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POLICY BRIEF

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Information & Communications Technology Solutions for Environmental Issues in the Greater Mekong Subregion

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Highlights

The Mekong River sustains the livelihoods of millions of people in the region, but its ecosystem is on the verge of collapse. Climate change and local environmental changes resulting from human activities along the river — such as hydropower dam construction, deforestation, sand mining, extensive irrigation for agriculture, and wetland conversion — are having negative social and economic impacts on the population.

Information and communications technology (ICT), particularly the development of a smart region, will be a critical enabler for solving environmental issues in the Greater Mekong Subregion.

Recommendations:

- Implement pilot projects to lay the foundations for a smart network in the region.
- Formulate a regional policy framework for ICT solutions.
- Promote renewable energy usage and data-driven renewable energy diversification.

ICT Solutions for Sustainable Management in the Greater Mekong Subregion

In recent years people in the Greater Mekong Subregion (GMS) have experienced significant environmental impacts, driven mainly by the increasing construction of hydropower dams along the river. The ecosystem is on the verge of irreversible collapse due to the cumulative effects of climate change (Korwatanasakul & Durongkaveroj 2022; Whitehead et al. 2019). In 2019 the river's water level fell to its lowest in a century, resulting in droughts in the lower Mekong River basin (Korwatanasakul & Durongkaveroj 2022). Moreover, erratic water flow is causing severe floods. The droughts and floods disrupt river-based economic activities such as fisheries and agriculture and, in turn, cause poverty and forced migration. The construction of dams results in adverse economic, environmental, and social consequences, hindering and even reversing progress on the SDGs.

Information and communications technology (ICT) can be a critical enabler for addressing climate change and advancing sustainable development. In particular, emerging ICT-led innovations in artificial intelligence (AI) and machine learning are helping to accelerate countries' progress on the SDGs (Korwatanasakul, Nguyen & Suonvisal 2022; Korwatanasakul & Takemoto 2021, 2022).

Advancing ICT promotes the development of smart cities that form networks of intelligent devices (hereafter sensors) and data-exchanging systems, employing data from the network to manage and utilise resources efficiently and sustainably. AI-enabled initiatives can contribute towards achieving environmental and social targets. For instance, Malaysia has implemented a "City Brain" initiative to improve urban planning, while Indonesia, the Philippines, and Viet Nam have created an image recognition tool to monitor and control plastic waste management and ocean pollution (AI4SDGs Think Tank 2022). The concept of smart cities can extend to smart regions (groups of smart cities) or smart environments in general.

Creating smart environments relies on a complex matrix of sensors monitoring economic, environmental, and social activities, informing timely policies and government actions towards achieving SDG targets. Moreover, innovations in the application of AI — such as climate modelling, smart fishery conservation, land-use monitoring, and smart grids — create a large pool of data on environmental issues (particularly SDGs 13, 14, and 15). These applications utilise the collected data to monitor and control changes in activities affecting the environment, including marine life migration, fishing activities, pollution levels, and disease vectors and outbreaks (Korwatanasakul & Takemoto 2022). The data collected by sensors allow abnormal patterns to be identified, enabling estimation of the probability of extreme phenomena occurring. Vinuesa et al. (2020) found that AI directly and positively affects 79% of SDG targets, including 93% of the environmental targets, 70% of the economic targets, and 82% of the social targets.

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This policy brief identifies ICT solutions to prevent and mitigate environmental challenges in the GMS while addressing the SDGs, supporting the mission of the Mekong River Commission. It reflects the four fundamental components of smart cities: data and technology, physical environment, society, and governance (Visvizi & del Hoyo 2021). Recommendations are provided on adopting ICT solutions for sustainable management — and ultimately establishing a smart region. While intended for local policymakers, the recommendations are also of relevance for a broader range of stakeholders as the concept and implementation of a smart region can be tailored to different contexts.

Policy Recommendations

1. Implement Pilot Projects to Lay the Foundations for a Smart Network in the Region

As a first step, policymakers should conduct an in-depth study of technological readiness and infrastructure in the GMS. Each country should establish a research committee to investigate the feasibility of available ICT solutions and follow the example of the ASEAN Smart Cities Network to identify specific areas for implementing a pilot project. The pilot project should target particular regions of each country and set specific goals and timelines. It should then be scaled up, taking account of lessons learned during the pilot phase and expanding the scope to cover more areas within the GMS.

