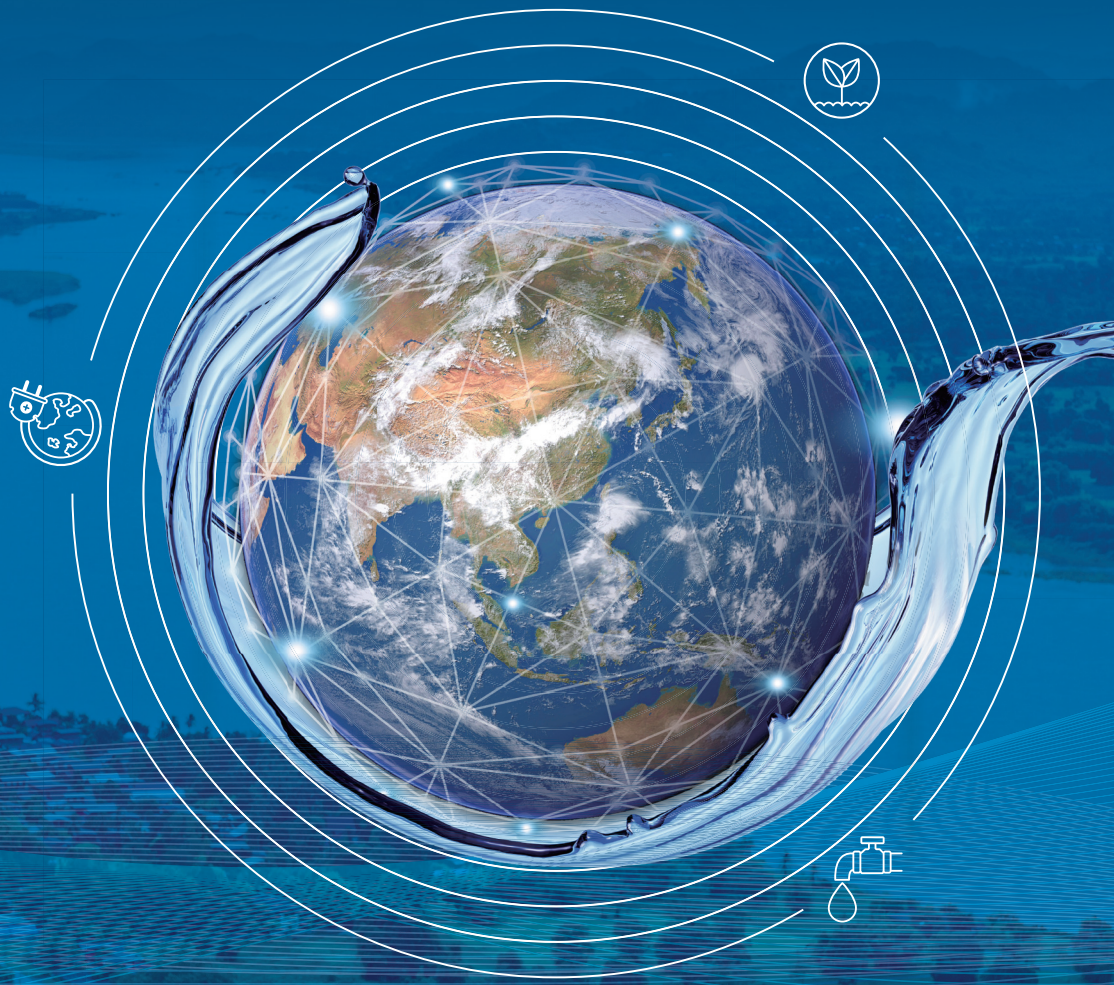
Programme/Facility for Sustainable Development in the Mekong Basin based on the Water-Energy-Food (WEF) Nexus and South-South and Triangular Cooperation (RoK-UNOSSC Phase 3)

The Republic of Korea-UNOSSC Facility Phase 3

Review of WEF Nexus related projects toward informing project pilot's delivery of SDG-impact



STEPI SCIENCE AND TECHNOLOGY POLICY INSTITUTE

Ministry of Science and ICT

United Nations
Office for South-South Cooperation

Review of WEF Nexus related projects toward informing project pilot's delivery of SDG-impact

ABOUT MSIT

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ABOUT THE ROK-UNOSSC FACILITY (P-LINK)

The "Triangular Cooperation Project on Sustainable Development in the Lower Mekong River Basin based on the Water-Energy-Food (WEF) Nexus" (2021-2025) aims to strengthen access to water, food and energy for vulnerable communities living in the Lower Mekong Basin (Cambodia, Lao PDR, Thailand, and Viet Nam) through strengthening development approaches and management in these sectors. It will take integrative and multi-sectoral approaches in application of highly demanded technologies on water, energy and food to improve the livelihoods of the people based on South-South and triangular cooperation modalities. The 5-year project is supported by the Ministry of Science and ICT, Republic of Korea, and the UN Office for South-South Cooperation (UNOSSC) leads the project in partnership with other institutions including the Mekong River Commission Secretariat (MRCS), Mekong Institute (MI) and the Science and Technology Policy Institute (STEPI) and will enlist the help of other Korean institutions.

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Acknowledgement

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Drafted and edited by STEPI Team

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Acronyms and Abbreviations

BMZ	German Federal Ministry for Economic Cooperation and Development
EOI	Expression of Interest
EU	European Union
FPV	Floating Solar Photovoltaic
IDB	Inter-American Development Bank
IoT	Internet of Things
IUDCs	Integrated Urban Development Concepts
IWRM	Integrated Water Management System
K-water	Korea Water Resources Corporation
LAC	Latin America and the Caribbean Region
MIFAFF	Ministry for Food, Agriculture, Forestry and Fisheries
MOTIE	Ministry of Trade, Industry and Energy
PAEGC	Powering Agriculture: An Energy Grand Challenge for Development
PPPs	Public-Private Partnerships
RFP	Request for a Proposal
RIH	Regional Innovation Hub
Sida	Swedish International Development Cooperation Agency
SWFF	Securing Water for Food
ToC	Theory of Change
USAID	U.S. Agency for International Development
WE4F	Water and Energy for Food

Executive Summary

Population growth, economic development, and global climate change are increasing pressure on water, energy, and food resources, accelerating environmental stress and distressing livelihoods. Especially, they highlight the severe socio-economic losses on vulnerable communities and indigenous peoples' living and the urgent need to take actions on climate change. The global demand and pressure on water, energy, and food resources will increase significantly in the future.

