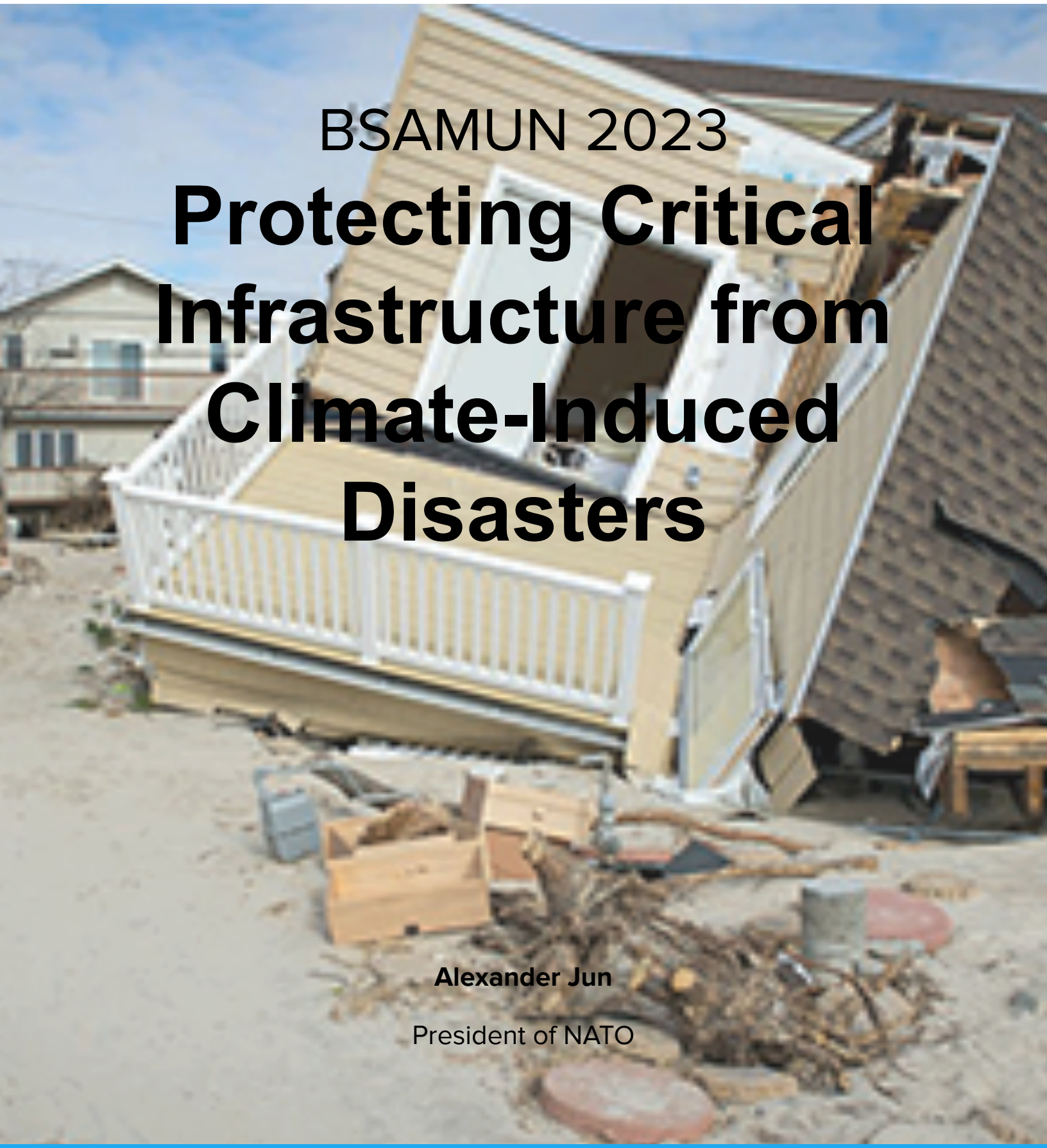

BSAMUN 2023

Protecting Critical Infrastructure from Climate-Induced Disasters

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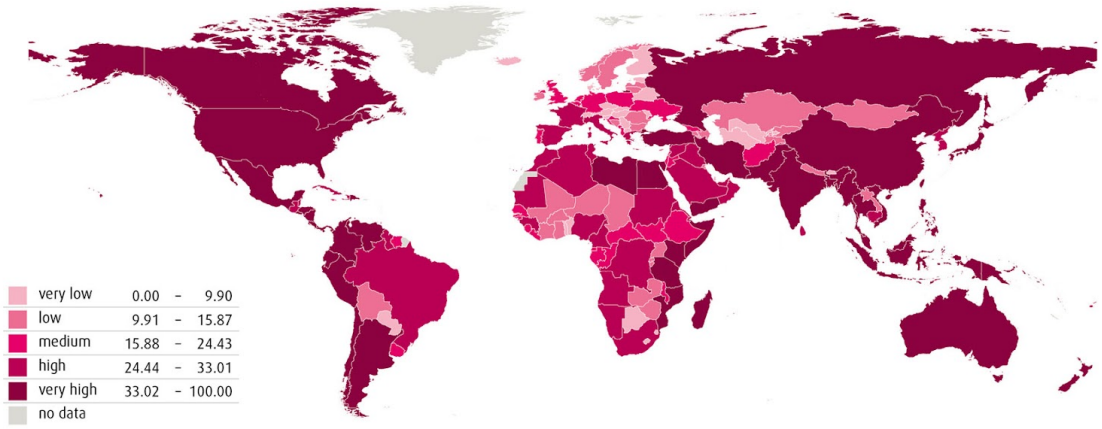
Introduction

According to the UN Office for Disaster Risk Reduction, there have been 75% more reported disasters in the last 20 years than 20 years before. These disasters, many of which directly link to the repercussions of climate change and human activity, have posed an extreme threat to critical infrastructure necessary for the functioning of society in various countries. Damage to critical infrastructure in less economically developed countries have exacerbated the vulnerability of these people to unimaginable extent.



Definition of key terms

Climate Change: Climate change refers to long-term shifts in temperatures and weather patterns, according to the United Nations. Human activities have been the main driver of climate change, primarily due to burning fossil fuels like coal, oil and gas, which generate greenhouse gas emissions.

Greenhouse Gases: Greenhouse gases are gases that trap heat in the atmosphere, leading to an increase in global temperatures.

Critical Infrastructure: Critical infrastructure is the body of systems, networks and assets that are so essential that their continued operation is required to ensure the security of a given nation, its economy, and the public's well being.

Climate-Induced Disasters: Climate change-induced natural disasters are one of the most prominent consequences of climate change and include droughts, floods, storms such as cyclones and hurricanes, earthquakes, tsunamis, and volcanic eruptions. These disasters can affect health, food systems and sustainability, structures, safety as well as livelihoods. These disasters occur naturally, however the severity and frequency are exacerbated by human activities linked to global warming.