ICT can bring benefits in energy production, including in regions that are dependent on hydropower like the GMS. It improves efficiency in hydropower generation while monitoring the impacts of energy production on the environment. ICT-led innovations such as AI and machine learning should be adopted as a fundamental enabler to upgrade and modernise the operation of hydropower plants by improving efficiency, supporting the scheduling of power generation, and predicting failure and necessary maintenance (e.g., Bordin et al. 2020). Furthermore, ICT applications, together with the Internet of Things and AI, can monitor and predict environmental issues such as pollution, saline water intrusion, droughts, and floods. For instance, in the case of Hubei Province in China, ICT is used to consider multiple causes and input variables, such as precipitation, temperature, evaporation, and surface water, to calculate a multivariate drought and flood index (Chen et al. 2020). In addition, ICT provides benefits in disaster recovery management. It can assess disaster-induced impacts, develop recovery plans, track the recovery process, and estimate loss and repair costs (Sun et al. 2020).

2. Formulate a Regional Policy Framework for ICT Solutions

At a macro level, ICT enables an informed society in which relevant stakeholders share data and knowledge on climate change and environmental impacts, participate actively in decision-making at the local and regional levels, and make informed decisions based on analytical data. Adopting ICT solutions for environmental impacts in the GMS requires a regional framework properly addressing the role of ICT in energy production, environmental protection, mitigation, adaptation, and other spheres. In addition, a regional framework should foster sharing of knowledge and information between relevant stakeholders while enhancing the participation of the private and public sectors.

The GMS should leverage the existing ASEAN Smart Cities Framework to establish a GMS Smart Region Framework. Accordingly, dialogue must be initiated involving all relevant stakeholders in the region, including Cambodia, China, the Lao People's Democratic Republic, Myanmar, Thailand, and Viet Nam, to formulate a clear roadmap and guidelines specifically tailored to each country and ecosystem, recognising differences in digital readiness. This roadmap would be aligned with the Greater Mekong Subregion Climate Change and Environmental Sustainability Program, which supports GMS countries to realise economic development while considering climate and the environment (Asian Development Bank 2022).

Standardisation, established through a common framework and guidelines, is critical to address heterogeneity issues in the interactions of cross-domain related stakeholders (Nurwatik & Hong 2019). Developing smart regions requires sensor deployment, data centralisation and standardisation, and well-structured collaboration between different actors and domains capable of working in harmony on critical issues (Nurwatik & Hong 2019). ICT-led innovations, such as AI, could be a powerful tool for environmental management, but only if all involved actors adopt a common framework (Corrado 2021).

It is also essential to build high-quality infrastructure and human capital for the framework, and that it accounts for the ongoing digital economy transition in the region. This transition may change the job market and resource dependency — such as reliance on particular sources of (renewable) energy — and, therefore, support local preparation for economic, social, and environmental structural changes.

3. Promote Renewable Energy Usage and Data-driven Renewable Energy Diversification

Even though it is essential to shift towards renewable energy, heavy dependence on a few renewable sources makes a country or region vulnerable to demand and supply shocks. Such dependence also exacerbates trade-offs between SDGs — for example, contributing to affordable and clean energy (SDG 7) while impeding progress on environment-related SDGs. In the GMS, strong reliance on hydropower energy has incurred costs in environmental degradation — climate action (SDG 13), life below water (SDG 14), and life on land (SDG 15). It has also caused other economic and social issues, including poverty and forced migration due to loss of shelter and agricultural lands — no poverty (SDG 1), zero hunger (SDG 2), and clean water and sanitation (SDG 6). The increasing number of dams along the Mekong River and the lack of data and regulation for hydropower production are damaging the ecosystem and adversely affecting millions of people's lives in the region. Thus, reducing dependence on hydropower electricity generation should be another policy priority.

A potential solution is to diversify energy supply through applying ICT, for example smart grids. Data collected from a smart region network helps to establish an efficient energy mix while realising substantial socio-economic and environmental benefits. Alternative energy sources such as solar and wind present viable alternatives for the GMS if the regional ICT framework can facilitate their usage at a large scale. Siala et al. (2021) show that regional coordination on solar photovoltaic systems between Cambodia, the Lao People's Democratic Republic, and Thailand can meet projected electricity demand and CO2 emission targets while reducing dependence on hydropower. Alternatively, Sahu (2018) highlights the potential of wind energy with cooperation from China, due to its advanced technology and supportive government policies in this field.

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