances inland. For all ports located at the mouth of navigable rivers, waterway transport can be an efficient mode of inland access for high volume flows of container traffic, as is still sometimes the case for inland transport in Russia and Central Europe.

However, it is true that this mode of inland transport is quite slow (about 10 to 20 km/h depending on the direction of river currents) although it remains cheap, at around EUR 0.2 per TEU/km in Europe or even less, which can be very competitive when compared with rail costs. In integrating sea and land transport, there will always be a trade-off between transport costs and time, which is measured in days rather than hours.

At the current time, intercontinental maritime transport is measured in weeks and will take from 3 to 4 weeks on the major routes between Europe, Asia and America with reliable scheduling of stops and containers that can be tracked.

In ports, stacking operations -- irrespective of the speed of transhipment, which aims primarily to limit ship dwell time -- may also involve a delay of several days, so the time taken for the terminal haul has to be weighed against transport costs, bearing in mind that transport scheduling will generally be reliable in any event.

Although it is difficult to give accurate estimates of this time/cost trade-off, certain port professionals sometimes refer to an estimate of USD 100 per day per TEU, which is a useful indicator for trade-offs between alternative routes and modal choices for maritime containers.

For rail transport, the conditions of access to the rail terminal within the precinct of the port are crucial.

This means that the organisation of rail transport within the precinct of the port will play a key role in the competitiveness of the whole rail link: that is why port authorities seek to control their rail network inside the port, whereas previously national railway companies remained the owners of the rail network inside the port precinct. This seems to be the general trend in most countries in order to promote the use of rail as an inland access mode.

Organisation concerns, firstly, the quality of connections between storage areas and port railway facilities and, secondly, the possibilities for forming complete trains from different wharves or storage centres.

At this stage, complete trains can be formed from port traffic alone, volume permitting, or from a marshalling yard outside or inside the port, by combining container traffic with other inland traffic from the port area and/or from nearby industrial or commercial activity zones.

Combining traffic will tend to become more extensive if the port is located in an area of activity providing combined transport services for continental traffic, the aim being to be able to increase provision of a regular rail service, with a relatively high frequency, for a larger number of domestic destinations.

In conclusion, rail access will often depend on a relatively complex rail organisation for forming direct trains for container traffic and even traffic for an entire surrounding logistics area.

Therefore, ports with limited space for railway facilities will tend to create "external rail centres" specialising in the formation of trains for longer distance transport nearby or even tens of kilometres away

from ports. This will be the case for many Mediterranean ports located in densely populated areas along narrow coastal plains. It was recently the case for inland transport to and from the US ports of Chicago and Los Angeles, which led to the construction of a new railway line between port facilities and a regional hub.

The solution then involves moving the container out as quickly as possible by road or rail shuttle to such a centre, where trains to various destinations are formed; in this case, maritime container transport will tend to combine more easily with combined inland transport (swap bodies), either local or regional.

Alameda Corridor (US)

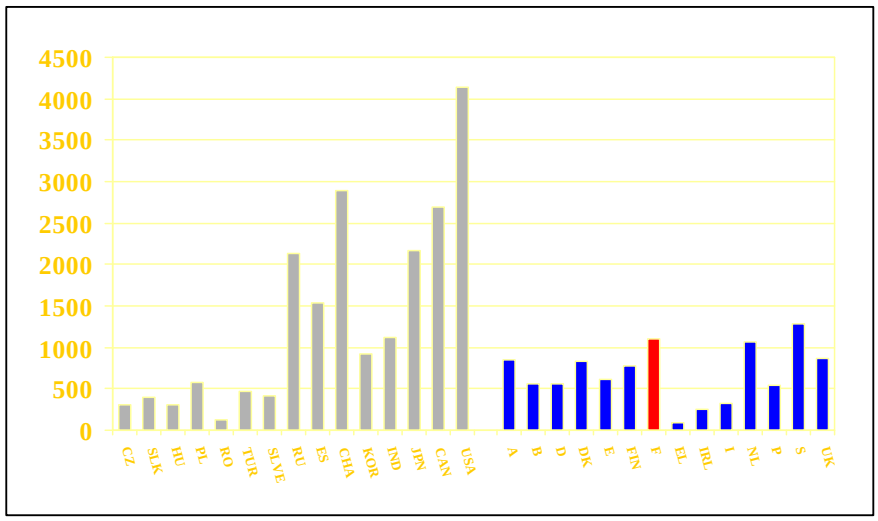
3.2. Terminal rail transport

"Industrialisation" of the rail link was a central theme in a recent study on the future of rail transport and plans for freight priority networks in Europe (the NEW OPERA project). The aim is to develop rail transport along the same lines as sea transport, investing in high performance, interoperable rolling stock that generates few nuisances, the idea being to provide mass rail transport along the main corridors serving ports. These are the prerequisites if the whole of Europe is to assume a more effective role in the globalisation of trade.

The initial analysis points to the possibility of high productivity gains for rail transport and, in particular, for intermodal rail transport if flows can be made to converge and infrastructure capacity (in terms of train

paths) is available. The United States and Canada have provided examples of this since the beginning of the 1980s, and there are now substantial differences in rail productivity between various countries.

Tonne-kilometres per year
(Louis Thomson – World Bank 2001)



From this standpoint, no distinction need be made between the "industrialisation" of container transport and the industrialisation of "combined intermodal transport" for continental trade flows between countries, which will be addressed below: in both cases, the procedures – with their focus on achieving economies of scale through higher volume flows, growth in productivity and investment in equipment – are parallel and the issues are similar, although maritime container transport, in principle, has a substantial advantage in that container traffic is concentrated in ports.

The table below, taken from an MDS report gives a practical example which shows that, in the United Kingdom, rail transport is already competitive with road transport over a distance of 370 km. Such examples are increasingly frequent in Europe even for distances of less than 300 km.

Costs of terminal road / rail services

(Distance 370 km source MDS (GBP))

RAIL		ROAD	
Rail transport	106		
Port handling	35	Fixed cost	132
Inland handling	31	Km cost	134
Overheads	8	Repositioning	63
Road transport	100 - 150		
Total	**280 - 330**	**Total**	**329**
Grant (20)	260 - 310		

A recent study for the European Parliament (Buck, consultant 2008) draws a distinction between:

- « Primary » inland « hubs » which serve to consolidate shipments for onward haulage to a port (such as Duisburg in Germany or Ghent in Belgium) generally located less than 300 km from the port.
- « Secondary » hubs located further inland.

These hubs also frequently function as regional distribution points for world trade products.

3.3. Maritime feeder transport and its impact on landside services

Transport by feeder is used for the sea approach to terminal services and is difficult to classify, either as a link in long-distance sea transport or as a regional terminal service link.

With the increasing size of ships, the use of feeders to service ports without enough containers to warrant a call has become more widespread: the 'mother' ship unloads some of its cargo in a regional 'hub' from which freight can be distributed regionally on smaller ships known as feeders.

This way of organising shipping provides higher volume container flows over long distances between two hubs while also diversifying access to ports within these regions. It has an effect on inland terminal services

Feeder transport is thus short sea shipping organised to cater for large ship rotations which limit port calls[2].

Europe has two main shipping hub areas, one in the Mediterranean, and the other in the North Sea and the Channel providing alternative access points to mainland Europe from the north and south, respectively.

The major Mediterranean shipping hubs may specialise in container transhipment without any real inland transport services: this applies in particular to Malta, Algeciras, Port Said and Gioia Tauro where the majority of container handling is transhipment.

[2] The number of calls varies with the amount of cargo loaded or unloaded, and with ship operating restrictions.

In the North Range, most of the hubs such as Rotterdam, Antwerp and Hamburg, are also major ports with inland access, or 'hinterland' ports.

Whether the European mainland is approached via the South Range, Mediterranean, or North Range will thus depend on the geographical location of the origin/destination and on the quality of its inland road, rail or waterway transport services.

The broad decision was for a long time left solely to operators who even set the conditions for landside transport with the aim of keeping their overall costs to a minimum, including those of the maritime link; this is why the European Commission took action against the prevention of competition in the provision of inland services, eventually obtaining an agreement that inland transport prices would not be lower than costs.

This example illustrates the considerable complexity of the economic mechanisms involved in integrating sea and inland transport links, in a context of long conflict between a right of maritime transport and national legislation of landside transport.

Whether continental or feeder transport is preferred will thus depend on the quality of landside transport, which becomes the biggest constraint on inland accessibility, while feeder services give access to a wider range of smaller ports of entry and departure.

Simulations performed in Europe have revealed that establishing a rail 'freight priority' network in the long term would significantly alter the parameters governing the provision of feeder services, since rail transport sometimes competes with them. This may be the case along the Atlantic and Mediterranean coast, bearing in mind that a North Sea distribution hub for trade with Asia would lengthen the main sea journey by several days in order to round the Iberian Peninsula and enter the Channel.

Similar questions have also been raised about the sea approach to the continent in the light of land-based transport conditions in North America, in which entry via the St Lawrence estuary and on to the Great Lakes competes with entry via the major ports on the eastern seaboard.

In some areas, the development of feeder services from major maritime hubs has provided a new supply of services between countries in the same region and has helped to improve regional services.

A good example, once more, is the Mediterranean, where feeder services now provide new services between countries on the coast via a hub set up initially to be able to operate large container ships between continents as will be discussed below for the purposes of illustrating the variety of intermodal techniques used in this region.

4. An "intermodal model" for international inland transport

The principle of transport by 'loading unit', which the sea container has shown to be so useful in global trade, has also thrived in continental transport where it has encouraged the use of combinations of different inland modes, whether road, rail or inland waterway.

Hence, for inland transport we will mainly address 'combined transport', turning first of all to road/rail combinations.

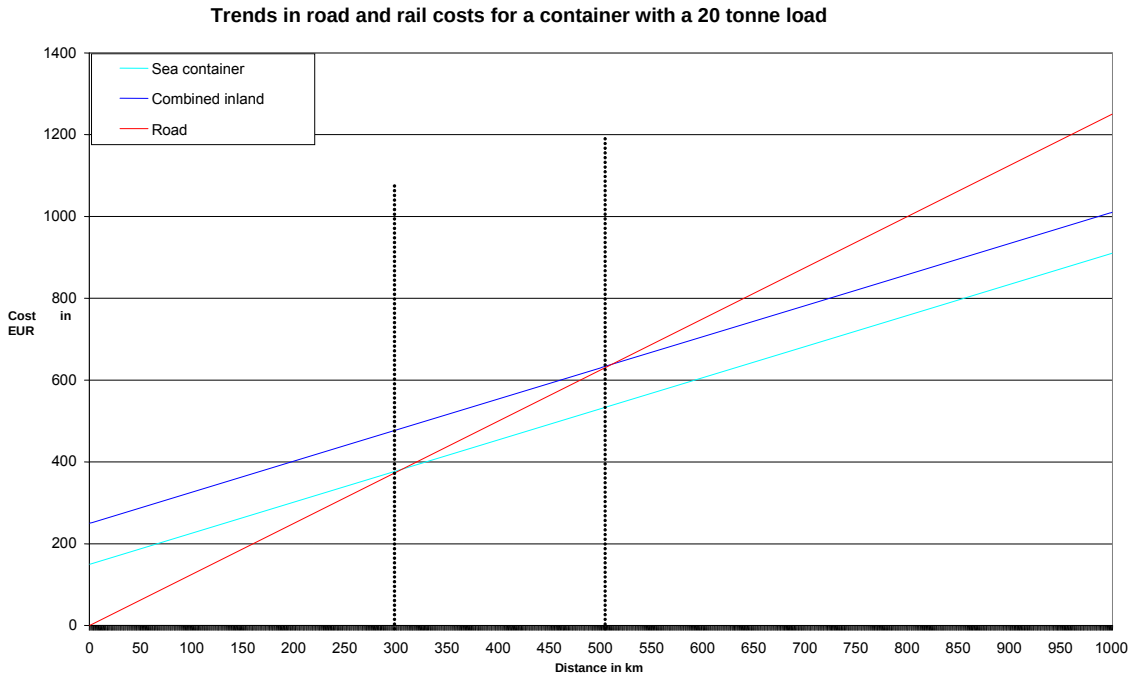
This new mode of transport has developed more particularly:

- either for crossing natural barriers, such as the Alps in Europe;

- or for long-distance haulage, where rail links becomes much more effective than road links, as in the United States where average rail distances are 1 300 km.

In the case of combined inland transport, transhipment costs in the two terminals at each end of the distance covered must be offset by savings achieved on the rail link.

The graph below, which is a simplified representation of cost trends in transport by mode over distance, shows that this is the case for distances of over 500 or 600 km in Europe, when there is enough traffic to justify the provision of rail services of adequate frequency.



