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SUSTAINABLE FREIGHT TRANSPORT DEVELOPMENT AND FINANCE

The importance of freight transport as a trade enabler, engine of growth and a driver of social development is widely recognized. However, the associated adverse impacts of freight transport activity on the environment, human health and climate are also cause for concern. Overall, transport consumes over 50 per cent of global liquid fossil fuels and is projected to grow by 1.4 per cent per year from 2008 to 2035 and to account for 82 per cent of the total projected increment in liquid fuel use. It is also estimated that freight in tons per kilometre will triple by 2050 and that energy demand of commercial transportation – trucks, aeroplanes, ships and trains – will rise by over 70 per cent by 2040, driven by economic growth particularly in developing countries. At the same time, the transport sector accounts for around 13 per cent of all world greenhouse gases (GHGs), of which 5.5 per cent are related to logistics (with freight transport accounting for 90 per cent of the total share). Nearly 25 per cent of global carbon dioxide (CO_2) emissions are transport related and these are expected to increase by 57 per cent worldwide (or 1.7 per cent a year) between 2005 and 2030.

If left unchecked, unsustainable patterns are likely to intensify, increasing the potential for global energy and environmental crises, and undermining progress being made on sustainable development and growth. This chapter highlights the relevance of sustainability imperatives in the freight transport sector and focuses on the need to reduce the sector's energy consumption and air emissions. Some of the main developments and initiatives undertaken by countries, industry and the international community with a view to promoting sustainable freight transport are also presented, along with a number of financial considerations that can determine the ability to implement a shift towards sustainable freight transport systems.

A. INTRODUCTION

Environmental sustainability is a pressing issue that is gathering momentum globally. This is triggered by the growing needs of an expanding world population and increasing economic activity which are depleting world natural resources and imposing great pressure on the environment, including the climate. In this context, adhering to sustainability principles becomes crucial to enable an effective balancing act between these competing trends and developments.

The need to achieve sustainability objectives has been further moulded by the global economic and financial crisis, highlighting the emergence of so-called green economies. This term is understood to mean an economy which is low carbon, resource efficient and socially inclusive.[1] The green economy is seen as a key policy option that can address the growing economic, environmental and social challenges.

The United Nations General Assembly and several United Nations agencies have called for the development of green economy initiatives as part of the stimulus packages put in place to support recovery and stimulate growth. The green economy concept was also one of the two major themes considered during the United Nations Conference on Sustainable Development (UNCSD), held in June 2012 in Brazil (RIO+20)[2], which included, for the first time, explicit reference to sustainable transport. The Conference recognized the importance of sustainable transport within the framework of global sustainable development and identified measures to promote such transport systems, including, inter alia, by energy efficient multimodal transport systems, clean fuels and vehicles, as well as improved transportation systems in rural areas and the promotion of integrated approaches to policymaking.[3]

Achieving a green economy also implies tackling climate change and accelerating low-carbon green growth. Estimates indicate that by 2050 the world will need 50 per cent more food, 45 per cent more energy and 30 per cent more water.[4] At the same time, these resources are likely to become depleted or scarce, and only available at prohibitive costs due, in particular, to the negative impacts of climate change. Despite international efforts, namely under the United Nations Framework Convention on Climate Change (UNFCCC), which promoted the adoption of an international binding regulatory regime to mitigate climate change, GHG emissions increased by 5 per cent in 2010, taking the total volume of emissions to 30.6 gigatons (Gt).[5] Thus, immediate and strong action to cut GHG emissions, while at the same time promoting growth and development, is ever more crucial.

Against this background, an appraisal of the transport sector, including freight transport, within the framework of sustainable development is seen as an essential contribution to the present Review. Around 95 per cent of fuels used in the transport sector are fossil based. With transport depending heavily on oil for propulsion, the sector emits large amounts of GHGs (notably CO_2[6]) and other air emissions such as nitrogen oxides (NOx), sulphur oxides (SOx), volatile organic compounds, particulate matter and lead. All these emissions have negative impacts on human health, the environment (water quality, soil quality, biodiversity, land take, land use, congestion and noise)[7] and the climate.

Freight transport activity will continue to grow in tandem with projected growth in business activities, rising incomes and greater movements of goods – both within and between nations. Growing freight transport activity will in turn lead to a commensurate rise in global demand and use of oil and emissions of GHGs, which can lead to unpredictable changes in the global climate.

In addition to GHG emissions and related global climate effects, local and regional emissions of air pollutants are also raising concerns. Worldwide, air pollution from transport is responsible for about 1.1 per cent of all deaths annually.[8] Trucks and ships are a major source of air pollutants, especially particulate matter. For instance, although only 4 per cent of vehicles in China are trucks, they are responsible for 57 per cent of particulate emissions from transport.[9] Also, particular matter contains black carbon and diesel emissions that are now confirmed carcinogens.[10]

Sustainability in freight transport requires a balancing act between economic, social and environmental considerations, and *entails the ability to provide fuel efficient, cost-effective, environmentally friendly, low-carbon, and climate-resilient transport systems.*[11] Governments and industry have now started to mainstream sustainability criteria into their planning processes, policies, and programmes. Specific actions may involve reshaping transport architecture and networks, balancing transport modes, adapting and developing appropriate infrastructure, rethinking supply chain designs and operating procedures of freight logistics, harnessing new technologies, and supporting information and communications

technology (ICT) and intelligent transport systems (ITS). Even though there has been significant progress in sustainable freight approaches and practices, meeting effectively and in full the sector's sustainability objectives has yet to be achieved.

While addressing climate change impacts on freight transport through adaptation action is also a key consideration when pursuing sustainability objectives, this issue falls outside the scope of this chapter and is addressed in greater detail in chapter 1. This chapter highlights the importance of achieving sustainability in freight transport and the need to mitigate the sector's emissions and to reduce the sector's energy consumption as well as its heavy reliance on oil. Some key developments and initiatives undertaken by countries, industry and the international community with a view to promoting sustainable freight transport are also discussed in the present chapter, along with a number of financial considerations that may help to determine the ability to implement a shift towards sustainable freight transport systems.