The Water-Energy-Food(WEF) Nexus is a conceptual framework that offers an integrated and holistic approach to analyse the dynamic interrelations between water, energy, and food sectors. The WEF sectors are intricately connected and have dynamic interlinkages among three resources. Understanding the interlinkage of climate change with water, energy, and food access/security and responding with the support of Science, Technology and Innovation is critical to sustainable development and sustaining people's livelihood.

There are several studies and research on WEF nexus, but this paper focuses on lessons from WEF nexus related projects that have been conducted over the world and aims to highlight innovative investments in water, energy, and food nexus that yielded efficient solutions. This paper presents three significant project cases; 1) Water and Energy for Food(WE4F) project, 2) The Urban Nexus projects, and 3) WEF Nexus projects implemented by the Republic of Korea. The paper seeks to explore the success factors and lessons learned from three cases and provide practical solutions for planning WEF nexus projects.

WE4F program is focused on environmentally sustainable innovations aiming to improve more resilient global food production by providing, closely with the private sector, promising technology and innovation solutions to developing and emerging markets in the water, energy, and food sectors.

The urban nexus projects seek to find the relationship between urban development and natural resource management. The urban nexus is a conceptual framework focused on optimizing water-energy-food/land based on five enabling dimensions consisting of governance, inclusive decision-making, STI (science, technology and innovation), finance and business, and urban planning for environmental sustainability, social harmony and green economy.

The selected WEF Nexus project implemented by Korea is taking advantage of Korea's water management technology. The project seeks to contribute an efficient planning and integrated management of water, energy, food resources in developing countries to ensure water and food security, sustainable agriculture, and energy production by applying technology from South Korea.

Anticipating potential trade-offs and synergies, we can design, appraise and prioritize response options that are viable across different sectors. By considering these, this paper seeks to unleash the potential of WEF nexus interventions in the Mekong Region towards promoting equitable and inclusive development and to achieve the Sustainable Development Goals(SDGs) including gender equality and climate adaptation.

The Republic of Korea-UNOSSC Facility Phase 3

Part I

WE4F

(Water and Energy For Food)

Review of WEF Nexus related projects
toward informing project pilot's delivery of SDG-impact

01 OVERVIEW

Overview of Water and Energy for Food (WE4F)

WE4F, the most recent Grand Challenge for Development[1], is and a joint international initiative of the German Federal Ministry for Economic Cooperation and Development (BMZ), the European Union (EU), the Ministry of Foreign Affairs of the Ministry of Foreign Affairs of the Netherlands, Norwegian Agency for Development Cooperation (Norad), Sweden through the Swedish International Development Cooperation Agency (Sida), and the U.S. Agency for International Development (USAID).

It Is the successor program to two previous Grand Challenge for Development programs, Powering Agriculture: An Energy Grand Challenge for Development (PAEGC) and Securing Water for Food (SWFF). Inheriting the scope of PAEGC, Energy-Food, and SWFF, Water-Food, the WE4F expands its scope by adopting the Water-Energy-Food nexus approach, and aims to provide a more resilient and improved solutions in water and energy efficiency in the global agricultural value chain.

WE4F was first announced at World Water Week 2018 and officially launched at Social Capital Markets 2019. The program has its Steering Committee and two separate Secretariat Units, the GIZ Secretariat Unit and the USAID Secretariat. The Secretariat Units are in charge of overseeing the implementation and management of the Hubs. There are five Regional Innovation Hubs (RIHs) operated by different organizations: one in East Africa, one in West Africa, one in Southern and Central Africa (S/CA), one in the Middle East and North Africa (MENA), and one in South and Southeast Asia (S/SEA). The GIZ Secretariat Unit is in charge of activities in East and West Africa while the USAID Secretariat is in charge of activities in South and Central Africa, MENA, and SSEA. Adopting a decentralized approach, WE4F provides its services through these RIHs. The main activities of the RIHs include grants for innovative enterprises, technical assistance, investment facilitation, enabling environment, capacity development, and communication and knowledge transfer.

1) It is an innovation and acceleration initiative by USAID and other partners that began in 2011. While it is allowed to support small and growing enterprises from all over the world, their business implementation should be targeting a developing or emerging country market.

Table 1 SSEA Hub- Water and Energy for Food (WE4F)

Partners	BMZ, EU, FMA-NL, Norad, Sida, USAID
Target Area	Water-Food, Energy-Food, or Water-Energy-Food
Main Objective	Sustainably scale-up innovators' solutions to meet the challenges in the water and energy for food.
Project Period	October 2019 ~
Direct beneficiaries	32 innovators as of 2022 with a target to support 40 innovators by 2024
Outputs & outcomes	Providing $4 million grant Mobilizing $20 million investment Supporting 1 million end-users (250,000 of which are women)

Note: German Federal Ministry for Economic Cooperation and Development (BMZ), the European Union (EU), the Ministry of Foreign Affairs of the Government of the Netherlands, Norwegian Agency for Development Cooperation (Norad), Sweden through the Swedish International Development Cooperation Agency (Sida), and the U.S. Agency for International Development (USAID)

Source: retrieved from WE4F (2019) and WE4F homepage

Relation with WEF NEXUS

The WE4F directly identifies the issue of water-energy-food nexus as one of the grand challenges for development in developing and emerging economies and aims to directly tackle the issue by providing promising technology and innovation solutions to developing and emerging markets in pursuit of a more resilient global food system. The main objectives of the program are presented as below:

- Increase food production along the value chain through a more sustainable and efficient usage of water and/or energy,
- Increase income for base of the pyramid women and men in both rural and urban areas,
- Sustainably scale innovators' solutions to meet the challenges in the WE4F nexus,
- Promote climate and environmental resilience and biodiversity through the sustainable, holistic management.

Considering its objectives, operation activities, WE4F not only incorporates the concept of WEF nexus approach, but also highly focuses on the successful scale-up of new technological solutions and business models to commercial markets within the WEF concept.

02 BACKGROUND

WE4F is a direct successor program of the two previous Grand Challenges for Development programs which aims to support innovative market solutions for major international development problems. They are Powering Agriculture: An Energy Grand Challenge for Development (PAEGC) and Securing Water for Food (SWFF) as shown in Table 2 and 3.

Overview of PAEGC

With $51.2 million USD, the PAEGC started from 2012 as a multi-donor initiative in the field of energy and food challenges in lower and middle income countries. It specifically aimed to deploy clean energy technologies for agricultural value chains. Partner institutions to fund and manage the program include USAID, Sida, BMZ, Duke Energy, and OPIC. The program continued until December 2019, successfully supporting 34 innovators and mobilized the additional funding of $38.23 million USD.

