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Small island developing States: Challenges in transport and trade logistics

Note by the UNCTAD secretariat

Executive summary

Small island developing States (SIDS) are a diverse group of island countries that share some common features and vulnerabilities such as insularity, geographic remoteness, and smallness of economies, populations and area. Together, these factors emphasize the importance of well-functioning, reliable, sustainable and resilient transportation systems, in particular maritime and air transport for SIDS development and survival. In this context and capitalizing on the renewed international commitment to advance the sustainable development agenda of those States, UNCTAD is increasingly focusing its attention on to tackle challenges in transport and trade logistics faced by SIDS. Relevant activities include a special chapter of the annual Review of Maritime Transport 2014 (forthcoming) devoted to developments in the maritime transport sector of SIDS, an ad hoc expert meeting held on 11 July 2014 considering the theme "Addressing the transport and trade-logistics challenges of the small island developing States: Samoa Conference and beyond", and a contribution to the Third International Conference on Small Island Developing States (Samoa Conference) in the form of a substantive report entitled "Closing the Distance: Partnerships for Sustainable and Resilient Transport Systems in SIDS" (forthcoming).

This paper highlights some of the key challenges in transport and trade logistics facing SIDS and identifies areas of potential action with a view to meeting these challenges and explores potential opportunities. Considerations raised seek to inform deliberations at the meeting and stimulate discussions with a view to shaping the way forward, in particular, in the light of the outcome of the Samoa Conference and the post-2015 development agenda.

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Introduction

1. SIDS[1] are a diverse group of island countries in terms of geographical location, land area, population size and markets, gross domestic product (GDP) and level of development. Despite these differences, however, SIDS share some common features that distinguish them as a special sustainable development case.[2] These include insularity, geographic remoteness, and smallness of economies, populations and area. As a by-product of these features, SIDS have extensive territorial waters and exclusive economic zones, high export concentration, deep openness to international trade, heavy import reliance, significant exposure to external shocks, and vulnerability to environmental degradation and threats, in particular natural disasters or extreme events. SIDS are threatened by factors affecting climate change, particularly sea-level rise and extreme weather events.

2. With SIDS being sea locked, access to well-functioning and reliable transportation systems, in particular maritime and air transport systems, is vital. Seaports and airports are the lifelines sustaining the survival of these States, especially since they are highly dependent on transport-intensive imports for much of their consumption needs, for example food and energy. While maritime transport accounts for nearly 80 per cent of world merchandise trade by volume, this share is higher for SIDS. Although maritime transport is the predominant mode used to carry cargo and freight, air transport is relied upon primarily for passenger and tourist transport and domestic inter-island shipping and mobility.

3. Recognizing the special case of SIDS and related sustainable development challenges, the United Nations system has worked towards mitigating their vulnerabilities. In 1992, the United Nations Conference on Environment and Development – the Earth Summit – defined SIDS as a distinct group of developing countries with specific economic, social and environmental vulnerabilities. In 1994, the Programme of Action for the Sustainable Development of Small Island Developing States (Barbados Programme of Action) was finalized and adopted. It was reviewed in 2005 and revamped by the Mauritius Strategy for the Further Implementation of the Programme of Action for the Sustainable Development of Small Island Developing States. In September 2014, the Third International Conference on Small Island Developing States, held in Samoa, provided the international community with a fresh opportunity to revisit the vulnerabilities of SIDS in the light of changing global circumstances and new insights, including in relation to the impacts of climate variability and change.

4. Capitalizing on this opportunity and in accordance with its most recent Doha mandate which directs UNCTAD to "advise SIDS on the design and implementation of policies addressing their specific trade and trade logistics challenges linked to their remoteness and geographical isolation" (para. 56 (j); see also paras. 6 and 48). UNCTAD has carried out a number of activities to help advance the transport agenda of SIDS. These include a special chapter of the annual Review of Maritime Transport 2014 (forthcoming)

[1] For the purposes of this paper and unless otherwise specified the term refers to the following 29 SIDS categorized by UNCTAD: Caribbean – Antigua and Barbuda, the Bahamas, Barbados, Dominica, Grenada, Jamaica, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Trinidad and Tobago; Pacific: Fiji, Kiribati, Marshall Islands, the Federated States of Micronesia, Nauru, Palau, Papua New Guinea, Samoa, the Solomon Islands, Tonga, Tuvalu and Vanuatu; Indian Ocean and West Africa – Cabo Verde, Comoros, Maldives, Mauritius, Sao Tome and Principe, Seychelles and Timor-Leste.

[2] See in particular R Read, Trade, Economic Vulnerability, Resilience and the Implications of Climate Change in Small Island and Littoral Developing Economies, ICTSD Issue Paper No. 12, June 2010; L Briguglio and W Galea, 2003, Updating and Augmenting the Economic Vulnerability Index, Occasional Paper by the Islands and Small States Institute of the University of Malta.

devoted to the maritime transport sector in SIDS, as well as an ad hoc expert meeting on the theme "Addressing the transport and trade-logistics challenges of the small island developing States: Samoa Conference and beyond". Held on 11 July 2014, the meeting offered an opportunity to discuss the specific transport-related challenges facing SIDS and consider ways in which these could be better understood and adequately addressed. Insights gained from the meeting[3] helped inform the contribution of UNCTAD to the Samoa Conference in the form of a substantive report entitled "Closing the Distance: Partnerships for Sustainable and Resilient Transport Systems in SIDS" (forthcoming).

5. Against this background and drawing in particular on the outcome of discussions at the ad hoc expert meeting of July 2014,[4] as well as on the contribution of UNCTAD to the Samoa Conference, this paper highlights some of the key transport and trade logistics-related challenges facing SIDS and identifies areas of potential action with a view to meeting these challenges and exploring potential opportunities. The aim of the paper to is to stimulate discussions at the meeting and shape the way forward in the light of the outcome of the Samoa Conference and the post-2015 development agenda.

I. Key challenges in transport and trade logistics faced by small island developing States

6. The small size, remoteness and insularity of SIDS pose daunting challenges in transport and trade logistics and undermine their ability to achieve their sustainable development goals. While their unique vulnerabilities with regard to transport had been recognized decades ago, they, nevertheless, remain ever more present today and are further exacerbated by concurrent trends such as globalization, environmental degradation, climate change and limited financial resources for infrastructure development and maintenance. In relation to maritime transport, relevant challenges are affecting, among others, shipping services, transport costs, port infrastructure and equipment, as well as markets and operations.

