UNESCO'S INTERNATIONAL HYDROLOGICAL PROGRAMME AND CONTRIBUTION OF VIET NAM TO THE PROGRAMME

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1. Introduction

The International Hydrological Programme (IHP), a UNESCO's intergovernmental scientific co-operative programme in hydrology, is a vehicle through which Member States can upgrade their knowledge of the water cycle and thereby increase their capacity to better manage and develop their water resources. It is the only intergovernmental programme of the UN system devoted to the scientific, educational and capacity building aspects of hydrology.

Since its inception in 1975, IHP has evolved from an internationally coordinated hydrological research programme into a comprehensive programme to facilitate education and capacity building, and enhance water resources management and governance. Originally implemented in six-year phases and now in eight-year phases since 2014, IHP stimulates and encourages hydrological research, and assists Member States in research and training activities.

IHP facilitates an interdisciplinary and integrated approach to watershed and aquifer management, which incorporates the social dimension of water resources, and promotes and develops international research in hydrological and freshwater sciences.

1.1. Hydrology Initiatives

As a science and education programme at the global level, the IHP covers a wide spectrum of projects and initiatives. All IHP-related activities are endorsed, recommended and coordinated through the IHP Intergovernmental Council.

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IHP's two cross-cutting initiatives, FRIEND-Water and HELP, interact with all IHP themes through their operational concepts. IHP's associated initiatives cover projects and activities that contribute to the development and implementation of IHP themes, and are often interlinked with joint initiatives and interagency components.

- FRIEND-Water *(Flow Regimes from International Experimental and Network Data)*. An international research initiative that helps to set up regional networks for analysing hydrological data through the exchange of data, knowledge and techniques at the regional level.

- GRAPHIC *(Groundwater Resources Assessment under the Pressures of Humanity and Climate Change)*. A UNESCO-led project seeking to improve our understanding of how groundwater interacts within the global water cycle, how it supports human activity and ecosystems, and how it responds to the complex dual pressures of human activity and climate change.

- G-WADI *(Global Network on Water and Development Information in Arid Lands)*. A global network on water resources management in arid and semi-arid zones whose primary aim is to build an effective global community to promote international and regional cooperation in the arid and semi-arid areas.

- HELP *(Hydrology for the Environment, Life and Policy)*. A new approach to integrated catchment management by building a framework for water law and policy experts, water resource managers and water scientists to work together on water-related problems.

- IDI *(International Drought Initiative)*. The initiative aims at providing a platform for

networking and dissemination of knowledge and information between international entities that are actively working on droughts.

- IFI *(International Flood Initiative)*. An interagency initiative promoting an integrated approach to flood management which takes advantage of the benefits of floods and the use of floodplains, while reducing social, environmental and economic risks. Partners: the World Meteorological Organization (WMO), the United Nations University (UNU), the International Association of Hydrological Sciences (IAHS) and the International Strategy for Disaster Reduction (ISDR).

- IIWQ *(International Initiative on Water Quality)*. An initiative aimed at international scientific and policy cooperation to promote research, knowledge generation and dissemination, and effective and innovative policies to meet global water quality challenges in a holistic and collaborative manner towards ensuring water security for sustainable development.

- ISARM *(Internationally Shared Aquifer Resources Management)*. An initiative to set up a network of specialists and experts to compile a world inventory of transboundary aquifers and to develop wise practices and guidance tools concerning shared groundwater resources management.

- ISI *(International Sediment Initiative).* An initiative to assess erosion and sediment transport to marine, lake or reservoir environments aimed at the creation of a holistic approach to the remediation and conservation of surface waters, closely linking science with policy and management needs.

- IWRM *(Integrated Water Resources Management).* Implementing IWRM at the river basin level is an essential element to managing water resources more sustainably, leading to long-term social, economic and environmental benefits.

- JIIHP *(Joint International Isotope Hydrology Programme).* A programme facilitating the integration of isotopes in hydrological practices through the development of tools, the inclusion of isotope hydrology in university curricula and support to programmes in water resources using isotope techniques.