Overview of SWFF

The SWFF was also launched in 2012 as a multi-donor initiative in partnership with USAID, Sida, MFA-NL, and DST. The main objective of the program was to promote and support high-potential technical solutions and/or business models that can either provide higher productivity with sustained water supplies or the same productivity with lower overall water demands in the food value chain. Therefore, the main area of challenges tackled was Water and Food. The SWFF program also continued until December 2019 and successfully supported 46 innovators and mobilized the additional funding of $25 million USD.

Lessons learnt from the PAEGC and SWFF

Through the final performance evaluation of the two precedent programs, PAEGC and SWFF, in 2020, three important issues among others are identified. The main concern from the PAEGC and SWFF was how innovations supported by the two programs continue scale-up to commercial stage after the discontinuity of the two programs. It is also noted that both PAEGC and SWFF provided limited access to private financing opportunities and lacked support of the enabling environment. Therefore, it is recommended that the WE4F should capitalize on the lessons drawn from the predecessor programs. Key recommendations include,

- Milestone-based funding in tandem with incremental acceleration support services,
- More reflections on the local context and promotion of enabling environment, and
- Connecting innovators to private financing opportunities for sustainability of business models.

In this regard, the WE4F adopted 'decentralized approach' reflecting on the model of 'RIH' from the PAEGC and the concept of 'technology assistance facility' from the SWFF.

Table 2 Powering Agriculture: An Energy Grand Challenge for Development (PAEGC)

Partners	USAID, Sida, BMZ, Duke Energy, and OPIC
Target Area	Energy–Food
Main Objective	The deployment of clean energy technologies for agricultural value chains in lower and middle income countries
Project Period / Budget	2012 – 2019 / USD51.2 million USD
Direct beneficiaries	34 Innovators (24 directly by PAEGC and 10 separately by BMZ)
Outputs	1,908W renewable energy facility and mobilization of USD 38.28 million
Outcome	2,653 tons of CO2 and 44,043 beneficiaries including farmers
Lesson for WE4F	Concept of RIHs

Note: Federal Ministry for Economic Cooperation and Development (BMZ), Overseas Private Investment Corporation (OPIC), Swedish International Development Cooperation Agency (Sida), United States Agency for International Development (USAID)

Source: retrieved from WE4F (2019) and Hemson et al. (2020)

Table 3 Securing Water for Food (SWFF)

Partners	USAID, Sida, FMA–NL, and DST
Main Objective	Source, incubate and accelerate technical solutions and/or business models that find new and sustain existing water supplies as well as lower overall water demands in the food value chain
Target Area	Water–Food
Project Period /Budget	2013 – 2019 / USD 35 million
Direct beneficiaries	46 projects out of 1,500 applications from more than 90 countries
Outputs	USD 35 million Storage and reallocation of more than 17 billion liters of water production of 0.6 billion tons
Outcome	Additional funding of USD 58 million
Success factor	Innovator selection process and tailored technical assistance to innovators by local consultants

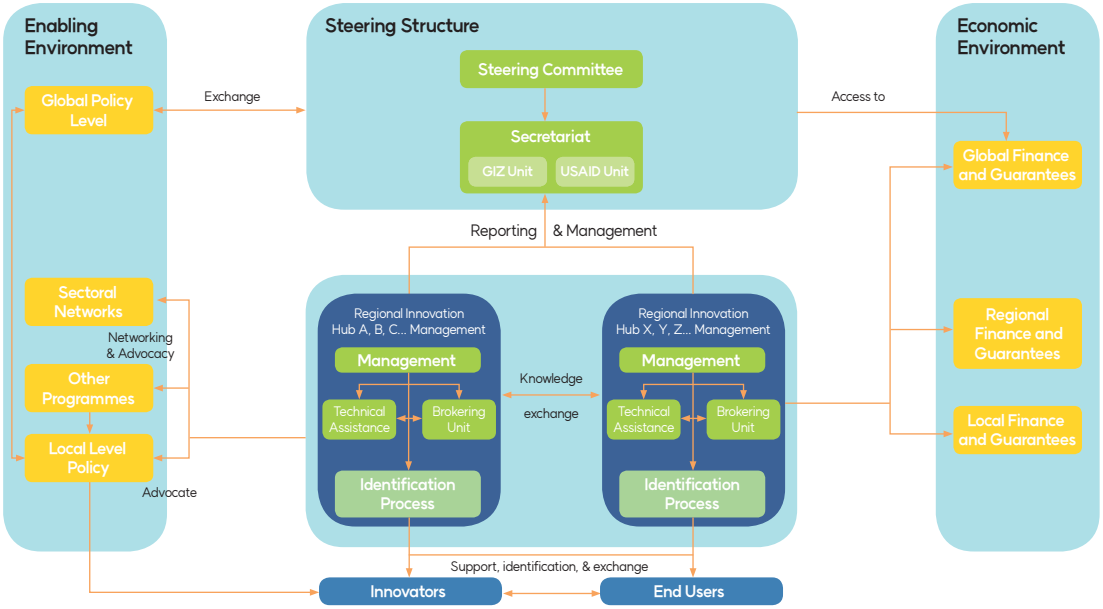
Note: South African Department of Science and Technology (DSI–SA), Foreign Ministry of the Kingdom of the Netherlands (FMA–NL), Swedish International Development Cooperation Agency (Sida), United States Agency for International Development (USAID)

Source: retrieved from McMahan et al. (2019) and Crane et al. (2020)

03 METHODOLOGICAL APPROACH

Structure of the WE4F

Figure 1 Structure of WE4F



Source: Syspons (2018)

In order to achieve its purpose, the WE4F operates through its steering system and RIHs. Each component of the steering system cooperates interactively to achieve the goals of the WE4F by fulfilling their respective functions and roles. **The Steering Committee** is the supreme decision-making body of the WE4F, which externally represents the WE4F and generally manages its operation, such as setting general outline and guidelines for the program and representing the interest of donor countries. **The Secretariat** is responsible for practical work of the WE4F and exchange within the initiative, such as implementation of the decisions made by the Steering Committee and contact between RIHs and the Steering Committee. RIHs represent the WE4F in local areas, contacting with local innovators, identifying local situation and delivering the information to the Secretariat and the Steering Committee.