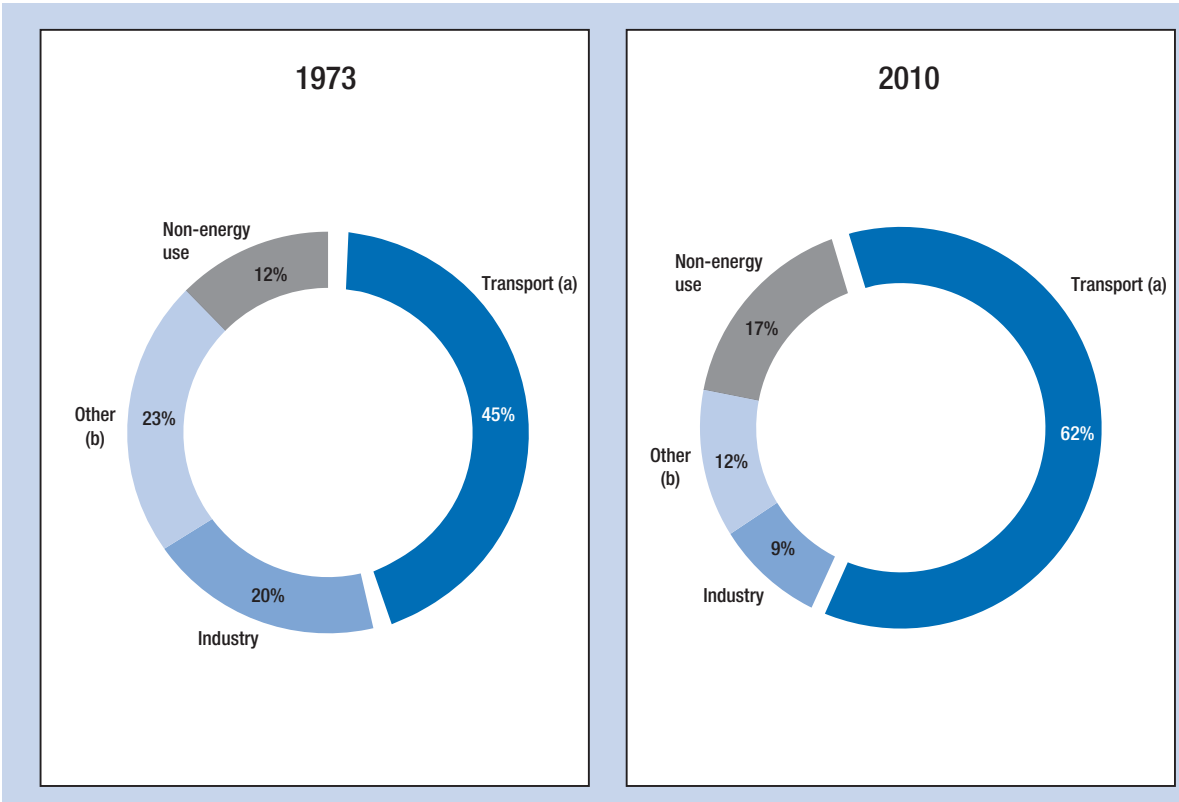
B. TRANSPORT SECTOR ENERGY USE AND EMISSIONS

This section highlights the large energy use and emissions from transport, including freight transport, and underlines the importance of reducing the sector's oil consumption and dependency to achieve greater environmental sustainability, and reduce exposure to rising and volatile energy prices that drive up fuel and transport costs.

1. Energy use

The transport sector is heavily dependent on oil as its main source of fuel. As shown in figure 6.1, transportation consumes more than 50 per cent of global liquid fossil fuels and its share of world consumption has grown by 17 per cent between 1973 and 2010.[12] In comparison, other economic sectors have recorded a declining trend during the same period. World liquid fuel consumption for transportation is expected to grow by 1.4 per cent per

Figure 6.1. World oil consumption, 1973 and 2010



Source: *Key World Energy Statistics 2012*, International Energy Agency (IEA). The oil products comprise refinery gas, ethane, liquefied petroleum gas (LPG), aviation, gasoline, motor gasoline, jet fuels, kerosene, gas/diesel oil fuel, oil, naphtha, white spirit, lubricants, bitumen, paraffin waxes, petroleum coke and other oil products.

(a) Includes international aviation and international marine bunkers.

(b) Includes agriculture, commercial and public services.

year from 2008 to 2035 and accounts for 82 per cent of the total projected increment in liquid fuel use.[13]

Freight transport has been growing more rapidly than passenger transport and is expected to continue rising in the future. Some existing forecasts indicate that freight in tons per kilometre will triple between 2010 and 2050, driven by economic growth particularly in developing countries.[14] Energy demand for commercial transportation – trucks, aeroplanes, ships and trains – is projected to rise by more than 70 per cent from 2010 to 2040. Most of this growth will come from heavy duty vehicles, which include freight trucks of all sizes, as well as buses, emergency vehicles and work trucks. [15]

Oil supply and demand and price fluctuation are important considerations for transport and will continue to play a significant role in the future, as uncertainty over global oil reserves, among other issues, become more prevalent. Alternative sources of energy and fuel efficiency in transport may take up a more prominent role, assuming continued research and development, technological advances and strong policies are put in place to ensure their implementation at an affordable cost and on a massive scale. In the meantime, this should not prevent practical steps being taken to gear current operations towards more energy-efficient practices (see section C).

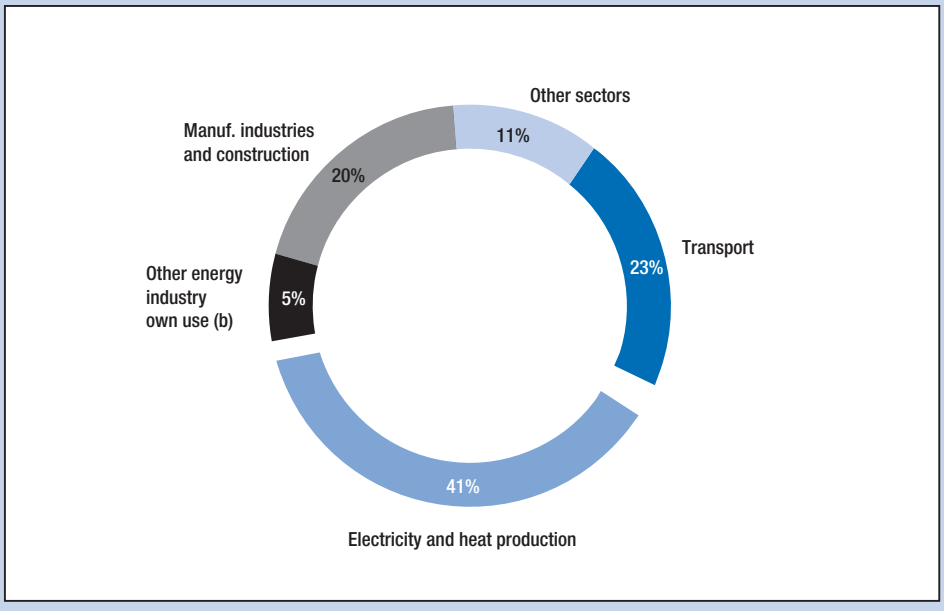
2. Emissions

The transport sector is estimated to have accounted for around 13 per cent of all world GHGs in 2004.[16] Logistics, including freight transport and 'logistics buildings' account for 5.5 per cent of global GHG emissions. Of this total, freight transport accounts for the lion share of 90 per cent or 4.95 per cent of total GHG emissions.[17] In terms of CO_2 emissions, the transport sector is estimated to have accounted for around 23 per cent of global CO_2 emissions in 2009.[18] As shown in figure 6.2, the transport industry is the second largest CO_2-emitting sector after electricity and heat production.

Figure 6.3 compares CO_2 emissions from major freight transport modes. It shows that in terms of grams of CO_2 produced for every ton carried over one kilometre, air transport is the largest emitter, followed by road. It should also be noted that air and road transport are the two most expensive modes of transport in terms of freight rates per volume.

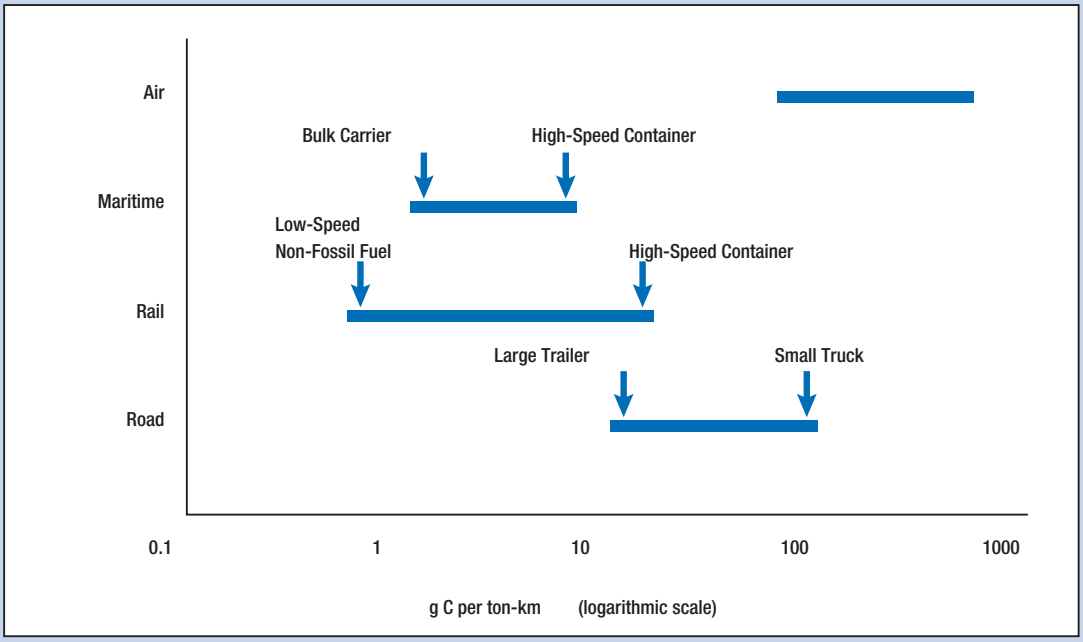
If current trends persist, transport-related CO_2 emissions are estimated to increase by 57 per cent worldwide (1.7 per cent a year) for the period 2005–2030.[20] It is also expected that more than 80 per cent of the predicted growth in transport

Figure 6.2. World CO_2 emissions from fuel combustion by sector, 2009 (a)



Source: CO_2 Emissions *from Fuel Combustion Highlights, 2011, IEA.*
(a) Includes international bunkers in the transport sector.
(b) Includes emissions from own use in petroleum refining, the manufacture of solid fuels, coal mining, oil and gas extraction and other energy-producing industries.

