MINISTRY OF METEOROLOGY, ENERGY, INFORMATION, DISASTER MANAGEMENT, ENVIRONMENT, CLIMATE CHANGE AND COMMUNICATIONS

United Nations Nations Unies
Economic and Social Commission for Asia and the Pacific

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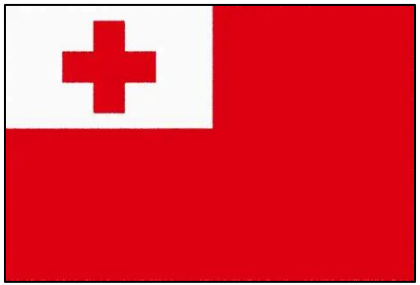
TONGA REPORT ON DIGITAL TECHNOLOGY AND CLIMATE CHANGE



GEOGRAPHY AND CLIMATE

- **Climate**: Tropical maritime climate, moderated by the surrounding Pacific Ocean.
- **Seasons**: Warm, wet season (November - April) and cooler, drier season (May - October).
- **Temperature**: Generally warm throughout the year, with average temperatures around 23–27°C.
- **Rainfall**: Varies across the island groups, with generally wetter conditions in the northern islands.
- **Cyclone Season**: November - April, with exposure to tropical cyclones, heavy rainfall and strong winds.
- **Geography**: An archipelago of approximately 170 islands, spread across a large ocean area.



POPULATION AND ECONOMY

Population
~106,000
2025 World Bank estimate

GDP (2025)
US$679M
World Bank estimate





- **Population Distribution**: Approximately 74% of residents live on Tongatapu, with the remainder spread across the outer island groups.
- **Economic Structure**: Driven by services, agriculture, fisheries, tourism and public-sector activities.
- **Remittances**: Overseas remittances are a major source of household income, equivalent to approximately 39% of GDP in 2025.
- **Economic Vulnerability**: High dependence on imports, geographic isolation, limited domestic markets and exposure to natural disasters.
- **Climate Impacts**: Extreme weather and environmental changes threaten agriculture, fisheries, tourism, infrastructure and livelihoods.

CLIMATE CHANGE CHALLENGES

- **High Climate Vulnerability:** As a Small Island Developing State (SIDS), Tonga faces disproportionate climate impacts despite contributing minimally to global emissions.
- **Extreme Weather Events:** Tropical cyclones, heavy rainfall, flooding and storm surges threaten communities and essential infrastructure.
- **Rising Sea Levels:** Coastal erosion, inundation and saltwater intrusion threaten low-lying settlements and freshwater resources.
- **Environmental and Economic Impacts**: Drought, ocean warming, coral bleaching and changing rainfall patterns affect agriculture, fisheries, tourism and livelihoods.
- **Limited Adaptive Capacity**: Geographic isolation, dispersed islands, infrastructure vulnerabilities and financial constraints complicate climate adaptation.





EXTREME WEATHER EVENTS



- **Tropical Cyclones:** Tonga is exposed to destructive cyclones, including Cyclone Gita (2018) and Cyclone Harold (2020), causing widespread damage to communities and infrastructure.
- **Heavy Rainfall and Flooding:** Intense rainfall can overwhelm drainage systems, flood low-lying areas and disrupt transportation and essential services.
- **Storm Surges and Coastal Flooding:** Strong winds and high waves associated with cyclones can cause destructive coastal inundation.
- **Extreme Heat**: Rising temperatures and periods of excessive heat pose risks to public health, agriculture and water resources.
- **Infrastructure and Economic Disruption:** Severe weather can damage electricity networks, telecommunications, roads, agricultural production and public facilities.

RISING SEA LEVELS



- **Accelerating Sea-Level Rise**: Rising ocean levels increase the exposure of Tonga's low-lying islands and coastal communities to flooding and erosion.
- **Coastal Erosion**: Shoreline retreat threatens homes, roads, public facilities and coastal ecosystems, particularly in vulnerable island communities.
- **Coastal Inundation**: Higher sea levels increase flooding during high tides, storm surges and extreme weather events.
- **Saltwater Intrusion**: Seawater entering groundwater and agricultural land threatens freshwater security and food production.
- **Infrastructure and Communities:** Coastal roads, electricity networks, telecommunications, schools and settlements face increasing risks, potentially requiring coastal protection or relocation.