Steering System: Steering Committee and Secretariat

Table 4 Overview of Steering System

	Roles	Responsible Entity
Steering System	Overall management of the WE4F program	
Steering Committee	• Making agenda items set for donor countries • Making strategic decisions for project management • Providing strategic guidelines • Monitoring the beneficiaries of RIHs, their activities, and the project progress • Supervision and decision making of innovators • Setting selection criteria of the proposed candidates • Review of the strategic regulations and overall performance of the WE4F • Determining the allocation and the use of funds considering the political, industrial and regional context	• BMZ • EU • Ministry of Foreign Affairs of the Netherlands • Norad • Sida • USAID
Secretariat	• Executive body of the Steering Committee • Coordination between the Steering Committee and RIHs • Fund raising • Audit on compliance of RIHs with guidelines • Overseeing the use of the fund • Preparation of innovator selection • Design for projects and criteria for innovators specialized in the specific region • Review the shortlist of the proposed candidates by RIHs	• GIZ unit – Fund management invested by the BMZ and the EU and direct support to the RIHs in West Africa and East Africa • USAID unit – Direct support to the RIHs in South and Southeast Asia (S/SEA), Southern and Central Africa (S/CA), and Middle East and Northern Africa (MENA)

Source: retrieved from WE4F website

The Steering Committee, which is an assembly of donor organizations and countries, is the highest decision-making body of the WE4F. As such, the Steering Committee may make subjects that donor countries deem necessary for agenda items. Besides, in relation with projects, the Steering Committee makes strategic decisions for project management, provides strategic guidelines, and monitors the beneficiaries of RIHs, their activities, and the progress of projects from the perspective of individual innovators.

As an executive body of the Steering Committee, the Secretariat has the responsibilities for smooth execution. As such, its scope of responsibility is wide. It can be regarded that the Secretariat takes a big responsibility in the WE4F, including administrative work of the Steering Committee, work related to RIHs, and exchange work between the two organizations.

In relation with RIHs, the work of the Secretariat is significant in supporting them to identify innovators and helping the WE4F to select innovators. Based on the guidelines of the Steering Committee and region-specific needs of RIHs, the Secretariat takes responsibility for the plan and criteria for the selection of innovators through respective units. Moreover, it aligns capacity development activities of RIHs for innovators to the strategy of the WE4F, and contribute to forming partnership with other organizations to make sure that innovators in regions can have stable financing.

Regional Innovation Hubs (RIHs)

Table 5 Overview of Regional Innovation Hubs

Regional Innovation Hubs (RIHs)	Objectives	Roles & Responsibilities
	• Ensuring that WE4F's regional needs and priorities are appropriately reflected and adapting the WE4F guidelines in accordance with specific situation and context of respective regions • Understanding specific situations of innovators and facilitating the communication of the WE4F with them	• Management of the identification of new innovators • Report of regional issues to the Secretariat • Technical assistance • Financial brokering • Capacity development of innovators in the region • Advocacy for an enabling environment in the regions
Region	**Location**	**Responsible Entity**
Middle East and North Africa RIH	Lebanon	Berytech, Chemonics Egypt, cewas, International Water Management Institute (IWMI)
West Africa RIH	Ivory Coast	GFA Consulting Group, GIZ
Southern and Central Africa RIH	South Africa	Tetratech, Open Capital, IWMI
East Africa RIH	Kenya	NIRAS, Intellecap, GIZ
South and Southeast Asia RIH	Thailand	Tetratech, Crossboundary, DevWorks International

Source: retrieved from WE4F website

RIHs are responsible for the identification of new innovators. Core process of RIHs is selecting appropriate innovators to fulfill the purpose of the WE4F in the region. Based on the strategic guidelines of the Steering System, RIHs consult the respective RAB and sectoral networks to develop the selection criteria in order to meet the strategic requirements and specific conditions in each of the countries. The process that RIHs select innovators in the region is as follows:

- Step 1: After designing the process and selection criteria, the RIH needs to engage with the target groups to make the fund known to all potential applicants. This engagement includes presentations in social network meetings, advertising as well as mobilization of other networks.

- Step 2: Once the regional call is public, interested candidates will submit their ideas and seek feedback on their ideas, which country coordinators as well as the technical advisory and financial brokering teams can give. Afterwards the country coordinators guide their applicants through each of the stages.
- Step 3: After closure of the regional call, the respective RIH prepares a shortlist of candidates that is then passed on to the Steering Committee.
- Step 4: The Secretariat summarizes, organizes and compiles the selection processes of all RIHs.
- Step 5: By obtaining approvals of each donor organization, RIHs and the secretariat finally selects innovators.

WE4F Regional Call for Innovations

WE4F seeks mid-late stage organizations that have a sustainable business model to realize the above-mentioned goals, and they are called Innovators. The innovators include private or for-profit enterprises with innovative business models that solve the water-energy-food nexus, non-profit organizations, non-governmental institutions, research institutions, or academic institutions that maintain their own budget by generating profits by selling innovative technology-applied products for commercial purposes. Other actors certified by WE4F's RIH on a case-by-case basis with WE4F's core values are also included. All of them should have a sustainable business model, a willingness to expand their business commercially, and a track record of successful sales.

Furthermore, the innovators must have the capacity to effectively implement the water-energy-food nexus. Such capabilities are determined by the services and products the innovators make. These include innovative technologies that can reduce water consumption for its services and products for better food production, efficient use of water resources, sustainable energy and water use in farms, and energy innovations in food processing or logistics.

Together with organizations that meet these standards, WE4F provides them with technical assistance and expert advice to conduct their business, arranges contacts with other financial institutions to help them finance, and also promotes a gender-smart sustainable model. It aims to solve the following problems by promoting a smart sustainable model).

The problems are the lack of affordable technology, lack of user-centered design in technology development, poor supply chains, lack of distribution networks, high up-front investment costs, lack of end-user finance access, and growth in developing countries. Lack of confidence that developing and emerging countries have the market mechanisms necessary for growth, limited knowledge about local and global policy and regulatory environment that inhibit scaling of innovation), lack of adequate means of financing, etc., and these issues are not limited to those listed.

There are four categories of how innovators are selected for WE4F. The first category is the innovator selected through the regular, competitive calls for innovations processes within the water-

agriculture-food nexus of the WE4F. The second type is the innovator from the Asia EDGE Ag-Energy Prize. The third type is innovator from the predecessor programs, SWFF and PAEGC, requiring the scale-up support. The last is Public Private Partnership Matching Grant innovator that requires the selected innovators to contribute matching capital equal to the grant value.

Process of WE4F Regional Call for Innovation

WE4F selects innovative institutions through a series of processes and enables them to carry out projects through financial and technical support. According to the 2022 Regional Call for Innovation, the process is as follows.[2)]

1. Concept Note intake (6 weeks)
2. Concept Note review (2 weeks)
3. Up to 50 finalists submit full proposals
4. Review of the final report (3 weeks)
5. Video conferencing (3 weeks)
6. Pre-awarded bootcamp (3 days)
7. Acceleration workplan development and required documentation submitted
8. Award announcement and grant agreement signing (grant agreement signed)

Organizations wishing to participate in WE4F's Call for Innovation primarily submit Concept Notes to WE4F online, and after WE4F evaluates them, about 50 supporting companies submit full proposals. Then WE4F opens a Regional Advisory Board (RAB) consisting of technical experts, business experts, sustainable development/ESG experts and water/energy/agricultural innovation experts, and together with the RIH, conduct video interviews with supporting organizations.
Through this process, the finally selected supporting organization attends the pre-awarding bootcamp, comes into contact with other supporting organizations and RIHs, and sets up work plans and goals for contract and administration. After that, the final winner will be announced after the review by the Secretariat and approval by the Steering Committee. These selected institutions will be able to receive grants ranging from $25,000 to $200,000 while conducting business for up to two years, and further guaranteed investment opportunities through technical support from WE4F and contact with other financial institutions.

