



Strategic Transport Infrastructure Needs to 2030



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Foreword

Major international gateway and corridor infrastructures such as ports, airports and key rail routes are crucially important to the exports and imports of all the products and resources of modern-day economies. These infrastructures will become even more important in the future.

Following a brief recovery in economic growth rates at OECD and world level, at the time of writing global activity has slowed again and the near-term economic outlook is for very weak growth. However, over the longer term to 2030, modest but sustained growth is expected in developed countries and significantly higher growth in the major developing countries. International passenger and trade demand are likely to see strong growth as well.

As a result, rapidly increasing volumes can be expected, particularly along major trade and transport corridors between the largest regions, i.e. Asia (China, India), Europe and North America. Aviation and maritime services will carry most of the long-distance traffic, with ground handling likely to remain heavily concentrated at the major international gateway airports and ports.

This volume looks in particular at whether gateway ports, hubs and their inland transport connections are up to the demanding tasks ahead. Case studies explore the opportunities and challenges and help identify the pertinent key issues. Much of this infrastructure will require improved capacity to handle volumes two or three times current levels, not to mention the largest passenger aircraft and container vessels in use by 2030. Improved funding and financing arrangements will be needed in many countries, given their current deficit and debt levels and other expected demands on budget resources.

The report proposes a set of policy options to enhance the contribution of these infrastructures to economic and social development at home and abroad in the years to come. The options include recognition of strategic infrastructure (including gateways, hubs and key connections) in national policy frameworks and comprehensive measures to strengthen approaches and support the infrastructure development required.

The project from which this report is drawn followed on from previous OECD work on infrastructures to 2030, which addressed surface transport, energy, telecommunications and water infrastructures.

Funding and expert advice were provided by a steering group that included representatives from OECD member countries' Ministries of Transport, Mobility and Public Works, Environment and Energy, Sustainable Development and the Sea, as well as from other departments and agencies; non-OECD member economies (Chinese Taipei and India), international organisations (the European Investment Bank) and private enterprise. A full listing of steering group members is included in Annex A.

The OECD International Futures Programme team managed the project, which was undertaken in consultation with the OECD/International Transport Forum and Joint Transport Research Centre, with OECD in-house and external experts participating as appropriate (see also Annex A). The project explored the future opportunities and challenges facing some key gateway areas, inland hubs and their inland connections. A case study approach was taken to help “drill down” to assess the opportunities and challenges related to infrastructure; case studies were chosen following discussions with the steering group members. Workshops were undertaken to ensure input from local experts and to allow discussion and more detailed consideration of the assessment results.

The workshops were generally hosted by the country ministry principally involved and attended by participants from the relevant ministries of other countries as well as the OECD International Futures Programme project team. The purpose of these workshops was to allow the project to focus on several key aspects: the current situation in relation to gateways, inland transport and transit traffic; expected future growth and development; the infrastructure planned and related funding and financing arrangements; and opportunities and challenges related to the current and forecast positions.

The case study workshop report topics were:

- Northwest European Gateway Area – Port of Rotterdam;
- Turkey Bosphorus Area – Istanbul Marmara, Mersin and Nabucco;
- “High North”/Barents Area – strategic infrastructure in Finland and Sweden;
- France’s gateway ports – Le Havre, Marseille;
- Denmark – Greater Copenhagen Area;
- Austria/Switzerland – inland hubs;
- India – Mumbai Gateway Area, JNPT and other ports.

These case studies are available on the OECD International Futures Programme website at www.oecd.org/futures/infrastructure, and may be viewed individually by clicking the individual web links.

Workshop reports include background and factual material (e.g. on national policy settings and investment programmes) provided by the host ministries, agencies and workshop participants. Each report includes an assessment prepared by the OECD International Futures Programme project team of the opportunities and challenges facing the gateway area or inland hub and their international and inland transport connections.

Acknowledgements

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Abbreviations

ACI	Airports Council International
BOT	Build, operate, transfer
DoT	US Department of Transportation
EC	European Commission
EIB	European Investment Bank
ETP	Energy technology perspectives
FTKs	Freight ton kilometres
GDP	Gross domestic product
GDP pc	Gross domestic product per capita
GHG	Greenhouse gas
GTP	Green transport policy
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
IEA	International Energy Agency
IFP	International Futures Programme
IMF	International Monetary Fund
IMO	International Maritime Organization
PPM	Parts per million (of CO ₂)
PPP	Private-public partnership
RPK	Revenue per passenger kilometre
RTK	Revenue per ton kilometre
TEU	Twenty-foot equivalent unit (a measure of container size)
UNCTAD	United Nations Conference on Trade and Development
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
WB	World Bank
WEF	World Economic Forum
WEO	World Energy Outlook

Executive summary

Introduction

The OECD’s “Strategic Transport Infrastructure Needs to 2030” project brought together experts from the public and private sector to take stock of the long-term opportunities and challenges facing gateway and corridor infrastructure (ports, airports, rail corridors, oil and gas pipelines, etc.). The intention was to propose a set of policy options to enhance the contribution of these infrastructures to economic and social development at home and abroad in the years to come.

The project followed on from work undertaken for the OECD’s *Infrastructure to 2030* report (2006-2007) and focused on gateways, hubs and inland corridors, which were not covered in the earlier report. The project’s main findings, conclusions and key messages are set out below.

Global outlook and infrastructure needs

Outlook for economic growth

Over the long term, world GDP is expected to grow strongly and could in fact double over the period to 2030.

Differentiated patterns of global economic growth, already emerging before the recent financial crisis, are expected to continue. The highest economic growth is expected in the Asia/Pacific region; China and India would lead the way, with many other economies also growing strongly. Among the developed country regions, North America’s GDP could be 50% higher and Europe’s 40% higher by 2030.

GDP per capita levels in the high-income countries are expected to increase steadily over the long term. Higher than average GDP per capita growth can be expected in the largest developing economies. GDP per capita levels in China and India could increase three to four times by 2030. However, levels in the developing economies will still be much lower in 2030 than in the high-income group.

International trade

Economic growth and growth in international trade are major drivers of increased passenger and trade flows. Other important drivers include population growth, the increasing proportions of people living in cities, and the growth of megacities.

The widespread economic growth expected over the period to 2030 will be associated with rapid growth in trade – especially within Asia and between the major regions.

Transport

The long-term outlook is for increasing international transport demand, widely spread across regions and transport modes.

With global GDP possibly doubling by 2030, airline traffic worldwide could grow by around 4.7% per annum over 2010-2030; air freight could increase by around 5.9% per annum over the same period; maritime container traffic could increase by more than 6% per annum; and rail passenger and freight traffic worldwide could increase at around 2-3% per annum. On this basis:

- air passenger traffic could double in 15 years;
- air freight could treble in 20 years;
- port handling of maritime containers worldwide could quadruple by 2030.

In line with expected GDP growth, high initial growth rates in transport demand are expected to moderate over time. The strongest growth will be in the Asia region and between the large emerging economies (China, India) and Europe and North America.

Caution is advised here as these are reference case projections that only take into account policy changes that have already been announced. At present, there are many uncertainties about possible future policy changes and their impacts (mainly related to reducing CO₂ emissions and stabilising CO₂ concentrations in the atmosphere). There are also many other possible risks (e.g. related to financial crises and global shocks). Thus, uncertainties are attached to all projections, particularly those involving maritime and aviation traffic.

The global outlook for oil and gas demand also remains highly sensitive to possible policy action to curb rising CO₂ emissions. According to the International Energy Agency's "Current Policies Scenario", global primary oil use would increase between 2009 and 2035, driven by population and economic growth. Under the IEA's "450 Scenario" (aimed at restricting CO₂ concentrations in the atmosphere to 450 ppm), oil demand in 2035 would be lower than 2009 levels. Natural gas demand is set to resume its long-term upward trajectory from 2010 and is expected to be higher in 2035, under all IEA scenarios.

Competitiveness and infrastructure

Quality infrastructure is a key pillar of international competitiveness. Infrastructure networks reduce the effect of distance, help integrate national markets, and provide the necessary connections to international markets. Quality infrastructure is trade enhancing – especially for exports – and has positive impacts on economic growth.

Infrastructure investment needs

Globally, future investment needs over the period to 2030 will depend in part on the infrastructure currently in place, the growth in demand expected over that period, and the additional capacity required in the different locations.

Infrastructure to 2030 (OECD, 2006; 2007) concluded that global infrastructure investment needs across the land transport (road, rail), telecoms, electricity and water sectors would amount to around USD 53 trillion over 2010-2030.

The new assessments undertaken in the current volume conclude that global infrastructure investment needs – for airports, ports, rail, and oil and gas (transport and distribution) – could amount to over USD 11 trillion over 2009-2030.

The two previous OECD infrastructure reports together suggest that future annual investment needs across key sectors – telecommunications, airports, ports, road, rail, electricity, oil and gas (transmission and distribution) and water infrastructure – are likely to total around 2.5% of world GDP over 2010-2030.

Infrastructure investment needs could be a higher percentage of GDP in fast-growing developing economies, reflecting the extensive new infrastructure they will require and the increased maintenance needs that can be expected beginning around ten years after the initial investment in that infrastructure.

Strategic transport infrastructure

The importance of gateways, hubs and inland infrastructure

International gateways and trade corridors deliver services important to national and regional competitiveness, productivity, employment, quality of life and a sustainable environment.

The future growth in passenger and freight demand will lead to rapidly increasing volumes that will likely be concentrated along the major inter-regional passenger and trade routes – with increasing shares carried by extra-large aircraft and container vessels able to carry high volumes at lowest cost. And the major international gateway airports and ports will have both the high-volume capacity and the special facilities needed for these extra-large aircraft and shipping liners – and are therefore likely to benefit from both the increasing growth and a continuing concentration of demand. Increases in volumes can also be expected along inland connections from gateways to the cities and industrial areas in their hinterlands.

For these reasons, each country’s key international gateways and inland trade corridor infrastructure will become even more important to its national economy in the future.

Opportunities and challenges to be faced

A number of case studies to examine major infrastructure projects, both under way and in prospect, were undertaken for the present volume. Most studies benefited from workshops hosted by national authorities that allowed the OECD/IFP team to “drill down” to assess countries’ opportunities and challenges and future infrastructure needs. The case studies focused on:

- the Northwest European Gateway Area – Port of Rotterdam;
- the Turkey Bosphorus Area – Marmaray project, Mersin container port, Nabucco gas pipeline;
- the “High North”/Barents Area – strategic infrastructure in Finland and Sweden;
- France’s gateway ports – Le Havre, Marseille;
- Denmark – Greater Copenhagen Area;

- Austria/Switzerland – inland hubs;
- India Mumbai Gateway Area – Mumbai, JNPT and certain other ports.

The case studies confirmed the role that major international gateways, inland hubs and inland trade and transport connections play in international trade and passenger transport. As key economic infrastructures, they are centrally important to national growth and development.

As to the strategic transport infrastructure being developed or under consideration, the case studies highlighted many opportunities and challenges that are summarised in this report and set out in detail in the separate case study/workshop reports posted on the OECD/IFP website: www.oecd.org/futures/infrastructure. Key among these opportunities and challenges:

- benefiting from future economic and trade growth;
- changing policy objectives (competitiveness, green growth and a “greening of transport”);
- better gateway structures and organisation;
- improved strategic planning and evaluation processes;
- the significant increases needed in infrastructure capacity;
- the improvements needed in international connections;
- better funding and financing for gateways and inland infrastructure;
- national policy frameworks better adapted to strategic transport infrastructure.

Will current infrastructure be adequate?

The short answer is “no”. Most of the gateway and corridor infrastructure currently in place could not handle a 50% increase, let alone a doubling or tripling of passengers and freight in 20 years. Many gateways need greater capacity to meet the projected rapidly increasing demand from 2010-2030. Importantly, greater inland transport capacity is needed to match additional gateway capacity.

The gateway and corridor infrastructures that actually get built will depend on broad national objectives and national and gateway policies and plans for handling such increasing demand. Major infrastructure can take 10-20 years to plan and develop and the useful life of the infrastructure may be 50 years or more.

Countries will need to get two crucial things right at the same time if they are to plan, develop and fund the infrastructure needed in the locations and at the time required. The two essentials are national policy frameworks and assured funding.

National policy frameworks

National policy frameworks must set down how strategic infrastructure is to be planned, evaluated, developed and financed – as well as provide a solid basis for communication with stakeholders and the public. Most of the countries in which case studies were undertaken had good national policy frameworks; nonetheless, there is room for improvement.

National frameworks need to highlight the importance of strategic infrastructure. As the European Commission now recognises, there needs to be a focus on strategic, multi-modal “core networks” that can be funded and will be able to handle the major share of the future growth and transport tasks.

A recurrent concern is that many countries do not assign the same priority accorded to gateway ports to the key inland rail, road and waterway connections required to move freight between the gateway ports and the cities and industrial areas in the hinterlands they serve. There needs to be a (new) “strategic infrastructure” category that actually includes the major international gateways **and** their key inland connections. The inclusion and linking of gateway and inland connection needs in national policy frameworks will be important for the downstream actions required, including reservation of land for gateway expansion, funding of the new corridors, and increasing capacity on the existing corridors needed for key inland connections.

National policy frameworks are also important for gateway structures and organisation. “Landlord port” models are widely used, with port terminal infrastructure and freight/logistics services provided on a competitive basis by private operators. Government-owned corporation structures – such as are used by the Port of Rotterdam – are a possible next step. In conjunction with user-pays, they create opportunities for ports to become fully self-financing, important for reducing demands on budget funding.

Funding and financing major gateway port and inland transport infrastructure

A well-performing transport network requires substantial resources to maintain the quality and condition of the infrastructure and to meet future needs. The impacts from any lack of investment are not only tangible but also economic. The construction-cost inflation associated with deferred investments can be greater than borrowing and other financing costs involved in earlier funding – but the losses in economic and societal benefits are likely to be greater still.

National and local governments and their ports mostly retain primary responsibility for gateway port infrastructure provision and regulation as well as for inland road and rail transport infrastructure. Major infrastructure is funded directly from government budgets.

In countries with major ports that are dependent on government funding, there are real concerns that given the post-crisis fiscal situation, future funding of gateway and inland transport infrastructure from traditional sources could “dry up” at the same time as infrastructure needs increase quickly.

Innovative funding and financing – possible options

Improved funding arrangements will be needed in the future to ensure funding security and funding levels consistent with strategic infrastructure needs. The case studies uncovered good practice examples of funding and financing arrangements over five- to ten-year periods, including:

- Multi-year funding for strategic/major projects, supported by dedicated project-specific organisational and funding structures. An example is the Danish government-owned corporation set up to construct, operate and charge for use of the Fehmarn Belt link (Denmark – Germany), to be completed by 2020.

- Fully funding an entire multi-modal programme of infrastructure projects for ten years. One example is Danish Government approval of a full multi-modal land transport programme to 2020, with its Infrastructure Fund providing the secure funding needed for that period. Another is Swiss Infrastructure Funds established for special financing of road traffic (1958) and major railway projects (1998). Also, in 2008, Switzerland established a new Infrastructure Fund for completion of the motorway network and metropolitan transport (road and rail) projects.
- Allowing savings on approved project costs to be retained for future programme funding.

These and other options can help balance long-term needs and the economic advantages of investing in infrastructure against short-term pressures and the costs and consequences of not investing.

In some countries with a high quality of overall infrastructure, diversified infrastructure funds play an important role in delivering project and programme funding. They could play a role in countries that are reliant solely or primarily on budget funding. Such long-term funds are likely to have:

- earmarked, multiple sources of funding – e.g. Budgets, fuel taxes, user charges, savings;
- some cross-financing from road taxes and revenues to rail/public transport infrastructure;
- any funding reviews signalled well in advance.

Private-sector investment

In many countries, private-sector financing has proved important in helping deliver the equity and debt financing needed to make infrastructure projects operational. Private-sector involvement can also help manage the transition to user-pays/self-financing investments.

Private funds invested directly in listed and unlisted infrastructure assets are already active in many infrastructure markets.

Pension funds are well-resourced and potentially larger investors in transport infrastructure. However, access is needed to better-quality projects that have risk-reward balances consistent with their responsibilities to fund contributors' interests. Strategic transport infrastructure could be attractive in this regard. Public-private partnerships (PPPs) are also widely used – in the transport sector, primarily for facilities that have a degree of monopoly in their geographic areas. Examples include major roads (in conjunction with user revenues from road tolls) and international gateway airports/terminals. PPPs are often successful but there have also been some significant failures.

Privatisation (full or partial) of publicly owned infrastructure also plays a major role.

In the future, given expected limitations on public funds, increased private-sector investment will be essential.

Planning and evaluation

National visions need to reflect wider objectives, including those related to economic and trade growth, productivity, competitiveness and sustainability. National infrastructure plans adapted to new international settings will help establish future directions and guide detailed planning.

Long-term strategic infrastructure (with consistent policies, co-ordinated developments and connected networks) is an essential element in project planning and evaluation. Planning horizons need to be long enough for full evaluations and may well extend to 2050. Good projects can only be established on the basis of good planning and evaluation, with merit-based ranking.

Protecting the environment and improving sustainability – including reducing CO₂ emissions – have also become more important policy objectives. There is increasing support for green growth and a “greening of transport”. Important contributions can be made during infrastructure planning and development stages. Once developed, good management and use of innovative and energy-efficient technologies can significantly increase these contributions.

Evaluation processes for strategic infrastructure need to be adapted to the changing objectives, including international competitiveness and green growth. Evaluations need to be improved to capture the full range of benefits and costs that can be expected over the longer periods involved. These improvements should include, *inter alia*: lower discount rates to better and more consistently value long-term costs and benefits (e.g. CO₂ reductions); analyses undertaken from an international as well as domestic perspective; and accounting for dynamic changes generated by strategic infrastructure over short and longer periods, in addition to “static” effects (e.g. estimated user savings).

In conclusion, an integrated package of measures is needed to get investments in strategic infrastructure back on track in countries whose strategic infrastructure is not rated highly enough. The strategic infrastructure package needs to include improvements across all major factors, encompassing: national policy frameworks, more commercial business models, better planning and evaluation, “assured” long-term funding and financing, adequate gateway capacity, efficient international and inland connections, and green growth and a “greening of transport”. Once these improvements are made, better strategic infrastructure with clear construction schedules can be expected – and better stakeholder communications can be expected to follow.

Key messages

Over the longer term, world GDP is expected to grow strongly and could possibly double over the period to 2030. On this basis:

- Air passenger traffic could double in 15 years; air freight could triple in 20 years; and port handling of maritime containers worldwide could quadruple by 2030.

Quality infrastructure is a key pillar of international competitiveness. It is trade-enhancing – especially for exports – and has positive impacts on economic growth.

Major international gateway and corridor infrastructures are crucially important to the exports and imports of all the products and resources that the economies of all countries need. In the future, they will become even more important.

- There needs to be a new “strategic” infrastructure category that includes the major international gateways **and** their key inland connections.

Current gateway and inland transport infrastructure capacity will not be adequate to meet 2030 demand.

- Most of the current gateway and corridor infrastructure could not handle a 50% increase, let alone a doubling of passengers in 15 years or a tripling of freight in 20 years.

Despite the recent financial crisis and recession, which has increased deficits, debt and unemployment:

- Countries with good planning processes and strategic infrastructure plans linked to assured funding are continuing to successfully build the strategic infrastructure they need.

In the future, since funding of gateway and inland transport infrastructure from traditional sources will “dry up”:

- Improved funding is needed in many countries to ensure funding security and levels consistent with the development of the strategic infrastructure required to meet future needs.
- Countries without good funding arrangements may not see their strategic infrastructure built.

In many countries, there needs to be greater project certainty and funding assurance, because:

- Plans without assured funding can create a credibility gap, weaken stakeholder interest, and damage future gateway performance.

Given the risks to future infrastructure funding in countries with an over-reliance on budget sources:

- Infrastructure funds like the ones being used successfully in a number of countries could be central to the more secure government funding of strategic infrastructure needed in other countries in future.

In many countries, private-sector financing has been important in helping deliver the equity and debt financing needed to make infrastructure projects operational.

Key messages (cont'd)

- Private involvement can also help manage the transition to user-pays/self-financing investments.
- Part and full privatisations may increase efficiency as well as reduce public funding requirements.

Private funds invested directly in listed and unlisted infrastructure assets are already active in many infrastructure markets.

Pension funds are well-resourced and potentially larger investors in transport infrastructure. However:

- Access is needed to better-quality projects that have risk-reward balances consistent with fund contributors' interests. Strategic transport infrastructure could be attractive in this regard.

In the future, given expected limitations on public funds:

- Increased private-sector investment in strategic transport infrastructure will be essential.

There is increasing support for green growth and a “greening” of transport. Important contributions can be made during infrastructure planning and development stages. Once developed, good management and use of innovative and energy-efficient technologies can significantly increase those contributions.

Part I

The traffic growth challenge

Chapter 1

The global and regional outlook for the economy, trade and transport

Reference projections suggest “global GDP will continue to grow strongly and could double over the period to 2030” – and GDP, GDP per capita and international trade are major drivers of increased passenger and trade flows and related international transport needs. In the future, the largest increases in these flows are expected intra-Asia and along the major trade routes between Asia and the largest developed regions, i.e. Asia-North America and Asia-Europe. In terms of trade, world port container volumes could be three to four times higher by 2030 and five to six times current levels by 2050. Rail passenger and freight demand could increase at around 2-3% per annum, close to world GDP. Robust but differentiated global economic growth across developed and developing countries – and the resulting trade and transport growth – will place increasing pressure on infrastructure, which will need to handle the large increases in traffic.

The global and regional outlook mapped out in this chapter reflects forecasts and projections prepared by authoritative sources. The projections themselves are based on well-established “framework assumptions” on matters such as world population growth, world economic growth, and expected GDP per capita. Over long periods in the past, such framework assumptions have proved very reliable. Although the assumptions remain just that and are no guarantee for the future, they are considered likely to provide a fairly robust basis for projections in the future as well.

In accordance with convention, the reference case projections outlined in this report are based on expected outcomes in the absence of future policy changes – i.e. they reflect only policies in place or that have already been announced. Possible future financial crises and unforeseen and “*force majeure*” events are not explicitly taken into account. Although such events can be expected to occur from time to time, usually there is absolutely no advance knowledge about their timing. In any circumstances, the uncertainties in looking forward to 2030 and especially to 2050 would need to be acknowledged and taken into account when interpreting the projections presented.

Clearly in current circumstances, there are potential impacts associated with unchecked CO₂ emissions and climate change, as well as from imposed measures to reduce CO₂ emissions and concentrations. Any climate/CO₂-related policy measures could have a significant impact on demand – which could fall outside the bounds associated with the business-as-usual assumptions and demand relationships underpinning the reference case scenarios. Of course, other policy directions currently under consideration could also lead to paradigm shifts and futures somewhat different from the ones implied by reference case projections and a continuation of current trends.

Economic outlook

Financial crisis: Global and European recovery

The International Monetary Fund’s *World Economic Outlook Update* advised that the two-speed recovery is continuing.

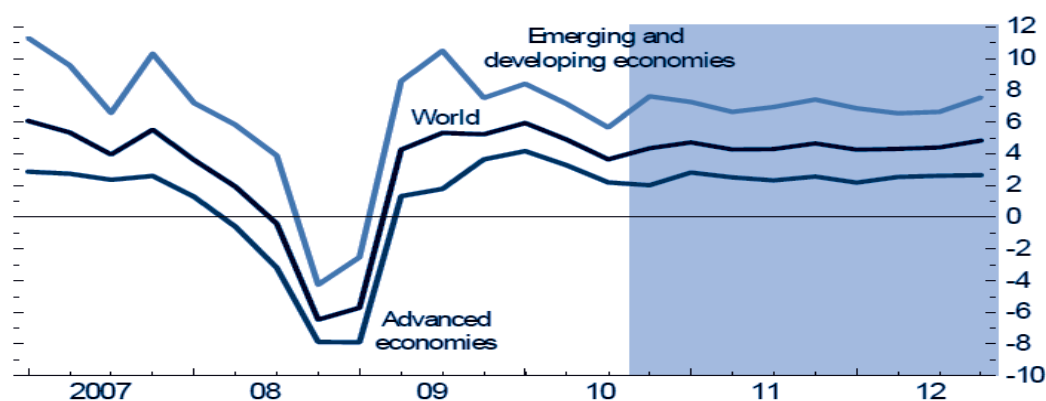
In advanced economies, activity has moderated less than expected, but growth remains subdued, unemployment is still high, and renewed stresses in the euro area periphery are contributing to downside risks. In many emerging economies, activity remains buoyant, inflation pressures are emerging, and there are now some signs of overheating, driven in part by strong capital inflows. Most developing countries...are also growing strongly. Global output is projected to expand by 4.5% in 2011. (IMF, 2011)

Figure 1.1 highlights that the world economy could grow more strongly in 2012, underpinned by high growth in “emerging and developing economies” and steady growth in “advanced economies”.

The impacts of the crisis were more severe in Europe than in many other parts of the world. European countries suffered sharp falls in GDP in 2009, followed by a slow – and often tentative – recovery in most countries in 2010. Fiscal consolidation will be needed in all countries, given their lower tax receipts during the recession, large “stimulus” funding, and the elevated unemployment levels in many countries.

Figure 1.1. **Global GDP growth**

%, quarter over quarter, annualised



Source: International Monetary Fund (2011), *World Economic Outlook Update: An Update of the Key WEO Projections*, IMF, Washington, D.C., January.

Global outlook to 2030 and beyond

There will be continued global population growth, with growth rates decreasing over time. Global population is expected to increase from 6.5 billion in 2005 to 8.2 billion in 2030, and 9.2 billion in 2050.

World GDP is expected to grow strongly, perhaps doubling over the period to 2030. By 2050, global GDP could grow to three to four times its current level.

Differentiated patterns of global economic growth evident since the recent financial crisis are expected to continue. The highest economic growth is expected in the Asia/Pacific region – underpinned by China and India – with many other economies also growing strongly. Among the developed country group, North America’s GDP could be 50% higher and Europe’s 40% higher by 2030.

GDP per capita is expected to grow by around 60% over the period 2007-2030; levels in the high-income countries are expected to increase steadily. The largest absolute increases will be in OECD developed countries; the fastest growth rates, however, will be in developing countries, with high growth expected in the largest developing economies, China and India. Nevertheless, GDP per capita levels in the developing economies will still be much lower in 2030 than in the high-income group.

Regional outlook

Asia – Asian economic growth is expected to be very strong over the period to 2015, with growth widely spread round Asia and South-East Asia. In the medium and longer term, strong Asian growth is expected to continue but at lower rates, lessening the differences in growth rates between Asia and the rest of the world. Nevertheless, GDP in China and India could increase three to four times over the period to 2030 – and could grow seven times or more over the period to 2050. GDP per capita could increase to levels seven times higher in China and over five and a half times higher in India over 2005-2050.

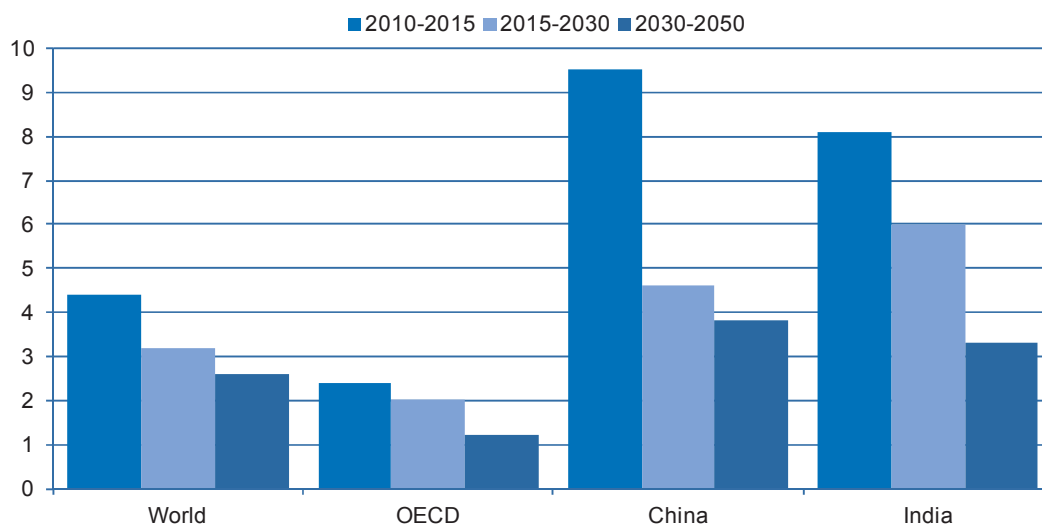
Europe – projections anticipate a slowing in population growth over the period to 2050. In the short term, Europe is likely to benefit from the stronger economic growth in and increasing trade with China, India and other developing countries/regions. In the medium term, robust European economic growth of around 1.8% per annum is expected over 2015-2030. As a result, GDP is expected to grow but more slowly than previously, i.e. around 40% over 2007-2030; it could increase by a little over 60% from 2007 to 2050. In combination, these trends will contribute to steady but significant increases in GDP and GDP per capita for Europe as a whole and in most European countries.

North America – population projections anticipate the North American population increasing from over 450 million in 2010 to close to 540 million in 2030 and 580 million in 2050. In the short term, GDP growth will be below trend levels as the United States deals with the consequences of the financial crisis and recession. GDP growth from 2015 to 2030 is expected to be around 2.3% per annum – with GDP rising over 50% by 2030.

Other regions – higher growth than historic trend levels is expected in some large economies (e.g. Brazil, Indonesia) and in developing countries in other regions, including the Middle East, Latin America and Africa.

Anticipated GDP growth rates for OECD member countries, China and India highlight the differentiated economic growth expected over the next 10-20 years – with some convergence later (Figure 1.2).

Figure 1.2. **GDP growth rates per annum: Major economies**



Source: International Energy Agency (2010), *Energy Technology Perspectives 2010: Scenarios and Strategies to 2050*, OECD Publishing, Paris, June, http://dx.doi.org/10.1787/energy_tech-2010-en.

Economic growth associated with increasing urbanisation and growth of major cities and megacities

Urbanisation levels are increasing rapidly around the world, particularly in developing regions and countries. Recent UN data suggest that for the first time in history, more people live in cities and towns than in rural areas. Given that factor plus increasing population levels, the outlook is for cities to grow rapidly, particularly cities in developing countries.

There will be a great increase in the number and size of megacities, particularly in Asia. Experience over many years indicates that urban population growth and development leads to increasing productivity and contributes to economic growth – and generally, to higher income levels.

Trade growth and outlook

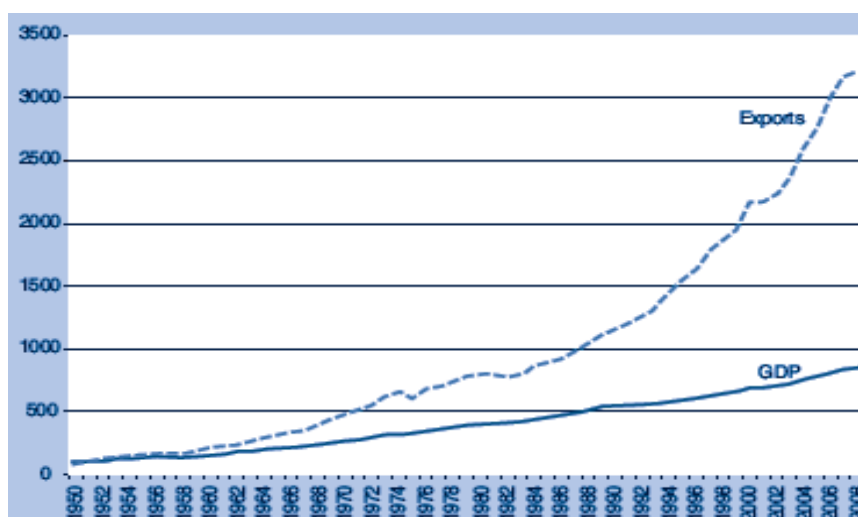
Relationship between GDP and trade

The global and regional increases in population levels and economic activity have been associated with increasing trade and trade-related transport requirements. In general, trade growth rates have exceeded the rate of increase in global GDP. From 1970 to 1990, trade growth was around 1.5% per annum above GDP growth; between 2000 and 2006, it was approximately twice the GDP increase (WTO, 2007). For many years, world merchandise exports have grown at faster rates than global GDP.

The trend in export trade elasticity to GDP can be seen clearly in Figure 1.3, which covers 1970-2004. From 1990 to 2000, the figure was close to two; it then remained above two through to 2004. More recently, the elasticity increased to a peak level of around 2.5 before 2007, but fell with the recession.

Figure 1.3. **World economic growth (GDP) and world merchandise exports (volumes)**

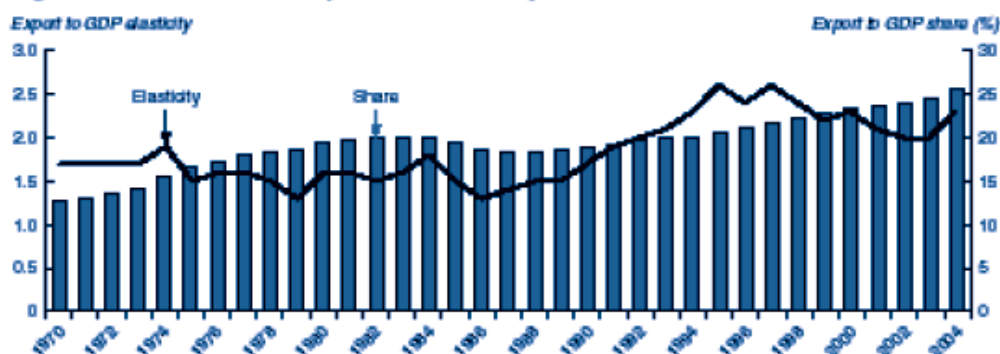
Indices, selected years (1950 = 100)



Note: Merchandise trade refers to trade in goods that adds or subtracts from the stock of material resources of a country by entering (imports) or leaving (exports) its economic territory. Trade volumes data are derived from customs values deflated by standard unit values and the adjusted price index for electronic goods.

Source: UNCTAD (2009), *Review of Maritime Transport 2009*, United Nations, Geneva, based on World Trade Organization (2008), *International Trade Statistics*, Table A.

Figure 1.4. Growth in trade exports as a share of GDP



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

Source: Reynaud, Christian (2009), “Globalisation and its impacts on inland and intermodal transport”, ITF Forum Paper 2009-5, OECD/ITF, Paris.

In the future, world trade is expected to increase steadily but with both the trade elasticity-to-GDP ratio and trade growth rates possibly lower than before.

The patterns of international trade flows in 2006 by value are shown in Table 1.1.

Table 1.1. Intra- and inter-regional merchandise trade flows (2006)

Trade flow	Trade value (2006 USD billions)	% of 2006 trade value
Intra-Europe	3 651	31.1
Intra-Asia	1 638	14.1
Asia – North America	1 022	8.8
Asia – Europe	970	8.3
Intra-North America	905	7.8
Europe – North America	709	6.1
Asia – Middle East	451	3.9
CIS – Europe	388	3.3
Africa – Europe	268	2.3
Central/South America – North America	242	2.1

Source: WTO (2007), *International Trade Statistics in 2006*, WTO, Geneva.

The top six flows in 2006 involved just three regions, Europe, Asia and North America; trade within and between these regions accounted for three-quarters of world trade value. Internal European flows alone make up almost one-third of all international trade. Six of the top ten countries involved in international trade are European, with two from North America (Canada, United States) and two from Asia (China, Japan).

Impact of the crisis and trade recovery

The worst global recession in over seven decades led to a sharp decline in the volume of global merchandise trade. International seaborne trade volumes (loaded) contracted by 4.5% in 2009 to 7.94 billion tons. By early 2010, global recovery was under way, led by fast-growing developing economies, although it was uneven and fragile. Global trade recovered during 2010 – building on the continuing economic growth in China, India and other major developing countries. By the end of 2010, there had been a relatively robust recovery in both developing and developed countries.

Maritime trade and transport composition

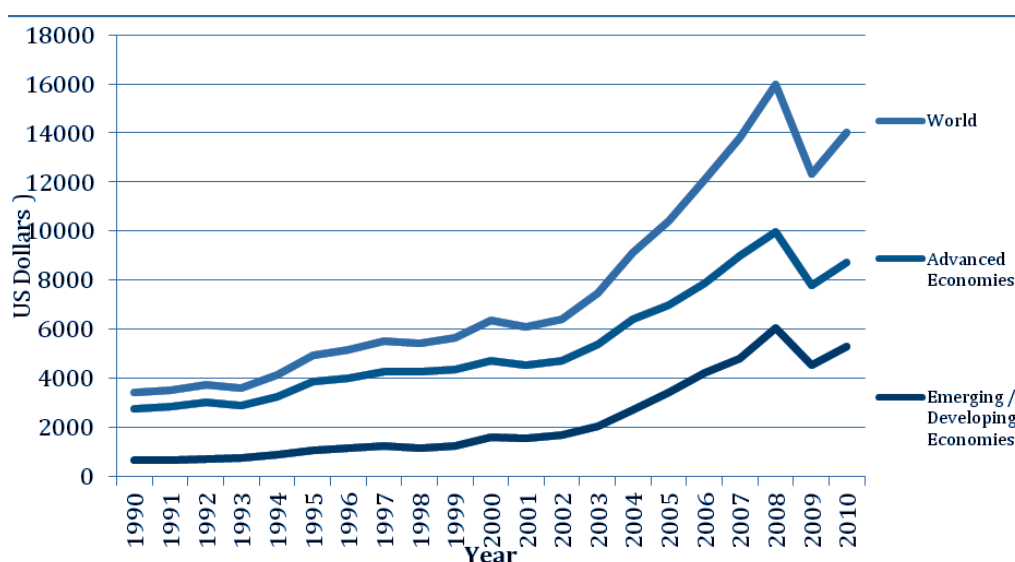
Maritime trade represents the major share of world merchandise trade by volume. Maritime shipping and ports handle the bulk of freight tonnage moved around the globe.

Maritime freight demand

The main cargo types are crude oil, petroleum products and gas (including LNG); dry bulk cargoes, including iron ore, coal, grain, bauxite/alumina and phosphate rock; and containerised cargoes.

Figure 1.5. **World trade – annual exports of goods**

USD billions (1990-2010)



Sources: WTO (2010a), *International Trade Statistics 2010*, Geneva; WTO (2010b), *Trade Growth Forecast Revised Upwards for 2010*, Press Release September 2010, Geneva; and OECD (2011), *Main Economic Indicators, International Trade*, OECD. StatExtracts.

Maritime demand for these main cargo types can be expected to continue increasing to 2030 and beyond. Crude oil and petroleum products demand in most OECD member countries is expected to stabilise but gas (including LNG) will increase. All are expected to increase strongly in China and India and other developing countries/regions. Dry bulk

cargos, including iron ore, coal, grain, bauxite/alumina and phosphate rock can also be expected to increase in the regions with the fastest economic development – the Middle East, South America and South-East Asia, as well as those regions and countries with the fastest population growth to 2030 and beyond (e.g. India, Africa, South America). However, container traffic – which over the past two decades increased at around 8-10% per annum – is expected to remain the fastest-growing category of maritime freight on a global basis.

Indeed, while all categories of cargo are important to most ports, the container trades need special attention and are the major maritime focus in this report.

Containers

Container traffic growth was particularly strong during the 1990s and up to 2007, exceeding world trade growth by a large margin. It increased at even faster rates relative to GDP. Then in 2008 container handling slowed, falling around 10% in 2009 globally but by much more at many ports. Container volumes then recovered strongly in 2010, with global growth of around 10% per annum. (Estimated container flows between major regions in 2008 and the levels achieved in 2009 are set out in Table 1.2.)

Table 1.2. **Estimated cargo flows on major east-west container trade routes**

Millions of TEUs

	Trans-Pacific		Europe-Asia		United States-Europe	
	Far East-North America	North America-Far East	Asia-Europe	Europe-Asia	United States-Europe	Europe-United States
2008	13.4	6.9	13.5	5.2	3.3	3.3
2009	11.5	6.9	11.5	5.5	2.5	2.8

Source: UNCTAD (2010), *Review of Maritime Transport 2010*, United Nations, Geneva, based on European Liner Affairs Association and *Containerization International* (2010), August.

Demand outlook to 2015

Container traffic is expected to grow strongly again over the short term to 2015, though not necessarily as strongly as before. Nevertheless, container volumes are expected to increase quickly within Asia. Volumes are also expected to recover and continue to grow on routes across the Pacific between Asia and North America and, via the Suez Canal, between Asia and Europe.

Substantial increases can also be expected across the Atlantic between North and South America and Europe. Traffic growth, albeit in smaller volumes, can be expected between developed countries, the Middle East and other developing regions. Significant increases are also anticipated along routes between major developing countries in different regions as well (e.g. in Africa, Asia and South America).

Demand outlook to 2030/2050

Trade growth sets a “floor” level for container growth. Over many decades, growth in international trade was around 1.5% above GDP growth, while container volumes increased at much faster rates as container shares of world trade volumes increased.

Over the past two decades, while GDP growth has been around 3-4% per annum, port handling of containers has increased on average 8-10% per annum. Drewry Shipping Consultants (2010) projects container throughput to increase globally by an average of 7.2% a year between 2009 and 2015, with the result that global container port volumes would increase by just over 50% in that period. Those estimates are based on global TEU growth factors that have been increasing on average by 5.6% per annum above GDP increases. The high rates of TEU growth are generally well replicated by models along the following lines:

$$\text{Change TEU/TEU} = k * \text{change GDP/GDP}, \text{ with } k \text{ a growth factor for the faster rate of TEU growth}$$

Given the scarcity of long-term projections for container handling, the project team made its own assessments (taking Drewry's forecast to 2014 as a starting point) utilising a range of scenarios that recognised the strong growth of containers in maritime transport over the past few decades as well as the uncertainties. According to these, the higher growth scenario has port handling of containers possibly quadrupling by 2010.

The assessments are set out in Table 1.3, with more detail in Annex C.

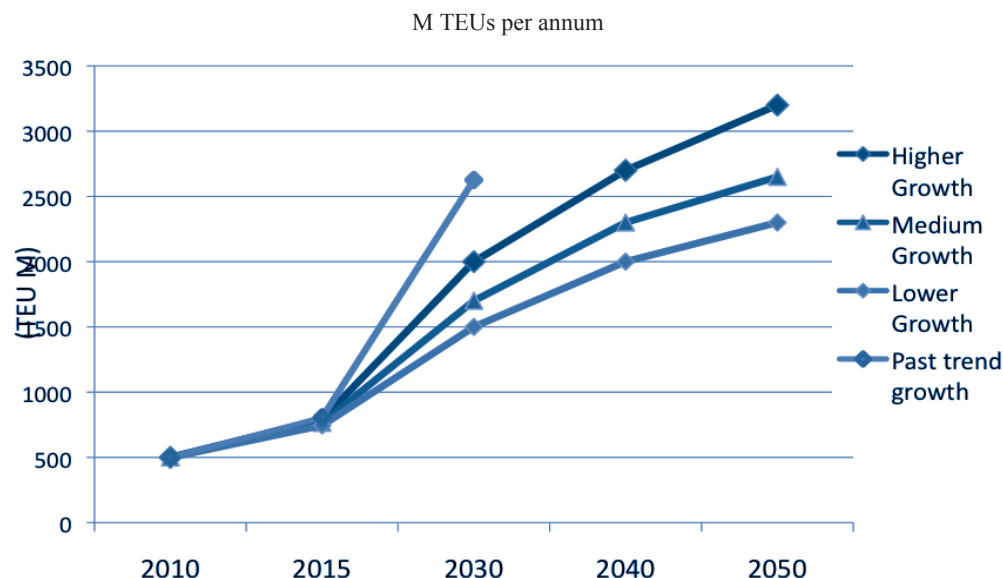
Table 1.3. **World port container handling (including trans-shipment)**

Millions of TEUs per annum				
TEU growth scenario	2010	2015	2030	2050
Higher TEU growth	500	790	2 000	3 200
Medium TEU growth	500	765	1 700	2 650
Lower growth	500	745	1 500	2 300

Source: Project authors' estimates, taking into account Drewry Shipping Consultants projections to 2014.

The project authors' assessments of port container handling (including trans-shipment) are shown in Figure 1.6.

Figure 1.6. **World port container handling – higher, medium, lower TEU growth scenarios**



While recognising the long period of rapid growth to date and the likely future impact of the “upside” factors, including increasing shares of containerisation in some markets, using past growth trends to calculate future levels of world port container handling would nonetheless generate unrealistic results – both in terms of overall shipping (as the IMO points out) and probably also in terms of the port container handling capacity and investment expenditure that would be required.

At the same time, all project scenario assessments could be regarded by some as somewhat conservative, because they assume a gradual “sea change” away from the long-standing trend levels of Drewry’s “Regional Container Activity and Economic Wealth” forecast. The actual recent worldwide levels of container handling since the recession seem to be broadly in line with the lower growth scenario projections over the period to 2015. Container demand has remained subdued in most developed countries – which, from a global perspective, has counterbalanced somewhat the strong current growth occurring in developing countries and regions. If differentiated growth between developed and developing countries does continue in the future, as currently expected, moderate levels of growth in port container demand in many developed countries might continue as per the medium TEU growth scenario for some time.

Container vessel size and port handling

As containerisation has evolved, the size of the largest available container ships has increased. This has been a stepwise process. Changes have been rather sudden and often correspond to the introduction of a new class of containership by a shipping company (Maersk Line was usually the main early mover). Since the 1990s, two substantial steps have taken place. The first involved a jump from 4 000 to 8 000 TEUs, effectively moving beyond the “Panama” threshold of around 5 000 TEUs. The second step took place in the 2000s: a leap up to the 10 000-12 500 TEU level. This is essentially a “suezmax” level, or a “new panama” class when the extended Panama Canal is expected to be completed in 2014.

Indications are that the largest container vessels being delivered will operate among a smaller number of deep sea ports. In Europe for example, the numbers of deep sea ports able to handle recent E-class vessels are expected to be limited to just four – Le Havre, Zeebrugge, Rotterdam and Hamburg (with dredging).

In February 2011, Maersk Line announced an order for the world’s biggest container ships, each with a capacity of 18 000 TEUs. The new vessels will be 400 metres long and 59 metres wide – bigger than any existing ship. Maersk noted that container shipping – where volumes grew for much of the past decade at about 10% annually – was “back on its growth trajectory”. The cost of operating these ships would be 26% less per container moved compared with similar container ships now operating. The first of the ten ships ordered are expected to enter service in 2013 and 2014.

Clearly, these 18 000 TEU capacity container vessels are likely to be deployed on the highest-volume trade routes. Increasing numbers of such high-capacity container ships able to deliver containers at significantly reduced costs can be expected to further concentrate the container cargo movement along the high-volume trade routes. They will only be able to call at the even fewer deepwater ports that have the draft depth, berthing lengths and the container handling equipment they need.

The much larger container vessel sizes coming on stream will have considerable cost advantages in large-volume markets. They will increase the pressure on the largest gateway ports and terminal operators to develop port facilities commensurate in size. If the ports do not react, they will face the prospects of their competitive positions being damaged by shipping lines and logistics/supply chain providers taking their business elsewhere. Ports will therefore need to be proactive in providing the facilities required, improving productivity and providing world-class and competitive container services.

Trade routes: The big picture

Major trade routes between Europe, Eastern Europe, the Middle East, South Asia (India), South-East Asia and North Asia (China and Japan) are shown in Figure 1.7, which highlights the major port locations, the major maritime routes and diversifying inland routes.

Figure 1.7. Diversifying inland and sea routes between Asia and Europe



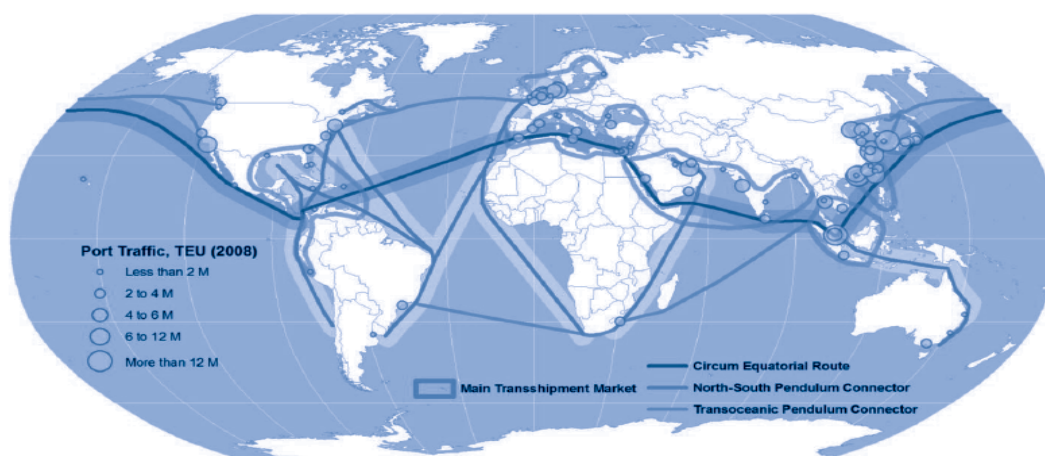
Source: Reynaud, Christian (2009), “Globalisation and its impacts on inland and intermodal transport”, ITF Forum Paper 2009-5, OECD/ITF, Paris.

Possible changes

A number of possible changes in trade routes and other expected maritime developments were raised in the case studies and workshops. The balance of demand along major trade routes is expected to change in the future as a result of a number of developments. A brief summary is set out below.

The emerging global maritime freight transport system is highlighted in Figure 1.8.

Figure 1.8. The emerging global maritime freight system



Source: Rodrigue, J.-P. (2010), “Emerging global maritime freight transport system”, speech delivered at Hofstra University, New York for the International Transport Forum.

Box 1.1. Possible short-term changes that could affect trade routes

These include:

- Completion of European TEN-T rail, road and waterway priority projects currently under way.
- Panama Canal enlargement – building of the third set of locks expected to be complete by 2014.
- Increasing liner shipping services from Asia/South Asia to Europe/North America via the Suez Canal.
- The greatly increasing size of liner ships that are currently being ordered and delivered, which will only be able to berth at a relatively small number of true deepwater ports.

Changes can also be expected in trade along routes using the Mediterranean, Bosphorus and Black Seas as demand develops. Completion of the TEN-T projects will lead to improved internal road and rail transport connections within the European Union, as well as to and from surrounding regions.

- Further changes can be expected to result from the EU work on its “core network” and its work on TEN-T and its connections outside the EU, in particular extensions to Eastern Europe/Eurasia.

Possible changes in the medium term to 2030 could include:

- Improved land transport connections between Asia and Europe, including possible upgrading of sections of the Russian, Trans-Siberian and Trans-Asian rail links (as proposed by UN ESCAP and other parties).
- Improved maritime connections with more localised impacts, e.g the proposed Sethusamudram Ship Canal dredging project in southern India to allow passage between India and Sri Lanka.

In the longer term (to 2050), new trade route possibilities could include:

- The Kra Canal across the Thai isthmus, which could dramatically reduce shipping distances between North Asia and Europe and avoid the security concerns associated with the Malacca Straits. The Kra Canal would be a huge and massively expensive project – major reasons why it has not gone ahead to date, although it has been under consideration for several hundred years.
- Opening of the Northern Sea Passage (north of Russia) for up to three months per year – and/or the Northwest Passage (north of Canada) for longer than at present.

A possible outlook for maritime route developments is described in Box 1.2.

Box 1.2. Possible outlook for maritime route developments

Circum equatorial route. With the expansion of the Panama Canal expected to be completed in 2014, a relative parity will exist for the first time between the Panama and Suez canals. Maritime shipping companies may elect to establish circum equatorial routes in both directions with high-capacity (8 000 to 12 000 TEU) containerships. This high-frequency “conveyor belt” could support a significant share of global east-west freight movements in a cost-effective way.

North-south pendulum connectors. These connectors reflect existing commercial relations, namely for raw materials (oil, minerals, agricultural goods), such as South America/North America, Africa/Europe and Australia/Asia. The rationale for container shipping is that there is not enough volume to support transoceanic services, so cargo is collected/delivered along a latitudinal sequence of ports. A circum equatorial route could expand the conventional network’s trans-shipment opportunities.

Transoceanic pendulum connectors. The three main transoceanic connectors are transpacific, Asia-Europe (through the Indian Ocean) and transatlantic. The industrialisation of Asia (China in particular) has made the Asia-Europe and transpacific connectors particularly important. Growth within the BRIC countries (Brazil, Russia, India and China) favours the emergence of a new connector in the southern hemisphere between the east coast of South America, the Cape of Good Hope and South-East Asia.

Trans-shipment markets. Regional port systems connect to transoceanic and circum equatorial routes mainly through hub-and-spoke services. The relay function between long-distance shipping services performed by those markets is also significant. The most important trans-shipment markets are South-East Asia, the Mediterranean and the Caribbean. They are referred to as markets because the trans-shipment function can be substituted to another port. Therefore, a group of ports in a trans-shipment market are “bidding” for port calls, as this type of traffic is difficult to anchor. The development of circum equatorial routes is thus likely to expand the opportunities of trans-shipment, including interlining between these routes.

Source: Rodrigue, Jean-Paul (2010), “Emerging global maritime freight transport system”, speech delivered at Hofstra University, New York for the International Transport Forum.

Aviation

International air passenger and freight demand

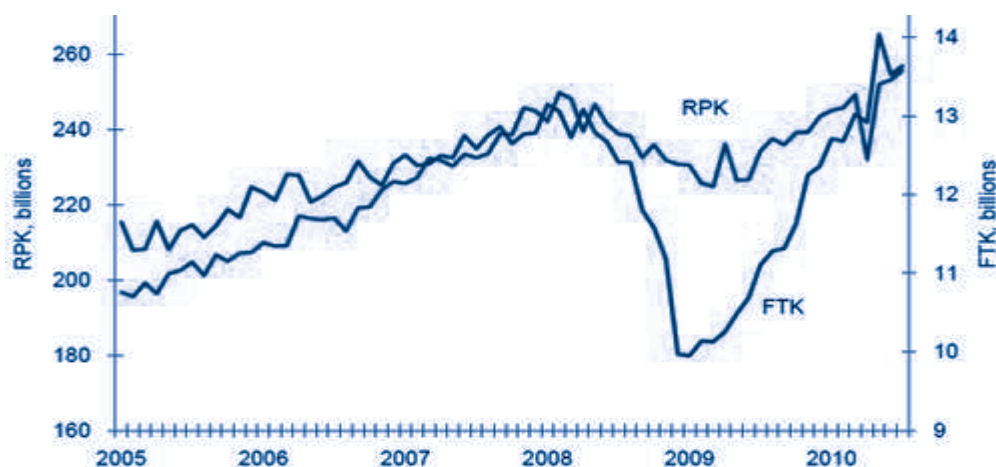
International air passenger numbers were depressed by the global financial crisis. Seasonally adjusted international traffic (measured in revenue passenger kilometers – RPKs) fell significantly in 2009 (Figure 1.9). In seasonally adjusted terms, the fall in international air freight traffic was much greater.

Since the low points were reached in 2009, the recovery in both international air passenger and freight traffic volumes has been faster than expected.

The recovery in international air freight in particular has been surprising. In an article entitled “Freight demand back” (CAPA – Centre for Aviation, 2010), IATA noted that the recovery in freight demand after the late-2008 collapse has been “remarkable”: “Not long ago we were expecting to have lost two to three years’ growth in this market”. By the

middle of 2010, air freight was back above pre-recession levels and almost back to the pre-recession trend.

Figure 1.9. **International air freight and passenger traffic volumes (seasonally adjusted)**
2005-2010



Source: IATA (International Air Transport Association) (2011), “International air freight and passenger traffic volumes”, 2005-2010, IATA.

Airports Council International reported in February 2011 that global passenger traffic had increased by just over 6% in 2010, by comparison with 2009 levels. International passenger traffic rose 7% and domestic passenger traffic increased 5%. The 6% growth takes the global industry well beyond pre-crisis volumes, but the recovery is continuing to progress in a two-paced manner between developing and mature markets. Europe was affected by the exceptionally harsh winter weather and disruptions to services (ACI, 2011).

Air freight traffic grew even more strongly, registering a 16.8% growth rate in 2010 compared to 2009 levels. The growth in international air freight was 21.5%, well above the growth in domestic freight, 8.9%.