- PCCP *(From Potential Conflict to Cooperation Potential)*. A project facilitating multi-level and interdisciplinary dialogues in order to foster peace, cooperation and development related to the management of shared water resources.

- UWMP *(Urban Water Management Programme)*. A programme that generates approaches, tools and guidelines which will allow cities to improve their knowledge, as well as analysis of the urban water situation to draw up more effective urban water management strategies.

- WHYMAP *(World Hydrogeological Map).* An initiative to collect, collate and visualise hydrogeological information at the global scale to convey groundwater-related information in a way appropriate for global discussion on water issues.

1.2. Milestones and Main Achievements of the IHP

The Programme started as the International Hydrological Decade (IHD, 1965-1974) and was followed by a long-term programme composed of successive phases of IHP. The IHD was mainly research-oriented and IHP-I (1975-1980) maintained much of the research orientation. However, in response to the concerns of Member States, the next phases were oriented to include practical aspects of hydrology and water resources. Hence IHP-II (1981-1983) and IHP-III (1984-1989) were planned under the theme Hydrology and the Scientific Bases for Rational Water Resources Management.

- *The International Hydrological Decade (IHD)* (1965-1975) is an outstanding example of international scientific and technical cooperation. It enabled collaboration between over 100 countries, bringing about important scientific and practical results, notably by: (i) Helping to develop a rational attitude towards the utilization and management of the water resources of the earth; (ii) Contributing to the understanding of the processes and phenomena occurring in the hydrosphere; (iii) Assessing the surface and groundwater resources and

their variability; (iv) Facilitating the international cooperation necessary to conduct research and to compile scientific and technical data necessary to provide guidelines and information for the advancement of hydrological sciences; and (v) Promoting research, education, training and technical assistance in hydrology, as well as facilitating the development of hydrology programmes, not only within UNESCO, but also in relation to other UN organizations and NGOs.

- *The First Phases (1975-2001):* Through its first phases, starting from 1975, IHP played an important role in: (i) Contributing to the assessment of water resources; (ii) Developing methodologies of water management; (iii) Improving knowledge of hydrological processes; (iv) Providing an effective transfer of technology, with significant contributions from postgraduate courses in training competent hydrologists and developing hydrological knowledge, including educational material; and (v) Transmitting and exchanging knowledge through its publications.

Since the inception of the IHD in 1965, and later the IHP in 1975, much progress has been achieved regarding methodologies for hydrological studies and training and education in the water sciences. Although the general objectives remain valid, greater emphasis is being placed on the role of water resources management for sustainable development and the adaptation of the hydrological sciences to cope with the expected changing climate and environmental conditions. Another important objective is to integrate the developing countries into the world-wide ventures of research and training. The principal modes of execution of IHP have been working groups, symposia, workshops, publications and extra-budgetary projects, the latter especially through the UNESCO regional offices where regional hydrologists are located.

- *The Fourth Phase (1990-1995)*: Hydrology and Water Resources for Sustainable Development in a Changing Environment. The IHP-IV comprised three sub-programmes: (i) Hydrological Research in a Changing Environment; (ii) Management of Water Resources for Sustainable Development; and (iii) Education, Training and the Transfer of Knowledge and Information.

- *The Fifth Phase (1996-2001)*: Hydrology and Water Resources Development in a Vulnerable Environment. The eight Themes of IHP-V was divided as follows: (i) Global hydrological and bio-geochemical processes; (ii) Eco-hydrological processes in the surficial zone; (iii) Groundwater resources at risk; (iv) Strategies for water resources management in emergency and conflicting situations; (v) Integrated water-resources management in arid and semi-arid zones; (vi) Humid tropics hydrology and water management; (vii) Integrated urban-water management; and (viii) Transfer of Knowledge, Information and Technology (KIT).