For reference, the Concept Note is a document consisting of a series of questions, respectively, on innovation viability, business/financial viability, and application and sustainability/ESG in developing or emerging country.[3)]

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2) WE4F(2021a), "Water and Energy for Food: A Grand Challenge for Development Regional Call for Innovations 2021 South and Southeast Asia".

3) WE4F(2021b), "Regional Call for Innovations 2021 South and Southeast Asia".

04 ACTIVITIES

Through the network of RIHs, WE4F provides the following support services for WE4F innovators.

Grants for innovative enterprises

The WE4F regularly opens calls for innovations in the field of WEF nexus and identify the WE4F innovators with high-potential to commercial markets. For these innovators, the WE4F provides mile-stone based grants if mutually agreed requirements are met.

Technical assistance

According to the needs of selected WE4F innovators, the WE4F provides relevant support of technical assistance, which include improvement of product quality, market fit, gender mainstreaming, environmental compliance, sustainability, and regulatory compliance in collaboration with external technical experts.

Investment facilitation

WE4F provides WE4F innovators with financial brokering and relevant investments facilitation services including the development of appropriate financial models. As a result, the business models of innovators can be appealing to and attract financial investment from private sector investors.

Enabling environment

Through the in-depth analysis on local policy and regulatory frameworks, WE4F aims to guide WE4F innovators to smoothly maneuver in their scale-up by highlighting institutional barriers and compliance requirements with their business models. It also produces enabling environment country profiles and suggests measures for better policy coordination in the area of water-energy-food nexus.

Communication and knowledge transfer and capacity development

Through the global network of the WE4F and its RIHs, WE4F innovators can learn lessons each other from their success and failure stories. The RIHs establish and operate regularly the global knowledge sharing platforms so that WE4F innovators share their experiences and benefit from them by engaging in the events of WE4F innovator community.

Case of Innovators

As of 2022 Oct, WE4F offers the list of 121 innovators on the website and introduce them by its focus area, product segment, financing status, country of incorporation and implementation. Following is the overview of innovators for few cases.

Table 6 Case Study of Innovators: Agros

Agros **Integrated Solar-powered Irrigation Technology and Services for Smallholder Farmers**			
Innovation Type	Water-Energy-Food	**Country of Incorporation**	Singapore
Company Stage	Stage 2: 101-1000 end-users	**Country of Implementation**	Cambodia, Myanmar
Financing Goals	Seeking equity (angel investor, venture capital or private equity)	**Product Segment**	Water - Irrigation, Financial Solution
Challenge	Southeast Asia is facing major food and energy challenges. Food production needs to double by 2050 while agriculture contributes 30% of GHG emissions and soils are degrading. Fuel and fertilizer prices have increased by 40% and 60%, respectively, leaving farmers behind with a huge financial burden. Farmers also don't have access to the technology, services, and financing required to double their yields and become more resilient to climate change.		
Solution	In the belief of a world where small farmers continue to feed the planet sustainably and profitably, Agros give millions of farmers the technologies, services, and financing to transition to long-term profitable farming with the mission to double farmers' income while abating millions of carbon emissions. Their flagship solar pumps are co-designed with farmers in the field, bundled with advisory services on improving water management for higher yields and flexible financing linked to their cash flows and payback periods. Agros also is Southeast Asia's first sustainable agriculture platform to help crop farmers be profitable in the long term. Its platform Agrosolar is a solution for farmers to increase their income by saving on fuel for irrigation and growing crops year-round. Another solution called Agrosoil restores famers' degraded soil by increasing its yields, and reduces expenses on synthetic fertilizers.		

Source: WE4F [4] and Agrosolar website [5]

4) https://we4f.org/innovators/agrosolar

5) http://www.agrosolar.asia/

Table 7 Case Study of Innovators: MimosaTEK

MimosaTEK Internet of Things (IoT) Platform for Precision Agriculture			
Innovation Type	Water–Energy–Food	**Country of Incorporation**	Vietnam
Company Stage	Positive net income	**Country of Implementation**	Vietnam
Financing Goals	Seeking equity (angel investor, venture capital or private equity), Seeking combination of debt and equity, Seeking corporate investors	**Product Segment**	Water – Re-use / Efficiency, Digital Solution
Challenge	The unstable and fragmented Vietnamese agricultural market has an agricultural value chain that involves many layers of middlemen who collect produce from farmers and sell them to buyers. Hence the middlemen take away the profit from the farmers and the buyers. The farmers often sell their produce at low price and the buyers often buy them at high price. In addition, the logistics is costly, and the quality of produce grown by farmers do not meet the required criteria of the buyers.		
Solution	MimosaTEK offers a solution of an Internet of things (IoT) platform for precision agriculture in Vietnam, that monitors and analyzes data on farms by sensors of measuring soil moisture, rain, wind, and light. It recommends farmers a precise irrigation schedule in real–time. MimosaTEK solves the intermediary issue of the supply chain by connecting the farmers to the wholesale buyers. This creates more value for both the farmers and the buyers. Drone and image analysis are used for crop yield forecast and supply planning. Also, MimosaTEK optimizes the transportation route and the use of appropriate vehicles to collect the produce from farms to the sorting center, and then deliver the produce from its center to different customers' warehouses. Finally, MimosaTEK helps the farmers to increase their yield and quality of produce by applying agricultural technology in their farming practice. IoT technology and agronomist help the farmers to improve the farming practice and crop yield. The technology helps the farmers to use water and energy resources more efficiently by telling the farmers how much water should be applied based on the crop demand. MimosaTEK is also working with households where female farmers take up 50% of number of farmers. Women are recruited to work at our vegetable procurement and processing center.		