Airports Council International (ACI) member airports report that total global passenger traffic grew by 7.1% in January 2011, with strong support from the international market (+7.8%) as well as good performance in the domestic sector (+6.5%). Europe, the largest international market, registered 8.3% growth compared to January 2010. Asia Pacific, the second largest market, rose by 9%. Both had strong domestic travel as well, with Asia Pacific up by 11.2% and Europe by 6.6%. Freight traffic saw a similar pattern of strong Asia Pacific and European results, contributing to the global growth of 6.8%.

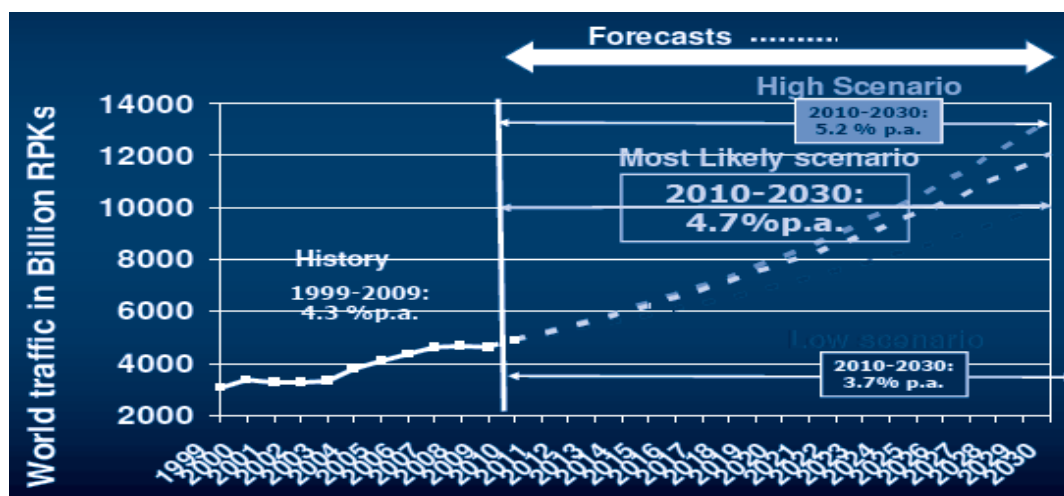
International air passengers – outlook

In the short term, international air passenger growth rates over 2008-2013 are expected to be highest in the Middle East, Asia-Pacific and Africa regions, based on the ACI’s projections for world and regional air passenger growth. European annual growth

rates are expected to average 2.1% per annum to 2013, with low-cost carriers increasing their shares of European and domestic aviation markets.

In the medium term, aviation is expected to grow rapidly. The International Civil Aviation Organization (ICAO) prepared long-term traffic forecasts for the period 2010-2030, for a range of scenarios. ICAO's "most likely" scenario anticipates growth of 4.7% per annum in global air passenger traffic over the period to 2030. Projections for each of the scenarios are shown in Figure 1.10.

Figure 1.10. ICAO world air traffic forecasts to 2030



Source: Teyssier, N. (2010), "Long term traffic forecasts for the period 2010 to 2030", presentation delivered at World Statistics Day, 20 November.

Airbus Industrie's "Global Market Forecast 2010-2029" (2009b) expects global air passenger RPKs to double in 15 years. In fact, Airbus expects world air passenger traffic will grow at this rate (4.8% per annum) for the next 20 years – with growth rates highly differentiated between developed and developing countries. The five largest air traffic flows in 2029 will be domestic United States, domestic China, intra-Western Europe, United States to Western Europe, and China to Western Europe.

In the "maturing regions" (Western Europe, North America), traffic is expected to grow at 3.7% per annum over the period 2009-2029. By contrast, traffic will grow at 6.1% per annum in the "expanding regions" (China, India and the rest of Asia, Middle East, Africa, CIS, Latin America and Eastern Europe). By 2029, around 68% of global air traffic volume will be within and between the "expanding regions". Traffic will remain concentrated around megacities, the numbers and size of which will increase significantly in Asia.

Boeing's *Current Market Outlook 2010-2029* (2010a) is also very positive. It includes advice on air passenger traffic by region in 2009, as well as projections for air passenger traffic by region in 2029.

Boeing expects air passenger traffic within Europe to more than double – as will air passenger traffic between Europe and North America – over the period to 2029. Air passenger traffic between Europe and Asia-Pacific regions could increase by close to three times by 2029.

Some of the regional increases are large, e.g. a fourfold increase in air passenger travel within the Asia-Pacific region and a similar increase from 2009 levels in the Latin American region over the 20 years.

Boeing's forecasts for traffic within and between regions are set out in Table 1.4.

Table 1.4. **Airline passenger traffic by region in 2009 and 2029**

RPKs in billions	Africa	Latin America	Middle East	Europe	North America	Asia Pacific
2009						
Asia Pacific	14.3	4.0	146.9	292.2	241.1	845.3
North America	11.8	173.4	44.3	406.4	898.1	
Europe	138.3	163.5	132.8	624.9		
Middle East	26.8	-	48.9			
Latin America	2.7	135.4				
Africa	36.1					
2029						
Asia Pacific	76.5	13.4	620.3	847.5	618.0	3 349.2
North America	48.3	484.4	484.4	946.2	1 566.4	
Europe	340.2	399.5	426.9	1 409.1		
Middle East	94.7	-	157.2			
Latin America	7.9	536.2				
Africa	108.6					

Note: Bold = Share within region.

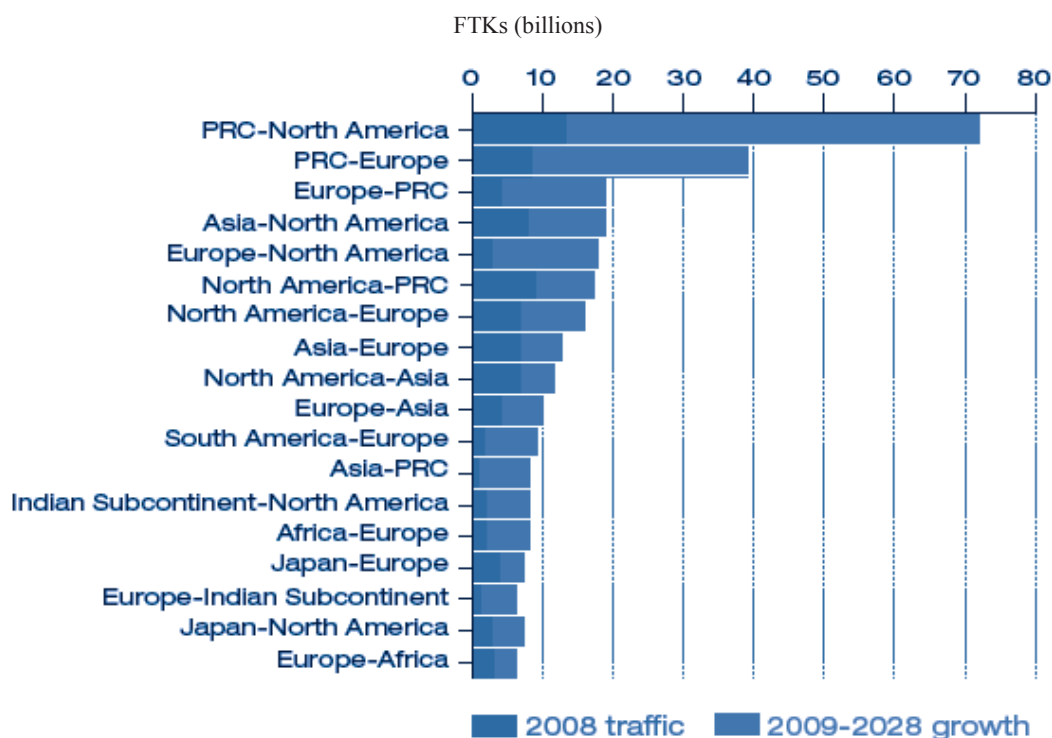
Source: Boeing (2010), *Current Market Outlook*, Boeing, Seattle, WA., October.

International air freight demand – outlook

Airbus' *Global Market Forecast 2009-2028* (Airbus, 2009b) highlighted expected growth in international air cargo traffic on the busiest routes, as set out in Figure 1.11.

Airbus Industrie's most recent *Global Market Forecast 2010-2029* (2010), prepared during the recovery in 2010, has an even more positive outlook for air freight. Airbus has increased its expected world air freight growth rate from 5.2% per annum in its previous forecast to 5.9% per annum, over the period to 2029. Airbus expects air freight traffic to triple in the next 20 years. By 2029, the international air cargo traffic share of the global air freight market could have increased further, from 84% in 2009 to 86% of world air traffic RTKs in 2029.

Boeing's *World Air Cargo Forecast 2010-11* (2010b) and *Current Market Outlook 2010* (2010a) note the strong relationship between air cargo traffic and GDP, with world GDP the best single measure of global economic activity. Boeing highlights that world air cargo activity typically outpaces GDP growth by a factor of two – adding that for nearly four decades, air cargo traffic, measured in RTKs, has expanded at more than twice the rate of GDP growth. It says that service and economic efficiency improvements, further expansion of international express services and adoption of inventory management techniques are expected to stimulate faster air cargo growth.

Figure 1.11. **International air cargo growth 2009-2028**

Note: PRC = People's Republic of China.

Source: Airbus (2009), "Global Market Forecast 2009-2028", Airbus, Toulouse.

Boeing concludes that the crucial advantages of air cargo over surface transport suggest that air cargo growth will continue to outpace GDP growth. Boeing's projections anticipate that "world air freight will grow 6% per year through 2029". If it does, world air cargo traffic would increase to between 500 and 600 billion RTKs (Boeing, 2010b).

While much air freight is carried in the belly holds of passenger aircraft, air freighter movements are already significant in Europe and can also be expected to increase.

Importance of air freight

Aviation and airports are handling increasing shares of cargo by value. Air freight has increased rapidly over recent decades; currently it accounts for over 40% of global cargo by value. A tripling in air freight FTKs (as anticipated in the air freight projections above) could therefore be expected to lead to an increase in the shares of the cargo by value that are handled by aviation and airports.

Rail

Rail outlook – freight carriage to 2015

Currently, there is a relatively high concentration of global rail freight traffic. Some 82% of world rail freight tonne-kilometres are carried by the railway systems of North America, China, the Russian Federation and India.

The OECD's *Infrastructure to 2030: Telecom, Land Transport, Water and Electricity* (2006) provided projections of expected growth in rail freight traffic over 2000-2015. The largest increases expected were in China, India, the Russian Federation and the United States. Expected increases in Europe were more modest, less than 1% per annum.

The *Rail Freight: Global Industry Guide* from Datamonitor (2010) sees expected growth in the global rail freight sector¹ by value and by volume over the five-year period to 2013 as follows:

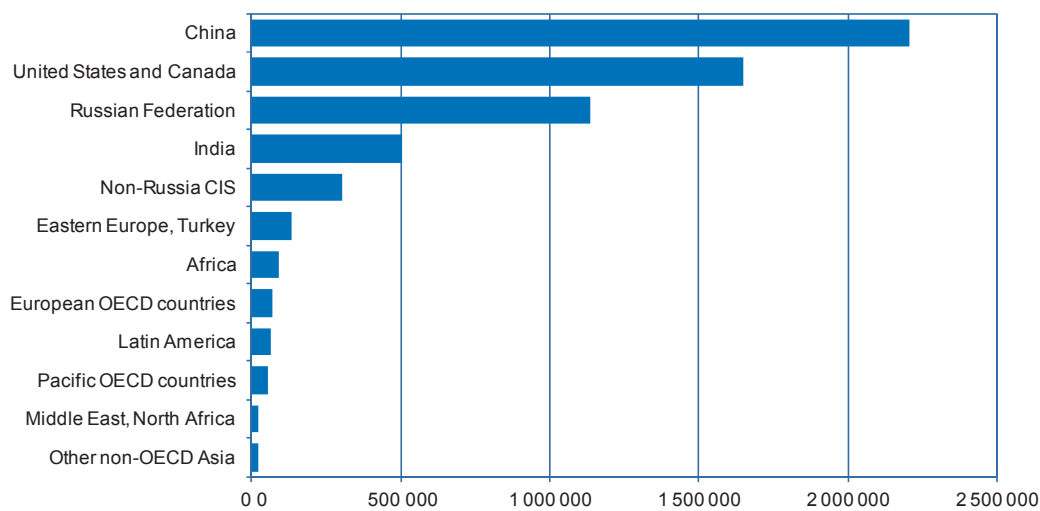
The global rail freight sector grew by 5.4% (by value) in 2008 to reach a value of USD 190.8 billion. In 2013, the global rail freight sector is forecast to have a value of USD 226 billion, an increase of 18.5% since 2008. The global rail freight sector grew by 7.1% (by volume) in 2008 to reach a volume of 11 413.6 billion freight tonne-kilometres. In 2013, the global rail freight sector is forecast to have a volume of 13 449 billion freight tonne-kilometres, an increase of 17.8% since 2008.

The recent *Rail Freight* forecasts appear to be broadly in line with the *Infrastructure to 2030* projections.

Rail outlook to 2030/2050

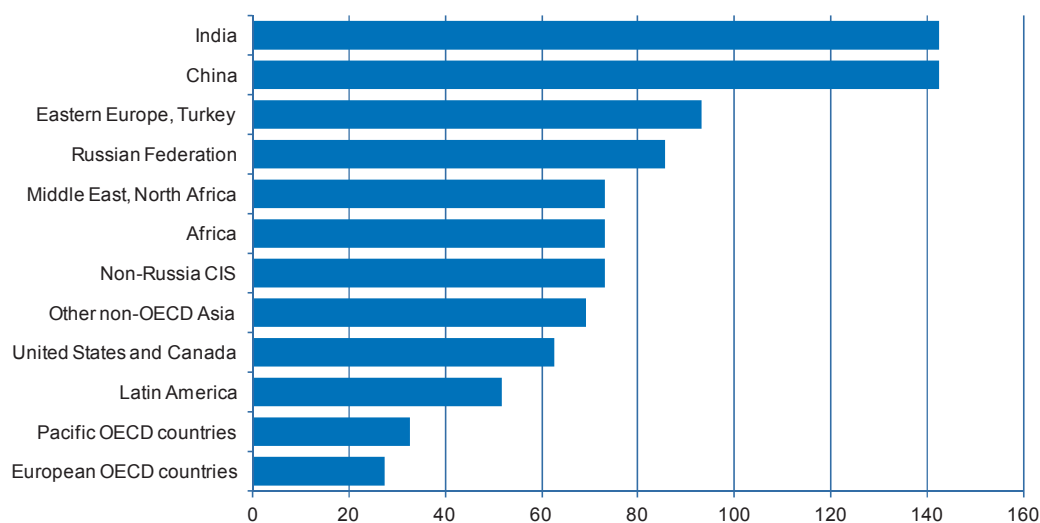
The OECD's *Infrastructure to 2030: Telecom, Land Transport, Water and Electricity* (2006) also provided projections of rail freight demand in the medium term. These projections anticipate that total rail freight traffic would increase by around 6.25 billion tonne-kilometres over 2005-2035. The major increases in annual rail freight would be expected in China, North America, the Russian Federation and India, as shown in Figures 1.12 and 1.13.

Figure 1.12. Annual rail freight – projected increases from 2005-2035
(million tonne-kilometres)



Source: Based on IEA (2010), *Energy Technology Perspectives 2003: Scenarios and Strategies to 2050*, Transport Model Spreadsheet Version 1.28, OECD Publishing, Paris, http://dx.doi.org/10.1787/energy_tech-2010-en.

Figure 1.13. Annual rail freight – projected overall growth (%)
2005-2035



Source: Based on IEA (2010), *Energy Technology Perspectives 2010: Scenarios and Strategies to 2050*, Spreadsheet Version 1.28, OECD Publishing, Paris, http://dx.doi.org/10.1787/energy_tech-2010-en.

Since these projections were prepared, there has been a resurgence of investment in rail infrastructure:

- In Europe, the EC's TEN-T priority projects include many major rail corridor projects, involving large expenditures over 10-20 years.

- In China, there have been successive accelerations of spending on rail infrastructure investment over the past five years, with very large funding increases in the stimulus package context.
- In the United States, USD 8 billion has been allocated to studies on development of future high-speed rail.
- India's plans include the development of rail corridors between Mumbai, Delhi and Kolkata.
- Russian Federation freight traffic can be expected to grow as a result of resources development and the long transport distances involved. As regards passenger rail, the Russian Federation has entered into arrangements with China for the development of high-speed rail in Russia.

The currently high actual and planned levels of expenditure on rail in some regions (e.g. China, Europe) over the period to 2020-2030 may lead to increases in rail passenger traffic and rail freight growth that are greater than those outlined above.

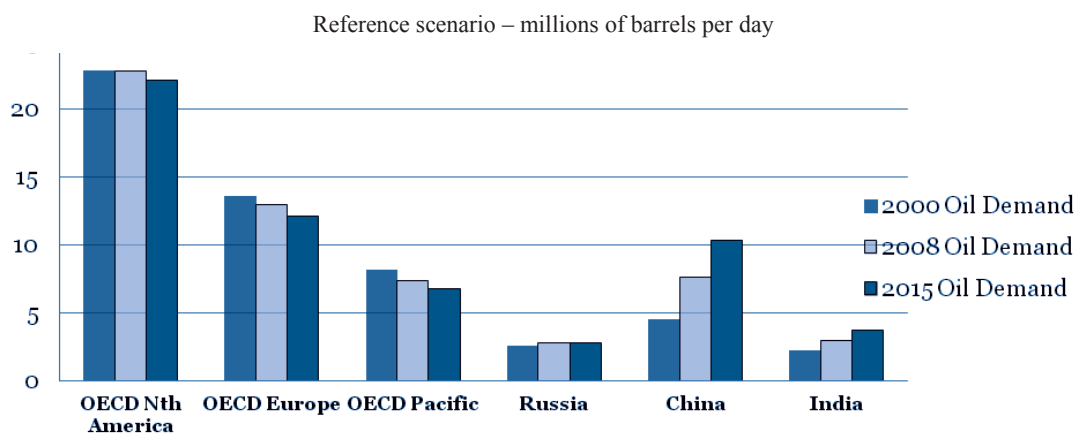
Oil and gas

Oil

Oil outlook to 2015

The International Energy Agency projections for increased oil and gas demand for 2000, 2008 and 2015 are set out in the following figures. For oil, non-OECD regions – especially Asia and the Middle East – account for all the growth in oil demand over 2000-2015.

Figure 1.14. **Oil outlook – forecast growth in primary demand (2000-2008-2015)**



Source: IEA (2009), *World Energy Outlook 2009*, OECD Publishing, Paris, November, <http://dx.doi.org/10.1787/weo-2009-en>.

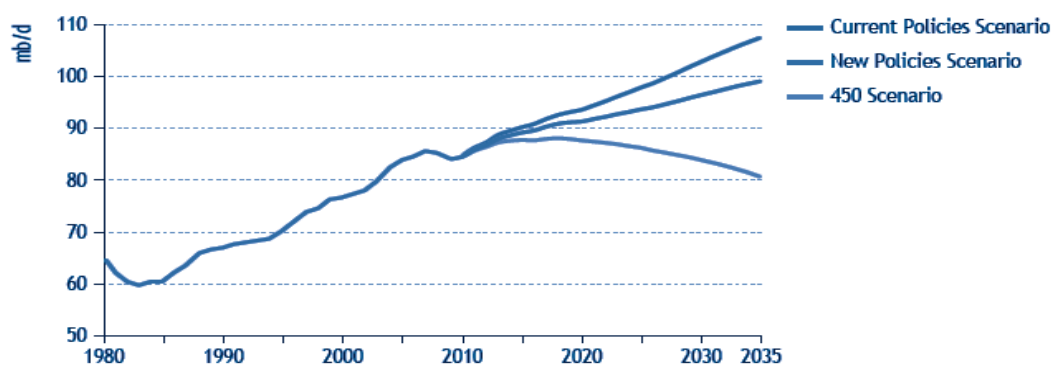
Oil outlook to 2030

The global outlook for oil remains highly sensitive to policy action to curb rising demand and emissions. The International Energy Agency has developed a set of scenarios for policy measures to ease energy demand and emissions and to try to capture the most likely range of oil demand outcomes.

The International Energy Agency's *World Energy Outlook 2010* advises:

- economic activity is expected to remain the principal driver of oil demand in all regions in every scenario, but the relationship weakens in the “New Policies Scenario” and, to an even greater extent, in the “450 Scenario”;
- in the “Current Policies” and “New Policies” Scenarios, global primary oil use increases in absolute terms between 2009 and 2035, driven by population and economic growth, but demand falls in the “450 Scenario” in response to radical policy action to curb fossil fuel use.

Figure 1.15. World primary oil demand by scenario



Note: Oil does not include biofuels derived from biomass.

Source: IEA (2010), *World Energy Outlook 2010*, OECD Publishing, Paris, <http://dx.doi.org/10.1787/weo-2010-en>, p. 102.

In relation to prices, the IEA *World Energy Outlook 2010* advises:

The prices needed to balance the oil market differ markedly across the three scenarios – reflecting the growing insensitivity of demand and supply to price. In the New Policies Scenario, the average IEA crude oil import price (in year 2009 dollars) reaches USD 113/barrel in 2035. In the Current Policies Scenario, much higher prices – reaching USD 135/barrel in 2035 – are needed to bring demand into balance with supply. Prices in the 450 Scenario are much lower, as demand peaks before 2020 and then falls. The weaker the response to the climate challenge, the greater the risk of oil scarcity and the higher the economic cost for consuming countries (IEA, 2010).

The transport sector is expected to continue driving the growth in global oil demand. China alone accounts for half of the expected demand. Oil remains the dominant source of energy for transport by road, rail, air and sea, though it comes under increasing competition from alternative fuels, notably biofuels and electricity for cars and trains, and natural gas for buses and trucks.

Table 1.5. Primary oil demand¹ by scenario (millions of barrels/day)

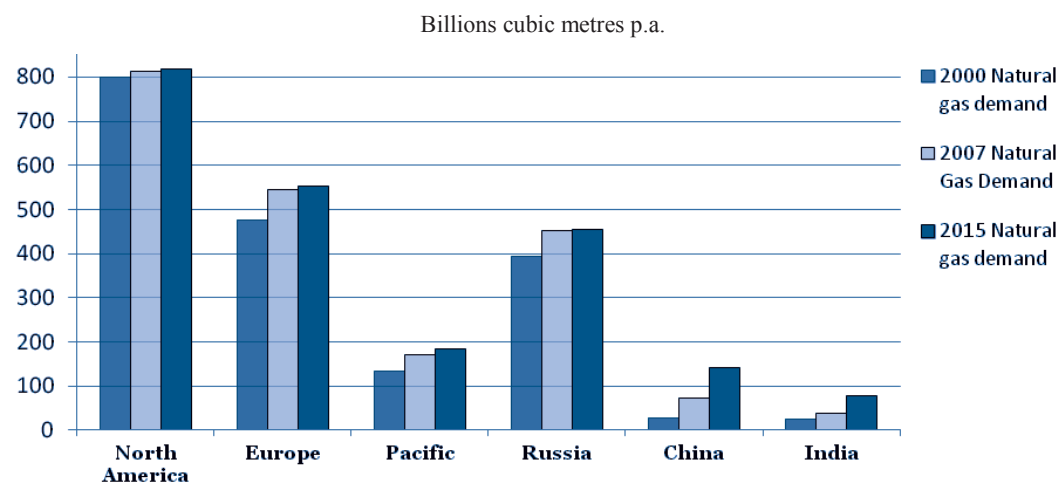
			New Policies Scenario		Current Policies Scenario		450 Scenario	
	1980	2009	2020	2035	2020	2035	2020	2035
OECD	41.3	41.7	39.8	35.3	40.5	38.7	38.2	28.0
Non-OECD	20.0	35.8	44.1	54.6	45.4	59.4	42.2	45.6
Bunkers ²	3.4	6.5	7.5	9.1	7.5	9.3	7.2	7.3
World	64.8	84.0	91.3	99.0	93.5	107.4	87.7	81.0
Share of non-OECD	33%	46%	53%	61%	53%	61%	52%	62%

Notes: 1. Excludes biofuels demand, which is projected to rise from 1.1 mb/d (in energy-equivalent volumes of gasoline and diesel) in 2009 to 2.3 mb/d in 2020 and to 4.4 mb/d in 2035 in the New Policies Scenario. 2. Includes international marine and aviation fuel.

Natural gas

The International Energy Agency's *World Energy Outlook 2010* advises that global natural gas demand is set to resume its long-term upward trajectory from 2010, following a gas "glut" during the recession that triggered an estimated 2% drop in demand in 2009 – the biggest since the 1970s.

Figure 1.16. Gas outlook – forecast growth in primary demand (2000-2007-2015)

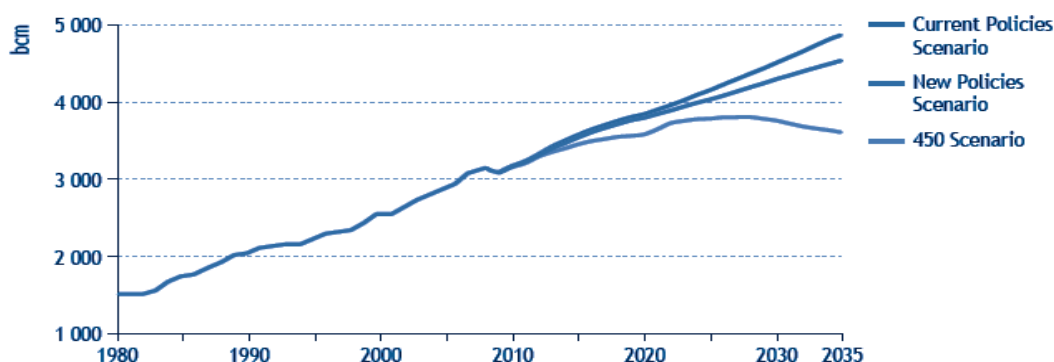


Source: IEA (2009), *World Energy Outlook 2009*, OECD Publishing, Paris, November, <http://dx.doi.org/10.1787/weo-2009-en>.

Natural gas is the only fossil fuel for which demand is higher in 2035 than in 2008 in all scenarios, though it grows at markedly different rates, according to the *World Energy Outlook* (IEA, 2010).

In the New Policies Scenario, demand reaches 4.5 thousand cubic metres (tcm) in 2035, an increase of 1.4 tcm, or 44%, over 2008 at an average rate of increase of 1.4% per year. Demand grows more quickly, by 1.6% per year, in the Current Policies Scenario; in the 450 Scenario, demand rises by a more modest 0.5% per year, peaking in the late 2020s (IEA, 2010).

Figure 1.17. World primary natural gas demand by scenario



In the New Policies Scenario, non-OECD countries account for 84% of the increase in demand between 2008 and 2035. China's demand grows fastest, at an average rate of almost 6% per year, and the most in volume terms, accounting for almost a quarter of the rise in global demand to 2035. Demand in the Middle East, well-endowed with relatively low-cost resources, increases almost as much. The IEA advises:

International trade in natural gas is set to grow. In the New Policies Scenario, gas trade between all WEO regions expands by around 80%, from 670 bcm in 2008 to 1 190 bcm in 2035. China's imports grow the most, from just 5 bcm in 2008 to 200 bcm in 2035. In fact, China accounts for a stunning 40% of the growth in interregional trade over the Outlook period. Most of the growth in gas trade takes the form of LNG; LNG trade doubles between 2008 and 2035. LNG supply will expand rapidly in the next few years as a wave of projects is completed. (IEA, 2010)

Demand for gas in industry is set to grow faster than in any end-use sector other than transport (where gas use remains small, globally).

By contrast with oil, gas is currently used relatively little in the transport sector. Natural gas vehicles are common in only a few countries, and the global use of compressed natural gas (CNG) as a road fuel is tiny. The biggest potential lies with heavy-duty vehicles (trucks and buses), as the costs of installing refuelling infrastructure for light-duty vehicles and adapting cars to run on gas are likely to limit the growth of CNG use in light vehicles.

The wide variations in oil and gas demand under these IEA scenarios would have major implications for oil and gas transport distribution and infrastructure investment requirements over the period to 2030 and beyond.

The global outlook for oil remains highly sensitive to policy action to curb rising demand and emissions. In the Current Policies and New Policies Scenarios, global primary oil use increases in absolute terms between 2009 and 2035, driven by population and economic growth, but demand falls in the 450 Scenario in response to radical policy action to curb fossil fuel use.

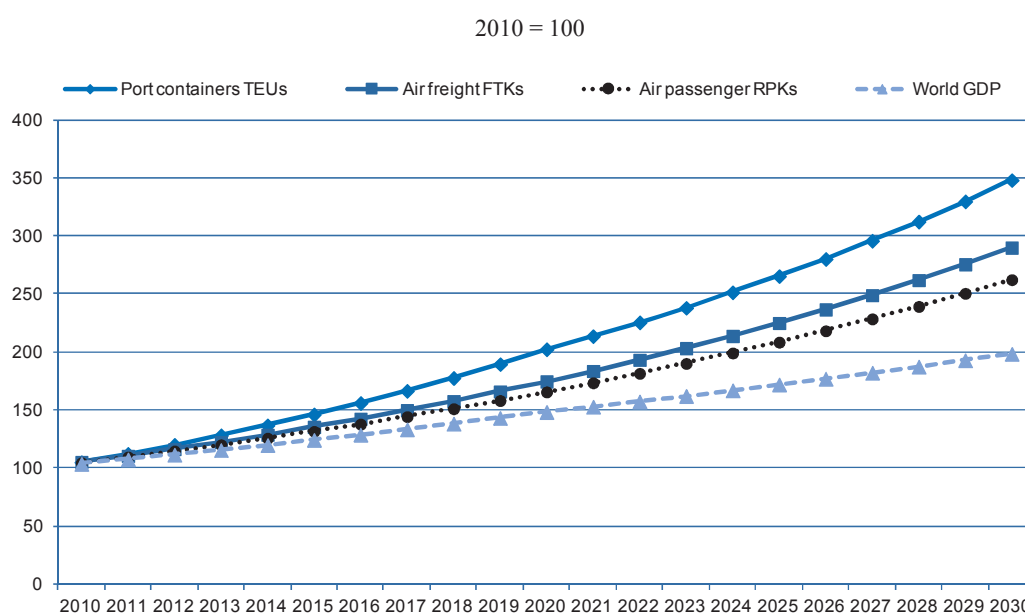
Risks and uncertainties

As mentioned earlier, projections outlined in this chapter are based on expected outcomes in the absence of future policy changes – i.e. they only reflect policies in place or that have been announced. Clearly there are potential impacts associated with

unchecked CO₂ emissions and climate change, and policy measures to address these could have a huge impact on demand. Significant changes in policy directions (e.g. in relation to energy) could affect energy supply and the prices of the fuels in the mix, and (therefore) also lead to paradigm shifts and futures different from the ones outlined in these projections.

Possible future financial crises and unforeseen and “*force majeure*” events are not explicitly taken into account. Although such events can be expected to occur from time to time, there is usually no advance knowledge at all about their timing. Despite all the uncertainties, however, reference case projections in the field of transport have generally proved fairly reliable indicators of actual outcomes. It seems reasonable to expect them to continue to do so.

Figure 1.18. Relationship between world GDP growth and transport demand



Note

1. The “Rail Freight: Global Industry Guide” (Datamonitor, 2010) used the following rail market definitions: “The rail freight sector is defined as consisting of revenues generated from freight transportation by rail. Units of volumes are measured in freight tonne-kilometres (FTK). Rail freight volumes include both domestic and international freight, which for the purposes of this report are counted in the country of origin. Any currency conversions used in the creation of this report have been calculated using constant 2008 annual average exchange rates.”

Chapter 2

Global infrastructure needs to 2030

Based on the new and revised estimates of infrastructure needs presented herein, significant investments in all four economic infrastructure sectors – ports, airports, rail corridors, and oil and gas pipelines – will be required on a global basis to meet the projected increases in demand over the next 20 years. However, given that governments in OECD member countries are facing large deficits and fiscal consolidation tasks over the next five years or longer, there is clearly a risk of inadequate investment in infrastructure in the medium- to longer term future. This would have significant impacts, given the key role infrastructure can play in facilitating and promoting competitiveness and growth.

Infrastructure networks

Infrastructure to 2030 (OECD, 2006) noted that: “Infrastructures are key to economic and social development”

Infrastructures are not an end in themselves. Rather, they are a means for ensuring the delivery of goods and services that promote prosperity and growth and contribute to quality of life, including the social well-being, health and safety of citizens, and the quality of their environments. In the past, infrastructures have provided significant social and economic benefits. Looking to the future, they will continue to play a vital role in economic and social development, not least because the networked economy is becoming increasingly important, and society ever more dependent on the smooth running of a growing range of infrastructure services. Moreover, the various infrastructure systems themselves are interacting ever more closely with one another, engendering interdependencies and complementarities, as well as heightened vulnerability, and thereby posing new policy challenges such as interoperability and reliability.

It also noted that: “The fast pace of world economic growth will put increasing pressure on infrastructures”.

Infrastructure projects can contribute to economic growth and development via improvements in efficiency, productivity and reliability. They generally also contribute to improved safety and security. Of course, individual projects do not result in infrastructure that operates on a stand-alone basis. Rather, infrastructure projects become part of extensive infrastructure networks that enable essential and interconnected services to be distributed over widely spread geographic locations.

Infrastructure as driver of competitiveness

In globally connected economies, infrastructure is increasingly seen as one of the important drivers of competitiveness. The World Economic Forum, for example, has positioned infrastructure in second place on its list of important drivers of competitiveness, second only to national institutions. The Forum’s rationale:

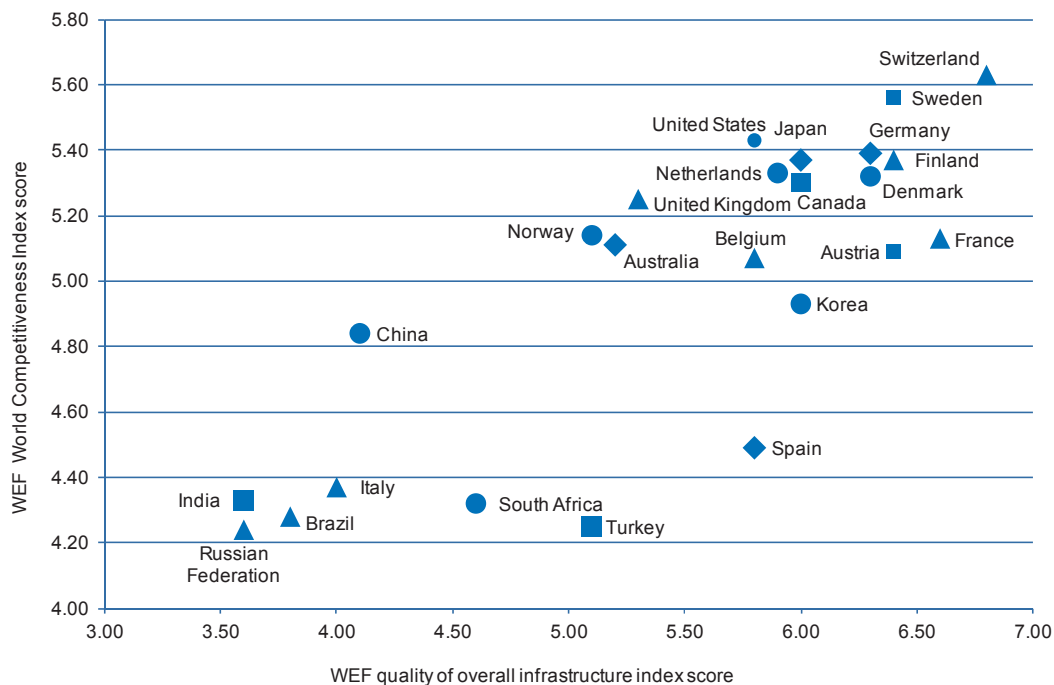
Extensive and efficient infrastructure ... is critical for ensuring the effective functioning of the economy, as it is an important factor determining the location of economic activity and the kinds of activities or sectors that can develop in a particular economy. Well-developed infrastructure reduces the effect of distance between regions, with the result of truly integrating the national market and connecting it at low cost to markets in other countries and regions. In addition, the quality and extensiveness of infrastructure networks significantly impact economic growth and reduce income inequalities and poverty in a variety of ways. In this regard, a well-developed transport and communications infrastructure network is a prerequisite for the ability of less-developed communities to connect to core economic activities and basic services. (World Economic Forum, 2010)

Infrastructure quality

In a highly connected world, effective infrastructure networks are crucial to the efficient delivery of produce and goods from sources of production to the major centres of population and industry – both within countries and, increasingly, internationally. They are equally important for the safe and reliable movement of people to work, educational, social, sporting and leisure activities, wherever those activities may be. As it is therefore vital to international competitiveness, development of quality infrastructure should be a real priority in all countries (Figure 2.1).

Despite its importance, infrastructure, in fact, does not always receive the investment priority one would expect. In recent decades, governments have tended to accord priority to short-term issues and expenditures expected to produce better short-term returns, more easily recognised in short election cycles. As a result, they have often failed to deliver infrastructure of sufficient quality and capacity to satisfy the future needs of their economies and the social needs of their people. A continuation of these trends could easily lead to under-investment in trade-related export and import infrastructure, which could compromise the future growth and development of national economies.

Figure 2.1. Competitiveness and quality of overall infrastructure



Source: World Economic Forum (2010), *Global Competitiveness Report 2010-2011*, World Economic Forum, Geneva.

Infrastructure to 2030 report

The OECD's *Infrastructure to 2030: Telecom, Land Transport, Water and Electricity* (2006) assessed the demand for infrastructure in the telecommunications, electricity, surface transport (road and rail) and water sectors. The report concluded that globally, the

amount of infrastructure spending likely to be needed in those four sectors from 2005 to 2030 was USD 53 trillion or around USD 2 trillion a year – around 2.5% of world GDP. Inclusion of energy generation and related infrastructure would increase the total to around USD 71 trillion, around 3% of world GDP.

The lion's share of investment in developing/emerging economies can be expected to go to expanding and new infrastructure networks, unlike in the OECD area. Many parts of infrastructure systems in OECD member countries are ageing rapidly, so that a larger effort would need to be directed towards maintaining and upgrading existing infrastructures than towards greenfield projects.

The *Infrastructure to 2030* report did not assess the infrastructure or related investment requirements for airports, ports, rail corridors and oil and gas transport and distribution. Airport and port investment as well as investment in major rail corridor development and oil and gas transport and distribution have become increasingly important in the context of increasing globalisation, international trade, and related international passenger, goods and commodity flows.

The situation pre-2008

Before the economic and financial crisis, the outlook with respect to infrastructures was broadly as follows. Demand for infrastructure was expected to continue expanding significantly over the next few decades, driven largely by growing populations and by healthy economic growth rates in large parts of the developing world and generally modest growth rates across the OECD. In many OECD member countries, however, public finances were thought to be getting increasingly tight through to 2030 due to mounting cost pressures from health and pension outlays, environment, security concerns, and so on.

As a result, a gap was seen to be opening up in OECD member countries between the future infrastructure investment required and the capacity of the public sector to meet those requirements from traditional funding sources. The OECD report concluded that bridging the looming “infrastructure gap” would require more efficient and more intelligent use of infrastructure assets through new technologies, regulatory changes and improved planning. It would also demand innovative approaches to find new sources of funding: better use of user fees, mechanisms for securing long-term financing such as infrastructure funds, and innovative sources such as land value capture schemes. Moreover, greater recourse to private-sector funding was viewed as inevitable, entailing a fresh look at public-private partnerships (PPPs) and at the possibilities for a more active participation of pension funds and other large institutional investors.

The impact of the crisis

The economic and financial crisis modified this general outlook for infrastructure investment in important ways, reshaping some key features while reinforcing others. When economic activity and world trade fell sharply in 2009, concerns in many OECD member countries about expected shortfalls in infrastructure capacity subsided somewhat. Indeed, in several sectors – notably natural gas, LNG, maritime ports, airports – concerns pointed more in the direction of capacity oversupply in the short term. Hence, many infrastructure projects were deferred and some shelved indefinitely.

Revised outlook

The recovery in international air passenger and air freight demand in 2010 was surprisingly rapid. Maritime demand also picked up considerably. Looking ahead, infrastructure use is expected to resume its growth over the next two to three years, depending on location, in line with economic recovery and growth. But the outlook for infrastructure funding and financing has been adversely affected by the financial crisis.

Governments in OECD member countries are facing large deficits and fiscal consolidation tasks over the next five years, and in some cases more. Some countries have put in place stimulus packages to benefit employment-intensive infrastructure projects, but many of these will have run their course or will be withdrawn in the not too distant future. The private sector's contribution is also under threat, given the banking system changes that have greatly restricted the availability of longer term finance, the increased risk aversion of potential infrastructure investors, and what appears to be a fairly widespread trend now in the private sector (at aggregate level) to spend far less than its income despite the unprecedented monetary loosening.

In these circumstances, there is clearly a risk that in many countries there could be inadequate investment in infrastructure in the medium- to longer term future. This would have significant impacts, given the key role infrastructure can play in facilitating and promoting growth, both domestically and internationally. Without adequate and efficient infrastructure, economies simply will not perform to their potential, and the additional growth that makes a shift towards more environmentally friendly solutions more affordable and more acceptable may not materialise to the desired extent.

Global infrastructure investment needs to 2030

Given the future growth expected in global GDP – the modest but sustained growth in GDP in the developed countries and the even stronger growth expected in the emerging BRIIC (Brazil, Russian Federation, India, Indonesia and China) and other developing countries – demand for infrastructure on a global basis can be expected to grow strongly over the period to 2030.

This volume presents new and revised estimates for global infrastructure needs to 2030 as follows:

- new estimates of infrastructure needs have been prepared for ports and airports, two strategic transport infrastructure categories not covered in the previous report;
- new estimates have also been prepared for oil and gas transport and distribution (T&D);
- revised estimates have been prepared for rail “new construction and maintenance” infrastructure needs, following a recent resurgence in investment.

These new and revised estimates of infrastructure needs for this group are set out in the following section.

Infrastructure needs to 2030 – airports, ports, rail, and oil and gas (T&D) infrastructure

The project's assessments of infrastructure investment needs to 2030 are set out in Table 2.1.

Table 2.1. **Annual and aggregate investment needs in selected economic infrastructure, 2009-2030**

USD billion (in constant 2008 USD)

Global	Annual average investment		Aggregate investment		
	2009-2015	2015-2030	2009-2015	2015-2030	2009-2030
Infrastructure facilities					
Airports' capital expenditure	70	120	400	1 800	2 200
Port infrastructure facilities' capital expenditure	33	40	200	630	830
Rail "new construction" (including maintenance)	130	270	920	4 060	5 000
Oil and gas – transport and distribution	155	155	930	2 325	3 255

Airport infrastructure – global investment needs to 2030

The authors' estimates of worldwide airport capital infrastructure investment needs over the period 2009-2030 are set out in Table 2.2.

Table 2.2. **Global airport infrastructure investment needs,¹ 2009-2030**

USD billions

Region	Average annual investment		Aggregate investment		
	2009-2015	2009-2015	2009-2015	2009-2015	2009-2030
Worldwide					
Aggregate expenditures	70	120	400	1 800	2 200

Note: 1. Includes updates or expansions of existing airport infrastructure and development of new airports on greenfield sites.

Source: Project authors' estimates, based on ACI (2009), *Airport Economics Survey 2008*, ACI; and ACI (2009), *Air Traffic Forecasts 2009*, ACI.

These assessments encompass expected worldwide airport capital expenditure needs related to updates and expansions of existing airport infrastructure in all regions – as well as anticipated expenditure needs related to development of greenfield airports in new locations in all regions. Final estimates of future airport investment needs take into account relationships between airport capital expenditure and passenger throughput in recent years, including during the recent crisis.

Risks and uncertainties

Of course, there are many possible uncertainties and risks on the demand side. The above estimates could be affected by future policy changes related to CO₂ emissions and measures to reduce future CO₂ concentrations in the atmosphere, including emission trading schemes and carbon taxes. There are also supply risks: inadequate preparation for meeting future investment needs could limit capacity and lead to greatly increased congestion, high degrees of unreliability and significant delays and service cancellations.

Both demand – and supply-side risks could have significant adverse impacts on economic growth and quality of life in the countries concerned.

Background and methodology

The background and methodology used to make these assessments of global airport infrastructure investment needs to 2030 are set out in Annex B.

Port infrastructure – global investment needs to 2030

Assessments of port infrastructure needs worldwide over 2009-2030 are set out in Table 2.3. These assessments encompass all port infrastructure for all categories of cargo – including petroleum, oil and liquid fuels (POL), dry bulk (mineral, etc.) and merchandise trade (including containers).

Table 2.3. **Global port infrastructure investment needs, 2009-2030**

USD billions

Region	Annual average investment		Aggregate investment		
	2009-2015	2015-2030	2009-2015	2015-2030	2009-2030
Worldwide					
Total	33	40	200	630	830

Container port berth infrastructure investment needs

Assessments of investment needs in new port container berths and rehabilitation of existing berths – an important part of overall port investments – are set out in Table 2.4.

Table 2.4. **Total port container investment needs (new berths and rehabilitation)**

USD billions

Region	Medium TEU growth scenario				
	Annual average investment		Aggregate investment		
	2009-2015	2015-2030	2009-2015	2015-2030	2009-2030
Global					
New berths	8	12	50	190	240
Rehabilitation	3	4	17	63	80
Total	11	16	67	253	320

Background and methodology

The background and methodology used to make these assessments of global port infrastructure investment needs to 2030 are set out in Annex C.

Rail infrastructure – global investment needs to 2030

Revised estimates of rail infrastructure needs to 2030 are summarised in Table 2.5.

Table 2.5. **Global rail infrastructure investment needs, 2009-2030**

USD billions

Region	Annual rail construction and maintenance requirements		Aggregate rail construction and maintenance requirements		
	2009-2015	2015-2030	2009-2015	2015-2030	2009-2030
Worldwide					
G7	37	55	260	830	1 090
Other OECD	30	65	207	950	1 160
Non-OECD	5	7	37	105	140
Big 5	55	140	390	2 090	2 480
Total	130	270	920	4 060	5 000

Note: Rail “construction and maintenance” includes “new investment” and capital expenditure on “maintenance”.

The revised estimates of rail infrastructure needs reflect the recent resurgence of interest in rail and the increasing investments in improved rail networks being undertaken in many countries. These include investments in high-speed rail in developed countries and some developing countries, as well as an expansion and improvement of existing passenger and freight rail networks in many countries.

The revised estimates also reflect the increasing proportions of rail expenditures within land transport investment programmes in many developed countries in recent years – evident in the EC’s TEN-T programmes and in many individual country programmes.

Improvements were made to the rail assessment models used in some important respects, including:

- more recent world and regional GDP growth projections, which reflect current expectations of the contributions of the large emerging economies and developing regions to world growth;
- more recent rail data, which include updated costs of new rail track development and the increasing costs of rail track maintenance;
- country-specific analysis, for G20 countries, of GDP per capita and rail track capital stock, rail new construction and rail maintenance.

On the other hand, the assessment of needs does not necessarily reflect government decisions to accelerate investment expenditures for several years (e.g. in recent stimulus packages). In many cases, the higher levels are regarded as temporary and unlikely to be sustained due to increasing pressures to rein in government budget deficits and reduce government debt.

More detailed assessments of global rail infrastructure needs are set out in Table 2.6. The estimates for the G20 group of countries are set out in Table 2.7.

Background and methodology

The background and methodology used to make these assessments of global rail infrastructure investment needs to 2030 are set out in Annex D.

Table 2.6. Rail infrastructure investment needs, 2009-2030

PPP constant 2005, international USD billions

Countries, regions and groups	Annual new construction and maintenance		Aggregate new construction and maintenance		
	2009-2015	2015-2030	2009-2015	2015-2030	2009-2030
1. Industrialised	72	126	504	1 890	2 394
a. G7	37	55	261	830	1 090
United States	10	15	70	230	300
Japan	10	17	69	251	320
Canada	2	2	11	28	38
Germany	5	7	38	104	141
Italy	5	8	37	118	154
United Kingdom	3	3	18	48	66
France	3	3	20	51	71
G7	37	55	261	830	1 090
b. Other-OECD	30	64	207	954	1 161
Europe and Central Asia	25	58	174	872	1 045
East Asia and Pacific	6	4	39	62	101
North America	2	5	14	68	82
OECD Industrialised	67	119	467	1 784	2 251
c. Non-OECD	5	7	37	106	143
East Asia and Pacific	1	1	4	11	14
Europe and Central Asia	0	0	2	6	8
Latin America and Caribbean	3	5	23	71	95
Middle East and North Africa	0	0	2	6	8
South Asia	0	0	0	0	0
Sub-Saharan Africa	1	1	5	13	18
2. Big 5	56	139	389	2 091	2 480
China	27	64	191	967	1 158
India	20	64	138	962	1 100
Indonesia	0	0	0	1	2
Russian Federation	8	10	57	152	209
Brazil	0	1	3	8	11
Big 5	56	139	389	2 091	2 480
3. Developing	4	6	26	84	110
East Asia and Pacific	1	1	5	17	22
Europe and Central Asia	1	2	10	24	34
Latin America and Caribbean	0	1	3	9	12
Middle East and North Africa	1	1	4	17	21
South Asia	0	1	2	9	11
Sub-Saharan Africa	0	0	3	7	10
World	131	271	919	4 064	4 983

Table 2.7. G20 countries – rail infrastructure investment needs, 2009-2030

PPP constant 2005 international USD billions

G20 countries	Annual new construction and maintenance		Aggregate new construction and maintenance		
	2009-2015	2015-2030	2009-2015	2015-2030	2009-2030
1. G-7	37	55	261	830	1 090
United States	10	15	70	230	300
Japan	10	17	69	251	320
Canada	2	2	11	28	38
<i>G7 EU members</i>					
Germany	5	7	38	104	141
Italy	5	8	37	118	154
United Kingdom	2	3	17	48	66
France	3	3	20	51	71
2. Rest of EU	25	58	174	872	1 045
EU total	41	80	285	1 193	1 478
3. Additional 7	6	8	43	125	168
Argentina	2	3	16	51	67
Australia	2	2	12	30	43
Mexico	1	1	6	15	21
South Africa	0	0	2	4	6
South Korea	0	0	1	2	3
Turkey	1	1	7	22	29
Saudi Arabia*	N/A	N/A	N/A	N/A	N/A
4. Big 5	56	139	389	2 091	2 480
China	27	64	191	967	1 157
India	20	64	138	962	1 100
Indonesia	0	0	1	1	2
Russian Federation	8	10	57	152	209
Brazil	0	1	3	8	11
G20 total	124	261	867	3 917	4 784
World	131	271	919	4 064	4 983

Oil and gas transport and distribution infrastructure – global investment needs to 2030

The *IEA World Energy Outlook 2010* identifies anticipated oil and gas sector “transport and distribution” investment needs over the period 2010-2030. Separate annual and cumulative estimates for oil and gas transport and distribution infrastructure, as well as annual and cumulative estimates for oil and gas combined, are shown in Table 2.8.

Background and methodology

The background and methodology used to make these assessments of oil and gas transport and distribution infrastructure investment needs to 2030 are set out in Annex E.

Table 2.8. Revised estimates for infrastructure investment in oil and gas transport and distribution, 2009-2030

USD billions 2009

Worldwide Breakdown	Oil		Gas		Total oil and gas	
	Annual	Cumulative	Annual	Cumulative	Annual	Cumulative
Downstream	47	987	95	1 995	142	2 982
Additions	10	210 ¹	3	63 ²	13	273
World total	57	1 197	98	2 058	155	3 255

Notes: 1. World total includes USD 241 billion investment in interregional transport infrastructure (2010-2035). 2. World total includes an additional USD 74 billion of investment in LNG carriers (2010-2035).

Source: Project authors' estimates, based on data from IEA (2010), *World Energy Outlook 2010*, OECD Publishing, Paris, <http://dx.doi.org/10.1787/weo-2010-en>.

Concluding remarks

Investment needs in OECD member countries¹ reflect the level of infrastructure already in place, the modest but sustained economic growth expected to 2030, and the increasing levels of maintenance required. Far larger investments will be needed in developing regions, reflecting the strong economic growth expected within and between the emerging economies and developing countries. Their maintenance requirements will increase too, some ten years later.

In the future, in many countries – particularly those most adversely affected by the recent global financial crisis and recession – governments are likely to remain focused on budget deficits, debt and unemployment, and for an extended period. They will be looking to reduce government expenditures to bring budgets into balance and to reduce levels of overall debt and unemployment levels at the same time. In these circumstances, governments are likely to be even more constrained financially than expected when the OECD *Infrastructure to 2030* report was published in 2006.

If infrastructure is not developed at the time required, demand will exceed capacity, levels of service will fall and efficiency and reliability will be reduced, placing at a disadvantage all those people and industries that depend on the quality and reliability of gateway infrastructure. Such outcomes can have adverse impacts on international competitiveness and national economic growth, productivity and development.

It is therefore clear that the funding and financing of the economic infrastructure facilities required is moving to central stage in many countries – which reopens the debate on where the money is going to come from. There are many different possibilities, including infrastructure-specific borrowings combined with user-pays, public-private partnerships, partial or full privatisation, and private funding.

If governments know they are going to be so financially constrained that they will not be able to invest the funds required for strategic infrastructure investments – within acceptable borrowing limits – they will need to consider the numerous public-private-

sector funding and financing options that are likely to be available. And given the 10- to 20-year time scales involved in planning, evaluating, funding and developing strategic infrastructure, governments would be well advised to take early decisions on which innovations they will introduce to the funding and financing arrangements, particularly for strategic infrastructure. Only early action will ensure that their future infrastructure investments contribute to the competitiveness, growth and productivity of the country and the improved quality of life that people in most countries are expecting.

Note

1. It should be noted that the estimates of needs provided should not be taken as firm guidance on investments that will actually be made over the period to 2030. Actual investments will depend on policies, plans and funding availability. Risks and uncertainties will of course also play a role.

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Part II

Opportunities and challenges for strategic transport infrastructure

Chapter 3

Strategic transport infrastructure case studies

The case studies reinforce the importance of major international gateway and corridor infrastructures to international trade and the economies of each country. International passenger and freight movements are highly concentrated along major trade corridors, distinguished by high-volume, efficient services. Major international ports, airports and key inland transport connections in each country handle the bulk of the traffic. Increases in demand can be expected along inland connections from gateways to the cities and industrial areas in their hinterlands, making each country's international gateways and inland trade corridor infrastructures even more important to its national economy. World-class gateway, hub and inland infrastructure will be required in the future to attract the transport services required and to fully support the growth and development of these economies.

Gateways, hubs and inland transport connections

International gateways and trade corridors deliver services important to national and regional economies. **International gateways** have key roles to play in providing the public and private port and airport infrastructure needed to handle large and increasing passenger and freight volumes and the special needs of the largest aircraft and ships in use. They must accommodate the high-quality passenger and freight terminals and other facilities that users need, and be able to attract the international aviation and maritime services required. They have to facilitate the movement of international passenger and freight traffic between international and domestic services and accommodate the large range of businesses and organisations that need port and airport locations and links to port and airport activities.

Hubs are generally important centres at the crossroads of trade and transport corridors that allow interconnections between multi-modal operations arriving at and departing from them. They facilitate transit traffic along the crossing corridors – as well as facilitating destination traffic to the hub.

Inland transport connections provide the links on which international gateways depend for services between the gateway, inland hubs and other activity centres in the port and airport hinterlands.

Gateways, hubs and inland transport connections are central pillars supporting international trade, facilitating the exports from and imports to the country that are carried by land, sea and air. They are also central to the global and regional supply chains and logistics services that provide the door-to-door services that industry and households need.

Trade logistics include the range of services and processes that are involved in moving goods from one country to another: customs and administrative procedures, organisation and management of international shipment operations, tracking and tracing, and the quality of transport and information technology infrastructures. Supply chains are often “footloose”, seeking the most efficient, reliable services provided at lowest costs.

Currently, international passenger and freight movements are highly concentrated along major trade corridors characterised by their high volumes and efficiency. Major international ports, airports and key inland transport connections in each country handle the bulk of the traffic.

Outlook for gateways and hubs

Passenger and freight demand is expected to increase substantially between most regions and countries over the period to 2030 and beyond. The large and increasing volumes will continue to be handled by the major international airports and ports with sufficient capacity and high-volume capability – as well as the special facilities that extra large aircraft and container shipping liners need.

As gateway volumes increase, matching increases in volumes can be expected along inland connections from these gateways to the cities and industrial areas in their hinterlands.

