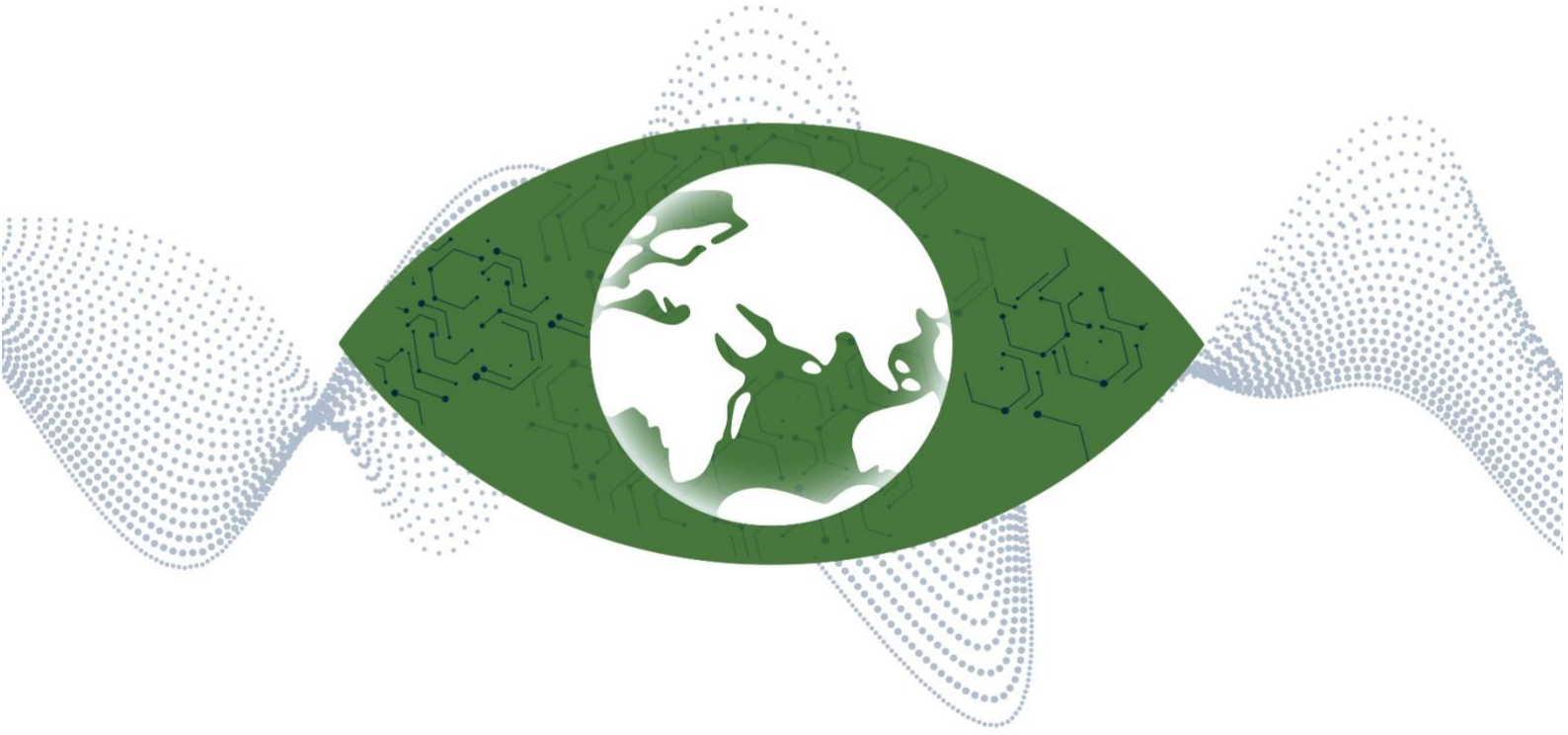
ICT for Climate Resilient Development

Academy of ICT Essentials
for Government Leaders



UNITED NATIONS ESCAP
Economic and Social Commission for Asia and the Pacific
/ APCICT

The Academy of ICT Essentials for Government Leaders

ICT for Climate Resilient Development

APCICT ASIAN AND PACIFIC TRAINING CENTRE FOR INFORMATION AND COMMUNICATION TECHNOLOGY FOR DEVELOPMENT

The Academy of ICT Essentials for Government Leaders

ICT for Climate Resilient Development

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ICT FOR CLIMATE RESILIENT DEVELOPMENT

This module introduces both the theory and practice of climate resilient development and provides an overview of how ICTs can be used to enhance climate resilient development. Real-life examples and case studies on the applications of ICTs in climate change adaptation and mitigation have been included in the module to encourage and support applied understanding of climate resilient development to participants' own areas of work.

MODULE OBJECTIVES

The key objectives of the module are:

- **Awareness raising:** Raise awareness on the role of ICT practitioners in addressing the global challenge of climate change;
- **Build understanding of key concepts:** introduce the concepts of climate resilient development and the applications of ICTs in climate resilient development, adaptation and mitigation; and
- **Strengthen integration and partnerships:** Highlight linkages between key concepts and the United Nations (UN) Sustainable Development Goals (SDGs), and strengthen collaborative partnerships between ICT and climate change professionals to achieve climate resilient outcomes.

LEARNING OUTCOMES

By the end of this module, participants will:

- Be familiar with climate resilient development and its associated terminologies, including key linkages between climate change and disaster risk management, the 2030 Agenda for Sustainable Development and SDGs;
- Be aware of ICT sector's contributions to the global challenge of climate change, including in reducing greenhouse gas (GHG) emissions;
- Understand how ICTs can be used to achieve climate resilient development in key sectors;
- Understand the key enablers for supporting the application of ICTs in climate resilient development, namely the importance of people, processes, policies and systems; and
- Apply digital applications introduced in the module to real-life situations or scenarios that are relevant to their area of work.

TARGET AUDIENCES

The module has been specifically designed for:

- ICT policymakers, managers and officers in the public sector (including those working in information and knowledge management);

- Technical officers working in climate-related sectors at national and subnational governments, including those in agriculture, fisheries, energy and environment; and
- ICT, climate change and environment professionals from the private and NGO sector.

MODULE STRUCTURE

The table below provides an overview of the structure for the module.

ICT for Building Climate Resilience	
Length	5 Thematic Blocks
Subject	Climate Change
Level	Introductory
Language	English [translation into other languages is recommended]
Completion Criteria	Complete a quiz for each thematic block (a minimum score of 70 per cent to pass) Interaction in module activities, discussions and exercises

MODULE FORMAT

The module can be delivered in person or online. For group learning, thematic blocks can include an extended collaborative activity framed around an overarching question:

"*What role can ICT play in supporting the transition to climate resilient development?"*

It is proposed that participants will work in small groups (group size to be determined based on participant numbers) through the module to consider this overarching question and prepare a short *lightning talk*[1] for presentation to the participant cohort in the final thematic block. Groups will be pre-assigned by the APCICT and training facilitators prior to the commencement of the training. Group discussion time will be provided in each thematic block with pre-assigned activities that enable reflective learning and group work towards the preparation of the *lightning talk*.

[1] A lighting talk is short presentation format, usually between three and five minutes. The time limit forces presenters to present their key messages in a precise and compelling manner.

WHAT IS ICT FOR DEVELOPMENT

"ICT for Development" (ICT4D, ICT4Dev or ICTD) is a general term referring to the application of ICTs within the field of international development and human rights."[2] Further definitions can be accessed in the APCICT Glossary.

CROSS-CUTTING THEMES: ICTD, DISASTER RISK MANAGEMENT, AND GENDER AND SOCIAL INCLUSION

The thematic blocks have been designed to focus on the important role of ICT practitioners in facilitating climate resilient development. Where relevant, the intersection between climate risk and disaster risk management will be highlighted and participants will be directed to the APCICT Academy Module on ICT for Disaster Risk Management. In addition, gender equality and social inclusion will be incorporated in each of the thematic blocks, rather than as a standalone learning unit, to foster integrated learning of gender and social dimensions of climate resilient development.

Each thematic block will be delivered using mixed digital media to encourage participants to engage in analytical thinking and critical reflection, and to support their applied knowledge of the learning content. These include:

- Lesson content that links theoretical frameworks with actual practice;
- A selection of videos and case studies from the Asia Pacific region;
- Short interactive and practical exercises including self-administered questionnaires, quizzes, group discussions and a lightning talk;
- Reflective questions to highlight the role of ICT practitioners relevant to each thematic area; and
- List of reading materials and useful resources for further learning.

LEARNING AND ANALYSIS THROUGH CASE STUDIES AND EXAMPLES

The interaction between ICTs and climate change is multi-dimensional and context-specific. For example, a technological solution or governance approach that is feasible in one part of the world may not be viable in another part of the world or even a neighboring country - due to a range of physical and socio-economic factors.

Undertaking an evaluation process of 'fit for purpose' ICT solutions, particularly in countries where human and financial resources are limited, can often be challenging for local policymakers. Noting these challenges, case studies and policy

[2] APCICT (2011). Everyday ICT terms for Policymakers and Government Officers. Available at: https://www.unapcict.org/sites/default/files/2019-01/ICT_Glossary-draft.pdf

recommendations included in the Academy Module have been identified based on a three-tier system:[3]

- **Direct effects of ICTs** - resulting from the physical existence of ICTs and the processes involved in making ICTs available;
- **Indirect effects of ICTs** - resulting from the ways in which ICTs are used economy-wide; and
- **Societal effects** - broad, society-wide transformations that new technologies can enable, in this case for climate action and resilience.

This framework provides a basis for building understanding and ongoing analysis of both current impacts of ICTs, their potential in managing climate and disaster risks, and enabling the transformation required to achieve climate resilient development.

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[3] Souter, D. (2012). *IISD Report - ICTs, the Internet and Sustainability: Where Next?* Available at https://www.iisd.org/publications/icts-internet-and-sustainability-where-next

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ABBREVIATIONS AND ACRONYMS

APCICT	Asian and Pacific Training Centre for Information and Communication Technology for Development
AR6	Sixth Assessment Report of the IPCC
CBA	Community Based Adaptation
COP	Conference of Parties
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
EBA	Ecosystem-based adaptation
ESCAP	Economic and Social Commission for Asia and the Pacific
FAO	Good and Agriculture Organization
GeSI	Global e-Sustainability Initiative
GHG	Greenhouse Gas
GIS	Geographic Information System
ICT	Information and Communication Technology
ICTD	Information and Communication Technology for Development
IPCC	Intergovernmental Panel on Climate Change
ITU	International Telecommunications Union
LDC	Least Developed Countries
M&E	Monitoring and Evaluation
NAP	National Adaptation Plan
NDC	Nationally Determined Contribution
SBTi	Science Based Targets initiative
SDG	Sustainable Development Goal
SFDRR	Sendai Framework on Disaster Risk Reduction
SIDS	Small Island Developing States
UN	United Nations
UNDP	United Nations Development Programme
UNDRR	United Nations Office for Disaster Risk Reduction

UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNSD	United Nations Statistics Division

1. BUILDING CLIMATE CHANGE RESILIENCE: THE BIG PICTURE

The learning goals for this thematic block are:

- Establish a shared understanding of the module format, facilitation method and expected learning outcomes.
- Build an understanding of the complexity of the climate change challenge and key concepts underpinning the module.
- Apply definition of key concepts to establish linkages between sustainable development, climate change and disaster risk management.

1.1. Scene Setting

We live in a complex and rapidly changing world. Many global challenges we face today involve interdependent structures and multiple actors. Examples include global environmental issues, such as climate change and biodiversity loss. They also include wider societal issues, such as global terrorism, migration and health pandemics.

Challenges of this nature are difficult to tackle. Due to the interconnected nature of issues, these problems are also often highly politicized. Addressing one problem in isolation can often lead to unintended negative consequences - or create new environmental or socio-economic challenges. For example, increasing food production in ways that deplete soil would eventually prove self-limiting. The resulting food production losses could potentially lead to displacement and conflict over resources.[4]

Complex global environmental and social challenges are sometimes described as 'wicked problems.' In other words, problems that cannot be neatly solved. A large part of the challenge is that people have very different perspectives on how to address the problem, based on their professional background or particular worldview (refer Box 1).

Climate change has been labeled a wicked policy problem. It cuts across boundaries, both disciplinary and national. It requires large-scale, systemic changes to society. As a result, international efforts to cut back on greenhouse gas (GHG) emissions have been uneven and politically divisive.[5]

[4] Bierbaum, R. et al. (2018). *Integration: to solve complex environmental problems*. Scientific and Technical Advisory Panel to the Global Environment Facility. Washington, DC. Available at https://www.thegef.org/sites/default/files/publications/STAP%20Report%20on%20integration.PDF

[5] Stang, G. (2015). *Climate change as a wicked problem*. EU Institute for Security Studies. Available at Alert_52_Climate_change.pdf (europa.eu)

Box 1. Environmental worldviews, technology and climate change

Environmental worldviews are the beliefs that shape how individuals or societies evaluate environmental issues.

These views are influenced by factors including **culture, faith, personal life-experiences, education and values.** Our environmental worldviews influence how we look at global challenges like climate change. First, in how we **understand** the challenge. Second, in how we **act**.


source: https://ensia.com/voices/climate-change-social-fix/

In recent years, there has been a growing collaboration with faith-based organizations on climate change and sustainability issues. In line with the 2015 Paris Agreement, the Islamic declaration for climate change set the framework for an ethical code of conduct to build a low-emission climate resilient future.[6] In the same year, the **Hindu Declaration on Climate Change** *'served as a global call to Hindus living worldwide to lead lives in harmony and balance with the natural world.'* Similar engagement on climate change issues is seen with other faiths - including the Baha'i[7] and Christian denominations.[8]

Reflective questions: What are your own environmental values? What are these influenced by?

Further reading:

Al-Jayyousi, O. (2018). How Islam can represent a model for environmental stewardship. Available at **https://www.unep.org/news-and-stories/story/how-islam-can-represent-model-environmental-stewardship**

Abumoghli, I & McCartney, E. (2020). The role of Environmental and Spiritual Ethics in Galvanizing Nature Based Solutions, UNEP Faith for Earth Initiative. Available at **https://wedocs.unep.org/bitstream/handle/20.500.11822/34063/1/ESE.pdf**

[6] Al-Jayyousi, O. (2018). How Islam can represent a model for environmental stewardship. Available at https://www.unep.org/news-and-stories/story/how-islam-can-represent-model-environmental-stewardship

[7] Dahl, A. (2017). The Revolutionary Baha'i Approach to Climate Change. Available at https://bahaiteachings.org/revolutionary-bahai-approach-climate-change/.

[8] Bloomfield, E (2019). Understanding Christians' climate views can lead to better conversations about the environment. Available at https://theconversation.com/understanding-christians-climate-views-can-lead-to-better-conversations-about-the-environment-115693

Bloomfield, E (2019). Understanding Christians' climate views can lead to better conversations about the environment. Available at **https://theconversation.com/understanding-christians-climate-views-can-lead-to-better-conversations-about-the-environment-115693**

Dahl, A. (2017). The Revolutionary Baha'i Approach to Climate Change. Available at **https://bahaiteachings.org/revolutionary-bahai-approach-climate-change/**

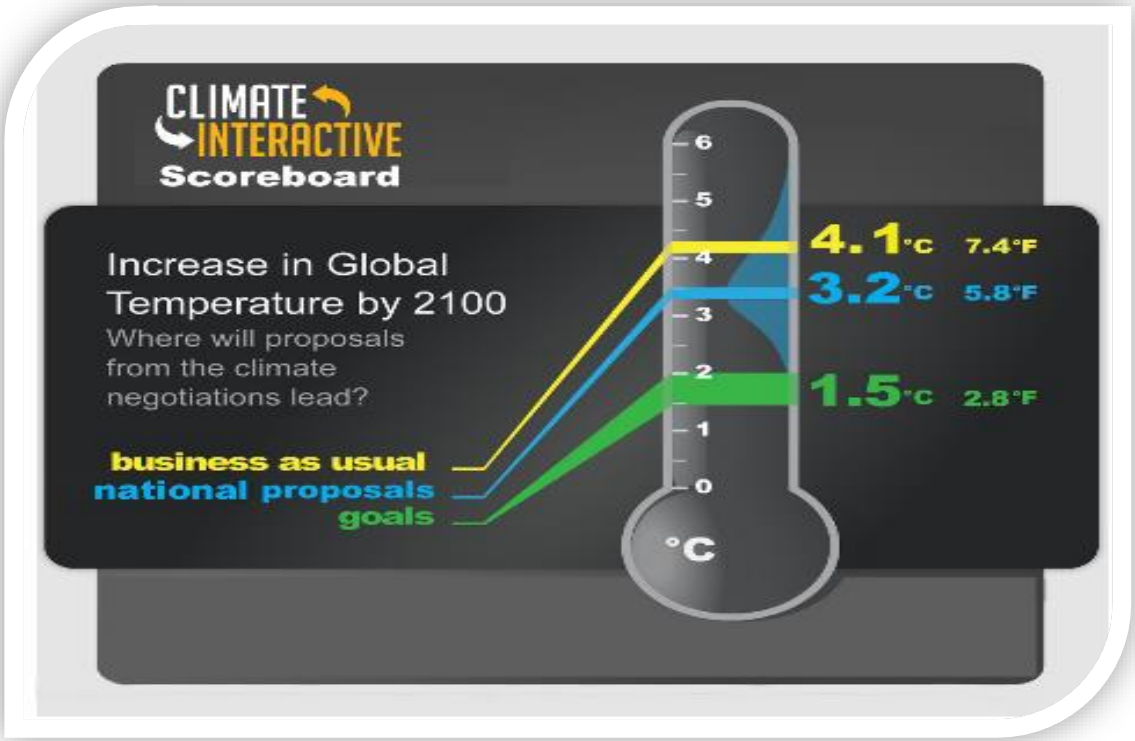
Climate change - what does the science say?

Human activities, including the burning of fossil fuels and the destruction of forests, are rapidly changing earth's climate. The rate of these changes in atmospheric greenhouse gases (GHGs) such as carbon dioxide (CO_2) and methane (CH_4) are considered unprecedented in millions of years, driving impacts on natural and human systems across the world.

How is the state of knowledge on climate change collated?

In an era of 'information overload' fast-tracked by digital innovation, it is important to reflect on the state of knowledge on climate change. Specifically, how it is collected, the process of agreement and how this information is used in international policy.

Figure 1. Climate Action Tracker



Source: Climate Interactive, 2018

The Intergovernmental Panel on Climate Change (IPCC) determines the state of knowledge on climate change. Through its assessment reports, the IPCC identifies where there is agreement in the scientific community on topics related to climate change, and where further research is needed.[9] The IPCC does not conduct its own research. The assessment reports are a key input into the international negotiations on climate change. In 2018, the IPCC released a special report on the impacts of global warming of 1.5 °C above pre-industrial levels. This report, known as SR1.5, marked an important point in the international negotiations process, with an increase in science communications and advocacy work supported by digital tools, following the launch of this report.

The SR1.5 assesses what a 1.5°C warmer world would look like, and the different pathways by which global temperature rise could be limited to 1.5°C.[10] Key conclusions from the Report are outlined below.

Understanding Global Warming of 1.5°C

- Human activities are estimated to have caused approximately 1.0°C of global warming above pre-industrial levels. **Global warming is likely to reach 1.5°C between 2030 and 2052 if it continues to increase at the current rate**.
- **Climate-related risks** for natural and human systems are higher for global warming of 1.5°C, but lower than at 2°C. These **risks depend** on the quantity and rate of warming, geography, levels of development and vulnerability. Climate-related risks also depend on the **choices and implementation** of adaptation and mitigation options.

Emission Pathways and System Transitions Consistent with 1.5°C Global Warming

- Pathways limiting global warming to 1.5°C require **rapid and far-reaching transitions** in energy, land, urban and infrastructure (including transport and buildings), and industrial systems.

Strengthening the Global Response in the Context of Sustainable Development and Efforts to Eradicate Poverty

- Climate change impacts on sustainable development, eradication of poverty and reducing inequalities would be greater if global warming were limited to 1.5°C, if **mitigation and adaptation synergies are maximized** while **trade-offs are minimized**.
- **Limiting the risks** from global warming **implies system transitions** that can be enabled by an increase of adaptation and mitigation investments, policy instruments, the acceleration of **technological innovation** and **behavior changes.**
- **Strengthening local capacity for climate action** (national and subnational authorities, civil society, the private sector, indigenous peoples, minority groups

[9] See IPCC website. Available at https://www.ipcc.ch/

[10] IPCC (2018). Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty, Available at: https://www.ipcc.ch/sr15/

and local communities) **can support the implementation of ambitious actions.**

IPCC – Sixth Assessment Cycle

The IPCC is now in its sixth assessment cycle, with the IPCC producing the Sixth Assessment Report (AR6) with contributions by its three Working Groups and a Synthesis Report, three Special Reports, and updates to its Methodology Report. In August 2021, the Working Group I contribution to AR6, *Climate Change 2021: The Physical Science Basis* was released. The report brings together the latest advances in climate science. The Synthesis Report will be the last of the AR6 products, currently due for release in 2022. More information on the Sixth Assessment cycle is available here.