A. Shipping

1. Cargo volumes and imbalances

7. Small cargo volumes in SIDS limit their ability to benefit from economies of scale or attract shipping services and investors. Smaller vessels need to be used, which bring higher costs per 20-foot equivalent units (TEUs) than larger vessels. When combined with relatively low and imbalanced import and export volumes, remoteness, which results in long and indirect transport routes, can have a significant impact on transport costs.[5] Meanwhile, significant trade imbalances are also creating operational challenges and higher costs. In this context, considerations of ship economics (ship size in relation to volume of

[3] Ad Hoc Expert Meeting on Addressing the transport and trade-logistics challenges of the Small Islands Developing States: Samoa Conference and beyond, Summary of Discussions and Outcomes, UNCTAD/DTL/TLB/2014/3.

[4] For presentations and documentation, see http://unctad.org/en/pages/MeetingDetails.aspx?meetingid=586.

[5] Apart from Trinidad and Tobago, Seychelles, Papua New Guinea and the Solomon Islands, import values are many times the export values. Available evidence suggests that this is also the case for weight-based data. UNCTAD estimates the total volume of goods unloaded in developing Oceania (i.e. the Pacific SIDS) at 13.1 million metric tons in 2013, nearly twice the weight of goods loaded (7.5 million metric tons). (Review of Maritime Transport 2014 (forthcoming), chapter 1).

cargo, required service frequency, route length, ship speed, physical constraints to ship size at ports and time in ports) and indivisibilities in associated seaport infrastructure, superstructure and equipment can all drive up transport and import costs, and reduce the competitiveness of exports.

2. Access to global shipping networks

8. Participation in global trade depends significantly on a country's ability to access reliable transport services that connect regional and global trading partners and to do so cost effectively. A country's position within the global liner-shipping network depends largely on factors that determine transport cost levels. These include in particular, geographical location, the hinterland and the captive cargo base, as well as port characteristics and overall non-physical aspects, including efficiency, process and the underlying regulatory framework. The UNCTAD liner shipping connectivity index computed for the first time in 2004 illustrates the difficulties faced by SIDS in accessing regional and global markets. Symptomatic of their underlying transport challenges, SIDS rank very low on the index.[6]

9. SIDS are very remote from the major global markets located in Asia, North America, North Europe, the Mediterranean, Western Asia and the Indian subcontinent. The weighted average distance from these markets is around 8,200 kilometres (km) for Caribbean SIDS and around 11,500 km for Pacific SIDS. This remoteness is an important factor contributing to higher transport costs in these States. As SIDS are not in the path of the main shipping lanes network connecting these markets, they are served primarily by north–south shipping routes based in major relay or transhipment hubs located on the east–west container belt. Among others, the smaller container volumes on the north–south routes means that the vessel sizes employed on these routes are smaller with concomitant higher costs per TEU.

3. Inter-island domestic shipping

10. While international and regional transport connectivity is important for all SIDS, inter-island domestic transport is of equal importance, not only to reach outer islands that are spread across vast distances, but also to service productive sectors such as tourism, fisheries and agriculture. For example, domestic inter-island shipping services in many countries of the Pacific region – especially to outer islands – are infrequent and unreliable. This has a negative impact on the production and income generation possibilities of islands, as regular access to markets is a critical factor. The lack of adequate shipping services limits the ability of islanders to generate the income necessary to pay for shipping services, while infrequent and unreliable shipping schedules also lead to increased safety risks to passengers and cargo, and added costs for outer island transport. These conditions in turn limit opportunity for social interaction; access to education, health, and business development services; and the ability of public agencies to deliver programmes and develop social infrastructure in the outer islands. They also increase the prices of essential goods

[6] UNCTAD has estimated the minimum theoretical number of transhipments necessary to ship a container between country pairs when no direct connections exist between them. For the Caribbean SIDS, the average minimum number of transhipment moves required to ship a container from the Caribbean to Europe is 0.8; to the Americas, 0.9; to Asia, 1.3; to Africa, 1.9; and to the Pacific region, 2.3. The average number of required transhipments for containers from Africa and Indian Ocean SIDS to Africa, Asia, Europe, the Americas and the Pacific region are 1.1, 1.1, 1.5, 1.9 and 2.4, respectively. To ship containers within the Pacific, to Asia, the Americas, Europe and Africa, UNCTAD estimates the average number of required transhipments as 0.5, 1.0, 1.8, 2.2 and 2.3, respectively.

and discourage production and marketing of local products, for example copra, fruits, vegetables, fish and handicrafts.

11. To address these concerns, franchising schemes[7] have been used, for example, in the Pacific region. These schemes allow governments to contract private operators to deliver inter-island shipping services of a predetermined quality to specified populations have been implemented in Pacific Island countries with varying degrees of success.[8]

4. High degree of dependency on energy imports

12. SIDS are highly dependent on fossil fuel imports; most of them spend more than 30 per cent of their foreign exchange earnings, annually.[9] Moreover, with oil prices having increased significantly over the past decade and sustained elevated price levels likely in the longer term,[10] the collective expenditure of island States is growing.[11] Given the geographical settings of SIDS, transportation is proving to be one of the fastest consumers of petroleum.

13. Transport consumes around 70 per cent of the total fuel imported in the Pacific region, and sea transport is the majority fuel user for some Pacific island countries.[12] In Tuvalu, for example, 38 per cent of total fuel imports or 64 per cent of all transport fuel in 2012 was for maritime use.[13] This puts a strain on countries' foreign exchange earnings and public finances and exposes SIDS to a high degree of rising and volatile energy prices. This in turn increases transport and logistics costs, and has a ripple effect on their productive sectors.[14] Although renewable energy sources such as solar, biomass and wind are already being used in several SIDS and in a number of sectors, these need to be further developed to ensure a more sustainable approach to energy generation and use in SIDS. In this respect, the Draft outcome document of the third International Conference on Small Island Developing States (A/CONF.223/3, para. 47) recognizes this dependence on fossil fuel imports as a major source of SIDS vulnerabilities and highlights the efforts of SIDS to advance sustainable energy, including through the Barbados Declaration on Achieving Sustainable Energy for All in Small Island Developing States. Regional and international development banks, the United Nations system, the International Renewable Energy Agency and developed partners are urged to intensify funding, capacity-building and technology support to SIDS in advancing sustainable energy objectives.

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[7] For further details, see UNCTAD, forthcoming, op. cit.

[8] See Selected Policy Issues in Inter-island Shipping, Note by the secretariat of the Economic and Social Commission for Asia and the Pacific (ESCAP), TD/EGM.1/2011/INF/5, available at http://www.unescap.org/ttdw/MCT2011/EGM/EGM1-INF5.pdf.