Box 3.1. The importance of trade logistics

Quality logistics services play an important role in facilitating the transport of international trade in goods: inefficient logistics services impede trade by imposing an extra cost in terms of time as well as money. Trade logistics quality impacts exports more than imports overall; improvements in a given country's trade logistics will improve its export situation.

When comparing air infrastructure and sea infrastructure and their impacts on airborne and seaborne trade, it is found that infrastructure improvements have a particularly strong impact on airborne trade.

Across the board, elements of trade logistics such as customs procedures, tracking and tracing services, overall infrastructure and logistics competence are shown to impact trade relatively more than less policy-dependent trade determinants such as distance and transport costs.

These findings confirm other research that suggests that investments in logistics services and infrastructure can be highly trade enhancing and further infer which infrastructure investments are likely to bring the largest gains.

Findings regarding landlocked countries and their present reliance on airborne trade due to disadvantaged seaborne trade also point to the importance of regional co-operation in the area of trade facilitation reforms.

Source: Korinek, J. and P. Sourdin (2011), "To what extent are high-quality logistics services trade facilitating?", *OECD Trade Policy Working Papers*, No. 108, OECD Publishing, Paris, <http://dx.doi.org/10.1787/5kkgdthrlzn-en>.

However, the outlook for gateways and corridors individually will also be affected by the growth and competitiveness of the gateway area in which the gateway or hub is located – as well as the growth and competitiveness of the inland cities and industrial areas in the hinterlands and cross-border locations served by these gateways and hubs. Importantly, the outlook for these facilities will also depend on the growth, capacity, efficiency and competitiveness of the gateway and hub infrastructure itself. In other words, the outlooks for the gateways will depend on their own growth, productivity and performance, the growth and performance of the cities and industrial areas they serve – and the competitive performance of the alternative passenger routes and the freight and logistics supply chains which users might choose.

There are many complex and interconnected factors involved that need to be managed well. In this context, each country's key international gateways and inland trade corridor infrastructure will become even more important to their national economies in the future.

Long-term opportunities and challenges: A case study approach

A case study approach has been employed here as a means of "drilling down" to explore the opportunities and challenges facing some key gateway areas and inland hubs and their inland connections across the participating countries. The approach offers a more detailed infrastructure picture and provides insights into funding and financing arrangements and needs. The individual case studies were chosen following discussions with the project steering group members at the meeting in November 2009.

Workshops were undertaken – where resources were available – to ensure input from local experts and to allow discussion and more detailed consideration of the opportunities and challenges. The workshops generally helped the project to focus on the current situation in relation to gateways, inland transport and transit traffic; expected future growth and development; and planned infrastructure and related funding and financing arrangements.

Following the interest expressed at the steering group meeting in November 2009, the project took advantage of some assistance offered and made contact with people with local expertise in China, India, Mexico and the Russian Federation. In each case, these discussions were very helpful and identified some of the best potential targets. However, most of these contacts did not lead to case studies, due principally to the lack of local resources and funding needed to run workshops in any of these countries, except India. Based on advice received on potential gateway targets for case studies, the project team prepared a desktop case study for the Mumbai gateway ports – encompassing the adjacent ports of Mumbai and Jawaharlal Nehru Port (JNPT). Following the presentation on this desktop study’s findings to the steering group meeting in July 2010, some steering group members expressed interest in updating the study to reflect the latest developments on India’s west coast ports – including in particular developments at Mumbai and JNPT – and extending the coverage to encompass one of two of the more dynamic private sector ports.

National settings for the case study work: Quality of transport infrastructure

From the outset, it was important to have some understanding of the quality of the infrastructure in each of the countries in which case studies were undertaken.

The World Economic Forum’s *Global Competitiveness Report 2010-2011* (2010) provides rankings in respect of the quality of transport infrastructure – overall and by mode – for case study countries, as per Table 3.1.

Table 3.1. WEF rankings: Transport infrastructure quality by mode

	Quality: overall infrastructure index score	Quality: overall infrastructure overall rank	Quality of road infrastructure ranking	Quality of railroad infrastructure ranking	Quality of port infrastructure ranking	Quality of air transport infrastructure ranking
	2010-2011	2010-2011	2010-2011	2010-2011	2010-2011	2010-2011
Austria	6.4	15	7	15	-	15
Denmark	6.3	10	9	12	10	6
Finland	6.4	8	13	7	6	15
France	6.6	4	2	4	12	5
Netherlands	5.9	17	27	9	3	8
Sweden	6.4	7	18	14	9	12
Switzerland	6.8	1	3	1	35	5
Turkey	5.1	40	46	63	46	44

Source: World Economic Forum (2010), *Global Competitiveness Report 2010-2011*, World Economic Forum, Geneva, September.

Table 3.1 highlights that the countries in which the case studies were undertaken are almost all ranked by the WEF’s *Global Competitiveness Report 2010-11* as being in the top 20 countries, on the basis of the quality of their overall infrastructure. The only exception is Turkey, which was ranked 40 – a creditable result, given that Turkey is

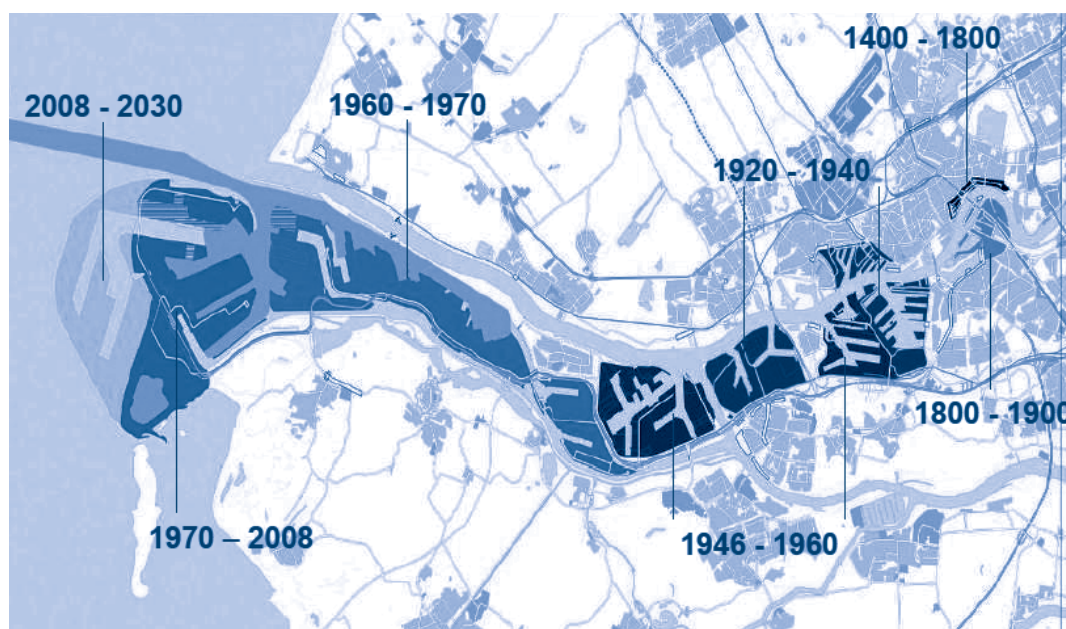
developing rapidly but not yet in the top group of developed countries. Turkey’s lower ranking highlights its opportunities for significant progress and improvement.

In other words, the projects and proposals put forward for consideration in the case studies relate to the planning and development of strategic infrastructure in countries that already have some of the best infrastructure in the world, according to the WEF’s rankings. Of course, this increases the prospects that there will be examples of “good practices” highlighted that could be of interest in other countries whose infrastructure quality is not ranked as highly.

Port of Rotterdam

The Port of Rotterdam is a hub for the international flow of goods, as well as a world-class industrial complex. The port area has been developed progressively downstream from the earliest port location, close to the centre of Rotterdam. A major extension of the port (Maasvlakte 2) is under way; reclamation of the land began in 2008. The Maasvlakte 2 project, shown in Figure 3.1, will secure the port area and terminal locations needed to allow the port to expand and adapt to expected future needs. The first container terminal is expected to be operating in 2013 or shortly afterwards.

Figure 3.1. Port of Rotterdam’s historical and current development areas



Source: Port of Rotterdam (2010), “The Port of Rotterdam and its hinterland”, OECD Workshop, 24 March, Rotterdam.

The Port of Rotterdam Authority is manager, operator and developer of Rotterdam’s port and industrial area. The Port of Rotterdam has well-designed organisational structures well-adapted to its roles. The Port Authority is a public limited company (N.V.) with two shareholders: the Municipality of Rotterdam (70%) and the Dutch state (30%). Governance arrangements have been chosen carefully to ensure a continuous focus on economic, commercial and environmental goals. The Port of Rotterdam is also a

landlord port. All the necessary powers and responsibilities are vested in the Port Authority to allow it to plan, develop and manage the port land and sea areas under its responsibility – as well as the common user infrastructure within the port’s jurisdiction. The corporation structure combined with a landlord port model means the organisation is publicly owned but commercially driven.

The workshop discussions highlighted the importance of the Port Authority having been transformed into a corporation. As a corporation, the authority had the cash flow and financial capacity to borrow up to the level of its existing equity (i.e. a capital structure with a 50:50 debt/equity ratio). This level of equity and borrowings was sufficient to allow the authority to assume full financial responsibility for the Maasvlakte 2 project.

Opportunities and challenges

The Port of Rotterdam is the largest port in Europe and one of the leading ports in the world. It has clearly built up a strong competitive position *vis-à-vis* other ports over many years. This has been reinforced by the high frequency of services and the high quality port, inland terminal facilities and road, rail and inland waterway transport connections, as well as its corporate structure and governance. The port’s competitiveness depends on important additional factors, such as the strength of the industries, commercial activities and operational services (including logistics in particular) co-located with the port, within the City of Rotterdam; the focus on local government functions crucial to the port’s operations; support from the local community for the port’s continuing operations and expansion; and supportive EU/NL policies. None of the aspects mentioned above can be matched easily by a start-up operator or a port that does not perform significantly better on at least some of these essential elements.

The Port of Rotterdam is well placed to benefit from the economic and trade outlook. The port can expect to handle increasing volumes of maritime freight generated by economic growth and trade between Europe and other regions, which will be carried on larger ships operating along the major trade routes to and from northwest Europe. In the future, the port’s already large throughput volumes could increase significantly. For example, total volumes could increase by more than 60% over 2008-2030. Container volumes could increase even faster, more than doubling 2008 levels by 2030. Of course, with less positive global or regional scenarios, volumes could be much lower.

Such rapid growth and large volume increases in port throughput require space to expand, as well as port infrastructure and logistics facilities well adapted to the tasks ahead. The Maasvlakte 2 Port development will provide the space and facilities required. Increased inland transport capacity will also be needed.

The Port of Rotterdam’s experience in the area of environmental protection is first-rate. The Maasvlakte 2 development project offers a “best practice” example of how integrated planning of this major port development can facilitate **growth** that will go hand in hand with **green**. The Port Authority is taking actions that highlight the ways in which infrastructure investment can best contribute to “green growth”.

The Port Authority recognises the importance of high quality, high frequency and reliable inland transport connections to the port’s overall performance. The port generates very significant volumes of inland transport. The inevitable consequence will be greatly increased volumes being carried on inland transport services over long distances between the port and major origin and destination activity centres in Europe.

One of the important issues is that the Port of Rotterdam, like many other ports in northwest Europe, relies heavily on road transport for inland transport services. The authority is now firmly focused on increasing the shares on inland transport handled by the port that is carried on lower impact modes (inland waterways and rail transport). Target shares for 2035 are: inland waterway, 45%; road, 35%; and rail, 20%.

In the longer term, when the world is likely to place even greater weight on reducing carbon intensity, fossil fuel use and CO₂ emissions, there is likely to be some questioning of the appropriate balance between efficiency, environmental impacts and sustainability – and related to this, some doubt about whether the outcomes will favour the Port of Rotterdam to the same extent in future. For these strategic reasons, it seems the jury is still out on whether the Port of Rotterdam's future is already written – or whether the changing times, circumstances and port-city competitiveness on a broader scale will mean greater challenges, different market shares and the need for sails to be trimmed accordingly.

Rotterdam Workshop Report

The Rotterdam Workshop Report is on the OECD International Futures Programme website.

Turkey – Bosphorus

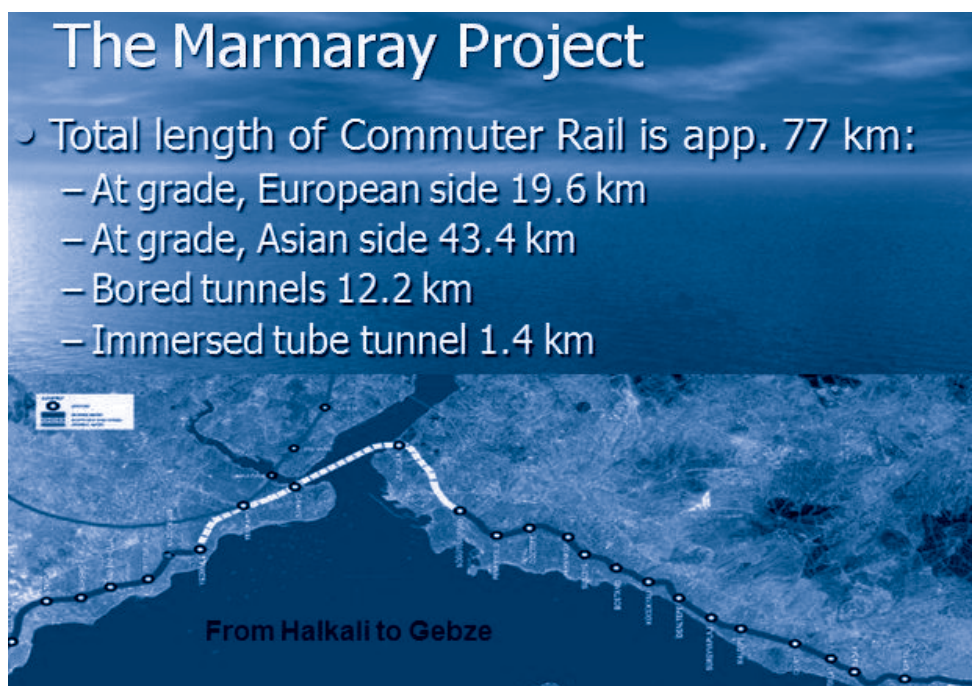
Marmaray project

The Marmaray project will provide an upgrading of the commuter rail system in Istanbul; its central element will be a rail tunnel under the Bosphorus that connects existing rail lines on the European and Asian sides. It includes the upgrading of approximately 77 kilometres of commuter rail, connecting Halkali at one end on the European side with Gebze at the other end on the Asian side with an uninterrupted, modern and high-capacity commuter rail system.

One of the important urban problems of Istanbul is the difficulty of transport resulting from the rapid and uncontrolled population growth and a rapid increase in motorisation and the related traffic jams. The Bosphorus Strait, which divides the city between two continents, exacerbates the transport difficulties. Crossing the Bosphorus between the European side (where the main axes of the city and work areas are located) and the Asian side (where the largest residential areas are located) causes great time losses for Istanbul's inhabitants. The waste of time and fuel and the associated air and noise pollution, together with the accidents associated with increasing traffic levels are having a serious negative effect on the health of both the city inhabitants and the city itself. Furthermore, the two bridges opened in 1973 and 1988 to resolve transport problems between Istanbul's two sides have created a transport system dependent on highways and private transport. The mass transport solutions required to help resolve Istanbul's transport problems have not yet been developed sufficiently.

In Figure 3.2, the dark line shows the parts of the railway that are above ground. The white dotted line shows the new railway sections being constructed in tube tunnels under the Istanbul Strait and the bored tunnels constructed between the tube tunnels and the adjacent stations on either side.

Figure 3.2. Marmaray project showing at-grade, bored and immersed sections



Source: Turkish Ministry of Transport (2010). “The Marmaray Project”, OECD Workshop, 19 April, Istanbul.

Project objectives include providing a long-term solution to the current urban transport problems of Istanbul, directly connecting railway systems on the Asian and European sides/continents, and relieving existing operating problems with the mainline railway services. The project is expected to:

- increase capacity, reliability, accessibility, punctuality and safety on the commuter rail services;
- reduce travel time and increase comfort for a large number of commuter train passengers;
- reduce air pollution from vehicle exhaust gases and thereby improve the air quality of Istanbul;
- reduce adverse effects on historical buildings and heritage sites by offering a potential for reducing the number of cars in the old centre of Istanbul.

Opportunities and challenges

This is one of the major transport infrastructure projects in the world at present. The Marmaray rail tunnel and railway upgrading is in fact such a major infrastructure project that it will influence not only daily traffic patterns in Istanbul, but also the development of the city and the region.

Clearly, there is no prospect of meeting future transport requirements on a metropolitan scale without adequate public transport. The Marmaray project should be very successful in its own right. It will contribute to improved accessibility and reduced travel times for the hundreds of thousands of passengers using its services each day,

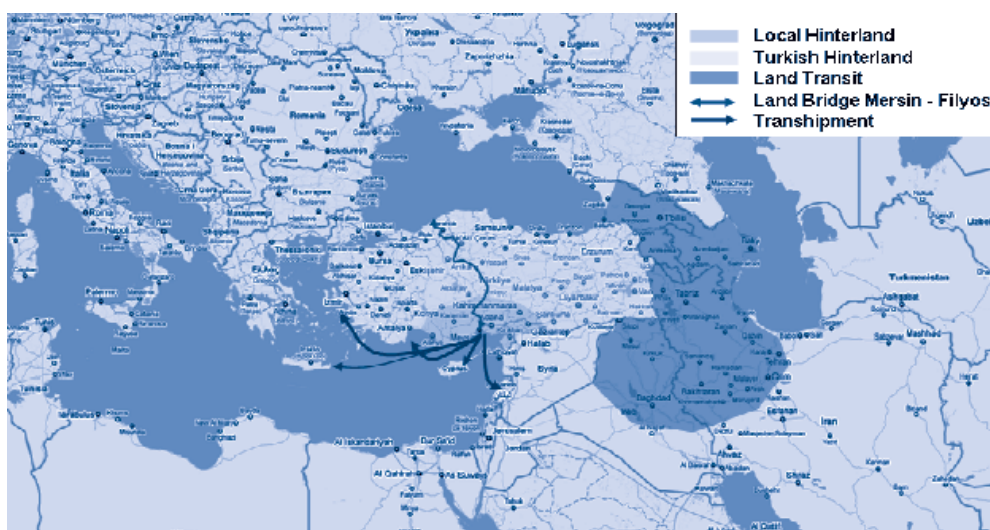
particularly to central areas. The extent of improvement in urban connections will depend in part on the quality of the network performance achieved across the metropolitan area after the Marmaray project is completed. Public transport interchanges between rail, underground, trams and buses will be centrally important and will need to be high quality and high capacity.

However, it would seem important to embark upon the complementary actions that will be required to ensure that the increasing levels of car ownership do not translate into large unwanted increases in motor vehicle use across the Bosphorus and into central areas and activity centres – which likely would in turn translate into highly unreliable travel times on the roads or effective “gridlock”. There could be a need for active traffic management on bridge crossings, access routes to central areas and on major arterials – as well as tight controls on parking – to avoid a serious increase in the geographic spread and duration of congestion.

Mersin Container Port

The Mersin Container Port’s potential importance, as illustrated in Figure 3.3, lies in its maritime and inland connections and its local and extended hinterlands in Turkey and countries to the east.

Figure 3.3. Mersin Container Port – hinterland traffic



Source: Turkish State Planning Organization (2010). “Turkey’s transportation policy and maritime infrastructure needs”, OECD Workshop, 19 April, Istanbul.

The new container port will be located adjacent to the existing Port of Mersin, which is an established multi-purpose port situated near the eastern end of Turkey’s Mediterranean coast. The existing port, which was privatised by transfer of operational rights in 2007, is a general cargo port currently handling a relatively low volume of containers. The authorities consider that the existing port should benefit considerably from the container port co-development.

The Mersin Container Port project's forecasting study anticipates container traffic of approximately 11 million TEUs by year 2035, in a neutral scenario. Being evaluated under international trans-European Networks, Mersin Container Port is planned to provide a hub port activity and act as a gateway between Mediterranean container shipping lines and Middle East, Mid-Asian landlocked countries – and as a trans-shipment hub for the rest of the countries in the region.

Opportunities and challenges

The Mersin Container Port project will provide a gateway location not only for Turkey and its proximate hinterlands but also for some Middle East countries (particularly Iraq) as well as Caucasia and landlocked Asian and some CIS countries. It is an important strategic project that attempts to respond to the identified need for a gateway port towards the eastern end of Turkey's Mediterranean coast, in a location close to the Suez Canal. With the additional potential to facilitate some cargo transport between the Mediterranean Sea and the Black Sea via Ankara, it could provide an alternative routing to help at least partially relieve congested shipping during periods of peak demand through the Bosphorus.

The timing of the Mersin Container Port's development will be important. Like other countries, Turkey's international trade was affected significantly by the financial crisis, and its maritime container freight volumes have fallen. This has taken some of the immediate pressure off port capacity and led to some rethinking of the scheduling of planned port developments. In the future, it will be important for the timing of Turkey's tendering processes and port development work to continue to be tailored to the recovery of maritime freight and container markets and increases in container demand in particular.

Since the workshop report was prepared, the Ministry of Transport has advised that maritime freight container volumes fell from 5.09 million TEUs in 2008 to 4.4 million TEUs in 2009 – a 13% fall. The increase, on the other hand, from 2009 to the 2010 level of 5.74 million TEUs was around 30%.

Nabucco Gas project

The Nabucco Gas Pipeline is a strategic project for gas supply from the Caspian and Caucasus and Middle East regions to Southeast and Central Europe. The Nabucco project will develop a new gas pipeline connecting the Caspian region, the Middle East and Egypt with Austria and further on to the Central and Western European gas markets via Turkey, Bulgaria, Romania and Hungary. The Nabucco project will become the fourth supply corridor for natural gas into Europe, after the North Sea, North Africa and Russia, enabling new suppliers from the Caspian and the Middle East regions to access the European gas market.

The Nabucco Gas Pipeline is a Trans-European Network (TEN) – energy project of European interest, as identified by the TEN-E Guidelines adopted by the European Parliament and the Council. The project offers source and route diversification for the demanding natural gas markets.

The pipeline length is approximately 3 900 kilometres, starting at the Georgian/Turkish and the Iranian/Turkish borders respectively and ending at Baumgarten in Austria. According to market studies, the pipeline has been designed to transport a maximum amount of 31 billion cubic metres per annum. The currently proposed route is shown in Figure 3.4.

Figure 3.4. Nabucco gas pipeline route via Turkey to Vienna



Source: Nabucco pipeline website: www.nabucco-pipeline.com, May 2011.

The project was a joint proposition by the respective gas companies of the involved states and is currently being executed by Nabucco Gas Pipeline International GmbH (NIC) – which is directly owned by the Nabucco Partners and is responsible for the marketing of the pipeline capacity. It will be the only company in direct contact with the shippers (one-stop-shop principle), and will operate as an autonomous economic entity on the market, acting independently from its parent companies.

An intergovernmental agreement was signed in Ankara and then entered into force in August 2009. The Nabucco National Company (Turkey) was established in June 2010 and will own the Turkish portion of the infrastructure. Heads of terms of the Standard Transportation Agreement have been agreed upon between the Nabucco Partners and will be used as a basis for shipping contracts to be entered into with shippers that book capacity under the open season procedure, as well as a transport contract.

Opportunities and challenges

The Nabucco Gas Pipeline is clearly a transcontinental infrastructure project of great strategic importance. According to the IEA's projections, oil and gas will remain major energy resources to meet growing energy demand in the medium term. Diversification of energy supplies and distribution – by both energy type and source, as well as by route – has been and will continue to be an important measure to improve energy security. Climate change is the most serious global energy-related environmental problem and action to counter the phenomenon could present a potential challenge to the level of gas demand in the future. There could be significant future policy changes aimed at reducing CO₂ emissions. However, natural gas has lower carbon intensity compared to other fossil energy sources, and hence is subject to less pressure given the prospects for reducing CO₂ emissions.

Despite a number of challenges, the project appears fairly robust in an organisational sense, based on the level of co-operation to date. A margin for adjusting the project's construction start and completion dates in response to market demand would provide a degree of useful project flexibility and reduce project risks. Given its level of ambition, the challenges to be overcome, and the final importance of the project internationally and

to the European region and project partners in particular, the Nabucco project appeared indeed suitable for highlighting in the OECD report.

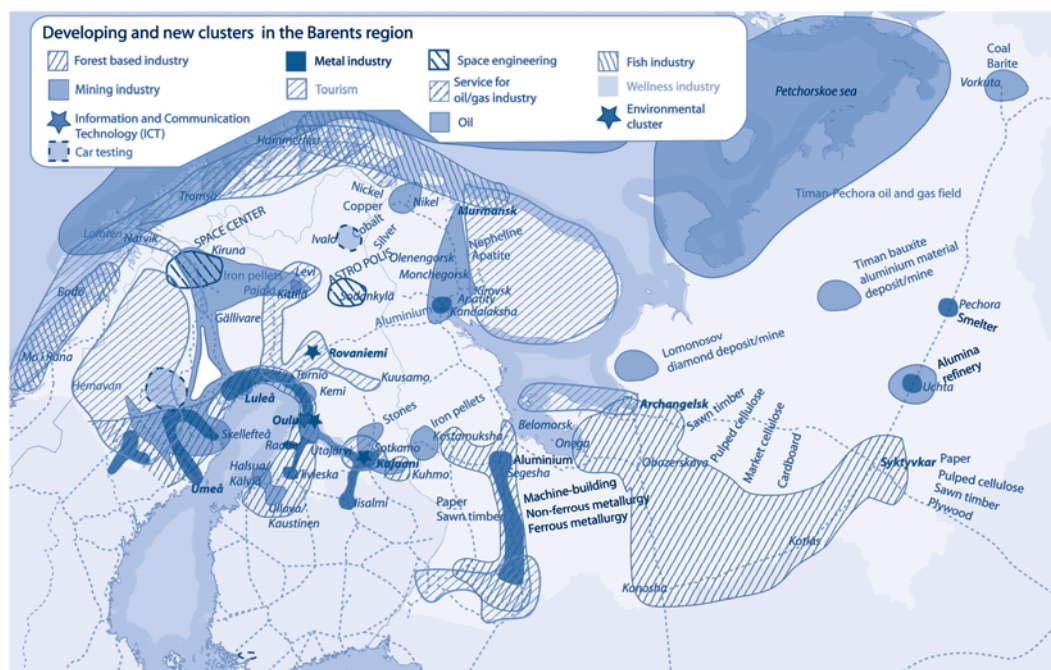
Istanbul Workshop Report

The Istanbul Workshop Report is on the OECD International Futures Programme website.

The “High North”/Barents area – strategic infrastructure in Finland and Sweden

In the short to medium term, resource developments seem likely to go ahead in a number of locations in Finland and Sweden, requiring rail (and possibly road) improvements and new rail track in these countries. Some linking to ports could be required. Most of the existing infrastructure forms part of national transport plans. There are a number of deficiencies in international/cross-border and regional connections in some locations (e.g. from resources to processing facilities and across borders to ports in adjacent countries). Improved international rail (and road) connections seem to be in prospect in the medium term, in particular with the Russian Federation. Resources locations in Finland, Norway, the Russian Federation and Sweden are shown in Figure 3.5.

Figure 3.5. **Developing and new clusters in the Barents region**



Source: Sara Jacobsson (2010), “TransBaltic”, OECD Workshop, 3 May, Helsinki.

In the longer term the possibilities are broader in scale but many of the options are more problematic. The Bothnian Corridor possibilities could require a significant infrastructure upgrading on either side of the Bothnian Sea. Improved northern east-west connections across Finland and Sweden to Narvik would depend largely on demand to

and from the Russian end – and probably also involve Norway making a significant funding contribution. In turn, Russian demand and flows probably depend on someone (else) – or a huge joint venture – tackling the Trans-Siberian Railway improvements required (with its massive funding requirements and challenging weather conditions). The Northern Sea route is likely to be open for longer in the future as a result of the contraction in the area of the Arctic ice cap. This could allow faster and lower cost maritime transport between Asia and Northern Europe. However, by 2030 the Northern Sea route is likely to be open for an extra month or so a year – i.e. less than three months in total per annum.

Opportunities and challenges

A more unified vision for a more integrated High North region seems to be in prospect, involving not only Sweden and Finland but also Norway – and in due course, the Russian Federation as well. At the same time, there are many different alternative projects under consideration. There needs to be a more co-ordinated regional vision and transport plan for the future against which eventual infrastructure options can be assessed.

Resource developments raise many challenges for infrastructure providers. The producers and their mines are subject to the vagaries of the international markets. Mines that are expected to be viable when demand and commodity prices are high may be mothballed when demand and/or commodity prices fall. Viability can also be affected by decisions on production levels in other countries. From an infrastructure provider's viewpoint, it will also be important to give careful consideration to the demand and risks involved.

That done, consideration can be given to funding availability and adequacy. It is possible that all needs can continue to be met using traditional government funding approaches. However, given the likelihood that alternative calls on government budgets will reduce the levels of infrastructure funding available in the future, consideration may need to be given to possible alternative funding approaches. More commercial terms – and even allowing the transport infrastructure required by resource developments to be funded by the resource companies themselves – could be particularly valuable. Alternative funding approaches may, in fact, allow some resource developments to proceed that would otherwise be hampered or blocked by limited public funding.

The largest institutional challenges are likely to relate to the diversity of regional and organisational interests and the greater regional co-ordination required. Given this diversity, strong government/industry proponents will be required to clarify the real needs and priorities and – supported by rigorous business cases – to garner support for the outcomes required.

Possible changes in trade and transport demand along key trade routes could lead in the longer term to improved inland transport between Asia and Europe. The Haparanda Declaration – signed by ministers/high-level representatives of China, Denmark, Estonia, Finland, Germany, Iceland, Latvia, Lithuania, Norway, Poland, the Russian Federation and Sweden on 17 June 2010 – has given the prospects a boost. Improved transcontinental infrastructure on this scale could have significant impacts on the High North.

But in organisational terms, it would be difficult indeed to contemplate a major transcontinental infrastructure project to improve Asia-Europe rail services, relying on a continuation of individual responsibilities to secure the necessary participation of all the

governments involved and to co-ordinate their rail operators and infrastructure providers sufficiently to achieve the unified outcomes required.

An alternative approach could be to make use of an inter-governmental framework similar to that adopted for the Nabucco Gas Pipeline. Partnership agreements between the commercial parties involved (along the lines of the Nabucco project's inter-governmental partnership arrangements) could also be a useful addition to the approach. A huge joint venture structured along these lines could help secure the support and participation required and offer the potential to raise the funding and co-ordinate the activities required. For this to be a prospect, there would need to be an effective project proponent. Depending on the structure of the joint venture, individual elements could perhaps be undertaken on a PPP basis.

Helsinki Workshop Report

The Helsinki Workshop Report is on the OECD International Futures Programme website.

France – gateway ports

Port of Le Havre

As the first port of call when sailing the English Channel/North Sea route, through which a quarter of the world cargo trade passes in transit, Le Havre is included in the round trips of large liner ships providing or able to provide the shortest transit times for intercontinental trade. As a genuinely deepwater seaport, Le Havre can accommodate all types of vessels round the clock and all year, without any tidal constraints.

Over the ten years preceding 2008, freight throughput volumes at the Port of Le Havre rose steadily, from 66.9 million tonnes (MT) in 1998 to 80.9 MT in 2008. In terms of its competitive position, Le Havre was ranked number five in terms of goods throughput in 2008 in the Hamburg to Le Havre range, with a market share of 6.7%. In 2009, during the global financial crisis, freight throughput volumes decreased from 80.9 MT in 2008 to 74.0 MT in 2009 – a decrease of 8.4%, similar to that experienced by other major ports.

Port of Marseille

The Port of Marseille Fos is the leading port of France, the first Mediterranean port, and the third oil port worldwide. As a general cargo port, the various types of traffic include crude oil and oil products (oil, gas and chemical products), general cargo (containers and other packaging), dry bulk (minerals and cereals) and liquid bulk (chemicals and food). The port also caters for passenger traffic from cruises and regular shipping lines to Corsica and North Africa. The port features two harbours, the 400-hectare East Harbour within the city of Marseille, and the West Harbour located 70 kilometres from Marseille at Fos, on a unique, impressive 10 000-hectare site.

Port Act 2008

The French Government's port reforms in 2008 made important changes to the roles of port authorities at France's autonomous ports – including those of Le Havre and Marseille:

1. Port Authority – the autonomous ports retained a public authority statute.
2. Port infrastructure – the focus of the autonomous ports was redirected to their public authority missions (maritime access, safety, security, etc.) as well as the planning, development and management of the port area (large infrastructure, terminal, adding land value).
3. Terminal operations – the autonomous ports were required to transfer operations of their port terminals to private sector operators. Such transfers were intended to allow the private operators to manage all aspects of their operations and to contribute to productivity gains. Personnel were to transfer voluntarily to the employment of the private sector operators.

Opportunities and challenges

The Ports of Le Havre and Marseille are now operating under new policy frameworks, following the implementation of the port reforms in 2008.

In terms of total traffic volume and market share, the French gateway ports lag well behind the largest ports in Europe (Rotterdam, Antwerp and Hamburg). Of course, a large part of the difference is due to the size and importance of the industrial areas in their respective “natural” hinterland markets – with Rotterdam and Hamburg directly connected to German industrial areas in particular.

The French ports have undertaken strategic planning exercises to identify the pertinent key strategic factors as well as a plausible range of possible future outcomes. It is clear that the Ports of Le Havre and Marseille can be expected to perform better in the future.

Port of Le Havre

Le Havre's Strategic Plan 2009-2013 anticipates significant Port 2000 investments that will help improve the port's facilities and competitive position. Some investment proposals still need to go through the extended port planning, consultation and decision-making processes required by the legislation on port reforms. Major activities covered by the revisions to the Strategic Plan include containers, new vehicles, and bulk chemical liquids. The levers identified include inland/hinterland connections, logistics chains, sustainable development of port territory – not only local but also covering the large projects – and reform of terminal operations.

The Strategic Plan for the Port of Le Havre could well mark an important turning point. Clear objectives and targets have been set for the port's operations. The Strategic Plan highlights an increasing focus on containers, new vehicles and bulk chemical liquids. Container market shares are expected to increase from 7% in 2009 to 9.3% in 2020; container volumes are expected to increase from 2.6 million TEUs in 2009 to 6.3 million in 2020. Achieving the targeted increases in container volumes – nearly doubling volumes by 2020 – would seem to be very ambitious. However, the prospects could be boosted by the high proportion of the container ships on order/being delivered

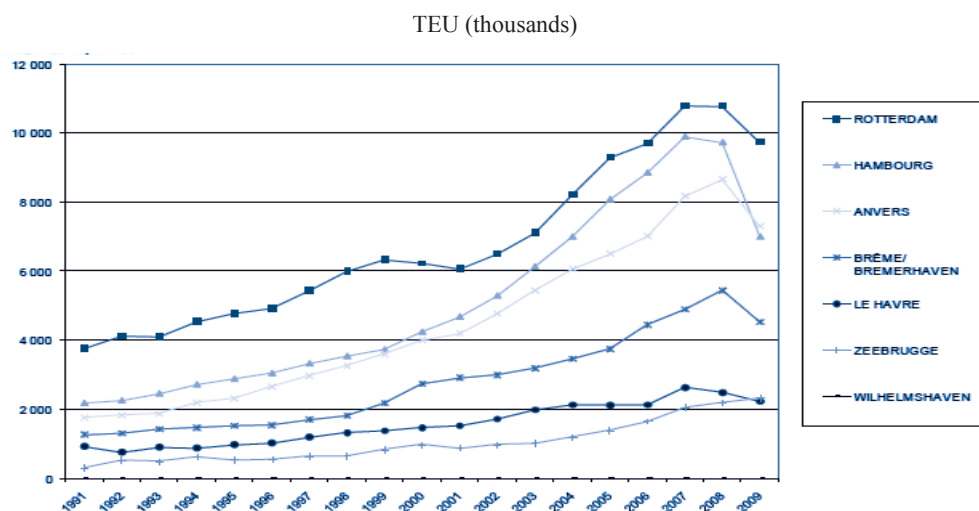
having a capacity in the range 10 000 to 15 500 TEUs. Le Havre seems to be one of only four northwest European ports – along with Zeebrugge, Rotterdam and Hamburg (with dredging) – that are genuine deepwater ports, able to handle the largest container ships being built.

In relation to inland transport, the Port of Le Havre is more dependent on road transport for inland freight coming and going than many other gateway ports. The Strategic Plan sets out the port's ambition to increase the use of the mass transit modes (i.e. inland waterways and rail transport) for hinterland traffic from around 15% in 2009 to 25% by 2020. The target reflects general support for the development on a multi-modal basis of the high-volume, low-impact modes (inland waterway, maritime transport and rail freight) to allow the increased market shares to be achieved.

There are major opportunities for improved inland waterway transport along the Seine axis as well as to the north of the Seine and the south of Belgium. Increased co-ordination is in prospect across the Ports of Le Havre, Rouen and Paris/Ile de France. Improvements are needed to the Port of Le Havre itself to permit barge access to the Port 2000 development. Their completion will generate prospects for competitive port services and for increasing volumes and shares of inland cargo to be carried by inland waterway services.

With rail, the opportunities relate more to enlargement of the hinterland that high-performing rail services can allow. The best opportunities seem to be along trade corridors to Paris/Ile de France, the Rhone Alps, the north of France and connections to the south of Belgium, and possibly Alsace with the connections this will allow to southern regions in Germany.

Figure 3.6. Trends in container traffic across western European ports (Le Havre-Hamburg)



Source: Le Havre Port (2010), "Projet stratégique du Grand Port Maritime du Havre", OECD Workshop, 7 May, Paris.

Port of Marseille

The Strategic Plan of the Port of Marseille in April 2009 highlighted five orientations for development. These were to meet the challenge of ramping up container volumes, diversify so as to continue accommodating all sorts of energy shipments, reinforce the port's position as the southern European port for dry bulk, remain a large Euro-Med Ro-Ro hub, and develop as a large southern passenger port.

As part of its strategic orientations, the port has set a target of increasing the share of container traffic using low-impact modes (inland waterways and rail). Inland waterways' share is expected to increase greatly, with a 10% share by 2013 requiring a doubling of its 2009 container traffic level. Rail freight is expected to increase even more, from 14% to 30% by the same date – representing nearly a fivefold increase in rail volumes. Although the road share is expected to fall as a result, the volume of containers carried by road freight would still increase by close to 60%, to over a million TEUs.

In this respect, the container-handling situation at the Port of Marseille is expected to improve considerably with the development of Marseille Fos as the new container-handling centre (70 kilometres to the west of the old harbour) and the completion of the new terminals and Distriport support facilities that are required. Some reforms are still needed (e.g. for rail operators of proximity), and there are very large investments still to be made.

Actions are required on many fronts at the Port of Marseille Fos to deliver on the five strategic orientations. Responding to the opportunities and challenges identified will require a high level of professional focus and commitment from all parties involved to ensure all the actions required are actually undertaken – and the performance objectives actually achieved.

MEEDDM¹ Paris Workshop Report

The MEEDDM Paris Workshop Report is on the OECD International Futures Programme website.

Denmark – Greater Copenhagen area

Prior to 2007, responsibility for infrastructure planning in Denmark was divided between the three levels of authority: the state, 14 counties and 271 municipalities. Following political reforms, the national government took over responsibility for 2 200 kilometres of the road infrastructure. Although the state only manages 5% of the road network, the trunk network accounts for nearly half the total traffic volume.

Green Transport Agreement. With the political Agreement on “A Green Transport Policy” of 29 January 2009, the government, the Social Democrats, the Danish People's Party, the Socialist People's Party, the Danish Social-Liberal Party and Liberal Alliance agreed on a number of overall principles and concrete initiatives. The agreement can be called historic as to its economic scope and its broad political support.

The Green Transport Agreement had wide political support. The guiding principles outlined in Box 3.2 reinforce ongoing priorities in the different areas (e.g. bicycling, CO₂, noise, air pollution). Road capacity is to be extended on the basis outlined, emphasising that roads have an important function within the transport system. Noteworthy are the

intention that a “green reorientation of the existing car taxation scheme shall be carried out” and the objective that: “Public transport shall absorb most of the future growth in traffic. The railways shall be reliable, safe and ultramodern”.

Box 3.2. Principles in the Agreement on a Green Transport Policy

- CO₂ emissions from transport shall be reduced and a green reorientation of the existing car taxation scheme shall be carried out.
- Public transport shall absorb most of the future growth in traffic. The railways shall be reliable, safe and ultramodern.
- Road capacity shall be extended primarily in the most congested areas at present, but also where the future growth in traffic as a result of economic and industrial development will require an upgrading of the infrastructure.
- Bicycling shall be promoted – the bicycle as a choice of transport means is preferred, where it is realistically possible.
- Denmark shall be a green test-bed for transport.
- Bridges, roads and railways must not spoil irreplaceable nature.
- Noise and air pollution in urban areas shall be reduced.

The total infrastructure programme over the period to 2020 approved by the Danish Government required funding of DKK 160 billion (around EUR 22 billion) for all the individual transport projects – which was also approved. A major Infrastructure Fund with approximately EUR 12 billion in total funding was created. The Infrastructure Fund will be financed partly by tax revenue and partly by other sources such as one-off returns from the sale of public assets, land value capture, and savings achieved in the budgeted costs of approved projects. The intention is that the Infrastructure Fund will be replenished with additional resources as new sustainable sources of funding are identified. The Fehmarn Belt Bridge connecting Denmark to Germany (financed by user fees) and the construction of the new city subway (“circle”) line were approved before the Green Transport Agreement. Separate funds were created for these two projects, with a total expenditure of around EUR 10 billion. In the longer term, other sources of funding are expected to become available.

The Green Transport Agreement and subsequent agreements in 2009 made a transformational change in the approval, development and funding processes for Denmark’s infrastructure investment programme.

Greater Copenhagen area

The Greater Copenhagen area, defined for this report’s purposes as a functional region, encompasses the capital region population of 1.6 million and the additional population in commuting zones on Zealand as well as on the islands Lolland and Falser and the population in Skåne Region, in Sweden.

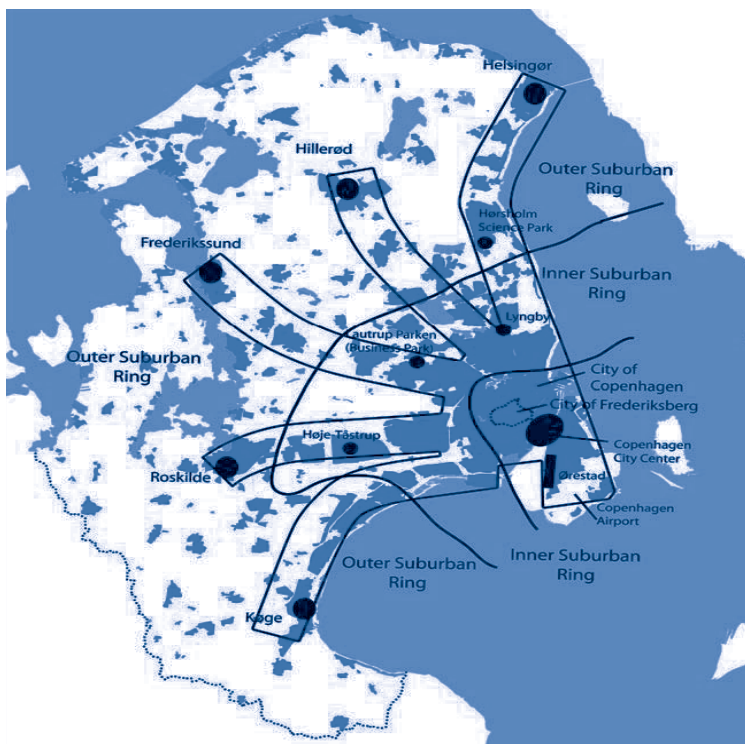
Urban development – the “Finger Plan”. Since 1947, Copenhagen’s urban development has followed a so-called finger plan, shown in Figure 3.7.

Figure 3.7. 1947 Finger Plan (stylised)



Source: Teknisk Kontor for Utvalget til Planlægning af Københavnsegnen, Copenhagen 1947.

Figure 3.8. 2007 Finger Plan



Source: Danish Ministry of Environment (2007).

Along with the Agreement on a Green Transport Policy, it was decided to initiate a long-term planning effort to analyse future large-scale infrastructure demands and identify major strategic options for infrastructure beyond 2020. Two strategic analyses – of the long-term infrastructure needs for Jutland and the Copenhagen Metropolitan Area – will form the framework for this long-term planning effort.

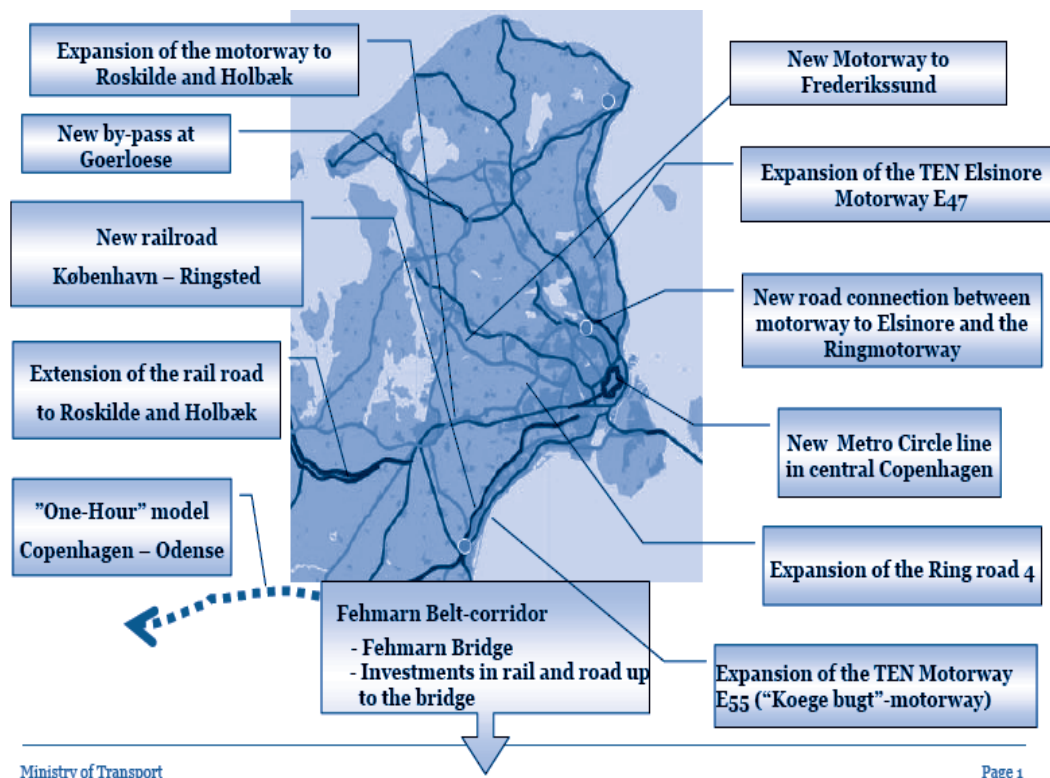
There are currently around 3.5 million people living in the Greater Copenhagen area, in Denmark and Sweden: a total of around 2.5 million people in the Greater Copenhagen area on the Danish side, and around 1 million people on the Swedish side.

Opportunities and challenges

The Green Transport Agreement and subsequent Agreements in 2009 produced a real change in the approval, development and funding processes for Denmark’s infrastructure investment programme. The country now has an agreed and fully funded programme over the period to 2020, with decided projects encompassing infrastructure and other investments in all transport modes.

The Infrastructure Fund and its many different sources – together with the special stand-alone funds for the large Fehmarn Belt and Metro projects – are providing security and ensuring sufficient funding for all the decided projects.

Figure 3.9. Decided infrastructure projects in Copenhagen over the period to 2020



Note: The map shows all projects most likely to be conducted by 2020.

Source: Danish Ministry of Transport (2010), “Infrastructure investment needs to 2020 and 2030/50”, 28 May, Copenhagen.

Copenhagen is already ranked highly in terms of its transport infrastructure. However, the city aspires to significantly improve public transport usage, reduce traffic congestion on the roads, and maintain high levels of mobility by road and rail systems, simultaneously and in a balanced fashion. The strategic analysis to be undertaken for the period beyond 2020 also provides solid opportunities to identify and explore projects that can make valuable contributions to the desired transport outcomes in the period to 2030 and beyond. Strategic issues include growing congestion, making collective transport an attractive alternative, and improved connections to nearby domestic and international regions.

The **Øresund Bridge** is one such connection. Its opening in 2000 created the first fixed link between Denmark and Sweden. As a regional artery for road and rail traffic, the bridge became a crucial linchpin that paved the way to a closer union between Zealand and Skåne on the Danish and Swedish sides of the Øresund Sound. It also created a strong new region for growth in Northern Europe – Øresund.

Another link, planned to be operational by 2020, is the **Fehmarn Belt**. This will provide a direct connection between Puttgarden in Germany and Rodbyhaven in Denmark. The economic benefit-cost analysis undertaken found the Fehmarn Belt link could result in total benefits of approximately EUR 1.9 billion over a 50-year period. Further analysis identified additional benefits arising from the dynamic and strategic effects – more trade (leading lower prices), and business dynamics (leading to increased productivity and lower costs). It also highlighted the importance of the cross-border link to Germany and Sweden.

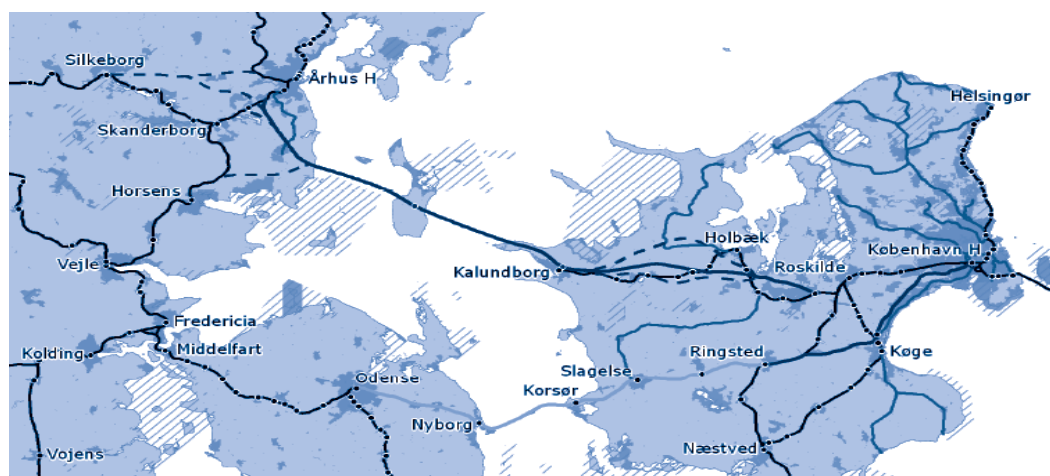
Strategic Infrastructure post-2020. There are many strategic opportunities over the period 2020-2030 and beyond. They include the creation of a future Fehmarn region in conjunction with the Fehmarn Belt fixed link, which would include Denmark, northern Germany and southern Sweden; an inner harbour tunnel that would improve road connections and facilitate urban redevelopment in Copenhagen; further improvement of the public transport system in Copenhagen, e.g. automatic suburban rail trains and new suburban rail services; options for improving connections between western and eastern Denmark, including improving domestic rail transport from Copenhagen to other Danish cities (in accordance with the “one-hour” rail policy) and a possible fixed link between Aarhus and Zealand (Kalundborg) – this would improve connections between Copenhagen and Aarhus as well as between Jutland and Zealand; improvements in air and land connections to Copenhagen Airport and rail connections to the relocated port; a possible Elsinore-Helsingborg fixed link across the Sound; and a possible western Ring 5 bypass of Copenhagen, separate from or in combination with any Elsinore-Helsingborg link.

In assessing the priorities for strategic infrastructure investment, careful consideration should be given to the opportunities for better connecting the largest population and employment centres.

Possible fixed link: Odense-Aarhus or Aarhus-Zealand. Possible new fixed link connections between Funen and Jutland – and between Jutland and Zealand – are currently being considered by the Danish authorities. Work on these possible connections – which could have important impacts on the Greater Copenhagen area – has identified three principal options. Options A and B would provide improved connections between Funen and south Jutland. Option A involves a somewhat shorter layout, including a new bridge across the Vejle Fjord in Jutland and upgrades on the existing rail corridor via the Funen/Little Belt. Option B is a new link across the northern part of the

Little Belt to shortcut the existing route between Odense on Funen and Aarhus in Jutland. Option C, shown graphically in Figure 3.10, would provide a more direct link between Aarhus and Copenhagen.

Figure 3.10. Possible fixed link Aarhus-Zealand (Kalundborg)



Source: Danish Ministry of Transport.

From a strategic viewpoint, there would seem to be little doubt that a direct Aarhus-Zealand fixed link would better contribute to connections to Copenhagen and would also better serve many strategic purposes. It could, for example, improve Copenhagen's connectivity and centrality in the Danish and Øresund transport networks, improve the integration of markets and workforces, and provide better connectivity between northern Jutland and Zealand. A direct road and rail link (if economically feasible) could be very much faster for passengers travelling between Copenhagen and Aarhus than routes via Funen or ferry services. The rail service could be faster than any road-based option and be expected to attract much of the existing road-based travel, as well as generate new travel by commuters and other passengers. Given the greater reductions in distances and travel times between Aarhus, Aalborg and northern Jutland to Copenhagen than offered by Options A or B, the benefits could be considerable. Of course, it is also the most expensive project under consideration. However, if technically as well as economically feasible, it would greatly help improve the overall transport network and its connections, enhancing Copenhagen's connectivity and centrality in Danish and Øresund networks and bringing the west and east of Denmark closer together.

Funding arrangements. Overall, the arrangements on which the very large infrastructure investment programme is based are widely supported and working well. The challenges ahead include assuring the future security of funding that will be required post-2020. The strategic problem is that the demand for transport and mobility is rising at the same time that other demands are increasing (e.g. health, environment and ageing populations).

Denmark has been considering the best approaches to take. As a first step, a kilometre-based road-charging scheme will be introduced for all trucks. Denmark will thus opt out of today's Euro-vignette – a time-based scheme covering all trucks above 12 tonnes driving the main international road connections in Denmark and nearby countries.

A forward-looking funding option could be to explore the opportunities (e.g. in the context of the proposed green congestion and other policy changes) for Denmark to move towards a financially self-sustaining transport **network funding** model, which could remove some of the limitations.

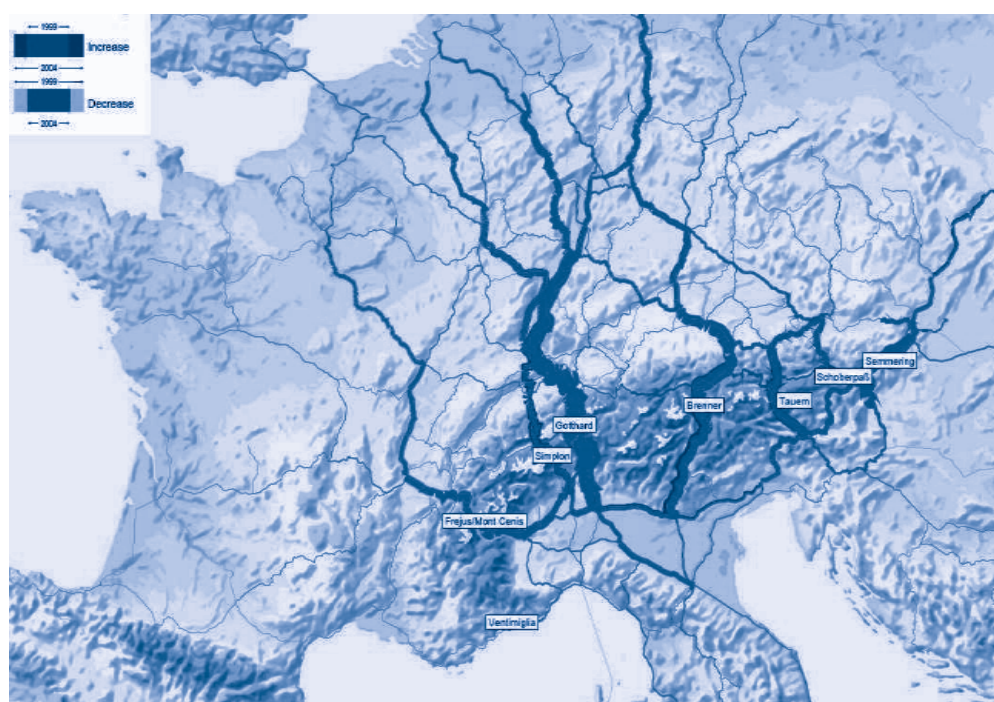
Copenhagen Workshop Report

The Copenhagen Workshop Report will be posted on the OECD International Futures Programme website.