While recognizing that IHP's first phases had been instrumental in promoting hydrological sciences, an external evaluation in 2003 on IHP's fifth phase suggested broadening the scope of IHP beyond purely scientific hydrological concerns. From its sixth phase on, the Programme began to focus primarily on water resource management and related cultural, societal and capacity building issues, evolving from a "pure science only" ethos to one of "science within society".

- *IHP-VI onwards: Shifting to a Holistic and Integrated Approach.* The Sixth Phase of IHP represented an important turning point for the Programme, whose focus shifted from studying the occurrence and distribution of water in the environment towards societal aspects of water resources, highlighting the need for better assessment and management, in particular at the transboundary level. In particular, the Programme: (i) Created a network of water professionals at all levels; (ii) Influenced policymaking, research and capacity building, highlighting the fact that institutional and economic issues are fundamental to the efficient use of water, conservation and depletion; (iii) Produced action-oriented and policy-relevant activities and outcomes in support of the "global agenda for sustainability", through training and capacity development in the field of water governance; (iv) Encouraged national activities through programmes broadly found to be comprehensive, relevant and

useful to almost all countries; (v) Addressed Member States as main audience, through National Committees and the UNESCO Water Family, in collaboration with governmental bodies, NGOs, and academic and research institutions; (vi) strong global relevance, enhanced by IHP's work with and inside developing nations, promoting South-South and North-South exchanges, its ability to propose conventions and take an active role in the prevention of water conflicts, and its contributions to the WWDRs; and (vii) Mobilized scientific opinion with only limited resources;

- *The Sixth Phase (2002-2007)*: Water Interactions: Systems at risk and societal challenges. IHP-VI was intended to shift the scope of the IHP itself and to focus more on societal aspects of water resources, thus raising the need for improved, more efficient assessment and management of water resources, especially at the transboundary level. IHP-VI had five main themes divided into focal areas as follows: (i) Global Change and Water Resources; (ii) Integrated Watershed and Aquifer Dynamics; (iii) Land Habitat Hydrology; (iv) Water and Society; and (v) Water Education and Training.

- *The Seventh Phase (2008-2013)*: Water Dependencies: Systems under Stress and Societal Responses. The core pillars of IHP-VII, structured into themes and focal areas, are the following: (i) Promoting leading-edge research that provides timely and appropriate policy-relevant advice to Member States; (ii) Facilitating education and capacity development as a response to the growing needs linked to sustainable development; (iii) Enhancing governance in water resources management to achieve ecosystem sustainability.

2. The Eighth Phase (2014-2021) of IHP

The new phase of IHP follows the Millennium Development Goals (MDGs) era and envisions new challenges to be set in Rio+20. During its eighth phase, IHP aims to improve water security in response to local, regional, and global challenges. For our purpose, water security is defined as the capacity of a population to safeguard access to adequate quantities of water of acceptable quality for sustaining human and ecosystem health on a watershed basis, and to ensure efficient protection of life and property against water-related hazards such as floods, landslides, land subsidence, and droughts. Given populationgrowth, degradation of water quality, growing impact of floods and droughts and other hydrological effects of global change, water security is an increasing concern. Consequently, the overarching focus of the IHP eighth phase is encompassed in its title "Water security: Responses to local, regional, and global challenges." To deal with the complex, rapid environmental and demographical changes (e.g., population growth and vulnerability to hydrological disasters, global and climate changes, uncontrolled urban expansion, and land use changes) holistic, multidisciplinary and environmentally sound approaches to water resources management and protection policy will be sought. The eighth phase of IHP reflects a deeper understanding of the interfaces and interconnections between the water-energy-food nexus, which aims to further improve integrated water resources management (IWRM). The role of human behavior, cultural beliefs, and attitudes toward water, and the need for research in social and economic sciences to understand and develop tools to adapt to human impacts of changing water availability, are challenges to be addressed in the eighth phase of IHP.