[9] The Small Island Developing States Sustainable Energy Initiative – SIDS DOCK Briefing Note, available at http://www.gov.gd/egov/pdf/SIDS_DOCK_doc.pdf.

[10] UNCTAD, 2010, Oil Prices and Maritime Freight Rates: An Empirical Investigation, Technical Report, UNCTAD/DTL/TLB/2009/2, 1 April.

[11] Collectively, all island States spend over $67 million a day for more than 900,000 barrels of oil ($75 per barrel), $90 million ($100 per barrel), $108 million ($125 per barrel), and $126 million ($140 per barrel). SIDS DOCK Briefing Note, see footnote 10.

[12] A Newell et al., 2014, Turning the Tide: The need for sustainable sea transport in the Pacific, http://www.mace.manchester.ac.uk/our-research/centres-institutes/tyndall-manchester/conferencesandseminars/.

[13] Ibid.

[14] UNCTAD, 2010, op. cit.

5. Shipping market structures

14. At the global level, liner shipping is a highly concentrated industry, with the top 10 companies accounting for 60 per cent of global container-carrying capacity and the top 20 companies controlling around 80 per cent.[15] In relation to the transport of SIDS, concerns have been expressed about anticompetitive practices, including collusion, in setting freight rates.[16] In the Pacific, the Governments of the Marshall Islands, the Federated States of Micronesia and Palau, with Saipan and Guam, have formed the Micronesian Shipping Commission. It restricts entry to the shipping market to encourage and promote an economical, reliable, safe and coordinated system that meets the demand for international commercial shipping throughout the three Micronesian island nations. Similarly, The Central Pacific Shipping Commission (Kiribati, the Marshall Islands, Nauru and Tuvalu) became operational on 1 January 2014 after it was officially launched on 4 August 2010.[17] The rationale of the Commission is to ensure sustained commercial shipping services for the common interest, needs and public welfare of the respective communities through controlled competition.[18] Two Pacific Island studies have, however, questioned the need for such arrangements and/or their suitability.[19]

6. Freight rates and transport costs

15. Low shipping costs are critical for trade, especially in developing countries, where international transport costs can often surpass customs duties as a barrier to international trade.[20] SIDS generally face relatively higher freight costs for the transport of their imports, owing to their unique features and vulnerabilities, in particular, remoteness, smallness and insularity. According to UNCTAD estimates (figure 1), the 10-year average of selected SIDS expenditures on international transport costs as a share of the value of their imports (2004–2013 average) was about 10 per cent, that is, two percentage points higher than the world average (8.1 per cent). The highest values are estimated for Comoros (20.2 per cent), followed by Seychelles (17.9 per cent), the Solomon Islands (17.4 per cent), and Grenada (17 per cent). The freight costs paid by SIDS totalled $4.1 billion in 2013, 60 per cent higher than in 2005.[21]

[15] UNCTAD, 2013, *Review of Maritime Transport 2013*, table 2.5.

[16] The Economic Commission for Latin America and the Caribbean, for example, in considering "Maritime sector and ports in the Caribbean: the case of CARICOM countries" (2009) noted that "Price arrangements of the oligopolistic quasi monopolistic structure of maritime service providers lead to an overpricing of services, which impedes competitiveness of export products". RJ Sanchez and G Wilmsmeier, Maritime sector and ports in the Caribbean: The case of CARICOM countries, CEPAL – Series Recursos naturales e infrastructura, No. 140.

[17] See http://www.spc.int/en/component/content/article/216-about-spc-news/1604-central-pacific-shipping-commission-special-general-meeting.html.

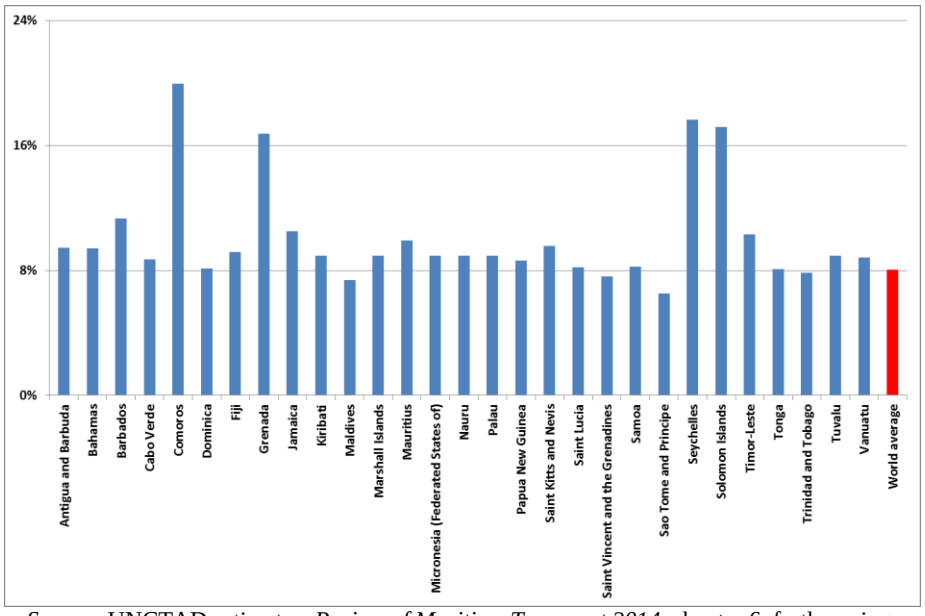
[18] Secretariat of the Pacific Community, Regional Maritime Programme, available from http://www.spc.int/maritime/index.php?option=com_content&task=view&id=204& Itemid=1. For further details, see http://rmipa.com/wp-content/uploads/2013/10/CPSC-Overview.pdf.

[19] Australian Agency for International Development (AusAID), 2004, Pacific Regional Transport Study, Country Reports; and Asian Development Bank, 2007, *Oceanic Voyages: Aviation and Shipping in the Pacific Region*, http://www.adb.org/publications/oceanic-voyages-aviation-and-shipping-pacific-region.

[20] UNCTAD, 2010, op. cit.

[21] UNCTAD, forthcoming, op. cit.

Figure 1
Average expenditures on international transport as a percentage of the value of imports, 2004-2013



Source: UNCTAD estimates, *Review of Maritime Transport 2014*, chapter 6, forthcoming.

B. Seaport infrastructure and equipment

1. Infrastructure

16. The age of some port infrastructure and superstructure, often combined with poor maintenance, means that their structural integrity may be compromised. Restrictions on vessel sizes berthing alongside the infrastructure need to be established and/or weight restrictions on cargo and vehicles imposed. The state of the infrastructure may make costly rehabilitation or reconstruction necessary. Relocation of the facility is generally not an option. The port infrastructure facilities of a number of SIDS were constructed before containerization**.** Consequently, deck loadings, terminal designs and layouts, including space allocated to warehousing and storage spaces, do not necessarily meet the requirements for the rapid handling of containers.