Over the past 20 years, inland intermodal transport has been a dynamic component of rail and inland waterway transport in Europe and North America, becoming an effective alternative to road transport along corridors where traffic is sufficiently dense over long enough distances.

However, one of the factors obstructing development of this technique is still the wide variety of standards for loading units, although the same no longer really applies to sea shipping containers.

4.1. Combined road/rail transport

This form of transport is, first and foremost, transport by semi-trailer or swap body. But semi-trailer transport is restricted by tunnel gauges, which has resulted in the use of more expensive special 'pocket' or low-floor wagons. This has led to the more widespread use of swap bodies, which are lighter and slightly wider than the ISO container.

At present, it is reasonable to suppose that combined road/rail transport may gain a share of the growing market in international trade along major corridors where there is scope for the development of sufficiently frequent competitive services, bearing in mind that these same corridors can also serve the main sea ports, therefore sea port transport services and international inland services can also be combined. The reform of

the rail system now occurring in many countries is also conducive to the establishment of new combined transport operators, including big maritime and port operators.

In integrated national railway undertakings, this development was harder to envisage because it could have been at the expense of other modes of haulage (single wagons, in particular) and there was not a sufficiently clear grasp of the costs entailed, terminal siting strategies or commercial procedures.

One condition, therefore, for the development of combined transport is to reform the rail system first, to provide for a fresh kind of commercial initiative, service design and grasp of the costs.

Yet so far, combined transport has developed essentially in Europe and the continent of North America. Before it is extended to other world regions, the issue of standards should be fully considered, as should the siting of terminals to provide for sufficient traffic density.

In the case of transalpine transport, Switzerland implemented a particularly proactive policy to develop combined road/rail transport and limit road transit. Today, the share of rail accounts for 73 % of traffic through Switzerland and combined transport accounted for close on 45 % of total traffic across the Alps via Switzerland in 2007.

In the long run, it is expected that the provision of combined transport will enable a reduction in international road traffic (number of HGVs) once the Lochberg and Gotthard rail tunnels are opened.

This policy relies not only on a high quality rail supply but also on the development of an entire network of intermodal terminals to the south and north of the Alps. In Italy, it is furthered by the development of an Interporti network covering the country which makes transfers between road and rail possible using swap bodies. To the north of the Alps, in Germany and Benelux, there is a competitive network of terminals and a supply of intermodal services. In Benelux and Northern Germany as well as this international road/rail service, there is also a maritime container transport service to or from « North Range » ports, which helps the extension of their hinterland to Eastern and Southern Europe. The same phenomenon also applies, to a lesser extent, to ports in the « South Range » and it is set to grow if ports in the « South Range » increase their influence in services to continental Europe for Asian traffic (via the Mediterranean et Suez) or for traffic from Mediterranean countries (also transiting via the Atlantic and Gibraltar).

4.2. New techniques in continental intermodal transport

The search for an alternative to road transport has led to redoubled efforts to find feasible intermodal systems combining the use of road, rail and waterway.

Usually, the road network is the main mode in these approaches and the road transport operator retains the commercial role as organiser of the transport chain even if an alternative mode (rail, maritime or waterway) is used.

If it is conceded that the road chain is the dominant mode in organising transport, then the solution must be sought in some form of lorry or semi-trailer transport, reducing the role of railway operators (or operators of other modes) to little more than “traction” providers.

An approach of this kind may appear more attractive to road transport operators, including SMEs in the sector, as they would not lose control of transport operations or their special relations with customers.

It has led to renewed interest in the idea of transporting lorries aboard trains or ships – which in itself can hardly be regarded as intermodal transport – subsequently progressing to transport using semi-trailers with

neither traction units nor drivers, once road operators are able to organise rotas for traction units and drivers at terminals.

The economics of the service proposed are thus based essentially on economies of scale gained from higher volume traffic and intensive use of equipment.

However, it is also clear that, eventually, a reversion to semi-trailer transport is essential rather than encouraging solutions that carry a substantial "dead" weight (traction unit and semi-trailer) thereby reducing the tonnage of products transported.

Two examples of this kind of approach are "rolling motorways" and "motorways of the sea", in which the rail or maritime link would be integrated *de facto* into a motorway network with rapid roll-on/roll off handling in the two terminals at each end of the journey.

- In the case of rolling motorways, the question of tunnel gauge is crucial given the height of lorries. Reliance on special wagons may be a way of offsetting this difficulty, although a distinction is drawn between short-distance rolling motorways for crossing a natural barrier (the Channel, the Alps) and the long-distance rolling motorway schemes envisaged in France to reduce congestion on the main motorway corridors and as an alternative to the construction of dual motorways.
- With motorways of the sea, the economic advantage will depend on the geographical context (whether or not the sea route is shorter than road, or can bypass a natural barrier or areas of acute congestion); in the longer term, it will depend on the ability to industrialise a RoRo shipping service with high-frequency, high-volume transport, as was the case with container transport.

The map of transport in the Mediterranean provides a clear illustration of the complexity of the situation for transit in Europe and the Mediterranean where there is a combination of maritime and inland modes and potential competition between intermodal solutions.

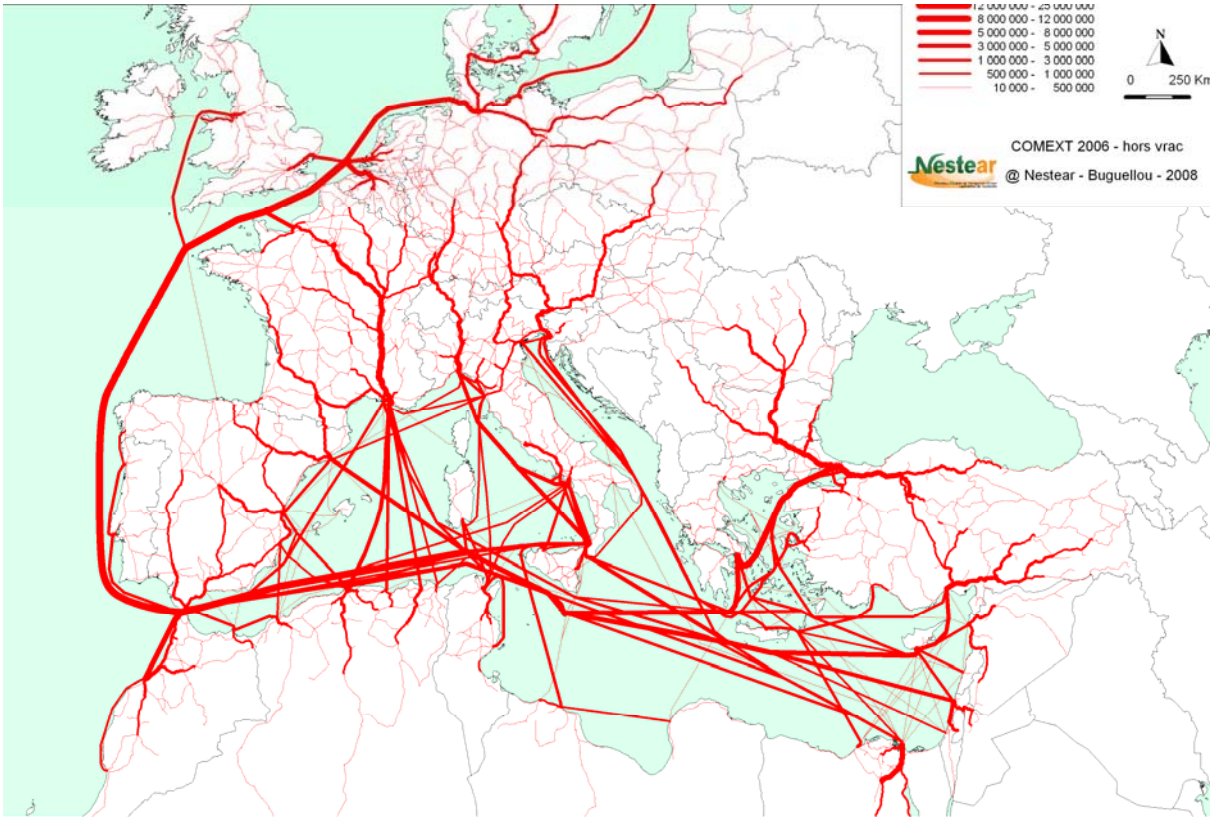
For trade between the EU and the other countries of the Mediterranean, traffic allocation was simulated using the NEST-MED model and shows:

- For short sea shipping between the shores of the Mediterranean in the North-South and South-North directions: this traffic extends to inland traffic inside countries, given that this international trade often accounts for over 50 % of the external trade of Southern countries (particularly the Maghreb) but much less for Northern countries (7 to 15 % for EU countries).
- For maritime transport between the counties of the South and East Mediterranean transiting via Gibraltar: ports in the North of the EU are actually the main gateway ports for trade between the EU and the Mediterranean. Here, transport is often organised to make use of the major « hubs » of the Mediterranean, set up to organise maritime transport on a global scale. In this case, worldwide transport has created new services between the countries of the Mediterranean themselves and between Mediterranean countries and the whole of the EU.
- Possible competition to the East and West of this Euro- Mediterranean area:
    - Between inland transport through the Balkans from or to Turkey and maritime RoRo transport via Trieste in Italy.
    - Between inland routes from Morocco to or from the EU via Gibraltar (ferry), then Spain and maritime routes via Moroccan ports.

With this in mind, the transport of « non bulk » products between Spain, France, Italy, Greece and Slovenia in the EU is essentially by road through the Pyrenees and the Alps, or the Balkans and not by sea. The goal is to develop Motorways of the Sea (RoRo) for maritime links which, moreover, have the

advantage of shorter distances. This traffic is not shown on the map. Today, a RoRo transport supply has developed mainly in the Adriatic between Greece and Italy.

Diversity of transport modes for Euro-Mediterranean trade in 2006



Source: Simulation of trade between the EU and Mediterranean countries using NESTEAR's NEST-MED model

4.3. The economics of combined transport: seeking high volume flows

The economics of combined transport still remains the same, the aim being to be competitive with road services, from origin through to end destination.

In the transport chain, this means that the line haul by the alternative mode has to offset the costs of two additional transhipments.

Therefore, economies of scale have to be achieved on the main mode, which entails meeting distance and frequency criteria in order to obtain the productivity gain needed in terms of staff and equipment.

The "corridor" approach may thus prove helpful when higher volume flow criteria are satisfied. However, it must not result in the fragmentation of supply by corridor, which would compromise subsequent opportunities for development and possibly creation of rail "hubs" covering the entire area.

One ultimate aim should definitely be to achieve genuine "combined transport supply networks" as an alternative to the road network over a whole range of long-distance international links.

The map below shows the development of a network of intermodal centres in China (Source: China Railways Transport Company). The studies conducted show that for container transport from Chongqing to Wuhan over a distance of 700 km the cost of rail transport is much lower than road transport (RMB 2 800 as opposed to around RMB 6 500) for a trip taking 6 days compared with 3 days by road. This said, transport by barge can cost 25 % less for around the same journey time as rail (deloitte 2006).

Much the same can be said for links between Chongqing and Shanghai over longer distances of 2 000 km and rail transport costs which amount to 35 % of the cost for transport by road with a longer journey time (around 8 days compared with 3 to 4 days by road and barge transport cheaper than rail). From Wuhan to Shanghai the distance is around 1 000 km and the percentages are the same.

Therefore, in China the organisation of intermodal transport, this time for a maritime container, is already demonstrating the competitiveness of rail for distances of over 700 km in inland areas where salaries are twice as low on average as they are in Shanghai. Intermodal transport can facilitate the integration of inland regions into the global economy and, at the same time, the national economy.

5. A cost accounting approach based on intermodal chain costs

To shed light on the problem of the competitiveness of various intermodal transport solutions, a "cost accounting" approach to the cost components of the transport chain is useful.

The method involves breaking operating costs down into different cost headings for personnel, equipment and infrastructure usage for the various modes or links in the chain.

- Costs of road and rail links

In this approach an initial distinction is drawn between hourly costs and costs per kilometre.

Hourly costs allow the direct inclusion of equipment and staff productivity and include:

- equipment depreciation;
- staff costs.

Costs per kilometre include:

- fuel consumption, which is an important component not just of total costs but also for environmental impact;
- the 'charge' for using infrastructure – doubtless one of the most sensitive aspects of the analysis of rail costs, along with path reservation.

For rolling stock prices, both locomotives and wagons, there is a market price which can be referred to: EUR 2-3 million for a locomotive, with a 20-30 % differential for electric "interoperable" locomotives, as

they are known, which can be used on different networks with different electricity supplies; and a price of around EUR 80 000-150 000 for a wagon.