OTHER CLIMATE RELATED CHALLENGES



- **Drought and Water Scarcity:** Changing rainfall patterns and prolonged dry periods threaten freshwater supplies, particularly in outer-island communities.
- **Agriculture and Food Security:** Drought, extreme heat, flooding and saltwater intrusion affect crop production, agricultural livelihoods and food security.
- **Public Health Risks:** Higher temperatures, water shortages and flooding increase health risks and pressure on essential services.
- **Environmental and Economic Vulnerability:** Climate impacts threaten natural resources, livelihoods and the long-term sustainability of island communities.

ROLE OF DIGITAL TECHNOLOGY IN ADAPTATION

- **Digital Connectivity**: Tonga's submarine fibre-optic network, mobile telecommunications and satellite connectivity support communications and access to digital services.
- **Digital Government** : Tonga is developing national digital platforms, including TongaPass, digital identity, API management and government information systems.
- **Climate and Environmental Information**: Meteorological observations, satellite imagery, GIS and geospatial data support climate monitoring, disaster assessment and planning.
- **Disaster Preparedness and Communication**: Digital communications and warning channels support the dissemination of weather forecasts, cyclone warnings and emergency information.
- **Emerging Opportunities**: Data interoperability, cloud services, AI and predictive analytics could strengthen climate-risk assessment, decision-making and coordination across government agencies.

EARLY WARNING SYSTEMS



- **Meteorological Monitoring and Forecasting**: The Tonga Meteorological Service provides weather forecasts, tropical cyclone warnings, severe weather advisories and climate information.
- **Tsunami and Multi-Hazard Warnings**: National authorities receive and assess regional tsunami information and coordinate warnings for potentially affected communities.
- **Disaster Management Coordination**: The National Disaster Risk Management Office (NDRMO) coordinates disaster preparedness and response with relevant government agencies.
- **Public Warning Dissemination**: Alerts are communicated through radio, television, mobile telecommunications, online platforms and community networks.
- **Regional and International Cooperation**: Tonga benefits from regional meteorological services, Pacific tsunami warning arrangements and international observation networks.