17. Adequate maintenance of port infrastructure is essential to enable the assets to provide the services for which they were designed and to prevent rapid deterioration due to maintenance postponements. In most grant-aided or loan projects, the responsibility for repairs and periodic maintenance lies with the recipient port or country; however, maintenance may be costly, and in many cases financing may not be adequate.

18. Growing tourism has resulted in increased calls of cruise ships. Without dedicated berthing facilities, cruise ships are generally given priority berthing at cargo-handling facilities. This delays the cargo-handling process, which increases the costs of imports and reduces export competitiveness. Separation of cargo and passenger services is also desirable for safety, amenity, and aesthetic and location reasons; in some cases, countries have found more centrally located sites for passenger terminals.

19. The approach channels, anchorages and port areas of many SIDS are particularly vulnerable to maritime accidents, such as vessels grounding and/or sinking, and vessels colliding with one another or with port infrastructure. This vulnerability arises because

narrow approach channels can become obstructed in the case of grounding or sinking. It also arises because ports may only have one cargo-handling berth which, if damaged by collision or rendered unusable – for example, by wreckage in case of a collision – would have major economic repercussions. Associated with such accidents are the risk of oil spills (bunkers or cargo)[22] and the limited technical and financial resources of SIDS to remove sunken or damaged vessels.

2. Equipment

20. The efficient handling of containers requires adequate equipment to move containers from the ship's side to the stacking area as well to move them in the stacking area or out of the port area. There are different subsystems in the movement of containers, the capacities of which need to be matched and timed to avoid delays and ensure optimal efficiency. In addition to adequacy of equipment, another issue is the maintenance of the equipment assets created by projects due to inadequate funding, lack of spare parts and the absence of adequate maintenance plans and/or of skilled local maintenance staff. There is a need to develop appropriate maintenance schedules, keep an adequate stock of spare parts,[23] allocate funds for maintenance and ensure that maintenance staff is appropriately trained.

3. Financial constraints

21. Financing is a key challenge when developing, rehabilitating and maintaining port infrastructure and facilities. Limited financial resources are at the heart of the problem, especially as SIDS are often highly indebted and – in view of their classification as middle-income countries – have limited access to concessionary loans and resources.

22. Sources of funds for capital expenditures on infrastructure include public sector budgets (current revenues or public borrowing), official development assistance (including concessionary loans and grants),[24] the private sector and combinations thereof. In many cases, only limited funding has been made available from public sector budgets for the development, rehabilitation and maintenance of maritime infrastructure.

C. Tourism: Air transport and cruise-ship transport

23. The importance of the tourism sector for SIDS economies and its strong linkages to transport cannot be overemphasized. Tourism is a key source of export earnings for all SIDS and, on average, accounts for about 30 per cent of total employment and up to 50 per cent of GDP.[25] Travel services[26] exports by SIDS reached $24 billion in 2012,

[22] See UNCTAD, 2012, Liability and Compensation for Ship-Source Oil Pollution: An Overview of the International Legal Framework for Oil Pollution Damage from Tankers (UNCTAD/DTL/TLB/2011/4).

[23] Related to this issue is the case where different donors may give different brands of equipment that require different sets of spare parts, making spare parts compatibility difficult.

[24] A number of organizations provide official development assistance: the Asian Development Bank, the World Bank, the International Finance Corporation, the European Investment Bank, AusAID, the European Commission, Agence française de développement, the German Agency for International Cooperation, the Japan International Cooperation Agency, and the New Zealand Government (New Zealand Aid Programme). Strengthening Inter-island Shipping in Pacific Island Countries and Territories, Background Paper 1, 10 July 2013, High-level Meeting on Strengthening Inter-island Shipping and Logistics in the Pacific Island Countries Organizers: Economic and Social Commission for Asia and the Pacific, 23–25 July 2013,Suva, Fiji.

[25] Statement by the Secretary-General of UNCTAD at the Blue Economy Summit, Abu Dhabi, 20 January 2014.

representing more than 50 per cent of their total services. Tourism arrivals by air are particularly high for the Caribbean SIDS (about 5.7 million passengers in 2011) as well as Mauritius, Seychelles and Cabo Verde. This high passenger carriage is due to the direct flight links that Caribbean SIDS, Mauritius, Seychelles and Cabo Verde maintain with trading partners.[27]

24. However, high air transport prices can lead to declining tourist flows and revenues, as price is an important determinant in tourists' choices. One study that assessed the competitiveness of islands as tourist destinations found that the cost of a holiday (price of flights and three- and four-star hotel accommodation) is a key factor determining demand for SIDS tourism.[28] In terms of domestic demand for air transport and tourism services, high fares, coupled with high poverty levels, common in the Pacific and some Indian Ocean and West African SIDS, makes it difficult to stimulate domestic demand for the tourism sector. Reduced traffic impedes the financial viability of highly capital intensive airport infrastructure, equipment and vehicles. Insufficient upgrading and maintenance of air transport infrastructure in turn leads to higher air fares and acts as an obstacle for most SIDS in terms of market route development.

25. Several SIDS have sought to overcome transport connectivity and cost issues of long-haul, multi-leg and expensive flights by setting up direct flight connectivity with cities of tourist origin and effectively utilizing cheap chartered flights that consume less fuel per passenger.[29] Regional air connectivity has also been effectively leveraged by some SIDS. In the Caribbean, regional air carriers such as Leewards Island Air Transport have been crucial to intra-Caribbean tourism by servicing all of the Caribbean, as well as outbound and inbound travel. Indian Ocean and West African SIDS are concerned that the fragmentation of the air transport sector and tourism markets may affect regional competitiveness. Consequently, the Indian Ocean Commission introduced the "Vanilla Islands" concept, which aims to seamlessly integrate air transport with tourism mobility among Indian Ocean SIDS and with the rest of the world.[30]

26. The Caribbean is a major destination for cruise ships, with up to 18.2 million arrivals in 2008. Other SIDS, such as Cabo Verde, Fiji and Seychelles, are also ports of call on around-the-world itineraries. This segment of the tourism sector is highly dependent on marine transport, as cruise ships require investment in port infrastructure to accommodate the increased size and number of vessels. As noted above, and since berthing space is limited, cruise ships often compete with cargo vessels to berth.

D. Natural hazards: Geological hazards and extreme weather events

27. Many SIDS are located unfavourably in terms of tectonic (seismic and volcanic) activity and in relation to global weather systems, resulting in increased exposure to natural

[26] All goods and services acquired from SIDS by non-resident travelers during visits shorter than one year.