On the other hand, there are often very striking differences in rolling stock use, stemming in particular from the organisation of one to four rotations for a locomotive, ranging from 100 000 km to 400 000 km a year or even more, with comparable variations for wagons. These differences in the rate of utilisation can largely be put down to the differences in rail productivity observed from one country to another pointed out previously.

This said, locomotive performance will also depend on the length of trains, which varies from 450/500 m to 750 m in Europe, and to over 1 000 m or 2 000 m in large continental countries such as Russia or China. The topography (gradient), type of coupling, braking methods and siding track gauges are all determinants of length, which also has an impact ranging from 30 to more than 50 per cent on productivity.

As far as staff costs, and particularly traction costs, are concerned, the introduction of competition between rail operators has generally brought an increase in staff productivity, under circumstances in which the big integrated national rail undertakings have found it very hard to adjust.

As regards usage costs for rail infrastructure, charges vary widely in Europe. They can range from EUR 0-5 per train/kilometre, depending on the country, the type of segment, the load and the timetable. The difference between countries is substantial but is not explained by the marginal usage cost which must be around EUR 3 to 4 per train/kilometre in Europe and certainly lower in the US.

Based on these data, the rail costs obtained for Europe will be in the EUR 0.5-0.8 range for a 40' container, which works out to EUR 0.25-0.4 per TEU/km.

These costs will certainly be much lower in the United States and, of course, in China, or less than EUR 0.1 per TEU/km for TEU 400 "double stack" trains, while in Europe trains rarely carry more than 60 to 80 TEU, i.e. 30 to 40 forty-foot equivalent units.

In contrast, the costs for road links are much more uniform per kilometre travelled with variables depending essentially on driver payroll cost, which is estimated to be around EUR 1 in Europe per vehicle/km and around USD 1 in the United States.

The use of 60 tonne "mega trucks" can reduce costs per tonne moved by 10 to 30 %.

Rail cost per loading unit (40' or two TEU) is thus lower than the average road cost but the use of heavier 60 tonne vehicles in Europe can significantly erode the competitive margin of combined transport, while that would not necessarily be the case in countries such as the United States where the cost differentials that give rail an advantage over long distances are higher.

Given the costs of transhipment and terminal services for rail, the cost accounting approach again indicates that:

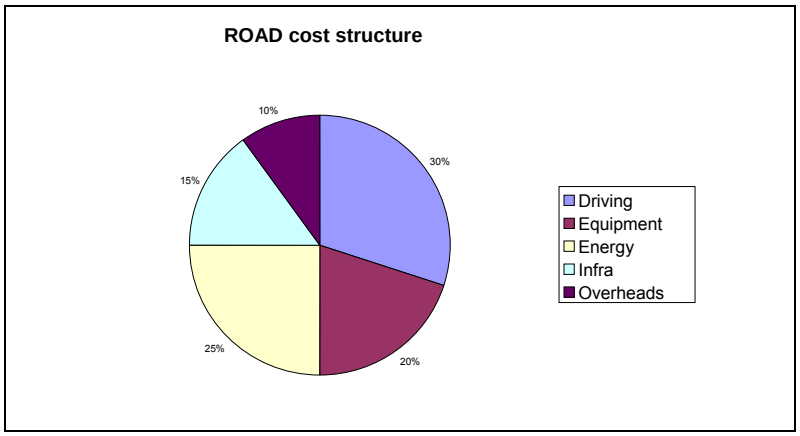
- Inland transport by rail of maritime containers appears to be competitive for distances of over 300/400 km, always assuming that the cost of rail transhipment within the port precinct is no higher than the cost of road transhipment, or lower.
- While inland intermodal transport with two transhipment operations, at the origin and the destination, would be more competitive than road only for distances of 600 or 700 km.

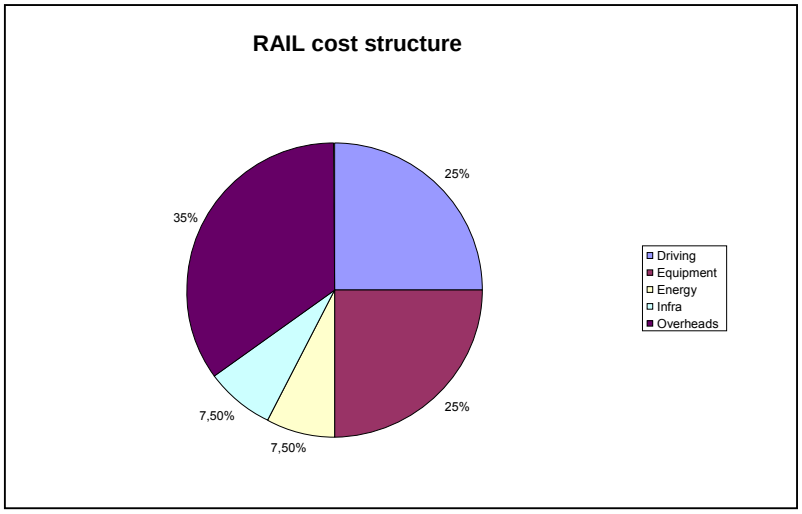
For inland intermodal transport, the cost structure is actually comparable to that for maritime container transport which is handicapped vis-à-vis road transport by two transhipment operations (whereas with

inland transport of maritime containers there is no such handicap in ports). The issue would then be to achieve high enough volumes between terminals to be able to provide competitive rail services at a high enough frequency.

A rail service (or waterway service) for ports is thus an appropriate response to the concentration of maritime traffic in major ports since it could avoid the road congestion problems typical of the immediate vicinity of most ports. For the many countries which possess neither such a rail network nor inland transhipment terminals, this type of solution would be more difficult to implement, making it more difficult for their inland regions to access world markets.

The two diagrams below illustrate the cost structures for road and rail, highlighting the relative share of the different cost headings, which makes it easier to evaluate development trends (author's compilation).





For rail costs, electric traction is assumed; the energy heading is generally higher for diesel traction.

- The cost structure of the full chain

The first stage in analysing the cost structure of the full chain is to add up the costs of each link, including maritime transport, in a door-to-door maritime container transport chain.

In this particular case, port transit costs should be factored in; these include not only transhipment and handling costs inside the port precinct, but also the costs of managing and repositioning containers, which can amount to 25 to 30 % of total costs for the chain.

Two approaches were developed for the next stage:

- an initial cost breakdown, which totals up all of the costs of the physical door-to-door operations as described above, including the cost of transit through the port and the inland terminal;
- an overall approach, which shows cost ranges and includes administrative operations and container management, based on corporate cost accounting methods.

The resultant averages are, of course, open to discussion, depending on total distances, relative sea and land distances and container flow balance.

The advantage is that they draw attention to an important aspect of overall costs, namely loading unit (shipping container) management, which is itself dependent on flow balancing and on the increasing proportion of the costs of the haul terminal.

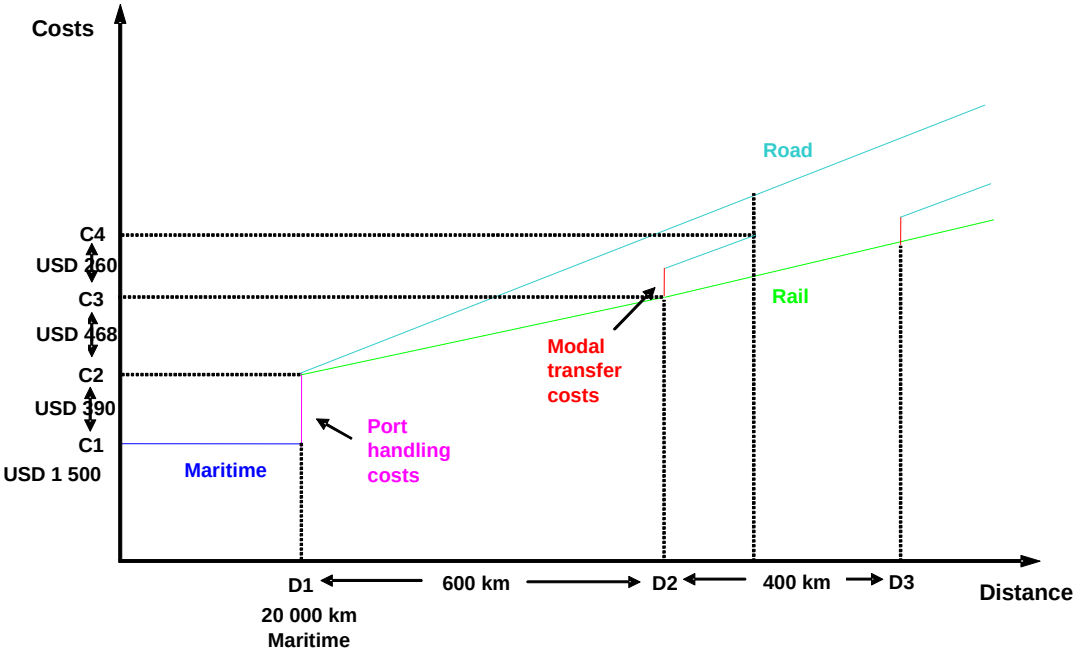
The kind of container management practiced in ports can also be conducted from a landside terminal sited further inland if a link like this seems more useful for more effective management of the fleet of containers and for possible rerouting to other ports.

The following diagram shows cost ranges for the different links in a long-distance maritime transport operation.

The diagram clearly shows that inland transport and consequently rail services (or waterway services) is becoming a strategic factor for the big container ports if they are to extend their hinterland towards inland centres over medium and long distances of more than 300 or 400 km.

In the total costs of the chain, the terminal haul for a transport unit over medium and long distances will rarely cost less than EUR 500 to EUR 1 000 inclusive of delivery by road, which makes the cost comparable to that of the maritime link for many destinations and again shows the relative share that landside services account for.

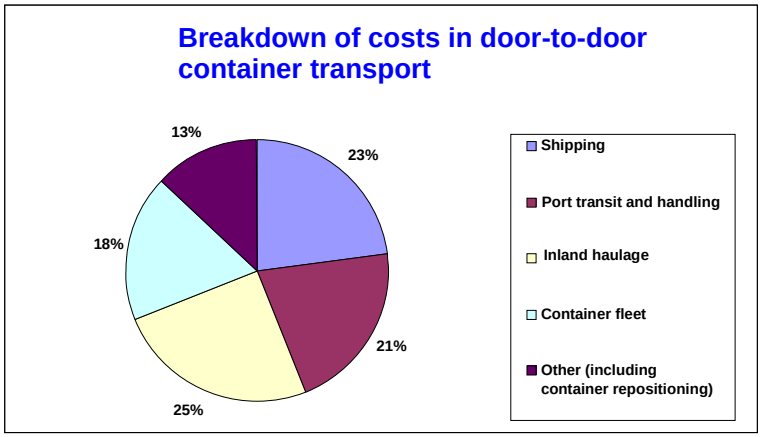
Structure of terminal haul costs
(NESTEAR)



In the second approach, the overall cost breakdown highlights four main budget headings, the relative shares of each vary, but are often comparable as follows:

- feedering,
- inland carriage,
- port transit, including administrative taxes and the cost of logistics operations,
- container fleet management.

In the example below it seems that shipping costs thus represent a relatively minor share of costs (around 25 %) which becomes comparable to the costs of inland haulage for inland distances of a few hundred kilometres at both ends of the chain. This is consistent with the breakdown shown in the diagram.



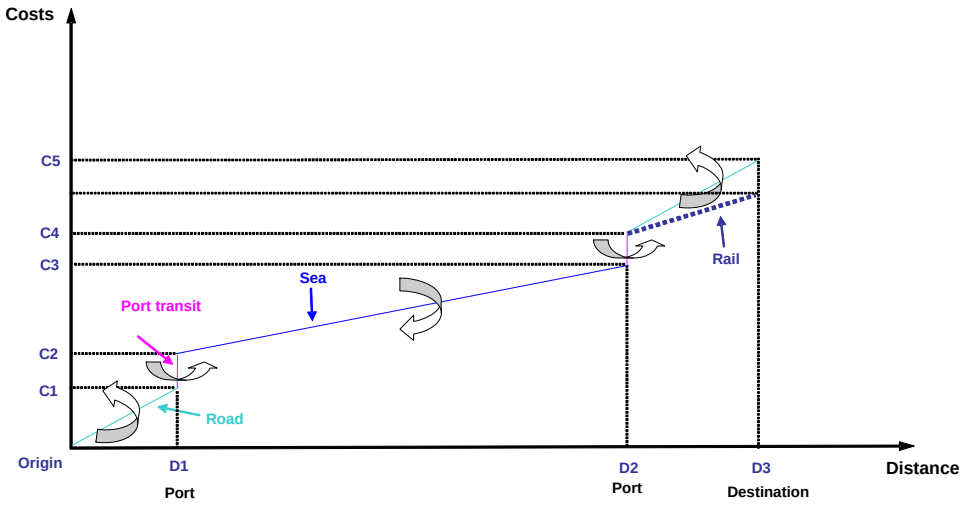
Source: INRETS, according to Stopford 2002

In a 2005 article (Notteboom and Rodrigue) put the portion of inland costs in the total costs of maritime container shipping in the broad range of 40 to 80 %, with the possibility of cutting them, by one-third, by consolidating shipments at inland centres.

