Climate Change impacts and adaptation for ports and coastal transport infrastructure

Regina Asariotis
Chief, Policy and Legislation Section, TLB/DTL
UNCTAD
regina.asariotis@unctad.org
unctad.org/ttl/legal
Transport: a critical facilitator of global trade and development

Over 80% of volume (70% of value) of world merchandise trade is carried by sea (port to port): shipping and ports are key nodes in the network of closely linked international supply chains.


Seaborne trade: over 60% of goods loaded and unloaded in developing countries (UNCTAD).

Environmental challenges: two sides of the coin

- Effects of transport on the environment (e.g. pollution, CO2 emissions)
- Environmental impacts on transport (e.g. Climatic Variability and Change, CV&C)

Important to address these global challenges effectively, also in the light of the Paris Agreement and the 2030 Sustainable Development Agenda.
Relevance in the context of the 2030 Sustainable Development Agenda

2030 Agenda adopted in September 2015, effective as of 1\textsuperscript{st} January 2016

Consensus by international community on a ‘plan of action’ involving 17 sustainable development goals with 169 targets, which are ‘\textit{integrated and indivisible, global in nature and universally applicable}’

\textbf{Sustainable and resilient transport among the cross-cutting issues}, of relevance for achievement of progress on several of the goals and targets, e.g.

\begin{itemize}
  \item \textbf{SDG 13} \hspace{1cm} Take urgent action to \textit{combat climate change and its impacts}
  \item \textbf{SDG 9} \hspace{1cm} \textit{Build resilient infrastructure}, promote inclusive and sustainable industrialization and foster innovation
  \item \textbf{SDG 14} \hspace{1cm} Conserve and \textit{sustainably use the oceans, seas and marine resources} for sustainable development
  \item \textbf{SDG 1.5} \hspace{1cm} By 2030, \textit{build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events} and other economic, social and \textit{environmental shocks and disasters}
\end{itemize}
Climate Variability and Change (CV & C)

A global challenge and “a defining issue of our era” (UN SG Ban Ki Moon, 2008)

Compelling scientific evidence of increasing CV & C / impacts (IPCC, 2013; 2018; 2019)

Huge potential costs associated with inaction
- **WEF (2019 and 2020) Global Risks Report**: Top 3 economic risks are extreme weather events, climate action failure, natural disasters
- **Stern Review (2006)**: 5 – 20 % of GDP, annually
- By 2100, global flood damages due to sea-level rise (and related extreme events) might amount to up to US$ 27 trillion/year – about 2.8% of global GDP in 2100 (Jevrejeva et al 2018 Environ. Res. Lett)
- **Global Comm. on Adaptation (2019)**: Investing US$1.8 trillion over next decade - in measures to adapt to climate change - could produce net benefits worth more than US$7 trillion

Very serious development threat, particularly for LDCs and the SIDS

Since 2008, integration of CV & C considerations into UNCTAD’s work on transportation
<table>
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<tr>
<th>Year</th>
<th>Follow-up</th>
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| 2009 | Follow-up | **UNCTAD Multiyear Expert Meeting:** *Maritime Transport and the Climate Change Challenge*  
| 2010 | Follow-up | **Joint UNECE-UNCTAD Workshop:** *Climate change impacts and adaptation for international transport networks*  
UNECE Group of Experts on Climate Change Impacts and Adaptation for International Transport Networks  
2013 EG Report - *Climate Change Impacts and Adaptation for International Transport Networks*  
2020 EG Report - *Climate Change Impacts and Adaptation for International Transport Networks* |
| 2011 | Follow-up | **UNCTAD Ad Hoc Expert Meeting:** *Climate Change Impacts and Adaptation: a Challenge for Global Ports*  
| 2014 | | **UNCTAD Ad Hoc Expert Meeting:** *Addressing the Transport and Trade Logistics Challenges of SIDS: Samoa Conference and Beyond*  
**UNCTAD Multiyear Expert Meeting:** *Small Island Developing States: Transport and Trade Logistics Challenges* |
| 2017 | | **UNCTAD Port-Industry Survey on Climate Change Impacts and Adaptation** |
| 2015-2017 | Follow-up | **UNCTAD DA Project** *Climate change impacts on coastal transport infrastructure in the Caribbean: Enhancing the adaptive capacity of Small Island Developing States (SIDS)*  
Monioudi et. al, *Climate change impacts on critical international transportation assets of Caribbean SIDS: the case of Jamaica and Saint Lucia*, Reg Environ Change 2018: 2211 |
| 2019-2020 | | **UNCTAD Ad Hoc Expert Meeting:** *Climate Change Adaptation for International Transport: Preparing for the Future*  
**UNCTAD – UNEP** *Climate-resilient transport infrastructure for sustainable trade, tourism and development in SIDS*  
*Climate Change Impacts and Adaptation for Coastal Transport Infrastructure: A Compilation of Policies and Practices* |
CV & C implications for Transport

Two sides of the “coin”: causes - effects

- **Mitigation**: action directed at addressing causes (long-term)

- **Adaptation**: action directed at coping with impacts (short- and long-term); requires assessment of impacts that can vary considerably by physical setting, type of forcing, sector, mode, region etc.