[27] UNCTAD, forthcoming, op. cit.

[28] I Vella, 2009, The Price of Competitiveness of Small Island States as Tourist Destinations, Occasional Papers on Islands and Small States, No. 6/2009, ISSN 1024-6282.

[29] http://www.cepal.org/portofspain/noticias/paginas/1/44351/Green_Economy_in_SIDS_Challenges_Opportunities_2011.pdf.

[30] Indian Ocean Commission, Placing the Indian-oceanic region on the world map, 8 November 2013, available at http://www.commissionoceanindien.org/fileadmin/resources/Partenaires/Booklet_IOC_English_nov13-GR.pdf.

hazards of tectonic and meteorological origin, including earthquakes, volcanic eruptions, tsunamis, hurricanes and typhoons.[31]

28. Many SIDS lie along tectonically active margins and/or volcanic hot spots (for example, Cabo Verde) and thus are vulnerable to earthquakes, volcanic eruptions and tsunamis. Most Caribbean SIDS are located close to the Puerto Rico Trench on the edge of the tectonic Caribbean plate, whereas several Pacific SIDS, such as Fiji, Vanuatu, Samoa, the Solomon Islands, Tonga, Papua New Guinea and Timor-Leste, are also located in tectonic plate collision zones. Therefore, these SIDS are exposed to potentially devastating earthquakes,[32] volcanic eruptions and tsunamis. For example, in the Caribbean region alone there has been evidence suggesting the occurrence of 75 tsunamis in the last 500 years – about 10 per cent of the total global number of tsunamis estimated for this period. Tsunamis have reportedly killed more than 3,500 people in the region since the mid-nineteenth century, according to the National Oceanic and Atmospheric Administration. In recent decades, population growth and a concentration of foreign tourists in the coastal areas have greatly increased the region's vulnerability.[33] Between 1990 and 2012, tsunami-related casualties in SIDS included more than 2,500 deaths; estimated asset and infrastructure damages amounted to nearly $660 million. In 2004, the Maldives ($470 million) and Samoa ($150 million) suffered the highest damages.

29. SIDS are also exposed to extreme meteorological events, such as storms, floods, droughts and heat waves, as well as changes in the patterns of particular climatic systems, for example, monsoons.[34] These extreme events can have very serious impacts on their transport infrastructure and services. Most SIDS are located in regions with intensive cyclonic activity (figure 2) that may generate extreme hydro-meteorological conditions, with consequences that are difficult to predict. Their variability covers a large spectrum, such as sudden and transient temperature changes, bursts of extreme precipitation, intensive storms and storm surges,[35] extended droughts and heat waves. There is evidence to suggest that tropical and temperate storms may respond to a warming climate by becoming even more extreme. For example, even a modest increase of 5 metres (m) per second in the surface wind speed of tropical cyclones, driven by a 1^0 Celsius (C) rise in the ocean temperature, may result in a substantial increase of the incidence of the most intense and destructive cyclones.[36]

[31] It has been proposed that there are no natural disasters, only natural hazards (http://www.unisdr.org/who-we-are/what-is-drr).

[32] The devastating shallow (13 km deep), powerful (7.0 R magnitude) earthquake of Haiti on 12 January 2010 resulted in 316,000 people killed, 300,000 injured, 1.3 million displaced, 97,294 houses destroyed and 188,383 damaged (http://earthquake.usgs.gov/earthquakes/eqarchives/year/2010).

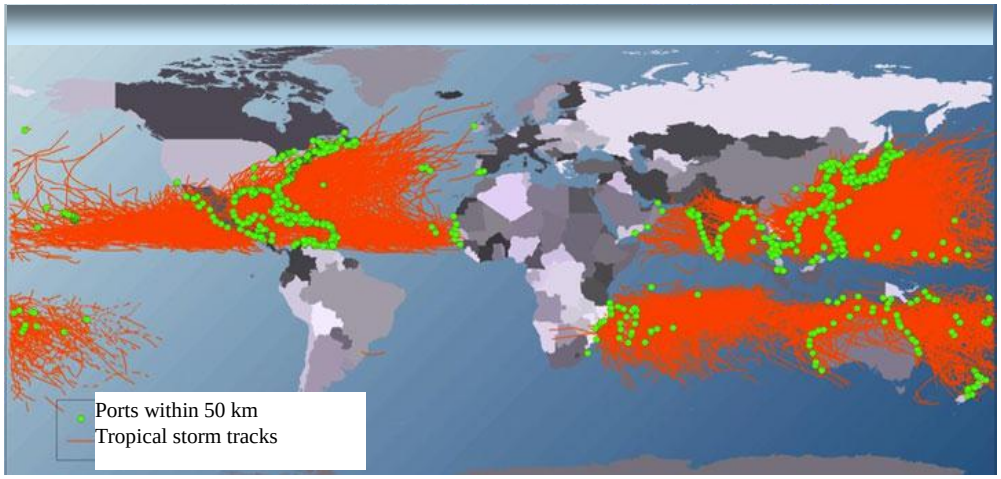
[33] See http://reliefweb.int/report/haiti/full-scale-test-today-caribbean-tsunami-warning-system.

[34] See K Richardson et al, 2009, Synthesis Report, Climate change: Global Risks, Challenges and Decisions, University of Copenhagen; and IPCC, 2012, *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation, Special Report of the Intergovernmental Panel on Climate Change*, CB Field et al., eds. (New York, Cambridge University Press).

[35] Storm surges are temporary increases in sea levels, caused by changes in atmospheric pressure and winds. Storm surges are controlled by the regional/local topography, add to the extreme tidal levels and increase the risk of coastal flooding.

[36] See K Emanuel, 2005, Increasing destructiveness of tropical cyclones over the past 30 years, *Nature* 436: 686–688; and RP Allan and BJ Soden, 2008, Atmospheric warming and the amplification of precipitation extremes, *Science* 321:1481–1484.

Figure 2
Ports within 50 km of tropical storm tracks, 1960–2010



Source: Becker A et al., 2013, A note on climate change adaptation for seaports: A challenge for global ports, a challenge for global society, *Climatic Change*, 120:683–695.