All of these data certainly illustrate how difficult it is to give exact percentages without reference to specific situations, but they nonetheless confirm the increasing strategic importance of inland transport.

The trends in the costs of long-distance maritime transport actually show a tendency to decline, losing ground to inland costs, particularly for goods vehicles, and to container management costs, which rise with flow imbalances.

General trend in transport chain costs (NESTEAR)

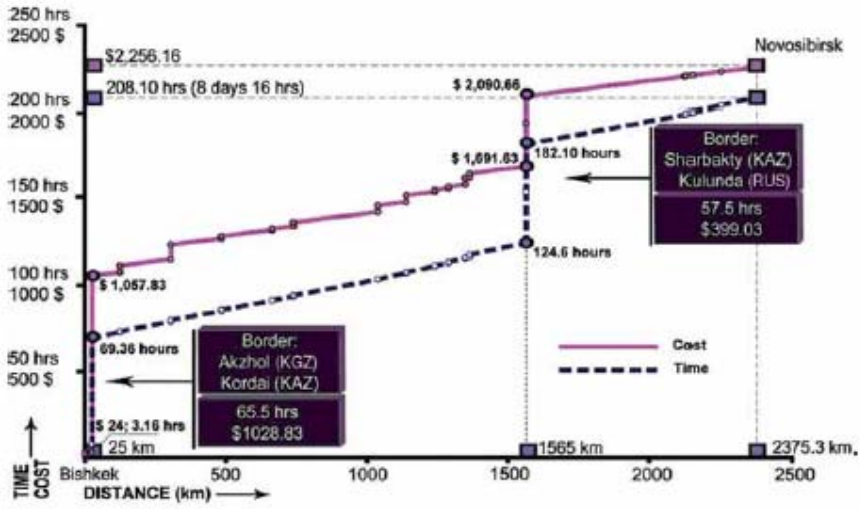


For continental inland transport, the UN has used time and cost diagrams like these for road and rail transport through Asia.

On these links, border crossings still account for a very large share of costs and transport time, often close to 50 %.

The following diagram takes the example of road routes from Bishkek to Novosibirsk, over a distance of 2 375 km, for which the total cost is USD 2,256, and the duration is 10.5 days.

Time at borders accounts for 50 % and border crossing costs for around 60 %. In all, this amounts to nearly USD 1 per vehicle/km for the shipper, but a road haulage operating cost of less than half that, under USD 0.4 or USD 0.5 per vehicle/km.



An example for rail transport from Lianyungang to Almaty gives 7 days and 6 hours of transport for a distance of over 5 000 km, which seems fairly satisfactory but with a time of 18 hours at the border.

Several tests conducted on various Europe-Asia routes give average speeds for container block trains at around 30 km/h, which would mean distances of 700 to 800 km per day.

IV – THE DIVERSIFICATION OF SEA AND INLAND ROUTES

Globalisation has led to a convergence of traffic on a few main sea routes, with several "unavoidable" points of passage, the most well-known being the Suez and Panama canals, the straits of Malacca, Gibraltar and the Bosporus.

Land transport has its own historical examples of major intercontinental routes such as the silk road, which is the best known, and even older routes across the continents of Asia, Africa and America.

However, these great transcontinental inland routes have played relatively little part in the growth of global transport in recent years, except within a few countries, such as the United States and Russia: in the United States, this applies to the land bridge between ports on the eastern and western seaboards, and in Russia to the trans-Siberian route although, here, primarily for bulk traffic with container traffic still relatively low.

In the case of world regions, the situation differs from one region to another: an unusual example being an integrated regional area, the European Union, which has developed the concepts of 'Trans-European Networks' and 'priority corridors' – which are being combined in order to implement a European transport policy. The corridor approach seemed to be the most practical for co-ordinating the public and private actors concerned.

The Trans-European Network is "intermodal" and includes all transport modes as well as their interfaces.

The corridors are also intermodal and extend towards the neighbouring countries of the CIS and around the Black Sea and the Mediterranean, promoting intermodal sea and inland transport solutions on a wider scale.

Within the European Union, which accounts for some 25 % of international global transport, there are around 20 intermodal corridors in all, some of which may be in competition with short sea shipping (SSS), organised or otherwise, from the big intercontinental hubs (feeder services).

In other regions, there are fewer examples of major intermodal inland transport routes, except in the continent of North America where there are major intermodal routes between Canada, the United States and Mexico.

One reason for this is probably that regional trade is relatively modest compared with global trade, something which does not apply to the European Union and the NAFTA countries. However, there are other reasons, too, which have to do with lack of international organisation of inland transport on a regional basis.

The present chapter thus seeks to demonstrate that the development of intermodal inland transport, whether it competes with or complements maritime container transport, enables the diversification of the main intermodal transport routes worldwide and is likely to make the international transport system less vulnerable and boost its effectiveness in terms of door-to-door services.

1. Main inland routes complementing maritime routes

Several scenarios are possible:

- major inland routes for transport between continental countries that cannot be accessed by sea;
- land bridges;
- short-sea shipping complementing inland transport.

The main inland routes between continental countries are primarily those that link Europe and Asia, as well as inland routes linking countries within Asia, not to mention the already highly structured Trans-European networks (TENs).

On these major routes, we have seen that inland intermodal transport is not very highly developed. Medium-term prospects seem to point instead towards the development of international road transport, which is particularly dynamic once barriers to trade come down.

Certain countries, such as Turkey with its very solidly organised international road transport sector warrant mention in this regard. In other countries, such as Iran and Ukraine, the road sector has grown more recently in response to international demand and especially on links with the EU.

International intermodal transport will diversify only gradually with road or rail operators taking the lead for:

- intermodal roll-on/roll-off (semi-trailer) transport for crossing inland seas, the Mediterranean, the Black Sea and the Caspian Sea, involving haulage contractors who have very quickly adjusted to these techniques as is the case on many of the links between Europe and Central Asia, such as the "TRACECA" corridors;
- provision of rail container transport, which is developing on the main Trans-Siberian corridors although there are some examples further south such as the service put in place between, Turkey, Iran, Kazakhstan and Turkmenistan. The containers most frequently used are ISO containers, even for continental transport.

A particularly interesting case is an intermodal link between Europe and Asia, along a northern route, via the Trans-Siberian Railway, or the more southerly TARS (Trans-Asian Railway southern corridor) route, which remains more problematic because of the rugged terrain through Turkey and Iran.

A route of this nature may be an alternative to the mode used to date, coastal transport, as it could also provide transport services to inland countries.

Indeed, there are several functions that such routes help to serve, which make them more than simply a land bridge:

- they potentially open up an alternative route to a maritime mode;
- they provide a continental link between regions or countries in which port access is difficult and sometimes very costly, in inland Asia or even Europe;
- they provide new links between continental countries with very poor connections.

In this specific case, the main Europe-Asia routes are also routes for "services" to landlocked countries.

Similar situations may arise in other continents in the provision of services to inland centres, particularly:

- in Africa in which most road and rail infrastructure has been designed to serve coastal areas and ports, except in North Africa; the advantage of an inland connection is probably all the greater for the fact that there is very little local trade between neighbouring countries;
- in South America, although in this continent the majority of international trade is coastal.

North America, on the other hand, is a case where there are 'land bridges' in the strict sense of the term, with trains operating directly between ports on the eastern and western– and indeed the southern and

western – seaboards: intermodal container transport complements sea transport, the aim being to avoid the Panama Canal route.

This is an example of especially effective high-volume transport using long (2 000 m), double stack container trains.

The two maps below show the difference between:

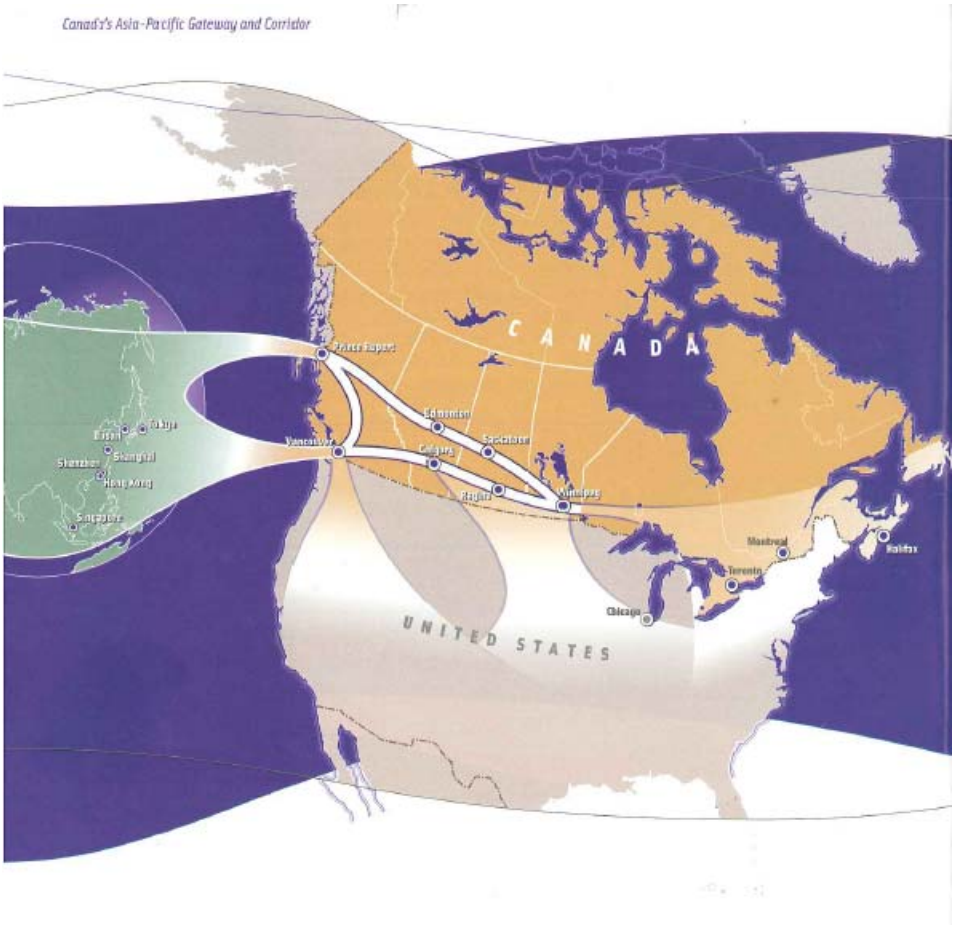
- North America, where there are land bridges across Canada, the United States and Mexico from east to west and west to east;

- and Sub-Saharan Africa, where the main inland routes penetrate inward from the coast, although in the southern part, genuinely international networks may gradually be established.

Sub-Saharan Africa: selected inland transport corridors

In Canada, the “land bridge” policy has the support of government. The east-west route actually serves two functions as a “land bridge” and also as a “Gateway” to the continent of North America from the Pacific and Atlantic seaboards with a north-south connection in the Great Lakes area.

Canada's « gateway and corridor » strategy



Other land bridges may also be contemplated in the future to provide new international routes:

- between the Mediterranean Sea and the Gulf once the link between the Syrian and Iraqi networks has been established, which is to planned for the near future, but primarily once peace makes it possible and appropriate port facilities have been opened in Iraq;
- between the Mediterranean and Black Seas as an alternative to the Bosporus route, as currently proposed by Turkey;
- between the Gulf and the Caspian Sea, which is itself linked to the Black Sea and the Volga network;
- between the Caribbean Sea and the Pacific, by rail, as was planned across Central America, although the widening of the Panama Canal makes this a less realistic project.

Once example that should be mentioned is the « Northern East West (N.E.W) freight corridor » linking North America, Russia and China, proposed by the UIC which will involve countries of Northern Europe and Norway in particular. The advantage of this corridor is that routes would be much shorter than existing maritime routes and would use the inland "Trans-Siberian" corridor. Although potential traffic along the corridor is currently low, the aim is to lose no time in setting up a one-stop-shop for services along the corridor and gradually attract a traffic potential that could rapidly increase.