Figure 6.3. Comparison of CO_2 emissions in freight transport by mode of transport (Grams carbon per ton freight carried per kilometre)



Source: Intergovernmental Panel on Climate Change (IPCC)[19]

emissions would be in developing countries (with China and India alone accounting for more than 50 per cent of the global increase[21]) and with most of the emissions being generated by land transport. Air pollution is also expected to be more intensive in developing countries due to the quality of fuel used for propulsion and the condition of equipment and vehicles, in particular the ageing trucks.

The challenge now is for all countries to promote sustainable transport policies, strategies, planning and investment decisions that balance the economic, environmental and social objectives. This is particularly crucial for developing countries that have the opportunity to consider from inception a sustainable development path. Missing this opportunity may lead to increased costs in the future, as Governments and industries would eventually face additional expenses to adapt to new circumstances and adopt new transport systems, including new technologies and operating practices. Retrofitting existing infrastructure and equipment to shocks, including those caused by climate change impacts, can be burdensome, capital intensive and costly. Thus, timely action at an early stage is crucial. Any delay in pursuing energy fuel efficiency and low carbon systems will promote false savings. It is estimated that every United States dollar spent on energy efficiency saves $2 through investments in new supply, with the savings being even greater in developing countries.[22]

C. RECENT DEVELOPMENTS IN SUSTAINABLE FREIGHT TRANSPORT

Addressing sustainability in the freight transport sector requires a holistic approach where the perspectives of all private and public stakeholders in the system must be considered and integrated, inclusive of all modes and activities. Institutional, technical and operational measures have to be defined and combined to overcome the various cross-cutting sustainability challenges characteristic of the sector. Some of the salient measures can generally be associated with three main areas for action – also described as the avoid–shift–improve approach[23] – which would encounter cross-cutting issues that can be summarized as follows:

- Avoid inefficient freight transport: avoid or reduce wasteful and unnecessary or empty trips, and duplication of roads, thus optimizing freight transport planning/volume/operations and reducing congestion, and the like.
- Shift to sustainable transport modes and systems: shift to cleaner transport modes (railways and waterways when applicable), to alternative fuels and to appropriate vehicle size, loads and routes, and the like.
- Improve the sustainability of freight transport, logistics, vessels and vehicles: improve infrastructure design and construction; improve fuels efficiency in all modes by improving freight transport operations (for example, by better management of transport system flows and capacities) and freight logistical systems (for example, creating smart logistics network concepts), leveraging technologies capable of improving fuel efficiency and reducing emissions, and improving drivers' behaviour (for example, through training and capacity building).

This section focuses on some of the measures and initiatives undertaken by the sector (maritime and inland) to promote a shift towards sustainable freight transport. These initiatives are expected to produce benefits in terms of improving the competitiveness of environmentally friendly transport modes and systems, increasing fuel efficiency, time and cost-effectiveness, thereby reducing the sector carbon footprint.

1. The maritime sector

As the debate on climate change has been gaining momentum globally, the maritime and shipping sector has been facing pressure to respond to the challenges of increasing GHG emissions (CO_2, SOx, NOx, etc.) and air pollution (especially particulate matter) and possible mitigation and adaptation measures are being considered, both at the regulatory and industry levels.

Although considered to be a relatively energy-efficient and climate-friendly mode of transport, especially in terms of emissions per ton of freight per kilometre, shipping and its environmental footprint is increasingly coming under public scrutiny.

According to the International Maritime Organization (IMO), shipping was estimated to have accounted for 3.3 per cent of the global emissions during 2007. International shipping was estimated to be responsible for 2.7 per cent of the global emissions of CO_2 in 2007. In the absence of global policies to control emissions from international shipping, ship emissions may increase by 200–300 per cent by the year 2050 (compared to the emissions in 2007) due to the expected continued growth in international seaborne trade.[24]

There does, however, appear to be a consensus within the International community, including the International Maritime Organization (IMO), that some measures affecting the technology of ships and fuels could help achieve some energy efficiency and reduce GHG emission intensity rates (CO_2/ton-mile) by 25–75 per cent below the current levels. Moreover, the international shipping industry is of the view that through joint and combined technical and operational efforts, it should be possible to reduce 15–20 per cent of CO_2 emissions per ton freight per kilometre by 2020.[25]

At the regulatory level, the international shipping industry is adhering increasingly to environmental sustainability principles and is recognizing its important role in maintaining the current international momentum on sustainability and climate change action in maritime transport. In 2011, the IMO (the body entrusted by UNFCCC to develop and enact global regulations to control GHG emissions from ships engaged in international trade) adopted the first global regime that addresses carbon emissions from international shipping, namely the Energy Efficiency Design Index (EEDI) and the Ship Energy Efficiency Management Plan (SEEMP) (see chapter 5 for a more detailed discussion of the new rules). Market-based measures, such as emissions trading or a global levy to help cut further emissions from international shipping are also being considered by IMO, but a number of outstanding issues are holding back a rapid adoption of an international agreement. These include the need to reconcile the principle of common but differentiated responsibilities and respective capabilities (CBDR) under the UNFCCC with the principle of uniform and global application of IMO instruments, as well as the need to determine the level of contribution by shipping into the Green Climate Fund (GCF) (established in December 2011 at the United Nations Climate Change Conference in Durban – see the following section on climate finance). The Fund aims to generate $100 billion per year by 2020 to enable mitigation and adaptation action in developing countries. While the United Nations Secretary-General's High-level Advisory Group on Climate Change Financing (AGF), established in 2010, suggested that some $16 billion per year could be raised from international

shipping, the World Bank suggests that instead some $25 billion per year could be generated.[26] The shipping industry is concerned that its potential contribution into the Fund will be disproportionate to its responsibility for global CO_2 emissions, and that it will be doubly charged through the UNFCCC as well as via a potential market-based instrument under the IMO.[27]

At the industry level, the shipping industry is taking important actions, including technological, operational or engineering-based measures to improve the sector's energy efficiency, reduce fuel consumption and emissions. Relevant initiatives include building fuel-saving and environment-friendly ships, promoting the switch to cleaner fuels and increasingly adopting slow steaming. As an example, SinoPacific Shipbuilding Group launched, in May 2012, a new generation of fuel-saving and environment-friendly bulk carriers which aim at the segmented markets for 60,000, 80,000 and 120,000 deadweight ton (dwt) bulk carriers (CROWN 63, CROWN MHI 82 and CROWN 121 Ultimate, respectively). At a service speed of 14.3 knots, the fuel consumption of CROWN 63 Ultramax bulk carriers is reduced to 25.8 tons per day, representing a 13 per cent reduction in fuel consumption compared to equivalent-sized bulk carriers currently operating.

For the ports and terminals, various opportunities have also emerged for improving environmental sustainability. Examples vary from enhanced port infrastructure design, switching to greener modes of transport for hinterland access (e.g. rail, inland waterways), the adoption of energy efficiency programmes and using renewable energy (such as biofuels, solar energy and wind turbines) to cater for port operations in general, including cargo loading, unloading and warehouses, as well as traffic management systems (both for servicing vessels and for cargo handling inside the terminals). In this context, one study has demonstrated that by mixing 30 per cent biofuels with used diesel can lead to a 13–26 per cent reduction of CO_2 emissions per terminal and to a 21 per cent emission reduction of the total container sector.[28] The so-called cold ironing – whereby ships, while in the port, use onshore electricity as energy source instead of running their engines – constitutes another strategy able to reduce emissions in ports and even in some cases completely eliminating, harmful air emissions from diesel engines. Furthermore, ports and terminal operators see a competitive advantage to be gained in integrating technology to their business processes and in using cleaner land-based cargo-handling equipment such as IT-driven quay cranes and eco-friendly rubber-tyred gantry cranes.