From a digital communications perspective, the AR6 provides a more detailed regional assessment of climate change, including a strong **focus on useful information** that can inform risk assessment and other decision-making processes.[11] This regional information can be explored through regional fact sheets, as well as a newly produced Interactive Atlas feature (refer Figure 2). The Interactive Atlas is available here.

Figure 2. IPCC WG1: Sixth Assessment Report – digital tools

Source: IPCC 2021

[11] IPCC (2021). 'Climate change widespread, rapid and intensifying', IPCC press release. Available at https://www.ipcc.ch/2021/08/09/ar6-wg1-20210809-pr/

Communication on the science – the enabling effects of ICTs

Climate science is complex. For non-scientists, processing the details that are outlined in technical assessment reports and policymaker summaries can be challenging. To address this, science communicators are looking at different ways to communicate both the **process and key findings** of these reports. For example, social media channels are being used by science communicators from a range of technical backgrounds. As such, ICTs are being applied to enable the communication of complex science and the political negotiation process to a wider audience.

Systems thinking and managing change- how do countries develop priorities within complex systems?

"When you are living in a globalized economy and a globalized world, you cannot live in isolation; all the problems and solutions are interconnected…" Kailash Satyarthi, 2014 Nobel Peace Prize winner[12]

There is a growing awareness that tackling interconnected environmental and social challenges, such as climate change, cannot be addressed by partial analysis. The challenge requires a **'systems thinking' approach** that understands the connections between variables and is grounded in the local context (refer to Box 2).

[12] Bierbaum, R. et al. (2018). Integration: to solve complex environmental problems. Scientific and TechnicalAdvisory Panel to the Global Environment Facility. Washington, DC. Available at https://www.thegef.org/sites/default/files/publications/STAP%20Report%20on%20integration.PDF

Box 2. Systems thinking: concepts and mega-trends

Systems thinking is an analytical approach that examines the relationships between the different parts of a system. Examples can include an IT network or a commodity supply chain. Systems can also occur at different scales. For example, a regional health system or a community food-system. With its origins in mathematics, biology and computer science, systems thinking has been applied across a range of fields – from health to business management, economics and law.

source: www.food.systems/

Systems thinking and global mega-trends:
The 2020 United Nations *Shaping the Trends of our Time Report* highlights five systems-level megatrends that are shaping the world and influencing sustainable development. Specifically: demographic trends, urbanization, technological innovation, climate change and environmental degradation.

COVID-19 crisis and the megatrends: The global health pandemic has impacted the megatrends in different ways. For example, the shift to online work and learning has accelerated the digitalization of the economy. The use of mobile tracking and tracing apps for COVID-19 infections are also examples of the ways that digital technologies have been deployed to adapt to the crisis and keep activities moving. Other impacts have been more complex and challenging. In cities and urban settlements, the pandemic is highlighting major inequalities in countries with limited social safety nets. This challenge is global - from informal settlements in India and Indonesia through to highly urbanized corridors in Pacific island countries like Fiji. Moreover, the global health pandemic demonstrates that governments are capable of intervening on a massive scale. More broadly, international organizations highlight that the health pandemic offers the opportunity to 'build forward better' (FAO 2020). In other words, reinvent and reimagine many of our structures towards sustainable development.

Reflective questions: How are the global mega-trends discussed above reflected in your country? Are any of the mega-trends directly related to your line of work? How has the COVID-crisis impacted on the way you work? In what ways have digital technologies supported systems change in your area of work?

Further reading:

Ballew, M. T. et. al. (2019). Systems thinking as a pathway to global warming beliefs and attitudes through an ecological worldview. Proceedings of the National Academy of Sciences. Available at

https://climatecommunication.yale.edu/publications/systems-thinking-can-support-public-understanding-of-climate-change/

FAO (2020). Building forward better initiative: Strengthening natural resources management capacities to revitalize agriculture in fragile contexts - E-learning Nugget Briefs. Rome. Available at **http://www.fao.org/in-action/building-forward-better/en/**

UNDESA (2020). *Report of the UN Economist Network for the UN 75th Anniversary: Shaping the Trends of Our Time*. Available at

https://www.un.org/en/desa/report-un-economist-network-un-75th-anniversary-shaping-trends-our-tim

Global development frameworks and UN initiatives: consensus and thinking at the systems-level

Global calls for action are also adopting a **systems-perspective on climate change**. The United Nations Decade on Ecosystem Restoration 2021-30, aims to scale up the restoration of degraded and destroyed ecosystems as a proven measure to fight the climate crisis and enhance food security, water supply and biodiversity.

There is strong consensus across the high-level objectives or aspirations in key global development frameworks. The 2030 Agenda for Sustainable Development is centered on economic, social and environmental sustainability. It recognizes the key requirements of ending poverty and hunger; combating inequalities; leaving no one behind; and protecting the rights and dignity of all segments of society.

Many of these high-level objectives or aspirations are also reflected in the Paris Agreement that highlights the importance of inclusive processes, the rights of all people, countries with special needs, be it landlocked developing countries, Small Island Developing States (SIDS), or Least Developed Countries (LDCs), and the need to act as stewards of the environment. These aspirations are also highlighted in other international agreements that contribute to the broader development agenda such as the Sendai Framework for Disaster Risk Reduction and the New Urban Agenda.

Systems leadership and technology: complexity at the national level

From an ICT perspective, there is also a strong consensus on the enabling role of data, information, knowledge and technology to understand risk and inform implementation, across the global development frameworks.[13]

Translating this consensus to implementation and action at the national level is complex. 'Connecting the dots' across different line ministries with varying budget priorities and hierarchies requires a strong understanding of relationships and

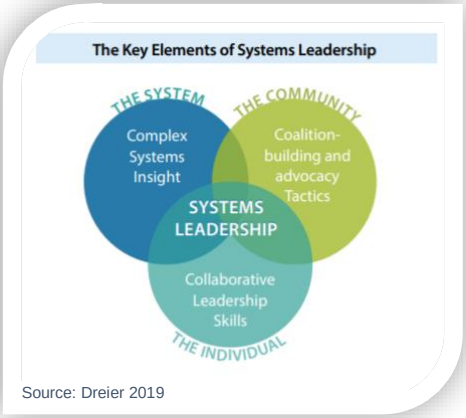
[13] Pearn, G (2019). Guidance Note: Coherence Concepts and Practices, Global Initiative on Disaster Risk Management. Available at https://www.gidrm.net/user/pages/get-started/resources/files/20201216105705-Guidance%20Note%20on%20Coherence.pdf

dependencies. It also requires the ability to engage broad networks of diverse stakeholders.

The principles of Systems Leadership offer a potentially valuable approach for addressing the complexity and scale of the climate resilient development challenge (refer to Box 3). By extension, it also informs how digital technology is being applied to consider complex and interconnected challenges.

Box 3. Systems thinking and climate change: leadership principles and practice

The principles of Systems Leadership offer a potentially valuable approach for addressing the complexity and scale of the climate resilient development challenge.



Source: Dreier 2019

A *2019 Systems Leadership for Sustainable Development* Report published by the Harvard Kennedy School argues that:

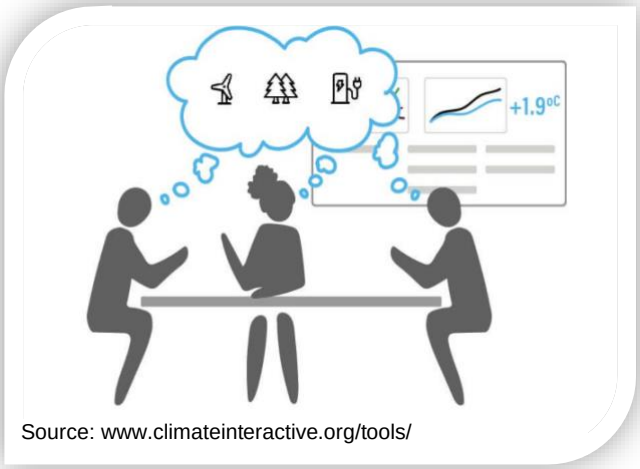
a) complex global challenges require **innovative and adaptive** approaches
b) the **ability to engage** broad networks of diverse stakeholders is key to advancing progress toward a shared vision for systemic change.

The **UN System Leadership Framework** highlights systems thinking as one of the four behaviors that leaders need to adopt in their practice. According to the Framework, leaders are asked to:

- analyze their environment as a set of complex ecosystems;
- identify their organizing principles as well as the linkages, interactions, dependencies and power distribution among components and constituencies; and
- identify leverage points to achieve maximum impact.

Systems thinking in practice – digital tools and techniques to model and simulate scenarios

Systems thinking is also the foundation for modeling techniques that explore 'future world' scenarios and climate change. These techniques are based on the understanding that climate change occurs in an interconnected world.



Source: www.climateinteractive.org/tools/

In other words, the interactions between history, culture, policy, biology, geochemistry and economics all influence the present state of the climate. Examples include the work of energy and environment think tank **Climate Interactive** and the **UN Global Climate, Land Energy & Water Strategies (CLEWS**) **model**, that allows users to navigate the relationship between water, energy, land and climate.

Digital technology is being applied to support **climate analysis** and the **communication and engagement process** on national commitments and future options in a carbon-constrained world.

Reflective questions: Think about leadership within your own organization. How does it view and analyze the issue of climate change? What decision-support tools (ICT or non-ICT related) are available to decision-makers and policymakers in your organization to address climate change?

Further reading:

Dreier, L., Nabarro, D., & Nelson, J. (2019). Systems Leadership for Sustainable Development: Strategies for Achieving Systemic Change.

Available at **https://4sd.info/wp-content/uploads/2021/02/2019_Dreier_Nabarro_Nelson-Systems_Leadership.pdf**

Messina, C. (2017). The UN Leadership Framework: a catalyst for culture change at the UN

Available at **https://www.unssc.org/news-and-insights/blog/un-leadership-framework-catalyst-culture-change-un/**

1.2. What is Climate Resilient Development?

Climate resilient development is difficult to neatly define. The concept continues to evolve, in line with society's understanding of how to most effectively address the climate change challenge.

Over the last decade, policymakers and researchers have generally described climate resilient development as an extension of adaptation planning.[14] There has been a strong focus on a 'development-needs first' approach, followed by an assessment of climate change risks to those needs.[15] Recent years have seen a growing interest in the possibilities of integrating mitigation, adaptation and sustainable development – across policy-making spheres and research institutions (refer to Appendix B Further Reading). This will be discussed in more detail in Thematic Block 4.

The concept of climate resilient development is underpinned by a number of key principles:

- Sustainable development and climate change are inseparable;
- The climate crisis is a politically charged 'wicked problem' that involves interdependent structures and multiple actors; and
- There is 'no one size fits all approach.

These principles are discussed further below.

Sustainable development and climate change are inseparable

Without a stable and healthy earth system, the Sustainable Development Goals (SDGs) will not be achieved.[16] Finalized in 2015, the relevant international development frameworks - the Paris Agreement of the United Nations Framework Convention on Climate Change (UNFCCC) and the UN 2030 Agenda for Sustainable Development are intended as interlinked frameworks that support country-driven implementation.

An acceleration of the Paris Agreement in the upcoming decade must be discussed in strong correlation with the achievement of the SDGs.[17] However, this presents a key challenge. As acknowledged by climate researchers, *"an ambitious climate goal such as the Paris Agreement objective of limiting global warming to well below 2 degrees*

[14] Kim, Y et al. (2017). A *perspective on climate-resilient development and national adaptation planning based on USAID's experience, Climate and Development*, 9(2), 141–151.Available at https://doi.org/10.1080/17565529.2015.1124037

[15] Fankhauser, S.& Schmidt-Traub, G (2011). *From adaptation to climate-resilient development: The costs of climate-proofing the Millennium Development Goals in Africa. Climate and Development*, 3(2), 94–113. Available at https://doi.org/10.1080/17565529.2011.582267

[16] Steffen, W. et al. (2015). Planetary boundaries: guiding human development on a changing planet. Science 347. Available at https://science.sciencemag.org/content/347/6223/1259855

[17] UNESCAP (2021). Asia and the Pacific SDG Progress Report. Available at https://www.unescap.org/sites/default/d8files/knowledge-products/ESCAP_Asia_and_the_Pacific_SDG_Progress_Report_2021.pdf

*Celsius and pursuing 1.5 degree Celsius helps achieve most SDGs but it creates a trade-off for some SDGs and balancing the goals will be a challeng*e".[18] For further discussion, refer to Thematic Block 2.

The climate crisis is a politically charged 'wicked problem' that involves interdependent structures and multiple actors

Food security, terrorism, health pandemics, migration and climate change are considered wicked policy problems. These social challenges are characterized by:

- involving multiple causes;
- anticipated and unanticipated effects; and
- high levels of disagreement concerning the nature of a problem and the appropriateness of solutions.

Often competing coalitions of policy actors are actively framing and reframing policy problems in different ways. As noted by geo-information technology scholars, spatial knowledge and its role for policymakers will differ, according to the political nature of the problem.[19] Examples of this are discussed further in Block 3.

There is 'no one size fits all approach'

The transition process to climate resilient development will differ from country to country. **Climate risk is not equally shared across the global economy.** Further, ICTs are not equally applied to monitor and address climate change challenges.

For one, countries are at different starting points. Industrialized economies will need to achieve 'net zero emissions' earlier than developing countries that are still building up their infrastructure and have less resources to contribute towards the transition to 'carbon neutrality' in the short term.[20] Natural and human resource assets also influence physical and social vulnerability, exposure and ability to adapt to unavoidable impacts of climate change.

[18] Lee, H. (2019). Climate Action and Sustainable Development are Inseparable. Available at https://sdg.iisd.org/commentary/guest-articles/climate-action-and-sustainable-development-are-inseparable/

[19] Georgiadou Y. (2019). Geo-information technology, wicked policy problems, and global development. Available at https://unctad.org/news/geo-information-technology-wicked-policy-problems-and-global-development

[20] Australian Academy of Science (2021). The risks to Australia of a 3°C warmer world. Available at www.science.org.au/warmerworld

1.3. What role can ICTs play in supporting climate resilient development?

The ICT sector consumes energy and materials, but its role and potential in response to climate change and development challenges is also significant.

These effects can be classified in three categories.[21] Specifically:

- **Direct effects** – energy consumed by the ICT sector;
- **Indirect effects** – efficiencies that ICTs *could* enable; and
- **Societal effects** – broad, society-wide transformations that new technologies could enable in the future, in this case for climate action and resilience.

This framework provides a basis for building understanding and ongoing analysis of both current impacts of ICTs, and their potential in managing climate risks, and enabling the transformation required to address the climate crisis (refer to Box 4). The case studies and policy recommendations included in the Academy Module have been categorized according to this framework.

Box 4. What role can ICT play in supporting climate resilient development?

Direct effects - Energy consumed by the ICT sector
ICTs have an impact at each stage of their life cycle. These impacts relate to resources used during production, distribution and end-use.
For example, the jobs created in ICT manufacturing and services, or the carbon emissions generated by manufacturing, data centers and the use of terminal devices.[22]

Further, there are societal risks and opportunities that come with the maintenance of a wide network of digital equipment over an extended period of time. Key considerations[23] include:

- What is the lifespan of network equipment?
- What is the relationship with the quality or suitability of the equipment in a particular geography?

[21] Woodhouse, T. (2021). Sustainable, universal access to the internet: Environmental implications and policy choices. Alliance for Affordable Internet. Available at https://a4ai.org/research/sustainable-access-report/

[22] Souter, D (2020). Inside the Digital Society: Measuring the impact of ICTs on development. Available at https://www.apc.org/fr/node/36025

[23] Woodhouse, T (2021). Sustainable, universal access to the internet: Environmental implications and policy choices. Alliance for Affordable Internet.

- Is there local capacity to trouble-shoot, repair and maintain digital assets?

Indirect effects - Efficiencies that ICTs *could* enable
Indirect effects relate to the use of ICTs. In other words, the applications of ICTs in society or how government processes and businesses adapt with technology. For example, making transport and machinery less wasteful. Other examples include heating and cooling houses only when needed, or turning commuting workers into 'telecommuters.' Indirect effects can have positive and negative implications for GHG emission reduction and economic 'winners and losers' across sectors. For example, the loss of jobs in sectors undermined by internet-enabled businesses - such as music or video retail. Another example is the reductions in carbon emissions achieved through automated management of electricity generation and distribution. The ultimate impact of these ICT interventions is dependent on a number of factors related to local needs, organizational culture and government processes.[24]

Societal effects - using ICTs for society-wide transformation
From a whole-of-society perspective, large numbers of people using ICTs over the medium-to-long term has the potential to fundamentally alter how economies and societies work. However, these changes don't result from millions of people doing more with their devices.[25] They happen from governments and corporations using ICTs to change big systems, which are themselves outside the ICT sector. For example, systems and businesses that generate energy, run infrastructure, make products, control urban environments and manage transport systems.

At a national-government level, there is increasing interest in the application of digital innovation to streamline and support public administration processes and the way that governments 'do business', particularly in the context of the COVID-19 global health pandemic (refer to Case Study 1).

Case Study 1. Digital Transformation and Climate Resilience

The Challenge: The transformation from paper-based administration to digital government services and e-governance is complex. Digital transformation efforts in the private sector are advancing, with significant acceleration through the COVID-19 pandemic. However, digital transformation is more than implementing a technology solution. Digital transformation requires equal attention to i) people with capabilities, roles, and responsibilities, ii) governance with strategies and leadership support to drive behavior change, and iii) processes which cover end-to-end digital

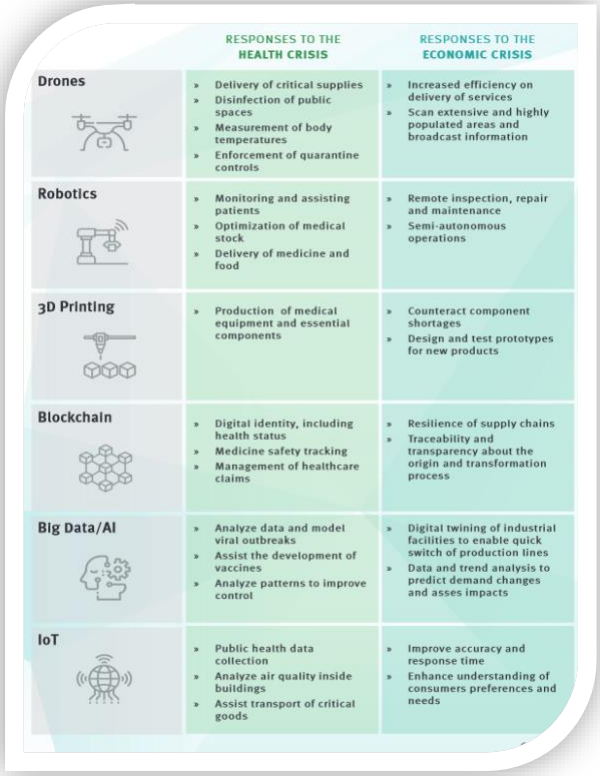
[24] Brown, R et al. (2015). Barriers to effective adaptation and resilience planning in the Pacific: an information management perspective. Available at https://www.researchgate.net/publication/282735518_Barriers_to_effective_adaptation_and_resilience_planning_in_the_Pacific_an_information_management_perspective

[25] Souter, D (2020). Inside the Digital Society: Measuring the impact of ICTs on development. Available at https://www.apc.org/fr/node/36025

information with services and interoperability across platforms in different departments and teams.

Opportunities: The interdisciplinary and cross sectoral coverage of climate data, information, and services provide a strong rationale for digital transformation. The COVID- 19 recovery and efforts to 'build forward better' support strengthening the institutionalization of digital transformation efforts.

Links to ICTs: Digital transformation approaches should not rely solely on technology implementation. 'Maturity measurements' are recommended to assess the readiness status of a particular department or ministry. This process can assist with identifying priorities, within the context of human resources, governance, and business processes. The **United Nations E-Government Survey 2020** provides comprehensive guidance and measurement of progress. Effective digital transformation efforts will also strengthen and advance innovative technologies such as big data, earth observations (EO), artificial intelligence (AI) and machine learning. However, this requires local capacity/skills training and a clear assessment and consultation process on the real and perceived risks associated with confidentiality and data breaches.