There are also instances where inland transport is the main mode and sea transport is a possible alternative for shorter distances, particularly within a given region.

This bring us back to all of the discussions about the development of short sea shipping (SSS), which is moreover the only mode possible for much of the regional trade between the countries of East and South Asia.

The suitability of a particular approach thus greatly depends on the geographical context, the result being:

- either a predominantly road transport approach, using roll-on/roll-off facilities as previously mentioned;
- or, a predominantly maritime approach and, specifically, an approach using intermodal ISO container transport, which creates new regional links following the development of 'feeder' type services;
- or, new methods of organisation and modes of transport in line with the wishes of the European Union and its Motorways of the Sea concept capable of competing with inland road transport.

2. How the different solutions perform

On main intercontinental routes, the preconditions remain higher volume traffic and the industrialisation of transport supply processes, whether one is dealing with sea, port transit or inland transport.

In the case of inland intermodal road/rail transport, these higher volumes are provided by multimodal terminals and their rail services. At present, there are several types of terminal, including 'European' style terminals capable of handling several hundred thousand (200-300) loading units, and "North American" style terminals designed differently and requiring greater space for up to one million units.

North America provides particularly efficient examples of inland intermodal transport over long distances which could be transferred to other continents given comparable high-volume and operating conditions.

US terminal

US « double stack » trains

For rail transport, the challenge is to form trains with a minimum load of 60 to 80 TEU, but scope for increasing it to 300 or 400 TEU. For inland waterway transport, the range would be 200-400 TEU.

With scenarios such as this, it is reasonable to assume that an intermodal mix could be developed along the main global trade routes, depending on distances, the terrain and connections with regional networks.

For services between Europe and Asia, initial estimates have been obtained showing that there is a competitive market in which inland intermodal transport between Europe and Asia could compete with maritime transport, since:

- differences in distance between inland and maritime transport, would give inland transport an advantage;
- the costs of pre and post-shipment port services to inland regions of Europe and China add to the costs of the maritime door-to-door chain, this could also be the case in China with the development of interior regions;
- and, lastly, there is the possibility of forming long trains, which increases rail performance and "double stack" transport where applicable.

Generally speaking, rail costs can be lowered substantially by higher volume flows and intensive use of equipment: to around EUR 0.1 per unit/km, a level at which regional terminal haulage conditions will be the determining factor, as in the case of maritime container shipping.

In the inland intermodal transport sector, there is the example of North America, which uses 48' or 53' boxes better geared to inland logistics than ISO shipping containers for average distances of up to 1 300 km with terminals that handle up to 1 million units in the densest areas: Los Angeles, Memphis, Chicago, Dallas.
While at present Trans-Siberian traffic is fairly modest, at under 200 000 TEU, it is not technically impossible to increase it significantly on a line used by passenger and bulk goods trains, which has been modernised and occasionally widened.

As regards direct trade between the EU and China, which already represents over 10 million TEU (with an enormous imbalance in the flows in each direction), the economic equation may give rail the advantage:

- with transport that takes 12-15 days by rail, as opposed to four weeks by ship;
- with rail costs from China up to the entry point into Europe of probably no more than EUR 2 000 per TEU, whereas sea freight and port transport costs alone would account for as much, exclusive of pre and post shipment haulage.

In a study conducted by NESTEAR in 2006, several scenarios were considered, ranging from the operation of 60-100 TEU block trains – which would immediately lower rail transport costs over a distance of 10 000-12 000 km to a level comparable to that of sea freight costs – to the operation of trains capable of transporting 200-400 TEU:

- either by lengthening trains, as is already possible on these lines for bulk transport;
- or by 'double stack' transport, which would have to be compatible with electrification of the line;
- or, yet again, by identifying freight priority routes – an option which is already being examined by China, and which could be considered in Russia.

Hence, a whole series of operating measures which are possible in principle could achieve a system whose performance would rival that of the North American system.

Based on the scenarios outlined in the table below, a significant share of the traffic between Europe and China, or indeed between Europe and the countries of East Asia, could use this alternative route and make extra capacity available through continental gateways in Europe and Asia that do not experience the same saturation problems as sea ports.

	Block trains	**Double stack trains**	**Dedicated lines (trans-Siberian transit)**
Unit capacity	60-100 TEU	300-400 TEU	
No. of train paths	50-100	50-100	>200 train paths
Organisation	Border transhipment	Border mega hub	Border mega hub
Trans-European Networks (TEN)	Rail corridors	Dedicated rail freight network (EU)	Dedicated rail freight network (EU)
Rail/sea time	20 days/40 days	15-20 days/35-40 days	15 days/35-40 days
Comparison of costs with ocean shipping costs	Competitive for Central Europe	Competitive for the EU	Competitive for the EU
Annual capacity	2-3 million TEU	7-15 million TEU	20-30 million TEU
Accessible market Between Europe and North-East Asia (million TEU)	2-3 million TEU	7-15 million TEU	20-30 million TEU
Potential rail traffic	2-3 million TEU	7-15 million TEU	9-16 million TEU

In this context, the problem of performance is therefore less of a technical issue and more of question of commercial dynamism and of opening the market to operators so that a good quality, reliable service can be provided.

Of course, another maritime alternative presented in the following section is also pointed out from time to time, namely a new sea route via the north that ought to be navigable throughout the year with the melting of the icecap.

For a whole series of trade links between Europe and Asia, and between America and Asia, this route is much shorter, cutting current shipping distances by half.

However, this solution does not overcome the problem of port congestion unless it also promotes the development of new ports in the north of Europe and northern Russia, which would then have to be linked by rail for longer inland terminal hauls.

In any event, the gains derived from this route in terms of transport time and/or cost would not be enough to undermine any proposal to develop a higher volume continental rail service, bearing in mind that inland regions in the continents of both Asia and Europe are becoming increasingly integrated into global trade.

The main intercontinental routes should thus be regarded as forming part of a vast intermodal global transport network, not just as a few specially selected corridors for which there is no alternative.

Further to the south of the Eurasian continent, similar problems arise with the development of trade in India, Pakistan and the Gulf countries.

For trade with Europe, Russia, and the countries of Central Asia, new corridors are certainly going to develop between the Gulf and the Caspian and Mediterranean Seas respectively, but they still require the completion of rail structures in order to build land bridges: between the Gulf and the Caspian and the Gulf and Mediterranean ports.

3. Transport vulnerability and diversification of global trade routes

While consolidating long-distance flows is obviously a more effective approach from the transport standpoint and often -- with the use of rail, river and sea -- from the standpoint of environmental impact, too, it still increases the vulnerability of transport where there is no alternative route.

Transport is vulnerable to breaks in any link on a route that has become a vital artery for the global economy. This risk exists in sea transport when traffic converges in order to pass through straits and canals, or in ports and airports, which are major global transport hubs, regardless of the external cause of the risk: accident, natural catastrophe or terrorism.

While measures may be developed to improve risk prevention, one of the most effective strategies against risk is to diversify global trade routes, which will limit the spread of the impact of a sudden break in one link to the entire worldwide transport system.

In seeking to diversify transport in this way, it is clear that extending intermodality to inland and sea modes increases the number of possible approaches and routes: the risk being primarily at unavoidable points of passage. Doing so will require a minimum number of agreements on standards, both material and information standards, and on the development of transhipment points. It is in this sense that a global transport network can only be an intermodal network in which all modes are on an equal footing, with no real hierarchy in its organisation.

The credibility of this intermodal vision is stronger for the fact that the terminal link itself must also be taken into consideration in integrating the transport chain, and is becoming increasingly important as long-distance transport improves.

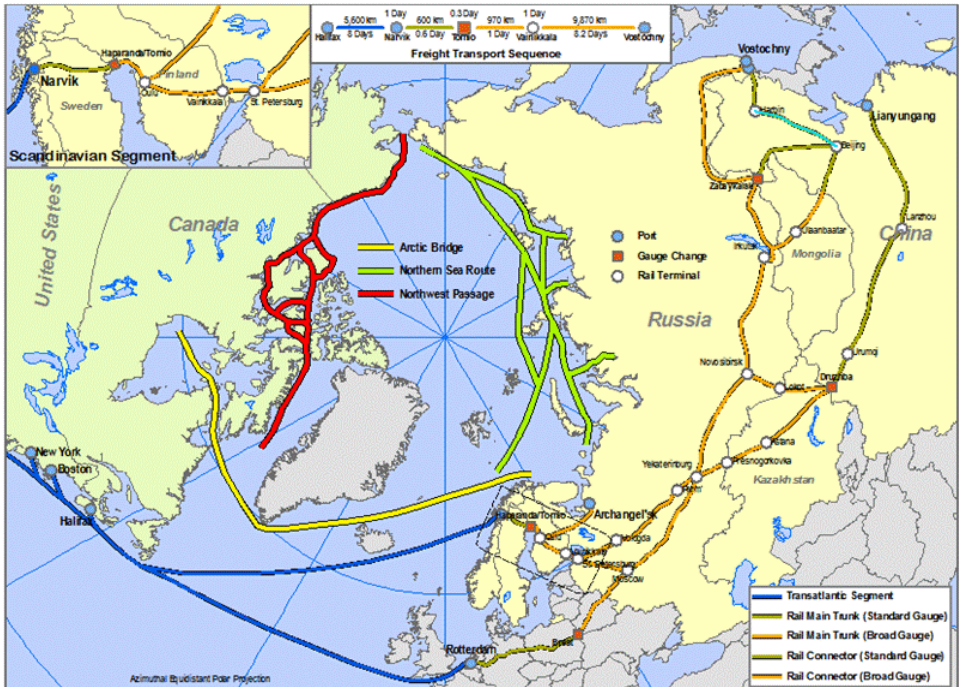
The map of trade routes between Europe and Asia shows how maritime traffic converges on a few geographical locations, namely straits, and how inland solutions can introduce more diversity in route choices (p77).

The following map below shows the new maritime routes that could hypothetically be opened up between Europe, Asia and America if the melting ice cap allowed routes all through the year: this hypothesis would considerably reduce time and distance for maritime transport between all three continents, which would once again be shorter than overland distances.

The gateways to the three continents would also be very directly affected and in Europe there would be a new role for ports in the Barents Sea, connected directly by rail to the countries of Central Europe and the EU and for Scandinavian ports further to the north, as far as Denmark and the North of Germany.

This would mean a very significant shift in port access routes from the continent of Europe for all extra-European trade as well as a shift in port access routes for the continent of America

Alternative east-west trade routes



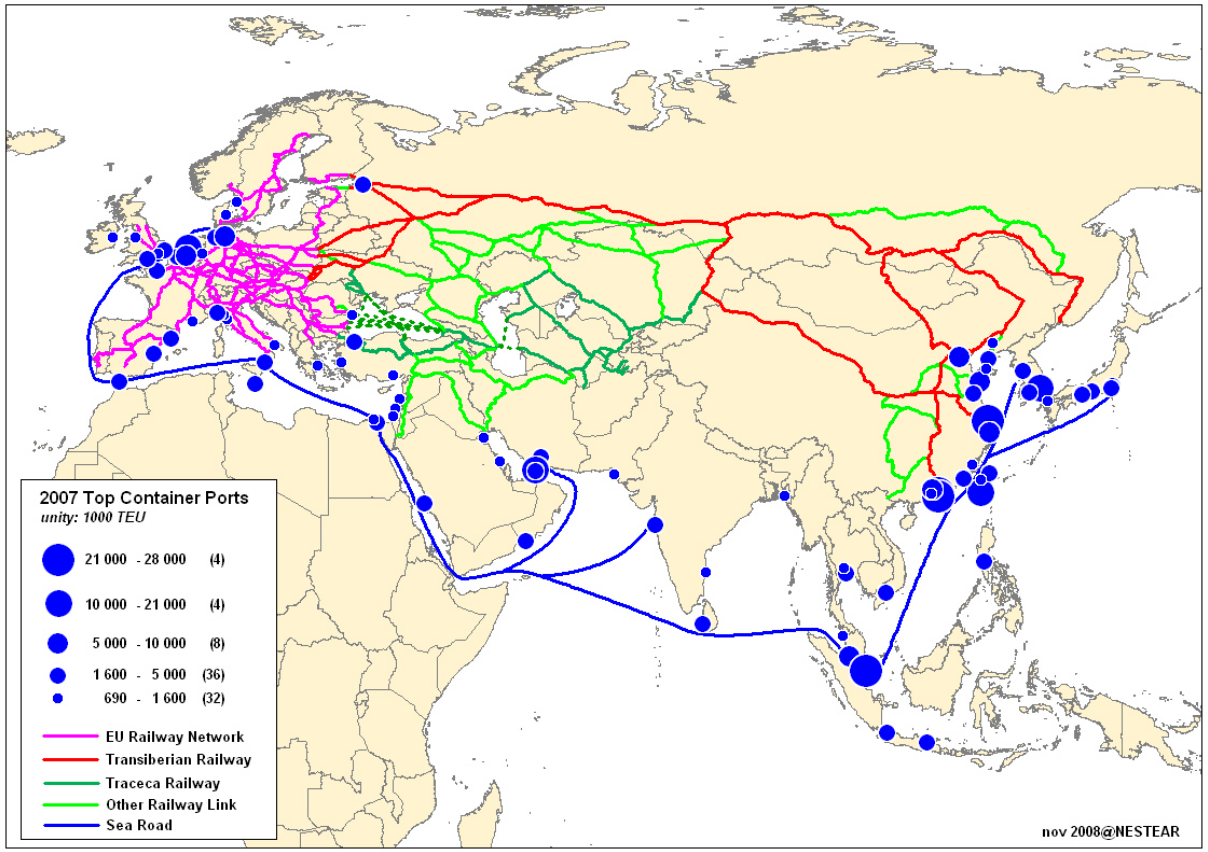
Source: Rodrigue, Hofstra University

The following table briefly summarises situations in which maritime and inland transport might compete with or complement each other at regional and inter-regional level.