Austria/Switzerland – inland hubs

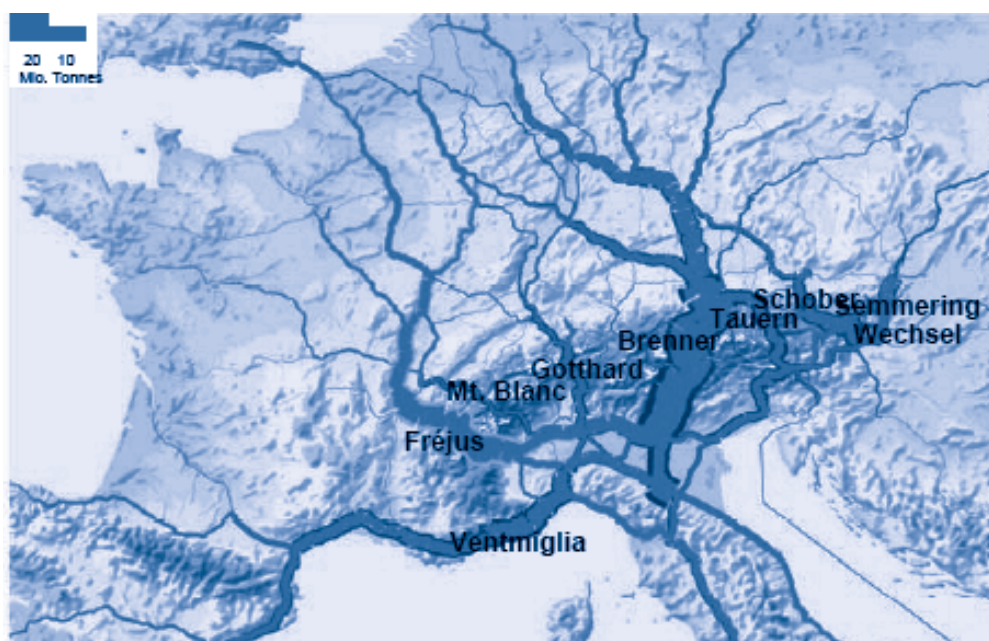
Recent road and rail freight flows across Switzerland and Austria are set out in Figures 3.11 and 3.12.

Figure 3.11. Transalpine rail freight flows (2004)



Source: Austrian Federal Ministry of Transport, Innovation and Technology (BMVIT) (2004), “CAFT Survey 2004”, Verlag Hölzel, Vienna.

Figure 3.12. Transalpine road freight flows (2004)



Source: Austrian Federal Ministry of Transport, Innovation and Technology (BMVIT) (2004), “CAFT Survey 2004”, Verlag Hözel, Vienna.

Switzerland

The base scenario projections anticipate ongoing increases in road, rail and total freight traffic across the Alps in domestic, import/export and transit categories. The major share is due to transit traffic (around 85%). Domestic, import and export shares of transalpine traffic are similar (around 5% each).

Modal shift. Modal shift of freight onto rail is now part of Switzerland’s federal Constitution. The goal is a transalpine limit of 650 000 heavy freight vehicles a year (*cf.* over 1 million vehicles per annum now), at the latest two years after the opening of the Gotthard base tunnel. Road taxes/charges are levied on transalpine road transport to limit that transport and promote modal shift. The charges themselves are set in accordance with an agreement reached with the European Union. The heavy vehicle tax has reached the maximum level allowed under the bilateral EU-CH Agreement on land transport and cannot be increased in the future.

Sources of funding. Switzerland has well-developed arrangements for the financing of the whole transport infrastructure system, including rail and road. The most important funding instrument is the “Special Financing of Road Traffic”, introduced in 1958 to finance the construction of the Swiss motorway network. Its main sources of funds are the petroleum tax (since 1958) and the motorway vignette (since 1985).

The “Special Financing of Road Traffic” (SFRT) contributes to replenishing the two additional Swiss transport funds that have been introduced more recently: the “Major Railway Projects Fund”, which was created in 1998 and which funds major extensions of the railway network; and the “Infrastructure Fund” which was established in 2008 and funds completion of the motorway network, elimination of motorway bottlenecks, and metropolitan transport projects (road and rail).

Cross-financing from road to rail. These current arrangements mean that under the Swiss financing system for transport infrastructure, roads to some extent cross-subsidise rail infrastructure. The Swiss advised that the road taxes/charges are paid partly (around 25%) by international road freight operators. Switzerland is using the funds raised to finance and build two alpine tunnels.

Austria

Austria has recently published a new Infrastructure Strategy (Government of Austria, 2011). There, the overall goals for infrastructure policy include accessibility, reliability, safety, and security. They also include:

- environment and social sustainability: focusing on a shift to the environmentally friendly modes (e.g. priority on rail infrastructure) and improving the sustainability within each mode;
- upgrading of infrastructure networks according to actual needs.

Within these overall goals, modal shift is an important long-term issue for transport policy. Measures that are necessary and need to be maintained include internalisation of external cost and cross-financing – both of which also help with the financing of the infrastructure. Additional measures might be necessary in ecologically sensitive areas, e.g. Alpine Transit regulatory schemes.

Austria has relatively well-developed funding and financing arrangements. The entire motorway network has been devolved to ASFINAG, a state-owned enterprise. As road network operator, it receives all of its revenue from a nationwide system of charging for use of the major roads. There are no state subsidies. The government retains control over road tolling rates. Public guarantees for loans to ASFINAG reduce the costs of borrowing, although the company's debt is not consolidated with the state's.

ÖBB-Infrastruktur AG (Austrian Federal Railways) is also a state-owned enterprise. It receives revenues from infrastructure charging (rail infrastructure charging) as well as from tickets and other revenue sources. Funding is also provided via state subsidies.

Greater use of the Mediterranean ports?

Austria and Switzerland are relatively close to Mediterranean ports. Austria makes more use of the ports than Switzerland. Nevertheless, Austria receives the majority of its inland freight from the northwestern European gateway ports – around a 64% share in 2007-2008 of the Austrian port/hinterland market in terms of total tonnages. The inland transport distances from the northwestern ports are long – over 1 000 kilometres in the case of the more densely developed areas in eastern Austria.

In the short term, it seems unlikely that there will be any major changes in overall patterns of usage of the northwest and Mediterranean ports. However, given the proximity of the Mediterranean ports to Austria and Switzerland and the increasing maritime freight volumes (including to eastern European countries) expected from Asia that will be delivered via the Suez Canal, it seems likely that the handling by these ports will increase, as will related inland freight volumes on inland connections. Port and inland rail infrastructure improvements that could be undertaken in the medium term would reinforce these trends.

Many aspects would need to be considered prior to such investments, including the infrastructure costs, business cases, possible sources of funding and financing – and contribution to wider objectives such as security, efficiency and regional development. The interests and capacity of the Italian and Adriatic ports would be crucial, as would those of the inland transport operators that would provide the inland services required. Of course, the views of the private sector would also be important, especially port terminal operators and logistics operators that could be involved in making future decisions on supply chains.

Opportunities and challenges

The workshop reinforced that good funding and financing arrangements are crucial to getting strategic infrastructure built. Austrian and Swiss transport infrastructure funding and financing have multiple sources of revenues – including user revenues, taxes and budget funding – and rely to some extent on cross-financing from road transport revenues to rail transport infrastructure improvements.

Switzerland

The Swiss infrastructure funding system is working well. It depends on earmarking of revenues from different sources and depositing them in the three Infrastructure Funds. Petroleum taxes and the motorway vignette are earmarked for the Special Financing of Road Traffic (SFRT Fund). The heavy vehicle fee and a small share of the value-added tax are earmarked for the Major Railway Projects Fund. A share of the SFRT Fund is transferred to the Major Railway Projects Fund and another share is used to replenish the new Infrastructure Fund established in 2008 for motorway and metropolitan transport projects.

The system's advantages include that it guarantees a reliable, long-term financing of the transport infrastructure, unaffected by the imponderables of the budget process. Good funding arrangements have provided the opportunity for major investments to be made that help meet the transport and sustainable mobility needs of Switzerland's population; provide the strategic transport infrastructure required by the country's position as an inland hub within Europe, at the crossroads of major transport corridors (e.g. Germany-Italy); and respond in particular to the need for increasing the use of rail freight to reduce the environmental impacts of existing transalpine transit traffic. Without this system, the ambitious capacity extension programme of the Swiss railway network (e.g. the New Rail Link through the Alps) would not have been achievable.

Austria

The Austrian funding system also works well and is well adapted to the country's infrastructure needs.

Austria is very well placed in relation to infrastructure funding by comparison with many other countries. It has robust road management arrangements, with a government-owned corporation in charge of the national motorway system and responsible for the truck charging and road tolling across the major road network. ASFINAG raises more funds from truck charges and road tolling than are needed for upgrading, extension and maintenance of the major roads. This allows cross-financing of rail infrastructure improvements. With a secure source of funds, revenues are also

relatively secure – although not immune to the effects on road volumes and revenues of a recession like that caused by the global financial crisis.

Cross-financing – i.e. use of funds raised from road taxes and charges to allow funding of rail and public transport improvements – is an important part of the Austrian arrangements that will need to be continued. Cross-financing from this secure revenue base in the future – in conjunction with user charges on rail and other public transport – will mean that Austria can expect to be well placed to undertake the many strategic rail investments needed over the next ten years.

Challenges for the future include the need to consider a better charging regime to improve environmental outcomes. Austria (like Switzerland) is also planning to consider additional measures that might be needed in ecologically sensitive areas – such as Alpine Transit regulatory schemes.

Overall, the funding and financing arrangements in both Switzerland and Austria are providing the financial security needed to undertake the large multi-year infrastructure investment programmes they have under way. However, there are challenges ahead. The Swiss have concluded that their earmarked revenues are likely to fall in the future. Peak loading on transport systems will require action to manage demand. As in many other countries, revised and improved funding arrangements will be needed for the medium term.

Bern Workshop Report

The Bern Workshop Report is on the OECD International Futures Programme website.

India's West Coast ports: Mumbai Gateway area

India's economy is strong and the third largest in Asia. The country has reached a critical point where it must expand its infrastructure to keep up with its economic output. Though the bulk of Indian trade is carried by sea routes, the existing port infrastructure is insufficient to handle trade flows effectively; the current capacity at the major ports is overstretched. The situation of limited capacity and high demand has inevitably resulted in port congestion.

Major ports. India has 12 major ports, which are under the central government's jurisdiction and governed by policy and directives of the Ministry of Shipping. In the future, traffic at major ports is expected to grow at a compound annual growth rate (CAGR) of 7.6% from 2010 to 2015. Current projections estimate that by 2020 major Indian ports will process more than 2.5 billion tons of cargo per annum. The Indian Government is aiming to triple capacity at the major ports in the next ten years.

Mumbai ports

Port of Mumbai. For decades, Mumbai Port remained India's premier port. Even with other ports nearby, it still caters to about 11% of the total seaborne cargo handled by major ports of the country in terms of volume – and handles about 20% of POL traffic and 21% of general cargo shipped via India's major ports.

Jawaharlal Nehru Port. JNPT was set up in May 1989, and in 20 years has emerged as the premier container-handling port in the southern Asia region. It handled 4.06 million TEUs during 2009-2010 – over 50% of India’s container port handling – and ranked in the top 30 of the world’s container ports.

The Port of Mumbai is planning investments totalling INR 68.8 billion (around USD 1.52 billion) from 2010 to 2020. Projects currently include INR 500 million for development of a container freight handling station and INR 15 billion for development of an offshore container terminal. JNPT plans to develop a fourth container terminal and associated works by 2015, increasing throughput capacity to 10.9 million TEUs by 2015. The port is well connected to rail and road networks and presently connected to 38 inland container depots (ICDs).

India’s minor/private sector ports

India has around 45 fully operational “non-major” ports, many located in the west coast states of Gujarat, Maharashtra and Goa. A few of them have been developed as relatively large ports (Mundra and Pipavav) through private sector participation and attract a fair amount of cargo. These are comparatively newer ports with modern facilities and smaller, better-trained workforces, and they score high on efficiency parameters. Minor ports come under state governments’ jurisdictions and are governed by policy and directives of the state governments’ respective nodal departments/agencies.

Opportunities and challenges

Global and regional increases in demographic and economic factors are expected to drive huge increases in economic activity, trade and related transport requirements for India generally over the period to 2030 and beyond. The population of India is expected to increase from 1.2 billion in 2007 to 1.5 billion in 2030 and possibly 1.6 billion in 2050. India’s GDP could increase three to four times over the period to 2030 – and seven times or more from 2007 to 2050. Indian GDP per capita could increase 5.5 times over the period to 2050. A significant share of the overall growth in port handling is expected to occur at west coast ports.

Mumbai Port handles large shares (around 20%) of India’s petroleum-related and general cargo categories but not containers. JNPT Port is the premier container port in India, handling 4 million TEUs in 2009-2010.

Mumbai’s 19 million population (2007) could increase strongly over the period to 2030 and beyond, i.e. 26.4 million (2025) and possibly 38 million (2050). With increasing trade and the maritime services, the necessary port and related infrastructure, and the inland transport provided efficiently, the outlook would be very positive for the Mumbai Gateway area – and both ports could expect strong increases in future demand.

As regards inland connections, the Indian Government’s plans for new high-capacity freight rail corridors between Mumbai, Delhi and Kolkata could make a major contribution to inland rail freight transport. Rail freight to and from Indian ports – and to JNPT in particular – is likely to be improved considerably once rail freight services are fully operational along the dedicated Mumbai-Delhi-Kolkata freight corridors.

However, both Mumbai ports face severe port capacity expansion constraints. Mumbai also faces some performance and efficiency issues and constraints on inland connectivity due to urban congestion. As a result, in the future the Port of Mumbai is expected to cater mainly to the localised demands of Mumbai itself, the local hinterland

of Mumbai, and surrounding areas in Maharashtra. For JNPT, a realistic estimate of its overall capacity (given geographical and policy restrictions) is considered to be around 10.9 million TEUs, expected to be reached by 2016-2017 (at 70% occupancy). These limitations raise real doubts about the ability of the Mumbai Gateway ports to provide the capacity required for their wider hinterlands. Unless future rounds of strategic planning at these ports identify feasible infrastructure solutions, it can be expected that increasing shares of overall growth in port capacity and cargo will be accounted for elsewhere – most probably by the “minor ports” and new private sector ports.

The ports to the north of Mumbai Gateway, mainly in Gujarat, are likely to tap a larger share of cargo bound for the hinterland of North India. Nearby also, the minor ports Dighi, Revas and Dharmatar appear to be well placed for expansion. These ports with shorter linkages to the “Dedicated Freight Corridor” may benefit more in terms of incremental cargo. The ports in South India – being closer to the international maritime routes – are likely to attract larger shares of trans-shipment cargo.

Despite their expected limitations in capacity expansion and the expected growth in nearby ports, both JNPT and Mumbai still have large infrastructure needs over the period to 2020. As with many other major ports, the capacity expansion and productivity improvements they need are likely to be realised with the assistance of PPP projects.

Taking a broader view across the region, on a number of measures (such as GDP growth, regulatory reform and liberalisation as well as traffic growth), India is following a growth pattern similar to that followed by China and seems to be on a similar trajectory, possibly around 15-20 years behind China.

China began investing heavily in its road and rail systems before 2000 (i.e. over ten years ago), initially more in roads. Since around 2005, with an ambitious plan for the rail network to be achieved by 2020, it has focused increasingly on railways. Rail freight services have benefited significantly from the development of the vast high-speed rail system being built for passengers, which is using a purpose-built network that will free up capacity for rail freight operations. By 2010, China had also expanded its main ports considerably and completed the first stage of the Yangshan deepwater port south of Shanghai to circumvent growth limitations on the Port of Shanghai.

Although the timings and examples are only indicative, if India continues to follow China’s lead, India’s investments in Mumbai, JNTP and other ports in the vicinity of the Mumbai Gateway area ports – as well as in their rail and road connections inland (e.g. to the Mumbai region and to the hinterlands beyond) – are only just beginning.

Indian West Coast Ports Report

The Indian West Coast Ports Report will be posted on the OECD International Futures Programme website.

Note

1. Ministère de l’écologie, du développement durable, des transports et du logement (Ministry of Ecology, Sustainable Development, Transport and Housing).

Chapter 4

Strategic transport infrastructure in other key economies

A number of other economies that are large exporters or importers (or both) – and therefore important to international trade and transport – were not able to participate in the OECD's Strategic Transport Infrastructure to 2030 project. However, the approaches they take to transport infrastructure generally and strategic infrastructure in particular are of considerable interest, and can influence developments elsewhere. This chapter outlines recent developments in five such economies.

This chapter outlines some recent developments and approaches to transport infrastructure in Australia, Canada, China, the United Kingdom and the United States. These large trading economies were not able to participate directly in the project, but their approaches and activities are directly relevant and could influence developments elsewhere.

Quality of transport infrastructure

The World Economic Forum's *Global Competitiveness Report 2010-2011* provides the Forum's latest assessments of country rankings in respect of the quality of transport infrastructure by mode. Those rankings for the five countries discussed in this chapter as well as scores and rankings for quality overall are shown in Table 4.1.

In Canada's case, overall and modal infrastructure quality is ranked by the WEF at levels similar to those of all the European countries that participated in the study – i.e. Canada figures among the top 20 countries.

The United States' ranking is a little lower, and Australia's and the United Kingdom's significantly lower. Given the positions of the three countries in global rankings of GDP per capita (respectively, near the top and relatively high), these numbers suggest their infrastructure has been somewhat neglected – a conclusion in fact supported by their recent infrastructure investment history.

China is developing rapidly and has ramped up infrastructure investment levels to help it do so. The quality of its infrastructure has been improving rapidly, and given its recent investments will continue to improve rapidly in future.

Table 4.1. **Transport infrastructure quality by mode (2010-2011)**

	Quality of overall infrastructure		Quality of road infrastructure	Quality of railroad infrastructure	Quality of port infrastructure	Quality of air transport infrastructure
	Score	Overall rank	Ranking	Ranking	Ranking	Ranking
Australia	5.2	34	30	26	46	30
Canada	6.0	13	17	16	14	23
China	4.1	72	53	27	67	79
United Kingdom	5.3	33	35	19	23	34
United States	5.8	23	19	18	22	32

Source: World Economic Forum (2010), *Global Competitiveness Report 2010-2011*, World Economic Forum, Geneva, September.

Australia

The OECD *Economic Survey of Australia* (2010b) found that Australia suffers from an infrastructure deficit and argues that the country's management of public infrastructure provision needs attention. Relevant aspects include information gaps and weak co-ordination among governments, as well as regulatory and institutional arrangements for investment. Since then, the Australian Government has released a Ports Strategy and a draft National Freight Strategy.

National Ports Strategy (December 2010). This strategy (Australian Government/Infrastructure Australia and National Transport Commission, 2010) highlights the importance of Australia’s ports for its economic growth as they handle 25% of all the country’s freight movements. The strategy is about creating a co-ordinated approach involving all levels of government in long-term planning for ports and their road and rail links, so as to improve port productivity and attract greater private-sector investment.

Long-term planning will assist governments but will also give industry more confidence to invest in ports. With trade levels doubling every ten years, the strategy covers bulk commodity ports and also container ports – port handling is expected to increase 150%, from 6.2 million to 15.4 million TEUs, by 2030. (By comparison, the volume of international air freight will increase by 110%, from 5.5 to 11.4 BTKs by 2030.)

The strategy outlines priorities and actions to ensure that Australia’s ports and freight corridors are ready for the growing task. It highlights the need for action to protect freight corridors from urban expansion. The aim is nationally co-ordinated planning that ensures all modes – ship, road and rail – operate harmoniously with one another.

Draft National Freight Strategy (February 2011). This draft strategy (Australian Government/Infrastructure Australia, 2011) aims to avoid capacity constraints on the roads and rail lines, in the interests of lifting export earnings. It proposes that key national highways and roads – including those connected to the ports – be opened up to the massive “B-triple” trailer trucks (mostly restricted to rural/regional areas at present).

Dedicated freight routes will be created and cargo and passenger train lines separated to avoid the bottlenecks that choked export earnings during the last resources boom. There could be an expansion of “inland ports” in the capital cities – with goods shuttled from trucks to trains – and dedicated freight roads built to connect these to the seaports.

The plan would make special rail lines available for cargo so that it does not interfere with passenger travel – including the AUD 4.7 billion Melbourne-Brisbane inland rail – separating the current tangle of urban commuter and freight train lines that leaves freight subject to curfews.

The strategy proposes that important land corridors be quarantined from urban encroachment so that new infrastructure can be delivered without conflicts with the local community. And it says that the regulation of the AUD 61 billion transport industry should be changed so that state-based arrangements are replaced with a set of nationwide rules. Importantly, under the heading “Long-term Targeted Funding”, it proposes putting in place a long-term capital works programme that prioritises projects of the greatest strategic importance and draws on the financial resources of both the public and private sectors. Use of cost-effective new technology could help get the most from existing infrastructure.

Canada

Canada has clearly recognised the importance of international trade and its position as a trading economy. It has, therefore, invested in its infrastructure and its major international gateways over many years.

Canada's Asia-Pacific Gateway and Corridor Initiative in 2006 included a set of investment and policy measures seeking to boost Canada's commerce with the Asia-Pacific region, increase the share of North America-bound container imports from Asia, and improve the reliability of the gateway and corridor for Canadian and North American exports.

The Asia-Pacific gateway and corridor is a network of transport infrastructure that includes British Columbia's Lower Mainland and Prince Rupert ports, their principal road and rail connections stretching across western Canada and south to the United States, key border crossings, and major Canadian ports.

Canada's National Policy Framework

Canada's **National Policy Framework for Strategic Gateways and Trade Corridors**, released in 2007, was developed to advance the competitiveness of the Canadian economy on the rapidly changing playing field of global commerce. The intention was to provide focus and direction for strategies that foster further development and exploitation of the transport systems that are key to Canada's most important opportunities and challenges in international trade.

The National Policy Framework was also intended to help guide investment decisions for the new CAD 2.1 billion fund for gateways and border crossings established by Budget 2007 as part of "Building Canada", the government's long-term infrastructure plan.

Canada's **Atlantic Gateway and Trade Corridor Strategy**, which followed in 2009, is the result of a collaborative partnership between the Governments of Canada and the four Atlantic provinces. It aims to develop a strategic, integrated and globally competitive transport system for international commerce to and from North America. Further objectives are to advance a safe, secure, efficient and sustainable multi-modal transport system that contributes to the economic prosperity of the Atlantic provinces and Canada; and to promote the Atlantic gateway and trade corridor's transport system assets, specialised services and niche opportunities to exporters and importers, at home and internationally.

Under a "Strategic Infrastructure" heading, the strategy notes: international trade requires an efficient, adaptable and integrated transport system for the flow of goods; to achieve the full potential, both public and private sector players must contribute to the measures needed; and infrastructure investments need to be based on their contribution to Canada's trade competitiveness, to supporting opportunities and to increasing international trade.

Canada's National Policy Framework and Asia-Pacific and Atlantic Gateway and Trade Corridor Strategies represent important, innovative new ways in which governments can respond to the increasing importance of international trade to national economic growth and development objectives.

China

According to a Macquarie research report in November 2009:

Chinese infrastructure spending in the current five-year plan (2006-2010) is likely to reach an unprecedented level of close to RMB 7 trillion (USD 1 trillion) boosted by fiscal stimulus in 2008 and more than double the previous five-year plan. We do not think the spending would collapse beyond 2010 despite [the fact that] the growth rate of spending would inevitably be lower. Growing spending in railway and urban metro systems would replace the slowdown in spending in highway and ports. (Macquarie Equities Research, 2009)

The OECD's *Economic Survey of China 2010* (2010a) noted:

On the fiscal side, low public debt and a high budget surplus facilitated the introduction of a massive stimulus package. Precisely quantifying the total additional fiscal impulse is difficult as some outlays and tax reductions were already programmed, but its scale clearly dwarfed fiscal responses in many OECD countries, both in absolute and relative terms. A major portion of the stimulus is in the form of extra outlays on transport, energy and other network infrastructure, where needs remain conspicuous.

Taking the stimulus spending into account, China has invested huge amounts in rail improvements recently, high-speed rail in particular. The country is well along in developing a high-quality motorway network. It has made major investments in the capacity and quality of its gateway airports, particularly in Shanghai and Beijing. It has also invested heavily in the capacity of its gateway ports, including the Yangshan deepwater port built on the Yangshan islands, linked to Shanghai by the Donghai Bridge. As an indication of the overall results being achieved, across its ports Shanghai overtook Singapore as the world's busiest container port in 2010, helped by continuing growth in Chinese trade and the business generated by the World Expo in 2010. Shanghai's port handled 29.05 million TEUs in 2010.

Considerable improvements have been made to inland transport, too:

As a result of the controversial Three Gorges Dam project, completed in the summer of 2009, shipping has been made much easier on what was formerly the most treacherous stretch of the Yangtze. Throughout the year, barge fleets of up to 10 000 deadweight tons are now capable of sailing all the way from Shanghai to the Cuntan container terminal in Chongqing. Express journey times between the two cities have been halved to a maximum of seven days. The journey downstream, from Cuntan to Shanghai, can take as little as five days. (Yangtze Business Services, 2010)

Other recent improvements have come about as a result of technology. More than 90% of vessels passing the Three Gorges Dam are equipped with GPS devices. Vessels are more accurate in estimating arrival times at the locks; the authorities are able to manage the slots more efficiently.

In its *World Energy Outlook 2010*, the International Energy Agency advised:

The potential for continued brisk expansion of the vehicle fleet in those countries remains large, as vehicle ownership rates are still well below those in the OECD [area]: there are only 30 cars for every thousand people in China, compared with around 700 in the US and almost 500 in Europe.

[...]

In the New Policies Scenario, the total stock of passenger light-duty vehicles in non-OECD countries is projected to quadruple over the projection period to about 850 million, overtaking that of OECD countries soon after 2030. The vehicle fleet of China overtakes that of the United States by around 2030. (International Energy Agency, 2010)

United Kingdom

The new UK Government released its National Infrastructure Plan 2010 in October 2010. It begins:

Over the centuries, the UK has had a great record of investing in world-class infrastructure to underpin economic growth. From the earliest days, infrastructure has been built by a combination of private and public money... By contrast, for several decades the UK's approach to infrastructure investment has in general been timid, unco-ordinated, incremental, wasteful in its procurement and insufficiently targeted to supporting balanced and sustainable growth in the economy, both economically and environmentally. The result is our infrastructure is ageing, plans are unclear and costs are too high.

[...]

So the government is setting out, for the first time, a broad vision of the infrastructure investment required to underpin the UK's growth... We plan for UK infrastructure investment to be some [GBP]200 billion over the next five years. We will help make that happen through smarter use of public funding, improving private-sector investment models, encouraging new sources of private capital and addressing the regulatory failures that stand in the way of greater private sector investment... (HM Treasury and Infrastructure UK, 2010)

The National Infrastructure Plan's proposals for transport infrastructure included the following:

The government is committed to delivering an effective, sustainable, transport network for the United Kingdom. With the right transport infrastructure the government can:

- Contribute to the fiscal consolidation whilst supporting a competitive economy ... This will ensure that the links that move goods and people around the economy can be improved.
- Support sustainable economic growth and tackle climate change – by transforming the capacity and connectivity of key urban and inter-urban rail networks, and by implementing policies which deliver greener technology. In this way the urgent and unavoidable challenges of climate change can be addressed while maintaining long-term economic growth. (HM Treasury and Infrastructure UK, 2010)

Three aspects of particular interest follow.

Infrastructure and growth

Economic infrastructure drives competitiveness and supports economic growth by increasing private and public sector productivity, reducing business costs, diversifying means of production and creating jobs [OECD, 2009]. There is a clear correlation between investment in infrastructure and long-term growth. The OECD found that, between 1970 and 2005, investment in UK roads, rail and electricity generating capacity had a stronger positive effect on the level of GDP per capita, and on short-term growth, than other types of capital investment [Égert, Kozluk and Sutherland, 2009]. Failing to make the right choices risks slower economic growth and ultimately puts the UK's international competitiveness in jeopardy. (HM Treasury and Infrastructure UK, 2010)

Regulatory asset base model

The regulatory asset base (RAB) model is used by regulators as a mechanism for providing a credible commitment to the recovery of the sunk costs associated with capital investment by regulated monopolies. This commitment, in effect, arises from the payment for the risk of investment being passed on to the consumer. The credibility of this commitment is strengthened by the regulator's statutory duty to ensure that the regulated company can finance its activities.

The guarantee that the regulated company's investment will be remunerated over time by consumers, at such a level that the regulated company is able to meet its financing commitments, contributes towards making investment in the regulated utilities an attractive, low risk proposition and is typically associated with a lower cost of capital. Extending the RAB model to assets and/or sectors which are not currently the subject of economic regulation may create a similarly lower risk environment to which investors are attracted to commit funds and may result in a lower cost of capital relative to alternative financing models.

However, the advantages of a possible lower cost of capital need to be weighed up against possible disadvantages to the extension of a RAB model. For example, as the RAB model passes the risk of paying for sunk costs in respect of infrastructure investment onto the consumer, consideration must be given to the affordability implications of this approach. A particular issue is whether passing this risk onto consumers places undue burden either on the group as a whole or on certain parts of this group. Applying a RAB model to assets which are delivered within a competitive market is likely to result in the removal of the advantages of competition pressures for greater efficiency, optimal operation and innovation.

The government will investigate options for encouraging infrastructure investment from new sources of efficiently priced private capital. In particular, the government will conduct an internal review, supported by external experts, to consider extending the use of the regulatory asset base model. (HM Treasury and Infrastructure UK, 2010)

Asset sales

Government investments in new infrastructure should be seen alongside the ongoing need for government to review how it manages the infrastructure and assets which it already owns. Large amounts of value are tied up in the government's existing asset base; where public ownership is not necessary to achieve the government's policy objectives, some of this value could be released by a transfer [to] the private sector. In particular, the government should look to disposal of infrastructure where the private sector could derive additional value.

[...]

While the fiscal purpose of asset sales is primarily to support debt reduction, the government has already indicated that it will look to reinvest some asset sale proceeds into the Green Investment Bank, which would support private-sector investment in green infrastructure. (HM Treasury and Infrastructure UK, 2010)

United States

The American Recovery and Reinvestment Act 2009 represented a significant effort to restart the American economy, create (or save) millions of jobs, and address some of the country's long-neglected challenges. The act included many measures to modernise the nation's infrastructure and enhance its energy independence. According to the United States Department of Transportation website (2009):

Transportation is a great enabler of economic growth, the lifeblood of commerce. It moves people to jobs and goods to the marketplace. Without strong transportation arteries, economies stagnate. We will use the transportation funding in the act to deliver jobs and restore our nation's economy ... We will focus on the quality of our environment. We will invest in jobs to expand transit capacity and modernise transit systems ... to allow Amtrak to add and modernise cars and engines and upgrade its tracks ... to expand airport capacity and make safety improvements ... to build and rehabilitate and make safer roads, highways, bridges and ports ... and to launch high-speed rail in America. (US DoT, 2009)

The US DoT's *Crossroads* announcement in February 2011 outlined plans for the next transport budget, as follows:

[The] next six-year transportation bill ... provides the vision and funding to rebuild crumbling roads, bridges and transit systems, while spurring economic development and job creation with investments in the safest, fastest, most reliable ways to move people and products. [The] budget keeps us on track toward a national high-speed rail system, with its [USD] 8 billion investment in 2012 and [USD] 53 billion investment during the next six years. It increases resources for highway and bridge improvements by 48% and for affordable, efficient and sustainable bus, streetcar and transit systems by 126%. [The] budget includes a [USD] 50 billion commitment to fuel the engine of economic recovery in the short term, and a [USD] 30 billion National Infrastructure Bank that will finance significant projects over the long run ... For the first time, transportation expenditures will be subject to "pay-go" provisions that ensure the dollars [given] out do not exceed the dollars coming in. (US DoT, 2011)

The US Department of Transportation’s “High Speed Rail is the Right Track for US” announcement in March 2011 outlined the latest plans. In the short term, high-speed rail will create manufacturing and construction opportunities. In the longer term, the nation’s high-speed rail network will also spur economic development along new corridors. The statement concluded, “Finally, high-speed rail ... will connect 80% of Americans within 25 years ... Four decades from now, the United States will be home to 100 million additional people – the equivalent of another California, Texas, New York and Florida. If we settle for roads, bridges and airports that already are overburdened and insufficient, we will fight thickening congestion as we travel from one place to another. If we stand pat, tomorrow’s entrepreneurs will find clogged commercial arteries choking their productivity” (US DoT, 2011b).

Future of Aviation Advisory Committee (FAAC) – the Office of the Secretary, DoT convened the FAAC in November 2010 to focus on the following areas of concern: ensuring safety in aviation, sustaining a world-class aviation workforce, balancing the aviation industry’s competitiveness and viability, securing stable funding for aviation systems, and addressing the industry’s environmental challenges. The committee has made recommendations on many subjects, including achieving carbon-neutral growth from 2020 onwards, with a long-term goal of a 50% reduction in aviation carbon emissions by 2050.

The committee noted that implementing the components of the NextGen Air Traffic Control system could reduce greenhouse emissions by as much as 12%. The committee also noted that most commercial airports are publicly owned and operated, and that the private activity bonds issued to fund airport investments are subject to tax on the interest payments made to bond holders. That leads to higher interest rates on these bonds.

The committee highlighted that tax relief would lower airports’ costs and support growth of aviation infrastructure at airports.

Port Authority of New York and New Jersey (PANYNJ)

The Port Authority of New York and New Jersey conceives, builds, operates and maintains infrastructure critical to the New York/New Jersey region’s trade and transport network. These facilities include America’s busiest airport system, marine terminals and ports, the PATH rail transit system, six tunnels and bridges between New York and New Jersey, and the Port Authority Bus Terminal in Manhattan.

For more than eight decades, the Port Authority has worked to improve the quality of life for the more than 17 million people who live and work in New York and New Jersey – a region that supports 8.6 million jobs with an estimated gross regional product of more than USD 929 billion. Since the 1990s, the Port Authority has concentrated its efforts on the transport and trade projects that constitute its core mission. Under a *Preparing for the Future* heading, the Port Authority reports that it has “a long-term strategic plan to enhance regional capacity and the quality of intercity travel; increase the number and proportion of regional commuters who travel by transit; foster a streamlined goods movement network for faster and more reliable delivery; maintain and modernise existing facilities to ensure safety, security and environmental responsibility; and engage its regional partners in the creation of plans, policies and investments that provide a significantly improved quality of transport services for regional residents, businesses and visitors” (Port Authority of New York and New Jersey, 2011).

Comparing the five countries

The recent developments and approaches to transport infrastructure in Australia, Canada, China, the United Kingdom and the United States are different in some respects.

The United States is still generally following a government-owned and -funded approach to strategic infrastructure for ports. The United Kingdom is much more focused on private sector involvement, with public funding of infrastructure accorded a more limited role. Canada and the United Kingdom have national visions and infrastructure plans.

Australia and the United States are adopting a relatively strategic approach within their federal systems. Canada and the United Kingdom have Infrastructure Funds.

China is the only one of the five to have an approved five-year plan (2012-2016), and the only one to be currently allocating historically high amounts to investment in infrastructure. The country's unprecedented investment levels are helping it meet rapidly growing needs and also contributing to high and sustained growth in future.

Conclusion

Although very selective, the snapshots in this chapter provide some indications of how five key trading economies not covered by the case studies are preparing for future growth in international trade and transport. All are focusing more on strategic, key transport infrastructure and (especially) its contributions to international trade and competitiveness than was the case five to ten years ago.

Chapter 5

Key issues emerging from the case studies

The major gateways and hubs considered here are preparing for large increases in volumes in the future. Some have large infrastructure expansion plans and developments under way. Most are working on international connections and on the improvements needed to inland connections. All are acutely aware of the importance of good planning and secure funding and financing to take advantage of the opportunities. Good structures and organisational models are highlighted, as well as some of the best funding and financing models currently used to provide funding security. Other wide-ranging issues are raised that need to be addressed satisfactorily if the projects are to be successful.

Strategic policy objectives

Policy objectives are in a state of flux in different locations. A short overview of the changes in policy directions over the period since the 1970s allows this current flux to be seen in perspective.

Over the decades from the 1970s to 1990s, transport policy generally placed special emphasis on more competitive and more efficient transport services. In most countries this meant focusing on airports and ports for longer distance/international transport – and on roads and road transport to carry the growing volumes of freight transport. As the most efficient mode, road transport grew substantially in most countries and was used increasingly to satisfy cross-border and broader international freight transport requirements. As road transport's share of freight grew, the share of alternative modes – inland rail transport and inland waterway in particular – fell significantly. Initially, increasing road transport allowed considerable productivity gains but at the same time generated considerable local pollution and other unpleasant impacts, including noise and fumes. As technology improved, local pollution was reduced and other adverse impacts also diminished.

Since the 1990s there has been evidence of slowing levels of investment in motorways. Over the past decade the evidence has pointed to increasing investment in rail and public transport in many countries, as the need for improvements in these areas has received increasing attention. There has also been an increasing focus on multi-modal corridors, with each mode performing to its potential. This has generally meant road transport taking the lion's share of short-distance freight, inland waterways continuing to move bulk freight where waterways allow, and rail taking the major share of long-distance freight (i.e. over 500-750 kilometres). High-speed passenger rail in a limited number of countries resulted in a significant shift from passenger cars and also attracted passengers from air services over distances up to around 750-1 000 kilometres.

From the workshop discussions, it became clear that policy objectives and directions are changing. In some locations there has been a significant break from the past. Of course, many factors have been involved. In the short term, developed countries are focused on competitiveness and growth, as they seek the rapid recovery needed to deal with deficits, debt and unemployment. Investment in trade-related infrastructure is seen as an important driver of GDP, trade and productivity growth. Infrastructure's contributions to these and other objectives (such as quality of life) are being seen as increasingly important and needing to be fully reflected in infrastructure programmes and evaluation processes.

The increasing importance of economic growth and trade competitiveness has been matched by the growing importance of environmental and sustainability objectives, combined with concerns over CO₂ emissions that have also had a clear impact. In most cases it is commonly accepted that there needs to be a greening of transport. The changing policy objectives are clearly affecting the opportunities and challenges facing international gateways and trade corridors in relation to the movement of freight.

The changes are evident in the case study examples below, which illustrate a more proactive pursuit of the new and more **strategic** policy directions and broader policy objectives, and greater use of transport technologies with lower environmental impacts.

Benefiting from future economic and trade growth

Representatives from national ministries and other organisations involved in the workshops generally anticipated a relatively slow recovery and then steady growth in the global economy in the medium term (i.e. over the period to 2030) and in the longer term (beyond 2030). Participants were less positive about the prospects for growth in the short term, recognising the time that will be required to recover from the recent recession. Importantly, there was wide recognition that the growth would not be the same everywhere – strongly differentiated growth was expected between developed and developing countries, for example.

Despite the lower economic growth expected in developed countries, case study examples highlighted how the gateways in both developed and developing countries are likely to benefit from future economic and trade growth. Scenarios do vary. For the Port of Rotterdam in the Netherlands for example, the most positive scenarios see total cargo volumes increasing significantly in the future, from 421 MT in 2008 to at least 600 and possibly over 700 MT in 2030. Container volumes could increase even faster, from 132 MT in 2008 possibly to over 300 MT in 2030. Meanwhile in the least positive scenarios, overall and container volumes could be very much lower than these levels.

Other factors can come into play and create a virtuous circle with trade growth, a point illustrated by France’s gateway ports. In the medium term, increasing purchasing power in France and neighbouring European countries can be expected to lead to increasing import volumes. Export demand can be expected to increase with global population growth and as economic development – particularly in Asia – increases demand for France’s export products (e.g. agricultural and manufacturing/technology).

Mention was made in the case studies of how Copenhagen looks set to benefit from the Fehmarn Belt rail and road link once completed: regional economic activity and trade with Germany should increase and the city’s improved position as an “inland” hub between Germany and Sweden should yield further benefits. And the European economy’s expected tilt eastward in the next decade should prove advantageous for Austria and Switzerland, providing greater opportunities both for exports of goods and services as eastern European countries grow and develop, and for sourcing the goods and services they need from lower cost countries in that region. In addition, proximity to greatly increased trade flows along the Mediterranean suggests there will also be opportunities for Austria and Switzerland to benefit from the increasing growth of China and India, as well as other developing countries.

Some very strong growth is forecast in demand for strategic gateway infrastructure generally, due to the global economic and trade growth outlook. There may also be some increase in the concentration of interregional flows at the major gateways. One reason is that the larger container vessels with capacities of up to 15 000 TEUs in shipping fleets – which need very deep water draft and high volume port handling capacity – have increasingly fewer gateways able to meet their requirements.

Increasing competitiveness

In light of expected increases in international trade, many countries are focusing on the need for greater competitiveness across critical aspects of national economies. Investment in trade-related infrastructure is generally seen as an important driver of GDP, trade and productivity growth.

In France for example, the Ports Reform legislation adopted in 2008 aimed to improve the competitiveness of the seven large French Ports (Bordeaux, Dunkerque, Le Havre, La Rochelle, Rouen, Nantes-Saint Nazaire, Marseille). In a January 2010 Progress Report, the government communicated some of the tangible results from the changes made as well as further opportunities. Consideration was given to alternative structures, but a port authority structure was chosen as the roles and responsibilities involved correspond closely to public functions (safety, security, etc.). Other reasons included the relatively short-term horizons of many private sector operations and managers and the considerable investments that the ports required to be competitive in the new context and over the longer term. As well, it was not thought likely to be attractive to cede existing port land to the private sector, by way of full privatisation.

The drive for competitiveness is not without its challenges, many of which relate to improved productivity and performance. The Port of Le Havre, whose Strategic Plan was discussed in Chapter 3, has the ambition to double its container traffic to 6 million TEUs by 2020, increase its market share in the north European range up to 9% by 2015, and increase use of mass transit modes for hinterland traffic to 25% by 2020. These targets are indeed ambitious and will require exceptionally good planning, co-ordination and execution – as well as adequate and timely funding. In effect, a clearly developed strategy will be needed as well as a carefully developed implementation plan outlining how such improvements can realistically be achieved.

The strategic plans for Marseille Fos are also ambitious, particularly as regards container handling. The target for container traffic is to exceed 2 million TEUs by 2013 and reach 5 million by 2020. Another objective is to raise the port's European ranking from 20th position in 2007 to 15th position in 2013 and enter the top 10 rankings in 2020. A further target is to increase Marseille Fos' market share of European port container handling, from 1.7% in 2008 to 3% in 2013, and 6% in 2020.

Green Transport Policy

Environmental concerns and sustainability objectives figure strongly among the policy drivers for many countries. This is certainly the case with Austria's new Infrastructure Strategy, discussed in Chapter 3, and Denmark's "Green Transport Policy" Agreement (Box 3.2) enjoys wide political support. Much attention has been paid to the modal shift of freight onto rail – in Istanbul for example, with the Marmaray rail tunnel allowing more direct rail freight connections between European and Asian continents; and Switzerland's heavy vehicle tax, a measure to greatly reduce transalpine crossings.

Better structures and organisation

National/state and local governments have often had primary responsibility for major gateway and inland transport infrastructure. The governments and their ports mostly retain primary responsibility for port infrastructure provision and regulation – as well as inland roads and rail transport infrastructure – with major infrastructure funded directly from government budgets.

The workshops highlighted that better structures and organisation can help deliver the funding and financing needed, and are important for delivering many other important outcomes.

“Landlord port” models are widely used – the Port of Rotterdam is an example – with terminal infrastructure and freight/logistics services provided on a competitive basis by private operators. As a further step, corporation structures may be used to create opportunities for ports to become fully self-financing, removing reliance on budget funding. Good projects still need to be established on the basis of good planning and evaluation, with merit-based ranking.

Denmark is generally using a traditional government authority or fully government-owned corporation model as the organisational structure adopted to oversee projects and deliver the investment or funding needed. A government model is being used to manage the investments in the Infrastructure Fund, which is delivering over DKK 98 billion (EUR 12 billion) over the period to 2020. Funding from general taxation, sales of assets and savings on budget allocations are being channelled into the Infrastructure Fund.

Some rather different business models could be needed in other settings.

In the High North, the development of new mines means there are likely to be requirements for new and extended rail track and bulk ore rail freight services in both Finland and Sweden. This would place additional demands on existing infrastructure and also require new infrastructure. Meeting these needs would allow the ore to be moved efficiently and reliably to processing plants, ports and final destinations.

International experience suggests that decisions on resources-related transport infrastructure improvements are increasingly likely to be taken on a commercial basis – i.e. in the expectation that the industries involved will meet the full costs of the infrastructure improvements and services they need. Such approaches could become important in the High North if the resources-related infrastructure needed cannot be funded by public sector providers (e.g. government-owned freight rail operators) alone. In some countries, resource companies themselves sometimes assume responsibility for providing the transport infrastructure and services they require.

In a number of countries and settings, the outlook and changing expectations have led to transformational reforms – as illustrated by France’s ports reforms. Some of the key proposals in France’s “Port Reforms Report 2007” were mentioned earlier, such as transferring the operation of their port terminals to private sector operators. Giving effect to these strategies has involved replacing all references to “public service” in the ports code with a “competitive activity” approach, setting a time frame within which the transfers of specified facilities needed to take place (three years for containers and dry bulk), and requiring each port to develop a strategic plan within six months for its terminal operations.

Better funding and financing

In countries with major ports that depend on government funding, there are real concerns that, given the post-crisis fiscal situation, future funding of gateway and inland transport infrastructure from traditional budget sources could “dry up” even as infrastructure needs increase quickly.

The case studies highlighted the high-quality funding and financing arrangements in place in a number of countries. Most emphasised that these arrangements have been centrally important to getting strategic infrastructure built, and even assured the necessary degree of continuity during the most severe recession since the 1930s.

Denmark, Copenhagen – Green Transport Policy

It was mentioned above that the Government of Denmark, with broad parliamentary support delivered by the Agreement on Green Transport Policy, decided in 2009 to invest more than DKK 160 billion (around EUR 22 billion) in the country's infrastructure over the period to 2020. The total investment package is split between the Infrastructure Fund and two separate project-specific funds created for the two largest projects previously approved, as follows:

- the Infrastructure Fund was established to fund the major share of investments in roads and railways in the coming years; it will deliver over DKK 98 billion (EUR 12 billion) over the period to 2020;
- the separate project-specific funds established for the fixed Fehmarn Belt Link and the Metro Circle Line will together deliver approximately DKK 60 billion (*ca.* EUR 10 billion) over that same period.

As a result, projects that have been decided on over the period to 2020 are fully funded, provided there are no serious cost overruns.

The sources of these Danish infrastructure funds are important to their stability and security:

- The long-term strategic **Infrastructure Fund** is financed out of general tax revenues, sale of state-owned assets, and savings on approved projects where there is investment under-spend (e.g. where network modernisation leads to savings in expected future maintenance).
- **Metro funding** – the separate funding for the Metro project comes from user fees and from the sale of public assets (power stations) as well as from land value capture and property taxes. Around half the funding for the Metro project is expected to come from “other” (i.e. non-user) sources.
- **Fehmarn Belt link funding** is based on the model used for the Danish fixed links that has been very successful, involving a government-owned corporation established under the corporations law, a government-secured loan, and financing via user fees. The European Commission supports the project; up to 30% of the costs for constructing the fixed link may be granted. The fixed link costs will be repaid by road and rail users.

Switzerland: Alpine Crossing Exchange and longer term challenges

While Switzerland's infrastructure funding system has worked well, there would appear to be room for improvement in pricing and related arrangements.

The government is currently considering revised arrangements that could involve a trading system for alpine crossing rights. This would need to be developed in agreement with other Alpine countries and in line with European legislation.

The Swiss strategy for the national infrastructure networks to 2030 has identified two major challenges:

- more energy-efficient motor vehicles will mean lower fuel consumption – which in turn will lead to the revenues from the petroleum tax decreasing over time;
- peak loading problems will make demand management inevitable.

A further consideration is that mobility pricing is likely to be needed on the roads as well.

The Swiss authorities concluded that within a 20-year outlook period – i.e. by 2030 – they would need to move towards a completely new system of transport infrastructure financing.

Given the importance of efficient operations across the entire transport network, the challenge in the longer term will be to devise a new mobility pricing system that works effectively on a network basis, encompassing both road and public transport travel.

Many other countries face similar challenges, and may also need a completely new mobility pricing system before 2030.

Infrastructure development

The case studies showed there is already pressure in many places to improve existing infrastructure and to develop new infrastructure able to meet expected future demand over the period to 2030 (and beyond). This is not surprising given that international gateways and trade corridors are now very important to the economies of all countries – delivering services vital to national and regional competitiveness, productivity and employment – and will be even more important in future. It is also not surprising because the planning, approval and development of such important infrastructure can take 20 years – and its useful life may be 50 years or more.

Gateway capacity expansion

According to the case studies, management anticipates that future growth in demand will require improved capacity and the efficiency of the gateways themselves.

The Netherlands provides an example. In 2008, the Rotterdam Port Authority began construction of Maasvlakte 2, a land reclamation project which – after almost two decades of preparation – will increase the port area by 20% (2 000 hectares, of which 1 000 will be lettable sites). The first containers will be handled in 2013.

In 2009, the authority invested around EUR 350 million, around half of which was invested in the existing port area and the other half on Maasvlakte 2. The Port Authority's Annual Report advised in 2009 that the project entered a new phase as planning preparations had been completed. The authority let a contract in 2009 for "Sea defences and first port sites", at a value of almost EUR 1.1 billion, and the construction of the sea defences got under way.

With Port 2000, France's Port of Le Havre has new large capacity to handle containerised trades. Since 2007, 2 100 metres of additional quay have been added. Investments scheduled by the Grand Maritime Port of Le Havre over the period 2009-2013 will account for around EUR 700 million. With the final stage, expected in less than ten years, the container capacity of the Port of Le Havre will have trebled. Meanwhile, the Port of Marseille Fos' first priority is to increase its container throughput, and capacity will need to expand if it is to do so. Priorities include delivering Fos 2XL terminals to the concessionaires in 2010. The authorities will carry out studies and invest EUR 106 million in initial work on Fos 3XL and 4XL, needed before 2020.

The estimated cost to build all basic infrastructure projects currently in the pipeline in Belgium is around EUR 332 million per year. Under the Port Infrastructure Financing – Port Decree, the funding available for future investments in new basic infrastructure (which is 100% government funded) – under current policy – is EUR 17 million per year. There is a large gap between future needs and current funding.

Inland transport connections – capacity

Many countries recognise the importance of their major gateway ports and airports in their national policy frameworks and support the planning and development of the infrastructure required. However, most countries do not assign the same priority to the key inland rail, road and waterway connections required to move freight between the gateway ports and the cities and industrial areas in their hinterlands.

Case studies highlighted some countries that do devote considerable attention to inland transport requirements. One is the Netherlands, which recognises that a major challenge will be the size of the expected increases in rail freight volumes from the northwestern ports. Some scenarios have the Port of Rotterdam anticipating greatly increased throughput volumes by 2030. A large portion of the increase could be in container volumes, which could increase as much as threefold. Also in the Netherlands is the Betuwe line, a 160 kilometre-long double track rail line that connects the Port of Rotterdam to the Dutch-German border. Dedicated to freight and equipped with ERTMS (the European Rail Traffic Management System), the Betuwe line was inaugurated in 2007. The overall TEN-T project cost was EUR 4.7 billion. The planned capacity of the line was around 200 trains per day. The track on the German side has not yet been upgraded, and at present, actual usage is around 200-300 trains per week. Current restrictions are due to signalling problems and other difficulties.

France's ports are developing new infrastructure to improve their services (particularly in the field of multi-modal transport) and assist in introducing new services (by local rail operators). The National Freight Initiative launched by the government in September 2009, with a EUR 7 billion financial assistance package, will contribute to a significant increase in rail services to French ports.

The Austrian presentation highlighted a number of points: hinterland connections play an important role in the Austrian economy, improvements are necessary to maintain the competitiveness of Austria as an inland country, and sustainable modes of transport like rail and inland waterways will necessarily play the most important roles in future hinterland connections.

In Switzerland, the combination of higher port throughput and higher rail freight mode shares of the inland transport involved, if realised, would result in rapid increases in port-related freight on inland waterway and rail modes. This would fit neatly with Swiss objectives for a modal shift away from road transport. However, significant increases in the next ten years – i.e. before the major Swiss and neighbouring countries' rail improvements are completed – might put considerable pressure on long distance rail services along these corridors.

Improved international connections

As the case studies demonstrated, the focus for some infrastructure development was on improved international connections. Thus the truly transformational Øresund Bridge – with the road and rail connections it provides between the Danish and Swedish side of the Øresund Sound – will promote further integration of the previously separate urban development areas on both sides. The Fehmarn Belt Link will greatly improve freight and passenger connections between Denmark and Germany as well as improved connections – and so reduce modal share carried by road – between Germany and Sweden. And the Marmaray project's tunnel under the Bosphorus will provide an uninterrupted railway connection between Asia and Europe.

Infrastructure management

Increasing focus on lower impact modes

Countries have set some ambitious targets for increasing the use of lower impact inland modes. As revealed earlier, the Port of Rotterdam's target shares for 2035 are: inland waterway, 45%; road, 35%; and rail, 20%. The improved rail services offered by the Betuwe line should provide a boost to rail freight between the Port of Rotterdam and inland activity centres and present one of the most important opportunities for improving the efficiency, reliability and modal share of inland rail connections along the important trans-European corridor between Rotterdam and Genoa. Ambitious targets have been set for non-road modes (other than air freight) at the Port of Le Havre, to increase its market share from 14% to 25% of (total) freight cargo traffic by 2022. And the Strategic Plan for the Port of Marseille Fos has set some ambitious targets for increasing use of lower impact inland modes. The targets are for the inland waterway share to rise from 4.7% to 10%, and the rail share to rise from 13.7% to 30% by 2013.

With regard to inland multi-modal terminals, the Port Authority of Rotterdam initiated the concept of a Container Transferium, to improve the accessibility of the container terminals at the Maasvlakte and to relieve the pressure on the A15 in the port area (reducing congestion and improving air quality). The Container Transferium aims to transport containers between the sea terminals and a location in the immediate hinterland of Rotterdam. Containers are transported in groups between the sea terminals and the Container Transferium on an inland vessel. The Container Transferium is part of the Port of Rotterdam in the (nearby) hinterland, with integrated information exchange, customs clearance and chain security.

Freight priority

One of the difficulties in offering competitive rail freight services in Europe is that freight rail suffers from passengers having priority over freight on European rail systems. In some other parts of the world, rail authorities and private operators have avoided the passenger versus freight priority issue by building separate passenger networks – or separate rail lines in critical locations.

Doing anything similar in the European context would be a major challenge, given the space and geographical limitations, even if the European Commission has signalled its intentions and increased the prospects of some action being taken.

In France, any proposed improvement to rail services to the ports will have to contend with congestion on jointly used passenger/freight rail tracks throughout the rail networks. An example that affects the Port of Marseille in particular is the congestion on rail lines near Lyon, due in large part to passenger rail volumes. A possible new rail bypass to the west of Lyon through Clermont-Ferrand is under consideration but may not be assigned the priority needed to secure funding for some years.

Specifically in relation to rail, it is important to focus on the problems that giving absolute priority to passengers causes for rail freight. Realistically, at some times and in some locations, it will be important for rail freight to be given priority over passenger services. Where this is important to meet the objectives set for rail freight – but the priority is not accorded – consideration needs to be given to separate freight rail tracks and rail freight bypasses that are worthwhile, on a benefit-cost assessment basis. In relation to sources of funds, some of the tunnels under consideration for passenger rail are very expensive – and more balanced outcomes may produce better overall results (e.g. with the Lyon freight rail bypass and Le Havre rail built earlier).