Other port-based measures aiming to achieve greater efficiencies in ports include changing terminal layouts to reduce time and processes required to move containers and cargo. By doing so, a reduction of CO_2 emissions can be generated, as illustrated by the Rotterdam Shortsea Terminal which noted a CO_2 emission reduction of nearly 70 per cent.[29] Another more comprehensive approach consists of incorporating systemic logistics solutions aimed at reducing time and cost into the design and planning of ports and terminals, as shown by the port-centric logistics or cargo hub operating structure.[30] Recent studies[31] have shown that the port-centric model does address the key supply chain challenges of time, cost and carbon emissions. However, in some countries land availability and affordability may be a barrier to delivering fully efficient port-centric solutions. The development of port-centric models have been widely accepted in Europe, where there is a growing shift to the building of logistics centres adjacent to new sea or inland water transport terminals.[32] For example, DP World's London Gateway is developing a large port-centric logistics park connected to a new 3.5 million TEU deep-sea container port located east of London. London Gateway would offer a quicker, more reliable and greener way to transport goods to their destination compared with existing supply chain models. It is estimated that 65 million road-freight miles every year will be saved since goods will no longer need to be transported from deep-sea ports to inland distribution centres.[33] Another scheme to improve sustainability is to investigate how logistics chains can be developed in ways that mitigate empty cargo loads and consolidate shipping journeys via so-called optimization. Enhanced logistics and supply chain management can improve freight loads and storage, thereby reducing the number of trips required for deliveries. Other innovative approaches used by ports to reduce emissions include the so-called low emissions zones or the geographically defined areas that seek to restrict or prevent access to polluting vehicles within and around port areas. Low emissions zones exist in Singapore, Hong Kong (China), Seattle and Antwerp and coast lines such as the West Coast of the United States and the East Coast of China (planned). Together, all these measures can help reduce the carbon footprint and control air pollution in the maritime transport sector while, at the same, improve efficiency in the business.

2. Inland freight transport and logistics

As previously mentioned, the large scale of transport energy consumption and CO_2 emissions is due mainly to land modes, in particular haulage by road. This is likely to grow significantly in the next decades, mostly in developing countries. The travel activity of surface freight transport– including rail, medium-duty truck and heavy truck (in ton-kilometres) worldwide is expected to increase by an average annual rate of 2.3 per cent from 2000 to 2050.[34] In India, this growth will likely be 3.8 per cent over the same period, followed by China at 3.3 per cent, Africa 3.1 per cent and Latin America 2.8 per cent.[35] Therefore, achieving growth and sustainability will become increasingly difficult in the future, without taking into consideration improving fuel efficiency and reducing emission from land transport.

Past experiences, namely from the developed countries, have demonstrated that given the long-lived nature of the transport assets and huge investment implications of the sector, land transport is one of the toughest sectors to switch from or within which to reduce emissions once the systems have been established. For instance, switching to more environmentally friendly modes, such as rail and inland waterways, offers a well-known initially costly alternative that would require long-term planning and appropriate corrective and supportive measures at policy, as well as business and operational levels.

Moreover, there are several challenges, including a fragmented inland freight sector, inadequate policies and institutional arrangements, as well as the limited availability and high cost of technologies that are preventing wide adoption of sustainable strategies.

Yet, there are considerable opportunities to improve sustainability in land freight transport and logistics through a "comprehensive and integrated approach". Subject to a considered cost–benefit analysis and assessment of trade-offs (energy efficiency gains, transport costs, speed and reliability of services, and the like), a number of integrated options have the potential to promote sustainability in land freight transport. This entails, inter-alia, optimizing the performance of multimodal logistics chains, improving the competitiveness of environmentally friendly modes of transport, leveraging technologies capable of improving energy efficiency, logistical efficiency and reducing emissions, as well as creating integrated transport networks and environmentally -friendly dedicated freight corridors.

An example of an integrated transport planning approach is the European Commission White Paper on transport (adopted in March 2011) that defines a strategy towards competitive and resource-efficient transport systems and sets clear objectives and targets such as:

(a) Optimizing the performance of multimodal logistics chains;

(b) Promoting the use of more energy-efficient modes of transport at a larger scale, facilitated by efficient and environmentally friendly freight corridors;

(c) Instigating a 50 per cent shift in longer-distance freight journeys from road to other modes;

(d) Instigating a 40 per cent use of sustainable low-carbon fuels in aviation;

(e) Achieving at least a 40 per cent cut in shipping emissions.

This has the overall objective of achieving a total of 60 per cent reduction in CO_2 emissions and a comparable reduction in oil dependency.[36]

Another example is provided by the Government of Indonesia, which has introduced comprehensive policies that aim at promoting sustainable freight transport systems and reducing the transport burden on roads, the predominant mode of transport (which accounts for about 70 per cent of freight ton-kilometres). These policies include a shift towards greener modes of transport such as rail and short sea shipping (where ferries can carry out roll-on, roll-off operations) and develop rail-based logistics in Jakarta to relieve traffic congestion caused by freight movements. Improving fuel efficiency and reducing land transport related emissions is crucial, given the recent growth in freight movement in Indonesia (which has increased by 67 per cent in 5 years, i.e. from 9.4 billion tons in 2006 to 15.7 billion tons in 2011) and the significant share of CO_2 emissions from land transport (which represent 89 per cent of total transport emissions and about 20 per cent of total national emissions).[37]

An integrated transport planning strategy aimed at promoting more efficient transport and logistics systems would usually encompass the development of intermodal transport and integrated freight transport networks. These would also require the development of appropriate infrastructure and services, facilitating

movement of goods and reducing or eliminating cumbersome procedures along the supply chain, which in turn would enhance efficiency of freight transport systems. One example is the development of multimodal hubs and logistical centres (linked to seaport and freight terminals through railways or waterways) which exist already and are quite advanced in several developed and some developing countries. In Asia, for instance, dry ports with logistics service centres are being developed as an integrating mechanism for regional transport networks. Examples can be found in China, India, Nepal, and Thailand.[38]

Other innovative concepts that countries have developed to promote sustainable freight transport is the establishment of dedicated freight corridors (such as in Australia and India). The purpose of these corridors is to ensure efficient freight movements and shift freight traffic from carbon intensive transport modes such as roads to less carbon intensive transport modes such as rail.[39] Other initiatives have fostered the development of urban logistics centres (such as in Germany and the United Kingdom) to promote efficient delivering and collecting goods in town and city centres while mitigating congestion and environmental externalities. The growing significance of urban freight transport and logistics is related to increased population and sustained economic growth in urban areas. Similarly, in many developing countries, where trade remains largely dependent on primary products and represents a major source of income for a big part of the population, rural transport and logistics networks (such as in China, India and South Africa) are increasingly becoming key for the countries' overall economic development. Many of these countries face significant transport infrastructure deficits in rural areas, including logistics practices and services which increase their losses and hamper their competitiveness.[40] Promoting such concepts would help countries to reduce important inefficiencies in their value chain systems and introduce sustainable and environmentally-friendly transport solutions.