Source: WE4F [6] and MimosaTEK website [7]

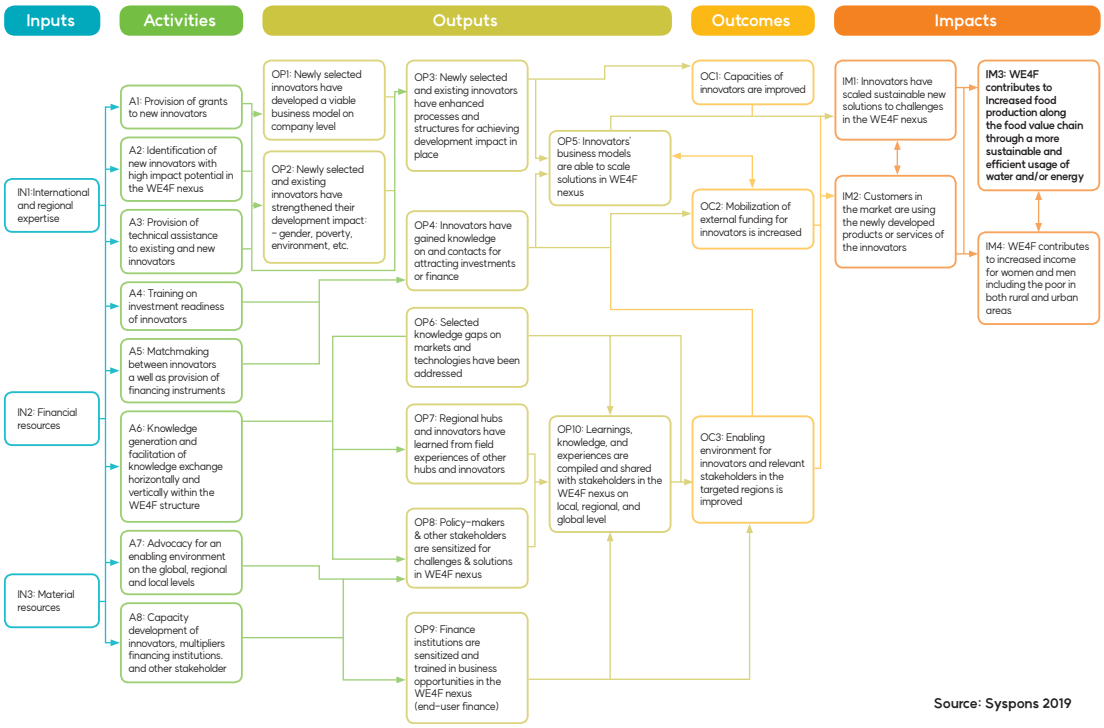
6) https://we4f.org/innovators/mimosatek-2

7) https://mimosatek.com/en/

05 RESULT

Theory of Change and Result Framework

Figure 2 WE4F Theory of Change



Source: Syspons 2019

Based upon the made experiences and lessons learned from the predecessor programs PAEGC and SWFF, the WE4F programme possesses a Theory of Change (ToC), which:

- Ensures that acceleration support services are paired with milestone-based funding,
- Facilitates gender-inclusive programming
- Guarantees that funded innovations do not negatively affect natural resources, biodiversity or the climate
- Capitalizes on the created knowledge of the predecessor programs about challenges and needs in the respective regions with regard to innovators and the enabling environment
- Makes it possible to understand the local context in order to promote successful and sustainable scaling.

Therefore, WE4F has developed a ToC that takes these lessons learned into account and makes transparent the necessary steps of the pathway towards the expected outcomes and impacts of the WE4F programme.[8)]

The result framework of WE4F consists of following dimensions: 4 Impacts (3 indicators for each Impact), 3 Outcomes (3 indicators for each Outcome), 10 Outputs (34 indicators), 8 Activities (3 indicators for each Activity). Each indicator is explained with its baseline & target values, definition, level, time & regularity, and source of verification.

Some examples of the indicator list for RIHs' M&E framework are shown in the table below.

Table 8 Example of Indicator List for Regional Innovation Hubs' M&E Framework

	Indicator	Definitions	Level	Source of verification
Impacts Innovators have scaled sustainable new solutions to challenges in the WE4F nexus	1.1 Share of innovators that have increased production/ delivery of their core product/service related to WE4F by X%	Baseline: year of first grant reception from WE4F Production/service delivery: units produced/service unit delivered in the field of WE4F	Innovators	Business documents of innovators
	1.2 Share of innovators that have introduced their product/service to at least 1 new market	Baseline: year of first grant reception from WE4F New market: country or region	Innovators	Business documents of innovators
Outcomes Capacities of innovators are improved	1.1 Share of innovators that have increased their physical production capacity by X%	Baseline: year of first grant reception from WE4F Physical production capacity: maximum possible production units per year with current physical and human resources available	Innovators	Survey with innovators
	1.2 Share of innovators that have enhanced management capacities as a result of WE4F support in terms of: a. roles and responsibilities of key decision-makers b. financial management c. human resource management	Baseline: established through a survey at the point of grant reception from WE4F Management capacity: qualitative assessment by CEO	Innovators	Survey with innovators

8) Syspons(2019)

	Indicator	Definitions	Level	Source of verification
Outputs Newly selected innovators have developed a viable business model on company level	1.1 Share of innovators that have developed a viable business model for their product/service	Baseline: year of first grant reception from WE4F Viable business model: in terms of a. having identified a specific market demand that the product/service addresses b. having outlined a path to break even within 5 years	Innovators	Survey with innovators
	1.2 Share of innovators' business models that are assessed as viable by the financial brokers	Baseline: year of first grant reception from WE4F Viable business model: see criteria in OP1.1 Financial brokers: either internal or external experts with knowledge of the innovators' business models	Innovators	Interviews with experts from financial brokering
Activities Provision of grants to new innovators	1.1 Total grant volume (USD) provided to new innovators		WE4F structure	WE4F accounting documents
	1.2 Grant volume provided per new innovator		Innovators	WE4F accounting documents

06 CHALLENGES

Some considerations are also needed within the framework of WE4F in order to better serve the needs of WE4F innovators.

- In the form of open call for innovations, unbalanced applications of innovations are observed due to language barrier, lack of local coordinator etc.
- No demand survey and limited network with policy stakeholders at the local level may hamper creating enabling environment for innovation solutions and business models.
- Administrative cost could have been an issue for some small-scaled Innovators. So, the length of the original concept was halved and RIH had a monthly call and check to make sure of the administrative process.
- Expectation management was needed to fulfill the expectation for Innovators in terms of investment. Investment Readiness Checklist was prepared since 2022 to provide a self-check opportunity for Innovators.

07 SUCCESS FACTORS AND LESSONS LEARNED

Drawing on the experience of the on-going WE4F program, the following success factors and considerations are identified for the P-LINK.

Success factors

From its initial stage, the WE4F was strategically designed to capitalize on the experiences of its predecessors, PAEGC and SWFF. Therefore, many success factors are originated from the reflections on PAEGC and SWFF.