Dealing with increased transit traffic

Freight traffic across the Alps by road and rail has increased significantly. In 1980, there was around 15 million tonnes via Austria; by 2008, the volume had increased to 50 million tonnes. In 2008, the share by road was 71.5% and the share by rail was 28.5%. The bulk of the freight travelled along the Brenner Pass corridor. Austrian efforts to improve the rail infrastructure are focused on projects such as the Brenner Base Tunnel, Semmering Base Tunnel and Koralm railway line. Challenges for the future include the need to consider a better charging regime to improve environmental outcomes. Clearly, the Swiss legislative framework for limiting transalpine crossings by road transport will be important in the short to medium term in limiting and reducing road transport volumes and their adverse impacts on sensitive Alpine areas. Austria is also planning to give consideration to additional measures that might be needed in ecologically sensitive areas – such as Alpine Transit regulatory schemes.

Related to expected increases in rail volumes between Denmark and Germany and between Copenhagen and Sweden, the challenge will be to ensure that cargo is carried more sustainably, with energy, the environment, accessibility and road safety centrally important. In response to an expected increase in transit volumes, the specific challenge will be to ensure that rail transport investments are made where rail freight has the greatest potential – including international shipments and transit freight over relatively long distances (e.g. 300-500 kilometres or more). A further possible challenge in the medium and long term could be the degree of competition between passenger and freight rail for use of rail tracks.

Increasing reliability

In many cases, increased traffic volumes are leading to increasing congestion, particularly on inland connections by roads and rail freight. In the future, as congestion levels increase, reliability is likely to shrink.

One of the greatest challenges for all ports will be to improve the reliability of inland transport connections as cargo volumes increase. Maintaining and improving reliability is going to require a major step up in the management of the infrastructure, to ensure its capacity is protected. This will be a priority issue for container traffic, where larger vessel

sizes will add to the numbers of containers arriving at port terminals each time – increasing the volumes to be handled on inland transport.

Sustainable mobility

Mobility is to be promoted, but to what extent?

Denmark’s Capital Development Plan, 2008 (prepared not by the Danish authorities but by the advisory Capital Regional Organisation) raised expectations with regard to mobility that would be challenging for any transport authority: “mobility for all citizens, irrespective of where they come from and where they are going to, and irrespective of income, as well as to lower the strain on the environment”. The “Green Transport Policy” Agreement sets out principles that seem more balanced and provide clearer guidance for the development of a vision and integrated transport plan for the Greater Metropolitan Area. A further challenge is to ensure that the vision and the transport plan are fully integrated with the Øresund Region, which is clearly so important to the growth and development of the Greater Copenhagen Area.

Managing congestion in urban areas

Congestion in urban areas can have a serious impact on business productivity as well as on quality of life in the city, both of which are important to its competitiveness. Congestion can affect international connections and inland connections to and from the major port. Traffic congestion can affect the productivity and performance of many gateway ports in or close to major metropolitan areas.

Generally, the levels of congestion deemed acceptable rise somewhat as cities grow. In large urban areas, road congestion needs to be managed as demand increases, to prevent congestion becoming “excessive”. Not doing so can lead to chronic congestion or wasteful infrastructure investment (e.g. to meet peak hour demand).

The challenge here is to find the right balance between infrastructure investment (e.g. to remove bottlenecks) and the key actions available to protect the capacity of the roads. These key actions are access controls (such as limiting through traffic), parking controls (to moderate and spread demand) and road/congestion pricing (if and where appropriate). Whichever approaches are taken to manage traffic congestion, rail and public transport needs to be improved first – to ensure high levels of accessibility and services in congested areas.

The expectations reflected in the project documents relating to Turkey – which include that there will be no increases in private car passengers across the Bosphorus by 2025 and reduced congestion in Istanbul – seemed very optimistic. The levels of car ownership are expected to increase five times in Turkey from 2000 to 2025.

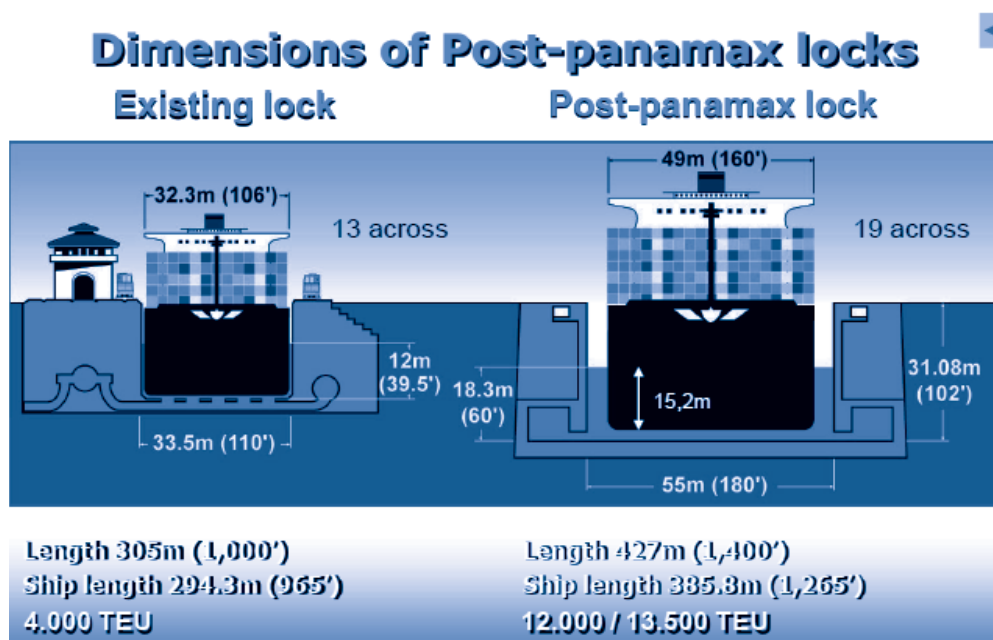
In most major metropolitan areas, increases in transit shares of the magnitude projected would not be possible, even with truly draconian actions to restrict the usage of private vehicles and to restrict vehicle parking. In Istanbul, the geographical layout of the city and the likely capacity restriction on direct road travel to the central areas together suggest they may be possible. However, achieving such outcomes would most likely require related action to promote the use of the Marmaray rail services and strong complementary action taken to discourage increases in the use of private vehicles and other road-based transport. As an example, it could be important to have active traffic management on bridge crossings, on access routes to central areas and on major

arterials – as well as tight controls on parking – to promote rail travel without a serious increase in the duration and geographic spread of road traffic congestion.

New technology aimed at improving efficiency and reducing adverse impacts

There has been little change in maritime transport’s underlying technologies, but there has been a big change in the capacity of the container ships being deployed, as illustrated in Figure 5.1.

Figure 5.1. Increasing size and capacity of container vessels



Source: Mersin Port Workshop presentation based on Mersin Steering Committee, November 2009.

This increase in vessel size will be one of the other important developments that will influence future outcomes. The move from 8 500 to 12 500 TEU vessels can be expected to save 20-30% of the costs for the maritime part of the journey. (Maersk Shipping Lines placed an order for container ships in March 2011 that was for even larger vessels, with 18 000 TEU container capacity. The first deliveries are expected in 2013 and 2014.) Of course, such cost savings will only be available for ocean shipping services via those gateway and trans-shipment ports at which the new large container vessels call.

Currently, the “heavy lifting” involved in inland transport is mostly handled by waterway, rail and roads, although pipelines are also used for some bulks such as petroleum. No totally new technologies are available to actually **move** the liquid, dry bulk and container freight inland in the volumes required. In the future, roads, rail and inland waterways are expected to continue to carry the load. However, higher capacity vehicles are available for use in road freight, rail freight and waterway sectors than are being used.

Where new technologies will be available is in helping improve the management and operational performance of the different modes (as well as improving the overall performance) of the multi-modal transport system from the viewpoint of providers and users. Examples include:

- new cargo and vehicle tracking technologies – which can help improve reliability and productivity;
- vessel management technologies (such as Vessel Management Systems) – which help maritime safety and security services perform their important roles;
- new rail technologies (such as the European Rail Traffic Management System) – which will ensure consistent standards and operating practices across national borders;
- new gateway port and airport technologies – for multi-modal terminal and container operations.

Improving evaluation processes

The workshops on strategic infrastructure brought into focus several important aspects of evaluations that need to be reconsidered when undertaking benefit-cost assessments (BCAs) and other assessments.

First, strategic infrastructure can be expected to have a useful life of 50 years or more. Evaluations need to capture the long lives involved via longer evaluation periods.

In conjunction with this change, further consideration needs to be given to how best to assess the importance of contributions to long-term objectives (including contributions to green growth and CO₂ reductions in the very long term, i.e. 2030-2050 and beyond). The very long periods involved in the case study projects – and the importance of the contributions they can make to priority objectives such as green growth and reducing CO₂ emissions in the long term – suggested lower discount rates should be used (as the UK *Stern Review* did) for assessing strategic infrastructure investments in the future.

Many of the opportunities and challenges identified related to external linkages to inland markets that fall under the responsibility of other parties. Clearly, greater consideration needs to be given to the wider regional and network effects of gateway projects and their inland connections, taking into account their network value from a user perspective and likely impacts on supply chain performance and user demand.

As well, the evaluations need to be undertaken from an international perspective – rather than (or as well as) from a national perspective. They should also identify the **dynamic** effects of the strategic infrastructure – as was done for the Fehmarn Belt link (see the Copenhagen case study) – as well as the **static** effects (such as productivity benefits) on which most BCA are commonly based.

National visions and long-term plans for strategic infrastructure development (with consistent policies, co-ordinated developments and aligned networks) are essential factors in the long-term infrastructure planning, evaluation assessments and funding and financing required. Providing for future economic growth and competitiveness are centrally important to such national frameworks and evaluations.

Greater policy coherence

Co-ordination of policy on cross-Alpine traffic

Some greater coherence in cross-Alpine traffic policy could be useful with respect to the approaches being pursued in Austria, Germany, Italy and Switzerland. Austria and Switzerland are in discussions but to date have not adopted a co-ordinated uniform approach. Separate work is being undertaken on the TEN-T projects. Even though the different legal frameworks involved might limit the options available, a joint approach by Austria and Switzerland alone relying on a corridor approach may not achieve the desired results.

Most of the cross-Alpine freight has origins and destinations in Germany and Italy. A joint network-based approach would seem better suited to the strategic objectives of increasing rail freight modal shares – including to and from the major ports – and limiting cross-Alpine road transport movements. It would seem important for all four countries to be involved to ensure policy coherence. The European Commission could take an effective role as well.

Greater use of the Mediterranean ports

The possibility that the Mediterranean ports could carry increasing shares of European gateway port traffic in the future was raised in several of the case study workshops. Clearly, the Mediterranean ports are at a competitive disadvantage compared with the northwest European ports for much European inland freight transport. However, improvements are possible, and workshop participants advised they would welcome greater use of the Mediterranean ports.

The barriers for Italian ports include inefficient port operations. The Italian ports in particular are improving but still regarded as being uncompetitive with the north-western ports. Concerns are broadly based, relating for example to organisational arrangements, labour productivity and efficiency. Mediterranean port throughputs are relatively low and ports' market shares among European and Mediterranean ports are also low. They are generally regarded as under-performing as a group. By comparison, the north-western ports are mostly very efficient and striving to improve their efficiency and their infrastructure, so that their performance is continuously being improved.

No doubt the performance of the Italian ports is interlinked with the performance of Italian inland transport. Until a few years ago road freight was greatly preferred in Italy, and freight rail was not seen as a priority. Consequently, the Italian rail freight services have not been good enough or competitive enough to provide the rail freight advantage over longer distances that the Mediterranean ports need to attract more hinterland traffic. Over the past few years, important investments have been undertaken to close the gap with rail freight services of other EU countries, and help provide a good inland transport system.

Since the workshops, there have been some market developments that suggest increasing awareness of the prospects for accessing nearby European countries more directly, via the Mediterranean ports.

Port of Venice – offshore terminal

In September 2010, the President of the Venice Port Authority announced a proposed offshore terminal (at a depth of 20 metres) off the Venetian coast. This would allow the handling of up to 3 million TEUs a year “of the container traffic between Europe and the Far East and also between Europe and the Eastern Mediterranean”. It would depend on the development, in terms of size and traffic, of the ports of Ravenna, Trieste, Koper and Rijeka that, together with Venice, make up the North Adriatic Port Association – NAPA Multiport as it is now known. Costs are estimated to be EUR 1.38 billion for the offshore platform and EUR 310 million for terminals in Marghera. The offshore terminal could be “fully operational within five years”.

Piraeus Port

In October 2010, while on an official visit to Greece, the Chinese Premier made reference to Chinese container terminal operators having to take up long-term terminal concessions at Piraeus Port, in Greece – and indicated their intention of accessing Eastern Europe markets from the port. The Ports of Venice and Koper (Slovenia) are already linked by direct shipping services to Piraeus. The presence of Chinese terminal operators in the Port of Piraeus should increase the prospects for more direct transport of cargo between Asia and the Adriatic ports – with trans-shipment at Piraeus Port to liner services to and from Asia.

Croatia, Rijeka Port

In March 2011, at the Port of Rijeka, the International Container Terminal Services Inc. (ICTSI), a Philippines company, was awarded a 30-year contract for the management, operations and development of the Adriatic Gate Container Terminal (AGCT). This is part of a Rijeka Gateway Project, which aims to improve the port’s competitiveness and link Rijeka and the Balkan region to international transport corridors. Initial investments that could lead to a capacity of 0.6 million TEUs per annum include super post Panamax quay cranes and the draft dredged to 14.5 metres. Rijeka is indeed well placed in relation to the emerging economic centres of Central Europe. The intention is that it become a trading gateway for Hungary, the Czech Republic, Slovak Republic, south Poland, Serbia, and Bosnia and Herzegovina, in the port’s hinterlands.

Improved inland connections and services from the Mediterranean ports could lead to some re-balancing of traffic from the southern and northern ports to European countries. Some wider assessments of the prospects might be beneficial – and if needed, some policy co-ordination could be useful.

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Part III

Meeting the challenge: Possibilities for gateway management, funding, finance and planning

Chapter 6

Gateway structures and organisation

Better structures and organisation can help deliver the funding and financing needed for strategic gateway infrastructure, and are in fact important to delivering many other outcomes that will be required in the future. Of the current structures and organisational modes described here, the “landlord” model offers clear advantages, and is increasingly used.

As mentioned in the key messages, national/state and local governments have often had primary responsibility for strategic gateway infrastructure, with major infrastructure funded directly from government budgets. But varying degrees of private-sector involvement have evolved that can better tailor gateway structures to requirements, now and in the future.

Gateway structures and models

Gateway structures well adapted to the tasks can make a major contribution to many important outcomes – such as efficient and reliable services, increased competitiveness and national economic growth and welfare. They can also facilitate the funding and financing that will be centrally important to achieving the objectives of the gateway organisation.

Gateway ports (and airports)

There are a number of distinct organisational structures and models in use. The most common are set out in Table 6.1.

Table 6.1. **Models of ports**

Model 1	Port authority/government owns the land – with port responsible for (some) regulatory functions and for operation of port terminals and services
Model 2	Port authority/government owns the land and is responsible for (some) regulatory functions – with private sector operators responsible for terminal infrastructure and operations
Model 3	Private sector port operator responsible for port operations – with government retaining ownership of the land, leasing the port land (and facilities), and responsible for regulatory functions
Model 4	Fully private sector port, with private ownership of the land – with government responsible for regulatory functions.

These models can have different funding and financing arrangements. For example, in the second model, the port can be partly funded by government budget appropriations (e.g. for major infrastructure development). Alternatively, the port authority can be a fully commercial government business enterprise and fully financially responsible for its operations.

Landlord port (and airport)

A **landlord port** is the most favoured approach – across the case studies and workshops – and the model used for the key international gateways. The port authority/government owns the land and is responsible for (some) regulatory functions, with private sector operators responsible for terminal infrastructure and operations. The port landlord model is model 2 in the above list. Some illustrations are provided below.

Rotterdam

The Port of Rotterdam is a “landlord port”. All the necessary powers and responsibilities are vested in the Port Authority, to allow it to plan, develop and manage the port land and sea areas under its responsibility as well as the common user

infrastructure within the port's jurisdiction. The Port Authority will exercise similar functions inland, at the inland Container Transferium.

Le Havre and Marseille

The French Government recently designed organisational structures for France's gateway ports that are better adapted to their roles. The Ports of Le Havre and Marseille now follow a "landlord port" model, with terminal operations a private sector responsibility. Their governance arrangements help ensure a continuous focus on economic, commercial and environmental goals.

"Landlord port" models are widely used in other countries as well. The benefits are evident in the port authority being highly focused on its ownership and regulatory functions, and in being able to promote competitive private sector operation of the port's terminals. This functional split means the private sector is responsible for the timing and financing of port terminal infrastructure development and operations, ensuring that the terminals can respond to market demand and that there are competitive pressures to signal an appropriate expenditure ceiling. Many port organisations have adopted this model.

Corporatisation

Corporatisation of a landlord port can be the next step up to a higher level of sophistication. Under this approach, the government authority is transformed into a fully government-owned corporation, fully subject to the corporation laws of the country – as well as to oversight by the government in its roles as regulator and shareholder. Corporation structures help ports to become fully self-financing, which is often a worthwhile objective. Although less common, there are examples of government authorities that have been corporatised in this way. The benefits can be substantial, as the Rotterdam workshop illustrated.

Rotterdam

Following reforms made in 2004, the Port Authority is a public corporation; its shares are currently owned by the municipal government (70%) and the national government (30%). The corporation structure combined with a landlord port model means the organisation is publicly owned but commercially driven. It allows the authority to focus on operations without undue day-to-day political involvement. The authority is not as dependent on local politics as it was and there is no need now for locals to approve port expenditures.

Private sector port (and airport) models

Private sector models abound but they are relatively rare for key gateway infrastructure. Private sector gateway ports can arise through small private sector ports being developed over many years and growing to national gateway standing. They can arise from governments deciding to privatise a public authority port (i.e. as a brownfield private sector opportunity). They can also arise via government tendering processes, with calls for tenders to develop a gateway port from a fully greenfield site or as a major new development adjacent to an existing port operation.

Experience suggests that private sector port models can be successful – but also highlights the greater uncertainties and risks (principally financial) that are involved. As well, there is always the need for the government itself to manage, apply and enforce the full range of regulatory controls over the operation of the gateway port – rather than allowing a government port authority to discharge many of these functions. In the case studies, this was highlighted for the proposed build, operate, transfer (BOT) model chosen by Turkey for the proposed new Mersin container port.

Turkey, Mersin container port

BOT development means the government's role will be transformed, in this case from ports manager, operator and financier to one of regulator – overseeing development and operation of a major strategic gateway. Such changes often pose real administrative challenges. Effective government controls in relation to safety and security will be important, as will controls related to anti-competitive behaviour (access, pricing, service quality, etc.). Regulations or contracts should establish controls on other important public interest matters, e.g. ownership of strategic assets, financial reports, transparency, environmental performance and safety reporting. Requirements for consultation need thought as well.

Alternative port organisational arrangements

Independent structures and ownership of gateway ports help promote greater competition between the individual ports. Such approaches are generally consistent with national competition policies and could be expected to result in services to users that are fully competitive, ensuring that users reap the benefits of services adapted to their needs and provided on the most efficient and lowest cost basis. Such approaches are part of the policies and cultures of many western countries. The alternative of co-operation between ports could raise concerns among competition regulators about collusion and anti-competitive practices.

However, not everyone would agree that full and unfettered competition is all that is required. Many probably take the view that there should be room for some co-operation to ensure the best outcomes. If some degree of co-operation is not allowed by the law, governments may have to take a greater direct role in shaping the best outcomes possible. In fact, a more co-operative and coherent approach might help achieve outcomes that competition policy alone cannot achieve.

The Paris workshop highlighted one possible form of such co-operation, dependent on government action.

France's port reforms

The MEEDDM¹ discussions raised the possibility of further extending France's port reform process. There is increasing interest in short-term actions that could improve co-ordination of the ports at Le Havre, Rouen and Paris, the three major ports along the River Seine. In the short term at least, this would aim to improve inland waterway services along the Seine, focusing on the movement of inland waterway cargoes between these three ports and availability of the capacity required at each to facilitate such movements.

In the longer term, consideration may also be given to establishing a strategic body with overview, strategy and co-ordination responsibilities (rather than a single authority), to help ensure the best possible co-ordination of the activities of these three important ports.

Gateway airports

Structures and organisation

Traditionally, the major gateway airports were run solely by government departments and authorities. Governments were responsible for provision of all “airside” infrastructure and often most of the “landside” infrastructure as well, including the major passenger terminals. Airlines then leased the major terminals and other facilities they needed from the airport authority and operated their leased facilities on a competitive basis. This traditional airport model is still in place in many countries. A variant of the traditional model is the locally owned “non-profit” airport model used in Canada.

Over the past 20 or 30 years, most governments and their authorities have continued to be responsible for “airside” infrastructure and generally for international terminals. However, in some cases they have moved towards “landlord” models in relation to domestic air passenger terminals and selected (e.g. own-user) international terminals. When they have been prepared to accept the risks, the authorities may also have provided common-user terminals that facilitate new entrant airlines, particularly in domestic aviation markets.

A major attraction of gateway airports for both passengers and airlines is that frequent services to these major airports facilitate direct connections, e.g. better domestic-international or international-international passenger transfers. Such interconnections in turn allow improved travel time choices and better network performance. For these important commercial reasons, the major airline carriers hold on tightly to their airport slots and are loath indeed to move away from major gateway airports, even with compensation.

A further attraction is that the largest gateways have all the facilities needed to handle large volumes and the largest capacity aircraft in use (e.g. A380s, B787s). These facilities include not only aeronautical infrastructure such as runways and gates, but also the non-aeronautical facilities and services that users need, including passenger-related services in passenger terminals and their land transport connections to cities nearby.

Of course, secondary airports can be important too. There has been an increase in the use of secondary airports, in Europe and many other countries, by low-cost operators who mostly provide stand-alone services to such airports. However, the secondary airports and their low-cost operators are not likely to replace the major gateways.

Clearly, high-volume gateways and hub airports perform important functions now and can be expected to perform even more important functions in future.

International and transit infrastructure models

Greater international trade increases the international transport of the bulk liquids, gas, materials and products that need to be transported from one country to another. Good business models can help.

Denmark, Copenhagen

For the Fehmarn Belt link between Denmark and Germany, the government decided to adopt the successful model used previously for fixed links, i.e. a government-owned corporation established under the corporation law, a government-secured loan and financing via user fees.

In some cases, there can be an increasing need for transit across intermediate countries positioned between large origin and destination markets. The case studies highlighted one interesting example of how the organisational arrangements could be structured: the Nabucco Gas pipeline described earlier, to run from the Middle East across Turkey and other countries to Vienna, Austria. The pipeline arrangements provided a model that could possibly be applied to other infrastructure projects or possibilities. One such possibility under consideration for the longer term – raised at a TransBaltic Conference in Malmo and discussed at the Helsinki workshop – is a transcontinental rail infrastructure improvement project between Asia and Europe via Russia.

Gateway structure – market value considerations

There are other important matters that bear on the choices to be made on international gateway and transit infrastructure.

Consideration needs to be given in particular to the future financial value of the gateway organisation, in terms of both earnings and market capitalisation. Also to be considered are the government investments required over 30 years or more if the gateway infrastructure remains government- as well as user-funded over that period. Port earnings can be substantial and ensure an adequate return on investment, given the relative monopoly a gateway port generally has in its geographic location. However, unless the organisation has the ability to borrow in order to fund its necessary future investments, there will be regular calls on the government for funding in advance of those investments.

In relation to market capitalisation, a well-established gateway port can expect to be highly valued. In government or private hands, it could be valued by markets at 15 times earnings or more. By comparison, a private sector operator tendering for a greenfield operation would face much higher market demand and construction risks, and possibly greater competition risks as well. In valuing an opportunity to invest in such a gateway, the private sector would use very high rates when discounting possible future earnings to present value. Reflecting such risks and discounting, the tender bids would likely be very low – at least in comparison to bids that could be expected if the same gateway were privatised as a well-established brownfield opportunity after a sufficient number of years of operation.

There is little doubt that from this perspective, there are very important future earnings and market valuation factors to consider in making choices on the best organisational arrangements – and how these could or should vary over time.

Concluding remarks

In the case studies undertaken across a range of gateways, the examples of organisational arrangements on display generally reflected the high standards of infrastructure quality in the countries concerned. In fact, the more efficient the country and its people are generally perceived to be, the more efficient and better organised the gateway arrangements appeared to be for strategic infrastructure investment, funding and financing, and operations and management.

A “landlord port” is the model most widely seen in the case studies, and is used in a number of other developed countries as well. The case studies indicated that landlord ports encourage a clearer focus on commercial operations, promote competition in terminal operator services, and ensure essential safety and environmental regulatory functions. Corporatisation of landlord ports provides a higher level of sophistication; it can increase the prospects of gateway ports (and airports) being fully self-financing and able to develop strategic infrastructure as required, on a timely basis, to meet future needs.

Wider implementation of a “landlord” port model and a corporation structure for gateway ports would help develop a level playing field for competitive port operations and more of an ownership-neutral regulatory framework within which all gateway ports could operate on a more consistent basis.

Note

1. Ministère de l’écologie, du développement durable, des transports et du logement (Ministry of Ecology, Sustainable Development, Transport and Housing).

Chapter 7

Infrastructure funding: Gateways and inland links

There are a number of different options for general or gateway-specific funding arrangements. Models that rely on annual budget funding cycles to supplement user revenues rarely produce satisfactory outcomes; what counts is secure funding from multiple and diverse sources. Airports should be focusing on the capacity increases that will be required, especially given long lead times, and inland transport cannot be regarded as a second-order issue.

International gateway airports are the points of departure and arrival for millions of passengers and the valuable air freight cargo they handle. Globally, it has been estimated that air freight carries up to 40% by value of international freight. International gateway ports handle massive volumes of maritime cargoes that most often cannot be moved by other transport means. Typically, maritime transport carries around 80% of global cargoes by volume. The gateway functions of both airports and ports have to be performed to high standards, given the importance of international trade to their countries. Naturally, international trade is also important to the partner countries involved in exports and imports. All gateways are part of economic networks connected by global and regional logistics and supply chains.

International gateways stand out among the infrastructure needing to be funded in any country due to the strategically important tasks they perform. They also stand out because their quality and efficiency have a direct impact on the costs, timeliness and reliability of air passenger travel and air freight handling – which in many countries represents a major share of their country's international trade. In these ways, they contribute to the competitiveness and productivity of the multitude of businesses that rely on the gateway ports and airports for passenger travel and cargo handling. Clearly, international gateways make essential contributions to the performance of national economies.

Given this strategic importance, it is clearly in each country's national interest to ensure their gateways are performing well. Of course the gateways do not stand alone, as their performance depends on that of related inland infrastructure via which the port cargoes arrive and leave. While there may be some room to manoeuvre on timings, funding (and financing) cannot simply be overlooked – or the gateway and its inland connections deprived of funding for long – without serious implications. A related consideration is that, because they usually require major investments, the planning lead times and approval processes are generally long and the development periods even longer. Gateway infrastructure can take 10-20 years to plan and develop, but availability is crucial to performance.

Funding of strategic infrastructure

Funding of infrastructure is often a contentious subject. Due to the competing priorities, tensions abound over any call on public funds for significant infrastructure investments – especially investments that may take years to be transformed into efficiently operating new infrastructure.

With expenditures in areas such as education, health and care for the elderly increasing, investment in infrastructure as a share of national GDP in many countries has been falling. The United States, for example, invests roughly 1.3% of its GDP in infrastructure (compared with 3% invested in 1980) (CG/LA Infrastructure, 2010).

More recently, in many countries there has been recognition that a relative lack of investment in trade and transport infrastructure has had not only visible impacts (e.g. on the quality and condition of the infrastructure) but also significant economic impacts. Examples include the adverse effects on businesses whose export cargoes have been delayed by inadequate port loading capacity and efficiency and the effects on business customers with just-in-time operations that are disrupted by congestion delays and unreliability of import cargoes through major ports.

The case studies and workshops highlighted the strategic nature of gateway infrastructure and the importance of secure funding and financing arrangements. They also highlighted the high-quality funding arrangements in place in countries with high-quality infrastructure, as well as the different financing methods in use.

Box 7.1. Funding vs. financing

Throughout, the project adopted a government perspective on funding and financing terminology, which is to say: **funding** comes from taxes, users, or some combination of both; and **financing** relates to the other finance activities involved in making the project operational. This categorisation of funding and financing recognises that ultimately it is either taxpayers or users (or both) who pay for the infrastructure that is provided for public use.

The following sections explore the funding of the gateways themselves – as well as funding of the inland infrastructure they need – and how these different funding arrangements can affect performance.

Infrastructure funding models – gateway ports (and airports)

There are a number of distinct organisational structures and models in use for international gateways. Those most common are set out below. All depend to some extent on user charges, e.g. revenues from shipping and terminal operators, which are therefore not mentioned in the alternatives described in Table 7.1.

Table 7.1. **Models of international gateways**

Model 1	Port authority/government owns the land – with gateway infrastructure investment needs funded by general taxes and annual government budget allocations to the ministry.
Model 2	Port authority owns the land, is responsible for (some) regulatory functions, major infrastructure partly funded by government budget allocations (and other tax/funding sources). Private sector terminal operators responsible for their terminal infrastructure. Port authority may be given limited borrowing powers.
Model 3	Government-owned port corporation – with gateway infrastructure funded in part internally by the corporation and in part financed externally by the corporation's borrowings. Private sector terminal operators responsible for their terminal infrastructure.
Model 4	Private sector port operator responsible for port operations – with gateway infrastructure funded by port owner/operator equity, charges and (possibly) own-use revenues, and financed by any external borrowings. Private sector terminal operators responsible for their terminal infrastructure.

These models provide a number of different options for general or gateway-specific funding arrangements. A government port authority (model 1) funded exclusively by budget allocations is the most problematic model for the gateway authority. Under central government ownership, annual funding is subject to the vagaries of national government budgets. Variations include joint state/local government ownership, which spreads the load but can make budget funding more complicated.

In the worst cases, the authority is not guaranteed even the minimum amounts on a multi-year basis or the degree of certainty needed to embark on major projects. Without such certainty, the authority may have to bid annually for budget allocations and wait until the result is known. The chances are that the budget will never allocate or guarantee in a single budget year the full funding needed to undertake a strategic investment – such as a major expansion of the gateway port capacity – that could take five or ten years to complete.

When some funds are allocated, the authority needs to decide whether to embark on the major infrastructure investment(s), based principally on assurances from the government (which could itself face elections before long and change as a result). In such cases, the outcome could well be that the authority does not receive sufficient funding to allow a responsible decision to proceed. With the strategic project deferred, perhaps indefinitely, the national economy is likely to suffer the performance consequences (e.g. a loss of competitiveness, business productivity, etc. – and loss of potential growth opportunities).

A more independent port authority (model 2) is similar to the first option in that the authority could be jointly owned by state and local governments – but there are some important differences. Diversified sources of government funding are likely to increase the prospects that funding will actually be provided. Securing funds could be more likely if the budget allocation decisions take into account assessments and advice from specialised infrastructure bodies that have a long-term perspective, rather than the short-term perspectives common among many politicians and finance portfolios. A public authority given some borrowing powers could be expected to achieve better results. Variations on the model include ports that are fully locally owned by municipal authorities and self-funding. However, even though more at arm's length, inevitably locally owned gateway port authorities may still be subject to local political pressures, sometimes contrary to the national perspective and actions their functions require.

A government-owned port corporation model (model 3) provides the huge advantage that the funding of the strategic gateway infrastructure depends primarily on user demand and user revenues. As the income is under its own control, a fully government-owned corporation is fully responsible and can take timely business decisions on the infrastructure and the funding and financing required. Of course, wider consultation, co-ordination and approvals will still be needed for the works involved – e.g. land reclamation, environmental impacts, safety and security, as well as consultation with stakeholders, etc.

However, the authority can devote resources to these tasks in the knowledge that once the necessary approvals have been provided, the funding and financing constraints of annual government budgets most likely fade away. A further advantage of this option is that, being a government business enterprise, the corporation will be able to borrow at costs that reflect its public status and that may get close to the borrowing costs of the government itself – indeed an advantage in capital-intensive activities.

A private sector port operator (model 4) is similar in some respects to the government-owned corporation model. The most obvious difference, however, is that a private operator will most likely not be able to borrow at costs close to those of a government-owned corporation – a significant disadvantage for a capital-intensive activity. Depending on the nature of the gateway and the nature of the operator, borrowing costs could be significantly higher.

A related consideration is that the ownership and financial capacity of private operator-owners can change quickly, as a result of takeovers, mergers and/or leveraged buyouts. Avoiding such uncertainties is likely to require government controls on an operator's ownership (e.g. some foreign ownership limits), on an operator's portfolio business activities (e.g. limiting functions to the gateway facility or excluding ownership of casinos and companies in tax havens) and/or limiting controlling interests in similar ways.

Examples illustrating some of these options and infrastructure funding models are provided below.

Netherlands, Port of Rotterdam

The workshop discussions highlighted the importance of the Port Authority having been transformed into a corporation. At the time the Maasvlakte 2 project was under consideration, the authority did not have the cash reserves or financing capacity to assume responsibility for the project funding. The final decision was to establish the Port Authority as a corporation whose shares were owned two-thirds by the municipal government and one-third by the central government. As a corporation, the authority had the cash flow and financial capacity to borrow up to the level of its existing equity (i.e. a capital structure with a 50:50 debt/equity ratio). This level of equity and borrowings was sufficient to allow the authority to assume financial responsibility for the Maasvlakte 2 project.

The Port Authority has met its external financing needs primarily through long-term subordinated loans granted by the Municipality of Rotterdam. These municipal facilities are gradually being repaid and refinanced on the private market. In January 2008 long-term credit facilities were agreed with the European Investment Bank, the Bank Nederlandse Gemeenten, ING, Rabo and Fortis for an amount of EUR 1.8 billion. This sum will be used both for investment in the existing port and to finance the construction of the first part of Maasvlakte 2.

India, Ennore Port

The only corporatised major port, the Ennore Port (a satellite port just outside the Chennai city) has two shareholders: the Government of India (68%) and Chennai Port Trust (32%). The port has an INR 16 billion capital expenditure programme over the next five years, which includes building rail and road connectivity and deepening of the approach channel to 20 meters for handling cape-size bulk carriers. As the port is a “Mini-Ratna” (literally, Mini-Gem) public sector undertaking (PSE) and not expected to get a government allocation of funds directly and rely on its own resources, the port is exploring the option to float an initial public offering for the expansion. The IPO would be in line with the Disinvestment Programme of the government, which seeks to raise INR 400 billion through disinvestment. With the Ministry of Shipping planning to corporatise more ports within its control, such a route may set the course for the rest of the major ports.

Inter-generational equity

The different models for strategic gateway infrastructure can also have implications for inter-generational equity. Models that depend primarily on government budgets – and the taxes they raise from current taxpayers – rely to a large extent on current generations to provide the full upfront capital needed now to undertake massive infrastructure projects that to a large extent benefit future generations. User charges are then likely to be paid in the future – after a five- to ten-year construction period – over the project’s life (e.g. 50 years). These charges may or may not reflect the opportunity costs of using current taxes now to pay in full for projects required to meet future growth. Such inter-generational issues are not encountered to the same extent when the capital needed

for strategic investments is provided partly from current taxes/savings and partly by debt (e.g. 50:50 debt:equity).

Concluding remarks on funding gateway infrastructure

Ports that are not self-financing rely to a greater or lesser extent on the annual budget funding cycles to supplement user revenues and provide the resources needed for strategic infrastructure projects. The outcomes are rarely satisfactory in terms of strategic infrastructure investments. At worst, they can lead to important investments being delayed for long periods or deferred indefinitely – possibly damaging the port’s prospects and the national economy. Often, annual allocations are not known sufficiently in advance to allow use of multi-year contracts that deliver the lowest costs. On-again off-again funding can also work against the country’s ability to develop a highly skilled industry able to build the infrastructure needed.

The aim should be to move government-funded gateway ports towards self-financing as quickly as possible – again, preferably with a “landlord port model” and taking the next step to corporatisation where appropriate.

Airport funding and Financing

Airport capacity

Given the relatively rapid recovery in aviation demand following the financial crisis and current growth projections, infrastructure capacity is again a critical concern, with many airports already working at or above capacity. Airports facing strong increases in demand and related increases in investment requirements over recent levels will need to focus quickly on their capacity utilisation and capacity expansion plans. Once these are settled, they will need to go through the long and complex development approval and environmental impact processes – and deal with community and environmental pressures.

Airports are taking action now to maximise the efficient use of current facilities. They are working closely with their airline and air navigation service partners to implement new technologies and agreed standards that streamline passenger and cargo handling processes as well as enhance airside operations. However, doing all these things will not be sufficient to absorb twice as many arriving and departing passengers by 2030, let alone the greater increases expected at airports with the highest growth in demand. Twenty years is a short time frame to plan, gain approvals, and finance and build the new facilities required.

The rapid demand side growth is therefore raising questions about whether airports can build fast enough to keep pace – and whether they can find the investors and lenders they need.

Airport planning and capital expenditure

Airports plan years, even decades, in advance. They are a capital-intensive business. Airports Council International (ACI) estimates airport capital expenditure fell in 2009 to USD 34.6 billion – for upgrades and expansions of existing airports only (i.e. excluding greenfield expenditures) – due to the recession. This is around USD 15 billion lower than pre-recession trend levels. The lower current levels reflect some project reassessment in

light of slower growth in demand compared with earlier expectations. They also reflect tight money, as well as the short-term need to focus on matters related to the fall and then rapid rebound in demand.

In 2010, ACI airports expect to spend a total of USD 38.5 billion, the borrowings portion of which will add to their long-term debt burden of USD 240 billion. With industry revenues reaching USD 95 billion, ACI reports that airports expect to pay around USD 57 billion out of operating expenses and also need to pay the costs of capital.

Challenges

Expected future airport infrastructure needs will present many challenges related to the financing of the airport developments required. Despite cautious investors and tight financial markets, ACI has noted that airports need to:

- meet short-term demands for profitability in an increasingly entrepreneurial environment;
- pay back long-term debt while keeping a focus on future expansion needs;
- contend with short-term shifts in airline schedules and frequencies;
- compete strongly with other airports for new routes and air services;
- be able to shape solutions better suited to current aviation business environments.

Of course, regulatory frameworks – the responsibility of civil aviation authorities – need to allow sufficient flexibility under prevailing economic conditions, policy settings and regulatory oversight for the airports and their service providers to respond to these challenges.

Airport business

Major aviation infrastructure investments at airports have always been funded in part by aeronautical charges. Landing charges are differentiated by aircraft size and in some cases may also reflect aircraft characteristics (e.g. noise and emissions). The airlines pay other aeronautical charges related to air traffic control, usage of airport facilities on the ground, etc. The security of aeronautical revenues will depend on the global and regional economy and health of the aviation industry, which has been patchy at best.

Over the past 20 years or so, airports have expanded and created demand and opportunities for further passenger and other services, promoting non-aeronautical revenues as additional sources. Many major airports now serve as regional multi-modal surface-transport nodes, and provide good opportunities for businesses, trade, information exchanges and leisure activities.

Passenger terminals now generally include shopping malls and provide a range of additional business and passenger-related services. Many major airports have attracted aviation-linked clusters of hotels; convention, trade and exhibition facilities; corporate offices; and retail complexes, along with culture, entertainment and/or recreation centres. In some cases, airports have been transformed into “airport cities” and are important centres in their own right in the urban areas they serve. Non-aeronautical revenues have increased as a result. The charges airports can levy for parking may match central business district charges, providing a very important additional non-aeronautical revenue

source. As a result of all these developments, non-aeronautical revenues have become a very important revenue source, often generating over 60% of airport revenues.

Many airports are subject to price monitoring or regulation. Some privatised airports that are not price regulated have shown they are prepared to take advantage of their degree of monopoly pricing power. In such cases, the major issue is not the ability to raise finance but whether their charges are reasonable.

Land transport connections

The largest international gateway airports generally have good land transport connections, for both passengers and freight.

Airport passengers can often choose very good regular fixed rail connections, such as those to Paris-Charles de Gaulle, Heathrow in London, German airports in Frankfurt and Berlin. Rail connections are also good at some smaller international airports such as Copenhagen Airport. In some locations special high-speed passenger connections have been developed, e.g. the Arlanda Express at Stockholm and the exotic and expensive maglev service in Shanghai.

Of course, fixed rail connections may not provide the most direct services, and also may not be convenient for people with heavy luggage, young families, the elderly or people needing support. Almost all airports have high-quality motorways and major roads connections, and are used extensively for private vehicle travel, taxis and buses.

Air freight mostly consists of high-value, relatively lightweight shipments – although air freight produce and some manufactured goods can be very heavy. Nevertheless, air freight is mostly transported to and from gateway airports by road. Large-volume freight consignments can be carried in high-capacity trucks. Smaller cargoes and packages may be carried in small vans, e.g. those used by express parcel services.

Where there are no fixed rail connections, the volumes of airport-related traffic (passengers and freight) on the major roads are often very high. That increases the prospects of a build-up in congestion, inconveniencing airport users and city residents alike.

Concluding remarks on airport funding

With air traffic growth getting back on track in many regions, including Europe, rapid increases in air passenger and air freight volumes can be expected in the future. Given the long lead times, airports should be focusing again on the capacity increases that will be required.

As a result of the recent recession, governments and publicly-owned airport operators may find themselves more cash-strapped and budget-constrained for a number of years. For this reason, the best strategy for airports dependent on government funding for major infrastructure development could be to look into better ways of securing the funding that will be required, including making use of possible private sector financing sources to help ensure the infrastructure required is developed in time.

Infrastructure funding models – inland transport

Importance of funding for inland transport infrastructure

Inland transport infrastructure and services are crucially important to the strategic international gateways to which they connect – as well as to the vast array of cities and activity centres, businesses and people in gateway hinterlands that depend on these inland connections. Throughout the country and in neighbouring countries, economies and businesses depend on the inland connections between gateways and their hinterlands for the transport of their export freight and the import cargo they need – as well as the domestic transport that is also important. As trade increases and economies and their gateways expand, key inland transport infrastructure along major trade corridors will often need to be expanded as well. Funding of inland transport infrastructure is often problematic but it too is important to economic performance.

Inland transport funding models

Inland transport infrastructure funding models are not always transparent or well understood. There are many different organisational structures and models in use. Most inland road and rail infrastructure has remained in government ownership. As a result, taxpayers are often a primary source of the funds needed for infrastructure development. Most of the models depend to some extent on user charges (e.g. rail access charges, road tolls, charges for freight carried, etc.). The most common models are set out below. In the short descriptions provided, there is reference to user charges only where the models used are distinctive.

Table 7.2. **Models of inland transport**

Model 1	Government ministry/department is infrastructure owner. Infrastructure investment needs funded by annual government budget allocations from general taxes.
Model 2	Government infrastructure authority responsible for rail, road and/or inland waterway infrastructure investment. Investment needs funded by annual government budget allocations from general taxes and/or other tax funding sources (e.g. heavy vehicle taxes, TVA, fuel taxes) or charges for infrastructure use (e.g. rail track access charges).
Model 3	Government-owned corporation with infrastructure ownership/management responsibilities and borrowing powers. Infrastructure funding provided by heavy vehicle tolls and fixed/variable tolls in specific locations.
Model 4	Mode- or project-specific infrastructure fund. Infrastructure funding provided from one source (e.g. fuel taxes, road charges) or diverse sources.
Model 5	Multi-modal infrastructure fund established for defined purposes and different modes. Investment funding provided from some combination of taxes and revenues from diverse sources (e.g. budget allocations, general taxes, fuel taxes, land value taxes, user revenues, fixed/variable road tolls, cross-financing from road revenues to rail, etc.).
Model 6	Special purpose vehicle (SPV) with mixed government and private sector equity. Infrastructure investment funded by a combination of equity and borrowings (with or without government loan guarantees, tax credits, etc.).
Model 7	Public-private partnerships (PPPs). Government usually owns land. Infrastructure built by private sector and funded entirely by user revenues (e.g. toll roads, port link access charges).
Model 8	Private sector funding models. Private operator owns land, funds infrastructure from user charges. If own use, operates its own services (e.g. mining company's own rail services on its own rail track). Funding may be provided by third party users where agreed – or imposed via competition policy provisions on third party access to strategic infrastructure.

The options look very different, and they are. In many cases there are very important differences between them that affect their value and performance in delivering the inland infrastructure that strategic gateways need, as well as the infrastructure of the country generally.

In this diverse group, the performance of the model used often depends on how well it is implemented. This comment applies particularly to the ministry/department (model 1). In some countries, results may be very good and in others completely unsatisfactory. In most countries the department model with its annual budget imponderables creates a lot of work in bidding for budget allocations, repeated in annual cycles. Often it does not achieve the minimum level of certainty required for strategic planning and analysis, multi-year programming and tendering, a robust local industry or the ability to develop strategic infrastructure at reasonable cost and at the time required by international trade, industry and users.

A modal infrastructure authority (model 2) appears to work reasonably well for rail track infrastructure provision and management. It also works very well at present for road authorities where they benefit from “earmarked” revenues (e.g. a certain share of fuel taxes) as the basis of their multi-year programming. When dependent on only one or two sources of revenue, the funding may not be as secure and reliable as is needed over the longer term.

A government-owned corporation (model 3) – e.g. a rail corporation or a road corporation – has the advantage of borrowing powers as well as “earmarked” revenues. When it depends on one source of revenue, the model is safest and most secure when that source is **network** road charges. For roads, the best-known example is Austria’s ASFINAG, which is government owned, manages the main road network, levies agreed road tolls, and collects revenues from road freight transport charges across the network. Denmark is using a government-owned corporation model for the Fehmarn Belt link (Denmark-Germany).

Denmark, government-owned infrastructure corporation

The Danish Government decided to adopt the successful model used previously for fixed links across the Great Belt and the Sound, i.e. a government-owned corporation established under the corporation law, a government-secured loan, and financing via user fees. A state-owned company is in charge of the preparatory work, planning, approval, construction, financing, ownership, operation and maintenance of the fixed link. The toll station will be on the Danish side. Denmark will receive the revenues from the bridge company and cover possible losses. Denmark has also reserved the right to use the toll revenues to finance the upgrading of the Danish hinterland connections (which is Denmark’s exclusive responsibility).

Infrastructure funds (models 4 and 5) are prominent in the case studies and among the models that perform best in terms of delivering secure funding for strategic infrastructure and other major projects. In Switzerland for example, a combination of multiple sources of funds and multi-modal infrastructure funding has ensured secure funding for ambitious rail infrastructure projects, with some cross-subsidy from roads. Because of their success, infrastructure funds are considered in more detail in the next section.

The last three models – special purpose vehicles, private-public partnerships and private funding (models 6, 7 and 8) – are used selectively in different countries but were not covered directly by the case studies undertaken. They can be very important to the

success of the projects undertaken in the countries using them. Nevertheless, experience in these countries shows that all of them can encounter challenging issues, and the outcomes can be either positive or negative. Examples of the use of such models include the following:

- In India, a special purpose vehicle (model 6) called the Dedicated Freight Corridor Corporation of India Limited (DFCCIL) was incorporated under the Companies Act in 2006 to build and manage the huge multi-modal trade corridors planned for the Mumbai-Delhi and Delhi-Kolkata corridors. Funding will include land value capture along the corridors as well as user charges.
- Public-private partnerships (model 7) have been used to build some of the largest toll roads and other strategic infrastructure. Since their first use in the 1990s, they have been used successfully in many countries around the world and have facilitated many projects that simply would not have been possible otherwise. However, they are not in favour in all countries.
- Private funding models (model 8) are less common for strategic infrastructure but increasingly used in some countries. In Australia for example, some of the largest mining companies (e.g. BHP, Rio Tinto and Xstrata) have built their own rail tracks from mines to coastal ports in Western Australia and in Queensland. They operate their own rail sets carting large volumes of mining ores and coal to the nearest ports (which they may also have built and own).

Privately owned strategic infrastructure (such as nationally significant mining company rail track) raises issues involving third party access. In Australia, competition policy and third party access provisions relating to strategic infrastructure have been used to require a mining company to provide third-party access to its competitors so they are able to use “nationally significant” infrastructure. Such access can help get the best use from the available infrastructure and avoid a private monopoly in strategic locations. It may also help with the funding of such infrastructure over its operational life (although it may be “help” that the infrastructure owner does not welcome).

In practice, the models available are often limited by local culture and current ownership of the infrastructure. In most countries, trade corridor and inland connections infrastructure is fully owned by the government. Most often, the government then takes full responsibility for funding any investments made in inland rail and inland waterway connections and (in many cases) the investments made in motorway and major roads. The real issue is that, despite being responsible for the important investments needed in inland connections, governments may often not wish to – or be able to – find the funds to undertake them.

Concluding remarks on funding of inland trade routes and transport infrastructure connections

Inland trade routes need improved funding arrangements in most countries. Often, decisions are taken to expand gateway infrastructure without any security of funding of the inland connections or increased infrastructure capacity that will be needed. In some cases, inland transport – particularly inland rail freight – seems to be regarded as a second-order issue. Such approaches run counter to OECD research (highlighted in Part II) on the extent to which high-quality logistics services and infrastructure are trade enhancing and therefore economically important.

Linked funding – gateways and hinterland connections

The case study workshops highlighted that in Europe, inland road connections to and from most of the northwest European ports are generally satisfactory, although congestion on the roads can affect services considerably. However, inland rail and waterway connections are not sufficiently good to ensure high shares of port freight are carried on rail and inland waterway modes – or that higher shares can be carried in the future. Given the long distances involved, this is an important issue in many settings.

In Europe, some of the strategic improvements required are being funded by the European Commission and individual countries as part of the Trans-European Network – Transport Programme, with its many strategically important “Priority Projects”. Nevertheless, in most countries many serious problems associated with inland transport between gateway ports and their hinterlands remain. In some cases the current situation is very poor and the outlook is seriously compromised. Inland rail transport connections from the Mediterranean ports, for example, are clearly inadequate. These problems were among the most important and challenging that the authorities, gateway ports and other parties involved are facing.

Currently, the TEN-T programme focus in Europe is on identifying a “core” transport network, comprising the key infrastructure (roads, rail, inland waterway, airport and ports) that is of greatest strategic importance. The EC “core network” will be the one expected to make the greatest contributions to economic and social needs – and the one able to be funded. It will encompass the key port and airport gateways – and important land transport links. However, it is not clear yet whether these land transport links will include all the key multi-modal trade corridors between all the important gateway ports in Europe – including the Mediterranean ports – and their hinterlands.

Many countries around the world face similar issues. Strategic gateway ports are often located centrally in major metropolitan areas – and have relatively poor or inadequate inland transport connections from gateways through urban and residential areas to their principal inland destinations (cities and industrial areas). Many gateways are undertaking the port planning needed for them to expand to meet growing trade and transport demands.

Apparently, the funding and financing of both international gateways and the related infrastructure on which their performance depends need to be handled as an issue of national importance, i.e. **separately** from other, non-strategic categories of infrastructure.

The intention should be to ensure that, as gateway demand increases and gateway infrastructure is expanded to meet that increasing demand, the inland transport connections on which the gateways and their hinterlands depend are given attention under national funding arrangements. One successfully tested method would be to somehow link the funding of gateways and their inland infrastructure in a higher profile way.

National frameworks and funding arrangements could do so – as the EU is doing with its “core network” – by making provision for:

- international gateways to be identified as part of the strategic infrastructure of the country;
- “strategic infrastructure” to be established as a special category for funding purposes;

- the key “multi-modal trade corridors” on which these international gateways depend to be included in the “strategic infrastructure” category.

This would make it much easier for strategic gateways and key inland infrastructure connections to be linked for funding purposes.

Concluding remarks on linked funding

In the future, funding for inland transport connections needs to be linked with funding for gateway development and expansion of capacity. Its priority should be established in the context of other strategic infrastructure centrally important to national and regional competitiveness, productivity, employment, green growth, quality of life and a sustainable environment.

One possible approach would be to declare both gateway and key inland connection infrastructure to be strategic infrastructure, and include them both in a special “strategic infrastructure” funding category – again, as the European Commission is doing with the EU’s “core transport network”.

Lifting the profile of gateways and inland connections in this way could also help ensure the many other related actions required, including reserving space for future expansion and capacity increases to meet expected future demand.

Infrastructure funds

Infrastructure funds (models 4 and 5) do not seem to be as widely used for inland transport connections as the first three funding models. However, where they are used they seem to be performing exceptionally well, as demonstrated below in the examples from Denmark and Switzerland. These countries combine the sophistication of diverse funding sources with the undoubted benefits of some degree of “earmarking”.

In Denmark’s case, the Agreement on Green Transport Policy, which relates only to land transport, helped the Danish Government win support on a multi-party basis for a fully developed infrastructure programme of “Decided Projects” over the period to 2020 – encompassing rail, roads and connections to airports and ports. Denmark’s Infrastructure Fund and the two special funds for the country’s two major projects are funding the entire land transport infrastructure investment programme to 2020.

Denmark/Copenhagen

The Infrastructure Fund and the special stand-alone funds for the Fehmarn Belt link and the Metro projects are providing the secure, stable and sufficient funding that Denmark needed to embark on its very ambitious infrastructure programme over the period to 2020.

The sources of funding are important and help provide funds at the level and stability required:

- The long-term strategic Infrastructure Fund is financed out of general tax revenues, sale of state-owned assets (e.g. Scanlines), and savings on approved projects where there is investment under-spend (e.g. for rail signalling improvements, and where network modernisation leads to savings in expected future maintenance).

- Metro funding. Separate funding for the Metro projects comes from user fees and from sale of public assets (power stations) as well as from land value capture and property taxes. For the Metro projects, around half the funding is expected to come from “other” (i.e. non-user) sources.
- Fehmarn Belt link. There is separate funding for the project, and around half of the funding is expected to come from “other” (i.e. non-user) sources.

Switzerland

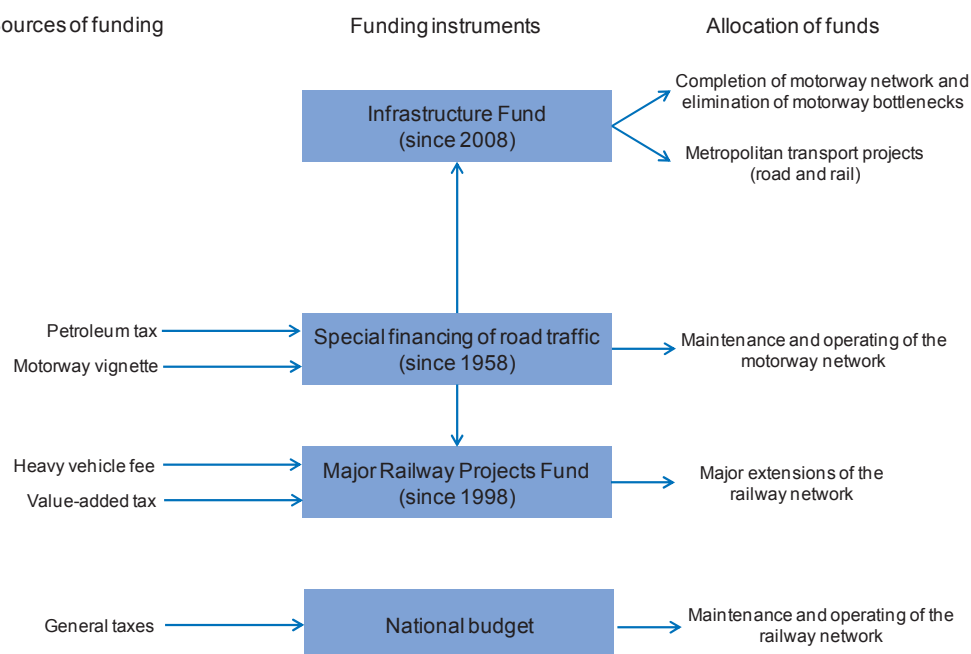
The Swiss system of infrastructure funding depends on earmarking revenues from the heavy vehicles fee and 0.1% of VAT to the Major Rail Projects Fund for large railway network extension projects (e.g. the three base tunnels and new railway link through the Alps).

The separate funds for specific purposes – with their earmarked sources of funding – are widely supported and seem to be working well. The funding arrangements guarantee reliable, long-term financing of transport infrastructure, unaffected by the imponderables of the budget processes.

The Swiss Federal Department of the Environment, Transport, Energy and Communications advised that without this system, the ambitious capacity extension programme of the Swiss railway network (including the new rail link through the Alps) would not have been achievable.

Switzerland’s infrastructure funds and their sources and allocation of revenue are shown in Figure 7.1.