In general, there is no single unified approach to defining and implementing sustainability measures in freight transport for all countries and regions, particularly when dealing with land-freight transport and logistics. Measures to promote sustainable freight transport have to be consistent with a country's longer-term development plans and objectives. These also need to take into account the relative importance of fuel security, emissions, air pollution and the geographical situation of a country. Furthermore, they have to be compatible with the country's level of infrastructure and logistics development as well as its specific local circumstances, including socio-economic issues. An overview of the nationally appropriate mitigation actions (NAMAs)[41] for non-annex I countries (that is, countries not bound by Kyoto targets) shows that there are no systemic actions presented by countries to promote less energy-intensive and carbon-intensive freight transport systems. Countries actions vary in terms of subsector and objectives as described in table 6.1.[42]

Various studies also demonstrate how a combined package of measures (institutional and technical) relating to inter alia energy efficiency, emission intensity, supply chain structure, modal split and vehicle utilization, can enable the move to sustainable freight logistics, but also underline the relative importance of a country's level of development and geography for the application of these measures. For example, the aerodynamic profiling of trucks, which is a cost-

Table 6.1. Overview of nationally appropriate mitigation actions in freight transport (2011)

	Country	Subsector	Type of action	Objective
Modernization of freight train infrastructure	Argentina	Rail cargo	Not known	Modernize the infrastructure of the Belgrano Cargas freight rail system and promote a modal shift from trucks to rail for agricultural products
Programme for energy efficiency in the transport sector in Chile	Chile	Road cargo	Strategy/plan	Promotion of energy efficiency in the transport sector to reduce GHG emissions and to secure sustainable cargo and passenger transport
National plan for freight transport: NAMA pilot study	Colombia	Road cargo	Strategy/plan	Build the planning and implementation capacity of the Ministry of Transport and the National Planning Department in Colombia to structure NAMAs in the transportation sector and more specifically in the field of freight transportation
Shifting freight to electric rail	Ethiopia	Rail cargo	Project	Increase in ton-km of freight transported by electric rail as opposed to road transport. Rail transport will be powered by renewable electricity.

Source: NAMA database.

effective measure of cutting fuel consumption and emissions in developed countries possessing good road infrastructure and high speed operations, may be much less beneficial in less developed countries where infrastructure is not adequate and average speeds are much lower.[43]

The role of industry

At the industry level, a large number of sustainable freight transport initiatives have been introduced, such as: promoting energy efficiency in vehicles (in kilometres and ton-kilometres, using simple options such as adjusting tyre pressures and promoting eco-driving, and more advanced use of technologies such as hybrid diesel–electric engine trucks), shifting to cleaner modes of transport, as well as using low-carbon technologies and ICT. The efficiency of logistics operations can be improved in a number of ways using ICT, including for instance the use of software able to improve the design of transport networks and allow the running of centralized distribution networks and management systems. Implementing such solutions will enable the reduction of freight congestion, waiting times in delivery places, unnecessary trips (reducing frequency of vehicles travelling empty or partially loaded), storage needed for inventory, and so lead to a greener and more efficient transportation. It was noted that optimizing logistics using ICT could result in a 16 per cent reduction in transport emissions globally and could achieve a decline in total global emissions of 1.52 Gt CO_2 by 2020.[44]

Some of the successful private-sector led sustainable freight transport initiatives are provided below:

- The German chemical company, BASF, has set a new policy to use inland waterways to transport over 70 per cent of its supplies, and IKEA has a policy of using trains wherever possible;
- The German food company, Kraft Jacobs Suchard, uses trains to carry raw coffee beans from Bremen to its factories in Berlin. The coffee bean trains, which have replaced local delivery trips by road, have saved 40 per cent of the energy previously used for road transport;
- In the Netherlands, EVO, the employers' organization for logistics and transport, organizes courses and training programmes to teach drivers to drive more economically. Drivers who follow these courses can achieve fuel consumption reductions of up to 10 per cent;[45]
- Walmart aims to double the truck fleet's fuel economy by 2015 and reduce CO_2 emissions by 26 billion pounds by 2020. Trucks in Walmart's distribution network drive 900 million miles a year to deliver goods to the retailer's 4,000 stores. Aside from tyre and aerodynamics technologies, auxiliary power units (APUs) were installed in 2006 on all trucks that made overnight trips, reducing CO_2 emissions by an estimated 100,000 tons and fuel use by 10 million gallons;[46]
- FedEx has launched "EarthSmart" Initiative which encompasses various sustainability efforts, including adding more sustainable delivery vehicles, optimizing delivery routes in order to minimize driving time, and maximizing cargo space in fuel-efficient planes to reduce the number of planes in the sky. Fuel efficiency has increased from 5.4% in 2006 to 15.1% in 2010;
- In China, the Henan Anyang Modern Logistics Information Development, a company established in 2006 as an online logistics information platform that provides freight information exchange services and other value-added services, has helped trucking companies in Anyang city (Henan Province) to reduce the empty mile percentage from 53 per cent in 2006 to 38 per cent in 2008. The total freight empty mileage saving in Anyang is about 137.5 million kilometres, which saved 27.5 million litres of fuel (equal to 165 million Chinese yuan (CNY)) during the same period. The platform has since expanded to the entire province, with more than 50,000 deals made per month and with average savings per month of 43.9 million kilometres, 8.8 million litres of fuel and 52.7 million CNY (approximately $8.2 million);[48]
- The European Chemical Industry Council (CEFIC) introduced in 2011 a study – *Guidelines for Measuring and Managing CO_2 Emissions from Freight Transport Operations* – to assist chemical companies understanding how they can assess and improve their transport-related operations and reduce emissions;[49]
- The Green Freight Asia Network, involving global freight logistics companies, manufacturers, freight carriers and industry associations was established in 2011 to support green freight initiatives and programmes in Asia;[50]
- A joint voluntary commitment to promote green freight in Europe and Asia has been reached

between the Clean Air Initiative for Asian Cities (CAI-Asia), the Secretariat for Green Freight Europe (European Shippers' Council - ESC and EVO Dutch Shippers' Council), and the Sustainable Supply Chain Centre Asia Pacific (SSCCAP) under the auspice of the Rio+20 conference. The programme, which will be fully operational in Europe and Asia, aims to help countries reduce fossil-fuel dependency, improve air quality and minimize CO_2 emissions that contribute to climate change, without hindering economic development.

Even though there has been significant progress in sustainable freight approaches and practices in recent years, sustainable freight transport is still in its infancy and most stakeholders are still in the learning phase. To ensure the delivery of successful initiatives, combined efforts emanating from both the public and private sectors, including comprehensive approaches that would ensure interdisciplinary and inter-institutional collaborations in areas such as research, data analysis and technology, must be strengthened. Strategic thinking and development related to sustainable freight transport must also be reinforced, with the objective of seeking common institutional and operational benefits and efficiencies in terms of transport decarbonization, energy conservation, cost management and efficient freight logistics movement in support of global trade and development.[51]

D. ENABLING SUSTAINABLE FREIGHT TRANSPORT: FINANCE-RELATED CONSIDERATIONS

Transport is shaped by financial flows from various sources – public and private, national and international. The state of financial resources in 2010 indicates that domestic flows (public and private) are the most important source of finance in the transport sector (representing around $583 billion), followed by foreign direct investment (around $149 billion) and international debt finance ($150 billion). Official development assistance (ODA) has been also available but of much lesser magnitude (around $8 billion). Other sources of finance, such as climate finance, are even less significant, representing around $1.25 billion.[52]

Shifting towards sustainable freight transport will require advanced systems which will necessitate more resources and capacities than are available. A fundamental element in this respect will be the promotion of a collaborative approach between public and private investment partners to meet the increased investment requirements for more sustainable transport patterns.

This section will provide a brief overview of some of the relevant sources of financing and their role in prompting current and future development of sustainable freight transport. It is by no means comprehensive, but does highlight some of the main considerations that arise in connection with financing a shift towards sustainable freight transport.

1. Domestic public finance

Domestic public finance (using both domestic and international flows, such as ODA) is an essential source of financing for the transport sector, namely for infrastructure construction and maintenance. Countries typically spend 2–13 per cent of their public budgets on transport.[53] For many developing countries, public financing of transport infrastructure faces a number of challenges. These include:

(a) Competition with other high-priority areas for public funds such as health care, education and debt service;

(b) Tightly constrained national budgets and limited ability of Governments to borrow either at home or abroad;

(c) A significant amount of public finance is spent on environmentally harmful subsidies, most notably on fossil fuels.[54]

Nevertheless, the public sector remains a key player. The role of Government can vary from that of an investment provider to a co-sharer of risks and facilitator of transport infrastructure and services development. The Government has a key role to play in providing incentives and market signals to trigger the shift to sustainable freight transport systems. These can take various forms, such as: the phasing out of fuel subsidies as deemed appropriate and supporting greener freight modes; the application of appropriate pricing mechanisms (such as road pricing taking into account actual externalities); the support of investment (through guarantee/funding) appropriate for the development and operation of sustainable freight transport systems.