	RESPONSES TO THE HEALTH CRISIS	RESPONSES TO THE ECONOMIC CRISIS
Drones	» Delivery of critical supplies » Disinfection of public spaces » Measurement of body temperatures » Enforcement of quarantine controls	» Increased efficiency on delivery of services » Scan extensive and highly populated areas and broadcast information
Robotics	» Monitoring and assisting patients » Optimization of medical stock » Delivery of medicine and food	» Remote inspection, repair and maintenance » Semi-autonomous operations
3D Printing	» Production of medical equipment and essential components	» Counteract component shortages » Design and test prototypes for new products
Blockchain	» Digital identity, including health status » Medicine safety tracking » Management of healthcare claims	» Resilience of supply chains » Traceability and transparency about the origin and transformation process
Big Data/AI	» Analyze data and model viral outbreaks » Assist the development of vaccines » Analyze patterns to improve control	» Digital twining of industrial facilities to enable quick switch of production lines » Data and trend analysis to predict demand changes and asses impacts
IoT	» Public health data collection » Analyze air quality inside buildings » Assist transport of critical goods	» Improve accuracy and response time » Enhance understanding of consumers preferences and needs

Digital transformation and industrial recovery: COVID-19 impacts and responses *source: UNDIDO, 2020*

Type of effect: Indirect effect, related to the use of ICTs but also a potential societal effect, based on how governments deliver services to society. Better outreach with services and community engagement can facilitate two-way communication and feedback to assess and improve e-governance and digital government. Examples include citizen science or co-designed early warning systems. Effective digital government services can also optimize the conditions for private sector contributions to climate resilient development.

References:

Anukoonwattaka, W et al. (2021). Digital economy integration in Asia and the Pacific, ARTNeT Working Paper Series, No. 208, August 2021, Bangkok, ESCAP. Available at **https://www.unescap.org/sites/default/d8files/knowledge-products/AWP 208 Witada Pedro Preety_1.pdf**

International Telecommunication Union (ITU and Teltscher, S. (2020). Accelerating action through digital transformation: strengthening digital skills and capacities for human wellbeing. Available at **https://sustainabledevelopment.un.org/content/documents/26666HLPF_Susan_Teltscher.pdf**

Skills Framework for the Information Age (SFIA) (2021). Available at **https://www.sfia-online.org/**

1.4. Key Takeaways

To summarize, the key takeaways from Thematic Block 1 are:

Thinking at the systems-level to inform local actions

- Climate change is a complex environmental and social challenge. The challenge requires a 'systems thinking' analysis and leadership approach that understands the connections between global variables and local issues.
- Sustainable development is influenced by mega-trends: demographic trends, urbanization, technological innovation, climate change and environmental degradation.

Climate science and the connection to climate resilient development

- Climate science is complex. To address this, ICTs are being applied to enable the communication of complex science and the political negotiation process, to a wider audience.
- Climate resilient development is underpinned by a number of key principles: sustainable development and climate change are inseparable; the climate crisis is a politically charged 'wicked policy problem' that involves interdependent structures and multiple actors; and there is no 'one size fits all approach. The transition process to climate resilient development will differ from country to country.

What role can ICT play in supporting the transition to climate resilient development – what are the implications for policy?

- The ICT sector is recognized as both a contributor and part of the potential response to climate change. These effects can be classified into direct, indirect and societal effects.
- The COVID-19 global heath pandemic has demonstrated that governments can intervene on a massive scale when the risks and threats are immediate and large enough, which has implications for how governments plan and respond to climate change risks.

Group Planning Session

Participants will have allocated time to meet with their assigned group members to discuss the *lighting talk* and what is required from this activity (the final presentation of *lightning talks* will take place in Block 5).

2. ICT FOR CLIMATE CHANGE MITIGATION

The learning goals for this thematic block are:

- Recognize key concepts and terminologies associated with climate change mitigation.
- Understand the complexities associated with reducing emissions and achieving digital connectivity for all.
- Evaluate the ICT sector's contribution towards GHG emissions (globally and regionally) and the role it plays in combatting global warming.
- Understand how ICTs are being deployed as a solution to inform and enhance mitigation policies, measures and decisions at national and subnational scales.

2.1. What is Climate Change Mitigation?

Climate change is a complex problem that requires solutions based on information and expertise from different disciplines.

In terms of policy, climate change responses typically fall into two main categories: mitigation and adaptation.

Climate change mitigation refers to human intervention to reduce the sources or enhance the 'sinks' of greenhouse gases. Examples include using fossil fuels more efficiently for industrial processes or electricity generation, switching to renewable energy like solar or wind power, improving the insulation of buildings, and expanding forests and other 'sinks' to remove or 'sequester' greater amounts of carbon dioxide from the atmosphere. [26] The idea of reducing GHG emissions by balancing a measured amount of carbon so they are equal to or less than those that are absorbed naturally by the planet (through forests, oceans and soils) is called **carbon neutrality** or **net zero emissions**.[27]

Th terms ecological footprint and carbon footprint are also often used in policymaking, research and marketing campaigns on climate change issues. The ecological footprint concept was introduced in the 1990s, as a measure of the sustainability of a population's consumption.[28] In simple terms, the footprint converts all consumption into the land used in production**,** along with the 'theoretical' land needed to absorb the greenhouse gases produced.[29] While the general assumptions underlying the ecological footprint concept have been debated, the ongoing discussions have fed into the development of other footprinting tools to measure environmental impact.

[26] UNFCCC secretariat (2021). 'Glossary of climate change acronyms and terms'. Available at https://unfccc.int/process-and-meetings/the-convention/glossary-of-climate-change-acronyms-and-terms#m

[27] UNFCCC secretariat (2021). 'A beginners guide to climate neutrality'. Available at https://unfccc.int/blog/a-beginner-s-guide-to-climate-neutrality

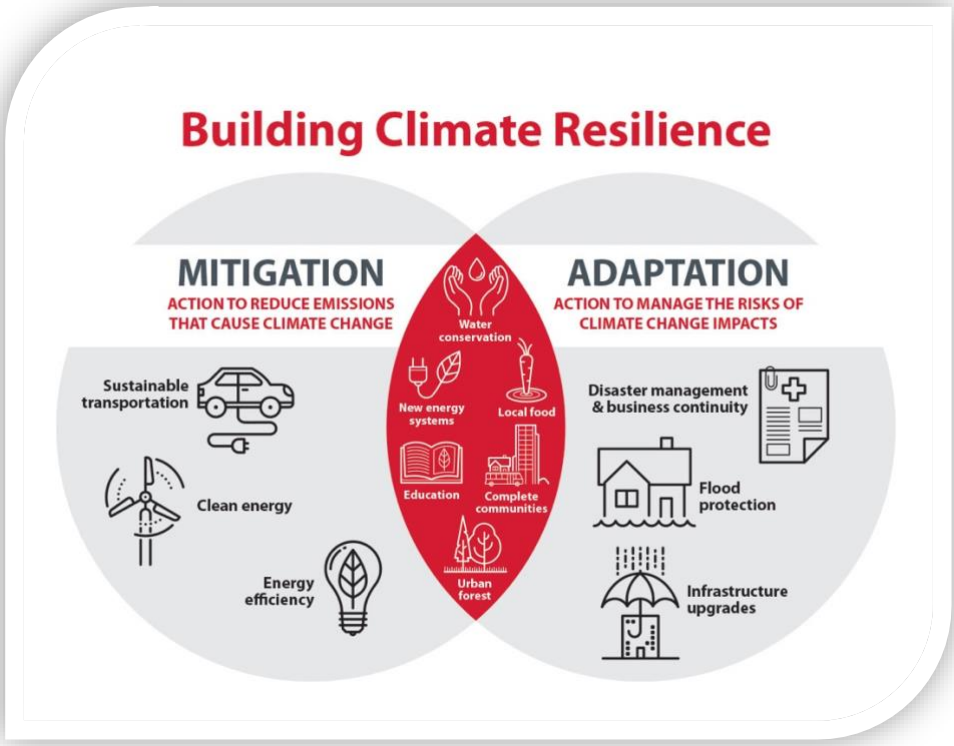
[28] Global Footprint Network (2021). 'Ecological Footprint'. Available at https://www.footprintnetwork.org/our-work/ecological-footprint/

[29] Fiala, N. (2008). 'Measuring sustainability: Why the ecological footprint is bad economics and bad environmental science,' Ecol. Econ. 519-525. Available at www.sciencedirect.com

The term **carbon footprint** refers to the measure of the total amount of carbon dioxide (CO2) produced through the burning of fossil fuels due to human activity.[30] Carbon footprint can be measured for individuals, households, companies, organizations and other entities. The carbon footprint concept has also been critiqued, based on its use in marketing campaigns by the fossil fuel industry, to redirect responsibility onto consumers.[31]

Whilst climate change mitigation is about reducing GHG emissions, climate change adaptation focuses on actions to manage the risks of climate change impacts. Together, they support countries and entities in building climate resilience as shown in Figure 3. The concept of adaptation is discussed in more detail in Thematic Block 3 ICT for Climate Change Adaptation.

Figure 3. How climate change mitigation and adaptation contribute interconnects to build climate resilience



Source: City of Calgary 2021 https://www.calgary.ca/uep/esm/energy-savings/climate-change.html?redirect=/climateprogram

[30] Ertug, E. and Hoekstra, A. (2012). *Carbon and water footprints: concepts, methodologies and policy responses*. United Nations Educational, Scientific and Cultural Organization, Paris, France. Available at https://unesdoc.unesco.org/ark:/48223/pf0000217181

[31] Mitloehner, F. (2020), 'Big oil distracts from their carbon footprint by tricking you to focus on yours,' Clarity and Leadership for Environmental Awareness and Research at UC Davis, Available at https://clear.ucdavis.edu/blog/big-oil-distracts-their-carbon-footprint-tricking-you-focus-yours

Mitigation and adaptation are recognized as the two policy pillars of response to reduce the negative impacts of climate change.[32] In practice, most mitigation and adaptation interventions have been implemented separately in policies and projects. In recent years, there have been increasing efforts to examine the links between mitigation and adaptation and how an integrated approach can be pursued to achieve priorities on climate change and disaster resilience, and sustainable development.[33]

Bringing mitigation, adaptation and sustainable development together, requires 'transformation' and systemic change. In other words, major structural changes to the global economy.

The IPCC views 'transformation' as systems-level changes that allow rapid advances in climate change mitigation and adaptation while also pursuing the SDGs of Agenda 2030.[34] In other words, ensuring that climate change initiatives are implemented in a way to facilitate sustainable development, while reducing GHG emissions and enhancing the adaptive capacity of natural and human systems to climate change and disaster impacts.

Co-benefits, synergies and trade-offs

The term **co-benefits** in climate change refers to the simultaneous achievement of several interests or objectives from a single intervention or investment.[35] The intervention and investment can be public or private, or a combination of both. Examples include climate change mitigation initiatives that also contribute to improvements in air quality and health, resource efficiency, waste minimization and economic prosperity.[36]

Climate change mitigation and adaptation responses that result in positive effects are also known as **synergies** and those that have negative effects are known as **trade-offs**.[37] Climate change interventions and investments need to consider the

[32] Jeong, J and Ko, H (2021), *Bracing for climate impact: Renewables as a climate change adaptation strategy*. International Renewable Energy Agency, Abu Dhabi. Available at Bracing for climate impact: Renewables as a climate change adaptation strategy (irena.org)

[33] WRI (World Resources Institute) and UNDP (2019), *Enhancing NDCs: A guide to strengthening national climate plans by 2020, WRI Publications*. Washington, DC, Available at www.wri.org/publication/enhancing-ndcs.

[34] IPCC (2018). *Global Warming of 1.5°C. An IPCC Special Report*. WMO, IPCC, Geneva. Available at https://www.ipcc.ch/sr15/

[35] Mayrhofer, JP and Gupta, J (2015). The science and politics of co-benefits in climate policy, *Environmental Science and Policy*, Vol 57: pp. 22-30. Available at http://dx.doi.org/10.1016/j.envsci.2015.11.005

[36] Helgenberger, S. et. al. (2019). Co-benefits of Climate Change Mitigation. In: Leal Filho, W, Azul, M, Brandli, L, Ozuyar, P and Wall T. *Climate Action*. Available at https://doi.org/10.1007/978-3-319-71063-1_93-1

[37] IPCC (2018). 'FAQ 5.1 What are the Connections between Sustainable Development and Limiting Global Warming to 1.5 above Pre-Industrial Levels?' Available at https://www.ipcc.ch/sr15/faq/faq-chapter-5/

opportunities to maximize synergies and minimize trade-offs with sustainable development.[38]

For example, installing reverse cycle air-conditioning to improve thermal comfort for people impacted by extreme heat or cold, could be considered a climate change adaptation measure. However, if the electricity source for the air-conditioning is derived from coal or gas, then the adaptation measure is resulting in a **trade-off** with mitigation targets. Trade-offs could potentially be minimized if the building is renovated. Passive cooling measures could be taken to reduce air conditioning requirements in hot climates, or thermal mass principles used in colder climates, to reduce heating requirements. This approach requires a large investment or 'systems-level' change but the long term **co-benefits** could include improved indoor air quality and well-being for residents and resource efficiency, as well as addressing climate change adaptation requirements.

Why urgent and significant action is needed to limit global warming

As one of the major challenges facing humanity in the 21st century, climate change presents serious disruptions and implications on our environmental, political, economic and societal systems.[39]

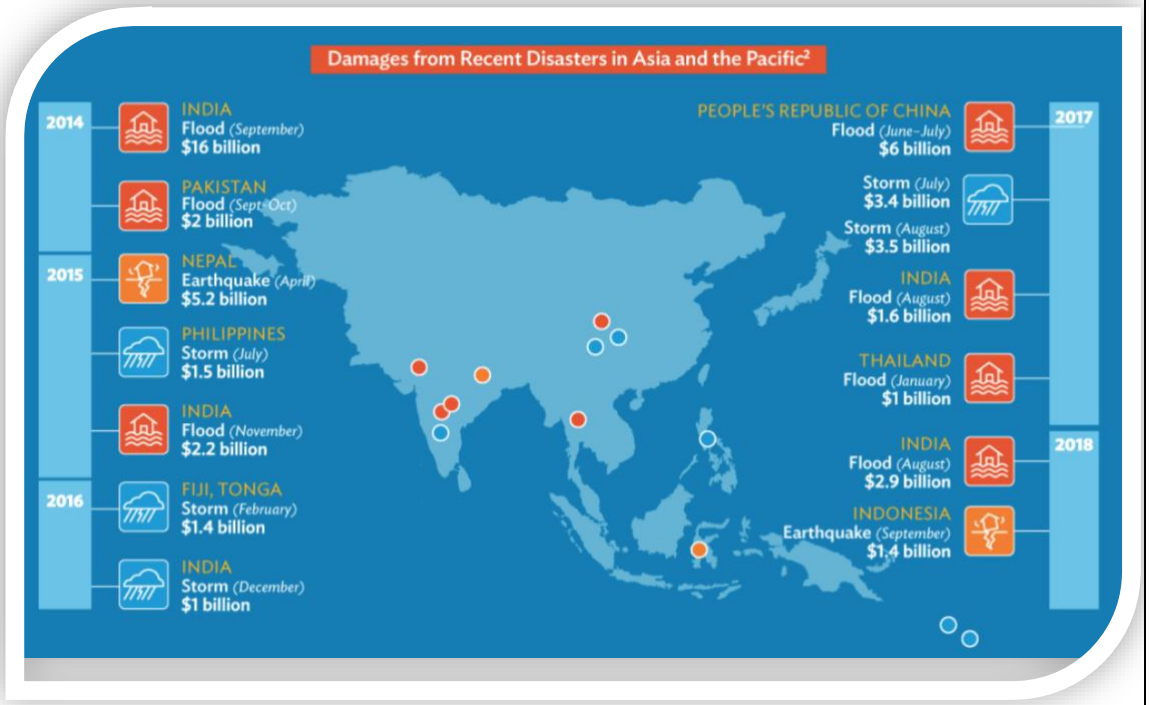
The impacts of climate change are recognized as greatest for people in poverty and those living in fragile and conflict areas. They may not have equal rights and access to natural resources (e.g. land and water), essential services (like health and education), financial capital (e.g. savings, property, income, insurance), technology (e.g. phones and devices to access early warnings) and other means required to effectively prepare, respond, manage and recover from climate and disaster events.[40] Climate change is a risk multiplier; if no significant actions are taken to address the issue then climate change can exacerbate poverty, trigger and intensify conflict over finite resources, and potentially displace millions of people across the world (refer to Box 5).

Box 5. Climate change and disaster impacts in the Asia Pacific region

The climate emergency is an immediate and ongoing threat for communities in LDCs, SIDS, low-lying coastal areas and deltas. Seven out of 10 countries worldwide with the highest estimated disaster risk are in the Asia Pacific region:

[38] Ibid.
[39] United Nations Security Council (2021). *Climate Change 'Biggest Threat Modern Humans Have Ever Faced', World-Renowned Naturalist Tells Security Council, Calls for Greater Global Cooperation.* Press Release. SC/14445. 23 February 2021.
[40] Aipira, A, et. al (2017). Climate change adaptation in Pacific countries: fostering resilience through gender equality. In: Leal Filho W (ed) *Climate change adaptation in Pacific countries*. Climate Change Management, Springer, Cham, pp 225–239. https://doi.org/10.1007/978-3-319-50094-2_13

Bangladesh, Cambodia, Philippines, Solomon Islands, Timor-Leste, Tonga and Vanuatu.[41]



Source: Asian Development Bank 2019

In the Asia-Pacific region alone, 5.2 billion people have been affected by disasters, 1 million lives lost and USD 843.6 billion in total direct physical loss experienced as a result of climate and disaster risks (such as floods, storms, earthquakes, drought, extreme temperature, wildfire) between 1989 and 2018.[42] These are based on available data. A recent study of the international disasters database (EM-DAT) found that 80 per cent of entries were missing data on economic loss.[43] Out of all types of disasters in EM-DAT, entries for storms, earthquakes and wildfires contained relatively more information on economic loss, compared to rare and complex events such as animal accidents, disease epidemics and other multifaceted disasters. Missing data on economic loss in the EM-DAT is the highest for Africa (95 per cent), followed by Europe (78 per cent) and Asia (77 per cent). The Americas and Oceania have lower proportion of disaster entries with missing data (72 per cent and 60 per cent respectively).

Reducing the number of fatalities and people affected by disasters, as well as minimizing disaster-induced economic loss, damage to infrastructure and disruption of basic services by 2030 are included in the global targets of the Sendai Framework

[41] Asian Development Bank (2019). 'Climate Change and Disasters in Asia and the Pacific'. Available at https://www.adb.org/news/infographics/climate-change-and-disasters-asia-and-pacific
[42] Ibid.
[43] Centre for Research on the Epidemiology of Disasters (2021). *Missing data on economic loss variables from EM-DAT*. Available at https://cred.be/sites/default/files/CredCrunch63_JvLFinal.pdf

on Disaster Risk Reduction.[44] As the risks of climate change and disasters are heightened, improving data collection and reporting is critical to policy-making and actions on climate change. To see an analysis of humanitarian crises and disaster data for the Asia Pacific region, refer to the European Commission's INFORM risk tools.

Reflective questions: What are the major disasters experienced by your country or province/locality in the last decade? Did the disaster event result in new or improved approaches to reducing disaster risks in your province/locality? Are you able to find data for these major disasters, including the number of affected persons, evacuees and fatalities?