Figure 7.1. Switzerland’s infrastructure funds and their sources and allocation of revenue



Source: Swiss Federal Department of the Environment, Transport, Energy and Communications (2010).

Cross-financing

The Swiss system of infrastructure funding depends on a degree of cross-funding between road and rail, with earmarked revenues sourced from the heavy vehicles fee transferred to the Major Rail Projects Fund. Major rail projects currently being undertaken with the benefit of this cross-financing include the transalpine rail tunnels. The Swiss regard cross-financing as important to their funding arrangements.

Cross-financing of this type has not been uncommon in other countries over the years. Examples in different settings include funds from road vehicle fuel taxes being applied to multi-modal infrastructure funding (United States), revenues from road tolls being applied to public transport improvements (e.g. City of London) and mass and distance charges on road freight being used to fund other improvements (New Zealand). However, cross-financing from road to rail does not seem to be as widely used now as in the past.

Infrastructure funds along the lines of those in Denmark and Switzerland depend on diverse and secure income sources. Revenues raised from road users by some combination of fuel taxes, road pricing, congestion charges or environmental taxes can be expected to remain relatively secure funding sources in the future, despite the possible impact of expected increases in fuel efficiency. In the future, as countries look for ways to promote greater use of lower environmental impact modes with lower CO₂ emissions, it seems quite likely that cross-financing could become more popular (e.g. for inland rail and waterway connections).

Concluding remarks on infrastructure funds

The case studies highlighted that infrastructure funds have important roles in some countries that have very good funding arrangements. Long-term infrastructure funds appear to offer the most robust approach, are able to deal with short-term fluctuations in economic conditions, and ensure predictable allocations to infrastructure in the longer run.

Multiple sources of funding are crucial. Cross-financing from road taxes and charges to rail and public transport is also very important for security and adequacy of funding, as are public support for and public acceptance of paying the high taxes and charges levied on the use of roads and road transport.

Infrastructure funding via government-owned corporations

Infrastructure funding via government-owned corporations is another model successfully in use in some countries for key gateway ports, gateway airports and some land transport networks, e.g. in Austria.

Austria has been using a government-owned corporation model to fund its national road and rail infrastructure networks for many years. Two companies, which are 100% owned by the federal government, are responsible for the construction, operation and financing of the Austrian high-level road and rail infrastructure networks.

Table 7.3. Austria’s road and rail network funding

Government-owned corporation	Sources of funding
Roads: ASFINAG – <i>Autobahnen- und Schnellstraßen-Finanzierungs AG</i> (Motorways and Express Roads Financing Corporation)	Road toll revenues as well as other revenues. No state subsidies from the federal government.
Rail: <i>ÖBB-Infrastruktur AG</i> (Austrian Federal Railways)	Revenues from infrastructure charging (rail infrastructure charging) as well as tickets and other revenues. Funding also provided via state subsidies.

ASFINAG is responsible for and manages Austria’s primary road system. The government has retained control over road tolling rates on the primary road network. ASFINAG receives all of its revenue from the nationwide system of charging for use of these particular roads. Public guarantees for loans to the road network operator (ASFINAG) reduce the costs of borrowing, although the company’s debt is not consolidated with that of the state.

Funding by different levels of government

In some cases, strategic infrastructure is jointly funded by different levels of government. The Fehmarn Belt link between Denmark and Germany, expected to be open in 2020, will be developed by a Danish Government-owned corporation – with the majority of the funding ultimately coming from user charges. However, a higher level of government is expected to contribute towards the cost.

The potential advantages of multi-level funding include the possibility of more funding being available than with a single level of government. The potential disadvantages include a dispersion of authority across the different levels, the scope for disagreements, and reduced certainty.

Innovative future funding and mobility pricing

Despite the exceptional results being achieved in Austria, Denmark and Switzerland, these countries are not resting on their laurels. Denmark and Switzerland are giving considerable thought to the improvements that will be needed in the longer term, post-2020 in Denmark and by 2030 in Switzerland.

Denmark, Copenhagen

Post-2020 challenges include assuring the future security of funding that will be required.

Road user charges have been identified as a possible source of secured funding beyond 2020. Denmark has been giving consideration to the best approaches to take. As a first step, a kilometre-based road-charging scheme will be introduced for all trucks. Denmark will thus opt out of today’s Euro-vignette – a time-based scheme covering all trucks above 12 tonnes driving the main international road connections in Denmark and nearby countries.

Beyond 2020, there may be opportunities for user-pay revenues to be channelled into the Infrastructure Fund. This could allow more major projects in the future to be funded in part or mostly by user charges (as has been the case with the Øresund Bridge). The possible Harbour Tunnel might benefit from such an approach, as might the new fixed links that could be required.

There appear to be further opportunities for land value and other funding sources as well for some of the projects under consideration. For example, in the case of the Harbour Tunnel, there would seem to be plenty of potential land available. Possibilities could include unused land like that at the Osterbro area, and stretches that are disused such as near the harbour or where old industry is moving out and redevelopment could take place. Overall, there seems to be significant potential for further land value capture schemes beyond 2020.

Switzerland, towards a new system of mobility pricing

The Swiss authorities are exploring the possibilities of a new system of transport infrastructure financing based on mobility pricing. This would likely involve:

- pay for use for all transport systems (road, rail, air, urban);
- price differentiation by space and time (demand management);
- price differentiation by ecological criteria (external cost);
- electronic charging (easy access);
- earmarked revenues;
- special funds.

The longer term funding challenges

Improved funding – where to start?

The best way to start on the path to improved funding could be to focus on funding security. Better funding prospects and increased confidence in the availability of funding will be essential. Good planning combined with funding security can be expected to “drive” strategic planning and analysis, help ensure that plans receive proper consideration, and – with appropriate “merit” criteria – deliver the funding required by strategic gateway infrastructure and key inland infrastructure projects. Importantly, secure funding will help provide the credibility required to attract and engage key stakeholders. Without more funding security, many people will not waste their time – and this could include some of the key stakeholders whose involvement is crucial to the objectives of the projects.

How best to keep going?

In the future, there will likely be a move in many countries from **project-based** funding to **network-based** funding, via more widely spread user charges. France and Italy have been tolling their *autoroutes* for many years. Austria and Germany now have network road charges for heavy vehicles. Others countries are contemplating making

initial moves in the same direction. Network charging on motorway systems could become an important future source of funding. If implemented by government corporations, network charging would be more likely to allow some infrastructure cross-financing of revenues from road users to the infrastructure needed for lower impact modes (rail and inland waterways). Either way, network charges could also be expected to avoid the need for high-risk greenfield projects to be undertaken on a stand-alone basis. As well, network charging would “do away with” the much-maligned pricing disruptions and distortions under current arrangements, caused by inserting highly tolled road sections into generally un-tolled road networks. This could help resolve some of the public acceptability concerns related to road charging, particularly if network charging replaced some existing road taxes.

The challenge of funding infrastructure needs to 2030 may seem daunting to many countries. However, some countries are already well on the way to meeting the challenge.

Concluding remarks on government funding

In countries with major ports that depend on government funding, there are real concerns that, given the post-crisis fiscal situation, future funding of gateway and inland transport infrastructure from traditional sources could “dry up” – at the same time as infrastructure needs increase quickly. However, this is far less likely to be the case in countries with good funding arrangements.

Countries with good funding arrangements

Countries with good funding arrangements are getting major infrastructure projects built. In conjunction with planning, good funding arrangements are the key and decisive factor in whether a country is able to plan and develop the strategic gateway infrastructure it needs. Good funding can transform the outcomes and make the funding uncertainties in infrastructure provision simply fade away. It can also avoid the waste of resources associated with annual budget funding models mostly favoured by finance departments.

What is good funding likely to involve? This will differ from location to location, but good infrastructure funding arrangements are likely to include:

- **Multi-year project funding.** Multi-year funding over the life of the project provides the certainty that major project proponents and financiers need. It encourages innovation and life cycle efficiency. It avoids the costs and waste for government and industry of stop-and-start decisions. It encourages the development and retention of a skilled and competitive industry able to deliver projects on time and at reasonable cost.
- **Funding security for key major projects over the infrastructure development period** (typically five to ten years). Funding security can be achieved with sufficient upfront funding, with a degree of “earmarking” of funds from different sources, and if necessary, with dedicated project-specific funding.
- Funding of a “fully decided” or “rolling” multi-modal infrastructure programme approved over a multi-year period (e.g. five to ten years). Multiple sources of funding will be required – together with some degree of earmarking of the funds needed – facilitating an orderly process of government action and industry

involvement. Allowing adequate time for preparation and tendering processes helps ensure that the projects are started and completed on time and on budget.

To be fully successful, infrastructure funds should probably have, to some extent:

- diverse and multiple sources of funding – e.g. budgets, other tax sources such as fuel taxes, charges for use of current and future infrastructure, and incentives (e.g. savings in expected project costs);
- earmarking of funds from key funding sources (e.g. fuel tax revenues, charges for infrastructure use);
- some cross-financing from road taxes and revenues to rail/public transport modes;
- planned reviews of future funding models announced well in advance (a decade in some cases).

Countries without good funding arrangements

Countries without good funding arrangements are not getting their strategic infrastructure built. This is actually the current situation in most countries, and the situation can be expected to deteriorate. Without good funding arrangements, there is not only the chance but the likelihood that the country will spend its time lamenting the poor state of its strategic and other infrastructure and searching for changes in areas other than funding – e.g. planning and approval processes – that could help overcome its infrastructure deficiencies.

Strategic infrastructure is most at risk in countries where budget funding is the sole or principal source of funding for the investments required. Countries where there is a high reliance on taxes on fuel are also at some risk, due to the prospects of strong future action to promote greater efficiency of fossil fuel use. It can be expected that improving the fuel efficiency of road vehicles will become a top priority, given the relatively low cost of significant reductions in fuel use and CO₂ emissions made possible by doing so.

Countries that do not have good infrastructure funding could find it useful to fix their infrastructure funding problems **first**. To do so, they will quickly need to develop better funding arrangements adapted to the immediate future.

Concluding remarks – what needs to be done?

Creating a “strategic infrastructure” category within national infrastructure frameworks would help improve the focus on “core networks” and strategic infrastructure improvements (gateways, corridors).

Declaring key inland connections to be “strategic infrastructure” would help secure funding for transport connections along inland trade routes, which need improved funding arrangements in most countries.

Good evaluation processes are needed to select the best projects. Broader national objectives and other portfolio objectives need to be taken into account. Evaluations should be undertaken from an international as well as national perspective, given the potential impacts on trade and competitiveness.

Improved funding arrangements will be needed in many countries in the future **to provide funding security** and funding levels consistent with assessments of strategic port and inland transport infrastructure needs. Long-term **infrastructure funds** based on diversified sources are expected to be **integral to successful delivery**.

The crucial challenge for the future will then be to implement the new, longer term arrangements that will unlock the key to the infrastructure that the country, its economy and its people will need over the period to 2030 and beyond. Given the long time frames involved, only strong action now will ensure that the infrastructure needed in 2020-2030 will be planned, developed and operational in time.

Chapter 8

Infrastructure financing: Private sector involvement

Private-sector financing can help deliver the equity and debt financing needed to make the infrastructure project operational. Private sector involvement can also help manage the transition to “user pays” and increased self-financing of future investments. Pension funds and private infrastructure funds are potential investors in the gateways and their infrastructure investments. However, they need access to good-quality projects with risk-reward balances consistent with their responsibilities to pension and infrastructure fund contributors. Debt-financing models – and guidelines – are discussed.

Importance of financing arrangements

In circumstances where infrastructure is government owned and budget funding is insufficient, financing arrangements can serve multiple purposes. They can help:

- bridge an “infrastructure funding gap” created by a shortage of public budget funding;
- secure borrowings from either public or private sources;
- make use of private sector expertise in project design and management, where private sector involvement could help achieve better project design and more efficient, lower-cost outcomes.

Private sector financial involvement can also be achieved by the private sector taking an equity position in the project – or becoming the owner of the infrastructure.

Financing arrangements help deliver any private sector equity and finance needed to make the project operational. Infrastructure financing can be appropriate for capital assets with long useful lives. It can be useful to deal with the high start-up costs of large infrastructure investments before funding by user charges begins – and while user revenues do not fully cover costs. Many different models are in use.

The outlook for infrastructure funding and financing was adversely affected by the financial crisis. While there are many potential sources of finance (e.g. private equity, private infrastructure funds, pension funds), there has been an increase in risk aversion among potential investors. Innovative financing arrangements adapted to “strategic infrastructure” could be needed to meet identified requirements in time.

Financing models

Financing models cover the full range of financing, from projects to networks and from conventional to innovative finance. The principal categories of financing models are set out in Table 8.1.

Many variations of these models are possible, reflecting whatever is agreed by the parties involved. In many cases, the financing models in use are limited more by the country’s government and business culture and knowledge of the alternatives in use than by people’s imagination. Examples are provided below.

Table 8.1. **Models of financing**

Model 1	Public ownership and operations. Public operator carries project risks – with finance raised either by the public or by the private sector (e.g. by way of infrastructure bonds, tax-exempt bonds, an investment loan with tax credits, etc.). Funding over the life of the project may be from general revenues, alone or in combination with separate taxes (e.g. on land value increase), user charges and cross-financing (e.g. from road taxes/charges to public transport and rail), etc. Taxes and any revenues from charges are used to service debt and repay financial loans/borrowings.
Model 2	Public ownership but concession for private operation. Private operator carries project risks – with the upfront and ongoing finance necessary raised by the concessionaire from lending consortiums (e.g. banks, institutions, co-ordinated loans, etc.) or from markets (e.g. by bonds, debt instruments, etc.). Funding (generally) comes from user charges, with revenues used to service debt and repay financial loans/borrowings.
Model 3	Public-private partnership. Risk allocation between public and private partners (e.g. public carries demand risk, private carries construction risk). Finance raised by the private partner (or possibly by both public and private partners) includes equity and/or debt. Funding (generally) by user charges, with revenues used to service debt and repay financial borrowings. In BOT cases, funding sources might include project-related taxes (e.g. taxes on land value increases).
Model 4	Private sector project. Private sector owns or leases the land. Private owner/operator constructs and operates their own infrastructure facility. Finance raised entirely from the private sector. Funding (generally) comes via user charges, with revenues raised used to service debt, repay financial loans/borrowings, and reward capital investment.

Public and private financing

Transport infrastructure can be financed by general or infrastructure-specific public borrowings, or by privately organised finance. The preferred method of finance most likely depends on overall value for money, equity availability and efficiency considerations, rather than solely on the cheapest source of finance. Thus the choice of method depends partly on the cost of finance and on the role of user charges and the ownership and management of infrastructure assets associated with each form of finance.

Full and partial privatisation

Privatisation of existing gateway ports (and airports) is another form of private-sector financing arrangements, albeit one that ends up using one of the four financing models listed above. Occasionally, both the land and infrastructure are sold by the public owner to a private consortium. More often, the government retains ownership of the land and gives effect to the privatisation by way of long-term concessions or leases (e.g. 50 years plus a 49-year option). In both cases, careful attention needs to be paid to the existing port (and airport) terminals, which may be fully government owned but are increasingly likely to be owned and financed by private operators under long-term lease.

Increasingly, governments are engaging in partial privatisations, where they sell down a significant share (e.g. 30%) in the gateway entity. At present, this is more common among gateway airports than ports.

As governments become more cash-strapped or conclude that other calls on their resources are higher priority, it is increasingly likely that the number of privatisations – especially partial privatisations in the first instance – will continue to increase.

Private-sector capital

The private sector often finances transport infrastructure independently from government – by issuing private debt or placing funds as investment equity, or through the use of more complex financial instruments. Private companies usually expect to service and repay most of this debt or equity from user payments for the services provided by the infrastructure.

Where a high proportion of the capital is serviced from user charges, there are strong (but not compelling) arguments for private-sector financing. The private parties that have raised the finance and incurred the liabilities have the means and the incentive to ensure that all or most of the capital is repaid.

Private infrastructure funds

Private infrastructure funds are increasingly active in infrastructure markets. Some of the largest private funds are very large indeed, having acquired billions of dollars of infrastructure assets.

Investment strategies vary considerably but may include acquiring majority or substantial equity or equity-like interests in infrastructure businesses. This allows a private infrastructure fund to exert significant influence or control over the business and, through an active management approach, to pursue revenue growth and margin improvements as well as optimising business capital structures over time. Some funds also target investments through which they acquire minority positions, in circumstances where their partners have similar objectives.

The investment focus of the funds can also vary widely. Some funds target investments in a broad range of infrastructure sectors, with a preference for relatively low-risk businesses. Examples could include sectors characterised by a dominant market position, sustainable and predictable cash flows over the long term, and the potential for long-term capital growth.

Private-public partnerships

PPPs have been used in many countries for many years. In the transport sector, they have been directed primarily at development of major roads and collection of user revenues (road tolls) and at gateway airports. Both are attractive because the infrastructure involved is likely to have a degree of monopoly in the geographic areas it serves.

As the EC White Paper entitled “Roadmap to a Single European Transport Area” (2011) notes:

Unlocking the potential of private finances equally requires an improved regulatory framework and innovative financial instruments. Project assessment and authorisation must be carried out in an efficient and transparent manner that limits time, cost and uncertainty. New financing instruments, for example the EU project bonds initiative, can support [PPP] financing on a bigger scale. (European Commission, 2011: 14)

Turkey, PPPs

PPPs have been often used in air transport, where projects are identifiable and risks are well understood. PPPs have been used much less in maritime, roads and urban transport, where projects generally carry more risks and there is less certainty over demand in particular. One urban project that is under consideration is the Istanbul Strait Road Tunnel Crossing, which has been proposed as a BOT. A draft implementation contract is currently being reviewed by the High Planning Council. Of the many different models possible, BOT, BO, long-term lease and transfer of operating rights are the most common. There is a clear need for a single framework setting out PPP law. An administrative structure is also needed to ensure compliance of PPP projects with National Development Plan objects, annual programmes and sectoral policies (Uzunkaya, 2010).

While PPPs have been relatively successful in many cases, there have also been a number of disasters, with operator financial failures and investors losing the funds they invested. There have also been numerous examples of public and private “partners” seeming more like antagonists than partners and spending years in the courts in battle over contractual provisions. While PPPs remain an approach that has attracted considerable support, they do not provide a guarantee of success. They require considerable skill and experience and seem to need a quantum of good luck.

Build, operate, transfer (BOT)*Turkey, Mersin Container Port*

Mersin Container Port provided a case study example of a private sector BOT concession for development and operations of a strategic gateway, with transfer back to the government at the end of the concession. The port will be co-located with the existing Port of Mersin, a general cargo ports which was privatised by the transfer of operational rights in 2007. There is expected to be a BOT tender called for the first three phases, with separate tenders for subsequent phases.

India, Dighi Port

Dighi Port, the first greenfield port in Maharashtra, is being developed under a 50-year “build, own, operate, share & transfer (BOOST)” concession agreement signed with Maharashtra Maritime Board to finance, develop, market, operate and maintain the port. It is an all-weather, deepwater multi-purpose, multi-cargo, direct-berthing port. The port has already signed a memorandum of understanding with Konkan Railway Corporation, Ltd. (KRCL) for development, operation and maintenance of a port railway line, with a total length of 47 kilometres. KRCL is a company owned by the Indian Railways (Government of India) and the coastal state governments of Maharashtra, Goa, Karnataka and Kerala, responsible for the main 760-kilometre trunk line running along a large part of the Western Coast of India. The Port Railway Line will connect to the Konkan Railway Main Line at Indapur – Mangaon.

Private sector involvement in aviation

During the last 20 years (but more often in the past 10) there have been increasing numbers of gateway airports that have been fully or partly privatised, and are now fully or partly privately owned.

UK BAA plc was the first owner company, in 1987. Australia's major airports were privatised by way of long-term leases (50 years plus a 49-year option) in the mid-1990s. Frankfurt Airport is one of the larger, more recent major privatisations.

Over the past ten years, there have also been increasing numbers of airports with partial private ownership, following government sell-downs of their equity, e.g. Aéroports de Paris and Copenhagen Airport.

Major airports where there has been a full or part privatisation over the period since 1987 include the ones in Table 8.2, identified in the ACI Airport Economics Survey (2010). This listing is not exhaustive by any means; for example, it does not list separately the four Australian airports (Melbourne, Brisbane, Perth and Sydney) privatised by way of 50-year leases with 49-year options in the late 1990s.

Table 8.2. A selection of major airports with significant private ownership

Former name	New name	Year of privatisation
British Airports Authority	BAA PLC	1987
Flughafen Wien Ges. mbH	Flughafen Wien AG/Vienna Airport plc	1992
Copenhagen Airports Authority	Copenhagen Airports A/S (formed 1990)	1993/94
Hongqiao International Airport Co. Ltd	Shanghai International Airport Co. Ltd	1994
Xiamen-Gaoji International Airport	Xiamen International Airport Group Co. Ltd	1996
Ljubljana Airport, Slovenia	Aerodrom Ljubljana plc	1997
Aeroporti di Roma S.p.A.	(now delisted)	1997
Auckland International Airport	Auckland International Airport Ltd (AIAL)	1998
Malaysia Airports Holdings Bhd	Malaysia Airports Holdings Bhd	1999
Beijing Capital Airport/CAAC	Beijing Capital International Airport Co. Ltd	1999
Zürich (FDZ + FIG)	Flughafen Zürich AG – Unique Zürich Apt	2000
Aeroporti di Roma S.p.A. (ADR)	Aeroporti di Roma S.p.A.	2000
SAF (Società Aeroporto Fiorentino SpA)	Aeroporto di Firenze S.p.A. – AdF	2000
Shanghai-Hongqiao Int. Airport	Shanghai International Airport Co. Ltd	2000
Flughafen Frankfurt AG	Fraport AG	2001
Haikou Meilan Int. Airport, China	Hainan Meilan Airport Co. Ltd	2002
Malta International Airport	Malta International Airport Ltd	2002
Macquarie Airports	Macquarie Airport Group	2002
Guangzhou-Baiyun International Apt	Guangzhou Baiyun International Airport Co. Ltd	2003
Airports Authority of Thailand (AAT)	Airports of Thailand Public Co. Ltd (AoT)	2004
Brussels (Régie des Voies Aériennes)	BIAC (Brussels International Airport Company)	2004
Budapest Airport Rt.	Budapest Airport	2005

Note: Compiled by Momberger Airport Information, November 2010.

Source: ACI (Airports Council International) (2010), *Airport Economics Survey 2010*, Airports Council International, Geneva, December.

The ACI report also includes:

- a two-page index of “who owns and manages privatised airports”, which lists 192 international and national airport and terminal operators, investment funds and companies involved in the ownership and management of (mostly) major airports;
- a 40-page tabulation providing details of their ownership and management interests.

These bodies include:

- international airport operators such as Abertis Airports Spain, Australia Pacific Airports Consortium (APAC), BAA plc UK, Fraport (Germany), Macquarie Airports (Australia), Schipol Group (the Netherlands) and Vinci (France);
- many other private national airport operators with diverse airport interests.

Comparison with gateway ports

In a number of countries there has been greater private sector involvement in gateway airports than in their other economic and strategic transport infrastructure. Reasons for this include the clearly defined and confined nature of airport operations and responsibilities, and fairly clear limits on the extent of potential competition. Gateway airports can to some extent be effective monopolies in the regions they serve.

However, despite gateway airports having characteristics different from gateway ports in some respects, they also have a number of similarities. Gateway airports and ports are both strategic infrastructure, of tremendous importance to the cities and industries they serve. Both provide global connectedness, connecting national and international businesses to domestic and global markets. And their efficiency, reliability, productivity and overall performance are crucial for national growth and international competitiveness. Both have important safety and security responsibilities that require government oversight. Both may have some degree of monopoly power that may require government oversight, monitoring and regulation. Airports and ports can both have significant local impacts from an environmental viewpoint (noise, local pollution, etc.) that require government regulation. Both may require some ownership scrutiny.

Given the extent of the similarities, it is rather surprising that there are such large differences between gateway ports and airports, in terms of private sector involvement of the gateways themselves (as distinct from their airport and port terminals).

Some of the differences could arise from the somewhat different nature of the markets they serve. Airports have a relatively higher share of revenues from passenger transport – and air passengers tend to be from higher income groups. The private sector interest in gateway airports may be due in part to the greater revenue potential attached to this higher spending power, as evidenced in the shopping mall trend.

However, the gateway ports serve robust markets such as petroleum, oil, motor vehicles, agriculture and manufactured goods. Globally, container growth (by volume) is expected to be larger than for aviation passengers or air freight. So, many of the gateway airports have very strong growth prospects indeed.

Of course, the differences in private sector involvement in gateway ports could be due primarily to the views and interests of governments. If governments do not provide opportunities by selling down or selling off their interests in gateway ports to the degree they have with airports, there will be little private sector involvement in the ownership of gateway ports.

Cost of capital

The UK Infrastructure Plan draws attention to the costs of capital when selecting funding models and considering the prospects for private sector involvement. Table 8.3 – which is provided in the *UK Infrastructure Plan Report* – shows the impact on cost of capital of different types of funding models.

Table 8.3 provides some examples of the types of economic infrastructure to which these funding models are currently applied. The increase in the cost of capital shown – relative to the publicly funded rate – reflects the increasing level of risk that sits with the private sector.

Table 8.3. **Indicative advice on the weighted average cost of capital (WACC) in the United Kingdom**

Type	Funding models	Indicative WACC (%) ¹
Publicly funded	Direct government-funded investment; e.g. flood defence, some rail and roads	3.913 ²
Government supported	Network rail	+0.0 – 1.25 ³
Regulated markets	Regulated asset base model; e.g. water, electricity, regulated airports	+0.25 – 3.0 ³
Availability-based payment	PFI/PPP schemes	+2.0 – 3.75 ³
Unregulated markets: demand based	User pays, for example corporate energy utilities, unregulated airports, waste operators and communications	+3.5 – 7.0 ³

Notes: 1. DMO Annual Reviews, regulatory price control reviews, company accounts, Bloomberg; HM Treasury; cost of capital numbers are presented as purely indicative of what may be achieved. Actual cost of capital is driven by a number of different factors and may ultimately depart from the range of numbers presented for each funding model. 2. Based on the cash-weighted average yield of actual issuance at the gilt auctions, syndicated offerings and mini-tenders between 2005/6 and 2009/10. 3. Increase relative to publicly funded option (3.913%). Figure expressed in nominal terms. Regulated sectors figures reflect a real WACC that takes the pre-tax cost of debt but the post-tax cost of equity.

Source: HM Treasury and Infrastructure UK (2010), *UK National Infrastructure Plan 2010*, October.

While it is evident that the cost of capital can be reduced through adoption of different funding models, that also results in greater risk being borne by the consumer or taxpayer.

Pension funds

Pension funds are often regarded as a desirable source of future equity investments for infrastructure. At the same time, infrastructure is often regarded as a possible investment that may well match the strategies and risk appetite of pension funds.

From the viewpoint of providers of infrastructure – and particularly the strategic infrastructure that is the focus of this book – the investments potentially required by major projects can run into billions of dollars. Potential investors therefore would need to

have deep pockets and large investment funds at their disposal. There is no doubt that pension funds do have large and increasing assets, which they hold and invest on behalf of their members.

OECD's Investment and Pension Fund Survey

The OECD's International Futures Programme undertook an Investment and Pension Fund Survey during 2010 to ascertain the levels of pension fund interest in investing in infrastructure. The survey included over 70 interviews with pension funds and other institutional investors in Australia, Canada, the United States, Europe and Asia¹ – whether they were active in the infrastructure sector or not.

The first objective of the study was to better understand the current appetite of selected investors for investment in infrastructure, and the key drivers for the investment decisions made by institutional investors. The second objective was to identify the current barriers to infrastructure investment and examine a variety of options for removing some of these hurdles.

The analysis was undertaken on a country-by-country basis to underline different stages of evolution of investment in infrastructure and specific problems encountered and solutions proposed in each market. Findings draw in part on interviews with industry professionals, in part on information obtained from a literature review, selected pension fund annual reports and an analysis of the available data sources.

The next sections look at the recent history and prospects for increased pension fund investment in the future.

Growth of pension fund investment in infrastructure

Several key factors account for the growth of pension fund infrastructure investment.

Availability of investment opportunities for private finance capital and therefore pension funds

Following a wave of privatisation – mainly in industrialised countries – over the past 25 years, there has been increasing private sector involvement in the provision and operation of infrastructure. In some sectors, full privatisation has not always been possible or politically viable. For major projects, governments have considered new forms of co-operation between public and private sectors in infrastructure, such as public-private partnerships (PPPs). For historical, cultural and public policy reasons, PPPs are more widely developed in some countries than in others.

Canada and the United States, for example, have generally relied on public financing of infrastructure such as highways, bridges, ports and canals. US federal and state governments generally still invest directly in infrastructure projects rather than rely on private-sector financing. Canada and its provincial governments do much the same but there has been some use of PPPs, e.g. in the transport sector. The level of private sector participation has been higher in Australia and Europe, including in their transport sectors.

Maturity and size of the pension fund market, i.e. the institutional capital available for investment

The aggregate OECD pension market is large, but the size of domestic markets varies considerably, reflecting the mix of public and private pensions, whether participation is mandatory or voluntary, and different investment policies. In European countries, the largest private investments in infrastructure have been in countries like Denmark, Finland, the Netherlands, Sweden and the United Kingdom, and which have well developed pensions markets. By contrast, in Greece, Italy, Spain and Turkey state-run public pensions play the major role in the old-age retirement system, limiting the growth of private pensions and the potential for investment in infrastructure.

Pension fund regulations

Pension fund regulation at country level has evolved over the years in line with different public policies, including protecting people's retirement savings. Some countries have required a high domestic weighting for investment, or given priority to funding government debt. Very often, local investment rules have favoured highly rated and liquid debt instruments. Such regulatory approaches help explain why institutional and investor exposure to infrastructure in some countries has been mostly via debt (i.e. bonds). Countries that do not impose any similar rules on pension funds' asset allocations now have higher exposure to equity investments.

Infrastructure is often a complex asset, and investment involves a steep learning curve

Investing in infrastructure often requires long lead times, given the need for due diligence investigations, planning, educating sponsors and time to establish appropriate investment and risk management structures. Canadian and Australian pension funds, which first started investing in infrastructure more than ten years ago, seem to be further along the learning curves and have built up significant fund allocations to the infrastructure sector. Despite the maturity of infrastructure markets in European countries such as France, Spain and the United Kingdom, European investors began building up infrastructure investments more recently.

The Pension Funds Survey findings included the following:

- Institutional investments in infrastructure are relatively new in some countries and entail a new set of challenges for investors.
- There is a shortage of objective, good quality data, and the lack of comparable information makes it difficult for investors to assess the risks of infrastructure deals.
- The recent financial crisis – which had a significant impact on the performance of many infrastructure projects – increased investor concerns about the risks attached to infrastructure projects. This has affected institutional investor perceptions about investments in infrastructure value.

Key problems. Key systemic problems preventing greater pension fund investment in infrastructure and possible policy solutions canvassed in survey presentations include the following:

- **poor understanding of the asset** – possible solutions include dedicating the right expertise to infrastructure, with either dedicated in-house expertise or outsourcing to external managers;
- **mismatch in risk profile** – possible solutions include structuring projects as attractive investment opportunities for institutional investors, debt capital markets, development of new financial instruments, and clarification of the investment and risk profiles offered;
- **lack of committed pipeline** – possible solutions include developing a strategic, co-ordinated approach to infrastructure; developing national, long-term policy frameworks for key individual infrastructure sectors; and improving integration of the different levels of government in the design, planning and delivery of infrastructure.

Some problems are related to the intrinsic characteristics of the infrastructure assets themselves (e.g. illiquidity) and their relative immaturity as an asset class. General improvements that might assist pension funds everywhere included:

- a transparent environment for infrastructure investment;
- a stable and accessible programme of infrastructure projects;
- opportunities for public-private partnerships;
- removing unnecessary restrictions on the use of pension funds;
- building expertise and fostering collaborative strategies and resource pooling.

Other barriers to investment were found to be different and specific to each country. Potential solutions will require an understanding of each country's situation and need to be addressed at the relevant political level, national or supranational.

Prospects for increasing pension fund investment in infrastructure

The long-term investment horizon of pension funds and other institutional investors should make them natural investors in less liquid, long-term assets such as infrastructure.

The prospects for future growth and opportunities for institutional investors are improving, especially in countries where private pensions and insurance markets are still small in relation to the size of their economies. More pension funds are looking at infrastructure to diversify their portfolios due to the low correlation of infrastructure to traditional asset classes.

What seem to be needed are sustained and steadily increasing infrastructure investment opportunities in the future. The challenge will then be securing long-term sources of finance and shielding them where possible from short-term exigencies and impacts. Before pension funds commit large amounts of capital to infrastructure, they will need more transparent and certain regulations governing the sector for the long term. Of course, pension funds will only make such investments if investors are able to earn adequate risk-adjusted returns and if appropriate market structures are in place to access this capital.

In such circumstances, institutional investors – in particular pension funds – can be expected to play a more active role in the future financing of long-term, productive infrastructure projects.

The OECD IFP Pension Fund Investment in Infrastructure Survey report is being released separately.

Survey findings

Some of the key findings from the pension fund survey are the following:

- There is a need to give infrastructure a more distinctive identity as an asset class – i.e. move it out of the “alternative asset” class.
- Many pension funds seem willing to become more active in infrastructure financing as appropriate to local circumstances. Of course, it would help if any unnecessary restrictions on the use of pension fund assets were removed. There is also a need to foster skills in investing in infrastructure.
- The most important aspects are the private sector’s risk appetite and associated risks and returns. Infrastructure projects need to be unbundled according to their characteristics, for example risk profile. There is also a need to recognise that investing internationally raises different risks, e.g. currency risks (which may require hedging) as well as political risks.
- Pension funds cannot invest solely in risk-free incomes, as the returns are too low. Pension fund boards will have to judge whether infrastructure investments will be too risky. There needs to be more emphasis on raising awareness of infrastructure opportunities with pension fund boards.
- If pension funds do invest in infrastructure, they are looking for long-term, stable cash flows. They are also looking for stable, inflation-indexed investments, preferably in the same currency. They are often looking to long-term ownership possibilities as well.
- As well as a supply of good projects, there need to be good planning that is credible to investors and clear commitments. To assist their decision making, investors need greater transparency on the performance of infrastructure businesses in public hands. Proper accounts and balance sheets are needed. Greater consistency would be possible if all accounts were prepared in accordance with corporation law requirements and accounting standards.
- Importantly, there is also the need to reflect carefully on the implications of new regulation for financial institutions, e.g. Solvency II and its treatment of infrastructure and insurance companies and occupational pension schemes’ books.
- Investments in greenfield infrastructure often bring major problems, including lack of clarity in bidding criteria, delays in the award of projects, pre-construction delays, and delays in financial approvals. Project delays could be related to land acquisition, environmental concerns or local protests. There are also project risks, including construction risks, cost overruns, market risks, upfront financing risks, vulnerability to economic cycles, and possibly single-asset concentration risk.

It seems the characteristics of established, **strategic** infrastructure could be more attractive to pension funds than investments in most other infrastructure, particularly infrastructure that is more subject to competition, changing demand patterns and possible policy change, as well as other risks.

Pension funds may therefore be interested in full privatisations (e.g. strategic gateway ports and airports) and in partial privatisations – if and when governments wish to sell down their holdings in particular assets – and interested selectively in other high-quality public-private partnership projects.

In summary, some pension funds have already made substantial investments in infrastructure. While in some countries pension funds have been relatively slow to seek out and take up the investment opportunities, in the future more will have the financial capacity to do so, and will be interested.

Project quality and risk reduction

Most prospective investors are currently more risk-averse than they were before the recent financial crisis. Many tenders were deferred following the onset of the crisis – and many of those have remained deferred due to continuing risk aversion, not only that of financial institutions but also that of investors who are seeking better project quality and lower upfront risks.

In some countries (such as Mexico), in the face of declining project investments, the government has responded by finding ways to improve the quality of the projects on offer and reduce project risks. One of the ways they have done so is to combine a mature asset with a greenfield opportunity – so that demand is more secure and overall project risk is reduced.

Debt financing

General principles guiding the use of debt

The US DoT report on *Paying Our Way: a New Framework for Transportation Financing* (2009) noted that recently, much has been written and said expressing caution about state and local governments' overall level of indebtedness – and in some instances, specifically their transport-related debt. Some analysts have suggested that states and localities have borrowed more debt than is prudent, inferring that debt in general is a bad thing. Conversely, policy makers struggling to encourage greater infrastructure investment in some instances have promoted “alternative financing approaches” – i.e. greater indebtedness – without adequate consideration of the underlying revenue streams. As a general rule, however, debt is neither a good thing nor a bad thing; rather, it is a tool that can be a part of the answer when used appropriately.

The report outlines four general principles to help guide the appropriate use of debt financing for a particular investment or set of investments. It notes that the principles should be considered together, not individually, and balanced with other policy factors. These principles are reproduced below.

Maximise upfront funding for long-lived capital assets and match the asset's useful life with debt term

As the “golden rule” of public finance, debt financing is appropriate for funding capital assets with long useful lives. Conversely, pay-as-you-go funding (i.e. paying out of currently generated revenues or funds on hand) generally is most applicable to

fund operations or assets with short useful lives. For assets with longer useful lives, debt financing of comparable duration to the useful life of the asset ensures that the burden of the capital costs is spread over an asset's life and is matched to available revenue streams – such as user fees, targeted dedicated taxes, or other ongoing revenues generated from direct users or other beneficiaries. In the context of comprehensive and ongoing capital programmes such as those administered by state departments of transport, applying the “golden rule” gets a bit more complicated. The subsequent principles in part address this added complexity.

Mitigate major capital investment spikes

Debt can be used to smooth the impact of a particularly large one-time spike or general “lumpiness” of a capital investment programme and help limit the extent to which other important projects or programme elements are crowded out by the major project or set of projects.

Accelerate benefits and/or reduce costs

Debt can accelerate investment in a major capital project. In many instances, financing costs are less than the construction cost inflation that would accompany deferred investment, thus reducing the overall project cost. Less quantifiable, but more important, are the economic and societal benefits that can be captured by using debt financing. Providing an asset earlier can provide environmental benefits (for instance, where the asset is a cleaner-fuelled transit vehicle), societal or safety benefits (for instance, improving an accident-prone highway or providing pedestrian or bike paths in a community), or economic benefits (such as roadway or transit investments that spur economic development in the surrounding area).

Match costs to benefits over time (generational equity)

The above principles notwithstanding, committing future revenues and shifting the burden to future generations through debt financing requires careful balancing. On the one hand, future generations benefit from prior investments. On the other, future annual revenues will be committed to servicing debt. Consideration must be paid to the distribution of the financial burden between current and future payers relative to the distribution of benefit, often referred to as “generational equity” and one of the commission's overarching guiding principles. (US DoT, 2009)

Taken together, these principles can help guide when and to what extent debt financing mechanisms can be appropriately used to help meet transport infrastructure investment needs – avoiding having to forgo or delay the benefits – without overleveraging available revenue streams, over-committing future users and taxpayers, or masking the true need for increased underlying funding.

Government borrowings²

General public borrowing is a low cost method of borrowing that spreads the burden of payment equitably. It is appropriate when user charges are not feasible (and so private financing is difficult) and when the government carries a high proportion of project cost and risk. It may also be appropriate when the market is not competitive.

Specific infrastructure bonds have few advantages, although revenue bonds may be useful in some situations.

The most common form of public sector borrowing is via long-term bonds. Bonds are interest-bearing certificates of debt. They entail the payment of interest to the lender as well as repayment of the principal at a nominated future date. Government bonds often have a maturity of ten years or more. In some cases interest payments are indexed against inflation. These “inflation indexed bonds” eliminate significant uncertainty for potential investors about the impact of inflation over the long life of a project. Government bonds are usually serviced out of general taxation spread over the life of the bond, although user charges may provide supplementary revenue.

Governments may also raise capital via specific infrastructure funds or infrastructure revenue bonds. These instruments are similar in that in both cases government raises money from the public via bonds for the purpose of constructing infrastructure. However, an infrastructure fund may allocate its capital to a variety of infrastructure projects. It may not be project or revenue specific. Also the capital may be serviced from general tax revenue or from a hypothecated tax source, such as a fuel levy. An infrastructure revenue bond is more likely to be project specific. The revenue raised by the bond issue provides capital to a specific project and this capital is serviced from project revenues, albeit with a government guarantee backed by the government’s tax powers. However, there are no precise general definitions of these concepts.

The issuing of special purpose **public infrastructure bonds** may be attractive to private lenders. They may provide a catalyst for mobilising private sector money and for some public-private partnerships. Also, the greater accountability and the hypothecated nature of such funds may make them more attractive to lenders. However, the issuing of such bonds does not relieve the government of any obligations that would attach to other borrowing arrangements. Investors are more interested in the nature of the risk than in the purpose for which the bond is used.

Another feature of infrastructure funds or revenue bonds is that they may be tax advantaged. In such cases, a bondholder typically receives a tax concession on the interest from the bond. The Australian Government offered tax concessions on infrastructure bonds for a period in the 1990s. In the United States municipal bonds (from which funds can be applied to various uses) are tax advantaged. (Abelson, 2008)

Tax-exempt infrastructure bonds

Tax-exempt bonds are the traditional mechanism for the debt financing of transportation infrastructure in the United States. Because of their comparatively low interest rates, tax-exempt bonds typically have created a very low cost of capital for borrowers, enabling state and local governments to finance infrastructure development under attractive terms. The U.S. municipal bond market demonstrates significant size and depth, with annual issuance of USD 350-400 billion.

Other forms of capital used to a lesser but growing extent in the transport sector include commercial bank financing, taxable bond financing, and private equity. While private-sector participation in transport infrastructure financing has flourished in Europe, Australia, and Canada, the United States has been slower to use direct private

investment – largely due to the availability of low-cost tax-exempt debt. (US DoT, 2009: 163.)

Other equity and debt financing models

Participation banking

Equity and debt financing through participation banks is an established but relatively new form of financing that is starting to be used in some countries (e.g. Turkey and the Middle East) as an additional option, suited to some situations and circumstances. The most frequent use to date has been in settings where Islamic development funding has been appropriate. The models being used reflect many of the different options available from conventional sources – with the distinction that they involve direct participation and profit sharing and are based on (upfront) fees rather than interest on the funds involved.

Cross-border financial support

One surprising opportunity highlighted in the workshop was that the Swiss had provided cross-border financial support to France and Germany, to help ensure the improved inland connections needed between Switzerland and Germany and between Switzerland and France. The financial support provided included:

- a loan to Germany for the electrification of the Basel-Munich line;
- co-financing with France of the Rhine-Rhone TGV connection.

Regional co-financing like this can obviously make it possible and much easier to develop the cross-border connections and facilities needed on both sides of the border.

Of course, there are pros and cons with cross-border financing of this type. Each case needs to be considered carefully on its merits, taking into account the infrastructure needs involved – as well as the nature of the risks and the balance of risks and benefits.

Innovative financing

The term innovative finance is often used to refer to financing arrangements that differ from those commonly in use in the country. It should be recalled that innovative finance does not by itself generate new funds. There are very many financing options available. In fact, the range of different financial models in use is really limited only by what the parties involved are prepared to agree.

United States – “innovative finance”

These financing tools do not generate new funds in and of themselves, but they can in some instances help to reduce upfront capital costs, achieve life-cycle cost efficiencies, maximise capital formation for construction, accelerate project benefits, and facilitate the transfer of risk away from the public sector. Sometimes referred to simply as “innovative finance,” government-sponsored financing initiatives – such as the Transportation Infrastructure Financing and Innovation Act (TIFIA) credit assistance programme, the capitalisation of state infrastructure banks, and administrative adjustments that have

facilitated grant-anticipation borrowing – should be considered in this light rather than as a magic means to solve the infrastructure investment deficit.

United States – tax credit bonds

Several recent legislative proposals call for the issuance of tax credit bonds, a form of debt financing that significantly subsidises the borrowing cost of the project sponsor (debt issuer) by having the federal government pick up part or all of the interest expense through the provision of tax credits to the investors. This is accomplished through the issuance of hybrid debt instruments where the lender receives an annual return in the form of federal tax credits, in lieu of cash interest payments, plus return of principal at bond maturity. The borrower is responsible for repaying the principal from local revenue sources. The investor can apply the tax credits against its other federal tax liability. Since interest expense on long-term bonds may constitute as much as 75% of the financial cost of debt service in today's market environment, tax credit bonds provide the borrower (project sponsor) with a much deeper subsidy than do tax-exempt bonds. (US DoT, 2009)

United Kingdom – tax increment financing

Plans to introduce tax increment financing (Tif) to help fund major infrastructure projects in the United Kingdom were announced by Deputy Prime Minister Nick Clegg, speaking at the Liberal Democrat's autumn conference.

In 2011, London Mayor Boris Johnson wrote to the Chancellor urging him to introduce the American-style Tif scheme. Tif, which allows local authorities to borrow against the predicted growth in their locally raised business rates, is already used in the United States to fund major projects. (Business Daily, 2010)

Concluding remarks

Privately financed infrastructure allows development of public infrastructure in circumstances where the public sector is not well placed – or the private sector is better able – to do so. Private financing is being used increasingly in many countries and is likely to be used much more widely in the future. One of the reasons is the difficult set of issues government budgets are likely to face that relate to the recent crisis; budget deficits and government debt; high unemployment levels; and the outlook for expenditures in education, health and ageing. At the same time, it can be a relatively high-cost form of financing for what are generally highly capital-intensive activities.

The *UK Infrastructure Plan Report* gives an indication that the weighted average cost of capital (WACC) in the United Kingdom that might be achieved (in nominal terms) could be between 3.5% and 7% above the indicative WACC for publicly funded investment, which was around 3.9% (over 2005-2010).

Private-sector involvement may allow greater room for innovation and overall project construction efficiencies. When user charges are feasible, private ownership and management may produce goods and services more efficiently than the public sector. These ownership and operational efficiencies may offset the relatively high cost of finance – but this needs careful assessment in each case.

Similar arguments apply to refinancing existing transport infrastructure by way of privatisation. This may be worthwhile economically and financially when there are efficiency benefits and the assets are sold at (or above) expected market prices. Privatisation is more difficult to justify in the absence of economic benefits, though there may be occasions when the financial benefits justify it.

In general, financing instruments should be chosen on the microeconomic merits of each case rather than on macroeconomic considerations. In parlous economic times, avoiding fiscal deficits and reducing debt are desirable objectives. At other times, they may not be such important objectives.

Notes

1. Interviews were conducted over the period June-October 2010 through meetings or conference calls with representatives of selected investors in infrastructure, consultants, and infrastructure funds.
2. The source of this section is Abelson (2008).

Chapter 9

Strategic planning and contributions to green growth

National visions and long-term plans for strategic infrastructure development (with consistent policies, co-ordinated developments and aligned networks) are essential inputs to planning and evaluation assessments of the gateway infrastructure required. Strategic planning at the national level especially can best assess the broad outlook, highlight major changes in demand, identify strategic options for how best to respond, and assess possible impacts of policy changes to address issues and improve outcomes. For infrastructure yet to be built, important contributions to green growth – clearly an emerging priority in many locations – can be made during infrastructure planning and development stages. Once developed, there is considerable scope for management of infrastructure use, including in relation to cleaner vehicle and vessels technologies, to raise those contributions.

Strategic planning

Context – Recent crises

Recent developments have highlighted the impacts that financial crises, large natural disasters and global shocks can have on the global economy as well as on individual countries and their populations. They have also highlighted the general resilience of the global economy, which has continued to grow and develop despite the serious setbacks in some sectors and large natural and related disasters in some regions.

Importantly, recent developments have also highlighted the importance of key infrastructure – including strategic energy, transport and communications facilities – and the incentives for countries to ensure that their infrastructure is high quality, well adapted to needs and as secure as possible. Quite clearly, in crisis circumstances, the costs of not doing so can be very high indeed.

Outlook

The earlier chapters highlighted that increasing GDP and income is expected to lead to continuing increases in international and domestic demand – for travel, goods and services and for freight transport in particular. The expected scale of the growth will be considerable:

- Global air passenger traffic is expected to double in 15 years.
- Global air freight could triple in 20 years, i.e. by 2030.
- Global container traffic is likely to at least double by 2030. If recent relationships between growth in GDP and container volumes were maintained, the increases could be much higher.

For gateway infrastructure, the increases at key locations could be even higher than these global average levels, owing to the expected concentration of demand along the major trade and transport corridors.

Clearly, the higher expected economic growth in the developing countries will have major impacts on gateway infrastructure needs in developed countries as well. Increasing growth in developing regions will mean increasing export opportunities and import demand – not only for developing regions but also for developed countries. Gateway infrastructure in any country is thus likely to benefit from the growth both in its own region and that in other regions – as long as it has sufficient capacity and offers competitive services.

Risks and uncertainties. Of course, there are many risks and uncertainties that could affect these projections. A number of authorities have put forward alternative scenarios, to help with contingency planning. The International Energy Agency, for example, has outlined several very different possible scenarios for energy demand, fuel prices, fuel consumption and CO₂ emissions – some of which depend on the very focused policy action that could be taken in the future. Possible changes could also follow a lessening of current global trade imbalances.

Current OECD work on *Future Global Shocks: Improving Risk Management* (2011) is identifying a number of strategic risks and actions that need to be taken on board in any longer term planning to mitigate the risks and allow intervention where necessary. Global shocks and the subsequent interventions may also impact on the future outlook.

The very significant economic growth in prospect and the related changes in the levels and patterns of demand in many locations require some serious and careful strategic infrastructure planning at regional, national and gateway area levels.

National strategic planning

National strategic planning is the planning that identifies national “core networks” of strategic infrastructure and outlines the actions required to ensure core networks are high performing and secure, and deliver the levels (including quality and reliability) of service that are needed to meet national objectives.

National strategic planning is also the level of planning that can best assess the broad outlook, highlight major changes (or a paradigm shift) in the patterns of demand, identify strategic options for how best to respond, and assess possible impacts of policy changes to address issues and improve outcomes.

In a national strategic planning context, gateways and the key inland connections on which they depend are obviously very important. They provide the facilities that link the country to the world and facilitate a major share of international passenger and freight movements. They are critical to trade, productivity and the country’s economy. The major gateways and key inland connections therefore need to be clearly identified as part of the “core networks” considered by national strategic planning – as they are in the European Commission’s proposals for the European Union’s “core transport network”.

Good planning is obviously important, helping to ensure all the important factors are taken into account and identifying needs that will be robust over time. Some examples:

- The European Commission has undertaken some major strategic planning as part of its review of the TEN-T networks. As mentioned earlier, the work has focused on the identification of a “core network” that encompasses the key road, rail and inland waterway links that are most important at a European level, and can be funded. The “core network” includes key gateway ports and airports and their key inland connections.
- The United Kingdom has also been undertaking some important strategic planning that contributed to its National Infrastructure Plan 2010 and related funding announcement.
- Turkey is another country that has made considerable progress. Its Transport Infrastructure Needs Assessment (TINA) Study for Turkey (2007) undertook some comprehensive planning and assessment of infrastructure priorities across the major modes.
- The steering group also suggested highlighting China’s planning efforts. China is currently developing a new high-speed rail network that will be very extensive but is not expected to be completed until 2020. By that time, it will include over 15 000 kilometres of high-speed rail track as well as the necessary rolling stock. The speed of construction and extent of the network have increased considerably over the last five years, as China first increased its level of ambition then its

overall investment in high-speed rail as part of its stimulus package following the global financial crisis.

- China's high-speed rail services will make a large contribution to passenger travel and business productivity. They are also expected to make a major contribution to China's rail freight system, because the HSR will operate on its own infrastructure. This will free up capacity on the existing rail network for freight rail services. Clearly, the results could not have been achieved without a high level of prior strategic planning.

Objectives focused on key deliverables

National visions and long-term plans for strategic infrastructure development (with consistent policies, co-ordinated developments and aligned networks) are essential inputs to the planning and evaluation assessments required for gateway infrastructure. Providing for future economic growth and competitiveness are centrally important, along with minimising environmental impacts.

International trade

International trade has become increasingly important as a driver of economic growth and development – and is reflected in the increasing trade shares of economic growth globally and in the major trading economies. International trade depends on quality logistics services, which in turn depend on quality gateway infrastructure and key inland connections.

International maritime and air carriers moved more than 8 million tons of freight globally in 2008. Quality logistics services play an important role in facilitating the transport of international trade in goods; inefficient logistics services impede trade by imposing an extra cost in terms of time as well as money. Trade logistics facilitate trade ... higher quality trade logistics are positively, significantly and robustly associated with higher bilateral merchandise trade. (Korinek, J. and P. Sourdin, 2011)

International competitiveness

Strategic planning needs to take into account the increasing importance of international competitiveness, which is now well entrenched as a priority in most countries.

As developed nations shift from traditional manufacturing and agriculture and are increasingly engaging in international vertical specialisation, the need for efficient logistics services becomes ever more important. High-quality logistics services improve the competitiveness of a country's exports by reducing the cost involved in transporting goods – especially for countries that are disadvantaged by being far from major markets. (OECD, 2011a)

Increasing export earnings

In general, improvements in trade logistics impact exports more than imports. Investments in trade logistics will enhance the potential for exporters to compete on international markets. Improvements in infrastructure are particularly trade-enhancing for exporters.

Benefits dependent on national income and transport mode

Transport is the single most expensive component of trade logistics – and adequate infrastructure is required to facilitate transport. High-quality infrastructure is an important factor in determining the quality of a country's trade logistics services.

Airport infrastructure has a strong effect on trade flows at all levels of development, with the weakest effect estimated for low-income countries. For seaborne imports, changes in low-income exporters' port infrastructure do not have a statistically significant impact on trade. However, strong estimated effects can be found for higher levels of income, with the maximum estimated effect in the upper-middle income category. Improvements in port and particularly air infrastructure benefit middle-income countries more than lower income countries. Higher income countries also profit significantly from such investments. (OECD, 2011a)

National economic objectives along the lines set out above should be centrally important to national strategic planning – along with matters related to the environment, regions, people, and their quality of life.

The case studies reinforced the importance of relatively secure funding for the strategic planning work that needs to be done.

Denmark, Copenhagen

The Infrastructure Fund and the two stand-alone major project funds are also providing a supportive climate for the Transport Ministry's current longer term planning and strategic analysis work, which is considering many major strategic infrastructure options for the period beyond 2020.

Gateway area planning*Gateway area*

Gateway area planning encompasses the gateway to its boundaries as well as adjacent areas where there are likely to high levels of interaction. Land uses need to allow space for expansion as well as inland connections (waterways, rail, roads, pipelines) from the gateway to its destinations in nearby cities, industrial areas and the wider gateway hinterlands.

The case studies highlighted the importance of identifying and reserving corridors for inland freight connections, including to and through cities and residential areas in the vicinity of ports and airports.

At this level of planning, with land areas under the control of different levels of government (national/state and local), it is very important that local stakeholders are fully involved. Their assistance will be crucial when action is required to protect the space required for future gateway development – as well as when current inland connections are no longer adequate in the future. In such cases, the land required needs to be reserved and protected from encroachment – or from acquisition for alternative uses.

Gateways

The case studies emphasised the importance of good planning processes, which need to be open and transparent and involve all the necessary stakeholders. As an example, good planning processes were needed to gain approval for a port expansion the magnitude of the Maasvlakte 2 development in the Netherlands, at the Port of Rotterdam. In that case, the scale and significance of the development required lengthy processes and sustained efforts over the duration to respond to the many competing objectives.

While the processes are important, so are the overall objectives. In the Maasvlakte 2 development, port-specific objectives included space to expand, competitiveness, environmental protection, safety and security. Gateway area objectives included being able to improve the capacity of inland connections and, at the same time, reduce the adverse impacts of a major increase in inland transport of cargoes handled by the port. Stakeholder relationship objectives included providing job opportunities for local residents, providing an attractive port environment for their use as well, and retaining the continuing support of the local community for the growth and development of the port. In the case of inland connections, objectives included major capacity expansion along existing corridors and greater use of low-impact modes, within a multi-modal corridor approach.

Master plans and development plans are important both to the gateway authority and to the local residents in surrounding areas, including for the certainty they provide. Residents in particular need to know, with a sufficient degree of certainty, the extent of the changes in areas and uses as well as the expected impacts on local communities associated with the changes proposed.

One of the problems encountered in many locations is the very lengthy periods involved from first planning to final approval. Many of the processes are very complex, ensuring all possible impacts are explored (e.g. via environmental impact statements) and residents and others have sufficient opportunities to lodge any objections. However, a view commonly heard is that the processes take too long.