Other incentives may involve the development of dedicated financing schemes that would support infrastructure development of sustainable freight transport. As an example, the United Kingdom Department for Transport has developed two freight grant funds to promote a shift of freight movement from road to rail or inland water. The two schemes

(the Mode Shift Revenue Support Scheme and the Waterborne Freight Grant Scheme) are designed to support environmental and social benefits that result from using rail or water transport.[55]

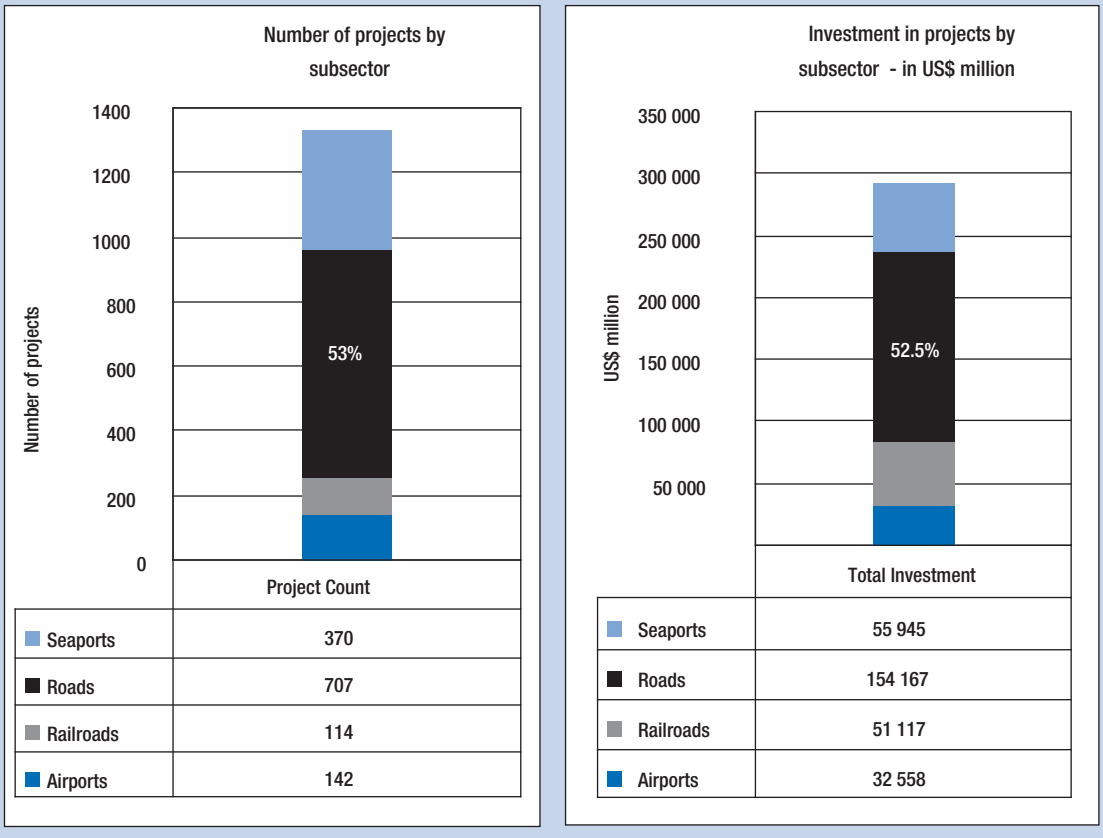
Another example is provided by South Africa, which in its new policy framework for achieving more inclusive and greener growth, has defined green transport as a key strategy that encompasses a new freight rail transport strategy to accelerate the shift from road. The state-owned transport enterprise, Transnet, will invest about R63 billion ($7 billion) in the freight rail system over a five-year period and continue promoting greater use of rail freight by companies.[56]

2. Private finance and public–private partnerships

Traditionally, Governments have had the main responsibility of financing and managing transport infrastructure, but with the growing demand for new infrastructure and efficient and cost-effective infrastructure services, many countries have increasingly turned to the private sector. In recent decades, public–private partnerships (PPPs) have emerged as an important mechanism to scale up public contribution with private sector investment and expertise. Today's transport systems require highly specialized managerial and operational skills, as well as cutting-edge technologies. Therefore, the expertise of private partners for building, operating and maintaining transport infrastructure and services is significant, and constitutes an important resource to draw from in addition to finance.

The private sector is a key player to leverage greater investment and most importantly it allows access to specialized skills, innovations and new technologies associated with sustainable freight transport. Public finance alone will not be able to fund the transition to sustainable freight transport, particularly for developing

Figure 6.4. Number of projects and investment in projects by subsector, 1990–2011



Source: Private Participation in Infrastructure Projects Database – the World Bank and the Public–Private Infrastructure Advisory Facility.

countries, at the speed, scale and expertise required. Private sector participation can enable the required changes and PPPs can serve as an effective means to realize sustainable investments and skills. In many countries, the potential of the private sector still remains largely underutilized and Governments may wish to explore alternative collaboration models of PPPs with appropriate risk-sharing frameworks and administrative and institutional arrangements supported by the necessary legal, regulatory and policy provisions.

Yet, the contribution of private sector investment in the transport industry is greatly influenced by the trends in public finance flows and international support. Observing the investment commitments of private participation in transport infrastructure in the last two decades (figure 6.4), it is clear that the road subsector received a large amount of private investment in developing countries. Of the 1,333 projects with private activities (totalling about $294 billion) carried out in developing countries over the period 1990–2011, 707 (53 per cent) where in the road subsector. Private activity in road projects in developing countries has undergone a resurgence in the past years. Investment commitments to road projects with private participation grew from $7 billion in 2005 to $16.7 billion in 2008.[57]

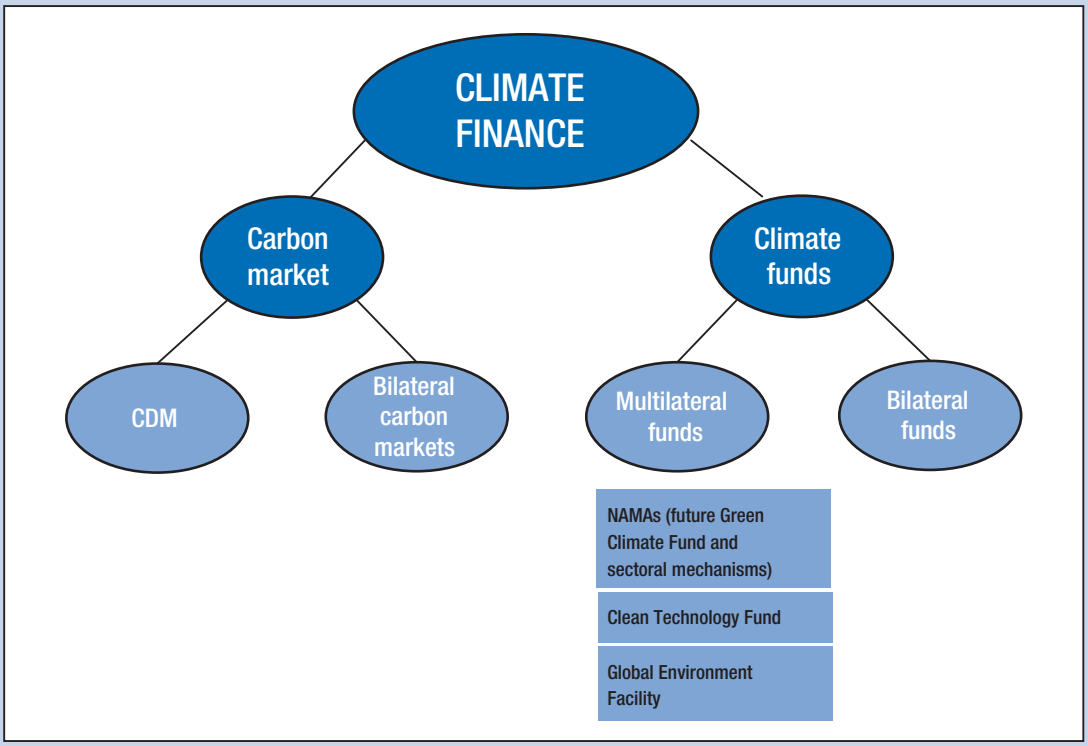
These trends will have to shift to enable the development of more sustainable and efficient modes of transport. The ability of the public sector to reorient and leverage significant private investment and cooperation into sustainable transport projects and initiatives will therefore be crucial.