Here again it is difficult to obtain any very definite assessment of where they will be complementary and where they will be competing, since the reality tends to be an ever more complex system of international transport in which intermodal transport introduces more flexibility for crossing physical barriers or for providing the best combination of mode performance.

	SEA	LAND
COMPLEMENTARY	● Short Sea Shipping Courte Distance Mediterranean, Asia	● Improved port access - EU, USA, access for land-locked Central Asia, Africa ● Land « Bridge » - North America, Middle East
COMPETING	● RoRo / Motorway of the sea - EU - MED ● Feedering (Europe)	● Intercontinental corridors (Europe - Asia) N.E.W corridor US-China

Diversifying inland and sea routes between Asia and Europe



V - OUTLOOK FOR INLAND INTERMODAL TRANSPORT

This outlook will be based on a retrospective analysis of the last 50 years and on the changes that have been observed in trends in both international trade and intermodal transport.

It will not therefore be a projection of long-term trends, bearing in mind the sudden breaks in trend that have occurred, with the industrialised developed countries first driving the world economy, then, more recently, emerging countries' economies of taking over as the mainspring of global growth.

It will instead be a projection of the new balances that are emerging over a medium- and long-term timeframe from 2020 to 2030, during which intermodal transport will become a very widespread organisational model in sea and inland international trade.

Given the foregoing, it is hard now to disregard the current financial crisis which will inevitably have repercussions for growth and international economic flows, and certainly for methods of regulating the international financial system, including the funding of public and private transport operations and infrastructure.

However, this will above all be an analysis of data on the 'real' economy, the economy of physical flows of goods, although it is clear that the 'real' economy is inseparable from the world of finance, which enables long-term investment and, in the short term, makes international trade mechanisms possible through documentary credit. The underlying assumption is that, in the medium term, the issue of international financial regulation will be resolved, enabling the real economy to return to its development foundations, based on the fundamental factors in the development of countries that have been identified, namely: demographic growth, the spread of new technology, and the 'coming of age' of developing economies. This was seen as the most important feature of the beginning of the 21st century, as IMF and World Bank forecasts were still pointing out several months ago. The liberalisation of global trade has unquestionably been an important factor in enabling under-developed countries to catch up in this way along with the revolution in digital technology.

Today, such an approach may seem to be rather optimistic with one plant closure announced after another in developed and emerging countries alike. However, the recent economic period has also witnessed the emergence of new approach to global growth, with firms operating on a global scale, even if it did occur in a – poorly controlled -- situation in which international finance supplied the liquidity needs on questionable economic (external deficit) and speculative grounds. These liquidity needs meant that the bad debt that led to the crisis in the autumn of 2008 -- diluted among the sheer volume of international financial dealings -- was too quickly forgotten.

The challenge now is to get back to more solid foundations for international financing so that the real economy approach to globalisation can get back on track.

Indeed, this period of financial crisis is a reminder that 'globalisation' also implies greater interdependence within a global system in which any serious dysfunction may have extremely serious worldwide consequences extending to every country and every person.

It is also a reminder that there are still other risks more directly linked to transport operation: these include the medium- to long-term risk of a breakdown in the fuel supply as well as climate change, of course, which may also result in successive climatic catastrophes that are difficult to forecast.

Among the potential alternative scenarios, therefore, there is always a risk of 'systemic crises' linked to dysfunctions in global finance, the energy crisis, environmental damage and indeed the vulnerability of transport networks to terrorist activity.

These scenarios all pose world regulatory and governance problems, given that globalisation has become an irreversible phenomenon and that any return to protectionism would have consequences even more serious than before the Second World War.

The present chapter will therefore be divided into three sections as follows.

1. The main features of the recent period (2000-08) as a basis for long-term forecasting
2. The baseline socio-economic scenario for the development of globalisation and international trade

This second section will include extensive reference to the publications of international bodies that produce economic projections, such as the World Bank, the IMF, the UN and its regional bodies and the International Energy Agency, as well as publications from specialist forward planning institutes.

3. The outlook for inland transport performance with special reference to intermodal transport

This outlook will also follow on from the analysis of the trends observed over the last few years, which have consistently shown an increase in the performance of the transport system, deriving full benefit from technological progress and stimulating global trade.

1. The main features of the recent period (2000-08) as a basis for long-term forecasting

There are two ways of viewing the current period at this precise moment in time at the beginning of 2009, in which the full scale of the financial crisis and ways that might be found to deal with it are as yet unknown.

The first is a positive approach**,** in a continuation of the previous period.

It is highly likely that the history of this first decade of the 21st century was already determined by that of the end of the 20th century.

The picture presented by globalisation in the early years of the 2000s was as set out in reports from public and private international institutions such as the World Bank, the IMF, and UNCTAD in 2007, or in early reports in 2008, i.e.:

- relatively tough prospects for advanced countries like those in North America or Western Europe, with smaller growth of around 2 %, particularly as a result of the rise of emerging countries;
- high and sustainable growth prospects for the emerging countries linked to the development of a sort of virtuous economic circle for a period of 20 or 30 years.

This virtuous circle is attributable to the following basic factors.

- The globalisation of the economy and the general involvement of countries in global trade in a context of continuing liberalisation of trade (notwithstanding the WTO's recent difficulties with agricultural negotiations), facilitation of trade (to which transport contributes) and modernisation of government (including customs operations as a result of which it appears possible to resolve even traceability problems).
- A recovery in domestic demand in many emerging countries: demand that may take over from international demand, while limiting internal disparities, thereby strengthening the economic and social cohesion of countries.
- Product diversification with the result that emerging countries are no longer limited to exporting lower value-added products, or products with fewer technological features than those of the developed industrial countries: this is a radical change compared with previous years at the end of the 20th century and a challenge to the rules on the international division of labour.
- Increasingly intensive involvement in research and training in the emerging countries.
  Research is also becoming a priority in the emerging countries, some of which earmark a higher proportion of their GDP for research than certain European countries, although this probably does not apply to the United States.
  A comparable effort is apparent in training, and the brain drain is now more limited in many emerging countries.

With the accelerating pace of history during this period, we have probably not yet properly gauged the full scale and consequences of this latest change.

Nonetheless, there is also a more negative view of the situation that the recent financial crisis of 2008 has indirectly brought into sharp relief, as follows:

- the risks that global growth poses for raw material resources and oil in particular;
- the risks for the environment and climate change, as few in the scientific community would now dispute;
- finally, the lack of a full understanding of financial data, when the easy options taken to finance international trade and, in a way, globalisation turned out to have been particularly dangerous given the rapidity with which the financial crisis spread.

Of course, these same risks had been forecast:

- since the 1970s in the case of energy and raw materials by the Club of Rome;
- for over 10 years -- with scientific certainty -- in the case of climate change;
- and more ambiguously in the case of financial risks, given that warning signals in the 1990s had not lead to a search for appropriate explanations.

This context will be the backdrop to the construction of the scenarios, although the reduction of 'systemic risks' also depends on the ability to establish suitable methods of governance (and therefore of regulation).

In all of these scenarios, transport also provides a good illustration as it reflects the concrete side of trade.

In many countries, including some emerging countries such as China and Russia, there will be population ageing, which will have an impact on the structure of the working population, with people aged over 60 in the developed countries almost tripling (to reach 30 % as opposed to 13 % at present). This is the combined effect of the low fertility rate (1.5 % in Europe) and the fact that people live longer: in an area

such as the EU, demographic growth will be essentially attributable to immigration, which is growing as a result of human relations, savings achieved in the country of origin, and the interdependence of the countries experiencing emigration and immigration.

The results of demographic trends on the labour market in various countries, and on ways of life and patterns of consumption will thus be particularly significant.

A second feature of these demographic trends will be an increase in the urban population, which primarily affects developing countries with faster-growing populations and which is also caused by the internal migration of poor rural populations to towns and cities likely to offer more opportunities for employment. This second trend inevitably increases the need to organise the flow of goods entering and leaving the main cities, which is hard to implement without urban planning.

As regards economic growth up to 2020-25, most international bodies project the trends observed during the recent period taking an average growth in world GDP of over 3 %: globalisation will continue to stimulate world economic growth, especially in the emerging countries.

Within this growth, there will be a significant difference between in the developed countries and emerging and developing countries: in the developed countries, growth is likely to be 2.5 % a year and weaker in Europe (2 %) than in the United States, whereas it will be around 4.5 % in the developing countries overall.

The most recent forecasts by international bodies at the beginning of 2008 indicated even higher growth differentials between developed and emerging countries, based on trends in recent years: the differential could reach 4 percentage points per year, from 2 % in the developed countries to almost 5-6 % for the emerging countries. These projections are set out in more detail in the following table.

Tableau 4.4. Résumé du scénario de référence

Taux de croissance du PIB (variation annuelle en pourcentage)		2010	2020	2030	2040
États-Unis		2,60	2,64	2,51	2,40
Japon		2,05	1,70	1,70	1,67
Europe orientale		1,81	2,78	2,37	2,24
Europe occidentale		1,89	2,39	2,26	2,19
Pays de l'annexe I		2,18	2,46	2,32	2,23
Chine		10,19	5,04	3,50	2,70
Autres pays émergents ou en développement		4,54	5,39	4,33	3,82
Pays de l'OPEP		2,31	3,97	3,39	3,14
Pays autres que ceux de l'annexe I		5,19	5,20	4,10	3,58
Monde		2,83	3,21	2,88	2,71
Niveaux d'émissions ($GtCO_2$)	2002	2010	2020	2030	2040
États-Unis	5,8	6,2	7,5	9,1	11,0
Japon	1,2	1,4	1,6	1,8	2,1
Europe orientale	3,1	3,0	3,5	4,1	5,4
Europe occidentale	3,5	3,7	4,1	4,7	5,4
Pays de l'annexe I	14,5	15,1	17,8	21,2	25,0
Chine	3,3	3,8	8,2	12,3	16,6
Autres pays émergents ou en développement	5,0	5,0	8,2	12,8	18,8
Pays de l'OPEP	1,7	1,5	1,9	2,7	3,6
Pays autres que ceux de l'annexe I	10,0	10,2	18,2	27,8	39,9
Monde	24,4	25,3	36,1	48,9	64,0
Parts d'émissions (pourcentage)	2002	2010	2020	2030	2040
États-Unis	23,5	24,3	20,7	18,6	17,2
Japon	4,9	5,5	4,4	3,8	3,3
Europe orientale	12,7	11,8	9,8	8,4	7,5
Europe occidentale	14,2	14,5	11,4	9,7	8,4
Pays de l'annexe I	59,3	59,7	49,4	43,3	39,1
Chine	13,5	14,9	22,7	25,2	26,0
Autres pays émergents ou en développement	20,4	19,6	22,6	26,1	29,3
Pays de l'OPEP	6,8	5,8	5,3	5,5	5,6
Pays autres que ceux de l'annexe I	40,7	40,3	50,6	56,7	60,9

Source : calculs des services du FMI.
Note : OPEP = organisation des pays exportateurs de pétrole; $GtCO_2$ = gigatonnes de dioxyde de carbone.

With regard to economic output, a real reversal of economic relations may thus be expected, with the continent of Asia becoming a hub of world growth. The share of OECD countries in global GDP is set to fall from 55 % in 2000 to 40 % in 2025, while the share of the Asian countries is expected to rise from 24 % to 38 %, reaching a level comparable to that of the OECD countries.