Most of the case study gateways were well advanced in their planning for the longer term. Most were also well advanced in their development of the infrastructure required over the period to 2020. Despite the complexity of planning, there was often more concern about the availability of the funding required.

Concluding remarks on strategic planning

As developed nations shift from traditional manufacturing and agriculture and are increasingly engaging in international vertical specialisation, the need for efficient logistics services becomes even more urgent.

It is very important to ensure that the space required for future development of strategic infrastructure and its inland connections is clearly identified and protected against encroachment (e.g. by urban development) or acquisition for alternative uses. Recognition of its importance in national strategic infrastructure plans will provide greater leverage to do so. With land areas on and off the gateway possibly under the control of different levels of government (e.g. national, state, local), it is equally important to ensure all key stakeholders are involved and on-side, wherever possible.

In many cases, such processes may be fairly well established. But it is clear that objectives are changing, in response to acceptance of the need for a “greening” of transport – and the importance of green growth. This could affect longer term planning considerably, suggesting the value in reviewing long-term plans now.

Green growth

Inevitably, any discussion of planning is likely to focus on objectives relating to a “greening of transport” and more generally to the importance of green growth. This in turn raises the question about the relationship of green growth to the concept of sustainable development, which is addressed below.

Where sustainable development represents a grand paradigm, green growth seeks to present an actionable and achievable policy framework. While the principles of sustainable development reflect long-term aspirations, green growth combines efforts to exploit opportunities to shape a more robust economic recovery in the short term with the objective of promoting new, greener sources of growth over the longer term.

Green growth is about maximising economic growth and development while avoiding unsustainable pressure on the quality and quantity of natural assets. It is also about harnessing the growth potential that arises from transiting towards a green economy.

Green growth strategy

The need for green growth strategies arises from the fact that the way growth is framed is incomplete. Our understanding of growth and the “rules of thumb” we use to guide economic policy frequently do not account for natural assets and the role they play in underpinning economic growth and contributing to human welfare. There is a need to go beyond a conventional conception of growth, like changes in GDP, in order to appropriately assess the role that the environment plays in supporting growth and the possible trade-offs between growth and the environment.

A recent OECD publication titled *Towards Green Growth* (OECD, 2011b) explained current thinking on green growth strategy in the following terms: “green growth strategy is a contribution to realising the ideals of sustainable development, by providing an actionable policy framework to generate new and greener sources of growth today and in the future.”

The need to reframe growth is becoming increasingly important, because imbalances being created in environmental systems pose systemic risks to growth. These imbalances also manifest themselves as rising tensions between local and global environmental and economic priorities.

There is no certainty whether these imbalances will spontaneously “correct” and, if so, exactly how costly that could be. There is a risk that, in the meantime, bottlenecks may emerge that would choke off growth. This is especially so because patterns of growth and technological change tend to build on one another and therefore economic and policy decisions can have long-lived consequences. This kind of “path dependency” can set in motion patterns of growth that may be very costly to reverse. Moreover, the timing is unpredictable and likely to be abrupt and irreversible. Given the interdependency of environmental and economic systems there are risks of a major systemic collapse in growth, both at a local and global level.

A “greening of transport”

The case studies showed the increasing importance attached to a “greening” of transport.

Denmark, Copenhagen

The Green Transport Policy Agreement reinforced that the sector must make its contribution to meeting the requirement for a reduction of at least 20% in CO₂ emissions from the non-trading sector in 2020 compared to 2005 levels.

Contributions to green growth

The case studies and workshop undertaken on gateways and their inland transport connections highlighted opportunities for the “Greening of Transport” – and some significant infrastructure contributions to green growth. Examples are provided below to highlight the significant reductions in CO₂ emissions, local pollution, congestion and noise that can be expected over many decades ahead as a result of the infrastructure developments that were studied.

Planning and development stages

The importance of targeting green growth contributions at infrastructure planning and development stages is illustrated below.

Port of Rotterdam

The Port Authority is implementing arrangements to significantly increase the modal shares of inland waterway and rail transport (less polluting modes than road transport) for the inland transport movement of cargo handled by the port. Requirements for a modal shift to less polluting modes are being included in the new contracts the authority is offering as terminal operators progressively take up leases in the Maasvlakte 2 port expansion area. Of course, the planning and development work will include the additional infrastructure required for inland waterway and rail transport to handle greatly increased inland volumes, which will need to be funded separately from the port development itself. The benefits of the change to less polluting modes over the period to 2035 and beyond are expected to include very significant reductions in CO₂ emissions associated with inland freight transport across Europe, by comparison with current mode shares – as well as reductions in local pollution, congestion and noise.

Further, the Port of Rotterdam authority has plans to restrict entry to the Port post-2016 to vehicles with engines that meet Euro V & VI engine emission standards.

Contributions during operations and use

The following examples provide evidence of the very significant contributions that infrastructure operation and use can make to green growth.

Port of Rotterdam

By 2035, the Port of Rotterdam's throughput volumes could increase from the current 400 million tonnes to around 600-750 million tonnes. In light of such growth prospects, the authority is aiming to reduce the share of goods transported by road and increase inland waterway and rail shares of inland transport. The target is to raise inland waterway's share from 30% now to 45%; rail from 11% to 20%; and to reduce road's share from 59% to 35%. Achieving these modal shifts towards less polluting modes than road transport would result in around 150 million tonnes of freight being carried on inland waterway and rail within Europe that would otherwise have been carried by road transport.

Based on an average inland transport distance of 450 kilometres, the inland road freight across Europe would be reduced significantly (in the order of 75 M freight tonne-kilometres). Use of inland waterway and rail transport instead of road transport could result in net savings in CO₂ emissions of over 20 million tonnes per year.

If all the other major northern and north-western ports in Europe were able to achieve the same modal shift towards less polluting modes than road transport, the total savings in CO₂ emissions would be around three times the Rotterdam savings – i.e. over 60 million tonnes of CO₂ per annum. There would also be significant reductions in local pollution, congestion and noise.

Of course, very significant investment in rail and inland waterway infrastructure will be required in advance. The Betuwe rail line between the Port of Rotterdam and Germany was completed in 2008 at a cost of around EUR 4 billion but will not be fully effective until sections of the rail track in Germany are upgraded as part of the TEN-T corridor improvement project.

Istanbul Marmaray project

As mentioned earlier, one of the important urban problems of Istanbul is the difficulty of transport resulting from the rapid and uncontrolled population growth, a rapid increase in motorisation and related traffic jams.

The Bosphorus Strait, which divides the city into two continents, exacerbates the transport difficulties. Crossing the Bosphorus between the European side and the Asian side causes huge waste of time and fuel, creating air and noise pollution as well as traffic accidents. The Marmaray Rail Project will upgrade the commuter rail system in Istanbul by providing an uninterrupted railway connection for Asia and Europe.

With the tunnel in place, total passengers trips per day across the Bosphorus are expected to increase from around 1 million in 2004 to over 2.2 million in 2025. However, the rail share of passenger trips across the Bosphorus is expected to increase dramatically, with Marmaray rail accounting for 77% and the roads 23% (compared with 53% on bus and van transit and 47% car passengers respectively in 2004). The savings in passenger road vehicle trips across the Bosphorus attributable to the Marmaray project could amount to 5 million vehicle-kilometres per day, reducing CO₂ emissions from road vehicles by around 0.27 million tonnes per annum in 2025. These savings would be partly offset by an increase in CO₂ emissions from rail services, but the net savings in CO₂ are estimated at around 0.25 million tonnes per annum in 2025.

A lowering of the chronic congestion and much needed reductions in local pollution across Istanbul would be important additional contributions to the benefits, as a result of better infrastructure, operations and use.

Transalpine traffic

Austria and Switzerland are at the crossroads of major transport corridors in Europe. Both are landlocked countries that depend on international freight transport from neighbouring as well as more distant countries, to meet needs that are not being satisfied locally. Road freight and rail freight through the Alps play an important role in meeting the diverse needs of both countries and are the principal means of carrying both import and export freight. Transalpine road freight and rail freight are also important to the economies of neighbouring countries – including the Czech Republic, France, Germany, Hungary, Italy, the Slovak Republic and Slovenia – whose export and import needs often include transit across Austria and Switzerland as a part of the transport between origin and destination countries.

The impact of transit traffic on fragile Alpine areas and the populations of Austria and Switzerland is sufficient to guarantee that freight flows in this region are very important to national and international transport policy in the countries concerned. Rail freight services on transalpine routes are especially important, as rail is often the most efficient mode over the long distances and has lower environmental impacts than road freight transport. Transport policy and regulatory frameworks in Austria and Switzerland have needed to adapt to deal with the pressures on transport and the environment in the sensitive Alpine regions. Policy is now directed towards promoting use of lower impact modes for transalpine freight traffic.

Modal shift of freight on to rail is now part of Switzerland's federal Constitution. The goal is a transalpine limit of 650 000 heavy freight vehicles a year, at the latest two years after the opening of the Gotthard base tunnel (expected to be complete around 2020). Road taxes/charges are levied on transalpine road transport to limit road transport and promote modal shift. Rail freight volumes are expected to rise from around 25 million tonnes in 2010 to around 38 million tonnes by 2019 – over the same period as transalpine road freight movements reduce to 650 000 heavy vehicles per year. A continuation of the current policy and regulatory framework could see rail freight volumes rise to 45 million tonnes by 2030.

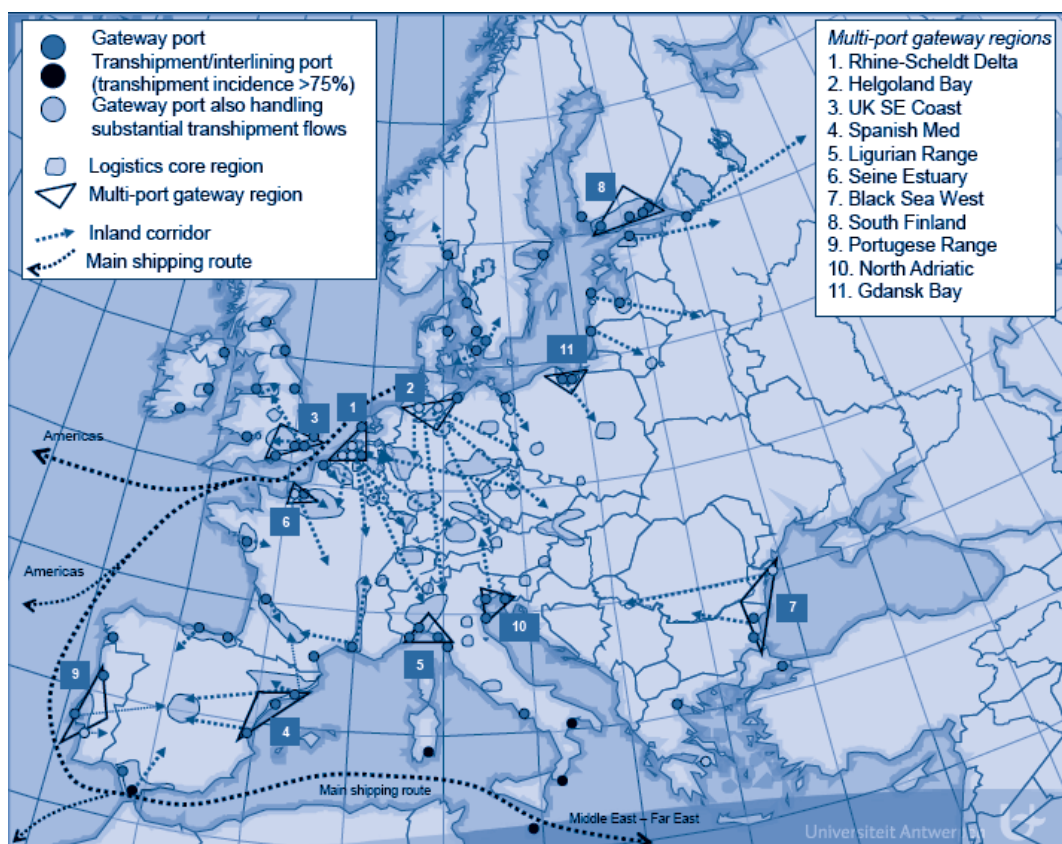
Austria's transport policy and regulatory frameworks are also directed towards two similar goals: modal shift to rail transport and financing of infrastructure.

Greater use of the Mediterranean ports

Use of Europe's Mediterranean ports is currently relatively low while that of north-western European ports is relatively high. The north-western ports have location advantages by being close to the major industrial centres of Europe. They are deepwater ports that can handle the largest container ships in use. Over many years, the north-western European ports have become very efficient and they now have advantages in scale and scope over the Mediterranean ports. Their competitive advantages have led to their growing use and their hinterlands extending for long distances inland. In the case of Austria, for example, the north-western European ports handle 64% and the Mediterranean ports 36% of its requirements.

The northwest Europe and Mediterranean gateway areas are shown in Figure 9.1. It highlights the different gateway port locations as well as the principal inland markets served from the gateway ports.

Figure 9.1. Northwest European and Mediterranean gateway areas and inland corridors

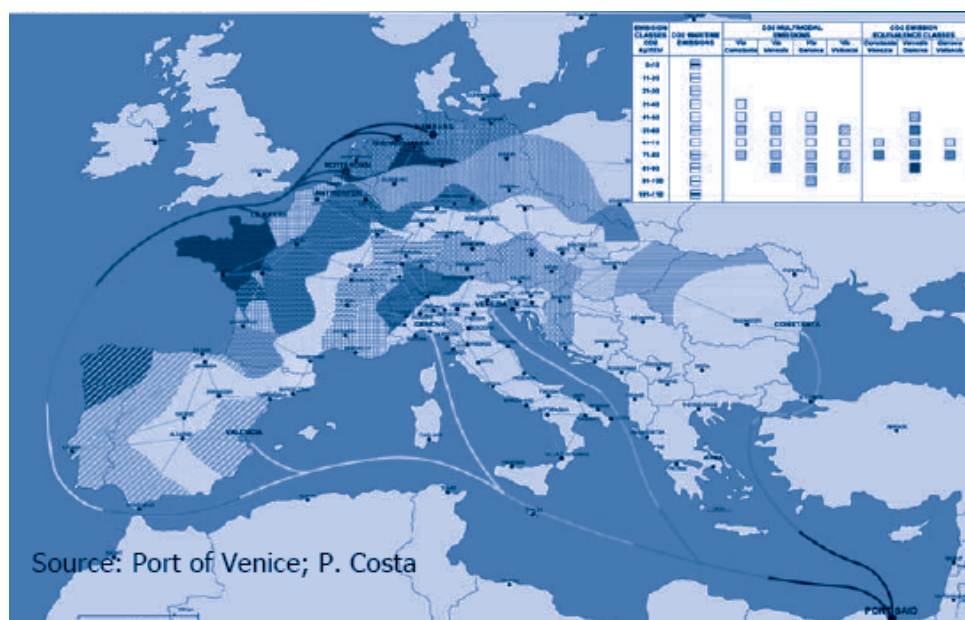


Source: Notteboom, T. (TIMMA – University of Antwerp and Antwerp Maritime Academy) (2008), presented at “Seaport Competition and Hinterland Connections”, Round Table, OECD/ITF.

A number of organisations are discussing the possibility of greater use of Europe’s Mediterranean ports in the future. The rationale for doing so includes the reduced shipping distances involved for the largest transport markets – e.g. to and from south Asia (India) and Asia (China). As well, inland transport distances from the port will be significantly reduced, particularly for activity centres in the more rapidly developing countries in Eastern Europe. With shorter shipping and inland distances, CO₂ emissions would be significantly less and lower congestion and local pollution on routes across Europe would also contribute to the benefits. As an indication, direct services between Port Said, Egypt and Genoa or Venice would save over 3 000 kilometres in shipping distance in each direction. In the case of Vienna, inland transport connections could be in the order of 500 or 700 kilometres less than via the northwest European ports.

The Venice Port Authority prepared Figure 9.2, showing CO₂ emissions patterns if this happened.

Figure 9.2. CO₂ multi-modal equivalence classes emissions (sea and railways) from Port Said to main European destinations



Source: Port of Venice; P. Costa

Bringing about greater use of the Mediterranean ports would entail concerted infrastructure investment decision making among European governments based on careful analyses of future trade and traffic flows, as well as benefit-cost analysis of the infrastructure improvements and operational changes required on the one hand and environmental costs and benefits on the other.

Box 9.1. Prospects for CO₂ reductions

Of course, CO₂ reductions would need to be supported by wider benefits for there to be any realistic prospects of such increases in Mediterranean port shares being realised. Governments would need to see the prospects of greater economic benefits are sufficiently strong to justify any significant infrastructure investments. The private sector would need to see there would be tangible commercial benefits for them to invest in complementary infrastructure and provide or use the improved services the infrastructure would allow. Users would need to satisfy themselves that the origin to destination services will be higher quality, more reliable and lower cost than the other options on offer.

Recent investment decisions outlined earlier suggest there is growing interest in the opportunities:

- **Port of Venice – Offshore Terminal.** The Venice Port Authority’s proposed Offshore Terminal off the coast of Venice (20 metre draft depth) would allow the handling of “at least 10 million TEUs” per annum.

- **Piraeus Port.** Chinese container terminal operators having taken up long-term terminal concessions at Piraeus Port. This may increase the prospects for improved and more direct maritime freight services (particularly container services) between Asia and the Adriatic ports.
- **Croatia, Rijeka Port,** which has awarded a 30-year contract for the management, operations and development of an “Adriatic Gate Container Terminal (AGCT)”, in the Rijeka Gateway Project.

Improved maritime services to the Mediterranean ports (and the Adriatic ports in particular), improved port handling and improved inland connections from these ports could be in prospect. Together they might lead to some rebalancing of traffic between the major northern European ports and the somewhat underutilised southern European ports. Some further assessment of the prospects might be beneficial – and, if appropriate, some further policy co-ordination might be needed to help achieve the best outcomes. Possible wider benefits from a more even balance could include better utilisation of rail freight service capacity, improved security with greater diversity of gateways and supply chain routings, and better regional development opportunities. The European Commission’s recent publication “Road Map to a Single European Transport Area 2050” (2011) has lent some support to the argument: “On the coasts, more efficient entry points into European markets are needed, avoiding unnecessary traffic crossing Europe.”

Greening of aviation

Looking ahead, huge increases in passenger and freight volumes are possible – and can be expected without much doubt at many gateway airports over the period to 2030 and beyond. In a more carbon and CO₂ emissions-constrained future over the period to 2030-2050, it is worth considering the possible impacts on aviation and gateway airports – and the possible actions to reduce their carbon footprints and impacts.

Aircraft and engine manufacturers will have the prime responsibility for the technological innovations necessary to further improve aircraft energy efficiency and move away from reliance on current fossil-based aviation fuels and towards the use of alternative fuels and fuel mixes (e.g. including aviation biofuels).

Airport operators themselves may have some ability in the future to influence the outcomes, e.g. by requirements or restrictions they could place on airlines in relation to the energy efficiency and energy technology of aircraft using their airport (much as the Port Authority is doing from liner and other vessels at Rotterdam now). Airport operators are in charge of overall “airport cities” and may be able to take proactive steps to promote and facilitate the use of alternative fuels for much of the energy needed to run the airport. However, while useful and in line with best practices, the savings in carbon footprints and CO₂ emissions that might be expected from such technological changes would probably not be huge.

The main area in which a gateway airport operator could exert influence and make a real contribution to a “greening of transport” could well be in the choice, use and impacts of ground transport connections.

In relation to air freight, even though air freight volumes could treble by 2030, there are obvious reasons (security, the time-critical nature of the freight) to expect air freight handled by the major gateway airports will continue to be carried mostly by road transport. In this respect, in due course operators may be able to exert some influence on

the energy technologies being used, for example by limiting or excluding vehicles using solely fossil fuels from on-airport operation. This could exert some influence over the type of fuel and engine technology used for all air freight deliveries to, from and on the airport.

The situation is likely to be rather different in relation to air passengers and ground transport connections. Globally, air passenger numbers could double before 2030; air passenger volumes at gateway airports could increase even more. There will be greatly increased volumes of air passengers needing ground transport. At the same time, air freight volumes using the road connections are likely to double or treble. In most cases, road connections to and from airports are much more likely to be overloaded and congested in future – and increasing local traffic will compound the traffic congestion that can be expected.

Improving existing fixed rail services and building new rail connections in time to meet the rapidly increasing air passenger demand for ground connections would help avoid the adverse impacts otherwise expected before 2030. Fixed rail connections would help get passengers off the roads and reduce congestion; could provide safer, lower impact and less stressful travel than being stuck in traffic congestion on the major airport routes; and would allow air passengers using the gateways to reduce their carbon footprints. New and improved rail connections would be one important action that could be taken by authorities and airport operators and, if they move quickly, could be completed in time.

Airport operators will need to contribute to the action required. Land reservations will need to be identified, protected and included in master plans. Terminal facilities will need to be planned, approved and developed, consistent with the ground transport corridors reserved and interchanges that will be needed.

The most environmentally responsible airport operators might be expected to support improved public transport connections and services to the gateway. However, many operators could well face a conflict of interest – because airport revenues are often very dependent on car parking revenues. In the future, as volumes increase, parking charges at close locations could be expected to increase even further and parking revenues could increase even faster. Airport operators are therefore likely to be even more dependent on parking charges in future.

The major question is whether airport operators could be expected to act contrary to their financial interests in parking charge revenues and support authorities and other parties seeking to develop the high-capacity rail services that would be required. Indications to date in several airport locations are that they will not.

Comparison with ports

Many gateway ports are now realising their wider responsibilities and taking an active role in contributing to the improvements in inland connections from the ports to the cities and industrial areas they serve. Best practice case study examples of these active roles include ports:

- mandating the energy efficiency and pollution control standards that shipping vessels and road vehicles will need to meet (e.g. Euro V or VI emission standards by 2016);

- getting actively involved in the improved inland rail, road and waterway connections that are required to improve the productivity, reliability and efficiency of the ports and the inland services;
- putting targets for the use of low-impact modes into lease contracts with port terminal operators;
- investing themselves where necessary in the improvements required within port boundaries (e.g. rail links/connections), as well as outside (such as inland multimodal container terminals).

In this respect, inland transport issues are a major priority for many port authorities, and their managements are often devoting significant time to achieving better outcomes in future.

Taking port authority approaches as a guide, an alternative approach to dealing with expected land transport access to airports would be for the airport operators to use some of their greatly increased parking revenues to take an equity share in the development rail connections and to cross-finance the operations of improved rail connections to their airport, at least during start-up stages. This could be the decisive action required in the development of rail services at large airports with fixed rail links – and could also make a real contribution to meeting the needs of their airport users. Doing so would also mean airport operators taking charge of possibly the most significant contribution that their airport could make to offset its large and increasing carbon footprints and promoting a greening of transport.

Technology innovation

Innovative technologies can make major contributions to important objectives such as reducing CO₂ emissions from operations at gateways and along inland transport corridors, and increasing contributions to green growth.

What needs to be done?

Governments could consider taking action themselves on a range of technology matters important to both operators and users, such as ensuring:

- Their gateways have the facilities needed to handle the large capacity, more fuel-efficient aircraft and liner/container vessels currently being built. This is important, as the latest models have lower unit costs, better engine and frame technology, reduced fuel consumption and reduced emissions.
- Adoption of rail technologies that increase rail reliability and consistent standards and operating practices across national borders. Systems like the European Rail Traffic Management System (ERTMS), for example, eliminate the need for a multiplicity of safety control systems on board. They allow rail operators to provide the more efficient international and cross-border freight services needed to be competitive in longer distance freight markets.
- Authorities are equipped with the latest maritime vessel technologies (e.g. Vessel Management Systems) and the latest road transport ITS information, monitoring and tracking technologies – which can help reduce congestion and emissions by increasing efficiency as well as reliability, productivity, safety and security.

- Authorities give consideration to mandating that vehicles using their gateway facilities comply with certain minimum standards in relation to fuel efficiency, CO₂ emissions and local pollutants. (The Port of Rotterdam, for example, has mandated that port users must meet Euro V and VI emission standards by 2016.)
- Further consideration is given to development of dedicated freight routes to ports – possibly in conjunction with the use on these routes of higher capacity/higher volume road transport vehicles that would allow reduced road freight movements, reduced emissions and lower costs. (Australia’s recent draft National Freight Transport Strategy is canvassing taking both actions; France is also considering action on larger capacity road transport vehicles).
- New GPS and Internet-based passenger cargo and vehicle tracking technologies are employed. These can improve passenger information services, cargo security, connectivity, reliability and productivity.
- Further consideration is given to road-charging technologies that can price the use of roads on a network and location-specific basis, to help manage demand, avoid excessive congestion and improve environmental outcomes. In this respect, the EC’s “White Paper on a Single Transport Area” (2011) notes that: “The long-term goal is to apply user charges to all vehicles and on the whole network to reflect at least the maintenance cost of infrastructures, congestion, air and noise pollution.”

Concluding remarks and priorities

National visions and national infrastructure plans adapted to international settings will help ensure growth, productivity, competitiveness and sustainability. Long-term plans for strategic infrastructure (with consistent policies, co-ordinated developments and connected networks) are essential factors in planning and evaluation assessments and the funding and financing required. Providing for future economic and trade growth and competitiveness are centrally important to such frameworks.

An integrated package of measures is, moreover, needed to get investments in strategic infrastructure back on track in countries whose strategic infrastructure is not rated highly enough.

Strategic planning needs to encompass periods extending at least 20 years into the future and often much more, based on projections of demand that take into account all the key drivers of change. It can often take 20 years to plan and develop the strategic infrastructure required. Evaluations should cover at least 20 years after the infrastructure would be built – meaning a current planning horizon around 2050.

The planning processes for such long periods need to be very good and the evaluations well adapted to the full range of national and local objectives.

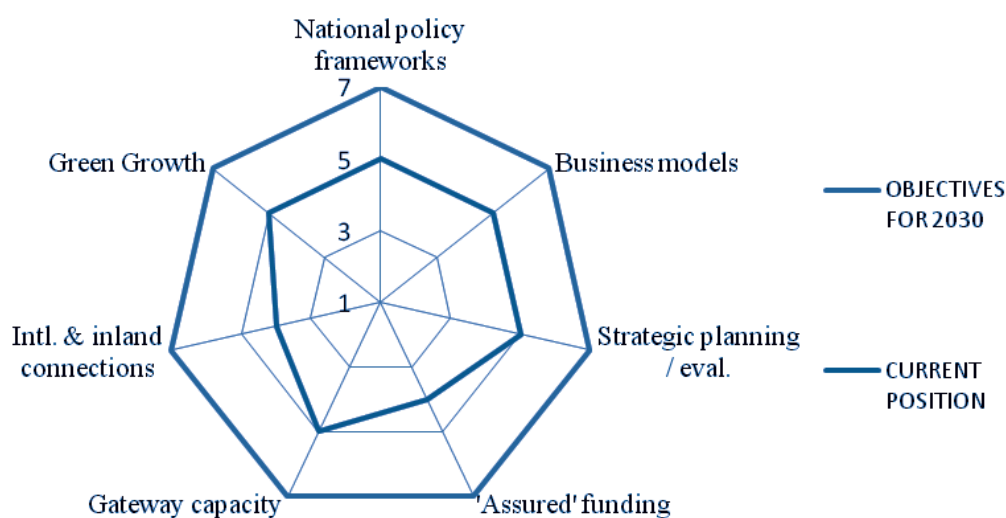
At the same time, priorities are changing. High-quality logistics services are a priority as they improve the competitiveness of a country’s economy and are trade enhancing – especially for exports. Environmental protection and improving sustainability – including a reduction in CO₂ emissions – have become even more important policy objectives. There is increasing support for a greening of transport.

Increasingly, it is being recognised that market-based instruments (MBIs) will need to be at the heart of implementing green growth strategies. However, there is still public resistance to paying energy or carbon taxes. Their necessity and associated benefits, e.g.

in terms of reductions in other taxes, need to be clearly communicated. At the same time, while necessary, MBIs are far from sufficient.

The strategic infrastructure package needs to include improvements across all major factors, encompassing national policy frameworks; more commercial business models; better planning and evaluation; “assured” long-term funding and financing; adequate gateway capacity; efficient international and inland connections; and green growth and a “greening of transport”. Once these improvements are made, along the lines of the objectives for 2030 in Figure 9.3, better strategic infrastructure with clear construction schedules can be expected – and better stakeholder communications can be expected to follow.

Figure 9.3. **Multiple strategic transport objectives – current and 2030 (indicative values only)**



Chapter 10

Improving evaluation processes

Evaluations of strategic infrastructures need to capture the possible infrastructure contributions to the full range of longer term objectives – including growth, productivity, competitiveness, trade, energy efficiency and CO₂ reduction. At the moment there is much room for improvement, which could take the form of longer evaluations, lower discount rates, and recognition of infrastructure's contributions to green growth.

Current evaluation processes

Current evaluation processes are sometimes inadequate or incomplete. They often ignore important objectives, dynamic interactions and the wider effects of infrastructure investment. As well, there can be significant differences between the evaluation processes adopted in different countries and regions.

Important matters sometimes overlooked include: objectives in sectors other than transport (the ability to attract and retain skilled labour, workforce productivity), competitiveness (improving national and urban competitiveness), and international objectives (relating to the benefits of international trade). High infrastructure quality generally makes important contributions in each of these areas.

There is a range of matters that are not handled as well as they should be. These include evaluation time scales that are often too short (undervaluing strategic infrastructure); discount rates that are too high (undervaluing very long-term benefits – e.g. reduced CO₂ emissions); objectives inadequately reflected (e.g. improving reliability, which may be more important than shorter travel times); dynamic benefits (e.g. benefits over time to different sectors resulting from the improved accessibility, competitiveness, etc.); and benefits accruing internationally (important in an international trade system context).

Evaluations that are narrowly focused may well provide reasonable assessments of projects from a transport viewpoint alone – but not provide much sound guidance to decision making from a whole-of-government point of view. In the case of strategic infrastructure, its benefits and impacts can extend well beyond its geographic location and encompass different sectors and far more people than simply the numbers of actual users of the infrastructure.

Clearly, good evaluation should be emphasised in order to improve the guidance provided on the selection of the best projects – and to avoid “bad” projects.

Need for improved evaluation processes

Evaluation processes need to be adapted to longer term objectives (e.g. productivity, competitiveness, trade, energy efficiency/CO₂ reduction, etc.) and to the infrastructure’s useful life. In the future, policy analysts need to focus on a number of important aspects generally being overlooked completely, or to some degree:

- **Longer evaluation periods**, reflecting the project’s useful life. Strategic infrastructure can be expected to make significant contributions to overall objectives over long time frames – e.g. 50 years at least and possibly 100 years or more.
- **Lower discount rates** in economic evaluations of strategic infrastructure. Long-term objectives are centrally important aspects of the need for strategic infrastructure. With longer planning horizons, lower discount rates are needed that value both short- and longer term impacts consistently. They are also crucial to evaluations of environmental policies.

- **Contributions to green growth.** Strategic infrastructure can make significant contributions to green growth objectives – and a “greening of transport”. The contributions it makes – including reduced CO₂ emissions, local pollution, congestion and noise, and increased safety, etc. – of course need to be quantified where possible, and included in economic evaluation assessments.
- **Undertaking benefit-cost analyses from an international perspective** (as well as a domestic perspective) is essential in a trading environment – to capture the benefits of improved international trade and transport services for both domestic and international users.
- **Dynamic and strategic effects – in addition to static effects.** High-quality infrastructure is a key pillar of competitiveness. Trade and logistics (including infrastructure) improvements are highly trade enhancing – especially for exports. Dynamic and strategic effects that need to be included in evaluations cover both trade-enhancing effects and the wider economic benefits of improved infrastructure quality – such as the effects on productivity, attraction and retention of a skilled workforce, etc. Often, the expected dynamic and strategic benefits of gateway and inland transport infrastructure investments will be widely spread, both domestically and internationally. An example follows.

Denmark, Fehmarn Belt link

Economic evaluation of the construction and operation of a cable-stayed bridge across the Fehmarn Belt indicates the link could result in total benefits of approximately EUR 1.9 billion over a 50-year period with a project internal rate of return of around 7%. On the basis of a sensitivity analysis, the results for all countries are found to be relatively robust.

The further analysis undertaken for the Transport Ministry identified additional benefits arising from the dynamic and strategic effects. These relate to more trade (leading to increased competition and lower prices) and business dynamics (leading to increased productivity and lower costs).

Double counting. There has been much debate in a range of settings about whether inclusion of such wider benefits in evaluations of strategic infrastructure might amount to double counting. However, there is now a considerable body of support for the view that benefit-cost evaluation methodologies that are developed at a local project level are not adequate if applied unchanged to strategic infrastructure. Strategic projects in large cities, for example, clearly affect agglomeration benefits – and in fact these are often key factors in the choices actually made and the strategic infrastructure decisions taken – even if they are not taken into account in transport project evaluations. A recent OECD/ITF paper on *Improving the Practice of Cost Benefit Analysis in Transport* (2011) supports this view on agglomeration benefits. The OECD’s *Going for Growth* (2009a) report highlighted that economic infrastructure drives competitiveness and supports economic growth by increasing private and public sector productivity, reducing business costs, diversifying means of production and creating jobs. Assessments that include such benefits are not likely to be double counting the effects of strategic infrastructure. Assessments that do not capture such important effects of transformational projects are likely to systematically underestimate their benefits.

Carbon pricing. Another matter that needs to be resolved is whether pricing of carbon should be built into evaluations. The suggestion made at the Steering Group meeting was to undertake evaluations without and with a carbon price (where appropriate). The assessments with a carbon price could include sensitivity analysis assuming different levels of carbon pricing.

Competitiveness and related impacts

All countries have a wide range of national policy objectives – including objectives for other sectors that also need to be taken into account. International competitiveness is one such objective that may not be taken sufficiently into account in transport evaluations. Some of the rationale for doing so is set out below.

National competitiveness

The World Economic Forum has identified “infrastructure” as the second important “pillar” of global competitiveness among four, second only to “national institutions”. The World Economic Forum’s Global Competitiveness and Infrastructure Quality work has some important messages that need to be reflected in the strategic evaluations undertaken, including:

- the quality and extensiveness of infrastructure networks significantly impact economic growth;
- effective modes of transport for goods, people, and services – such as quality roads, railroads, ports, and air transport – enable entrepreneurs to get their goods and services to market in a secure and timely manner, and facilitate the movement of workers to the most suitable jobs;
- a well-developed transport and communications infrastructure network is a prerequisite for the ability of less-developed communities to connect to core economic activities and basic services.

Urban competitiveness

Strategic infrastructure contributes to international competitiveness but also the competitiveness of urban areas and the industrial regions they serve. There is increasing recognition of the contribution of urban competitiveness to national economic growth and development, the welfare of the population and the quality of life.

There is clear evidence that large urban areas attract increasing shares of wealth, economic activity and skilled workers. Innovation and research is increasingly agglomerated in and around large metropolitan areas. Cities offer a range of advantages for firms, including access to a deep labour pool, superior connectivity and a diverse choice of property and suppliers.

Agglomerations enable firms to “mix and match” their various inputs, access scarce resources and adapt their workforce more easily in response to changing business needs. Proximity is important for creativity and innovation, by facilitating communication and sharing of complex ideas between firms, centres of research and related organisations. Cities offer unique benefits to consumers, with spin-offs for growth through business and domestic tourism and the attraction of talent.

There is vast empirical evidence for these agglomeration effects. Research has found that a doubling of employment density in certain regions in France, Germany, Italy, Spain and the United Kingdom increased labour market productivity by some 4.5%.

Urban competitiveness has become more relevant over recent decades. Trends towards lower-cost transport and communications have continued. Rather than reducing the importance of location assets, they have tended to stress their importance. Increased global trade flows have augmented the position of urban areas as central nodes in global supply chains. (OECD, 2009b)

The OECD's *Territorial Review of Copenhagen, Denmark* (2009b) highlighted the five main determinants of urban competitiveness – including infrastructure – as identified in the academic literature.

The academic literature on urban competitiveness finds basically five main determinants of urban competitiveness: skills, innovation, entrepreneurship, infrastructure and urban amenities....

- availability of skilled people, good innovative capacity and entrepreneurship are essential in increasing labour productivity;
- urban amenities, including infrastructure and environmental quality, help to attract highly skilled people. (OECD, 2009b/ 65, 246)

The following extract from the Port of Rotterdam Report (Box 10.1) provides some insights on the wider contributions to competitive performance – and the need to take account of such factors in assessing infrastructure.

In summary, the “real world” benefits of strategic transport infrastructure vary over time and across economies. They can be expected to add significantly to the “static effects” normally taken into account, such as the travel time and resource savings that accrue directly to users.

Evaluations therefore need to be improved and undertaken in ways that ensure they:

- encompass the full range of benefits and costs that could be expected – i.e. both static effects and the dynamic and strategic benefits over time;
- make assessments across the full range of objectives, not just transport sector objectives;
- assess changes from an international as well as a domestic perspective.

Box 10.1. Port of Rotterdam Report

The Port of Rotterdam has clearly built up a strong competitive position *vis-à-vis* other ports over many years. This has been reinforced by:

- the high frequency of services now underpinning the port's operations;
- the high-quality port and inland terminal facilities that have been developed;
- the relatively high-quality road, rail and inland waterway transport connections;
- good corporate structure and sound governance arrangements;
- well-developed stakeholder relations and extensive consultation with its stakeholders.

The workshop also highlighted that the Port of Rotterdam's competitiveness depends on important additional factors, such as:

- the strength of the industries, commercial activities and operational services (including logistics in particular) co-located with the port, within the City of Rotterdam;
- the focus and successful performance of the local government functions crucial to the port's current operations and future need;
- support from the local community for the port's continuing operations and expansion;
- the Netherlands ports policy and legislative/regulatory frameworks relating to port governance, operations and environmental, safety and security performance;
- European Union policy in respect of port reform and port operations.

All of the above aspects – and particularly the qualitative aspects – take very many years to develop. They cannot be matched easily by a start-up operator or a port that does not perform significantly better on at least some of these essential elements.

Economic versus financial evaluations

Economic evaluation and financial evaluation are both important to project evaluation. They perform rather different functions, which are not always well understood despite the copious literature available.

Economic evaluations are intended to guide government decision making. Economic evaluations focus on the social benefits and costs associated with the project. They aim to take into account all the quantifiable impacts and are generally accompanied by some analysis of matters that are considered to be important but that cannot be quantified. Such evaluations concentrate on real benefits and resource costs excluding taxes, transfer payments and inflation. Future benefits and costs are discounted to present values in real terms, using social benefit cost discount rates. For projects with long lives, residual values of the infrastructure at the end of the planning period are also taken into account.

The levels of the discount rates used originally reflected long-term (low-risk) borrowing rates, e.g. government bond rates. More recently, higher discount rates have been used. Discount rates actually in use in economic evaluations differ across countries, and may differ according to purpose.

Financial evaluations are intended to inform the parties involved (private sector and government) of the financial viability of the project. Financial evaluations focus on the financial transactions involved. They concentrate on incomes and expenditures, cash flows and internal rates of return on capital employed, based on actual and expected incomes and outgoings, at market prices (including taxes).

The Steering Group suggested some further consideration be given to the discount debate in evaluation processes – noting the divergence between the recent trend to use lower discount rates and the trend to higher expectations of returns as signalled by investors. They also suggested further consideration be given to the possibility of differentiated discount rates for environment-related infrastructure.

Discount rates. The history of discount rates used in benefit-cost assessment includes many countries that consider such discount rates should reflect social time preference rates and that decide to use levels similar to long-term government bond rates (e.g. 3-4% per annum). Subsequently, countries generally decided to increase the discount rate they used. Levels between 5% and 8% per annum were not uncommon; some countries used 9% or even 10% per annum. At such levels, they do not reflect social time preference rates. Rather, they operate to some extent as hurdle rates of return, excluding projects from consideration unless they achieve the specified (high) rates of return. One reason for using hurdle rates is that, as the proportion of national GDP devoted to infrastructure fell – and there was insufficient funding for investment to meet future needs – hurdle rates reduced the number of projects that needed to be considered. Higher rates may also have been used in some circumstances to counter “project optimism bias”.

More recently, there has been increasing interest in the longer term outlook, related to growing concerns (e.g. CO₂ increases and climate change). With a longer planning horizon, the use of hurdle rates can have the perverse effect of discounting the benefits or costs incurred 50 or more years hence (e.g. related to CO₂ reductions) to close to zero. In response, there have been proposals to reduce discount rates used in evaluations of environment-related infrastructure over such long periods. The UK *Stern Review* on the Economics of Climate Change, with very long horizons, used discount rates of around 1.4% per annum.

Environmental and other long-term infrastructure. Some countries have since adapted the discount rates used in evaluations of policies and projects with very long-term impacts to better value the long-term benefits (and costs) involved. In the United Kingdom’s case, the Steering Group was advised that: “The UK is continuing to use its regular discount rates for estimating the present value of benefits and costs over the next 30 years – but has decreased the discount rates it uses for periods beyond 30 years.”

Comments. While pragmatic in making changes in discount rates to better account for concerns more than 30 years ahead, the method used clearly distorts the original objective of evaluating all benefits and costs on a consistent basis. A 30-year dividing line seems quite arbitrary and the magnitude and extent of the distortions may not be transparent. In an environmental infrastructure setting, why should the benefits of CO₂ reductions in the next 30 years be discounted to present value at a much higher rate (e.g. 8% per annum) than the benefits of CO₂ reductions beyond 30 years (e.g. 3% per annum)? This would provide artificial incentives to defer some investment expenditures on CO₂ reductions measures to beyond 30 years.

A better approach could be to ensure all future benefits and costs – including in particular long term environmental impacts – are valued appropriately and assessed consistently throughout the project life. The overall result of this more rigorous approach would be an increase in the number of strategic projects with positive assessments. Of course, if this meant more projects than could be funded, that can easily be overcome by applying a hurdle rate to the results – e.g. by deciding to only consider further projects if their estimated present value of benefits is at least 10% greater than the estimated present value of costs.

One of the difficulties in doing so is that evaluations undertaken previously may need to be reviewed. But this may be useful, given the central importance of discount rates to the quality of the evaluations undertaken. Clearly all countries need to keep the discount rates they use for assessing major projects – such as strategic infrastructure investments – under careful and regular review.

Financial returns. At the same time as the discount rates used in government economic evaluations have been trending downwards, there has been a shift in market expectations, with expectations of financial returns – as signalled by investors – trending upwards. Investors now expect – and more actively seek out – higher financial returns than they did in the past.

There are many possible reasons for the expectations of higher returns but one of the most obvious is that globally there has been an extended period of increasing risks and uncertainties. Where there are higher risks, investors generally expect higher rewards. So it would not seem surprising on these grounds alone that higher returns are needed to attract investors. Of course, there are many other possible reasons as well, including the trend that originated in the United States for businesses to give much greater weight to shareholder interests *vis-à-vis* longer term business growth. This promoted a greater focus on companies' share market performance in the short term. The result has been increasing competition over short-term returns.

In summary, there would seem to be good arguments in favour of the use of lower discount rates, probably no higher than long-term bond rates, for government economic evaluations of strategic infrastructure investments. However, there is not yet any consensus on how low the rates should be in evaluations of environmental and climate change policies with impacts 50-100 years ahead. Clearly, national practice on such environmental evaluations should be kept under review.

In a similar way, there would seem to be some rationale based on “risk and reward” for market expectations of higher financial returns, where risks and uncertainties have increased. Time will tell whether the current market focus on short-term returns – displacing to some extent the importance attached to longer-term growth returns – is sustainable or not.

Nevertheless, there is not necessarily any conflict in the diverging trends in expectations. These trends – towards lower discount rates in government economic evaluations and higher investor expectations of higher financial returns – reflect well the different responsibilities and cultures of the parties involved, and their respective interests.

Concluding remarks

Evaluations of strategic infrastructures need to be improved. They need to capture the possible infrastructure contributions to the full range of longer term objectives – including growth, productivity, competitiveness, trade, energy efficiency, CO₂ reduction, safety, security and quality of life, etc.

In summary, the areas in which improvements in evaluation processes are most clearly required include:

- **Longer evaluation periods**, reflecting the project’s useful life. Planning horizons could currently extend to 2050.
- **Lower discount rates** in economic evaluations of strategic infrastructure. Over periods of 30 to 50 years or more, lower discount rates are needed to value both short- and longer term impacts appropriately and consistently.
- **Contributions to green growth.** Strategic infrastructure’s significant contributions to green growth objectives – and a “greening of transport” – also need to be quantified.
- **Undertaking benefit-cost analyses from an international perspective** (as well as a domestic perspective) to capture the benefits of improved international trade and transport services for both domestic and international users.
- **Dynamic and strategic effects – in addition to static effects.** High-quality infrastructure is a key pillar of competitiveness. Dynamic and strategic effects that need to be included in evaluations cover both trade-enhancing effects and the wider economic benefits of improved infrastructure quality – such as on productivity, attraction and retention of a skilled workforce, etc.

Improvements made in these areas should considerably improve the quality of the evaluations undertaken and make a significant contribution to identifying the best projects.

Chapter 11

Developing national policy frameworks

National frameworks in certain countries are relatively well defined and supportive of infrastructure planning, funding and development. Those frameworks are no doubt one of the reasons for the high infrastructure quality evident in most of these countries. But the same does not hold everywhere. One way to provide stakeholders with greater certainty, stability and security with regard to the funding needed would be to establish a National Infrastructure Fund.

National policy frameworks

National frameworks generally flag broad policy objectives and guide policy measures and investments that can respond to national and regional situations and the opportunities available. They set out the more detailed policy, structures and arrangements within which governments and businesses can undertake their planning, make their assessments, and take firm decisions on their investments and operational activities.

The national policy frameworks in use often include content on policy, structures and arrangements related to networks and strategic infrastructure: aviation and maritime networks; national highways and motorways; national rail networks; and inland waterway networks. Within multi-modal approaches, they may focus on the major gateways and hubs that provide the facilities needed for multi-modal transfers of passengers and multi-modal transfers of freight. They may also encompass the key passenger routes and trade corridors that link such gateways and terminal facilities to cities and industrial areas in their hinterlands.

For all these reasons, national policy frameworks provide very important opportunities to communicate with both government and private sector stakeholders, as well as the general public and local communities.

In the case studies undertaken, national policy frameworks underpinned the different major projects that were the principal focus of this project. While not addressed directly, the different country frameworks within which gateway ports and inland connections are being provided seemed to be working reasonably well. In some cases there were indications of the extent to which the frameworks in place were supportive of the projects highlighted at the workshops. Some further insights are provided below.

Yet it should be borne in mind that in many countries there are no overarching national policy documents well adapted to the multiple purposes mentioned above. Few highlight strategic transport networks or provide sufficient clarity about planning and evaluation processes for strategic infrastructure. Most are not designed to attract and retain the interest of stakeholders and the public.

Austria

In Austria, the national policy framework includes government-owned corporations responsible for the funding, development and operation of the national road and rail network. The government retains responsibility for setting location-based charges levied on road transport for its use of the road network. National policy aims to promote a more sustainable balance in transalpine traffic.

Austria has recently published a new infrastructure strategy (BMVIT 2010). It identifies the overall goals for infrastructure policy, which include accessibility, reliability, safety and security, environment and social sustainability, and upgrading of infrastructure networks according to actual needs. Within these overall goals, modal shift is an important long-term issue for transport policy.

As an indication of the effectiveness of its policy framework, Austria has many **strategic** infrastructure projects under way. They include the priority projects being undertaken in accordance with the Trans-European Networks – Transport (TEN-T) priorities.

Belgium

In Belgium, governments and the Parliament review projects of strategic importance and the law includes some special procedures for the larger projects.

The Flemish Port Act was approved in 1999. This act was meant to lay the groundwork for a modern port policy in Flanders. It is founded on six pillars:

1. the granting of greater management and operating autonomy to the local port authorities;
2. the formulation of uniform procedures and conditions for all Flemish seaports;
3. the introduction of more flexibility into the personnel policy for the port authorities;
4. the mandatory acquisition of their own legal status for all port authorities;
5. the unambiguous and transparent relationship between the Flemish authorities and the local port authorities;
6. an objective finance policy for the ports.

In respect of pillar 6, the financing system needs to be objective and treat all Flemish ports in an equal and equitable fashion. The financing regime in the Port Act is aimed at dovetailing with the European developments regarding port financing and state support: on the one hand, it places far-reaching responsibilities upon the port administrations for the construction of commercially exploitable infrastructures; on the other, it makes the Flemish Region financially responsible for safeguarding the general maritime accessibility and for the construction and preservation of the basic infrastructure. The implementation decisions relating to the financing of the ports have been submitted to the European Commission.

Denmark

In Denmark, following political reforms in 2007, the national government took over responsibility for the principal road network, i.e. European highways and the majority of the primary routes. The Danish Government is therefore now responsible for major land transport infrastructure throughout the country.

The national policy framework was clarified in January 2009, with the political Agreement on “A Green Transport Policy”, which covers investments in land transport. The agreement includes a set of principles that shape strategic policy directions over the period to 2020. In the context of the Agreement on Green Transport Policy, the government and other parties to the agreement decided on a fully funded listing of major land transport infrastructure projects in Denmark over the period to 2020, including improved connections to ports and airports.

Denmark’s funding arrangements are high profile and stable. The Infrastructure Fund and two special funds for major projects are well resourced.

France: Gateways and trade corridors

France has undertaken substantial port reforms in accordance with national reform legislation. The Ports Act 2008 sets out the objectives, the port structures, the requirements (including requirements for strategic planning), and other governance matters. The autonomous ports have adopted landlord port models and have prepared strategic plans, as required. Rail freight reforms have been made as well, which include opportunities for local rail operators. The French Government has provided significant funding for rail freight improvement. Policies in support of improved inland waterways services have also been announced.

The Netherlands: Port gateways and trade corridors

In the Netherlands, the national ports policy framework is encouraging efficient operation of international gateway ports and their inland connections. Under the Netherlands' arrangements, long-term planning is required by law. Reference is made to **strategic** infrastructure.

The Rotterdam Port Authority operates on a landlord port model and has a corporation structure that allows adequate funding for the authority's port infrastructure. Planning arrangements are working well. There appear to be good communications with stakeholders across the range of the port's activities.

Switzerland

In Switzerland, the national policy framework is supported by the federal Constitution (with provisions relating to transit traffic through the Alps) and legislation (e.g. relating to the Special Financing of Road Transport and the Major Rail Projects Fund). Policy seeks to promote rail transport and reduce the volume of transalpine road transport crossings by the time strategic rail infrastructure improvements are complete around 2020.

In **Sweden** and **Finland**, there are very clear government responsibilities for the planning and provision of strategic infrastructure. Finland has published its "Transport Policy Guidelines and Transport Network Investment and Financing Programme until 2020". Improvements are being made to cross-border connections. Some strategic consideration is being given to possible transcontinental and international connections and policy frameworks adapted to these possible developments in the longer term.

In **Turkey**, national frameworks are focusing on ambitious growth plans and achieving the best delivery methods for some very important strategic projects, including gateway ports, transcontinental rail and transcontinental gas pipelines.

In summary, the national frameworks in these countries were relatively well defined and supportive of infrastructure planning, funding and development. These frameworks are no doubt one of the reasons for the high infrastructure quality evident in most of the countries.

Nevertheless, there seemed to be aspects of these policy frameworks that could need to be improved.

Passenger and freight growth will be substantial and concentrated at international gateways and along their inland connections. Major infrastructure development is going to be required in many locations. Considerable investment funds will need to be amassed

and applied to the improvements required. High performance will need to be maintained while the new infrastructure is put in place.

At the same time, it will be important to secure and retain the involvement of key stakeholders and to work together to ensure good co-ordination of all the actions required. Many stakeholders will need to be involved. Many local authorities and communities will be affected during the development periods. As well, when finished, these communities could be adversely affected by the activity and inland traffic.

High-quality communications will be needed to generate the higher public profile required and reinforce that, while international gateways and inland connections are important now, they will become even more important in future. In this context, the greater the security of funding and the better the quality of the communications, the more stakeholders are likely to listen and take the time to get involved.

Looking to the future, while many frameworks may be working well, there would seem to be increasing needs and opportunities for them to work even better. Possible improvements are explored below.

Improving frameworks for funding and communications

Looking across the OECD member countries, one national policy framework relating to gateways and inland connections seems to stand out from other good frameworks.

Canada spent many years developing a policy framework focused specifically on gateways and their inland connections. The outcome is a well-researched and high-profile framework that seems to be clearer and better communicated than many others. Canada's National Policy Framework for Strategic Gateways and Trade Corridors builds on the direction launched in October 2006, with Canada's Asia-Pacific Gateway and Corridor Initiative.

The framework guides investment and policy measures that respond to unique geographic, trade and transport opportunities in key regions, and that enhance infrastructure at key locations, such as major border crossings and, on the east coast, the Atlantic gateway.

The framework encourages an emphasis on the transport system, within a multi-modal approach, rather than any particular mode or element, to maximise the contribution of the country's transport to global supply chains.

When announcing the new National Policy Framework, the message from the Canadian Minister for Transport, Infrastructure and Communities said:

Canada is a successful trading nation. Our economic growth and standard of living depend on the export and import of products and resources as part of global supply chains. Transportation systems that enable us to move goods and people with world-class efficiency are therefore essential to our future prosperity.

That is why we are moving forward decisively with our gateway and corridor approach. It's a new policy direction, more aligned with the way business operates in today's global economy. It promotes coherent planning among governments and partnerships between public and private sectors.

The National Policy Framework for Strategic Gateways and Trade Corridors is intended to help guide federal investment decisions. In conjunction with its new policy framework, Canada established a new Infrastructure Fund to ensure there is greater certainty, stability and security of the funding needed.

Building Canada, the federal government's long-term infrastructure plan, included a national Gateways and Border Crossings Fund, first established with CAD 2.1 billion available over seven years. The Building Canada Fund is intended to advance multi-modal and technology initiatives that will improve system integration. Funding is to be awarded on a merit basis, which will help ensure the best outcomes.

The framework document explains one of the rationales for the new approach as follows:

Market-oriented federal transport policies of the last 25 years contributed to productivity gains in the sector that far outstripped those in the economy overall. Over the period 1991-2003, productivity in the transport sector increased 35% versus 23% in the overall business sector. However, these gains have tailed off in recent years. While the policies (commercialisation, privatisation and deregulation of transport infrastructure and services) were mode-specific, the next generation of productivity gains will require a considerably greater degree of integration across the elements of the national transport system. (Transport Canada, 2007, p. 2)

The Canadian National Framework is presented in a document devoted to Strategic Gateways and Trade Corridors. It is well articulated and can be readily communicated. The ideas and language would seem to be well suited to use in different settings. Overall, the Canadian Framework seems to provide a useful example of “good practice” in this field.

Improving strategic infrastructure

Improving strategic infrastructure presents other significant challenges that are more likely to be overcome with high-quality and supportive policy frameworks and high-quality approaches.

Planning requires a careful exploration of the current situation and the outlook over the planning horizon. It depends on extensive consultations, providing the many key stakeholders with opportunities to put forward their views on possible strategies and developments, as well as actions and priorities. The strategic work involved needs to be led by an organisation or unit dedicated to the task. It also needs the degree of credibility and certainty that comes only with some assurance of adequate funding. Experience suggests that only adequate funding and some security of that funding will provide the evidence that most stakeholders will need to devote the time and resources required to get involved and stay involved.

The planning and prioritising of the improvements required is demanding work. It calls for detailed analysis – including evaluations with benefit-cost assessments that take in all the major policy objectives across the sectors affected and use the best analytical approaches. It may take years – often ten years and sometimes more – before the strategic improvements required have passed all the planning hurdles, including environmental impact statements, etc., and have been approved and are ready to be funded. When the work begins, developing the infrastructure will take years and will require multi-year or rolling programme funding.

Of course, such periods are too long and need to be shortened. But are there any ways in which the levels of certainty about useful outcomes can be increased? It seems clear that a National Infrastructure Fund could help.

A National Fund including strategic gateways and trade corridor infrastructure

A National Infrastructure Fund with a “strategic infrastructure” category that includes gateways and inland connections could prove a useful way to create greater certainty for all the stakeholders involved.

Establishing a National Fund with a strategic gateways and trade corridor category would focus planning on the strategic challenges ahead. It would be likely to ensure the government remains focused on and actively contributes to achieving the best outcomes, which is a good start. A National Fund would be likely to attract the private sector’s attention and increase stakeholder involvement and “buy-in”, by giving key stakeholders the incentives they might need to become involved.