3. Climate Finance

Climate finance is an important component that could help the shift towards low-carbon and climate-resilient transport development.

Climate finance relates to funding that can be used to support climate change mitigation and adaptation activities. It encompasses both public and private sources of finance and can be used to support activities

Figure 6.5. Climate finance mechanisms



Source: UNCTAD secretariat.

in all sectors of the economy in both developed and developing countries. Consequently, climate finance can be used to help achieve the shift and scale-up of funding for sustainable low-carbon freight transport that directly contributes to the enactment of sustainable development on a larger scale. Yet, climate and environmental concerns are not usually given all the necessary attention when evaluating transport investment projects. Generally, cost–time analysis remains the most significant focus in a project appraisal.

There are, however, several sources and mechanisms of climate finance that can be applied in transport sector today (figure 6.5). These mechanisms can be grouped into two categories: the carbon market and climate funds.

Carbon markets

Carbon markets are mechanisms that provide an incentive to reduce GHG emissions by creating a market for emissions allowances and credits. The carbon market channels financial resources to low-carbon investments through, inter alia, project-based mechanisms such as the clean development mechanism – CDM (regulatory/compliance market) and voluntary markets.[58] The CDM projects are supposed to contribute to sustainable development in developing countries, and also generate real and additional emission savings.

Only 47 out of 7,532 projects in the CDM pipeline were related to transport as of January 2012 (11 of which had been registered).[59] These 47 projects are expected to reduce 5.5 megatons CO_2-equivalents per year up to 2012 – just 0.5 per cent of the total reductions of the current CDM pipeline.[60] The barriers which currently prevent the application of CDM projects in the transport sector relate to the size, scope and complexity of the sector itself. The narrow approach to measuring the mitigation potential of policy actions (and the associated incremental costs), together with the lack of data to allow for the measurement, reporting and verification of mitigation actions, limits the transport sector's access to this source of finance. Nevertheless, within the context of the ongoing negotiations on climate change, the design of financial instruments is becoming increasingly concentrated on tools that can be applied to the transport sector, something that the existing instruments such as CDM have not succeeded in covering (see box 6.1).

Climate funds for sustainable freight transportation

The term climate funds designates financial resources, investment funds and financing instruments that can be used to address the adaptation and mitigation of the climate change impacts activities. Recently, there has been a proliferation of climate fund initiatives (multilateral and bilateral), which seek to mitigate climate risks and help the most vulnerable adapt to climate change. Although not specifically devoted to transport, several of the existing climate funds can be used for the mitigation of GHG emissions or to reduce the negative effect of impacts activities in the transport sector. These include, for example, the Global Environment Facilities, the Clean Technology Fund, the Global Climate Change Alliance, the Inter-American Development Bank (IDB) Sustainable Environmental Climate Change Initiative, the ADB Climate Change Fund, and the ADB Clean Energy Fund. Many of the funds include a sunset clause that stipulates the necessary steps that will be taken to conclude operations once a new UNFCCC financial architecture takes effect (see box 6.2). It is, however, far from clear what the future funding landscape will look like in the post-2012 regime.

For sustainable freight transport, climate finance can be an important tool to support activities targeted to

Box 6.1. The future role of climate finance in enacting green transport

Within a post-2012 framework, mitigation actions in transport in developing countries are likely to fall under the umbrella of NAMAs, which could be financed through:

- A transport window under a mitigation fund such as the GCF – see box 6.2;
- A scaled-up, programmatic CDM;
- A transport-specific instrument;
- Other potential funds specific to capacity building or technology.

The NAMAs supported by developed countries are likely to be financed by fund-type instruments, whereas actions taken to acquire credits would be enacted through a crediting scheme, such as a scaled-up CDM.

Source: United Nations Environment Programme, http://www.unep.org/greeneconomy/Portals/88/documents/ger/GER_10_Transport.pdf.

Box 6.2. The United Nations Green Climate Fund

The establishment of the GCF was decided at the sixteenth session of the Conference of the Parties (COP) to the UNFCCC, held in Cancun, Mexico, in 2010, with the goal of becoming the main multilateral financing mechanism to support climate action in developing countries.

The GCF is expected to start operating by 2014 and is intended to provide $100 billion each year by 2020 to help the mitigation and adaptation activities of the world's poorest countries. Private sector funds can also contribute to programmes.

The GCF will contribute to the achievement of the ultimate objective of the UNFCCC by providing support to developing countries to limit or reduce their GHG emissions and to adapt to the impacts of climate change. Application of the Fund will take into account the needs of those developing countries particularly vulnerable to the adverse effects of climate change. The Fund will also play a key role in channelling new, additional, adequate and predictable financial resources to developing countries, and will catalyse climate finance, both public and private, and at the international and national levels. It will pursue a country-driven approach and promote and strengthen engagement at the country level through effective involvement of relevant institutions and stakeholders. The financing can be in the form of concessional lending, grants and other types as decided by the board.

The GCF will be a legally independent institution with its own separate secretariat and the World Bank as its interim trustee, but functioning under the guidance of and accountable to the COP. Arrangements between the COP and the GCF are to be concluded at COP 18 (in Doha, December 2012) to ensure that it is accountable to and functions under the guidance of the COP.

The biggest challenge of the GCF is to secure adequate and sustained long-term funding. Substantial financial pledges by contributing countries will be necessary to show broad political support for the GCF and secure its viability.
Source: GCF; for more information please refer to http://gcfund.net/home.html.

reducing GHG emissions. The range of eligible activities is broad and encompasses supporting programmes, policies, projects and enabling measures and strategies. However, given the unpredictable size of climate finance and the conditionality associated with it, direct funding to support large infrastructure, even by way of co-financing, is probably out of range. Yet, climate finance can have a particular impact where sustainable freight transport programmes require funding from a combination of sources and when the availability of climate finance can push an activity beyond the tipping point that determines whether or not a given project can be implemented. Climate finance instruments can also be used as a leveraging device that can help promote sustainable freight transport in several ways, including by awareness raising and capacity building, supporting national assessment and policy reforms, implementing pilot measures, identifying and implementing pilot projects, making marginal projects financially viable, and leveraging other funding flows.

E. SUMMARIZING THE POINTS

Some key elements appear as outstanding in the preceding discussions regarding the development and finance of sustainable freight transport. These can be summarized as follows:

(a) The transport sector is a major consumer of world fossil fuels and is responsible for an important part of global GHG emissions and air pollution at local and regional level. To achieve global sustainability and attain the global goal of reducing emissions, urgent actions are needed. These actions must transform the way in which freight transport is growing and address the fuel efficiency and rapid increase in all emissions from the transport sector. This is particularly relevant for developing countries, where freight transport activities will grow substantially and transport systems are being developed. Sustainable freight transport has the potential to increase energy economy and efficiency and thereby address concerns over non-renewable sources, costs and environmental degradation.

(b) Promoting sustainable freight transport systems requires a balancing act between economic, social and environmental considerations, and entails the ability to provide fuel efficient, cost-effective, environmentally friendly, low-carbon, and climate-resilient transport systems. Developing sustainable freight transport systems, based on the avoid–shift–improve approach will help addressing in a systemic fashion different transport and logistics concerns and issues stemming from current and future anticipated economic demands, and climate change and environmental challenges. Reconciling growth imperatives with climate protection and environmental sustainability can be challenging for

transport and logistics, but not impossible. Subject to a considered cost–benefit analysis and an assessment of trade-offs (energy efficiency gains, transport costs, speed and reliability of services, and the like) a number of options have the potential to reduce GHG emissions from transport, while at the same time tackling other environmental concerns such as soil, water and air pollution, noise and infrastructure degradation. Relevant options include, for example, including reshaping transport architecture and networks, rethinking supply chain designs and logistics, balancing transport modes, using cleaner technologies and ICT, switching to low-carbon fuel sources, and the like.