- Decentralized approach with RIHs allows for tailoring incubating services and creating enabling environment suited to local context.
- Milestone-based funding with technology assistance facility encourages WE4F innovators' active engagement.
- Well-designed result framework and systematic monitoring and evaluation structure are found in WE4F. Baseline/target values by activity, output, outcome and impact are clearly provided with regular monitoring and evaluation.
- Support from the innovation intermediaries and local expert groups facilitate commercialization and financial investment from private sector. Peer-review and interactive communication between participants were provided.

The following aspects are proposed to be considered to ensure the smooth functioning of the steering structure and the RIHs.

- Clear metrics of impact goals and objective indicators with regional adaptation considering the enabling environment and maturity of specific industries
- Clear roles and expectations among donors for a harmonious and effective steering structure
- Ability to release funding on time in order to ensure a smooth functioning of the challenge fund and timely implementation of activities
- Flexible approach regarding the needs of the innovators on amending their implementation /milestone activities during their funding
- RIHs should give sufficient autonomy and responsibility to country coordinators to ensure that the specific local contexts are considered [9)]

9) Syspons(2019), Water and Energy for Food : Project Activity Document, Federal Ministry for Economic Cooperation and Development(BMZ) Ministry of Foreign Affairs of the Netherlands (MFA-NL), Swedish International Development Cooperation Agency (Sida), United States Agency for International Development (USAID)

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The Republic of Korea-UNOSSC Facility Phase 3

Part II

Urban Nexus

Review of WEF Nexus related projects
toward informing project pilot's delivery of SDG-impact

01 OVERVIEW

Overview of Integrated Resource Management in Asian Cities: "The Urban Nexus" Project

The overall goal of this project is to enhance the capacity of local and national governments in developing countries in the Asia-Pacific region to formulate and implement integrated natural resource in urban Area. The object of this project is to ensure that Nexus concepts are increasingly taken into account in selected Asian cities and by relevant stakeholders. Project title and partners are "GIZ-Project Integrated Resource Management in Asian Cities: The Urban Nexus," and it started in mid-2013. The urban nexus project involves UN-ESCAP as political partner and ICLEI SEA as implementing partner. It primarily focuses on urban nexus interrelationships mostly in secondary cities. Regarding project cities, project partner cities are Baguio (Philippines), Chiang Mai (Thailand), Da Nang (Vietnam), Naga (Philippines), Korat (Thailand), Rizhao (PRChina), Weifang (PRChina), Santa Rosa (Philippines), Pekanbaru (Indonesia), Tanjunpinang (Indonesia), and Ulan Bataar (Mongolia) as of June 2015.

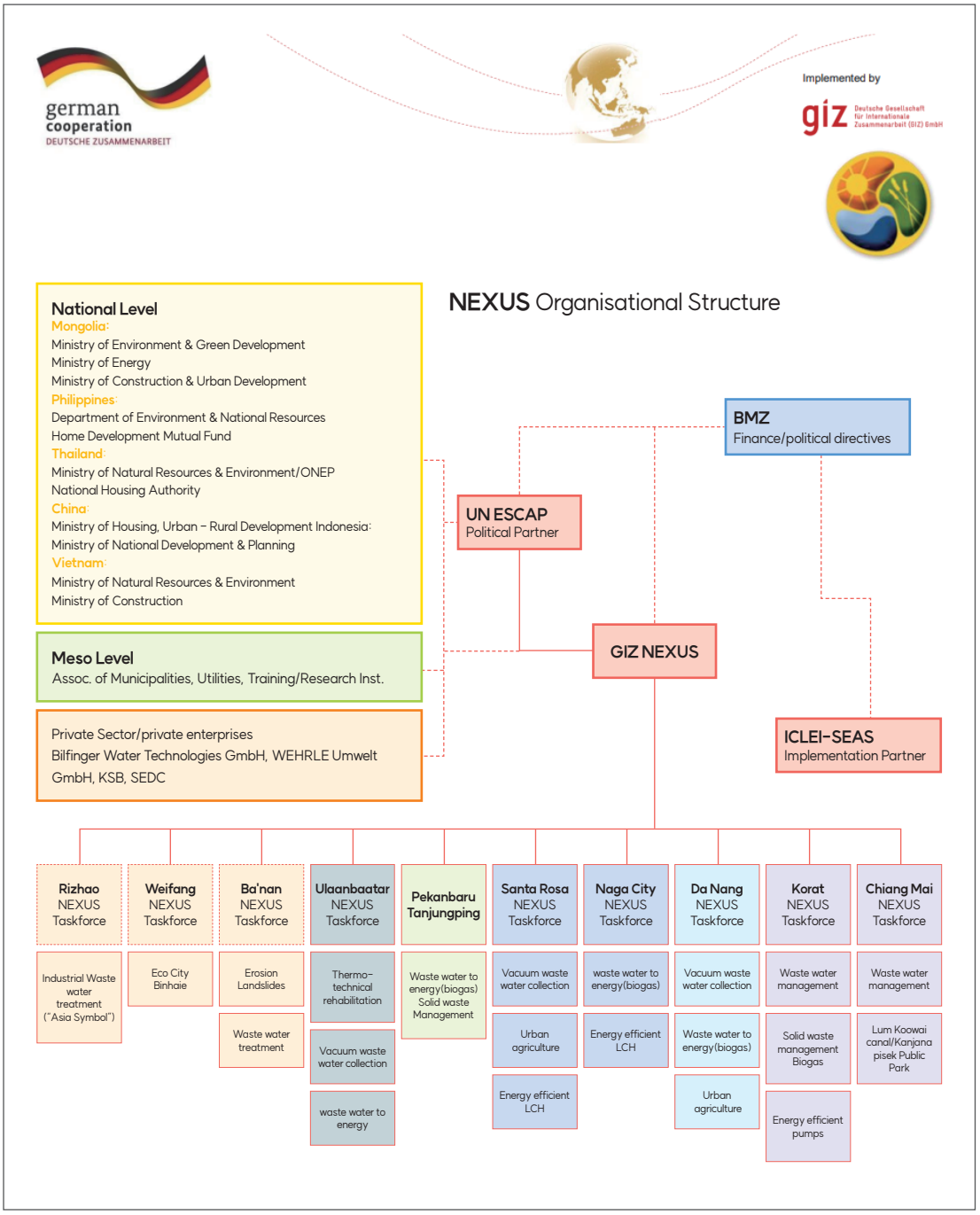
Table 1 Overview of "The Urban Nexus" project