30. The implications of these extreme events for the coastal communities and transport infrastructure of affected SIDS could be severe, as they increase the likelihood of extreme storm surges and wave run-up inundations, as well as resulting coastal floods.[37] Coastal floods pose a particular threat to the narrow, densely inhabited coastal areas of SIDS, as well as their low-lying transport infrastructure (seaports, airports and their coastal road networks); this is a major reason why SIDS have been shown to have among the highest relative GDP exposures to cyclones.[38] Coastal areas currently experiencing frequent coastal flooding and erosion are projected, with high confidence, to continue to do so in the future, due to increasing mean sea levels, all other contributing factors being equal.[39] SIDS are also subject to changes in temperature and precipitation associated with the El Niño–Southern Oscillation cycle,[40] which can have severe implications for the environment and resources (for example, bursts of coral reef bleaching)[41] as well as for coastal infrastructure.

31. Finally, SIDS are also vulnerable to human-induced hazards, such as maritime oil spills. With SIDS economies heavily dependent on income from fisheries and tourism,

[37] See X Bertin et al., 2013, A significant increase in wave height in the North Atlantic Ocean over the 20th century, *Global and Planetary Change*, 106:77–83; and IJ Losada et al., 2013, Long-term changes in sea level components in Latin America and the Caribbean, *Global and Planetary Change*, 104: 34–50.

[38] See, for example, United Nations International Strategy for Disaster Reduction and ESCAP, 2010, *Protecting Development Gains: Reducing Disaster Vulnerability and Building Resilience in Asia and the Pacific – The Asia Pacific Disaster Report*, available at http://www.unisdr.org/we/inform/publications/16132.

[39] See IPCC, 2012, *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation: Special Report of the Intergovernmental Panel on Climate Change* (New York, Cambridge University Press).

[40] The Subtropical Indian Ocean Dipole has also been referred to as the Indian Ocean El Niño.

[41] See e.g. http://oceanservice.noaa.gov/facts/coral_bleach.html.

exposure to damage arising from ship-source oil pollution incidents poses a potentially significant economic threat.[42]

E. Climate change

32. According to all available evidence there is a long-term increasing trend in the mean air temperature.[43] Projections for the end of the twenty-first century suggest that the atmospheric temperature will increase between 1° C and 3.7° C (mean estimates, see table 1), depending on the scenario.[44]

Table 1
Forecasts of global mean surface temperature and global mean sea-level changes for the period 2081–2100

	Temperature		*Sea-level rise*	
Scenario	Mean (° C)	Likely range (° C)	Mean (m)	Likely range (m)
RCP 2.6	1.0	0.3–1.7	0.40	0.26–0.55
RCP 4.5	1.8	1.1–2.6	0.47	0.32–0.63
RCP 6.0	2.2	1.4–3.1	0.48	0.33–0.63
RCP 8.5	3.7	2.6–4.8	0.63	0.45–0.82

Source: IPCC, 2013.

Notes: Forecasted means and likely ranges calculated with a baseline on data available for the period 1986–2005, according to different scenarios.

Predictions are made according to four radiative forcing scenarios (representative concentration pathways).[45]

Abbreviation: RCP, representative concentration pathway.

33. Precipitation has also been found to be changing. For example, rainfall records for the Caribbean region for the period (1900–2000) show a consistent reduction in rainfall; in comparison, rainfall on Seychelles in the same period has shown substantial variability that can be associated with the El Niño–Southern Oscillation. Nevertheless, average rainfall on Seychelles increased during the latter part of the twentieth century, 1959 to 1997.[46]

[42] See UNCTAD, 2012, Liability and Compensation for Ship-Source Oil Pollution: An Overview of the International Legal Framework for Oil Pollution Damage from Tankers (UNCTAD/DTL/TLB/2011/4).

[43] It must be noted, however, that temperature does not increase uniformly: the temperature close to the poles rises faster than at the equator.

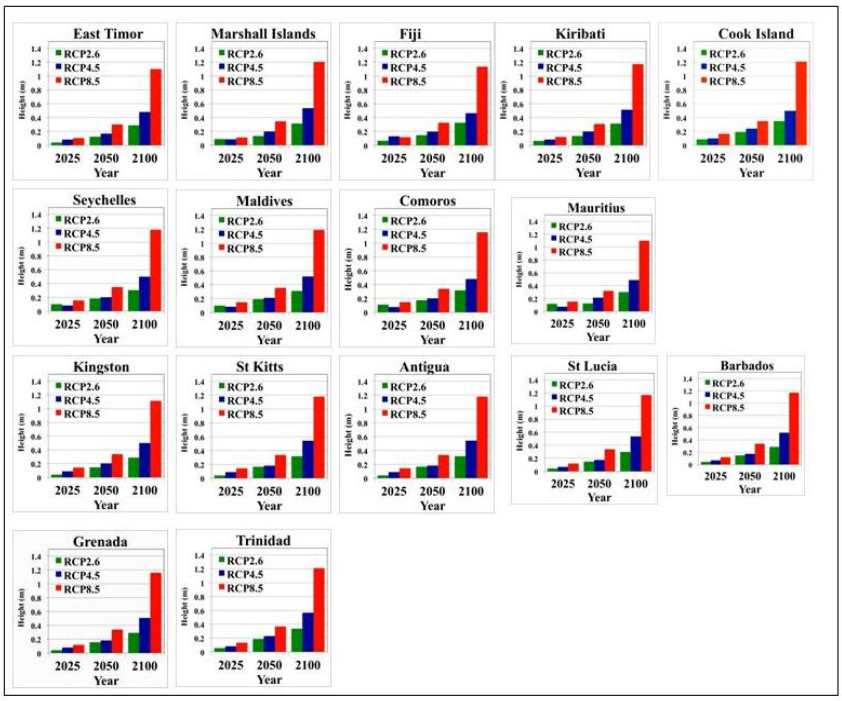
[44] Forced by a range of possible greenhouse gas concentration scenarios (IPCC, 2013), the mean estimate for the warming has been predicted to be 1.0–2.0 °C higher for the period 2046–2065 compared with the 1986–2005 mean, whereas by the late twenty-first century (2081–2100), increases of 1.0–3.7 °C are projected. However, the projection range broadens to 0.3–4.8 °C when model uncertainty is included.

[45] The recent IPCC Fifth Assessment Report (2013) forecasts are made on the basis of the representative concentration pathways scenarios, not those of the IPCC Special Report on Emission Scenarios. The CO^2 equivalent concentrations (in parts per million (ppm)) have been set at RCP 8.5, 1370 ppm $C0^2$ equivalent in 2100; RCP 6.0, 850 ppm CO^2 equivalent in 2100; RCP 4.5, 650 ppm CO^2 equivalent in 2100; and RCP 2.6, peak at 490 ppm CO^2 equivalent before 2100.

[46] See Overseas Development Institute and Climate and Development Knowledge Network, 2014, *The IPCC's Fifth Assessment Report: What's in it for Small Island Developing States?* Available at http://cdkn.org/resource/whats-in-it-for-small-island-developing-states-sids.