Resilient Infrastructure: Resilient infrastructure can be defined as adequate engineering design built robustly to withstand storms and other natural disasters of a predetermined magnitude. Resilient infrastructure is thus essential when it comes to adapting to and combating the repercussions of climate change.

General Overview

Recent human activity since the pre-industrial period between 1850 and 1900, specifically fossil fuel burning, has drastically increased greenhouse gas emissions. Due to emissions of greenhouse gases, heat is prevented from returning to space and is trapped in the Earth's atmosphere, leading to an increase in global temperatures. This increase has led to an increase in the possibility of droughts, intense storms, and other natural disasters. According to the United States Geological Survey, as more water vapour is evaporated into the atmosphere due to the increased temperature and ocean surface temperatures increase, more powerful storms can develop and wind speeds in tropical storms can increase. These repercussions directly create elevated vulnerability internationally, as

critical infrastructure necessary for society to function has been destroyed. These disruptions to critical infrastructure cause potential for systemic failures amongst delivery of essential services, such as the provision of energy, transport, water, food, communications, health, and emergency response services.

Various countries have been especially affected by climate-induced disasters, however particular ones could potentially be focused on, such as in Asia, where there is a very high risk for natural disasters (World Risk Report). Below are various countries strongly at risk and affected by natural disasters.