IHP-VIII focuses on six knowledge areas translated into themes. These themes address issues pertaining to managing water security, water quality and pollution control; adaptation to the impacts of climate change and natural disasters on water resources; management and protection of groundwater resources for sustainable living and poverty alleviation in developing countries and in arid and semi-arid regions and small islands; integration of catchment scale ecohydrological concepts and processes in advanced water management models; management of water resources for human settlements of the future; and water

education as a key element to attain water security. IHP-VIII has been designed to allow for a high degree of connectivity between topical areas. To connect thematic contents, crosscutting issues are addressed across the defined areas of knowledge or themes and are focused on: conjunctive surface water-groundwater sustainable management in an IWRM based on holistic and environmentally sound approaches as well as social and cultural traditions; integrated management consistent with transboundary water resources to prevent and/or overcome potential international conflicts over water; evaluation of the impact of key global change drivers on water resources availability and quality and population vulnerability; formulation of the framework for water governance policy based on multilevel and trans-sectoral approaches and integration of water stakeholders and general public; endorsement of the effort in water education, training, capacity building and hydrological research. In particular, IHP-VIII endorses the UNESCO goals to further equal opportunities for women and children.

The Eighth Phase of IHP focuses on six thematic areas:

- *Theme 1: Water-related disasters and hydrological changes:* (i) Risk management as adaptation to global changes; (ii) Understanding coupled human and natural processes; (iii) Benefiting from global and local earth observation systems; (iv) Addressing uncertainty and improving its communication; (v) Improving the scientific basis for hydrology and water sciences for preparation and response to extreme hydrological events.

- *Theme 2: Groundwater in a changing environment:* (i) Enhancing sustainable groundwater resources management; (ii) Addressing strategies for management of aquifer recharge; (iii) Adapting to the impacts of climate change on aquifer systems; (iv) Promoting groundwater quality protection; (v) Promoting management of transboundary aquifers.

- *Theme 3: Addressing water scarcity and quality:* Improving governance, planning, management, allocation, and efficient use of water resources; (ii) Dealing with present water scarcity and developing foresight to prevent undesirable trends; (iii) Promoting tools for stakeholder involvement and awareness, and conflict resolution; (iv) Addressing water quality and pollution issues within an IWRM framework improving legal, policy, institutional, and human capacity; (v) Promoting innovative tools for safety of water supplies and controlling pollution.

- *Theme 4: Water and human settlements of the future:* Game-changing approaches and technologies; (ii) System-wide changes for integrated management approaches; (iii) Institution and leadership for beneficiation and integration; (iv) Opportunities in emerging cities in developing countries; (v) Integrated development in rural human.

- *Theme 5: Ecohydrology-engineering harmony for a sustainable world:* (i) Hydrological dimension of a catchment - identification of potential threats and opportunities for sustainable development; (ii) Shaping of the catchment ecological structure for ecosystem potential enhancement - biological productivity and biodiversity; (iii) Ecohydrology system solution and ecological engineering for the enhancement of water and ecosystem resilience and ecosystem services; (iv) Urban Ecohydrology - storm water purification and retention in the city landscape, potential for improvement of health and quality of life; (v) Ecohydrological regulation for sustaining and restoring continental to coastal connectivity and ecosystem functioning.

- *Theme 6: Water education - key for water security:* Enhancing tertiary water education and professional capabilities in the water sector; (ii) Addressing vocational education and training of water technicians; (iii) Water education for children and youth; (iv) Promoting awareness of water issues through informal water education; (v) Education for transboundary water cooperation and governance.

3. Contributions of the Viet Nam National Committee for the IHP

The Viet Nam National Committee for International Hydrology Programme (IHP

Viet Nam) was established under the Decision No 122/CT on April 17th, 1991 of the Prime Minister of Viet Nam. The IHP Viet Nam works under the Sub-Committee on Natural Sciences of the Viet Nam National Commission for UNESCO. The Committee office is now located at the Viet Nam Institute of Meteorology, Hydrology and Climate Change.

In the region, IHP Viet Nam works with the coordination of the IHP Regional Steering Committee for the Southeast Asia and the Pacific (AP-RSC), whose members are representatives from the 17 IHP National Committees, to carry out IHP activities at regional level. Since 1993, annual RSC meetings have been convened in different countries of the region to report, evaluate and review various activities carried out within the framework of IHP, as well as to design new ones; in conjunction with the RSC meetings, annual international conferences and symposia have been held.