Further reading:

Asian Development Bank (2019). 'Climate change and disasters in Asia and the Pacific'. Available at https://www.adb.org/news/infographics/climate-change-and-disasters-asia-and-pacific
Eckstein D, Künzel V and Schäfer L (2021). *Global Climate Risk Index 2021.* Available at https://germanwatch.org/en/19777

The Sendai Framework Monitor. Available at https://sendaimonitor.undrr.org [For global and country reporting on SFDRR]

United Nations Office for Disaster Risk Reduction (UNDRR) (2018). Technical guidance for monitoring and reporting on progress in achieving the global targets of the Sendai Framework for Disaster Risk Reduction. Available at https://www.preventionweb.net/publication/technical-guidance-monitoring-and-reporting-progress-achieving-global-targets-sendai

UNDRR (2018). Monitoring the Implementation of Sendai Framework for Disaster Risk Reduction 2015-2030: A Snapshot of Reporting for 2018. Available at https://www.undrr.org/publication/monitoring-implementation-sendai-framework-disaster-risk-reduction-2015-2030-snapshot

Global frameworks on climate action

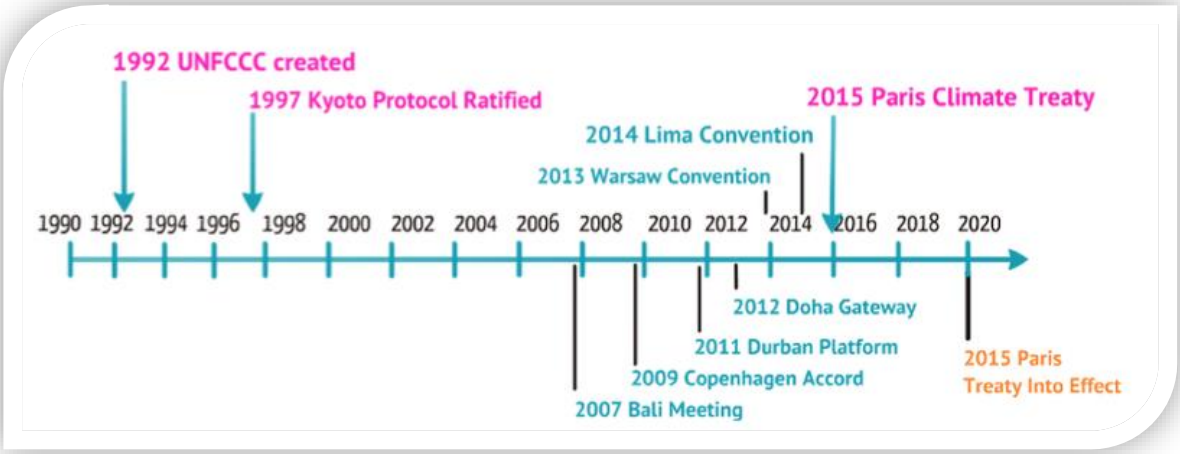
The United Nations Framework Convention on Climate Change (UNFCCC) is the first international treaty to explicitly address climate change. The core objective of the Convention is to stabilize GHG concentrations "at a level that would prevent dangerous anthropogenic (human-induced) interference with the climate system."[45] It states that "such a level should be achieved within a timeframe sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened, and to enable economic development to proceed in a sustainable manner." The Convention came into force on 21 March 1994 and it has been ratified

[44] United Nations (2015). 'Sendai Framework for Disaster Risk Reduction 2015-2030'. Available at https://www.undrr.org/publication/sendai-framework-disaster-risk-reduction-2015-2030
[45] United Nations (1992). *United Nations Framework Convention on Climate Change.*

by 197 countries.[46] Each member state is bound to act in the interests of human safety even in the face of scientific uncertainty.

The UNFCCC established an annual forum called the Conference of Parties (COP) to facilitate international discussions on how to advance and achieve the objective of the Convention. These meetings resulted in the Kyoto Protocol in 1997 (and associated Doha Amendment in 2012) and later, the Paris Agreement in 2015. Other major agreements and meetings of the UNFCCC are illustrated in Figure 4.

Figure 4. Historical timeline of major international agreements and meetings of the UNFCCC



Source: Eddebbar, Gallo and Linsmayer 2015 https://cmbc.ucsd.edu/wp-content/uploads/sites/399/2015/11/Eddebbar-et-al.-2015-The-Oceans-and-the-UNFCCC.pdf

The Paris Agreement: A new deal

At the 21st meeting of the Conference of the Parties (COP 21) to the UNFCCC in 2015, Parties to the UNFCCC adopted the Paris Agreement (the 'Agreement').[47] The Agreement is underpinned by the goal of limiting global temperature rise to 1.5°C and 2°C above pre-industrial levels.[48] It commits both developed and developing nations to reducing GHG emissions - a significant milestone reached in over two decades of climate change negotiations.[49] In addition to substantially reducing GHG emissions at

[46] UNFCCC secretariat (2021). 'What is the United Nations Framework Convention on Climate Change?' Available at https://unfccc.int/process-and-meetings/the-convention/what-is-the-united-nations-framework-convention-on-climate-change

[47] UNFCCC secretariat (2021). 'The Paris Agreement' Available at https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement

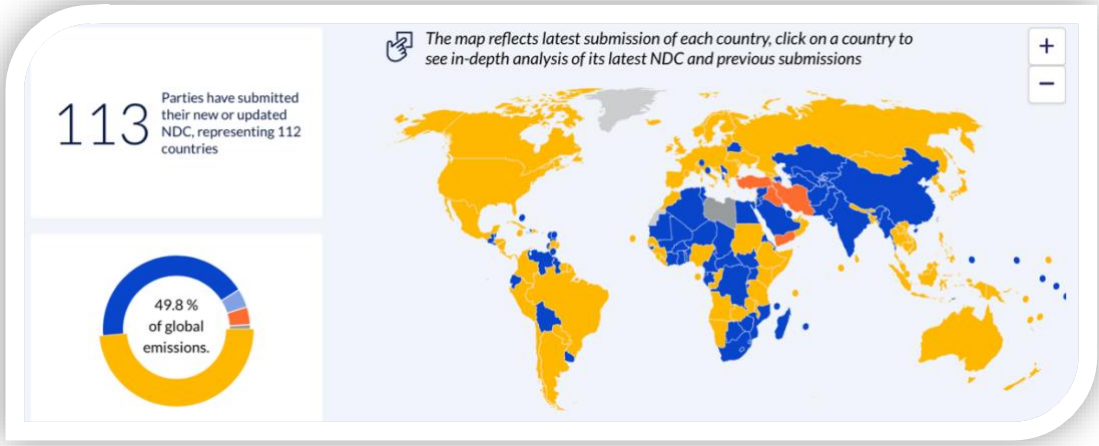
[48] UNFCCC secretariat (2015). *Paris Agreement to the United Nations Framework Convention on Climate Change*.

[49] ESCAP (2020). *Accelerating Implementation of Paris Agreement in the Asia-Pacific Region: A guide for Policymakers*. Available at https://www.unescap.org/sites/default/d8files/knowledge-

a global scale, the Agreement seeks to increase the resilience of countries against the adverse impacts of climate change, and ensure finance flows are available to support the implementation of these objectives.[50]

Box 6. Communicating climate targets and actions: Nationally Determined Contributions

Under the Paris Agreement, each Party is required to develop a nationally determined contribution (NDC) to communicate their national climate targets and accompanied by proposed measures and local processes for defining, implementing and evaluating these actions. Parties are required to update their NDCs every five years with the expectation that each successive NDC will represent a progression towards the Paris Agreement targets. As of August 2021, 113 Parties have submitted their new or updated NDC. Together, they account for 49.8 per cent of global GHG emissions.



Source: NDC Partnership 2021

In updating and reviewing their NDCs, governments in the Asia Pacific region could consider:[51]

- Just transition plans to create employment in clean energy and other sectors with greening potential to offset jobs in mining, heavy industries and other high carbon emitting sectors that will be lost as part of the decarbonization;
- Employment policies that incentivize clean energy transition; and

products/Accelerating%20Implementation%20of%20the%20Paris%20Agreement%20in%20Asia-Pacific_final_2021-02-16%20edited_0.pdf

[50] UNFCCC secretariat (2021). 'The Paris Agreement' Available at https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement

[51] ESCAP (2020). *Accelerating Implementation of Paris Agreement in the Asia-Pacific Region: A guide for Policymakers*. Available at https://www.unescap.org/sites/default/d8files/knowledge-products/Accelerating%20Implementation%20of%20the%20Paris%20Agreement%20in%20Asia-Pacific_final_2021-02-16%20edited_0.pdf

- ‘Smart’ technologies that can better regulate supply with demand, level out prices and increase the integration of renewables into the energy mix.

Online tools and platforms are being utilized to support countries develop, implement, track progress and report on their NDCs. Examples include the World Bank’s NDC Platform which visualizes initial national commitments to mitigation and adaptation actions in certain sectors and subsectors; the European Union-funded Intra-African, Caribbean and Pacific States’ NDC online tool which enables the user to explore opportunities for low-carbon and climate-resilient growth; the International Renewable Energy Agency’s Renewable Energy Dashboard and the Climate Action Tracker which reports on successive NDCs and their alignment in meeting the goals of the Paris Agreement.

Reflective questions: Using one or more of the online tools and platforms, check if your country has submitted an updated NDC. What commitments are made in the NDC to achieve the Paris targets of keeping global warming to 1.5 and 2°C above pre-industrial levels? Can you identify opportunities and challenges for ICTs to be mobilized to support your country in meeting its NDC commitments, including targets on GHG emission reduction?

Further reading:

NDC Partnership (2021). ‘Knowledge Portal: NDC Content’. Available at https://ndcpartnership.org/node/21071

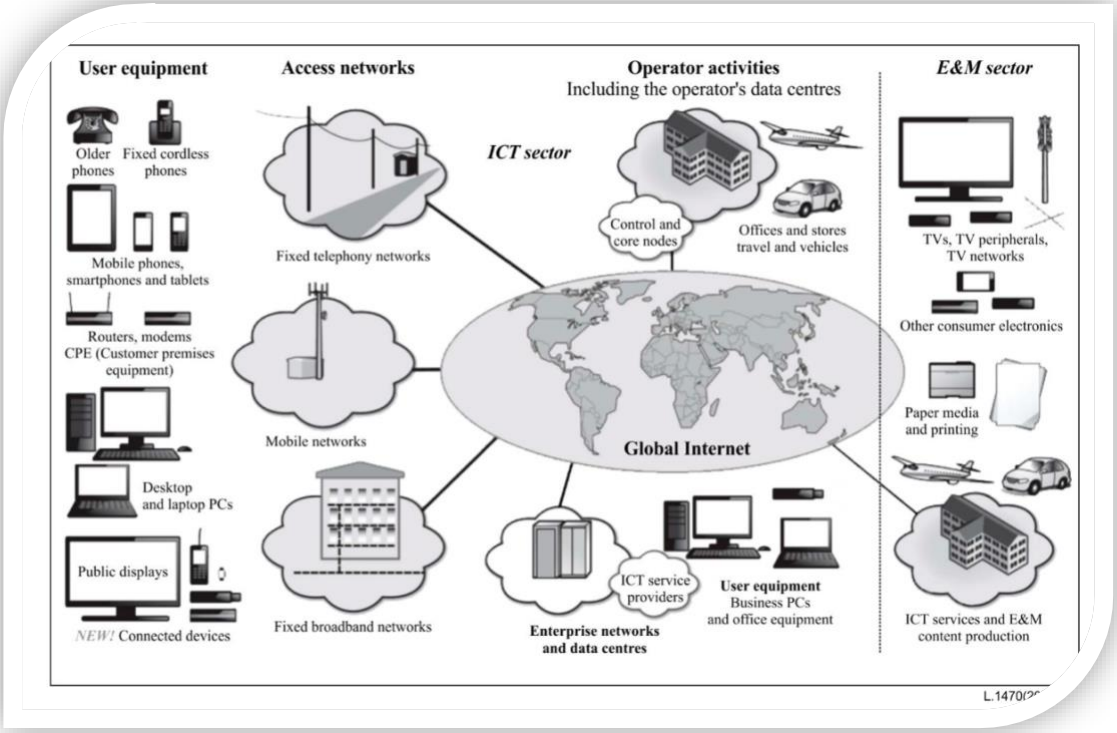
Regional Pacific NDC Hub (2021). ‘Pacific NDCs’. Available at https://pacificndc.org/pacific-ndcs
ESCAP (2020). *Accelerating Implementation of Paris Agreement in the Asia-Pacific Region: A guide for Policymakers*. Available at https://www.unescap.org/kp/2021/accelerating-implementation-paris-agreement-asia-pacific

2.2. What role do ICTs play in climate change mitigation?

The proliferation of ICTs has led to the increasing global demand for energy to power digital devices and services. The ICT sector – referring broadly to telecommunication networks (both mobile and fixed), data centers (including enterprise networks) and end-user goods (computing, internet and telecommunication devices) – is estimated to contribute between 1.4 and 3.9 per cent of global GHG emissions, at 730 metric ton of CO_2 equivalent.[52]

A visual overview of the ICT sector is shown in Fiugre 5. In 2020, data centers accounted for 45 per cent of the GHG emissions from the ICT sector, with the remaining comprising personal computers and data monitor use (31 per cent) and communication networks (24 per cent). These figures do not include entertainment and media, which is a growing subsector of the ICT industry.

Figure 5. ICT sector overview



Source: ITU 2020 https://www.itu.int/rec/T-REC-L.1470-202001-I/en

[52] International Telecommunication Union (2008). 'ICTs and Climate Change' Available at https://www.itu.int/themes/climate/docs/report/01_foreword.html;
UNFCCC secretariat (2016) 'ICT Sector Helping to Tackle Climate Change' Available at https://unfccc.int/news/ict-sector-helping-to-tackle-climate-change;
Malmodin, J, and Lundén, D (2018). The Energy and Carbon Footprint of the Global ICT and E&M Sectors 2010–2015. *Sustainability*. https://doi.org/10.3390/su10093027
Freitag, C et al. (2020). The climate impact of ICT: A review of estimates, trends and regulations. Available at https://arxiv.org/pdf/2102.02622.pdf

The United Nations Broadband Commission has set the goal to achieve broadband-internet user penetration of 75 per cent worldwide and 35 per cent in LDCs by 2025.[53] However, connecting more people to broadband-internet will simultaneously increase energy demand. Noting this development challenge, **the ICT sector can also play an important role in** transitioning towards **decarbonization** and providing **cutting-edge** solutions to **facilitate action on climate change**.

Case Study 2. Bangkok Action Plan on Global Warming Mitigation

The Challenge: The city of Bangkok is an urban metropolis with a population in excess of 10 million and has one of the largest carbon footprints of all cities in Thailand. In response to the global warming crisis and the need to reduce GHG emissions, the Bangkok Metropolitan Administration (BMA) developed the Bangkok Action Plan on Global Warming Mitigation for the 2007-2012 period.[54] The Action Plan was developed by BMA in partnership with Japan International Cooperation Agency (JICA) with technical inputs from interdisciplinary experts from 36 organizations such as the Ministry of Natural Resources and Environment, the Ministry of Energy, the Federation of Thai Industries, Thailand Environment Institute and other private and public sector organizations.

Source: Penggglieng 2017

Opportunities: The Action Plan sought to reduce at least 15 per cent of the total GHG emissions by focusing on five key initiatives: 1) expanding the mass transit rail system; 2) promoting the use of renewable energy; 3) improving energy efficiency of buildings; 4) improving solid waste management and wastewater treatment efficiency; and 5) expanding urban open space.[55] The Action Plan was somewhat successful in initiating local-level projects on climate change although there were issues with the overall implementation of the action plan.[56] The most effective initiative in reducing Bangkok's GHG emissions was improving energy efficiency of buildings, driven largely by a city-wide promotional campaign to conserve electricity. The second most effective initiative was the expansion of parks through planting of trees in the

[53] Broadband Commission for Sustainable Development (2018). '2025 Targets: Connecting the Other Half'. Available at https://www.broadbandcommission.org/broadband-targets/

[54] JICA (2012). 'JICA and the Bangkok Global Warming Mitigation Action Plan 2007-2012.' Available at https://www.jica.go.jp/thailand/english/office/topics/events120426.html

[55] Kiewchaum, A, Thepanondh, S, Sirithian, D, Mahavong, K and Outapa P (2017). Evaluation of the effectiveness and appropriateness of Bangkok Action Plans on global warming mitigations. *International Journal of GEOMATE*, Vol.12 (33): pp.14-21. http://dx.doi.org/10.21660/2017.33.2540

[56] C40 (2019). 'Bangkok Action Plan on Global Warming Mitigation'. Available at https://www.c40.org/case_studies/bangkok-action-plan-on-global-warming-mitigation

city and the neighboring provinces.[57] The direct GHG reduction potential of this initiative was low however there were other co-benefits including enhanced urban amenity and community wellbeing, and in the longer-term the carbon sink potential of urban forests to absorb carbon emissions. Building on the efforts of the Action Plan, the BMA released the Bangkok Master Plan on Climate Change 2013-2023 with a focus maintained on the five initiatives, which now includes adaptation planning.

Links to ICTs: To achieve the smart city vision for Bangkok, the Action Plan and its later version (the Bangkok Master Plan on Climate Change 2013-2023) rely on the utilization of ICTs, namely the use of smart technologies, big data and artificial intelligence. From monitoring traffic volume and flows on Bangkok streets to controlling electricity and cooling systems within public and commercial buildings, smart technologies play a role in reducing Bangkok's GHG emissions.

Type of effect: This case study shows that ICTs have a potentially indirect and wider societal effect on climate action. The use of smart technologies in Bangkok is beneficial for both emission reduction and wider positive outcomes for the environment, the economy and the society by making the city more liveable.

References:

C40 (2019). 'Bangkok Action Plan on Global Warming Mitigation'. Available at **https://www.c40.org/case_studies/bangkok-action-plan-on-global-warming-mitigation**

JICA (2012). 'JICA and the Bangkok Global Warming Mitigation Action Plan 2007-2012.' Available at **https://www.jica.go.jp/thailand/english/office/topics/events120426.html**

Kiewchaum, A, Thepanondh, S, Sirithian, D, Mahavong, K and Outapa P (2017). Evaluation of the effectiveness and appropriateness of Bangkok Action Plans on global warming mitigations. *International Journal of GEOMATE*, Vol.12 (33): pp.14-21. **http://dx.doi.org/10.21660/2017.33.2540**

Pengglieng, J (2017). Bangkok Climate Change Management. Presentation, BMA. Available at **https://www.metropolis.org/sites/default/files/09.urban_management_thailand_bangkok.pdf**

UNDRR (2021). 'Making Cities Resilient'. Available at **https://mcr2030.undrr.org**

The ICT sector as a solution: applying ICTs to turn ambitions into actions

There are many ICT solutions in place around the world that apply ICTs to turn these ambitions into tangible climate actions. These solutions are often referred to as being "smart", a general term applied to user-centered systems that apply automation and

[57] Kiewchaum, A, Thepanondh, S, Sirithian, D, Mahavong, K and Outapa P (2017). Evaluation of the effectiveness and appropriateness of Bangkok Action Plans on global warming mitigations. *International Journal of GEOMATE*, Vol.12 (33): pp.14-21. http://dx.doi.org/10.21660/2017.33.2540

innovative technology.[58] Examples of smart ICT solutions that contribute to carbon abatement are shown in the table below.

Table 1. Examples of ICT solutions for climate action

ICT solutions	Description	Application
Smart motor systems	Smart motor systems allow for motors to operate at optimal speeds to reduce energy output and improve energy efficiency.	Smart motor systems have applications in many industries and sectors, including building and construction, electricity generation and transport (land, sea and air).
Smart logistics	Smart logistics efficiently manage and minimize the transportation and warehousing of goods and cargo using real-time data and facilitating interconnectivity between different logistics networks.	Logistics, shipping, warehousing, transportation, retail and food distribution are among the industries where smart logistics can be applied to reduce their carbon footprint.
Smart buildings	Smart buildings use a combination of integrated systems, self-regulation and creative building design to deliver efficient building services and environments at the lowest cost, whilst reducing the environmental impact over the building lifecycle. Smart buildings enable occupants to be productive by offering services such as thermal comfort, physical security, hygiene and sanitation.	Smart buildings are suitable for commercial centers, government offices, educational institutions and other public and private infrastructure with mass occupancy and heating and cooling requirements.
Smart grids	Smart grids are electricity networks that use computers, digital technology and automation to detect and	Smart grids have applications in electricity networks (generation, transmission and distribution).

[58] Zoughbi, S. and Al-Nasrawi, S. (2015). Regional development getting smarter with ICT. In: Encyclopedia of Information Science and Technology, Third Edition. Khosrow-Pour, M. IGI Global, Pennsylvania, USA.

	respond to changing electricity demand. Smart grids enable a two-way flow of electricity and data between electricity suppliers and consumers.	

Using ICTs can offer opportunities to increase energy efficiency, reduce the production and consumption of goods, and minimize the movement of people and transportation of goods.[59] ICT-enabled alternatives include:

- e-services such as e-governance, e-commerce, e-health and e-ticketing;
- online media;
- videoconferencing;
- teleworking or other remote-participation services which reduce the need for travel and subsequently lowers travel-related GHG emissions.