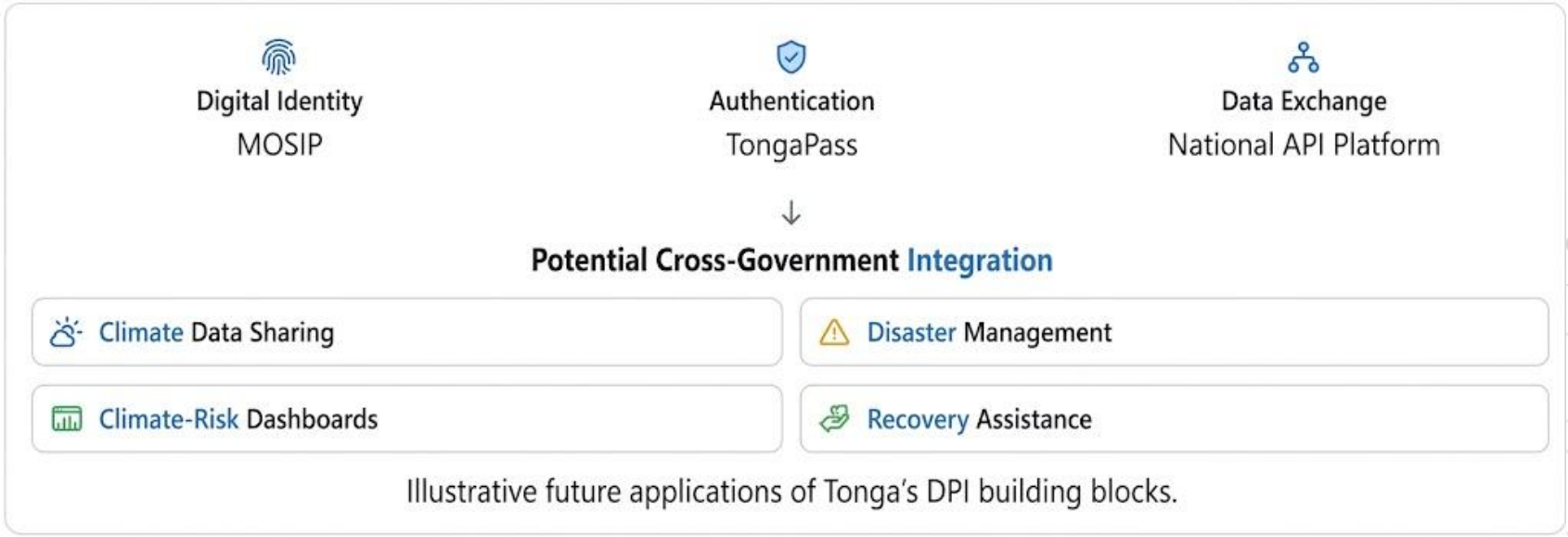
REMOTE SENSING AND MONITORING



- **Satellite Imagery and Remote Sensing**: Earth observation data supports monitoring of coastal changes, land use, vegetation, ocean conditions and disaster impacts.
- **Geographic Information Systems (GIS):** Geospatial information supports hazard mapping, infrastructure planning, disaster-risk assessment and climate adaptation.
- **High-Resolution LiDAR Mapping**: Tonga has invested in LiDAR surveys of low-lying islands to improve elevation modelling, coastal flood assessments and land-use planning.
- **Opportunities for Improvement:** Integrated geospatial databases, standardized data sharing, automated monitoring and AI-assisted analysis.

DPI AND DIGITAL GOVERNMENT

Digital Public Infrastructure



Illustrative future applications of Tonga's DPI building blocks.

CHALLENGES IN UTILIZING DIGITAL TECHNOLOGY

Connectivity & Infrastructure

Geographically dispersed islands, network disruptions, power and limited redundancy.

Technical Capacity

Limited specialist expertise in GIS, remote sensing, AI, data analytics and cybersecurity.

Data Availability & Quality

Gaps in localized, up-to-date environmental information and continuous monitoring.

Funding & Sustainability

High costs of equipment, connectivity, software, maintenance and long-term operations.

Data Integration & Sharing

Fragmented datasets, limited interoperaability and inconsistent data standards across agencies.

Cybersecurity & Resilience

Protecting critical systems, sensitive information and digital services during emergencies.

SITUATION OF DIGITAL TECHNOLOGY AND CLIMATE CHANGE IN TONGA

Existing Capabilities

Meteorological forecasting, early-warning arrangements, GIS, satellite observations and climate-risk assessments.

Geospatial Investments

LiDAR surveys and high-resolution mapping initiatives to support coastal resilience and infrastructure planning.

Digital Transformation

Developing DPI, including TongaPass, MOSIP-based digital identity and national API management.

Emerging Opportunities

Integrated climate data, AI-assisted analysis, shared risk dashboards and more localized decision-support tools.

ASSISTANCE NEEDED FOR DIGITAL TECHNOLOGY AND CLIMATE CHANGE

1. Technical Capacity Building

Specialized training in GIS, remote sensing, LiDAR, AI, data analytics and climate-risk modelling.

2. Data Integration & DPI

Interoperability standards, secure APIs, climate data sharing and integrated decision-support platforms.

3. Resilient Digital Infrastructure

Redundant connectivity, reliable power, backup systems and disaster-resilient communications.

4. Climate Monitoring & Data

Improved environmental observations, updated geospatial datasets and localized risk information.

5. Applied AI & Analytics

Practical pilot projects for coastal monitoring, climate-risk mapping and impact-based decision support.

6. Funding & Partnerships

Sustainable financing, knowledge transfer, regional cooperation and long-term operational support.



- **Climate Resilience Remains a National Priority**: Tonga continues to face significant climate risks, requiring stronger preparedness, adaptation and long-term resilience.
- **Building on Existing Digital Investments**: Early-warning systems, GIS, LiDAR and Digital Public Infrastructure provide a foundation for more informed decision-making.
- **Strengthening Integration and National Capacity**: Interoperability, technical expertise, reliable data and resilient infrastructure are essential to realizing the benefits of technology.
- **Partnerships for a Resilient Future**: Continued regional cooperation, knowledge sharing and sustainable technical assistance can accelerate Tonga's climate adaptation efforts.

MALO

Thank you