In co-operation with UNESCO Jakarta and the participating member states, the AP-RSC has co-ordinated a wide range of initiatives over ten years so far, including research studies, technical projects, workshops, training courses and annual symposia, bringing together many specialists involved in water-related activities. The most notable regional initiatives made possible by the cooperative efforts of the RSC are: the AP-FRIEND (Asian Pacific Flow Regimes from International and Experimental Network Data) project, the Asian Pacific Water Archive and the Catalogue of Rivers.

IHP Viet Nam has coordinated with national agencies and organizations in various fields such as Hydrometeorology, Climate Change, Irrigation, Water Resources and Environment.

In recent years, IHP Viet Nam has participated in activities such as:

- Participating in annually IHP Asia-Pacific conferences, in: Mongolia (2016), Indonesia (2015), Indonesia (2014), Korea (2013), Malaysia (2012), Japan (2011), Viet Nam (2010), China (2009), Mongolia (2008), Philippines (2007), Thailand (2006), Indonesia (2005), Australia (2004), Fiji (2003), Malaysia (2002), Viet Nam (2001), New Zealand (2000), China (1999), Korea (1998), Thailand (1997), Indonesia (1996), Japan (1995), Cambodia (1994), Philippines (1993).

- Attend and present scientific papers at annually IHP Asia-Pacific scientific conferences held in conjunction with annual conferences.

- Organize scientific workshops within IHP Asia Pacific in Viet Nam, organize training courses on hydrology, water resources, natural disaster prevention and climate change, and send staffs to participate in training courses organized by IHP Asia Pacific.

Figure 1. IHP International Workshop in Viet Nam

- Contribute to the Asian Pacific Flow Regimes from International and Experimental Network Data project, and the development of Asian Pacific Water Archive and the Catalogue of Rivers.

- Publish technical books and guidelines on hydrology, water resources and climate change.

- Coordinate with domestic and foreign

agencies to exchange professional knowledge on hydrological and water resources issues.

- Offer postgraduate courses and supervise doctoral students at the United Nation University in Japan, the Viet Nam Institute of Meteorology, Hydrology and Climate Change and other universities abroad and in Viet Nam.

In 2001, IHP Viet Nam collaborated with UNESCO-IHP to organize International Symposium on Achievements of IHP in Hydrological Research and 9th Regional Steering Committee for IHP in Southeast Asia and the Pacific.

The AP-FRIEND meeting of "Intensity - Frequency - Duration and Flood Frequency Determination" in Ho Chi Minh City from 9 to 10 March 2009.

IHP Viet Nam cooperated with UNESCO-IHP to organize the International Conference on Hydrological Regime and Water Resources in the Context of Climate Change (HWCC 2010) in conjunction with the 18th Regional Steering Committee for IHP Southeast Asia and the Pacific in Ha Noi from 8 and 9 November 2010.

In the coming years, the activities are oriented towards the goal of IHP-VIII period 2014-2021, IHP Viet Nam focuses on the following issues: (i) Water resources security; Water for sustainable cities; Disaster preparedness for schools and communities; Sustainable water resources management; Effectively managing rivers, national aquifers and transboundary aquifers; Raise awareness of all levels of climate change; (ii) Water, Energy and Food Nexus to improve the capacity of integrated water resources management; (iii) Propagate and disseminate themes of the eighth phase of UNESCO-IHP activities: 2014-2021 in agencies and schools; (iv) Actively participate in the IHP Asia-Pacific activities and contribute positively to Annual Scientific Conferences and Workshops; (iv) Registered and successfully organised of the 28th IHP-RSC meeting in Viet Nam.

Figure 2. IHP 18th Regional Steering Committee Meeting

Figure 3. Workshop on Rainfall Intensity Frequency Distribution and Design Flood Determination

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