Timor Leste

According to the UN Development Programme, Timor-Leste, a country in South-East Asia, has been prone to unpredictable weather patterns, specifically intense wet seasons and dry seasons. More than 70 percent of inhabitants live in remote rural areas with little infrastructure, therefore, the impact of climate-induced disasters (floods, landslides, erosion, sea level rise, and droughts) on their livelihoods cannot be understated. Most recently, droughts have ruined crop production and have increased food insecurity among subsistence farmers. The UNDP has established the project 'Safeguarding Rural Communities and their Physical Assets from Climate Induced Disasters in Timor-Leste' which supports the implementation of climate-resilient small-scale infrastructure, including new water supply systems, irrigation schemes, rural roads, and flood-protection infrastructure. The project also focuses on planning and implementing further rural infrastructure development programmes under village and municipality levels, aimed at improving Timor-Leste's policies, regulations and institutions related to climate change and disaster preparedness, as well as reforestation.

Thailand

Heavy rainfalls and floods have completely disrupted livelihoods and transport infrastructure in Thailand. According to the UNDP, more than 150,000 households have

been affected by floods in late 2022, and social and economic costs due to the climate-induced disasters have been devastating. While being one of the main contributors for Thailand's consumption of energy and emissions, the transport sector has been destroyed from the disasters. According to the UNDP, "Thailand is focusing on adaptation in order to respond to climate change, and the country is undertaking various adaptation actions from safeguarding biodiversity and establishing early warning systems to training farmers to increase climate resilience of nature and people". However, transport infrastructure and research into adapting roads and rails to climate change (through methods such as drainage system improvements, asphalt concrete resurfacing, and sleeper replacement) have mostly been left out of these adaptation measures. Making roads more resilient to natural hazards and climate change would accelerate Agenda 2030, as many Sustainable Development Goals focus on building stronger, safer and greener infrastructure. Thailand has been supported by the Sustainable Infrastructure Programme in Asia led by the Organisation for Economic Co-operation and Development, which has been focusing on strengthening institutional capacity for climate-resilient infrastructure planning in the transport sector.

Tajikistan

According to the Global Facility for Disaster Reduction and Recovery, by 2050, up to one third of glaciers across Central Asia are predicted to disappear entirely, which would raise the risk of floods from glacial lake outbursts. This would lead to a devastated agricultural sector and vital transport networks in the region. Tajikistan specifically has suffered the consequences of climate change, with the country seeing economic losses in excess of $1.8 billion due to major natural disasters. In order to address the issue, in 2017, the World Bank partnered with Tajikistan to strengthen critical infrastructure, with a $50 million project being implemented to focus on various aspects to improve resilient infrastructure. The project was also supported by a technical assistance grant of US$1.25 million from the Global Facility for Disaster Reduction and Recovery (GFDRR), who assisted Tajikistan by integrating resilience considerations into the design of critical

infrastructure and provided recommendations to reinforce disaster preparedness and response capacities to disasters. The UNDP also acted as a method of aid and support in order to provide financing and technical assistance that contributed to the project which benefited more than 650,000 people.

Such a program aided Tajikistan and could potentially aid other at-least LEDC's, as, in the case of Tajikistan, it aimed to;

- Reconstruct and upgrade critical bridges to improve their resistance to flooding.
- Secure important emergency transportation networks.
- Reconstruct and reinforce river embankments to improve river flow (to increase household safety, prevent erosion, and decrease disruptions to farming).
- Modernise the national crisis management centre and emergency communication systems.
- Develop a disaster risk financing strategy for Tajikistan to prepare for financing post-disaster response, recovery and reconstruction.

Major Parties Involved

United States of America: The USA has played an important role in action to improve the resilience of critical infrastructure, especially since it is a country with a high risk of natural disasters. President Joe Biden signed the Bipartisan Infrastructure Law in 2021 in order to specifically prioritise investment into modernising roads, bridges, and ports. Internationally, the US has also run programs such as the Partnership for Global Infrastructure and Investment, the Digital Invest Program from the United States Agency for International Development, and the Emergency Plan for Adaptation and Resilience in order to establish infrastructure projects in developing countries.

Organisation for Security and Co-operation in Europe (OSCE): The OSCE is the world's largest regional security-oriented intergovernmental organisation with observer status at

the United Nations. The OSCE has been supporting safeguarding energy infrastructure, mitigating natural hazards and man-made threats, and enabling energy transition. They have also been organising workshops and study visits, and developing training, capacity building, and information-sharing tools to raise awareness and build knowledge on existing risk prevention and mitigation policies and tools. Their trainings aim to provide decision makers with knowledge of key energy security topics, including risk analysis and risk management, infrastructure dependencies, resilience, emerging threats, and climate change. They also provide energy decision makers and practitioners with climate data and the capacity to integrate it into their energy policies in order to strengthen the climate resilience of their energy systems.