In Transport:
- much of the international debate/policy action focuses on mitigation (i.e. reduction / control of GHG emissions).
- comparatively little focus on study of impacts and development of adaptation policies/actions

*BUT: Transport is not (just) a ‘culprit’, it is (also) a victim*
CV & C Impacts on Transport

Direct and indirect impacts on transport infrastructure and services:

Sea-level rise, temperature-, humidity-, precipitation- changes, extreme storms and floods and other climatic factors are likely to

• affect coastal transport infrastructure, hinterland/connecting transport infrastructure, and transport throughout global network of supply-chains
  – potential for damage, disruption and delay – economic/trade related losses

• affect demand for transport

• exacerbate other transport-related challenges

• open new arctic sea-lanes due to polar ice melting

Enhanced climate resilience / adaptation for ports and other key transport infrastructure is of strategic economic importance

How prepared are we?
Online survey to
• improve the understanding of weather and climate-related impacts on ports
• identify data availability, information needs and levels of resilience and preparedness

Respondent port sample collectively handle more than 16% of global seaborne trade and can be considered as representative

• The majority of respondents had been impacted by weather/climate related events, including by extremes;
• The survey revealed important gaps in information available to seaports of all sizes and across regions with implications for effective climate risk assessment/adaptation

Key messages: Better data/information needed; mainstream CC considerations; ‘piggyback’ climate resilience when upgrading infrastructure/operations

Other surveys related to (inland) transport provided similar results (UNECE, 2013; 2019)
(a) Areas at flood risk in the Kanagawa area (Tokyo Bay) for the mean expected storm surge due to future storm typhoon in the year 2100 for a 0.59-m (thick blue line) and 1.9-m (thin blue line) mean sea-level-rise (MSLR) scenarios and

(b) Simulated damages for Tokyo and Kanagawa port areas due to combined MSLR and storm surge (Hoshino et al., 2015) (30 trillion yen approx. 285 billion US dollars)
Projections of increasing frequency of extreme sea levels at global ports

Projected changes in the frequency of the present day 1 in 100-year extreme sea level (ESL) under climate change at about 3700 global ports.

Key: SWL (Specific Warming Level) in degrees above pre-industrial times. Tr (years) = return period. (Asariotis et al., in prep.)
The special case of the SIDS

- Small (land mass, economies, population), remote & highly vulnerable to external shocks
- Large dependency on imports (i.e. international transport); high transport costs
- Key concerns: connectivity and transport costs (accessibility and affordability)
- High exposure to natural disasters and CV & C; low adaptive capacity
- Coastal transport infrastructure (seaports/airports): critical lifelines for external trade, food, energy, tourism (cruise-ships and air transport) and DRR; fisheries and blue economy
- Strong nexus between transport and tourism: “Sun-Sea-Sand (3S) tourism“, often a most significant SIDS industry, is threatened by climate-driven beach erosion / coastal inundation, as is its facilitating transport infrastructure
- These assets are threatened by sea level rise and extreme events (storms)

N.B. Airports in SIDS are mostly located at low coastal elevations, due to physical constraints (volcanic islands with little level land)
Some findings:
High risk of marine flooding for key assets under extreme events and different CV & C scenarios, as early as in the 2030s

Operational disruptions also identified, using an operational thresholds method


See also IPCC Special Report on Global Warming of 1.5ºC 2018 (Ch. 3); IPCC 2019
All international transport assets (airports/seaports) appear vulnerable under all scenarios, and from as early as 2030s.

**Marine flood maps:**
- (a, c, e) George Charles Int. Airport; Castries seaport;
- (b, d, f) Hewanorra Int. Airport; Vieux Fort seaport for the: 1-100 year extreme sea level event, ESL100 (1.5°C SWL, 2030); 1-50 year extreme sea level event, ESL50 (2050, RCP4.5); ESL100 (2100, RCP8.5)

Monioudi et. al., Reg Env Change (2018); IPCC 2018; IPCC 2019
Dynamic modeling inundation projections for coastal assets

Different scenarios were tested

SIA (70% of international tourist arrivals) and Kingston seaport (KFTL) appear vulnerable under all scenarios

Marine flood maps for: (a, e, i) Sangster International Airport (SIA, Montego Bay, Jamaica); (b, f, and i) Kingston Container Terminal (KFTL, Kingston, Jamaica) under the 1-100 year extreme sea level event- ESL100 (for 1.5 °C temperature increase, 2030), 1-50 year extreme sea level event -ESL50 (2050, RCP4.5) and ESL100 (2100, RCP8.5)

Mionioudi et. al. (2018)
Action needed to reduce vulnerability and build resilience

Accelerate action to ensure that by 2030 critical transport infrastructure is climate resilient to 2050 (cf. MPGCA Milestones for ‘Transport’ and ‘Resiliency’)

Risk assessments, based on the best available science, will be needed as well as innovative adaptation responses (regulation, management and technical measures)

- **Improve understanding** of impacts on transport infrastructure/operations; **improve data collection/availability**; **plan early** (asset lifespan); **systems approach**;

- **Mainstream** CC considerations in transport infrastructure planning/operations;

- (Funding for) technical risk/vulnerability assessments to inform policies, plans, action;

- **Capacity building** (human resources, at local levels) and better **access** to climate finance;

- **Ecosystem approaches to adaptation**: important elements in any future strategy;

- Integrate relevant considerations into National Adaptation Plans and NDCs;

- Adaptation strategies need to be underpinned by **strong legal, regulatory and policy frameworks; standards, guidance, methodological tools**
Thank you!

Save the date: 27-28 October 2020
UNCTAD Intergovernmental Expert Meeting (virtual):
Climate change adaptation for seaports in support of the 2030 Agenda for Sustainable Development