Good strategic planning and a greater degree of confidence about funding would help highlight the real priorities and help deliver the secure funding needed to undertake the nationally important projects.

Possible political approach

The approach Denmark adopted to its 2009 Agreement on Green Transport Policy provides another useful example of how new policy directions and secure multi-year funding for infrastructure development could be achieved in democratic, market-based economies. The key steps taken included the government:

- establishing a general transport Infrastructure Fund and two special funds for its largest projects;
- developing and proposing a Green Transport Policy with clear policy principles;
- negotiating with other parliamentary parties and securing the “Agreement on Green Transport Policy”;
- with agreement on policy directions and secure Infrastructure Funds, proposing and seeking agreement to fully fund “decided projects”, including key strategic infrastructure, over the period to 2020.

Denmark’s multi-party parliamentary approach was key to securing the political agreement needed for both new policy directions and fully funding a complete programme of priority infrastructure projects.

Concluding remarks

Strategic gateway and trade corridor infrastructure – whether provided by governments or the private sector – is important for trade, business productivity and competitiveness.

Some countries highlight the importance of their major gateway ports and airports in their national policy frameworks and support the planning and development of the port infrastructure required. However, this is certainly not always the case. As well, most countries do not assign the same priority to the key inland rail, road and waterway

connections required to move freight between the gateways and the cities and industrial areas in the hinterlands that they serve.

Creating a “strategic infrastructure” category within national infrastructure frameworks could help improve the focus on national “core networks” that make the greatest contributions and have to be funded. It would also improve the focus on strategic infrastructure at major gateways and along key inland trade and transport corridors that will be crucial parts of these core networks. Formal recognition in this way would provide greater scope to reserve the land required for future expansion of the gateways and to prevent encroachment on the key inland transport corridors and connections required to meet future needs.

In the future, funding for inland transport connections needs to be linked in some way with funding for gateway development and expansion of capacity – and its priority established in the context of other strategic infrastructure centrally important to national and regional competitiveness, productivity, employment, green growth, quality of life and a sustainable environment.

A **“virtuous process” is needed** – encompassing national policy frameworks, more commercial business models, green growth, “assured” long-term funding and financing, and better stakeholder communications.

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Annex A

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Annex B

Airport infrastructure needs to 2030: Background to global estimates

The project's assessments focused on current airport capital expenditures, current and future passenger and freight levels, and the relationships between them. Details are set out in the following sections.

Current air passengers and future traffic projections

Industry estimates of actual terminal passengers in 2007 and 2008, and forecasts of domestic, international and total terminal passengers (including transit) in 2017 and 2027 are set out in Table B.1.

Table B.1. **Terminal air passenger forecasts, 2007-2027 (millions)**

	Total air passengers 2007	Total air passengers 2008	Total air passengers 2017	Domestic air passengers 2027	International air passengers 2027	Total air passengers 2027	Growth air passengers (%) 2007-2027
Africa	138	146	245	135	261	401	295
Asia/Pacific	1 150	1 200	2 193	2 629	1 272	3 916	340
Europe	1 472	1 517	2 143	659	2 200	2 868	195
Latin America/ Caribbean	328	339	539	583	273	869	265
Middle East	158	167	264	67	315	387	245
North America	1 552	1 539	1 935	2 127	404	2 536	163
World	4 798	4 907	7 320	6 200	4 725	10 976	229

Note: Estimates of total air passengers include scheduled and non-scheduled flights and include transit passengers.

Source: ACI (2009), *Global Traffic Forecast 2009*, ACI, Geneva.

Industry airport capital expenditure (CAPEX) estimates

Estimates of airport capital expenditure in 2007, 2008, 2009 and 2010 were published in ACI *Airport Economics Surveys* 2008 and 2010. The ACI reports make a number of qualifications and note some important limitations to these industry estimates, including the following.

Table B.2. Airport capital expenditure (Capex) by region¹

USD millions					
Region	2007	2008	2009	2010	2011
Africa/Middle East	6 000	7 500	3 000	1 800	2 200
Asia – Pacific ²	8 500	11 500	5 800	6 900	6 500
Europe	14 000	17 500	12 800	12 500	11 800
Latin America/Caribbean	1 600	2 600	1 800	3 500	3 800
North America	10 000	11 800	11 200	13 800	10 800
Total	40 100	50 400	34 600	38 500	35 100

Notes: 1. ACI's estimates include **only upgrades or expansions** of **existing** airport infrastructure. 2. ACI's Asia/Pacific region 2007 and 2008 estimates excluded all CAPEX investments in China. ACI's 2010 report advises its 2009, 2010 and 2011 data include two airports in mainland China.

Source: ACI (2008), *Airport Economics Survey 2008 for 2007*, ACI, Geneva; and ACI (2010), *ACI Survey 2010 for 2009*, ACI, Geneva.

In its reports, ACI defines airport capital expenditure as follows: “CAPEX: A capitalised expense for a newly purchased capital asset or an investment that improves the useful life of an existing capital asset. New/greenfield airports are not included.”

The survey response rates for the ACI Survey 2010 varied by region. Responses in most regions accounted for airports handling over 50% of the terminal passengers in the region. For the Africa region, the responses encompassed 36% of the region's total passengers. For the Middle East, the survey response was a statistically invalid sample. For this reason, **Middle East airports are not included** in the ACI Survey Report 2010. Overall responses encompassed airports handling around 68% of global passengers.

In its 2008 Survey, ACI advised that airport investment in China was expected to rise to USD 30 billion in 2009, but that it was unclear which proportion will be invested in existing airports. For this reason, ACI excluded China's airport CAPEX in 2009 from its CAPEX estimates (shown in Table B.2). ACI's 2010 survey results included data from only two airports in China.

Globally, the ACI 2008 Report anticipated a total CAPEX in 2009 of USD 50.2 billion. ACI's 2010 Report revised the 2009 CAPEX to USD 34.6 billion. Reflecting the impacts of the recession, the revised level in 2009 and the levels expected in 2010 and 2011 are all well below previous trend levels of around USD 50 billion per annum.

Nevertheless, overall airport capital expenditures would be considerably more if all current investments in airport upgrading and expansions in China and the Middle East were included – and would be higher again if all expenditures in all countries on new airports in greenfield sites were also included. These aspects are considered in more detail in following sections.

Relationship between air passenger movements and ACI CAPEX

The global levels of passengers and ACI's (narrow) estimates of airport capital expenditures set out in Tables B.1 and B.2 provide insights on airport infrastructure expenditure per global terminal air passenger. Trend levels during the pre-recession

period of rapid air traffic growth were around USD 10 per passenger. Post recession levels in 2009, 2010 and 2011 are closer to USD 8 per passenger.

From the limited data available, it appears that the ratio of current capital expenditure to future passenger levels is more stable. ACI data suggest that current global CAPEX forecast per passenger two to five years ahead is around USD 6.50.

Of course, all these unit costs per passenger figures exclude capital expenditures actually made but not encompassed in ACI estimates, e.g. in the Middle East, China, and on greenfield sites.

Currently planned major airport investments

The ACI Airports Economics Survey 2010 identified an indicative list of planned major airport investments that had been signalled in different countries. This listing includes both upgrades and extensions of existing airports and possible investments in new airports on greenfield sites.

For each of the regions, Table B.3 summarises the ACI listing of major planned investments in upgrading/extensions to existing airports and in new airports in greenfield locations in the region.

Table B.3. **Planned airports investments – including major upgrades/extensions at existing airports and possible major greenfield site investments**

USD billions

	Planned major investments existing airports	Possible greenfield airports (number by region)	Indicative expenditure for greenfield sites	Total planned investments existing and greenfield A/Ps
Africa	4	5	4	8
Asia/Pacific	74	11	61 (including A/P Tokyo Bay – 35 billion).	135
Europe	79	5	12	91
Latin America	7	2	2	9
Middle East	42	6	20	62
North America	128	–	–	128
Total	335	29	100	435

Source: ACI (2010), *Airport Economics Survey 2010*, ACI, Geneva.

Some of these investments are currently under way. Many of the planned investments do not have firm starting dates. A few investments were started but postponed due to the recent financial crisis. Some will most likely be started if post-recovery trends are in line with current global projections for air passengers (i.e. a doubling of air passengers in 15 years) and air freight (i.e. a tripling of air freight within 20 years). The major expenditures involved would most likely be undertaken over a period of 10-15 years after the project begins.

It is important to note that the ACI listing of planned expenditures is not exhaustive by any means. As an example, it only lists one major planned airport development in China – which is for a new airport Kunming International, Yunan, southwest China. It does not list any expenditures on upgrades or extensions of any airports in China. As

well, there will be many smaller investments at the hundreds of other airports not included in the ACI listing of planned major projects.

China's airport expenditures

China's GDP could increase three to four times over the next 20 years. Boeing's *World Air Cargo Forecast 2010-2011* highlighted the Chinese State Council announcement in 2008 of its National Airport Allocation Plan, which is aimed at ensuring that:

- 82% of the country's massive population lives within 100 kilometres of an airport by 2020 (up from 61% at present);
- 96% of GDP can be accessed via air services by 2020, up from just 61% at present.

To achieve this goal, the report advises another 52 new airports will be developed by 2020, following the 45 new airports to be completed by 2010 that brought the total number in China to 177. This programme would require a total investment of USD 67.1 billion through 2020, of which USD 20.9 billion had been allocated by 2010. Of the 97 totally new airports, 50 will be developed in the northern and north-western regions, including the second Beijing Airport.

Clearly, there are extraordinarily high current levels of airport expenditure in China – and expected future expenditure remains uncertain, with plans being revised as circumstances change. The safest course of action seems to be to rely on announced programmes and make revisions if necessary in the light of actual expenditure levels reported after the event. Official announcements on planned investments in new airports over the period to 2020 indicate China's greenfield airport investments could amount to around USD 7 billion per annum over the next decade.

For the period 2020-2030 and beyond, China's GDP growth rate (possibly around 4% per annum) can be expected to be lower than current levels (which are around 9% per annum). However, the lower growth rates will apply to an expanding base. As a result, air passenger and freight volumes and capacity requirements can be expected to continue to grow quickly. It seems very likely that China's annual expenditures on greenfield airports between 2020 and 2030 could be lower than over the period to 2020. However, its investments in upgrading and expansion of existing airports could be expected to increase, given that these airports will handle most of the passenger and freight growth. Overall, annual airport investments might continue at levels not so different from current levels.

Airport investments elsewhere

Over the next 10 to 20 years many other large developing countries – including Brazil, India and the Russian Federation – will continue to grow and expand. Other countries in developing regions (e.g. in Asia, the Middle East, Africa and Latin America) can be expected to continue to grow, too.

No comprehensive listing is available of expected investments in upgrades and expansions of existing airports **and** development of greenfield airports in all these countries – but they are likely to be substantial. From 2020 to 2030 and beyond, for

example, India's likely economic growth can be expected to follow a similar path to China's, with a 20-year time lag – and can be expected to lead to rapid increases in air traffic demand and investment needs.

Taking all the above factors into account, the project's estimates of likely airport investments on greenfield sites in China and the other major developing countries combined are USD 10-20 billion per annum over the period to 2030. These amounts have been included in the forecast airport capital expenditures in Table B.2. The foregoing discussion suggests these estimates may well be quite conservative.

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Annex C

Port infrastructure needs to 2030: Background to global estimates

Container port handling – Market activity to 2015

Drewry Shipping Consultants made global estimates of container port handling in their *Container Market Report 2009-10* (October 2009). Table C.1 summarises projections to 2014.

Table C.1. Port container handling – projections to 2014

Thousands TEUs of port handling, including empties and transshipment

	2007	2008	2009	2010	2011	2012	2013	2014
North America	47 885	45 888	40 243	41 377	43 232	44 940	46 706	48 539
West Europe	91 058	91 788	79 855	80 871	84 998	89 095	93 240	97 429
North Europe	55 740	56 372	49 132	50 037	52 725	55 400	58 051	60 669
South Europe	35 318	35 416	30 723	30 833	32 273	33 695	35 188	36 760
Far East	180 307	193 870	177 204	184 689	199 648	216 814	235 965	255 789
South-East Asia	67 377	71 127	62 999	64 068	67 580	71 656	76 127	80 592
Middle East	28 382	31 715	29 517	30 425	32 466	34 812	37 314	39 981
Latin America	35 253	37 422	33 503	34 030	35 549	37 414	39 374	41 434
Caribbean/ Central America	18 147	18 971	16 905	17 079	17 693	18 328	18 988	19 674
South America	17 106	18 451	16 598	16 951	17 856	19 086	20 385	21 759
Oceania	8 643	9 406	8 774	8 952	9 393	9 848	10 291	10 739
South Asia	13 554	14 723	13 477	14 057	15 234	16 597	18 166	19 871
Africa	17 897	20 643	19 346	19 764	20 785	21 971	23 296	24 686
Eastern Europe	7 206	7 987	5 718	5 176	5 503	6 010	6 572	7 204
World	497 563	524 567	470 634	483 409	514 388	549 156	587 054	626 263

Note: The Drewry projections include “**empties and trans-shipment**”. These add significantly to the total port handling requirements but mean their port handling estimates do not need any further adjustment.

Source: Drewry Shipping Consultants (2009), *Container Market Report 2009-10*, Drewry Shipping Consultants, London, October.

Drewry’s projections for 2009 global container activity were close to actual volumes. UNCTAD’s *Review of Maritime Transport 2010* reported that world container throughput declined by an estimated 9.7% to 465 million TEUs in 2009. In 2010, the global container market recovered more quickly than expected.

Drewry advised in October 2010 that it expected the container shipping market would grow by about 7% annually in the next five years, as stability returns to the industry. A TEU estimate for 2010 of 500 M TEUs and 7% per annum growth rate to 2015 leads to the following container handling projections.

Table C.2. **World container port handling projections to 2015 (millions TEUs per annum)**

2010	2011	2012	2013	2014	2015
500	535	572	613	655	701

Source: Project estimates: port handling, including empties and trans-shipment based on Drewry projections.

UNCTAD Review of Maritime Transport 2010

UNCTAD's *Review of Maritime Transport 2010* advises that since 1990 there has been more than a fivefold increase in containerised cargo. Developing countries have contributed an increasing share. The figures available on world container port traffic in 2008 show that the container throughput growth rate for developing economies was 8.2% per annum. With a throughput of 347.2 million TEUs in 2008, **developing countries accounted for approximately 68% of total world throughput**, up from around 66% the previous year. Asia's share in world port container throughput increased from around 49% in 2000 to around 57% of the increased volumes in 2008. The growth in Asian port container handling is reflected in Table C.3 which lists the world's ten busiest container ports.

Table C.3. **World's ten busiest container ports**

World ranking		Port name	Country	Trade region	Total TEUs in 2009
2009	2008				
1	1	Singapore	Singapore	South-East Asia	25 866 400
2	2	Shanghai	China	East Asia	25 002 000
3	3	Hong Kong	Hong Kong, China	East Asia	20 983 000
4	4	Shenzhen	China	East Asia	18 250 100
5	5	Busan	Korea	East Asia	11 954 861
6	8	Guangzhou	China	East Asia	11 190 000
7	6	Dubai	United Arab Emirates	West Asia	11 124 082
8	7	Ningbo	China	East Asia	10 502 800
9	10	Qingdao	China	East Asia	10 260 000
10	9	Rotterdam	Netherlands	Europe	9 743 290

Source: UNCTAD (2010), *Review of Maritime Transport 2010*, United Nations, Geneva.

Container handling projections to 2015/2030/2050

UNESCAP Container Traffic Forecast 2005-2015

The UNESCAP Regional Shipping and Port Development Report's Container Traffic Forecast 2007 – prepared before the 2008/9 crisis and recession – anticipated that the

level of containers in 2015 would be 795 million TEUs. This implied an average growth rate over the period from 2005-2015 of 7.9% per annum.

International Maritime Organization (IMO) Study: GHG Emissions from Ships to 2050

The IMO's *Updated 2000 Study on GHG Emissions from Ships* (IMO, 2008), September 2008 (also prepared before the recession) carried out some extensive “long-term modelling of maritime demand and shipping services”. The IMO study focused on both of the two modelling approaches often taken – one based primarily on **historical relationships with GDP**; and the other **utilising scenarios** to quantify a range of possible demand for maritime services – in terms of container shipping tonne-miles.

The GDP-related methodology produced growth estimates (particularly for container shipping) that were very high – with global container shipping levels (in tonne-miles) in 2050 expected to increase between 7 and 12 times 2007 levels. The IMO noted:

During the past 20 years, container transport has grown nearly 10% annually. This trend cannot be assumed to continue to 2050 since container transport would then in itself exceed the projected tonne-mile levels for world seaborne trade. Instead it is assumed that the average growth of containerised transport is 2% points higher than other cargo types. This results in 55% of the global tonne-miles (in 2050) being containers as opposed to 24% in 2007. (IMO, 2008)

The IMO's second approach involved consideration of scenarios. The IMO made reference to the OPRF in Japan (a Japanese research body), which was undertaking a major study where transport demand in tonne-miles was projected to 2050 based on the International Panel of Climate Change's scenario variations. Its A1B Scenario assumed world GDP would grow at 3.9% per annum over the period from 2000 to 2050. The OPRF found that, under the A1B Scenario, **container shipping by 2050 would grow to 5.7 times container shipping levels in 2007**. Under other scenario variants (A1F, A1T, A2, B1, B2, which assumed economic growth ranging from 4% to 2.4% per annum over the period to 2050), **container shipping in 2050 would be between 5.7 and 3.6 times levels in 2007**.

IMO acknowledged the uncertainties with each of the above-mentioned approaches and eventually settled on projections that averaged the high GDP-related growth estimates and the lower growth from the scenarios work. The IMO 2008 Study's final projections of **container shipping levels in 2050 were from five to nine times container shipping levels 2007** – with the A1B scenario level being the highest of these, i.e. nine times the 2007 level. Intermediate results (e.g. 2020, 2030) could be interpolated from these projections. On this basis, the 2020 level was anticipated to be over 50% higher than 2007 levels.

Project assessments

The project focused on a number of factors that are centrally important to container market/port handling projections but that are subject to considerable future uncertainties. “Upside” factors include:

- The high “elasticities” between TEU volumes and GDP growth that have underpinned the rapid global and regional container growth in recent decades, and particularly from 2000 to 2007. These long-standing trends suggest there will be a strong recovery in container growth as the recession passes and more normal economic growth resumes.
- The relatively low level of container penetration in freight markets in quite a number of countries and the prospects of greater container penetration in many of these markets. Increasing container shares in India and some of other large developing countries – as well as in some regions with low containerisation (e.g. South-East Asia) – could suggest higher than average container growth in the future in these regions than if based solely on GDP factors.

“Downside” factors include:

- The possibility that, in developed countries at first, the relationship between economic growth and growth in container demand could weaken somewhat over time. As GDP and incomes increase, demand could begin to approach saturation levels in some developed economies – leading to a moderation of demand and a “maturing” of container markets.
- The prospects of increasing demand being constrained by a lack of infrastructure capacity in crucial markets. Limitations on infrastructure capacity – with the greater congestion, delays, unreliability and costs that follow – might to some extent limit container demand itself.

The project adopted the GDP projections to 2030 and beyond, provided by IEA *World Energy Outlook* and *Energy Technology Perspectives* reports as the basis for its assessments of future container volumes.

Port container handling: Scenario projections

Port container handling projections on a global scale can be expected to be linked to global GDP growth. IEA projections anticipate global GDP will increase by around 4.4% per annum over the period from 201-2015, and by around 2.9% per annum over the period from 2020-2030. Over the period from 2008-2035, average annual global GDP growth is currently expected to be 3.2% per annum – which is somewhat lower than the 3.9% per annum assumed in the 2008 IMO Study of *GHG Emissions from Shipping* referenced in the previous section.

Over the past two decades, while GDP growth has been around 3-4% per annum, port handling of containers has increased on average between 8-10% per annum. The higher rate of TEU growth is generally well replicated by models along the following lines:

$$\text{Change TEU/TEU} = k * \text{change GDP/GDP},$$

with k a growth factor for the faster rate of TEU growth

Drewry’s analysis indicated global TEU growth factors have been increasing on average by 5.6% per annum above GDP increases. Drewry saw this as clear confirmation of the multiple from economic activity to merchandise trade and of the increasing share of global output that is entering world trade.

In relation to the period to 2030 and beyond, the project’s assessment is that, despite the long history of high TEU growth based on constant TEU/GDP growth rates, it would be unrealistic to assume constant growth factors would continue to apply unchanged in the future over a 20- to 40-year period. Many studies have reached similar conclusions and TEU growth factors relative to GDP are generally expected to reduce over time. As well, over long future time horizons, the regional contributions to overall projections will change, reflecting differing growth rates between developed and developed countries and differing levels of container penetration in regional TEU activity.

The project team’s assessments used as a starting point the Regional Container Activity & Economic Wealth factors – in TEUs per USD billion of GDP (in constant values) – that underpinned Drewry’s 2009 container growth projections to 2014. Although it seemed clear there would be a divergence from past trends, there are obviously considerable uncertainties over when and how this will happen. The project developed lower, medium and higher TEU growth scenarios to explore some different possibilities. In doing so, the project adopted what may be regarded as conservative factors linking GDP with future TEU growth, under the lower, medium and higher growth scenarios – generally below their trend levels to date.

The project’s assessments of port container handling (including trans-shipment) projections are as follows.

Table C.4. **World port container handling (including trans-shipment)**

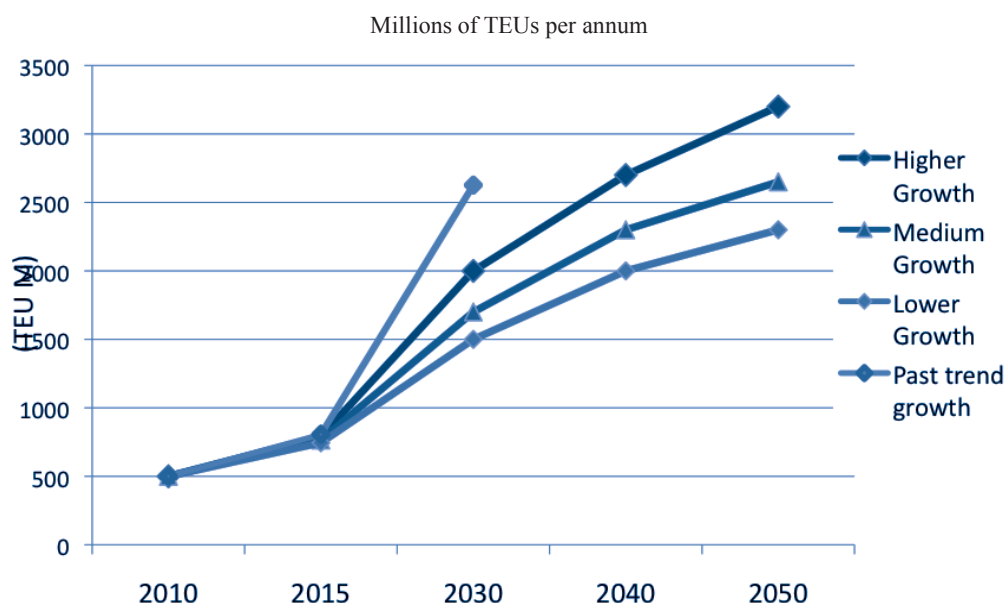
Millions of TEUs per annum				
TEU growth scenario	2010	2015	2030	2050
Higher TEU growth	500	790	2 000	3 200
Medium TEU growth	500	765	1 700	2 650
Lower growth	500	745	1 500	2 300

Source: Project estimates, taking into account Drewry Shipping Consultants projections to 2014.

These assessments of possible lower, medium and higher growth scenarios are illustrated in Figure C.1. The figure also shows a continuation of past trend growth to 2030 – but not beyond this point, because the 2040 and 2050 data points would be off this graph.

In the Lower TEU Growth Scenario, robust global demand is evident during the period of recovery from the recession, but with average TEU growth factors somewhat lower than recent trend levels. With growth factors continuing at these levels over the period to 2030 and global GDP reducing to around 2.9% per annum from 2020, TEU handling in 2030 would be over 3.5 times 2009 levels. From 2030 to 2050, global levels of TEUs would continue to grow steadily, the lower rates of TEU growth relative to GDP, reflecting a maturing of growth in TEU handling in some markets (e.g. in the most developed countries). From 2040 to 2050, growth factors could reduce to around zero with respect to GDP growth, or even be slightly negative. The outcome would be TEU levels in 2050 over 4.5 times levels in 2009.

Figure C.1. World port container handling: Higher, medium, lower TEU growth scenarios



Under the medium TEU growth scenario, with TEU growth factors more than half historic levels, world port container handling would increase by around 50% from 2009 to 2015. Port container handling in 2030 would be around four times 2009 levels. With lower growth factors beyond 2030, port container handling in 2050 would still be over five times 2009 levels.

Under the higher TEU growth scenario, global container markets would not show signs of “maturing” as early as assumed in the other scenarios. However, there would be a slowing of the high-growth GDP growth rates in developing countries, modest GDP growth rates in developed countries, and some reductions in TEU growth factors with respect to GDP. The outcome would be worldwide container handling much higher than the medium growth scenario. The outlook under this scenario would include:

- port container handling in 2030 of around 2 billion TEUs – around four times 2009 levels – with the overwhelming share of overall growth occurring in developing countries;
- port container handling in 2050 reaching over six times levels in 2009.

Unlike the above scenarios, which all anticipate a reduction in TEU growth factors with respect to GDP, the “past growth trend” projection shows that a continuation of recent trend TEU growth rates relative to GDP would lead to a fivefold increase in port container handling by 2030. If the exponential growth rates were continued, port container levels in 2050 would be 12 times higher than in 2009.

While recognising the long period of rapid growth to date and the likely future impact of the “upside” factors, including increasing proportions of containerisation in some markets, the levels of world port container handling using “past growth trends” would seem rather unrealistic – in terms of overall shipping (as the IMO points out) and probably also in terms of the port container handling capacity and investment expenditure that would be required.

At the same time, it can be expected that all the project scenario assessments could be regarded by some as somewhat conservative – because they assume a gradual “sea change” away from the long-standing trend levels of Regional Container Activity & Economic Wealth factors as high as 5.9% with respect to GDP.

Looking at actual levels, the recent worldwide levels of container handling since the recession seem to be broadly in line with the lower growth scenario projections over the period to 2015. Container demand has remained subdued in most developed countries – moderating from a global perspective the strong current growth occurring in developing countries and regions. If differentiated growth between developed and developing countries does continue in the future, as currently expected, moderate levels of growth in port container demand in many developed countries might continue as per the medium TEU growth scenario for some time.

Container port berth requirements

UNESCAP estimates

The UNESCAP 2007 study notes that estimating port capacity requirements is a complex and often contentious issue, and precise estimates require the application of detailed simulation models, data on vessel arrival patterns, and service times. The detailed analysis required is clearly beyond the scope of the present assessments. However, the UNESCAP study provided the following indications of throughput per berth according to the class of the port – together with an indication of berth costs.

Table C.5. Port classification and indicative throughput per berth

Port class	Description	Throughput per berth (TEU)	Indicative cost per berth (USD million)
1	World-class hub port	680 000	100
2	Major port with mainline services	460 000	80
3	Important secondary port	300 000	60
4	Feeder or regional port	230 000	40
5	Minor port using multipurpose facilities	180 000	40

Source: UN ESCAP 2007 Report, p. 57.

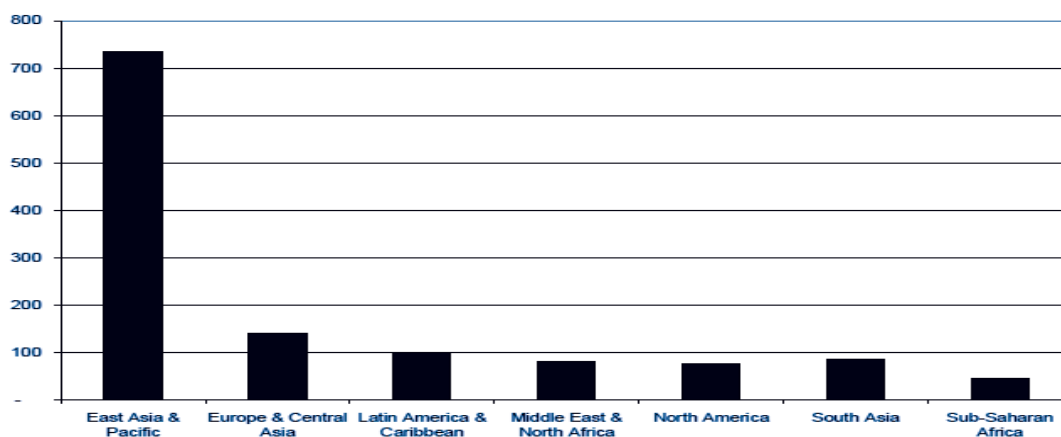
UNESCAP expected worldwide port container volumes to increase from 386 M TEUs in 2005 to 795 M TEUs in 2007. UNESCAP 2007 estimates of the new container berths needed to meet anticipated world and ESCAP region demand over the ten-year period from 2005 to 2015 were as follows.

- 1 264 new container berths will be required to meet anticipated world demand in 2015;
- East Asia and the Pacific will account for approximately 740 of this total, with a further 85 berths required in South Asia.

Of course, estimates of requirements allowed for a significant proportion of the growth in demand being absorbed by spare capacity at existing berths. As well, the 1 264 new container berths would not be full on completion but rather would provide spare capacity able to absorb some of future growth.

The report provided an assessment of the regional distribution of the new container berths that would be required. Although substantial new capacity would be required in all major regions of the world, the ESCAP region would dominate the requirements for new berths during this period, as per Figure C.2.

Figure C.2. **Regional distribution of container berth requirements, 2005-2015**



Source: UNESCAP (2007), *Container Traffic Forecast 2007 Update*, United Nations, Bangkok.

Project container berth needs – assessments to 2015/2030

The project's assessments of container berth requirements are based on the project's medium TEU growth scenarios and make use of the general relationships between container growth and new berth requirements as assessed by UNESCAP.

New berths required 2015-2030

The project's assessments of future increases in port container handling – and in the number of berth needed worldwide – under low, medium and high growth scenarios are set out in Table C.6.

Table C.6. **Total port container berths (2009-2030)**

Region	TEU growth and total port container berths needs				
	Annual average port container growth (TEU M) and new berths needed		Aggregate container growth (TEU M) and aggregate new berth requirements		
Requirements	2009-2015	2015-2030	2009-2015	2015-2030	2009-2030
Port container handling	45	65	265	1 000	1 200
Worldwide new berths	110	165	660	2 500	3 160

The number of new berths required over 2009-15 would be less than 50 in most regions except for the ESCAP region, where the number could be around 350, and in Europe where it could be above 50.

Port container berths – investment needs

UN ESCAP 2007 estimates

UNESCAP's 2007 estimate of total investment requirements over 2005-2015 was approximately USD 73 billion worldwide for 1 264 container berths, of which USD 51 billion was for approximately 740 ports in the ESCAP region. The estimate average cost per container berth in ESCAP region ports was around USD 69 million – a higher cost per berth than the world average of around USD 58 million.

Project estimates

The project's assessments of port container handling infrastructure investment estimates are based on the medium growth scenario projections set out in Table C.4. They are based on estimated current average costs of up to around USD 75 million per berth, reflecting increasing costs in the ESCAP region and the high and growing proportion of overall berth needs in the ESCAP region. It should be noted that many recent container berth developments cost considerably more than this average level.

Project estimates for port handling berth needs and investment requirements are set out in Table C.7.

Table C.7. **Total port container berth and investment requirements (2009-2030)**

Region	USD billions				
	Medium TEU growth scenario				
	Annual average investment		Aggregate investment		
	2009-2015	2015-2030	2009-2015	2015-2030	2009-2030
Global Requirements	8	12	50	190	240

The infrastructure estimates are based on typical costs to develop new infrastructure and procure the handling equipment required to allow the terminal to operate at a satisfactory level of efficiency.

The costs presented for containers include only the cost of developing the terminals themselves. Actual investment requirements will depend on the particular conditions that prevail at each development site. Substantial additional investment will also be required to secure adequate access to the terminals by road, rail and inland waterways, which will be essential for the effective distribution of containers to expanded port hinterlands. The additional costs of dredging, the provision of breakwaters and the establishment of land transport links and intermodal interchanges would add significantly to this total.

Devising appropriate strategies to mobilise the investments needed will be a major challenge for the governments in all regions over the next decade – and particularly for governments in the big emerging economies and other fast-growing economies in developing regions.

Total port investment requirements

Shipping categories other than containers make up a significant proportion of total international seaborne trade. Oil products represent around 35% of overall tonnage. Main bulks make up another 25%. Although the rate of increase in these categories is expected to be lower than for containers, very significant additional port investment costs related to oil and main bulks are to be expected, including specialised requirements for products needing special handling such as LNG.

From the project's viewpoint, there is considerable interest in overall estimates of global port investment needs. However, investment data are not readily available for ports throughout the world.

The approach taken to estimate global port investment requirements was to select some target regions and ports that are to some degree representative of the data being sought (developed, developing country, etc.) and that are able to provide approximations of both overall port investments and port container investments. From detailed consideration of the data for the target countries selected, it is then possible to assess the scaling up involved from container port investments to overall port investments

Selected target regions and ports

United States

The United States was chosen as a possible target because there is a considerable amount of published material available. The US DoT's Maritime Administration published a "US Port Public Development Expenditure Report (FYs 2006 and 2007-2011)" in February 2009. The report indicated, in its Table 2, that for 2006 US public port expenditures by category for 2006 were as follows.

Table C.8. US ports – actual and projected port capital expenditures over the period 2006-2011

Type of facility	Port capital expenditures 2006 (USD M)	Expenditure share (%)	Projected port capital expenditures 2007-2011 (USD M)	Projected expenditure share 2007-2011 (%)
General cargo	174	16.1	1 294	13.8
Specialised general cargo	360	33.3	2 831	30.2
Dry bulk	33	3.1	119	1.3
Liquid bulk	7	0.7	286	3.1
Passenger	56	5.2	527	5.6
Other	187	17.2	2130	22.7
(Access) infrastructure	73	7.0	959	10.2
Dredging	144	13.3	965	10.3
Security	47	4.0	270	2.9
Total	1 084	100.0	9 384	100.0

Source: US DoT Maritime Administration (2009), "US Port Public Development Expenditure Report" (FYs 2006 and 2007-2011), US DoT, Washington, D.C.

The report advises that “specialised general cargo” includes container, roll-on/roll-off (RO-RO) and auto facilities. It notes that specialised general cargo facilities (including container and RO-RO) were the leading expenditure category, both overall and among the six facility types, accounting for one-third of 2006 capital investments. Of this, container new construction amounted to USD 261 million (26%) and container modernisation/rehabilitation amounted to USD 79 million (around 8%) – giving a total of around USD 340 million (34% of the total).

India’s 12 major ports

India currently has a low rate of container use compared with container penetration of maritime freight markets in other countries. The Port of Rotterdam Authority’s Adviser’s report prepared for the India Ports Association in 2007 included, for India’s 12 major ports, the following table of consolidated cargo for 2007-2008 and projections for 2011-2012 and 2025-2026.

Table C.9. India’s 12 major ports – consolidated cargo forecast in M tonnes

	2007-2008	2011-2012	2025-2026
POL	160.66	216.51	335.95
Iron ore	95.64	108.97	139.52
Coal	74.49	126.68	189.61
Containers	83.88	161.38	679.97
Fertilisers	15.34	19.76	37.20
Other cargo	80.44	106.11	212.82
Total	510.47	739.41	1 595.07

Source: Rotterdam Port Authority Advisers (2007), *Co-ordination of Business Plans for Major Ports in India*, Volume 1, Rotterdam Port Authority Advisers.

The consolidated cargo forecast indicates that in India’s case, the container proportion of consolidated cargo is currently quite low but by 2025-2026 it is likely to be well over 33% of total port handling (in MT). Given that greater container penetration can be expected as growth continues, the container share can be expected to increase. As an indication, planned expenditures at the two Mumbai ports are as follows.

The Port of Mumbai’s overall investment programme for the period from 1 July 2010 to 31 March 2020 provides for annual capacity to be increased by 67 MT by 2020. The overall investment expenditure over this period is expected to be INR 68 835 million (USD 1.53 billion) with USD 1.07 billion funded from internal resources and USD 365 million funded by the private sector. Of these totals, development of an offshore container terminal Phase II would add 4.5 MT of container capacity (around 400 000 TEUs) at a cost of INR 15 000 million (around USD 333 million).

JNPT is the other major Mumbai port and is India’s largest container port. JNPT’s investment programme includes two major container projects. The first is the development of a stand-alone container handling facility with a capacity of around 10 MT (i.e. around 800 000 TEUs) per annum at a cost of INR 6 000 million (USD 133 million). The second is the development of a fourth container terminal with a Phase I capacity of 30 MT per annum, at a cost of INR 41 billion (USD 0.9 billion) and with a Phase II additional capacity of 30 MT per annum, at a cost of INR 26 billion (USD 0.6 billion). Together they will handle an additional 5 million TEUs per annum.

For the two Mumbai ports together, their total investment programme over this period amounts to USD 3.8 billion and container berth/terminal developments amount to around USD 1.6 billion – around 40%. Given that JNPT currently handles more than half India's maritime containers, the port container investment shares of total investments at these two ports are relatively high.

Overall port container investment at India's 12 major ports would be very much less than 40% of the total investment programmes of the 12 major ports. The container proportion of port investments across all Indian ports would be a much smaller percentage again. With the exception of a few private sector ports, most other Indian ports presently handle very little container traffic. Of course, as container penetration and containerisation levels in India increase, the port container investment shares will rise, probably quite rapidly.

China

No consolidated port investment estimates are available for China's ports. China already has relatively high levels of container penetration and six of its ports are included in the top ten busiest container ports in the world. Although it is already high on the lists of container handling, China's port container handling can be expected to grow at very high rates in future. China's port container investment levels will therefore also continue to increase for many years ahead.

Overall conclusions

The port capital expenditures for the United States can be taken as providing relevant insights into possible levels of port capital expenditure in developed countries as their GDP per capita levels move along the path towards those in the United States at present. The container share of overall port investments in the United States can also be expected to give some indication of the share likely in other developed countries in future.

Among the developing economies, China and India together represent a major share (over 30%) of the world's population. China already has relatively high levels of container penetration, and its port container handling can be expected to grow at very high rates in future – thus its port container investment levels will continue to increase for many years ahead.

India currently has relatively low maritime container penetration. With India following China along a similar path around 20 years behind, these two countries will be major drivers of growth and will have increasing shares of total worldwide growth in maritime trade and maritime container handling. India's port container investment levels will therefore also continue to increase for many years ahead.

At present, based on the data available, it seems likely that new port container infrastructure is likely to amount to around 26% and container rehabilitation to around 8% of overall port investment in developed countries, which have relatively high container penetration. Rapid growth in container handling in China at present and in India in the future suggests that developing economies are likely to achieve similar levels quite quickly.

For project purposes, it seems likely that worldwide port investment in new container berths and maintenance/rehabilitation of existing berths is likely to be around **34%** of overall port infrastructure investments in future.

Total port container investment needs (new berths and rehabilitation)

Port container rehabilitation expenditure is clearly an important part of port container infrastructure investments. Based on such rehabilitation expenditure being around one-third of the investment in new berths, the port container investment needs table can be extended, as shown in Table 2.4.

Total port facility investment needs

At present, it seems that port investment in new container berths and container rehabilitation can be expected to represent around one-third of total port infrastructure investment in developed countries. For developing countries, the container level would be higher in the fast-growing ones but much lower in other developing countries.

In the future, container volumes are expected to increase at much faster growth rates than other cargo categories. Container investment will therefore constitute an increasing proportion of overall port investment. Based on expected overall increases in the different categories of maritime cargo, it is likely that, on a global average basis, container investment needs could rise to around 50% of overall port investment needs in the longer term.

For study purposes, to make order of magnitude assessments of overall port investments, it was assumed that overall port facility investment requirements are likely to be around three times the expenditure levels on port container investment in the short term in new berths and rehabilitation of existing ones, reducing to around 2.5 times container investment levels over the period 2015-2030. In the long term, say by 2050, they might reduce to two times.

The project's estimates of overall port facility investment requirements from 2009 to 2030 are provided in Table 2.3.

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Annex D

Rail infrastructure needs to 2030: Background to global estimates

Background

The revised estimates of rail “new construction” requirements (including new rail track and track maintenance) extend and update the infrastructure (rail and road) capital stock projections in the *Infrastructure to 2030* report (OECD, 2006). The approach adopted generally followed the methodology outlined in Chapter 4 of the Report, as prepared by David Stambrook, which was based on World Bank methodology (Fay and Yepes, 2003). A number of improvements were made and some of the original assumptions were adjusted and updated to fine-tune the work and help improve the assessments.

Updates for all country and region categories

All monetary values were updated and shown in PPP constant 2005 international dollars, the latest available from the World Bank. This is consistent through all levels of the model, from elasticity regressions to final output projections.

Country-specific data for rail track length (rkm) and GDP per capita growth forecasts were updated to 2008 data, the latest available at the time. Individual asset values to GDP elasticities were established for the G7 and Big 5 countries individually.

Additional G20 countries and European Union countries were also analysed individually to provide more insight into country-specific characteristics as a basis for assessing the expected distribution and shift of global rail spending patterns in the next 20-40 years.

Adjustment to the maintenance cost component assumptions for Category 1 (industrialised)

A comparison with actual gross investment data from the International Transport Forum 2010 indicated that the *Infrastructure to 2030* assumptions for annual maintenance expenditures were too low for the Category 1 (industrialised) countries.

The new assumptions provide for a higher rate of rail infrastructure maintenance spending in higher income countries. The distinction is achieved by setting the annual rail maintenance cost component for the Category 1 countries and regions at 1/10 (10%) of the total rail track capital stock (RTCS) ten years earlier, i.e. RTCS (t-10). For the

Category 2 and 3 countries and regions with incomes below these levels, annual rail maintenance cost components stand at 1/30 (3.33%) of the total RTCS (t-10).

Adjustment to the elasticity assumptions for China, India and the Russian Federation

The high growth rates forecast for China, India and the Russian Federation will bring about a rapid rise in GDP per capita for these countries over the periods to 2015, 2030 and 2050. Robust but diminishing growth rates can be expected, in line with GDP growth projections over the period to 2030.

The relationships between GDP per capita, total asset value/RTCS and new construction cannot be expected to be the same for an economy whose level of income per capita is a few thousand dollars and an economy whose level of income per capita is tens of thousands of dollars a year. A singular elasticity value, for example, which assumes that China's rate of spending relative to GDP growth will be the same rate in 30 years' time, when most of the infrastructure network is already in place, seems unrealistic. It is more likely that in the earlier stages of development (e.g. over the period 2010-2020), there will be much higher growth rates in new investment and RTCS. As well, many countries singled out infrastructure (including rail infrastructure) as one of the major areas of post-recession fiscal stimuli. It seems unlikely that current high levels of investment will be maintained for the extended periods ahead.

As China, India and the Russian Federation move towards current OECD level incomes over the next 20, 30 or 40 years, the corresponding rate of growth of investment relative to GDP (i.e. elasticity relative to GDP) can be expected to become lower and more in line with OECD levels now. A "stacked" model of elasticity was therefore used for China, India and the Russian Federation, whereby China and India have three levels of elasticity and the Russian Federation, which already has higher levels of GDP per capita, has two levels.

Methodology

The Fay-Yepes methodology continued to be used to forecast the rail infrastructure capital stock in the future, based on the economic elasticity relationship between growth in GDP per capita and in rail track capital stock in recent years. Other than the adjustments to the maintenance cost component for Category 1 (industrialised) countries and the country-specific elasticities derived from regressions as outlined above, no country-specific adjustments were made. This helps ensure internal consistency in the model and in the modelling projections. Of course, investment plans such as those included in the Chinese stimulus package and the European TEN-T projects may lead to investment levels in particular years to deal with particular circumstances that are different from model assessments of average investments needs over extended periods.

Tables 1.11 and 1.12 summarise the key estimates for global rail new construction and maintenance investment needs and those for G20 countries from 2009 to 2030.

Given the lumpy spending patterns and the medium-term implementation timelines of infrastructure investment, the "annual new construction and maintenance" investment needs should be taken as a guide to the total spending in a 5- to 15-year period rather than expected annual investment levels in individual years.

Accelerated expenditure on rail

Accelerated expenditure on rail has been evident in a number of countries in different regions.

In relation to China, successive announcements have accelerated China's anticipated rail expenditures, bringing forward expenditures that were originally expected to be made over the period from 2005 to 2020. Most announcements have confirmed very high levels of current year expenditure. Announcements in May 2011 highlighted a cutback in plans for the development of China's high-speed rail network together with a reduction of maximum operating speeds from 350 km/hr to 300 km/hr for safety reasons and also to reduce costs and make the high-speed rail services more affordable.

In Europe, the TEN-T programme of priority projects includes a relatively high proportion of rail infrastructure improvement expenditures – including on high-speed rail, which is progressing steadily. As well, renewed efforts are being made to improve freight rail service and competitiveness, including via promotion of greater priority for rail freight services in some circumstances.

In the United States, rail investment was boosted as part of the American Recovery and Reinvestment Act (ARRA) 2009 announcements and plans are progressing for high-speed rail over specific routes.

The projections overall anticipate a continuing interest in rail in all these countries, and increasing interest in many other countries. They anticipated (but did not assume) that current levels of rail infrastructure expenditure in most developed countries would at least be maintained as a percentage of country GDP – and that their levels could increase relative to GDP in many developing countries.

In the big emerging economies and some of the large developing countries, investment levels can be expected to increase and continue at historically high levels as the countries invest more heavily in rail to support their high current levels of economic growth and to promote a continuation of high growth in future.

Assumptions

Key assumptions included that GDP and GDP per capita increase as outlined in the IEA *Energy Technology Perspectives* report.

In making assessments for the medium term to 2030 and beyond, the modelling used recent investment levels as its base for assessments of future requirements. The assessments anticipated (but did not assume) that current levels of rail infrastructure expenditure in most developed countries would at least be maintained as a percentage of country GDP – and that their levels could increase relative to GDP in many developing countries.

The GDP growth, per capita income and investment levels used as the base are important to the results.

In support of the investment side, the EU's recent report "Roadmap to a Single European Transport Area", for example, anticipates investment levels in future will remain very significant:

A well-performing transport network requires substantial resources. The cost of EU infrastructure development to match the demand for transport has been estimated at over EUR 1.5 trillion for 2010-2030. The completion of the TEN-T network requires about EUR 550 billion until 2020 out of which some EUR 215 billion can be referred to the removal of the main bottlenecks. This does not include investment in vehicles, equipment and charging infrastructure, which may require an additional trillion to achieve the emission reduction goals for the transport system. (European Commission, 2011)

The “Roadmap” also highlights possible actions, by 2050, including:

- 30% of road freight over 300 kilometres should shift to other modes such as rail or waterborne transport by 2030, and more than 50% by 2050, facilitated by efficient and green freight corridors. To meet this goal will also require appropriate infrastructure to be developed.
- Complete a European high-speed rail network. Triple the length of the existing high-speed rail network by 2030 and maintain a dense railway network in all member countries. By 2050 the majority of medium-distance passenger transport should go by rail.
- Connect all core network airports to the rail networks, preferably high speed; ensure that all core seaports are sufficiently connected to the rail freight and, where possible, inland waterway systems.
- Move towards full application of “user pays” and “polluter pays” principles and private sector involvement to eliminate distortion, generate revenues and ensure financing for future transport investments. (European Commission, 2011)

Major new routes

The assessments of rail infrastructure investment demand do not at this stage include any allowance for major additional expenditure over and above existing programmes for possible major new routes – such as Pan-European, Trans-Asia (e.g. TAR), Trans-Siberian (Beijing-Hamburg) or North Europe – South Asia – that are being given some degree of consideration in various settings. Nor do they include even longer-term possibilities such as a US-Canada-Alaska-Russia-Asia link (which some believe might be considered in conjunction with construction of a proposed Alaska natural gas pipeline).

Of course, the project’s estimates of rail infrastructure investment demand could be revised to include expenditures on such possible major routes once they make the transition in status from possible projects to expected, planned or budgeted projects.

Conclusions

The revised estimates of rail infrastructure investment needs are significantly higher than those in *Infrastructure to 2030* (OECD, 2006). The increases in expected rail infrastructure investment needs came from different sources, including:

- The G7 and other developed countries. The individual country-specific estimations undertaken took into account International Transport Forum (see www.internationaltransportforum.org/statistics/investment/data.html) data on recent rail investment and maintenance expenditure in these countries. Investment

in both new construction and maintenance levels were significantly higher than assumed in the 2006 estimates. Higher investments in new rail construction reflect the shift in investment programme shares towards rail (and the consequential reduction in road investment shares) in regional and many national investment programmes. The improved models indicated that rail maintenance expenditures in these countries would be higher in the future than previously expected – reflecting higher current expenditures and the future increase in maintenance levels from around ten years after new construction is complete.

- The Big 5 countries (China, India, Russian Federation, Brazil and Indonesia). A large share of the increases relate to the Big 5 countries in which GDP growth and the increases in GDP per capita incomes have been greater than anticipated. Future growth expectations have also increased and are greater than previously anticipated. The uneven impact of the global recession in 2008 and 2009 left the Big 5 relatively unscathed compared to their western developed economies. This is especially evident in China, where recent rail expenditure has been at unprecedented levels, and India and the Russian Federation, where planned expenditures in their rail building programmes are also higher.

The project assessments anticipate a continuing interest in rail in developed countries and the largest developing economies, and increasing interest in many other countries.

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Annex E

Oil and gas transport and distribution infrastructure needs to 2030: Global estimates

Background

The IEA World Energy Outlook 2008 included advice on global energy trends, inter-regional trade, energy security and oil “shipping” and gas “transport and distribution” infrastructure needs.

The IEA has since then published two further reports that provide insights and estimates. These are *Energy Technology Perspectives 2010* (IEA, 2010a) and *World Energy Outlook 2010* (IEA, 2010b).

IEA World Energy Outlook, 2010

Oil investment needs to 2035

The IEA *World Energy Outlook 2010* includes some advice and indications of breakdowns of infrastructure investment needs for oil and gas.

It notes that:

The projected trends in oil supply in the New Policies Scenario call for cumulative infrastructure investment along the oil-supply chain of around USD 8 trillion over 2010-2035, or USD 310 billion per year.

About 85% of this investment is needed in the upstream. Including upstream investment needs for gas yields a total annual upstream oil and gas capital spending requirement of about USD 440 billion – slightly less than the USD 470 billion the industry is planning to spend in 2010.

This fall in the overall level of upstream investment, mainly in the latter part of the projection period, is caused by the shift in investment towards the Middle East and other regions, where finding and development costs are generally lower. This, together with lower unit costs as technology progresses, more than offsets cost increases due to resource depletion. Around three-quarters of global cumulative oil investment to 2035 is needed in non-OECD countries in the New Policies Scenario. Investments in OECD countries are large, especially in the upstream, despite the small and declining share of these countries in world production. In contrast, investment in Middle East countries – the biggest contributor to production growth –

accounts for only 12% of total investment, because costs are lowest in this region. (IEA, 2010b)

The report also notes that the world total includes an additional USD 241 billion investment in inter-regional transport infrastructure.

Natural gas investment needs to 2035

The IEA WEO 2010 notes that:

The projected trends in gas demand in the New Policies Scenario would require a cumulative investment along the gas-supply chain of about USD 7.1 trillion (in year 2009 dollars), or around USD 270 billion per year (see Table E.1). Roughly two-thirds of that capital spending, or USD 175 billion per year, is needed upstream, for new greenfield projects and to combat decline at existing fields. Six LNG facilities account for about 9% of the total, and transmission and distribution networks for the rest. Unsurprisingly, the majority of the investment is needed in non-OECD countries, where local demand and production grows the most.

Table E.1. **Cumulative investment in gas supply infrastructure by region and activity in the New Policies Scenario (2010-2035)**

USD billions in year 2009 prices

	Exploration and development	Transmission and distribution	LNG ¹	Total	Annual average
OECD	1 863	862	150	2 875	111
North America	1 263	459	24	1 746	67
Europe	419	320	11	751	29
Pacific	180	83	114	378	15
Non-OECD	2 680	1 074	397	4 152	160
Eastern Europe/Eurasia	797	383	33	1 213	47
Caspian	227	84	–	311	12
Russia	525	234	33	792	30
Asia	721	321	94	1 136	44
China	180	132	48	360	14
India	129	58	29	216	8
Middle East	261	221	104	586	23
Africa	583	60	122	764	29
Latin America	319	89	44	452	17
World ¹	4 543	1 936	622	7 101	273
European Union	179	305	11	496	19

Note: 1. World total includes an additional USD 74 billion of investment in LNG carriers.

Source: IEA (2010), *World Energy Outlook*, OECD Publishing, Paris, <http://dx.doi.org/10.1787/weo-2010-en>.

The advice provided in the *World Energy Outlook 2010* points towards the following estimates of oil and gas sector investment needs over the period 2010-2035 and the breakdowns shown between upstream and downstream investment needs.

Table E.2. **Oil and gas investment needs – upstream and downstream (2010-2035)**

USD billions 2009

Breakdown	Oil		Gas	
	Annual	Cumulative	Annual	Cumulative
Upstream	263	6 300	177	4 700
Downstream	47	1 700	95	2 400
World total	310	8 000	273	7 100

Source: Project estimates, based on above advice from IEA (2010), *World Energy Outlook*, OECD Publishing, Paris, <http://dx.doi.org/10.1787/weo-2010-en>.

Revised estimates for oil and gas “transport and distribution” infrastructure investment over the period 2010-2030 are set out in the Table E.3.

Table E.3. **Revised estimates for infrastructure investment in oil and gas “transport and distribution” (2009-2030)**

USD billions 2009

Breakdown	Oil		Gas	
	Annual	Cumulative	Annual	Cumulative
Downstream	47	987	95	1 995
Additions	10	210 ¹	3	63 ²
World total	57	1 197	98	2 058

Note: 1 World total includes USD 241 billion investment in inter-regional transport infrastructure (2010-2035).
2. World total includes an additional USD 74 billion of investment in LNG carriers (2010-2035).

Source: Project estimates, based on above advice from IEA (2010), *World Energy Outlook*, OECD Publishing, Paris, <http://dx.doi.org/10.1787/weo-2010-en>.

Infrastructure investment estimates – IEA Energy Technology Perspectives 2010

The IEA *Energy Technology Perspectives 2010* estimates of total energy infrastructure investment needs are set out in Table E.4.

Table E.4. **Average annual investment by sector – baseline and BLUE map scenarios**

USD billions

	Baseline			BLUE map		
	2010-2015	2015-2030	2030-2050	2010-2015	2015-2030	2030-2050
Power generation	210	360	430	270	470	640
Transmission and distribution	170	220	210	270	260	350
Industry	130	150	290	150	170	340
Transport	3 800	4 490	7 220	4 028	4 760	8 080
Total investment (excluding buildings)	4 310	5 210	8 150	4 720	5 660	9 400

Source: IEA (2009), *Energy Technology Perspectives 2010: Scenarios and Strategies to 2050*, OECD Publishing, Paris, http://dx.doi.org/10.1787/energy_tech-2010-en.

The IEA noted that investment needs in the BLUE Map Scenario would be 8.6% higher between 2010 and 2030 than in the baseline scenario.

Table E.5 highlights the IEA’s findings for all fuels (i.e. not just oil and gas) on the average annual and cumulative investment by energy sector all fuels. Oil and gas transport and distribution investments (as estimated from IEA, 2010b report) make up a significant share of the energy transmission and distribution costs set out in Table E.5.

Table E.5. Average annual investment by the energy sector – BLUE map scenario

Region	USD billions				
	Infrastructure investment needs all fuels (2009-2030)				
	Annual investment requirements		Aggregate investment requirements		
	2010-2015	2015-2030	2010-2015	2015-2030	2010-2030
Worldwide					
Power generation	270	470	1 300	7 050	8 350
Transmission and distribution	270	260	1 350	3 900	5 250
Industry	150	170	750	2 550	3 300
Transport ¹	4 028	4 760	20 140	71 400	91 540
Total	4 720	5 660	23 600	84 900	108 500

Note: 1. “Transport” investments refer to vehicles (cars, tankers, etc.).

Source: IEA (2009), *Energy Technology Perspectives Report 2010: Scenarios and Strategies to 2050*, OECD Publishing, Paris, page 524, http://dx.doi.org/10.1787/energy_tech-2010-en.

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