Figure 3

Sea-level rise predictions for 2025, 2050 and 2100 for some Pacific Ocean, Indian Ocean and Caribbean small island developing States



Source: Overseas Development Institute and Climate and Development Knowledge Network, 2014, *The IPCC's Fifth Assessment Report: What's in it for Small Island Developing States?*

Note: For an explanation of the different scenarios (RCP 2.6, RCP 4.5 AND RCP 8.5), see footnote 46.

34. Temperature increases are also associated with a substantial rise of the mean sea level.[47] Since 1860, sea levels have increased by about 0.20 m, with the rate of increase becoming progressively greater, particularly since the 1990s; satellite information[48] shows that sea levels rise at a rate close to the upper range of previous IPCC projections (about 3.1 millimetres per year). Due to the large spatial variability observed in the sea-level rise, regional trends in sea level should be considered when assessing potential impacts over any particular SIDS. Combinations of global and regional factors can cause relatively rapid rates of sea-level change along particular island coasts that can be different from the current global rate (3 millimetres per year).[49] Some models are predicting a sea-level rise of 1 to 2 m by the end of this century. Such rises will be catastrophic for a number of low-lying SIDS, especially if combined with storm surges. For example, most of the land of Maldives, Kiribati, the Marshall Islands and Tuvalu has an elevation of less than 5 m, whereas 72 per cent of the Bahamas's land is below 5 m in elevation. Between 30 per cent

[47] See E Hanna et al., 2013. Ice sheet mass balance and climate change, *Nature*, 498:51–59.

[48] JA Church and NJ White, 2011. Sea-level rise from the late 19th to the early 21st Century. *Surveys in Geophysics* 32:585–602.

[49] See TM Cronin, 2012, Rapid sea-level rise, *Quaternary Science Reviews* 56:11–30. Future change can also be amplified by reinforcing feedbacks, that is to say, climate change-driven processes that can induce further global warming and, consequently sea-level rise (for example, the mobilization of currently inert carbon reservoirs such as the tropical peat lands, the methane stores of the Arctic permafrost and the reduction in the spatial coverage of Arctic Ocean ice).

and 50 per cent of the land in Antigua and Barbuda, Seychelles, Micronesia, Nauru and Tonga is less than 5 m in elevation.[50]

Potential impacts and the need for adaptation

35. Given the strategic importance of coastal transport infrastructure for the growth and development of SIDS, understanding climate-related risks and vulnerabilities and developing adequate adaptation measures is vital.

36. Climate change (for example, mean sea-level rise, warmer water temperatures, higher intensity of storms and storm surges, and potential changes in the wave regime) may have a severe impact on the coastal transport infrastructure and services of SIDS. Daily port operations can be directly influenced by both long-term and short-term (storm surge) coastal flooding; terminals, intermodal facilities, freight villages, storage areas and cargo can suffer extensive damage, affecting supply chains and transport connectivity. Seaports and airports, which form the lifeline of the international trade of SIDS, will be particularly affected by climate change, due to the long lifetime of their key infrastructure, exposed coastal location and low elevation (table 2).

37. Precipitation increases may affect roadways, coach terminals, and seaport and airport facilities. Direct damages can be suffered during extreme events, necessitating emergency responses. There can also be long-term effects on the structural integrity of roads, bridges, drainage systems and telecommunication systems, necessitating more frequent maintenance and repairs. Increases in heavy precipitation events and floods will cause more weather-related accidents, delays, and air and road traffic disruptions. Extreme precipitation and wave change-induced silting can have an impact on port navigation channels, leading to considerable increases in dredging costs. Increased delays and cancellations of flight operations due to airport flooding are also likely, together with effects on the structural integrity of runways and other specialized airport infrastructure.[51]

38. Extreme winds can damage coastal roads, damage port facilities such as cranes and loading terminals, destroy agricultural crops and, as a result, indirectly affect the transport industry. Extreme winds may also induce more frequent interruptions in air services and damage airport facilities such as equipment, perimeter fencing and signs. In addition, changes in the wind and wind–wave directional patterns may also have important implications on seaport operations and safety, for instance.

39. Heat waves can also have substantial impacts on transport services and infrastructure through wildfires and crop failures, and can stress water supplies, food storage and energy systems, as well as increase refrigeration requirements. Heat waves can damage roads and affect airport facilities, runways and operations.

40. Demand for transport services grows in line with the global economy, trade and population. As transport is a demand-driven industry, climate change-induced changes in population distribution, commodity production and trade, consumption and tourism patterns, for example, can also have significant indirect implications for the transport of SIDS.

[50] UNCTAD, forthcoming, op. cit.

[51] See Economic Commission for Europe (ECE), 2013, Climate Change Impacts and Adaptation for International Transport Networks, Expert Group Report, Inland Transport Committee, (ECE/TRANS/238), available at http://www.unece.org/fileadmin/DAM/trans/main/wp5/publications/climate_change_2014.pdf.

41. As the above overview shows, climate change presents a range of significant challenges for both SIDS freight and passenger transport. Some of these are summarized below in table 2. A range of potential adaptation options for SIDS is presented in table 3.

42. Since 2008, UNCTAD has considered climate change to be part of its ongoing work in transport law and policy and carries out substantive work to help improve the understanding of issues at the interface of maritime transport and the climate change challenge. Special emphasis is placed on climate-change adaptation and the need to enhance the climate resilience of transport systems.[52] The particular needs of SIDS in respect of adapting transport infrastructure to the impacts of climate change have been particularly highlighted at a number of UNCTAD expert meetings, as well as part of the work of an ECE group of experts established following a joint ECE–UNCTAD workshop in 2010.[53]

Table 2
Summary of potential climate change impacts of different climatic factors on transportation

Temperature	*Road*	*Ports, and airports*
Higher mean temperatures; Heat waves and droughts; Increased variability in extreme temperature	Thermal pavement loading and degradation, asphalt rutting, thermal damage of bridges, increased landslides on mountain roads, asset lifetime reduction, increased cooling needs (passenger/freight), increased construction and maintenance costs; changes in demand	Damage to infrastructure, equipment and cargo; higher energy consumption for cooling cargo; air transport payload restrictions
Precipitation	*Road*	*Ports and airports*
Changes in intensity and frequency of extremes (floods and droughts)	Inundation; increased landslides and slope, earthwork and equipment failures; impacts on critical transport nodes (e.g. bridges); poor visibility and delays; changes in demand	Land infrastructure inundation; damage to cargo and equipment; port navigation channel silting
Winds and thunderstorms	*Road*	*Ports and airports*
Changes in frequency and intensity of events	Damages to fences; road accidents	Problems in vessel navigation and berthing in ports; air transport cancellations and delays

[52] See http://unctad.org/ttl/legal. Relevant work includes the UNCTAD Expert Meeting on Maritime Transport and the Climate Change Challenge, February 2009, the UNCTAD–ECE Workshop on Climate Change Impacts on International Transport Networks, 8 September 2010; the UNCTAD Ad Hoc Expert Meeting on Climate Change Impacts and Adaptation: A Challenge for Global Ports, 29–30 September 2011; a volume edited by UNCTAD, entitled "*Maritime Transport and the Climate Change Challenge*", was also co-published by the United Nations and Earthscan (Routledge/Taylor and Francis) in May 2012.