Difficult decisions and choices must be made to keep global warming to 1.5°C and to 'leave no-one behind' by delivering positive outcomes for local communities and businesses. Policymakers have an important role to play in this ICT development challenge – from regulation and compliance, awareness-raising and incentive structures for businesses and consumers. The appropriate policy mix will depend on the particular country context (refer Policy Box A).

Policy Box A. Managing the Footprint of the ICT sector – what does this mean for policymakers?

'From cradle to grave, or even cradle to cradle, we will need to be sure that we are using clean and green digital and technology services and practices, **' Technology and Digital Leaders Network Chair, United Kingdom Greening Government Commitments [60]**

Policy context

It is estimated that the ICT industry will need to reduce GHG emissions by 45 per cent by 2030 to meet the UNFCCC Paris Agreement's goal of limiting global warming to 1.5°C above pre-industrial levels.[61]

[59] GeSI (2011). Using ICTs to tackle climate change. Available at https://www.itu.int/dms_pub/itu-t/oth/0B/11/T0B1100000A3301PDFE.pdf

[60] DEFRA (2019), ICT and Digital Services Strategy 2020-25. Available at: https://www.gov.uk/government/publications/greening-government-ict-and-digital-services-strategy-2020-2025

[61] International Telecommunication Union (2020). Series L: Environment and ICTs, Climate Change, E-waste, Energy Efficiency, Construction, Installation and Protection of Cables and Other Elements of Outside Plant: Greenhouse gas emissions trajectories for the information and communication

Source: derived from Finland Ministry of Transport and Communication, 2021

Energy consumption | Countries are increasingly developing ICT-specific strategies to align with the Paris targets and domestic commitments. Examples include strategy developed in Finland (Ministry of Transport and Communications, 2021), the United Kingdom, under wider Greening Government Commitments (DEFRA, 2019), Germany *(ICT Strategy of the German Federal Government: Digital Germany 2015*) and Singapore (*Singapore Green Plan 2030*). Strategy examples from the wider Asia-Pacific region are more limited, although promoting and supporting the establishment of e-waste/green ICT programs has previously been highlighted in the Pacific island region *(2010 Framework for Action on ICT for Development in the Pacific, Strategy 4.2.5).*

Emissions into air, water and soil | China's 2018 decision to block waste imports has had the flow-on impact of waste industries relocating to countries where environmental regulation is less stringent. Electronic waste dumping has become a significant problem in Southeast Asia and more broadly in Latin America and Africa. Thailand has recently taken a strong stance on the issue, passing a strict ban on the importation of electronic waste in September 2020.[62]

Policy recommendations

- Measurement and ongoing reporting | Establishing an energy consumption and emissions baseline and requirements for ongoing monitoring are key steps that policymakers can inform. The United Kingdom's *Greening Government Commitments*, for example, requires Government to quantify and report on its e-waste and the energy and carbon footprint of the digital and technology services it uses and their sustainability impacts.
- Green procurement strategies | Governments can influence IT-supply chains through purchasing and contracting decisions, including contracting cloud-based services. Considering the full lifecycle for a technology service may be challenging for under-resourced ICT ministries and departments. However, multilateral and bilateral development partners have the resources to consider construction, operation, disposal and decommissioning of assets and services, across all of their operations. This 'leading by example' can provide important local-level lessons that can inform national-level strategy.
- Regulatory reform – Anti-dumping legislation, as per the e-waste ban in Thailand, can set a strong foundation for protecting natural assets and

technology sector compatible with the UNFCCC Paris Agreement. Standard ITU L.1470 (91/2020). ITU, Geneva, Switzerland.

[62] Ministry of Commerce Thailand (2020), Electronic Waste Ban list, Accessed here: http://wiki.ban.org/images/4/49/Thai_e-waste-ban-list.pdf

communities at a national level. However, it must be linked to wider policies, that consider enforcement capacity and viable alternatives for domestic waste industries (refer Box Policy Box C).

References

DEFRA (2019), ICT and Digital Services Strategy 2020-25. Available at: https://www.gov.uk/government/publications/greening-government-ict-and-digital-services-strategy-2020-2025

Finland Ministry of Transport and Communications (2021), Climate and Environmental Strategy for the ICT sector. Available at: https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/162912/LVM_2021_06.pdf?sequence=1&isAllowed=y

Government of Singapore (2020), Singapore Green Plan 2030. Available at: https://www.greenplan.gov.sg/

2.3. Key Takeaways

To summarize, the key takeaways from Thematic Block 2 are:

The urgency of climate change mitigation

- The future of our planet depends on when and what action we take to drastically reduce GHG emissions. If countries fail to act in compliance with the Paris targets, global warming is likely to reach 1.5°C as early as 2030.

The role of ICTs for climate change mitigation

- ICTs have a role to play in climate change mitigation. The challenge for the ICT sector is to close the digital divide and at the same time adopt smart solutions for abating GHG emissions. Proactive measures like greening upstream and downstream ICT supply chains, designing sustainable ICT products and services, reducing and managing electronic waste, and enabling open and transparent data on GHG impacts of the ICT sector can improve energy efficiency and reduce the sector's footprint.

Managing the Footprint of the ICT sector – what does this mean for policymakers?

It is estimated that the ICT industry will need to reduce GHG emissions by 45 per cent by 2030 to meet the UNFCCC Paris Agreement's goal of limiting global warming to 1.5°C above pre-industrial levels. The footprint of the ICT sector encompasses energy consumption, raw materials usage and wider emissions into air, water and soil.

Recommendations for policymakers include:

- **Measurement and ongoing reporting |** Establish an energy consumption and emissions baseline and requirements for ongoing monitoring/The *UK Greening Government Commitments*, for example, requires Government to quantify and report on its e-waste and the energy and carbon footprint of the digital and technology services it uses and their sustainability impacts.
- **Green procurement strategies |** Governments can influence IT-supply chains through purchasing and contracting decisions. Multilateral and bilateral development partners have the resources to consider construction, operation, disposal and decommissioning of assets and services, across all of their operations. Providing vision and leadership in this area provides local-level lessons that can inform national-level strategy.
- **Regulatory reform –** Anti-dumping legislation, as per the e-waste ban in Thailand, can set a strong foundation for protecting natural assets and communities at a national-level. However, it must be linked to wider policies, that consider enforcement capacity and viable alternatives for domestic waste industries.

Group Planning Session

Participants will have allocated time to reflect on Block 2 learning and discussions to work on their group presentation for the *lightning talk* (this activity is part of Block 5 Summary).

3. ICT FOR CLIMATE CHANGE ADAPTATION

The learning goals for this thematic block are:

- Recognize key concepts and terminologies associated with climate change adaptation.
- Evaluate the ICT sector's contribution in enhancing adaptive capacity and resilience to the impacts of climate change.
- Understand how ICTs are being deployed to inform and enhance adaptation policies, measures and decisions at national and subnational scales, and the co-benefits of such policy measures.

3.1. Introduction to the Chapter

Climate change adaptation refers to adjustments in natural or human systems in response to actual or expected climatic stimuli or their effects.[63] Climate change adaptation aims to lessen the climate-related harm to natural and human systems and where possible, take advantage of opportunities to enhance outcomes for the environment and societies. Examples of climate change adaptation include adopting new agricultural techniques to maintain and enhance food security in times of prolonged dry spells, building and designing essential infrastructure to withstand the risks of sea-level rise and developing and implementing disaster management plans to help communities and businesses prepare, manage and respond to cyclones, hurricanes, floods, heatwaves and other hazards.

The concept of adaptation is defined as a function of **vulnerability** (the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change), **exposure** (the presence of people, livelihoods, environmental services and resources, infrastructure or economic, social, or cultural assets in places that could be adversely affected) and/or **hazard** (the potential occurrence of a physical event (natural or human-induced) that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, services and environmental resources). [64]

The above three factors are determinants of risk. **Risk** is defined as the potential for adverse consequences for human or ecological systems, acknowledging the diversity of values and objectives associated with such systems.[65] Risks can arise from potential impacts of climate change as well as human responses to climate change.

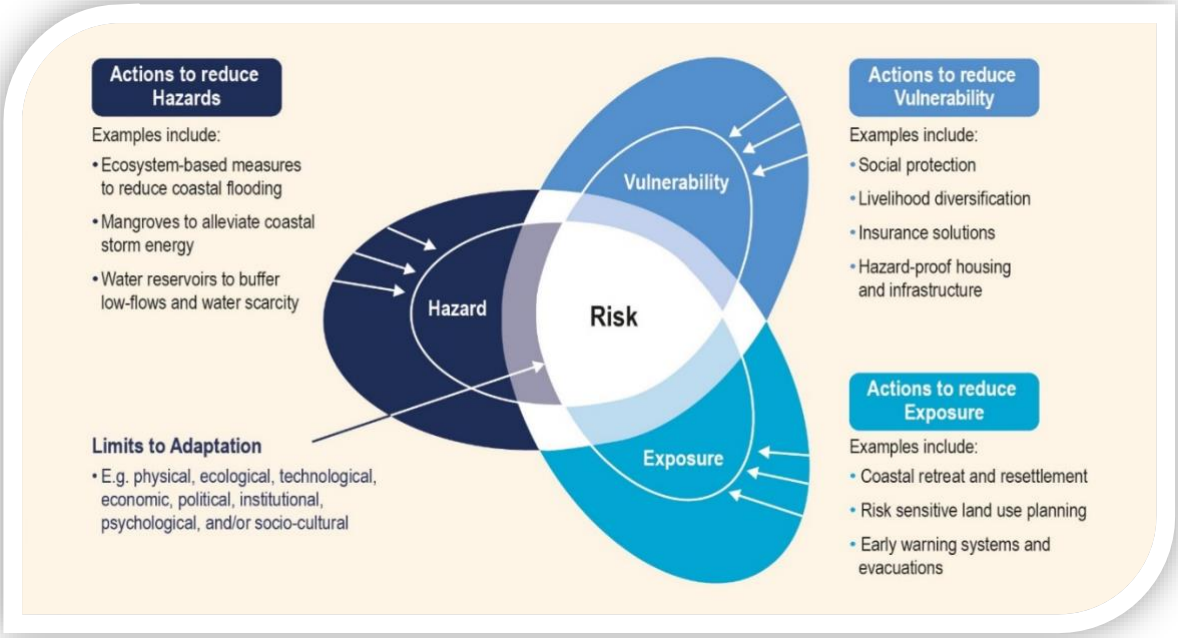
[63] UNFCCC secretariat (2021). 'Glossary of climate change acronyms and terms'. Accessed 02/07/2021. Available at https://unfccc.int/process-and-meetings/the-convention/glossary-of-climate-change-acronyms-and-terms#m

[64] IPCC, 2012: Glossary of terms. In: *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation* [Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen,M. Tignor, and P.M. Midgley (eds.)]. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change (IPCC). Cambridge University Press, Cambridge, UK, and New York, NY, USA, pp. 555-564.

[65] Reisinger, A., Howden, M., Vera, C. (2020). *The Concept of Risk in the IPCC Sixth Assessment Report: A Summary of Cross-Working Group Discussions*. Intergovernmental Panel on Climate Change, Geneva, Switzerland. pp15.

Adverse consequences include “those on lives, livelihoods, health and wellbeing, economic, social and cultural assets and investments, infrastructure, services, ecosystems and species”.[66] Adaptation offers options to reduce risk by addressing one or more of the determinants of risk: vulnerability, exposure, and/or hazard (refer to Figure 6 below).

Figure 6. Conceptual framework for risk, vulnerability, exposure and hazard



Source: IPCC 2019 https://www.ipcc.ch/srocc/chapter/technical-summary/ts-0-introduction/ipcc-srocc-ts_4/

By planning for and implementing adaptation measures, we are building or enhancing **adaptive capacity**, that is, the ability of a system to adjust to climate change variability and extremes, and cope with their consequences.[67] Take, for instance, retrofitting dwellings and buildings in a village in the Philippines or Fiji with windows and roofing structures that can withstand a typhoon or cyclone with sustained wind speeds of over 200 km per hour. Adaptive capacity will be different for each system depending on their vulnerability and exposure to climate and disaster risks.[68] Frequently, adaptive

[66] Ibid.
[67] Ibid.
[68] Cardona, O.D., M.K. van Aalst, J. Birkmann, M. Fordham, G. McGregor, R. Perez, R.S. Pulwarty, E.L.F. Schipper, and B.T. Sinh, 2012: Determinants of risk: exposure and vulnerability. In: *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation* [Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (eds.)]. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change (IPCC). Cambridge University Press, Cambridge, UK, and New York, NY, USA, pp. 65-108.

capacity is discussed in conjunction with **resilience**. There is no universal definition for resilience but in terms of climate change, it refers to the ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning.[69]

International literature and research on adaptation have since evolved to focus on different approaches to adaptation, including[70]:

Adaptation pathways

This approach involves sequencing the implementation of actions over time to enable the system to adapt to the changing social, environmental and economic conditions. This approach allows for flexibility into an overall adaptation strategy and prioritizes the management of existing risks to develop a set of potential long-term adaptation pathways. The pathways are informed by expert judgment, stakeholder consultation, and/or models that respond to different threshold levels of climate risk.

Ecosystem-based adaptation (EBA)

A nature-based solution that focuses on ecosystem services to reduce vulnerability and enhance adaptive capacity to the impacts of climate change. The EBA approach involves engaging with stakeholders to align their needs to adaptation planning outcomes and builds partnerships for implementation. The approach is often used in settings where people are reliant on natural resources for their wellbeing and livelihoods, such as ethnic and indigenous groups in Asia and communities in the Pacific Islands.

Community-based adaptation (CBA)

This approach is centered on engaging local communities in the adaptation process, especially vulnerable groups and people, including ethnic minorities, women, youth, children, people with disabilities and poor income households. The approach came about to counter top-down methods of adaptation planning which excluded the voices, priorities, needs, knowledge and capacity of local communities and recipients of adaptation projects. The use of participatory methods to plan and implement adaptation processes is a common feature of both EBA and CBA.

Livelihood diversification

The goal of this approach is to enable communities and households to diversify their sources of income to reduce their vulnerability to adverse climate change effects, whilst maintaining a certain standard of living. It is a bottom-up approach most commonly used to support adaptation processes for vulnerable groups and households like women farmers and producers.

[69] UNFCCC secretariat (2021) 'Glossary of climate change acronyms and terms'. Accessed 02/07/2021. Available at https://unfccc.int/process-and-meetings/the-convention/glossary-of-climate-change-acronyms-and-terms#m

[70] UNFCCC secretariat (2019). *Various approaches to long-term adaptation planning*. UNFCCC, Bonn, Germany.

Risk-based approach

An approach that provides a common framework to identify and analyze climate change risks, and develop adaptation options based on future risk scenarios to identify relevant adaptation measures and responses. The approach has its origins in risk management.

Risk-informed development

This approach recognizes the complexity of risks – whether they be risks related to climate change or disasters or development. This approach is a risk-based planning and decision-making process that recognizes and acts on multiple and concurrent threats and complex risks to and arising from development decisions.[71] It encourages decision-makers to understand that there are trade-offs to all development choices, and decisions need to reflect past experiences and lessons learned to avoid the creation of new development risks.

Global frameworks such as the Paris Agreement of the UNFCCC (refer to Section 2.3 on Global Frameworks on Climate Change), the SDGs within the framework of the 2030 Agenda for Sustainable Development and the Sendai Framework for Disaster Risk Reduction (SFDRR) 2015–2030 affirm the need for making risk-informed, sustainable development normative practice by integrating risks to development planning and practice.[72] The synergies between the Paris Agreement and the SFDRR are shown in **Error! Not a valid bookmark self-reference.**.[73]

Table 2. Synergies between Paris Agreement of the UNFCCC and Sendai Framework on Disaster Risk Reduction

Synergies	UNFCCC Paris Agreement	Sendai Framework on Disaster Risk Reduction
Understanding and managing risks	Recognize the importance of averting, minimizing and addressing loss and damage associated with the adverse effects of climate change, including extreme weather events and slow onset events (Article 8)	There is a need to address existing challenges and prepare for future ones by focusing on monitoring, assessing and understanding disaster risk and sharing such information and on how it is created (14) SFDRR Priority 1: Understanding disaster risk

[71] ODI, UNDP and Swiss Agency for Development and Cooperation (2019). *Risk-informed development: from crisis to resilience*. UNDP, USA.
[72] Ibid.
[73] Placard Network. (2019). Sendai Framework for Disaster Risk Reduction through a climate change adaptation lens. Available at https://www.placard-network.eu/sfdrr-cca/

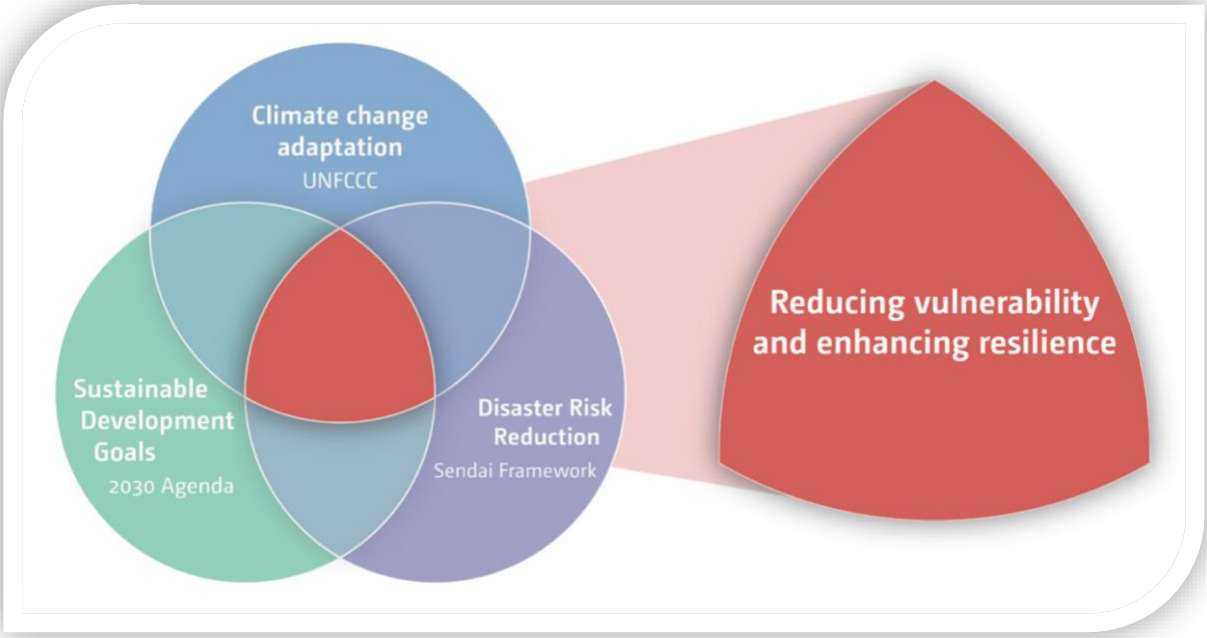
Strengthening risk governance	Acknowledge that adaptation action should follow a country-driven, gender-responsive, participatory and fully transparent approach, taking into consideration vulnerable groups, communities and ecosystems, and should be based on and guided by the best available science and, as appropriate, traditional knowledge, knowledge of indigenous peoples and local knowledge systems, with a view to integrating adaptation into relevant socioeconomic and environmental policies and actions, where appropriate (Article 7)	SFDRR Priority 2: Strengthening disaster risk governance to manage disaster risk. Incorporate disaster risk reduction measures into multilateral and bilateral development assistance programs and foster collaboration across global and regional mechanisms and institutions (47d)
Financing and investing in risk reduction for resilience	Areas of cooperation and facilitation to enhance understanding, action and support include comprehensive risk assessment and management, risk insurance facilities and climate risk pooling (Article 8)	Financing from a variety of international sources and enabling institutional and policy environments at all levels are critically important means of reducing disaster risk (46) SFDRR Priority 3: Investing in disaster risk reduction for resilience
Strengthening future-oriented risk assessment	Areas of cooperation and facilitation to enhance understanding, action and support include climate and weather information, and early warning systems (Article 8)	Prepare or review and periodically update disaster preparedness and contingency policies, plans and programs with the involvement of the relevant institutions, considering climate change scenarios and their impact on disaster risk (33a) SFDRR Priority 4: Enhancing disaster preparedness for effective response and to “Build

		back Better" in recovery, rehabilitation and reconstruction

Source: Adapted from PLACARD interchange, 2021 https://www.placard-network.eu/sfdrr-cca/

Together, these global frameworks and the SDGs provide a unifying call for action on climate change, sustainable development and disaster risk reduction to ultimately reduce vulnerability and enhance resilience of natural and human systems to climate and disaster risks, and development challenges (refer to Figure 7).[74]

Figure 7. Integrating climate change adaptation with the Sustainable Development Goals and the Sendai Framework on DRR



Source: UNFCCC secretariat, 2017[75]

[74] United Nations Climate Change Secretariat (2017). *Opportunities and options for integrating climate change adaptation with the Sustainable Development Goal sand the Sendai Framework for Disaster Risk Reduction 2015-2030: Technical Paper by the Secretariat*. UNFCCC, Bonn, Germany.
[75] UNFCCC secretariat (2017). *Opportunities and options for integrating climate change adaptation with the Sustainable Development Goals.* UNFCCC, Bonn, Germany.