In terms of GDP in 2025, the top five countries are most likely to be the US, China, Japan, India and Germany, while the top five in 2007 were (in descending order) the US, Japan, Germany, the United Kingdom and France: China and India are set to become major new industrial powers, with growth rates above 6 % over the next 20 years.

The consequences of the growth in global trade are:

- first, more diversified trade, with diversification in emerging markets;
- and, secondly, the likely consolidation of regional economic integration areas, as already observed in Asia, starting from a situation in which intra-regional trade is far lower than in Europe.

At the same time, it is likely that off shoring of production will continue, especially in highly labour-intensive sectors, in order to secure a comparative advantage in terms of wages; even if wages rise in

countries like China, they will remain lower than in the developed countries, while wages in other developing countries will not begin to catch up until much later.

All of these trends point to the likelihood of continued high-level growth in global trade, while trade becomes more diversified and relations between countries grow more numerous. If an elasticity of over 2 is maintained between global trade and global GDP, trade will doubtless grow in volume by 6-7 %.

However, the growth of emerging countries is also increasingly dependent on the growth of domestic demand, which consolidates their economic systems so that they are less vulnerable to external fluctuations, and enables internal disparities to be reduced. Countries that play a growing part in the global economy are already very outwardly oriented and the elasticity of their foreign trade with respect to GDP is probably lower than is observed in Europe.

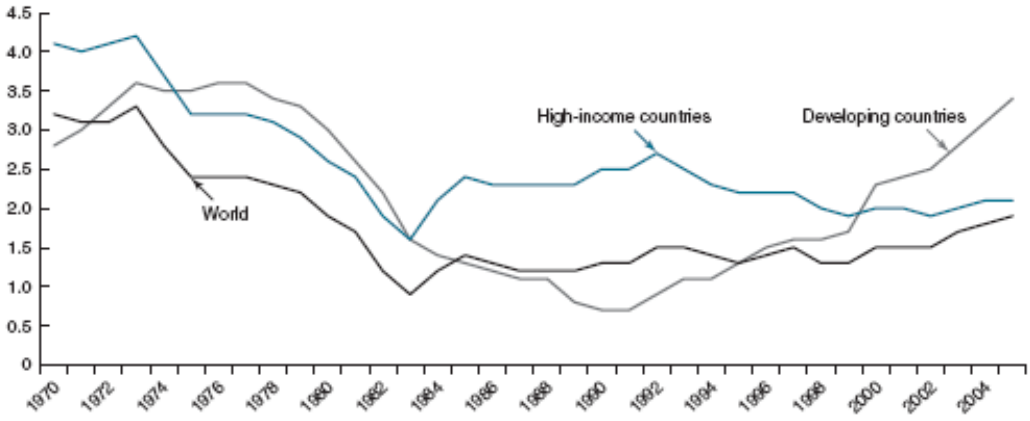
Based on this assumption, growth in international trade will probably be slightly lower, around 5 %, with higher trade elasticity in the developed countries where growth will be weaker than in the emerging countries.

Another very decisive factor in globalisation up to 2020 will be progress in technology, which has fuelled world trade in recent years and will have a continued impact for many years to come, thereby facilitating communications and the off shoring of firms and services. The use of new technologies is spreading and is not the preserve of the most advanced countries.

In the same vein, attention should also be drawn to the substantial research effort of the emerging countries, which are doing more than just engage in highly labour-intensive production, particularly India and China, and this policy can only boost the long-term growth dynamic to which transport will contribute.

Figure 2.14a Past global growth…

10-year per capita income annual growth rate, percent per year, 1970–2005



Source: World Bank DDP.

2. The baseline socio-economic scenario for the development of globalisation and international trade

The following key factors are standard data in constructing any socio-economic scenario used in transport:

- demographic data;
- data on production and trade with the emphasis on industrial production and commerce;
- trends in technology.

As far as demography is concerned, data used for forecasting are relatively sound and broken down by country.

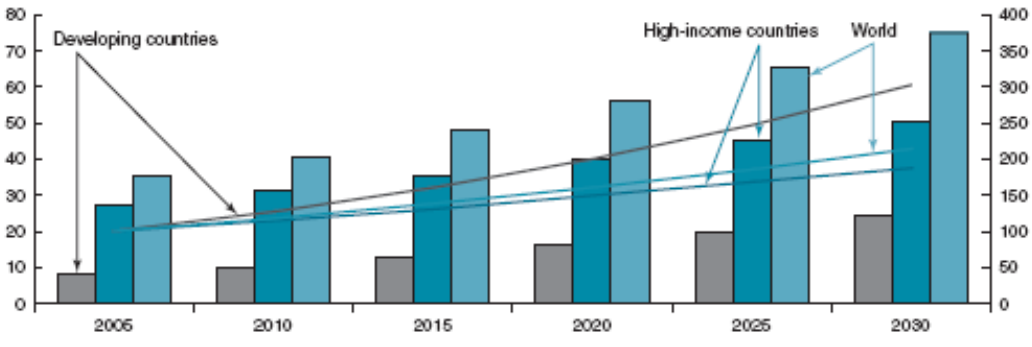
At global level, demographic growth data will remain crucial for economic development with very mixed situations from one country to the next, encouraging extensive migration, particularly among younger age groups.

By 2025, the world population is set to rise from 6 400 billion to 7 900 billion, an increase of 23 %.

This population growth will be especially marked in the developing countries of sub-Saharan Africa (around + 45 %), the Middle East and North Africa (+ 38 %).

In Latin America and Asia, growth is forecast at 24 % and 21 % respectively. In contrast, in the developed countries, population growth is expected to be very weak, though it will be more dynamic in the United States (+ 17 %), while levelling out in Europe (+ 2 %) and actually decreasing in Japan and Russia (at - 2.6 % and -10.8 % respectively).

Figure 2.8 Developing countries will account for a larger portion of world output in coming decades



Source: World Bank simulations using the Linkage model.
Note: Bars are measured on the left axis; lines are measured on the right axis.

3. Transport performance scenarios

As in the economic analysis, these transport performance scenarios are based on the findings of the analysis of the recent period, as follows.

3.1. The development of more sophisticated logistics

A key task facing global enterprises, including transport undertakings, is to integrate supply chain production/distribution in sites located in different regions of the world more effectively.

It is essential to establish appropriate transport logistics when developing complex production and distribution processes; yet many emerging countries manage to do so, as is already demonstrated by container ports in Asia, which are achieving record levels of efficiency in their transhipment operations. This trend is now paralleled by the development of new inland logistics facilities serving as distribution hubs in emerging countries close to the main centres of activity and population centres.

3.2. Improved sea transport performance

Here, a distinction has to be drawn between modes, bearing in mind that the increase in the average size of ships lowers maritime mode operating costs per unit transported, as demonstrated.

Over long distances, with ships larger than 9 000 or 10 000 TEU, the price of sea transport could be lower still, although the unknown quantity at this stage is the price of oil which, at over USD 100, would rule out any such decrease.

Costs thus exhibit a twofold trend:

- a tendency to decline with increasing vessel size and the rapid increase in capacity of the world fleet, which is maintaining very keen competition price-wise;
- upward pressure if the cost of oil rises again, given that the biggest ships are those with the lowest unit consumption per unit transported; speed is also an important factor, so speeds are reduced by 10-15 %.

Hence, these trends do not necessarily apply to all types of vessel, notable exceptions being smaller feeder ships, which consume proportionally much more fuel than big container vessels, or roll-on/roll-off ships, which remain high-cost vessels because industrial production is low.

Operating costs of a 4000-TEU and 10,000-TEU ship, according to Notteboom (2006)

	Panamax 4000 TEU	Mega-post-Panamax 10,000 TEU
Manning[1]	850	850
Repair and maintenance	900	1,150
Insurance	800	1,700
Stores and lupes	250	350
Administration	175	175
Fuel[2]	4,284	7,269
Port charges	2,000	3,000
Total operating costs per annum	9,259	14,494
Total cost per slot per annum	2,315	1,449

Notes: All costs are annualized and expressed in USD '000, except total cost per slot, which are actuals. The calculations are based on a basic trans-Pacific service taking in direct calls in southeast Asia with six ships spending 30 days at sea and 12 days in port. Each ship completes 8.7 voyages per annum.
[1]Based on use of competitive international shipping register.
[2]Fuel consumption is based on 22.5 knot service speed which results in Panamax ship consuming 120 tpd at sea and 4 tpd in port and mega post-Panamax 180 tpd at sea and 6 tpd in port. Bunker prices are calculated at USD 135 per tonne.
Source: Drewry Shipping Consultants (2001)

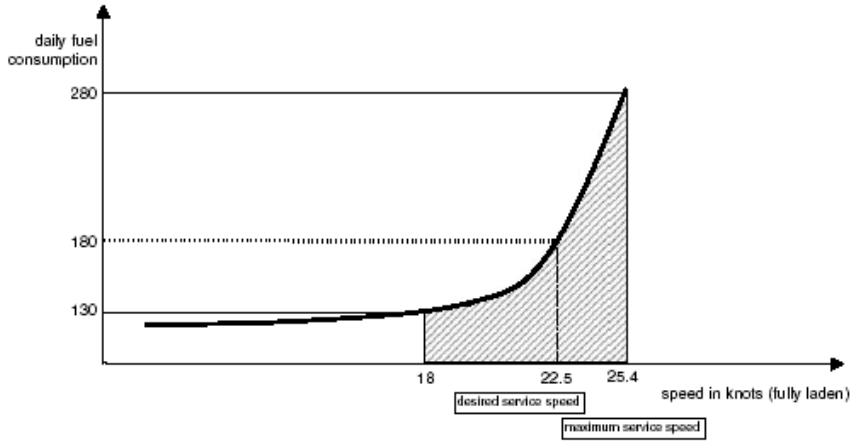


Figure 5: Example curve of daily fuel consumption/vessel speed.
Note: Data for CSCL Oceania, 8,468 TEU, 93,000 bhp.
Source: Based on data provided by Sea Span

3.3. The outlook for road transport

In general, a distinction should be drawn between the situation in developed countries and developing countries where freight transport by road often remains casual with little organisation.

In developed countries, road transport is in most cases an industry that has been able to modernise in terms of vehicle purchasing and assimilating new techniques for operating purposes and communication with its clientele.

Modernisation has been furthered by exposure to competition as well as the requirement for safety and environmental regulations and standards.

In the transition countries of Central Europe, it has been observed that international road transport has modernised very rapidly as a result of the commercial and regulatory pressures exerted by European organisations. This is reported to have contributed to modernisation of the whole inland transport sector.

However, this is not the case in many developing or emerging countries where the framework is not nearly as strict and the road infrastructure is not always in good repair. The result is the rather chaotic development of the entire road sector, which is actually not very 'professional' and uses vehicles of varying size that are heavy polluters.

Professionalizing road transport and regulating it so that equipment can be modernised are thus often the preconditions for a service which – if they are met – should considerably enhance its performance and contribute to the regional integration of countries, while also limiting pollution. New standards in Europe and other industrialised countries are substantially curbing road transport pollution notwithstanding traffic growth. To some extent, the two issues of greatest concern remain residual nitrogen oxide (NO_x) emissions and, of course, global emissions of CO_2.

A second requirement for road transport will thus be the development of an international road network.

At present, the UN is making a considerable effort here to develop continental road networks, especially between Europe and Asia and in the Middle East, as well as the countries of south Asia.

In this respect, Turkey provides a good example of a well-developed international road sector which could contribute rapidly to the development of international inland transport throughout the whole of central Asia, as it does for links between Turkey and Europe, while at the same time encouraging intermodal approaches and, in particular, roll-on/roll-off maritime transport.

Hence, there are two conditions -- professionalisation of the sector and the development of international networks -- that might greatly boost the role of road transport in regional integration, under more satisfactory economic and environmental conditions: the road transport sector has always proved to be highly capable of adapting once an appropriate regulatory framework was defined.

However, there is very little scope now for improved vehicle performance as regards fossil fuel consumption, with all the implications for the carbon dioxide emissions just mentioned.

The only possibility – though it remains controversial – is to authorise the use of 60-tonne lorries, which are likely to raise productivity by around 30 % but would probably have to be confined to motorway use, for size and safety reasons. This might also undermine the development of other possible approaches that would be more satisfactory from a sustainable development perspective.

3.4. Improved rail transport performance

Research into rail transport productivity in various countries has revealed considerable disparities, which are the outcome of differences in operating conditions and of internal rigidities in the organisation of rail transport within undertakings that are not very open to the market and benefit from monopoly situations.