[53] ECE, 2013, Climate Change Impacts and Adaptation for International Transport Networks, ECE/TRANS/238, available at http://www.unece.org/fileadmin/DAM/trans/main/wp5/publications/climate_change_2014.pdf .

Sea level/storms	*Road*	*Ports and airports*
Mean sea-level changes; Increased destructiveness of storms and storm surges; Changes in wave energy and direction	Increased risks of coastal inundation and erosion affecting coastal roads, temporary inundation, unusable roads during storm surges	Infrastructure and cargo damages from inundation and wave energy changes; higher port construction and maintenance costs; relocation of people and businesses, insurance issues

Notes: This list is not exhaustive.
See footnote 54.

Table 3
Adaptation options for seaports in small island developing States

Engineering	Enhance the structural integrity and efficiency of critical facilities including sea defences, berths, mooring facilities, runways and parking aprons, based on design criteria that reflect changing wind, sea-level and wave conditions; recalculation of return periods for major events such as hurricanes and floods, so that more resilient structures can be engineered
Technology	Invest in more climate-resilient technologies and equipment in planned expansion and upgrade programmes, for example, gantry cranes that can operate at higher wind thresholds; solar photovoltaics to generate electricity more efficiently for both operations and administration
Planning and development	Internal capacity-building and retraining that recognizes the magnitude and implications of the threat; building of redundancy into critical operations, wherever feasible; off-site warehousing and storage in less vulnerable areas, and so forth
Management systems	Various operational systems need to mainstream climate-change considerations into their procedures, for example, shut-down and start-up operations, emergency protocols and evacuation, environmental management systems, occupational safety and health protocols
Insurance	Some risks cannot be avoided; therefore, they must be insured by third parties; ongoing collaboration with port management, climate scientists and insurance providers will provide a basis for more reliable quantification of exposure and risks that must be covered

Source: L Nurse, presentation at UNCTAD ad hoc expert meeting, 11 July 2014.
Note: See footnote 56.

Integrating disaster risk reduction and adaptation to climate-change impacts

43. Building climate resilience and preparedness and promoting recovery from disasters is critical for the sustainable development prospects of SIDS. So is climate change

adaptation.[54] However until recently, countries have been operating under two different United Nations mandates and two United Nations bodies when dealing with disaster-risk reduction and climate-change adaptation. In the Pacific for example, there was the Pacific Disaster Risk Reduction and Disaster Management Framework for Action (2005–2015) and national adaptation plans, while under climate change adaptation there was the Pacific Islands Framework for Action on Climate Change 2006 to 2015, and national communications and national adaptation plans of action. A review carried out in 2012 by the United Nations International Strategy for Disaster Reduction and the United Nations Development Programme entitled "*Disaster Risk Reduction and Climate Change Adaptation in the Pacific: An Institutional and Policy Analysis*" recognized the need to integrate disaster risk reduction and climate change adaptation.[55]

44. Some proactive activities by SIDS include the development of a joint national action plan for climate change adaptation and disaster risk management (2010–2015) by Tonga in 2010. Similar plans have been developed by the Cook Islands, the Marshall Islands and Tuvalu. SIDS in other regions have also been working towards joint plans. In the Indian Ocean, for example, the Maldives have drafted a strategic national action plan for disaster risk reduction and climate change adaptation (2010–2020).[56] While disaster risk reduction and climate change adaptation in transport are sometimes mentioned in policy documents and as a justification for coastal protection projects, transport projects, with the exception of projects in the Pacific Adaptation to Climate Change Programme, appear to be the most underrepresented.

II. Addressing the challenges and harnessing opportunities

45. This note provides an overview of the current state of play in terms of maritime transport in SIDS, including sector-specific issues such as shipping and ports and cross-cutting themes that affect all aspects of maritime transport, including energy, climate change, disaster risks, and financial and capacity requirements. It highlights the existing transport-related gaps and needs in SIDS and makes the case for more intensified, focused and concerted action at all levels – national, regional and international. In this respect, a number of measures and approaches aimed at addressing SIDS marginalization are set out in in the forthcoming publication Closing the Distance: Partnerships for Sustainable and Resilient Transport Systems in SIDS. It underscores the critical role of development partners in helping translate relevant recommendations into tangible actions and emphasized the need for a set of response measures at the national, regional and international levels. It further argues that SIDS requires capacity-building in terms of transport connectivity, infrastructure development and maintenance, as well as in terms of know-how, knowledge and financial resources. Adopting a portfolio of actions spanning the transport sector and other relevant areas, such as trade, finance, energy efficiency, environmental protection and climate resilience, is considered a must.

46. While a step in the right direction, these conclusions and proposed actions need to be taken a step further to be better understood and translated into concrete and actionable outcomes that can be readily implemented. In this context, experts at the meeting are

[54] See Overseas Development Institute and Climate and Development Knowledge Network, 2014, op. cit.

[55] For further information, including on relevant national adaptation programmes of action with a transport components, see UNCTAD, forthcoming, op. cit.

[56] Ibid.

invited to reflect on, among other things, how best to follow through on the following issues:

- Addressing inter-island and domestic shipping connectivity requirements, port service levels and charges, port infrastructure development needs and maintenance issues, ageing fleets, low cargo and trade volumes, cargo imbalances, structure of the shipping market and prohibitive transport costs;
- Building the resilience of coastal transport infrastructure in the face of climate change impacts and disasters risks;
- Strengthening domestic and regional connectivity and promoting infrastructure development;
- Raising levels and diversifying sources of funding in support of transport, in particular maritime transport infrastructure development, maintenance, sustainability and resilience;
- Increasing private sector involvement in transport and promoting collaborative approaches between public and private investment partners, including for investment in energy-efficient and climate-resilient transport systems and services;
- Encouraging the sharing of lessons learned, experiences and best practices both within and across SIDS regions to ensure that existing opportunities are explored and exploited.