3.2. What role do ICTs play in climate change adaptation?

ICTs are increasingly playing a role in reducing climate change and disaster risks, and preparing countries, regions and localities to better adapt to climate change. Examples include the use of remote sensing for environmental observation, climate monitoring and climate change prediction at different scales. ICTs such as mobile- and internet-based messaging services are being used to issue emergency and evacuation alerts to the mass population. Similarly, ICTs are applied to communicate with and educate communities to better plan for, respond to and adjust to climate change and disaster impacts to help sustain their basic needs like food, water and health care.

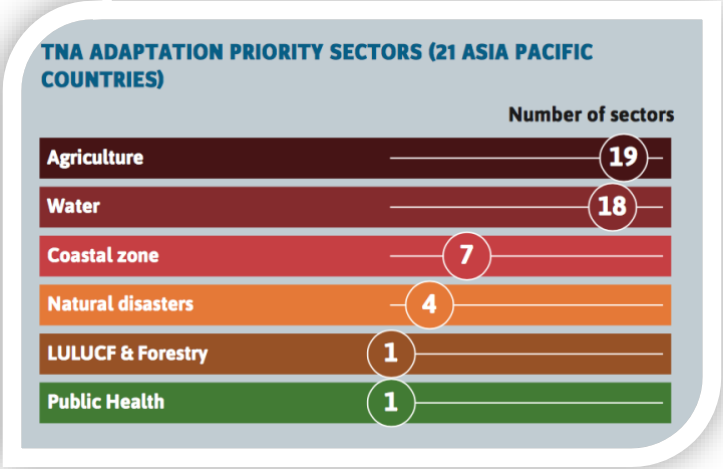
Box 7. Technology needs for climate change adaptation

The Asia Pacific region accounts for 60 per cent of the world's population and 30 per cent of its land area.[76] As a global manufacturing hub, the region has a proportionally greater share of GHG emissions while being home to LDCs and SIDS that are particularly vulnerable to sea-level rise, cyclones, floods, droughts and other impacts of climate change.

Accelerating the development, transfer and uptake of technology is essential to support climate action. Since 2009, the global Technology Needs Assessment (TNA) project has included thirty countries in the Asia Pacific region, to assess and articulate their technology needs for climate change adaptation and mitigation. TNAs are not only aligned with the Paris Agreement but they play a central role in the newly agreed UNFCCC Technology Framework, which provides overarching guidance to the UNFCCC's Technology Mechanism. TNAs provide information about the potential, ability and scale of climate change technologies, to inform the formulation and implementation of NDCs. They can be used to identify and attract investment in technologies to pursue national emissions targets and goals on sustainable development.

[76] UNEP and Technical University of Denmark (DTU) Partnership. (2020). *Regional Technology Brief Asia Pacific: Technology Needs Assessment.* Available at https://tech-action.unepdtu.org/wp-content/uploads/sites/2/2020/06/technology-brief-asia-pacific-1.pdf

TNAs for countries in Asia and the Pacific have identified three key adaptation sectors for technology development and transfer: agriculture, water and coastal zones.[77] Examples in the agriculture sector include technologies for the development of salt-, pest- and drought-tolerant crop varieties and drip irrigation systems. Technology needs for the water sector include rainwater harvesting, hydropower and integrated catchment management while multi-hazard early warning systems and coastal protection technologies are identified for coastal zones.



Source: NAP Global Network 2021

Reflective questions: Which sectors are prioritized for climate change technology needs in your country? What technologies needs are identified in your country's TNA?

Further Reading:

UNFCCC (2021). 'Technology Needs Assessments'. Available at https://unfccc.int/ttclear/tna

UNEP and Technical University of Denmark (DTU) Partnership. (2020). Regional Technology Brief Asia Pacific: Technology Needs Assessment. Available at https://tech-action.unepdtu.org/wp-content/uploads/sites/2/2020/06/technology-brief-asia-pacific-1.pdf

National Adaptation Plans

Within the UNFCCC, there is potential for countries to consider the application of ICTs to prepare their **National Adaptation Plans (NAP)**. The sixteenth Conference of the Parties to the UNFCCC held in December 2010 (COP16) established the NAP process under the Cancun Adaptation Framework and adopted as part of the Cancun Agreements (COP 16/CMP6).

The NAP process aims to reduce climate change vulnerability by enhancing adaptive capacity and resilience, and to enable coherent integration of climate change adaptation into country policies, programs and activities, and development planning processes (Decision 5/CP.17, paragraph 1).[78] The decision from the Cancun Agreements stipulate the NAP process to be "country-driven, gender-sensitive, participatory and transparent" and draw on the best available science, and where

[77] Ibid.
[78] UNFCCC secretariat (2015). Paris Agreement of the United Nations Framework Convention on Climate Change. Available at https://unfccc.int/sites/default/files/english_paris_agreement.pdf

appropriate, traditional and indigenous knowledge and local knowledge systems to develop and implement adaptation actions (Decision 5/CP.17, paragraph 3) at national, subnational and sectoral levels (Decision 5/CP.17, Annex).

The endorsement of the Paris Agreement at the twenty-first Conference of Parties (COP21) in 2015 further emphasized the utility of NAPs for medium to long term adaptation planning, and for mobilizing climate change finance for national, subnational and sectoral level adaptation initiatives. Parties to the Paris Agreement are to communicate their actions to build resilience and adapt to the impacts of rising temperatures in the NDC which is to be updated and submitted every five years. Additionally, Parties can engage in the NAP process to identify medium- and long-term adaptation needs and develop implementing strategies to address those needs.

The role of ICTs in NAP processes

Adaptation planning and development of NAPs necessitate systems-thinking, multi-stakeholder engagement and robust decision-making processes. How ICTs are integrated into the adaptation planning and implementation framework is integral to these processes: specific operational standards[79] and appropriate capabilities and skills are required to enhance the use of ICTs.

Each disaster and adaptation challenge may require different ICT solutions; what works in one situation or geographic location may not work effectively in another. ICT solutions require systematic understanding of problems to bring about behavior change and ICTs alone are not the solutions for climate change and disaster resilience.

The Least Developing Country Expert Group of the UNFCCC developed technical guidelines on the NAP process. The guidelines identify four key elements and associated steps (see Table 3). Elements A and B correspond to the “planning” phase of the above diagram, Element C to “implementation” and Element D to “M&E”. The NAP guidelines are not intended to be prescriptive, countries have the flexibility to select steps that are appropriate for their situation and implement them in any order according to their needs.

Table 3. NAP elements and steps

Element	Steps
A. Lay the groundwork and address gaps	1. Initiating and launching the NAP process 2. Stocktaking: identifying available information on climate change impacts, vulnerability and adaptation and

[79] ITU (2019). Turning digital technology innovation to climate action. Available at https://www.uncclearn.org/wp-content/uploads/library/19-00405e-turning-digital-technology-innovation.pdf; ITU (2015). *ITU-T Focus Group on Smart Sustainable Cities: Information and communication technologies for climate change adaptation in cities*. ITU Focus group technical report. ITU, Geneva, Switzerland.

	assessing gaps and needs of the enabling environment for the NAP process 3. Addressing capacity gaps and weaknesses in undertaking the NAP process 4. Comprehensively and iteratively assessing development needs and climate vulnerabilities
B. Preparatory elements	1. Analyzing current climate and future climate change scenarios 2. Assessing climate vulnerabilities and identifying adaptation options at the sector, subnational, national and other appropriate levels 3. Reviewing and appraising adaptation options 4. Compiling and communicating national adaptation plans 5. Integrating climate change adaptation into national and subnational development and sectoral planning
C. Implementation strategies	1. Prioritizing climate change adaptation in national planning 2. Developing a (long-term) national adaptation implementation strategy 3. Enhancing capacity for planning and implementation of adaptation 4. Promoting coordination and synergy at the regional level and with other multilateral environmental agreements
D. Reporting, monitoring and review	1. Monitoring the NAP process 2. Reviewing the NAP process to assess progress, effectiveness and gaps 3. Iteratively updating the national adaptation plans 4. Outreach on the NAP process and reporting on progress and effectiveness

Source: UNFCCC secretariat 2012
https://unfccc.int/files/adaptation/cancun_adaptation_framework/application/pdf/naptechguidelines_eng_high__res.pdf

Looking at the NAP elements and steps, ICTs come into play in the broadest sense to generate, capture, store, process and disseminate information and knowledge to support NAP planning, implementation and M&E. For instance, available information on climate change impacts can be stored on open data platforms to enable relevant actors at different levels of administration and planning to access (Element A: Lay the

ground work and address gaps), geographic information systems can be used to overlay remote sensing data with socio-economic statistics (including gender disaggregated data), local and indigenous knowledge of the environment and climate change scenarios to review adaptation options (Element B: Preparatory elements), investments can be made to enhance ICT resources, skills and capacity needs to support NAP implementation (Element C: Implementation strategies) and online dashboards can be set up for governments, communities, industry and private sector, and civil society organizations to monitor and track progress on NAP implementation.

3.3. Applying ICTs to strengthen adaptive capacity and resilience

Outlined below are a selection of sectors and contexts in which ICTs can be applied to address underlying vulnerabilities and climate/disaster-related risks. They include:

- Climate and environmental observation and monitoring;
- Early warning systems; and
- Building resilience in human settlements

Climate and environmental observation and monitoring

Remote sensors are widely used for monitoring and climate change prediction at different scales to safeguard natural resources and ecosystems that support human settlements, especially those that are under threat by climate change. Many countries have established and dedicated agencies for observing and monitoring climate and environmental conditions, as well as for disaster risk management.

These can be government agencies, academic institutions, and industry and research groups, that operate at international, regional, national and/or subnational levels. Remote sensing data (from satellites, drones and radar interferometry), spatial datasets, climate change projections (modeled using the internationally recognized Coupled Model Inter-comparison Project in line with IPCC assessments and assumptions), historical hazard and disaster data (from national disaster management agencies and international database like DesInventar) and population statistics are types of datasets collected, managed, analyzed and visualized using ICTs. Changes in the natural environment, whether this is due to climate change or other socio-economic factors, can be documented and monitored by communities using ICTs (refer to Case Study 3).

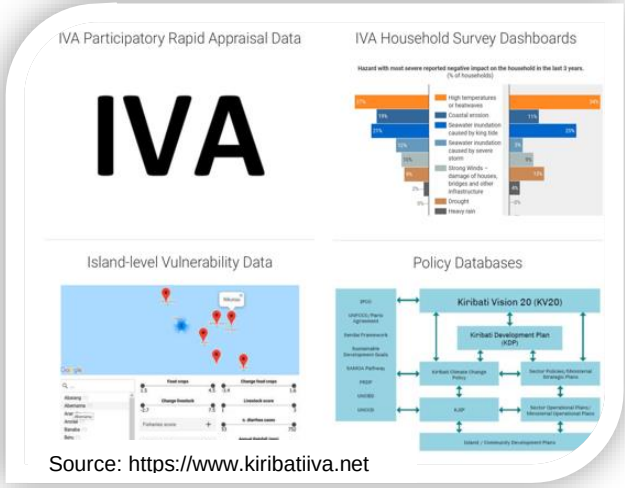
Case Study 3. Integrated Vulnerability Assessment (IVA) to inform national adaptation planning in Kiribati, Solomon Islands and Tuvalu

The Challenge: The impact of climate change is the greatest for remote communities in the Pacific Islands, where there is reliance on subsistent lifestyle and limited access to markets and infrastructure. The challenge for policymakers, implementers, and non-governmental organizations is to identify concise geographic locations and livelihood sectors that are most vulnerable to climate change impacts and require interventions to increase their adaptive capacity.[80] The Integrated Vulnerability Assessment (IVA) was developed by the Pacific Community (SPC), the Secretariat of the Pacific Regional Environment Programme (SPREP)

[80] Dumaru, P (2019). *Coordinating Climate-Resilient Development How Integrated Vulnerability Assessments Support NAP Processes in the Pacific Region*. [online]. Available at https://napglobalnetwork.org/wp-content/uploads/2019/01/napgn-en-2019-how-ivas-support-nap-processes-in-the-pacific-region.pdf.

and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) with the help of other Pacific regional organizations as a framework and tool for collecting and analyzing vulnerability data. The IVA uses participatory rapid appraisal to examine the risks and impact of climate change from the perspective of communities that are directly affected and consider their traditional knowledge and understanding of the environment and surroundings.[81]

Opportunities: The IVA process supports the formulation of National Adaptation Plans (NAPs) by identifying sectoral-, subnational- and national-level adaptation priorities.[82] The IVA framework incorporates seven Human Security Objectives (HSO) and five Livelihood Assets (LAs) into the qualitative assessment which the participants rank in order of vulnerability in a "climate-impacted" environment. The IVA process has so far been used by national climate change authorities in Kiribati, Solomon Islands and Tuvalu. In Kiribati, the IVA results were used to inform investment decisions on adaptation interventions. In the Solomon Islands, the IVA results were used for resilient development planning on Malaita Island. Likewise in Tuvalu, the IVA results were used to inform the country's NAP proposal to the Green Climate Fund.



Source: https://www.kiribatiiva.net

Links to ICTs: The IVA framework uses a standardized method to collect data and store qualitative and geo-locational data using handheld tablets. The software allows the user to store data on the tablet device, which can be uploaded onto the main server when there is internet connectivity. This function enables the users to efficiently collect and enter data in remote locations without internet access. The IVA data are visually presented on a digital dashboard with filtering options for location, group, HSO and LAs.

Type of effect: Indirect effect, whereby the use of open-source software and tablet devices for the IVA has enabled efficient data collection in remote locations. The process has also enabled policy makers and communities to visualize and discuss the results, which in turn supports planning and decision-making.

[81] SPC, SPREP and GIZ (2016). *Integrated Vulnerability Assessment Framework for Atoll Islands a Collaborative Approach.* [online]. Available at https://www.sprep.org/attachments/Publications/CC/iva-framework-atolls.pdf

[82] NAP Global Network (2020). *How Technology and Community Insights Are Driving Adaptation Planning in the Pacific*. Available at https://napglobalnetwork.org/stories/how-technology-and-community-insights-are-driving-adaptation-planning-in-the-pacific/

References:

Dumaru, P (2019). *Coordinating Climate-Resilient Development How Integrated Vulnerability Assessments Support NAP Processes in the Pacific Region*. Available at **https://napglobalnetwork.org/wp-content/uploads/2019/01/napgn-en-2019-how-ivas-support-nap-processes-in-the-pacific-region.pdf**

SPC, SPREP and GIZ (2016). *Integrated Vulnerability Assessment Framework for Atoll Islands a Collaborative Approach.* Available at **https://www.sprep.org/attachments/Publications/CC/iva-framework-atolls.pdf**

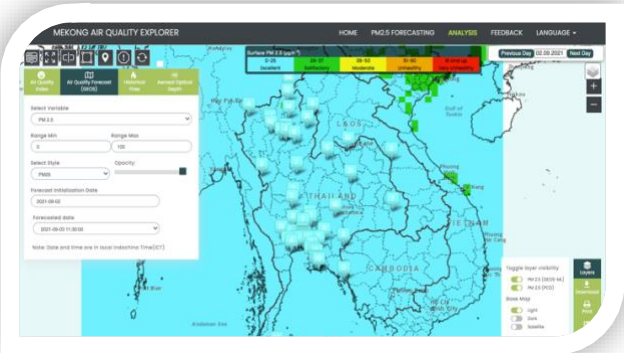
NAP Global Network (2020). *How Technology and Community Insights Are Driving Adaptation Planning in the Pacific | NAP Global Network*. Available at **https://napglobalnetwork.org/stories/how-technology-and-community-insights-are-driving-adaptation-planning-in-the-pacific/**

Early warning systems

ICTs are being deployed for early warning systems to save lives and reduce potential physical damage to infrastructure and avoid disruptions to education, health and other essential services. Modern early warning systems rely on ICTs for hazard and impact forecasting, and to communicate messages to relevant authorities and members of the public. There is a growing application of mobile phones and internet-based text messaging services to issue health, weather and evacuation alerts to populations in the Asia Pacific region with co-benefits for the environment and human health (refer to Case Study 4).

Case Study 4. Mekong Air Quality Explorer, Thailand

The Challenge: Air pollution is one of the major environmental and health challenges faced by countries in Asia and the Pacific. About 92 per cent of the population in this region are exposed to levels of air pollution which are detrimental to human health.[83] The Mekong Air Quality Explorer (AQE) is a tool developed to monitor hot spots and generate forecasts of air pollution. It was developed by SERVIR-Mekong, a partnership between the U.S. Agency for International Development (USAID), the U.S. National



Source: SERVIR-Mekong 2021

[83] Climate & Clean Air Coalition (2015). 'Air pollution measures for Asia and the Pacific.' Available at https://www.ccacoalition.org/en/content/air-pollution-measures-asia-and-pacific

Aeronautics and Space Administration (NASA) and the Asia Disaster Preparedness Centre in collaboration with the Thai Government's Pollution Control Department (PCD) and the Geo-Informatics and Space Technology Development Agency (GISTDA).[84]

Opportunities: The AQE is used to collect data over a large area to provide an accurate measure of air pollution levels across Thailand. It retrieves data from observations made by NASA's global aerosol forecasts from the Goddard Earth Observing System (GEOS). The information gained from GEOs is adjusted to Thailand's ground measurements using an advanced machine learning technique to retrieve biased corrected air quality forecasts up to three days in advance.[85] The data from ACE is used by the PCD to inform and alert the public about air pollution and to help citizens make better health and lifestyle choices.[86] ACE is also used by local decision-makers to improve air quality and environmental resilience, and develop national response plans for affected sectors such as agriculture, health, natural resource management and disaster risk management.

Links to ICTs: Thailand has previously collected and compiled air quality data from small on-ground monitoring stations. Using AQE has provided greater geographical coverage and it has been proven to provide consistent and accurate data. The data retrieved from AQE is loaded into a web-based platform that forecasts and monitors the air quality in the Mekong region.[87] AQE can compare recent data with historical databases to help understand the temporal impact of pollution in the region to assist the Thai Government in devising and implementing strategies to combat air pollution, with the co-benefits of improving health and quality of life outcomes for its citizens.

Type of effect: The potential societal effect of using ICTs for climate action and public health is clear from this case study. Decision-support tools like ACE connect people to the scientific data, and enables the government and the general public to make better decisions about pollution control, climate change mitigation and environmental health. Another similar forecasting tool is Google's **Flood Forecasting Initiative** which, in partnership with public water authorities in India and Bangladesh, has been used to predict flood risks to protect vulnerable communities in low-lying deltas.

References:

Climate & Clean Air Coalition (2015). 'Air pollution measures for Asia and the Pacific.' Available at **https://www.ccacoalition.org/en/content/air-pollution-measures-asia-and-pacific**

[84] US Agency for International Development (2020). 'U.S., Thailand Launch New Tool to Improve Air Quality Monitoring U.S. Agency for International Development'. Available at https://www.usaid.gov/asia-regional/press-releases/nov-24-2020-us-thailand-launch-new-tool-improve-air-quality

[85] Steele, J (2020). 'UAH helps develop air quality monitoring application for Thailand'. Available at https://www.uah.edu/news/news/uah-helps-develop-air-quality-monitoring-application-for-thailand

[86] SERVIR MEKONG (2019). 'Using space to monitor air quality at the surface'. Available at https://agatmekong-servir.adpc.net/en/

[87] Nicolau, A (2020). *Earth Observatory.* Available at https://earthobservatory.nasa.gov/blogs/fromthefield/2020/12/16/using-space-to-monitor-air-quality-at-the-surface/

Nicolau, A (2020). *Earth Observatory.* Available at **https://earthobservatory.nasa.gov/blogs/fromthefield/2020/12/16/using-space-to-monitor-air-quality-at-the-surface/**

SERVIR MEKONG (2019). 'Using space to monitor air quality at the surface'. Available at **https://aqatmekong-servir.adpc.net/en/**

Steele, J (2020). 'UAH helps develop air quality monitoring application for Thailand'. Available at **https://www.uah.edu/news/news/uah-helps-develop-air-quality-monitoring-application-for-thailand**

US Agency for International Development (2020). 'U.S., Thailand Launch New Tool to Improve Air Quality Monitoring U.S. Agency for International Development'. Available at **https://www.usaid.gov/asia-regional/press-releases/nov-24-2020-us-thailand-launch-new-tool-improve-air-quality**

Building resilience in human settlements

As explained in the previous section about NAPs, identifying available information on climate change impacts, vulnerability and adaptive capacity, and comprehensively and iteratively assessing development needs and climate vulnerabilities are part of the planning phase of the NAP process. The use of open-source data collection and analysis tools, and mapping applications can support countries and communities undertake climate change vulnerability assessments to inform NAP planning and implementation. Such application of ICTs assists policymakers and technical officers in national and municipal administrations to identify which communities are most vulnerable and what capacities they have or need to adapt to the projected climate change impacts (refer to Case Study 3). ICTs can also be deployed to help cities adapt to the effects of climate change, improve energy and resource efficiency, and keep the urban population safe from disaster risks.