European Union (EU): Outside of Asia, Europe's critical infrastructure has also been devastated by climate-induced disasters. According to the European Union's Joint Research Center, annual damage to Europe's critical infrastructure could ten-fold by the end of the century under business-as-usual scenarios due to climate change alone, from the current EUR 3.4 billion to EUR 34 billion. The EU conducts national disaster risk assessments, specifically focusing on the risk of transport accidents, disruptions in the supply of energy, water, food and pharmaceuticals, ICT and satellite services or financial services. A main focus amongst the EU has been assessing potential for large-scale disruption to electricity supply. The EU has presented various proposals for directives on the resilience of critical infrastructure to create all-hazards frameworks in order to prevent, resist, absorb and recover infrastructure from disruptive incidents. Furthermore, the EU Adaptation Strategy calls for building stronger links between climate change adaptation and disaster risk reduction.

Global Facility for Disaster Reduction and Recovery (GFDRR): The GFDRR is a global partnership program established to support developing countries on disaster risk reduction and climate change adaptation. The GFDRR, along with the European Union, the Government of Japan, and USAID hosted a special instance of the Resilience

Dialogue series alongside the 2017 World Bank/IMF Annual Meetings in order to multilaterally discuss climate-smart investments and leveraging resilient infrastructure, in the interest of safety in developing countries, such as Tajikistan.

United Nations Development Programme (UNDP): The UNDP is a United Nations agency tasked with helping countries eliminate poverty and achieve sustainable economic growth and human development, and has been deeply involved in improving resilience for critical infrastructure especially in developing countries, such as Thailand, Tajikistan, and Timor Leste. The agency can play a large role in potential solutions, as it represents multilateral collaboration to combat such an international issue.

Tajikistan: Tajikistan is a country in Central Asia that is geographically a heavily mountainous region, and has suffered many climate-induced natural disasters such as droughts, flooding, landslides, and more. Tajikistan is known as the most climate vulnerable country in all of Europe and Central Asia, especially when it comes to key infrastructure.

Thailand and Timor Leste: Thailand and Timor Leste (East Timor) are both Southeast Asian countries that have experienced devastating effects from climate-induced natural disasters.

Possible Solutions

Possible solutions to the growing, global issue include:

1. Increase in both domestic and international investment into the improvement of transport networks, such as roads, bridges, ports, trains, and buses, in order to allow people to evacuate more safely in an emergency.
2. Aid from unaffected states to improve the telecommunication systems, such as cables, satellites, and phone masts, that have been affected by natural disasters.

3. Further investment into improved infrastructure of school buildings, hospitals, and other health systems, all of which are under immense pressure and danger during natural disaster emergencies.
4. Increased attention to the importance of improving national policies, regulations and institutions related to climate change and disaster preparedness, such as risk information services, vulnerability/climate hazard mapping and monitoring
5. Focus on reforestation and agroforestry interventions to provide co-benefits for resilient rural infrastructure.
6. Investment in staff training to improve the application of new tools and technologies for climate-resilient infrastructure.
7. Implementation of carbon taxes, public-private partnerships, green, social and sustainability bonds, and other forms of green financing, in order to finance the improvement of resilient infrastructure, disaster risk transfer solutions, and critical public assets.
8. Provision of international systems for exchanging critical infrastructure protection ideas, studies and good practices, such as the EU's Critical Infrastructure Warning Information Network (CIWIN).
9. Development to modernise crisis centres and emergency systems to enable first responders to rapidly access hazard information, generate warnings for at-risk communities, and dispatch emergency services.
10. In future solutions, reference to and establishment of aid programs, such the World Bank's partnership program with Tajikistan, with specific aims that help rebuild critical infrastructure and prepare countries for future disaster adaptation.
11. Support for existing rural infrastructure development programmes in various countries, for example; the UNDP's involvement in Timor Leste and Thailand, international programmes run by the US, and directives and programmes led by the EU.

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