ADAPTATION ACTIONS IN PORTS

1. **COMPARE CLIMATE RECORDS, BEGIN CLIMATE CHANGE MONITORING AND DOWNSCALE CLIMATE CHANGE MODEL TO THE LOCAL LEVEL**

**PURPOSE:** to increase knowledge of historical data, climate trends and possible future climate conditions, so as to more accurately evaluate the likelihood, severity and magnitude of potential impacts and the timeframe required for implementing mitigation and adaptation measures.

**POTENTIAL ACTIONS:** search historical climate records and analyze trends; invest in data collection (buoys, thermometers, anemometers, water characteristics analysis, etc.); regularly evaluate climate change projection models (IPCC or others).

**USEFUL TIPS:** gather several years, or even decades, of available data; collect data using different meteorological variables (wind, waves, climate, ice); downscale the data as much as possible to evaluate specific impacts to key port areas; conduct continuous data collection.

2. **PREPARE HAZARD ASSESSMENTS FOR INFRASTRUCTURE, ASSETS AND OPERATIONS**

**PURPOSE:** to regularly assess possible hazards that could affect existing or planned infrastructure and assets, in order to identify possible changes and upgrades needed in design, adaptation or operations.

**POTENTIAL ACTIONS:** analyze design parameters for each critical infrastructure to identify thresholds; address maintenance issues; take corrective actions to reduce operational incidents and increase resilience.

**USEFUL TIPS:** increase the number of assets evaluated; the frequency of evaluation and the number of potential hazards considered.

3. **ADJUST INFRASTRUCTURE, DESIGN, OPERATIONS AND MAINTENANCE ACTIVITIES IN LINE WITH POSSIBLE HAZARDS (I.E. SEA LEVEL RISE, STORM SURGES, STORM FLOODING, HEAVY RAIN, EXTREME WAVES, RIVER FLOODING, STRONG WINDS)**

**PURPOSE:** to adapt, modify or strengthen existing or planned infrastructure, operations and maintenance in anticipation of future climate change conditions of sea level rise, storm surges, storm flooding, heavy rain, extreme waves, river flooding, strong winds and other hazards so as to minimize impacts.

**POTENTIAL ACTIONS:** raise aprons and breakwaters to protect against flooding and wave overtopping; design decks with relief slots, drain holes, valves or wave walls; install heat- or drought-resistant vegetation; incorporate heat- or drought-resistant vegetation; provide shade, using nature-based solutions where practicable; improve thermoregulation; incorporate heat- or drought-resistant vegetation; install air-conditioning or cooling systems on vessels and in offices, storage facilities, etc.

**USEFUL TIPS:** establish appropriate indicators to monitor and evaluate reduction in annual cost of damages related to sea level rise, storm surges, storm flooding, heavy rain, extreme waves, river flooding, strong winds and other hazards (%) and reductions in lost days of operation due to these hazards (%).

4. **ADJUST INFRASTRUCTURE, DESIGN, OPERATIONS AND MAINTENANCE ACTIVITIES IN LINE WITH POSSIBLE HAZARDS (I.E. SEA LEVEL RISE, STORM SURGES, STORM FLOODING, HEAVY RAIN, EXTREME WAVES, RIVER FLOODING, STRONG WINDS)**

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5. **ADJUST INFRASTRUCTURE, DESIGN, OPERATIONS AND MAINTENANCE ACTIVITIES IN LINE WITH POSSIBLE HAZARDS (I.E. SEA LEVEL RISE, STORM SURGES, STORM FLOODING, HEAVY RAIN, EXTREME WAVES, RIVER FLOODING, STRONG WINDS)**

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*Adapted from The World Association for Waterborne Transport Infrastructure (PIANC). (2020). Climate Change Adaptation Planning for Ports and Inland Waterways.*
**Adaptation Actions in Ports**

1. **Protect coastline and river or estuary banks through both hard and soft adaptation measures.**
   - **Purpose:** To protect the shoreline or riverbanks from wave energy to avoid adverse impacts in the project area, with co-benefits that include reducing or avoiding exposure to coastal flooding or fluvial flooding; mitigating social and environmental impacts, and adding recreational and aesthetic value.
   - **Potential actions:** Analyze and adopt both soft and hard engineering measures to improve adaptation. Soft engineering measures are actions that do not radically change the environment but are an effective countermeasure against natural processes. Examples include adding sediment to beach areas with shoreline erosion; restoring natural and artificial dunes; restoring ecosystems (e.g., saltmarshes or mangroves and seagrasses) or planting riparian vegetation; and protecting coral reefs. Hard engineering measures involve human-built, rigid and complex infrastructures that intervene in coastal processes by altering wave energy. Examples include shore-parallel detached or offshore structures (breakwaters) to reduce incoming wave energy at the shoreline; piers to protect adjacent low-lying areas from inundation under extreme conditions; and jetties at the banks of tidal inlets and river mouths to trap a portion of the longshore sediment to stabilize the inlet and prevent silting of the channel.
   - **Useful tips:** Establish appropriate indicators to monitor and evaluate such factors as the number of collaborative strategies developed with key stakeholders and co-benefits such as resource efficiency and more effective outcomes.

2. **Create diversified ports through the development of sustainable business opportunities that help to protect the natural environment and benefit the local economy.**
   - **Purpose:** To create sustainable businesses in the port area in order to protect the natural environment, increase awareness and provide socioeconomic benefits through new development opportunities.
   - **Potential actions:** Promote the development of tourism businesses such as whale watching, scuba diving centers and boat excursions. Co-benefits include promoting environmental conservation and improving the local economy.
   - **Useful tips:** Establish appropriate indicators to monitor and evaluate such factors as the number of operations with insurance for extreme weather events and the percentage of uncovered risks (€/year) and reductions in lost days of operation related to this indicator (%).

3. **Work in partnership with other relevant stakeholders.**
   - **Purpose:** To build partnerships and networks with relevant stakeholders (e.g., local governments, civil society, academia, supply chain logistic stakeholders) and collaborate in developing strategies to adapt to climate change.
   - **Potential actions:** Design connected logistics hubs; create local knowledge related to climate change; develop innovation tools and practices for vulnerability and risk management. Co-benefits include resource efficiency and more effective outcomes.
   - **Useful tips:** Establish appropriate indicators to monitor and evaluate such factors as the number of collaborative strategies developed with key stakeholders and resource efficiency (in economic terms) in implementing climate change adaptation actions.

4. **Insurance management.**
   - **Purpose:** To analyze financial exposure in light of the probability of climate change impacts and identify maximum loss value of assets or revenue, in order to manage insurance costs and coverage, reduce exposure and optimize costs.
   - **Potential actions:** Conduct a risk assessment to analyze the potential exposure of each asset to the main potential hazards; determine acceptable levels of risk (risk tolerance) for each hazard; verify and strengthen insurance coverage, including replacement and business interruption coverage; document the port’s assets via video or photo in the case of claims; establish or improve crisis management plans to take into account priority hazards.
   - **Useful tips:** Establish appropriate indicators to monitor and evaluate such factors as the number of operations with insurance for extreme weather events and the percentage of uncovered risks (%).