Policy Box B. Maximising the opportunities to address climate change through ICTs - what does this mean for policymakers?

'How can waste heat from data centers be converted into heating for homes?

'How can information and communication technologies help in reducing emissions from transport or industry?'[88]

Existing policy initiatives

[88] Finland Ministry of Transport and Communication (2021), Press Release - Finland announces climate strategy for ICT sector: harnessing data bits to combat climate change. Accessed from: https://valtioneuvosto.fi/en/-/finland-announces-climate-strategy-for-ict-sector-harnessing-data-bits-to-combat-climate-change

Although ICTs require energy resources, they also offer opportunities to mitigate and adapt to climate change and disaster risk across other sectors. Enabling these opportunities requires integrated policy approaches. For example, the Government of Finland has been progressive in this area, seeking to both reduce the ICT sectors' footprint and boost the favorable environmental impact of digitalization in other sectors (Ministry of Transport and Communications, 2021).

Source: derived from Finland Ministry of Transport and Communication, 2021

Integrated policy examples are more limited in the Asia-Pacific region, however more examples are emerging (e.g. Singapore Green Data Centre Initiative). Technology-enabled approaches from the region often take a disaster-risk (e.g. ThaiAWARE early warning and hazard monitoring system[89]) or sector-specific focus, sometimes with variable impact (refer Case Study 5).

Policy recommendations

- Multi-stakeholder collaboration | Working collaboratively across industry, academia and government has been fundamental to policy development work in Finland and Singapore. Moreover, working towards a strong whole-of-government vision is also key (e.g. Singapore's vision of a 'Smart Nation' supported by sustainable computing infrastructure – linked to National Climate Change Secretariat).
- Situation analysis | Understanding the domestic drivers for government ministries to collaborate on climate action (e.g. legislative requirements such as a Climate Change Bill, or national strategies, such as a Low Emissions Development Strategy) and barriers (e.g. lack of finance, incentives, technical capacity, political will) is a key step to developing strategies seeking to boost the positive impact of digitalization beyond the ICT sector. This is especially important for the Asia-Pacific region, given the competing priorities of ministries and limited resources. The strategy examples provided all link to whole-of-government targets and commitments.

References

Finland Ministry of Transport and Communications (2021), Climate and Environmental Strategy for the ICT sector. Available at:

[89] Paul (2022), Thailand's new early warning technology to protect 70 million from disasters. Accessed from: https://www.downtoearth.org.in/news/natural-disasters/thailand-s-new-early-warning-technology-to-protect-70-million-from-disasters-80985#:~:text=Published%3A%20Wednesday%2005%20January%202022,million%20residents%20from%20natural%20disasters.

https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/162912/LVM_2021_06.pdf?sequence=1&isAllowed=y

National Climate Change Secretariat Singapore (2022), Green ICT. Available at: https://www.nccs.gov.sg/singapores-climate-action/green-ict/

3.4. Key Takeaways

To summarize, the key takeaways from Thematic Block 3 are:

Building climate resilience through climate change adaptation

- Global frameworks on climate change, disaster risk reduction and sustainable development provide a unifying call for action to ultimately reduce vulnerability and enhance resilience of natural and human systems to climate and disaster risks, and development challenges.
- Adaptation planning at any scale necessitates systems-thinking, multi-stakeholder engagement and robust decision-making processes for which ICTs can be deployed to support policy-makers and communities identify, implement and monitor adaptation strategies.
- Every element of the adaptation planning process should be supported by appropriate ICT resources, policies, skills and capacities.

The role of ICTs for climate change adaptation

- There are many and diverse applications of ICTs in climate change adaptation. ICTs are increasingly being deployed to reduce climate change and disaster risks in areas such as environmental observation, climate monitoring, early warning systems and food and water security.
- ICT solutions alone will not solve adaptation challenges. ICT solutions require systematic understanding of problems to bring about behavior change.

Maximizing the opportunities to address climate change through ICTs - what does this mean for policymakers?

Although ICTs require energy resources, they also offer opportunities to mitigate and adapt to climate change and disaster risk across other sectors. Enabling these opportunities requires integrated policy approaches. Recommendations for policymakers include:

- **Multi-stakeholder collaboration |** Working collaboratively across industry, academia and government, towards a strong whole-of-government vision is a critical foundational step (e.g. Singapore's vision of a 'Smart Nation' supported by sustainable computing infrastructure – linked to National Climate Change Secretariat).
- **Undertake situation analysis |** Understanding the domestic drivers for government ministries to collaborate on climate action (e.g. legislative requirement such as National Climate Change Bill) and any barriers (e.g. financial, technical, institutional) is a key step to developing strategies seeking to boost the 'climate action' impact of digitalization beyond the ICT sector. This is especially important for the Asia-Pacific region, given the competing priorities of governments and limited resources.

Group Planning Session

Participants will have allocated time to reflect on Block 3 learning and discussions to work on their group presentation for the *lightning talk* (this activity is part of Block 5 Summary).

4. ICT FOR RESILIENT DEVELOPMENT

The learning goals for this thematic block are:

- Recognize key concepts and terminologies associated with sustainable development and climate resilient development.
- Analyze and evaluate the potential contribution of ICTs to climate resilient development, from both a behavioral and technological change perspective.
- Formulate considered perspectives on the role of ICT in climate resilient development in their own country context.

4.1. Climate resilient development and ICTs: a systems-view

"Nowadays, we have more knowledge than ever on climate change. But although we gain more and more knowledge, we observe less action" Valérie Masson-Delmotte, co-chair of, Working Group 1, IPCC[90]

Climate-resilient development pathways - integration of adaptation, mitigation and sustainable development

What are the scientists saying?

The IPCC highlights that climate change calls for **new approaches to sustainable development** that consider complex interactions between climate and social and ecological systems.[91]

Climate-resilient pathways - looking at systems: The concept of climate-resilient pathways was first introduced in the 2014 IPCC Fifth Assessment Report (AR5). In this report, a number of complex concepts around climate resilience and managing ongoing change are introduced. These concepts are based on **sustainable development** as the ultimate goal, with **mitigation** as a way to keep climate change moderate rather than extreme (as outlined in Block 2) and **adaptation** as a response strategy to anticipate and cope with unavoidable impacts, under different scenarios of climate change (as outlined in Block 3). Involving capacities for implementing and sustaining locally appropriate **risk management** (as noted in Block 2 & 3) are also highlighted by the IPCC AR5. In other words, **enabling local experts to lead,** both in the design and implementation of risk management strategies is critical.

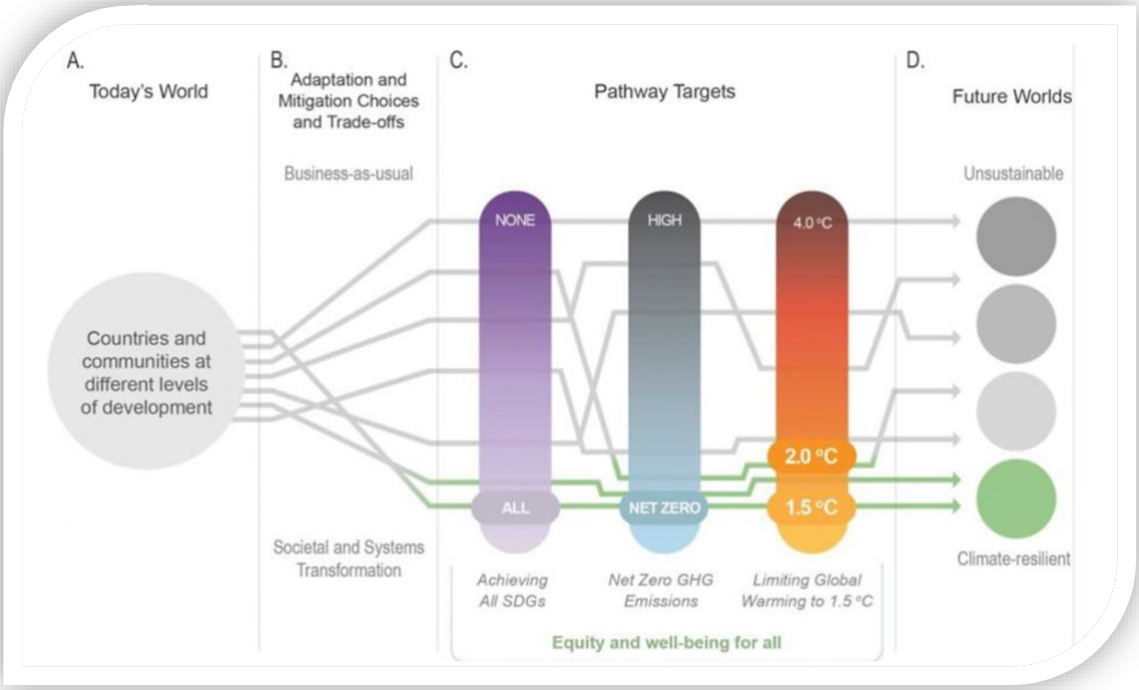
[90] Masson-Delmotte (2020). Valérie Masson-Delmotte on the role of academics in the climate emergency. Available at https://www.uu.nl/en/news/valerie-masson-delmotte-on-the-role-of-academics-in-the-climate-emergency

[91] Denton, F et. al. (2014). Climate-resilient pathways: adaptation, mitigation, and sustainable development. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Available at https://www.ipcc.ch/site/assets/uploads/2018/02/WGIIAR5-Chap20_FINAL.pdf

Climate-resilient development pathways - transition and societal transformation: The 2018 IPCC Special Report: Global Warming of 1.5°C presents the concept of climate-resilient development pathways (represented by green arrows, in Figure 8 below). OECD analysts[92] highlight climate-resilient development pathways that:

- Span from the present, where countries and communities are at different levels of development (Part A) to future scenarios, referred to as "Future Worlds" (Part D) that range from climate-resilient (bottom) to unsustainable (top).
- Part B highlights that climate-resilient development pathways involve **societal and systems transformations**, as well as **adaptation and mitigation choices.** Examples of these were provided in the earlier case studies in Thematic Blocks 2 and 3.

Figure 8. Climate resilient development pathways



Source: OECD 2021

[92] OECD (2021). *Strengthening Climate Resilience: Guidance for Governments and Development Co-operation*. OECD Publishing, Paris. Available at https://www.oecdilibrary.org/environment/strengthening-climate-resilience_4b08b7be-en

4.2. Applying ICTs to navigate pathways to climate resilient development

Science to Policy and Practice - the implementation challenge

As discussed in earlier sections of this module, there is strong agreement that how communities, organizations, and ultimately, nations approach climate resilient development - will be context-specific. How this is implemented is **less clear**.

Climate resilient development pathways include **strategies**, **choices and actions** that reduce climate change and its impacts and support sustainable development. These linkages are complex and often highly political, given the interdependencies, long timeframes involved and multiple actors. Addressing the implementation challenge is highly localized, requiring different ways of doing things, sometimes outside of traditional donor-government support models (refer to Case Study 5). Further, ICTs can play an important enabling role, in 'making the simple things easier.'

Case Study 5. A systems approach to food security: learning and information sharing with farmer organizations in the Pacific Island region

The Challenge: The Pacific island region is highly prone to natural disasters and exposed to external shocks – such as a global health pandemic and rising costs of imports. With increasing reliance on imported foods, growth in non-communicable diseases, increased malnutrition and obesity and heightened vulnerability to the impacts of climate change, a holistic approach to food security is required.

Breadfruit field visit source: pacificfarmers.com

Opportunities: Recent years have seen a growing interest in breadfruit (*Artocarpus altilis*) as a 'climate crop of the future'. Applying lessons from recent cyclone events, farmer organizations in the Pacific are linking back to traditional inter-cropping practices, to reduce crop losses and diversify risk for farmers. 'Seeing is learning' through demonstration sites, information is shared across farmer organizations, that can in turn, flow back to development partners and government departments to inform their climate change development support programming.

Links to ICTs: Various digital tools have been promoted to Pacific island farmers over the years, with limited uptake. Often the challenge is a pre-determined technical solution, that does not align with user requirements and business processes. Lockdowns associated with the COVID-19 health pandemic have required farmer organizations to determine their own 'fit for purpose' ways of sharing information. One such Fiji-based organization established a simple SMS system with a local telecommunication provider. The SMS alerts have been a key part of maintaining transparency and information flow – a core part of the businesses function as a cooperative. The proven success of the SMS alerts may be used in the future to communicate other updates to members – be it around demonstration projects, long-term climate risk management strategies or emergency-response related preparation.

Type of effect: Indirect effect, resulting from how ICTs are used in society. In this case, the ICT intervention is a small but important part of increasing resilience to external shocks – be it climate change or a global health pandemic. The key reflections here are that the digital innovation has to be borne from a need, or the intended beneficiaries won't use it. Moreover, ICT policymakers and development partner support need to be flexible enough to adapt their programs to support this form of simple, but ultimately business-led innovation.

References:

Australian Centre for International Agricultural Research(2020). *COVID-19 and food systems in Pacific island countries.* Available at **https://www.aciar.gov.au/sites/default/files/2020-11/covid-factsheet-pacific-island-countries_0.pdf**

FAO (2021). *FAO calls for renewed digital push in Small Island Developing States battered by COVID-19.* Available at **http://www.fao.org/asiapacific/news/detail-events/en/c/1437234/**

Pacific Island Farmers Organisation Network (PIFON), *Why Farmers Organisations?* Available at **pacificfarmers.com**

Climate governance and pathways to climate resilient development

Due to the political nature of climate change, climate governance has posed difficult challenges for national and sub-national governments for over a decade.[93]

Climate change governance requires governments to take an active role in changing how things are being done today – in particular, in terms of production and consumption practices in key economic sectors. As outlined in Block 2 & 3, these sectors include energy, agriculture and transportation. However, some of the most influential groups in society have done well from existing arrangements, and there is often a level of caution about disturbing the status quo.

[93] Meadowcroft, J (2010). Climate Change Governance. Washington, DC: World Bank. Available at https://openknowledge.worldbank.org/handle/10986/9063

Multilevel governance in climate change is considered a key enabler for systemic transformation and effective governance.[94] In practical terms, this means that all levels – from informal, local institutions, through to national and international institutions must be engaged in climate governance efforts. From a policy perspective, measures to help effect systems change can include: building coalitions for change, incentivizing new centers of economic power, creating new institutional actors, adjusting legal rights and responsibilities, and changing ideas and accepted norms and expectations. [95] It is important to note that these are broad principles, and what is appropriate in one context will not necessarily translate to another economy.

To date, experiences with low-carbon development pathways in developing countries highlight the key role of a) identifying synergies across policy themes b) removing institutional barriers, and c) ensuring equity and fairness in distributing benefits.[96] At a national level, international efforts of note include Fiji's Low Emission Development Strategy[97] and Costa Rica's ecosystem and conservation-driven green transition paths[98]. More recently, the Indonesian Ministry of Environment and Forestry launched Indonesia's Long Term Strategy for Low Carbon and Climate Resilience (LTS-LCCR) in March 2021. The LTS-LCCR strategy is aiming for net-zero emissions by 2070.[99] India has also adopted technology and renewables pathways, with increasing efforts to develop Electric Vehicle (EV) Policy at a sub-national level – where synergies to decarbonization targets include reducing air pollution levels in major urban centuries and generating skilled employment (refer to *Annex B, Further Reading*).

Going forward, good data collection practices, supported by well-resourced ICT systems and information governance approaches, can greatly assist monitoring and evaluation efforts (refer to Case Study 6).

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[94] IPCC (2018). *Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty*. Available at https://www.ipcc.ch/sr15/

[95] Meadowcroft, J (2010). Climate Change Governance. Washington, DC: World Bank. Available at https://openknowledge.worldbank.org/handle/10986/9063

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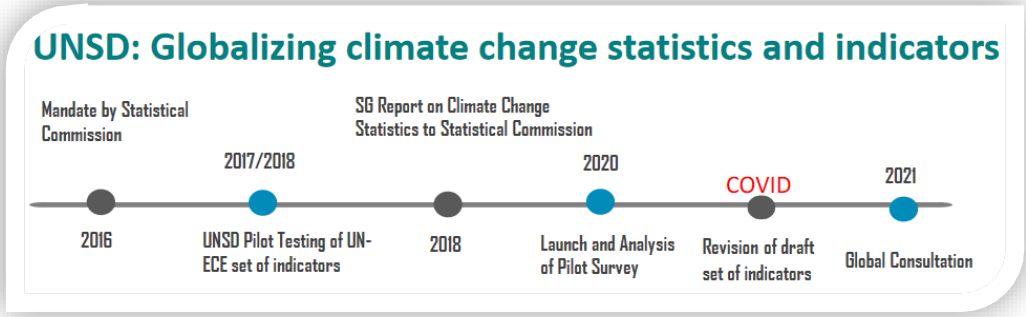
[99] Climate Works (2021). Raising Indonesia's net zero ambition: the pivotal role of energy systems in setting and reaching a net zero target. Available at https://www.climateworksaustralia.org/news/raising-indonesias-net-zero-ambition/

Case Study 6. Climate related statistics for building climate resilience

The Challenge: Effective data and statistics are essential to inform decisions and support the implementation of climate resilient development. However, no reporting framework for the Paris Agreement exists, and relevant climate related statistics are not standardized. Consequently, climate related data and statistics are created in different formats that are often not compatible and difficult to compare and analyze.



Source: United Nations Statistics Division (UNSD). (2020). Global Set of Climate Change Statistics and Indicators. Available at https://unstats.un.org/unsd/envstats/fdes/EGES7/Sess2_UNSD_Climate_global_set.pdf

The lack of dedicated and skilled climate data capacities further contributes to uncoordinated efforts with duplication and gaps. Initial steps towards harmonizing climate change reporting and statistics include the IPCC 2006 guidelines for standardizing GHG reporting. The IPCC Fourth Assessment Report (2007) and the **Framework for the Development of Environment Statistics (FDES 2013)** provide some guidance on climate change topics, namely drivers, impacts, vulnerability, mitigation, and adaptation.

Opportunities: The development of a **Global Set of Climate Change Statistics and Indicators** by the UN Statistics Division (UNSD) provides a promising effort towards standardization of climate related data. Progress is being made to establish an extensive dataset with definitions and guidance covering metadata, references, and other details. The new climate change statistics target connections between existing frameworks, for example, the SDGs, SFDRR, and others, while also covering the IPCC climate change topics. The National Statistics Offices (NSO) are key partners for existing and new climate related statistics, and for **SDG reporting**, the **Sendai Framework Monitor**, and other relevant socio-economic data and statistics. The mandate of NSO, as the key national data and service provider, creates opportunities to strengthen the availability, quality, and interoperability of climate related statistics to support policymaking and decision-making on climate change.

Links to ICTs: Significant amounts of climate change data and reporting are produced and provided by countries. However, information is often scattered across different national systems that are hard to find or access. A well-resourced ICT systems and information governance approach is needed to establish and operationalize climate related statistics effectively. Examples of good practice and guidance are documented in a **climate change related statistics wiki**.

Type of effect: Indirect effect, resulting from how ICTs are used in society. A universally standardized data and reporting structure for climate related statistics offers benefits for policymaking and climate action. The interoperability of available climate data and information can reduce duplication and mobilize synergies and efficiencies for data collection and information management across different local, national, regional, and global frameworks and systems.