(c) Developing sustainable freight transport systems, based on an avoid–shift–improve approach can help developing countries to leapfrog towards a sustainable development path. By investing in sustainable freight transport systems today, developing countries will be better prepared to reap future economic, social and environment benefits. Missing this opportunity may lead to increased costs in the future, as Governments and industries would eventually face additional expenses to adapt to new circumstances and adopt new transport systems, including new technologies and operating practices.

(d) Although global freight transport has over recent years made important progress regarding compliance with sustainability imperatives, including the efforts made to reduce negative externalities, these efforts are still insufficient. More work is needed and should include comprehensive and integrated approaches that will ensure interdisciplinary and inter-institutional collaboration at all levels (local, national, regional and global) as well as a greater involvement of industry. In this respect, coordinated and combined efforts by both public and private sectors in key areas (such as research and analysis, data collection, policy and regulatory frameworks, technology development) must be reinforced to achieve common institutional and operational benefits and efficiencies. These advances should be in the fields of transport decarbonization, energy conservation, and efficient freight logistics movement in support of global trade and development, and the like.

(e) There is no “one size fits all” standard approach to addressing the challenges associated with the development and the implementation of sustainable freight transport. While it will be important to draw from existing experiences and best practices, each country and region will have to formulate its own approach that will take into account its local-regional circumstances, conditions and opportunities, and that will be consistent with its longer-term strategic development plans and objectives.

(f) Sustainable freight transport requires substantial investments in transport infrastructure, services and equipment. The public sector (as an investment provider, a co-sharer of risk or guarantor, or as facilitator) and the private sectors (through PPPs) have important roles to play to ensure that requisite funding is forthcoming through diversified sources of finance, including climate finance. Climate finance instruments can be used as leveraging devices that can help promote sustainable freight transport in several ways, including by awareness raising and capacity building, supporting national assessment and policy reforms, implementing pilot measures, identifying and implementing pilot projects, making marginal projects financially viable, and leveraging other funding flows. These different sources can be designed to complement each other to drive the change towards sustainable freight transport. Therefore, there is a clear need to take stock of existing transport-relevant financial sources as well as to reorient and structure the sources in accordance with the sustainability criteria.

ENDNOTES

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3 With sustainable transport included for the first time, two paragraphs of the agreed outcome were devoted to sustainable transport (paragraphs 132 and 133) and seventeen sustainable transport Voluntary Commitments were presented by various public and private stakeholders in Rio, http://www.uncsd2012.org/index.php?page=view&type=12&menu=153&nr=371&theme=17).

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9 http://www.who.int/en/ and http://press.iarc.fr/pr213_E.pdf.

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12 Key World Energy Statistics, 2012, IEA.

13 *International Energy Outlook 2011*, The United States Energy Information Administration, http://www.eia.gov/forecasts/ieo/highlights.cfm.

14 http://www.delivering-tomorrow.com/mapping-a-decarbonization-path-for-logistics/.

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23 The "avoid, shift and improve" approach to climate change mitigation, as introduced in Dalkmann and Brannigan (2007) and endorsed in the *Common Policy Framework on Transport and Climate Change* (Leather et al, 2009) aims to reduce GHG emissions and energy consumption and promote sustainable transport, also presented in *Rethinking Transport and Climate Change*, by James Leather and the Clean Air Initiative for Asian Cities Centre, ADB, December 2009.

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26 International Chamber of Shipping (ICS), *Annual Review 2012*. 2012.

27 Ibid. See also Simon Bennett, ICS, presentation at UNCTAD Ad Hoc Expert Meeting 2011.

28 Geerlings H and van Duin R (2010). A new method for assessing CO_2-emissions from container terminals: a promising approach applied in Rotterdam. *J. Cleaner Production*, 11 November 2010.

29 Ibid. The same study emphasizes that one of the most effective measures for CO_2 reduction is undoubtedly the adaptation of the terminal layout as in the example of the Rotterdam Shortsea Terminal. This makes it possible to reduce the CO_2 emissions of the current terminals by nearly 70 per cent.

30 Mangal and Al (2008) defines port-centric logistics as the provision of distribution and other value adding logistics services at a port.

31 Such as the research paper *Time, cost & carbon – does the port-centric model have benefits in the supply chain where goods are imported by suppliers to UK retailers?* conducted by the University of Southampton (summary of findings can be found at http://www.importservices.co.uk/files/PDFFiles/Report%20V3.pdf), and the research project "Decarbonising the Maritime Supply Chain: Assessing the Contribution of the Shippers", being undertaken by the Logistics Research Centre, Heriot-Watt University , by Prof. Alan McKinnon, Dr. Dong-Wook Song, and Mr. Rob Woolford, http://www.fta.co.uk/export/sites/fta/_galleries/downloads/international_supply_chain/decarbonising_the_maritime_supply_chain_heriot_university_research_project.pdf, including article: http://www.portstrategy.com/features101/port-operations/port-services/portcentric-logistics/portcentric-steps-up.

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36 http://ec.europa.eu/transport/strategies/doc/2011_white_paper/white-paper-illustrated-brochure_en.pdf.

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41 Nationally appropriate mitigation action (NAMA) refers to a set of policies and actions that countries undertake as part of a commitment to reduce greenhouse gas emissions. The term recognizes that countries may take different nationally appropriate action on the basis of equity and in accordance with common but differentiated responsibilities and respective capabilities. It also emphasizes financial assistance from developed countries to developing countries to reduce emissions. The policy framework around NAMAs is still being developed but NAMAs are set to become a building block for a future climate agreement.

42 NAMA Database, http://namadatabase.org/index.php/Transport.

43 Examples of relevant studies mainly relate to those conducted by Professor Alan McKinnon, Kühne Logistics University in Hamburg, including: Mapping a Decarbonization Path for Logistics 2012; Green logistics: the carbon agenda, Vol. 6, Issue 3 No 1, logfourm, 2010; The role of Government in promoting green logistics 2010; The present and future land requirements of logistical activities: Land Use Policy, vol. 26S, 2009, etc. For list of publication, please refer http://www.the-klu.org/alan-mckinnon-publications/.

44 *Smart 2020: Enabling the low carbon economy in the information age*, a report by The Climate Group on behalf of the Global eSustainability Initiative (GeSI), 2008, http://www.smart2020.org/_assets/files/02_Smart2020Report.pdf.

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54 http://www.itdp.org/documents/A_Paradigm_Shift_toward_Sustainable_Transport.pdf.

55 Mode Shift Revenue Support (MSRS) assists companies with the operating costs associated with running rail freight transport instead of road (where rail is more expensive than road). It is designed to facilitate and support modal shift, generating environmental and wider social benefits from reduced lorry journeys on United Kingdom roads. Since September 2009 this scheme has also been open to inland waterway traffic and The Waterborne Freight Grant (WFG) scheme assists companies with the operating costs, for up to three years, associated with running water freight transport instead of road (where water is more expensive than road). http://www.dft.gov.uk/topics/freight/grants.

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57 http://ppi.worldbank.org/features/October2009/didyouknowOctober2009.aspx.

58 The United Nations Kyoto protocol established binding GHG emission reduction targets for 37 industrialized countries and the European Community. To help achieve these targets, the protocol introduced three "flexible mechanisms" – international emissions trading (IET), joint implementation (JI) and the CDM. The CDM allows developed countries to partially meet their GHG limitation commitments acquiring credits from emission reductions resulting from projects implemented in developing countries (which have no GHG limitation commitments under the Kyoto Protocol). JI allows developed countries to partially meet their targets acquiring emissions reductions credits achieved by projects implemented in other developed countries. IET allows countries to transfer and acquire emissions credit from other countries to help meet their domestic emission reduction targets.

59 Registration is the formal acceptance by the Executive Board of a validated project as a CDM project activity. Registration is the prerequisite for the verification, certification and issuance of Certified Emission Reductions related to that project activity.

60 From UNEP Risoe CDM/JI Pipeline Analysis and Database, http://www.cdmpipeline.org/cdm-projects-type.htm#2.