While the best performances, as seen in North America, Russia or China, cannot necessarily be transposed to every country, there is nonetheless a general trend towards in-depth reform of rail transport systems, making them more open to competition and more open to free market economy principles.

In Europe, this more open market entails the separation of infrastructure management from operations, in order to introduce greater transparency in cost formation, as demonstrated in the cost accounting approach.

The prospects are thus for an all-round improvement in rail transport productivity with big reductions in operating costs achieved by better use of equipment and staff especially over longer distances. The improvement in productivity in European countries might easily reach 30-40 %, reducing the difference with the major continental networks in America or Asia, although without actually reaching the same levels, since the latter also depend on physical factors, above all, topography and the mix of goods and passenger transport, which may be a very restrictive factor, particularly in Europe.

From this angle, intermodal transport appears to be solution comparable to maritime container transport, even though the former does involve two load transfers, unlike road transport, and the cost of rail transport between two transhipment terminals might be reduced by at least 30-40 % with the operation of direct train and shuttle services.

On some corridors, higher volume traffic might result in still higher gains with the use of long trains if the network provides for this, bearing in mind that double stack trains would not be possible in rugged terrain because of tunnels. It is worth remembering that certain transcontinental rail lines crossing the United States or Russia do not have the constraints of tunnels.

Regional rail transport prospects will depend to a great extent on initial conditions along with the following.

- The constitution of regional networks building on existing national networks as in Europe. Here, the first problems to overcome will be rail network interconnectivity and interoperability, which ensure the continuity of the network and its operation on an international scale: without interoperability, rail transport sees a sharp decline in performance at every border crossing and international service provision becomes less efficient when the stimulus provided by competition between operators is limited;
- The commercialisation of new rail services in networks that have long been confined to transporting heavy traffic, for the purpose of providing international intermodal services;
- The establishment of transhipment terminals that should also be programmed for intermodal transport.

These problems in developing a network of terminals and commercialising intermodal services are encountered in Russia, China and India, for example, and in many countries:

- Infrastructure modernisation is a necessity, since networks may date from the first half of the 20th century, with little major work done to them since;

- It is imperative to open the rail system up to competition so that attractive, reliable services can be offered. Productivity gains in the United States since the Staggers Act speak for themselves in this regard and are confirmed by Europe's railway reforms.

For example, it is apparent that the Trans-Siberian line with its extensions into Asia and Europe could, in the medium term, provide competitive intermodal services compared with ocean shipping, depending on the origins and destinations in Europe and East Asia. Yet, whatever the corridor under consideration, the

prerequisite will always be the reform of the railway system so that it can deliver a commercial supply so that it can meet competition from road mode, which is sure to keep growing and modernising itself along the major continental road corridors.

- Lastly, the establishment of interoperable regional networks will be necessary, sometimes with the construction of new connections as will be the case in many developing countries especially in Africa, the Middle East, Latin America and in some countries of South Asia

Indeed, in these countries, rail lines have often been the means of accessing ports from production centres and in particular mining centres: historically these have not been interconnected networks and they cannot easily be used to provide international intermodal services except along the corridors that they themselves form.

3.5. Establishing regional intermodal networks

Given the outlook, the vision of an 'intermodal' network may be very helpful. As the ultimate aim is to form a network, it is definitely worth designing one from an intermodal approach so that road and rail transport can compete but also complement each other when no other solution is possible.

Naturally, establishing a network of this kind always involves considerable investment, the full benefit of which should be comprehensively assessed in terms of the economic development of the regions concerned and environmental impact.

In the case of rail services, one should also emphasise the considerable growth potential arising from the introduction of new satellite control systems and from equipment standardisation, which may increase railway capacity by over 50 %.

Until now, because it is a "guided" transport system the operation of rail mode has been much more complex than road transport operation. Road transport does not really pose any interoperability problems at border crossing points once the basic regulations for 'weights and measures' and driving safety have been learned.

As a result of new satellite control systems, railway operation can begin to be more standardised at international level provided that an effort is made on harmonisation: accordingly, the conditions are 'interoperability' for improved performance over long distances and available capacity, both of which require the establishment of an international regulatory system for equipment and operations.

These difficulties in operating and commercialising rail services mean that priority is often given initially to road mode for international transport involving energetic outward-looking firms be they SMEs or large firms. In many countries, international road hauliers have been a sort of role model for less specialised domestic firms.

Opening rail mode to competition is harder, as the work of reforming rail in Europe again demonstrated recently, but it has already been pointed out that rail reform is a prerequisite which entails re-examining the way integrated national undertakings operate.

Furthermore, setting rail and road modes against each other in cut-throat competition is certainly not the solution while intermodal transport is an appropriate response which allows market openness in all modes to be used to better advantage to provide a structure for new regional areas, incorporating not just road and rail links but also inland waterways and/or short-sea shipping where necessary.

3.6. Diversifying intercontinental routes using new inland and sea combinations

In all such combinations, the limitations imposed by physical geography are a major factor, depending on whether or not there is an inland waterway and whether it is necessary to cross inland seas, such as the Caspian Sea, the Black Sea, the Mediterranean or great lakes.

Such combinations may also result in the emergence of new major continental routes across Asia on northern routes across Siberia but also on more southerly routes linking Europe to South Asia. In these scenarios, the Red Sea, the Gulf and the China Sea may be regarded as inland seas for routes that also carry continental transport.

This type of combination is certain to further diversify possible routes, especially through Eurasia, which is crossed by large navigable rivers, in Russia and Europe for instance.

For crossing 'inland' seas, roll-on/roll-off transport is generally the best approach for transport chains that will primarily be by road mode with ships larger than river-going vessels. In other cases, transport chains may consist mainly of rail services transferring swap-bodies from train to vessel.

In either case, the advantages of extending the use of loading units -- perhaps ISO maritime containers, moreover -- which is set to expand in the Mediterranean in regional transport involving rail and sea modes.

The challenge with all such possibilities is, once more, a command of intermodal logistics so that the various modes can be used more effectively to limit infrastructure development and maintenance costs, and/or encourage alternatives to road transport.

The conclusion reached by this review of performance by mode is indeed that an improvement is possible.

- First, in economic terms, with productivity gains for each of the modes, particularly rail, which should now regain a greater role in many countries where it was exposed to competition from more dynamic road transport in the second half of the 20th century.

The reform of the rail system in many countries appears to have led to very significant improvements in its performance, as the liberalisation of rail transport under North American transport conditions -- in the United States and Canada -- has already demonstrated. In countries such as China and Russia, rail costs are also relatively low, the main concern being to commercialise new services.

- Secondly, in terms of organisation with the wider use of intermodal networks providing more flexible transport and a greater number of international routes, while reaping the benefit of each mode's specific features.

In a scenario of this kind, intermodal transport is a means of shaping new regional areas and providing new solutions for intercontinental transport, including combinations that use the maritime mode.

CONCLUSION

INTERMODAL TRANSPORT AND THE GLOBAL GOVERNANCE OF TRANSPORT

Globalisation, which gained a firm hold in the early years of the 21st century, is now a reality, although we have not yet properly grasped the full consequences of the accelerating pace of history in the last 10 years.

In early 2008, all of the high-profile annual reports by international bodies -- the IMF, the World Bank and the WTO -- highlighted the force of changes that were set to last. The global economic balance showed a drastic shift for the medium and long term, with a large growth differential between developed and emerging countries: a trend of around 2 % compared with 5.6 % or over.

These trends are all the more inevitable since major changes in demographic structural trends are also in the offing: in the growth in the labour force in various countries and those leaving the labour force; and in the scale of international migration, which already stands at over 200 million people worldwide, quite apart from the internal migration of rural populations swelling the population of the main urban centres at a rate never seen before.

Globalisation has thus already reached the point of no return. It is difficult even to talk about off shoring or "back shoring" when firms are already operating worldwide or have distributed their activities, profiting from a general rise in skill levels, while big wage differences will persist for several decades to come.

As far as transport is concerned, containerised shipping is also a reality for a large majority of products not transported in bulk. It is gaining ground over inland transport via major ports which have adapted to the requirements of global trade, and in some cases have shot to the top of world port rankings in just a few years, instead of the decades or centuries it used to take to achieve such a commanding position in world trade. Global seaport operators wield a great deal of influence in the organisation of worldwide transport and logistics.

Yet this trend does not happen without sending fault lines shooting through a system that is more complex and also more vulnerable. Crises turn into 'systemic crises', shocking in their suddenness, but they are also crises that were foreseen although no preventive mechanism could easily be deployed. The weakness here lies in the global governance of the economy, policies and transport whose future is virtually inseparable from the movement of goods and people and from environmental risks.

World transport is increasingly converging on a handful of major shipping routes, which are themselves vulnerable. The risk is both global and local.

In the field of inland transport, change has been more limited as this sector has to deal directly with the realities in a region, with friction between neighbouring countries; international inland transport remains very dependent on national regulatory systems.

There is thus a contrast between a global transport system that overcomes the rigidities of existing regulations and an inland transport system that is constrained by national regulations to them. Inland intermodal transport may provide an answer that has many advantages.

At local level:

- flexibility of transfer between modes depending on the availability of existing infrastructure or regulations;
- logistically efficient in association with transport by 'loading unit' to which production and distribution logistics can adapt;
- security associated with tracking capability.

At global level:

- greater choice of less polluting modes with more economic fossil fuel consumption (CO_2);
- more effective co-ordination of local and urban networks within international inland and maritime networks;
- greater diversity in the main worldwide ocean shipping and inland routes.

This system would be much more flexible as regards existing constraints, whether geographical, regulatory, or general and specific policy or corporate strategy objectives.

From this standpoint, inland intermodal transport may also be a 'transitional' system taking us a step closer to more specialised transport logistics systems with dedicated equipment, as in the automobile, chemicals or agricultural produce sectors.

However if such an intermodal transport system is to be put in place, several conditions have to be met.

- Efforts to standardise weights and measures, emissions standards, information transmission, and finally 'interoperability' for the most advanced regional systems. The loading unit issue is also crucial for "boxes" and semi-trailers.
- The establishment of transhipment hubs with the development of regional networks, which may also first serve as border hubs for facilitating transport between countries and safeguarding the information needed for logistics integration; hubs also facilitate transfer from one mode to another, and from one country to another when the technical, regulatory or even cultural requirements for interoperability have not yet been met.
- Easier administrative operations in conjunction with improved information for combined transport, specific international permits could be delivered for intermodal transport (terminal access, etc.) where necessary.
- Opening of new inland intermodal routes (corridor approach) across continents, which may combine sea and inland modes or maritime 'bridges' depending on geographical factors. Besides diversifying routes, the goal would also be to demonstrate by example: special attention might be paid to experience with developing hubs along these corridors.

So many technical and policy requirements for bringing these conditions about call for the 'global governance of transport', in which intermodal transport will become a kind of 'spearhead' for practical initiatives, and for establishing transport as a facilitator of relations between neighbouring countries and communities across the globe

At global level, specific political objectives may be assigned so that the expected growth in international trade does not lead to any increase in environmental damage, as revealed by indicators implemented to monitor the environmental impact of international transport.

However, policies must not remain just theoretical and must also be accompanied by actions suggested by analysis of trends

- raising awareness of standards problems: physical standards for inland intermodal transport (and SSS), emissions standards and documentation standards for facilitation;
- facilitating the siting of intermodal logistics freight terminals, genuine gateways to the global transport system and hubs for organising point-to-point logistics chains;
- promoting experience with international intermodal maritime and inland corridors and their different dimensions: infrastructure, operation and environmental impact;
- setting ourselves an aim: world trade growth with a positive environmental outcome (reduction in nuisance and emissions);
- worldwide transport monitoring.

A last remark concerns the present crisis producing a contraction of international trade and hitting the transport sector hard, particularly maritime transport.

In actual fact, the maritime transport sector is doubly a victim of this crisis.

- It was a victim of financial speculation when it attracted speculative capital for vessel financing in a context of overcapacity foreseen since 2007 and 2008, despite the continued growth in transport.
- It was hit hard by the economic crisis that followed the financial crisis and the subsequent decline in trade.

The bulk sector was heavily hit by charter rates falling by more than 50 %, 80 % or even 90 %.

Inland transport is also going through a deep recession but is less exposed with prices which are declining by much smaller percentages in the international transport sector.

Nevertheless, this decline in the costs of maritime transport is not without incidence on the choice of route and the tendency is toward longer maritime transport rather than inland transport whenever possible, which is not necessarily the best solution for the environment. At this stage, the long-term risks associated with energy and environmental deterioration must not be forgotten and sustainable solutions to the crisis must be sought.

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