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Industry perspectives on climate resilient development and the role of ICTs

There is a strong call from multilateral organizations on the need to actively engage business and industry leaders on the climate challenge.

'Business Ambition for 1.5°C' is an urgent call to action from a global coalition of UN agencies, businesses and industry leaders. Coordinated by the Science Based Targets initiative (SBTi), the coalition is calling on companies to commit to setting ambitious science-based emissions reduction targets. As of June 2021, an estimated 700 companies have responded to the open letter from global leaders, and signed the Business Ambition for 1.5°C commitment.[100] These include international software and services companies such as the Microsoft Corporation and Atlassian Corporation, and regional utility providers such as the Tata Power Company Limited (India).

[100] SBTi (2021). 'Companies Taking Action Register.' Available at https://sciencebasedtargets.org/companies-taking-action#table

Policy Box C. Society-wide transformations and ICTs – what does this mean for policymakers?

"Transformation will only work if it is locally owned and driven" Laetitia De Marez, RMI Director, Climate Finance Access Network[101]

Policy context

As of early 2022, the majority of Southeast Asian nations have announced net-zero emissions pledges, accounting for some 90 per cent of the region's carbon emissions. This progress has been supported by policy and regulatory settings and innovative procurement models for renewable energy.[102] At the same time, the world is emerging from a global health pandemic, facing growing inequalities and rising energy costs – the latter linked to the evolving Russia and Ukraine conflict.

Within this context, the European Green Deal ('the Deal') recognizes that climate change and environmental degradation are a fundamental threat to Europe and the world. The Deal proposes a transformation of the EU economy and society to make Europe the world's first climate-neutral continent by 2050. To deliver this, the EC has approved proposals to make EU climate, energy, transport and taxation policies fit for reducing net GHGs by at least 55 per cent by 2030, compared to 1990 levels. Under the Deal, the Circular Economy Action Plan includes the role of ICTs in climate action and supporting Europe to reduce dependence on primary materials.

In the Asia-Pacific region, countries are also preparing Circular Economy (CE) strategies, aligned to national climate plans, or Nationally Determined Contributions (NDCs). By and large, the potential of frontier technologies (e.g. Big Data analytics, artificial intelligence) have not been reflected in Asia-Pacific CE strategies, NDCs or other national-level sustainable development plans. There is an opportunity for Asia Pacific countries to localize the principles of the EC Circular Economy Action Plan, and consider how ICTs can effectively support climate-resilient development planning.

[101] Stone (2022) 'Climate Action through Local Ownership: Tackling Global Climate Challenges by Localizing Climate Finance and Clean Energy Skills. Accessed from: https://rmi.org/tackling-global-climate-challenges/?utm_medium=email&utm_source=spark&utm_content=spark-b&utm_campaign=2022_03_10&utm_term=button

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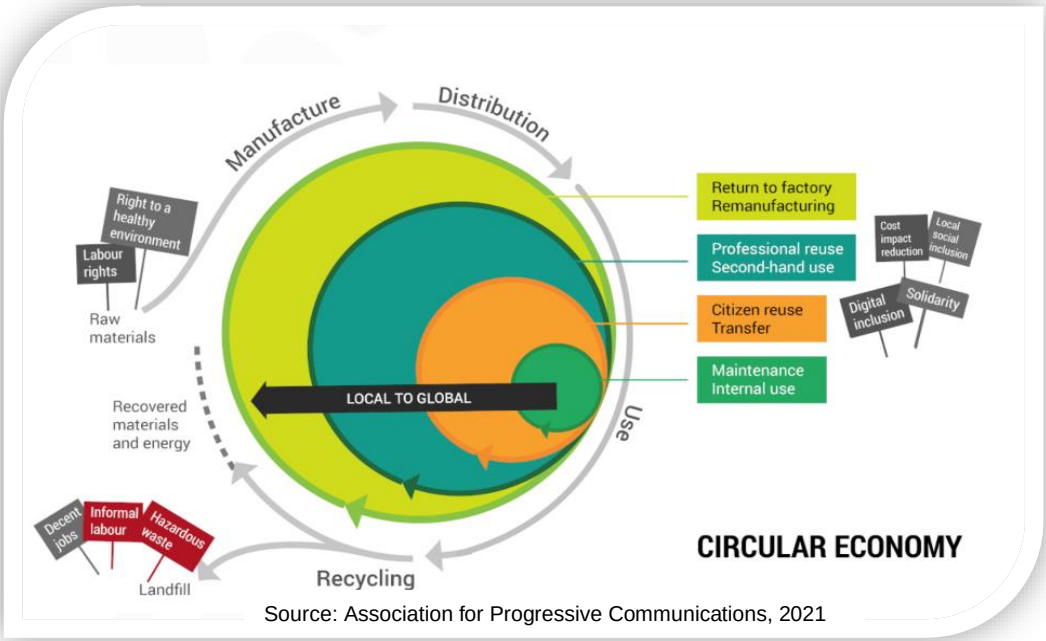

Source: Association for Progressive Communications, 2021

Policy Recommendations

- Focus on key resource-intensive industries and products | Consider undertaking circular economy (CE) assessments to identify priority areas of circular action, including where the ICT sector can enable action. Initiatives like UNDP Climate Promise have supported CE assessments in the Asia-Pacific region, including Vanuatu and Lao PDR.
- Supporting public organizations and businesses in the transition through legislation/non-legislation measures | Having undertaken a CE Assessment, public organizations and businesses can be supported in the transition through targeted institutional measures. For example, green public procurement criteria (GPP) that links to domestic climate and waste management legislation could be a regulatory measure to consider. Multilateral and bilateral development partners should also 'lead by example' and apply GPP criteria to all ICT product and service contracts.
- Proposing agreements, alliances and initiatives at a sub-regional scale | Learning at scale and undertaking initiatives at a sub-regional level will further our understanding of the opportunities for ICTs to support climate-resilient development. Financial support mechanisms associated with the EC Circular Economy Action Plan can also be channeled through sub-regional alliances and agreements.

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4.3. Key Takeaways

To summarize, the key takeaways from Thematic Block 4 are:

Climate-resilient development and the ICT sector: a systems view on adaptation, mitigation and sustainable development

- There is strong agreement that how communities, organizations, and ultimately, nations approach climate-resilient development will be context-specific. How this is implemented is less clear.
- Climate-resilient development pathways include strategies, choices and actions that reduce climate change and its impacts and support sustainable development. These linkages are complex and often highly political.
- The ICT sector can potentially help to manage the challenges of climate change at all levels of risk management and decision-making.
- From a policy perspective, measures to help effect systems change can include: building coalitions for change, incentivizing new centers of economic power, creating new institutional actors, adjusting legal rights and responsibilities, and changing ideas and accepted norms and expectations. It is important to note that these are broad principles, and what is appropriate in one context will not necessarily translate to another economy.

Applying ICTs to navigate pathways to climate-resilient development

- Climate resilient development pathways include strategies, choices and actions that reduce climate change and its impacts and support sustainable development. These linkages are complex and often highly political, given the interdependencies, long timeframes involved and multiple actors.
- There is a strong call from the international community to engage with the business and industry leaders to address the climate change challenge. This is particularly important for the ICT sector.
- Increasing the linkages between ICTs, climate change and sustainable development requires new policy approaches, key principles for policymakers include:
    - Principle 1. Reflecting local priorities and institutional context
    - Principle 2. ICTs enable, they don't drive the process
    - Principle 3. Public procurement - establish a fair, balanced and consistent regulatory approach to ICT solutions
    - Principle 4. Policy integration is a process, not a blueprint

Society-wide transformations and ICTs – what does this mean for policymakers?

The **European Green Deal** ('the Deal') recognizes that climate change and environmental degradation are a fundamental threat to Europe and the world. Under the Deal, the **Circular Economy Action Plan** includes the role of ICTs in climate action and supporting Europe to reduce dependence on primary materials. There is

an opportunity for Asia Pacific countries to localize the principles of the EC **Circular Economy Action Plan,** and consider how ICTs can effectively support climate-resilient development planning. Recommendations for policymakers include:

- ***Focus on key resource-intensive industries and products*** | Consider undertaking circular economy (CE) assessments to identify priority areas, including where the ICT sector can enable climate action. Initiatives like UNDP Climate Promise are supporting CE assessments in the Asia-Pacific region.
- ***Supporting organizations and businesses in the transition through legislation/non-legislation measures*** | Having undertaken a CE Assessment, public organizations and businesses can be supported in the transition through targeted institutional measures. Multilateral and bilateral development partners can also drive change by applying GPP criteria to all ICT product and service contracts.
- ***Proposing agreements, alliances and initiatives at a sub-regional scale*** **|** Learning at scale and undertaking initiatives at a sub-regional level will further our understanding of the opportunities for ICTs to support climate resilient development. Financial support mechanisms associated with the EC Circular Economy Action Plan can also be channeled through sub-regional alliances and agreements.

Group Planning Session

Participants will have allocated time to reflect on Block 4 learning and discussion and finalize presentation material for the *lightning talk* (to be presented in Block 5).

5. SUMMARY

The learning goals of this thematic block are:

- Evaluate the cumulative learning gained from each thematic block and how they contribute to both the theoretical and applied understanding of ICTs for climate-resilient development.
- Share group reflections on the content covered by all the blocks through the presentation of *lightning talks.*
- Appreciate additional support available beyond the module, including further reading materials and complimentary e-learning courses offered by APCICT and other institutions in the Asia Pacific region.

5.1. Key Takeaways

Block 1: Building Climate Resilience - the Big Picture

The key takeaway messages from Block 1 are summarized below:

Thinking at the systems-level to inform local actions

- Climate change is a complex environmental and social challenge. The challenge requires a 'systems thinking' analysis and leadership approach that understands the connections between global variables and local issues.
- Sustainable development is influenced by mega-trends: demographic trends, urbanization, technological innovation, climate change and environmental degradation.
- From a policy perspective**,** the COVID-19 global heath pandemic has demonstrated that governments can intervene on a massive scale when the risks and threats are immediate and large enough, which has implications for how governments plan, and develop policies to respond to climate change risks.

Climate science and the connection to climate resilient development

- Climate science is complex. To address this, ICTs are being applied to enable the communication of complex science and the political negotiation process, to a wider audience.
- Climate resilient development is underpinned by a number of key principles: sustainable development and climate change are inseparable; the climate crisis is a politically charged 'wicked policy problem' that involves interdependent structures and multiple actors; and there is no 'one size fits all approach. The transition process to climate resilient development will differ from country to country.

What role can ICT play in supporting the transition to climate resilient development?

- The ICT sector is recognized as both a contributor and part of the potential response to climate change. These effects can be classified into direct, indirect and societal effects. This framework provides a basis for analyzing the current impacts of ICTs and their future potential in risk management and society-wide transformation.

Block 2: ICT for Climate Change Mitigation

The urgency of climate change mitigation

- The future of our planet depends on when and what action we take to drastically reduce GHG emissions. If countries fail to act in compliance with the Paris targets, global warming is likely to reach 1.5°C as early as 2030.
- The ICT sector is estimated to contribute between 1.4 and 3.9 per cent of global GHG emissions. Without any intervention, the global demand for ICTs will continue to rise and the ICT sector could become a significant contributor of GHG emissions.

The role of ICTs for climate change mitigation

- ICTs have a role to play in climate change mitigation. The challenge for the ICT sector is to close the digital divide and at the same time adopt smart solutions for abating GHG emissions. Proactive measures like greening upstream and downstream ICT supply chains, designing sustainable ICT products and services, reducing and managing electronic waste and enabling open and transparent data on GHG impacts of the ICT sector can improve energy efficiency and reduce the sector's ecological footprint.

Managing the Footprint of the ICT sector – what does this mean for policymakers?

- ***Measurement and ongoing reporting* |** Establishing an energy consumption and emissions baseline and requirements for ongoing monitoring is key. The *UK Greening Government Commitments*, for example, requires Government to quantify and report on its e-waste and the energy and carbon footprint of the digital and technology services it uses and their sustainability impacts.
- ***Green procurement strategies* |** Governments can influence IT-supply chains through purchasing and contracting decisions. Multilateral and bilateral development partners have the resources to consider construction, operation, disposal and decommissioning of assets and services, across all of their operations. Providing vision and leadership in this area provides local-level lessons that can inform national-level strategy.

- ***Regulatory reform*** **|** Anti-dumping legislation, as per the e-waste ban in Thailand, can set a strong foundation for protecting natural assets and communities at a national-level. However, it must be linked to wider policies, that consider enforcement capacity and viable alternatives for domestic waste industries.

Block 3: ICT for Climate Change Adaptation

Building climate resilience through climate change adaptation

- Global frameworks on climate change, disaster risk reduction and sustainable development provide a unifying call for action to ultimately reduce vulnerability and enhance resilience of natural and human systems to climate and disaster risks, and development challenges.
- Adaptation planning at any scale necessitates systems-thinking, multi-stakeholder engagement and robust decision-making processes for which ICTs can be deployed to support policy-makers and communities identify, implement and monitor adaptation strategies.
- Every element of the adaptation planning process should be supported by appropriate ICT systems, resources, policies, skills and capacities.

The role of ICTs for climate change adaptation

- There are many and diverse applications of ICTs in climate change adaptation. ICTs are increasingly being deployed to reduce climate change and disaster risks in areas such as environmental observation, climate monitoring, early warning systems and food and water security.
- ICT solutions alone will not solve adaptation challenges. ICT solutions require systematic understanding of problems to bring about behavior change.

Maximizing the opportunities to address climate change through ICTs - what does this mean for policymakers?

- ***Ensure multi-stakeholder collaboration*** **|** Working collaboratively across industry, academia and government, towards a strong whole-of-government vision is a critical foundational step (e.g. Singapore's vision of a 'Smart Nation' supported by sustainable computing infrastructure)
- ***Undertake situation analysis*** **|** Understanding the domestic drivers for government ministries to collaborate on climate action and any barriers is a key step to developing strategies seeking to boost the 'climate action' impact of digitalization beyond the ICT sector. This is especially important for the Asia-

Pacific region, given the competing priorities of governments and limited resources.

Block 4: ICT for Climate Resilient Development

Climate-resilient development and the ICT sector: a systems view on adaptation, mitigation and sustainable development

- There is strong agreement that how communities, organizations, and ultimately, nations approach climate resilient development will be context-specific. How this is implemented is less clear.
- Climate resilient development pathways include strategies, choices and actions that reduce climate change and its impacts and support sustainable development. These linkages are complex and often highly political.
- The ICT sector can potentially help to manage the challenges of climate change at all levels of risk management and decision-making.
- From a policy perspective**,** measures to help effect system change can include: building coalitions for change, incentivizing new centers of economic power, creating new institutional actors, adjusting legal rights and responsibilities, and changing ideas and accepted norms and expectations. It is important to note that these are broad principles, and what is appropriate in one context will not necessarily translate to another economy.

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- Climate resilient development pathways include strategies, choices and actions that reduce climate change and its impacts and support sustainable development. These linkages are complex and often highly political, given the interdependencies, long timeframes involved and multiple actors.
- There is a strong call from the international community to engage with the business and industry leaders to address the climate change challenge. This is particularly important for the ICT sector.
- Increasing the linkages between ICTs, climate change and sustainable development requires new policy approaches, key principles for policymakers include:
    - Principle 1. Reflecting local priorities and institutional context
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Society-wide transformations and ICTs – what does this mean for policymakers?

The **European Green Deal** recognizes that climate change and environmental degradation are a fundamental threat to Europe and the world. There is an opportunity for Asia Pacific countries to localize the principles of the EC **Circular Economy Action Plan,** and consider how ICTs can effectively support climate-resilient development planning. Recommendations for policymakers include:

- ***Focus on key resource-intensive industries and products*** | Consider undertaking circular economy (CE) assessments to identify priority areas, where the ICT sector can enable climate action. Initiatives like UNDP Climate Promise are supporting CE assessments in the Asia-Pacific region.
- ***Supporting organizations and businesses in the transition through legislation/non-legislation measures*** | Having undertaken a CE Assessment, public organizations and businesses can be supported in the transition through targeted institutional measures. Multilateral and bilateral development partners can also drive change by applying Green Public Procurement criteria to all ICT product and service contracts.
- ***Proposing agreements, alliances and initiatives at a sub-regional scale*** **|** Learning at scale and undertaking initiatives at a sub-regional level will further our understanding of the opportunities for ICTs to support climate resilient development. Financial support mechanisms associated with the EC Circular Economy Action Plan can also be channeled through sub-regional alliances and agreements.

5.2. Further Learning

The following additional resources are available from APCICT to assist with further learning. These include:

- Recommended further reading (see Appendix B); and
- Related e-learning modules and platforms offered by APCICT and others.

Lightning Talk Presentations

Based on the cohort and the number of groups, participants will present their short talks to the wider group. Presentations will reflect on the content covered in the Module, applied to the particular context of the participant. The session will close with a facilitated discussion and a 'people's vote' from the participants for the most engaging presentation.

A *Lightning Talk* template will be provided to the participants prior to the course to provide indicative guidance for the presentation.

APPENDIX A: FURTHER READINGS

Block 1: Building Climate Resilience - the Big Picture

ESCAP (2021). *Weaving a Stronger Fabric: Managing Cascading Risks for the Climate Resilience.* Available at https://www.unescap.org/kp/2021/weaving-stronger-fabric-managing-cascading-risks-climate-resilience

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APPENDIX B: RELATED ONLINE MODULES AND LEARNING PLATFORMS

APCICT Academy Modules

ICT for Disaster Risk Management

Duration: Self-paced

Language: English

URL: https://e-learning.unapcict.org/courses/detail?id=53

Description: This module introduces disaster risk management (DRM) and provides an overview of how information and communication technologies (ICTs) can be used for DRM. The module introduces basic concepts of DRM and the applications of ICTs in disaster mitigation and prevention, preparedness, response, and recovery.

UN Climate Change Learning Partnership

Climate change: from learning to action

Duration: Self-paced (approx. 8 hours)

Language: English, French, Spanish and Russian

URL: https://unccelearn.org/course/view.php?id=48&page=overview

Description: This course introduces the user to climate change is, how it affects them and others, and what can be done to address it.

Climate information and services

Duration: Self-paced (approx. 1 hour)

Language: English and French

URL: https://unccelearn.org/course/view.php?id=32&page=overview

Description: This tutorial introduces climate information and services and their application in decision-making.

Gender and environment

Duration: Self-paced (approx. 6 hours)

Language: English, French and Spanish

URL: https://unccelearn.org/course/view.php?id=39&page=overview

Description: This introductory course examines the link between gender and environment in the areas of climate change, international waters, biodiversity, land degradation, and chemicals and waste.

Introduction to green economy

Duration: Self-paced (approx. 10 hours)

Language: English, Spanish, French, Romanian, Ukrainian and Mongolian

URL: https://unccelearn.org/course/view.php?id=51&page=overview

Description: This course introduces the basic concepts, policy instruments and international frameworks of inclusive green economies.

Indicators for an inclusive green economy

Duration: Self-paced (approx. 2 hours)

Language: English

URL: https://unccelearn.org/course/view.php?id=110&page=overview

Description: This course introduces the concept of indicators to support policy-making for an Inclusive Green Economy (IGE) and to illustrate the use of methodologies for selecting and applying indicators to assist countries pursue the attainment of global Sustainable Development Goals.

APCICT

The Asian and Pacific Training Centre for Information and Communication Technology for Development (APCICT) was inaugurated on 16 June 2006 as a regional institute of Economic and Social Commission for Asia and the Pacific (ESCAP), and is located in Incheon, Republic of Korea. Guided by the 2030 Agenda for Sustainable Development and other internationally agreed development goals, the Centre's objective is to build and strengthen the capacity of members and associate members of ESCAP to leverage information and communication (ICT) for the purpose of socio-economic development. APCICT's work is focused on training, knowledge sharing, and multi-stakeholder dialogue and partnership.

APCICT is located in Incheon, Republic of Korea.

http://www.unapcict.org

ESCAP

The Economic and Social Commission for Asia and the Pacific (ESCAP) is the most inclusive intergovernmental platform in the Asia-Pacific region. The Commission promotes cooperation among its 53 member States and 9 associate members in pursuit of solutions to sustainable development challenges. ESCAP is one of the five regional commissions of the United Nations.

The ESCAP secretariat supports inclusive, resilient and sustainable development in the region by generating action-oriented knowledge, and by providing technical assistance and capacity-building services in support of national development objectives, regional agreements and the implementation of the 2030 Agenda for Sustainable Development.

https://www.unescap.org

UNITED NATIONS
ESCAP
Economic and Social Commission for Asia and the Pacific
/ APCICT

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