Project Title	Integrated Resource Management in Asian Cities: The Urban Nexus
Funding Agency	The German Federal Ministry for Economic Cooperation and Development (BMZ)
Implementing Agencies	UNESCAP, GIZ, ICLEI
Project Period	First Period (2013 – 2015) Second Period (2016 – 2018)
Total Project Budget	Euro 400,000 for Phase 1 (GIZ to UNESCAP) Euro 550,000 for Phase 2 (GIZ to UNESCAP)
Goal	To enhance the capacity of local and national governments to formulate and implement integrated policies, plans and initiatives to sustainably manage natural resources in urban areas
Beneficiary Countries	7 countries including China, Mongolia, Indonesia, Myanmar, Philippines, Thailand, and India

Source: Retrieved from UNESCAP website[10)]

10) https://www.unescap.org

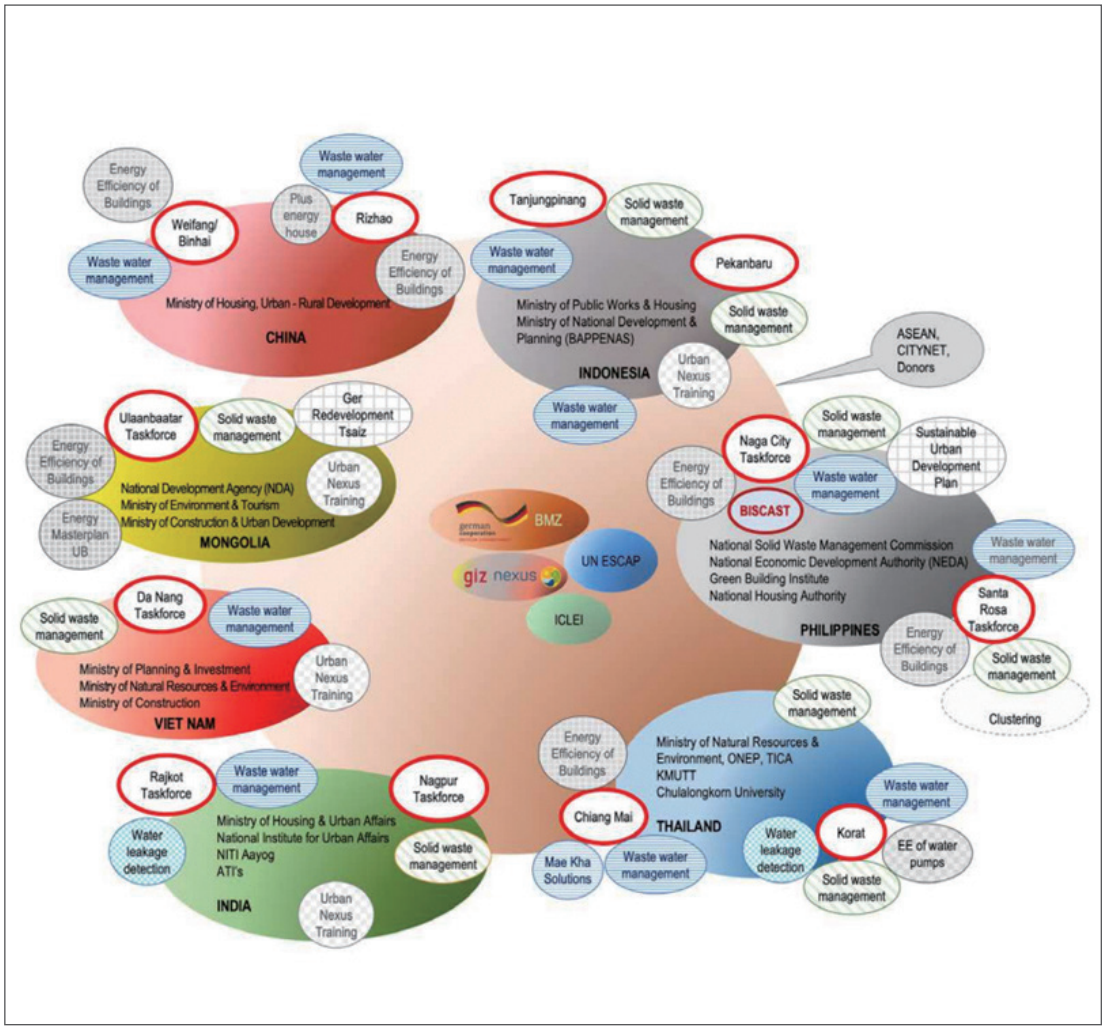
Figure 1 Organizational structure of "The Urban Nexus" First Period (2013 – 2015)



Source: Retrieved from UNESCAP website[11)]

11) https://www.unescap.org/sites/default/files/Day%201%20Session%201-Relevance%20of%20Nexus%20approach_GIZ.pdf

Figure 2 Project cities and Nexus measures (GIZ)



Source: ESCAP et al. (2019)

02 BACKGROUND

The project surveyed approximately 46% of the population living in urbanized areas in the Asia and Pacific region. The urban segment of the population is expected to reach 50% by 2026, indicating the rapid urbanization. Currently, urban areas encompass approximately 3% of Asia and Pacific region's land surface. Spatial urban extent is expected to reach 5% to 6% of land area by 2050. Particularly in the Asia and Pacific region, urban areas are a major engine of economic growth, with urban populations producing 80% of regional GDP and enjoying increasing GDP per capita. Urban expansion is significantly ignited by urban population growth caused by migrant workers from rural to urban areas and by increasing household incomes of an urban middle class.

The two significant trends in Asia and Pacific region are as follows: The first trend is intensifying resource flows. Cities form major hub of resource flows. Increasing numbers of urban dwellers consume more water and energy for household and production purposes. Households and firms discharge more waste water, generate more solid waste, and emit more greenhouse gases. The second trend is increasing conversion of agricultural land for urban purposes. Demographic dynamics as well as economic, social, and ecological demands intensify competition for land. Main challenges resulting from rapid urbanization include water and sanitation systems, energy, land and food.

Against this backdrop, the necessity to increase resource efficiency and resource productivity has begun to guide policy-making from the supra-national level down to the local level. With resource constraints growing, the nexus approach has progressively gained momentum, expanding to urban core themes such as urban infrastructure provision and integrated urban planning and development.

2.1 The Urban Nexus Approach as a New Management Process

The urban nexus approach strives for efficient uses of water, energy and land by taking the interrelationships between the three nexus dimensions – a systemic view. Thus, applying the urban nexus approach means to introduce new management processes which call for new and different ways of interrelated thinking. With optimization of resource efficiency at its core, the urban nexus approach is interrelated with the circular flow of resources. The circular thinking in life-cycles of infrastructure projects or building projects is required. This new systemic thinking needs to be mainstreamed into administrative practice.

2.2 URBAN NEXUS INTERRELATIONSHIPS

The urban context complements some unique parts to the primary nexus interrelationships such as the solid waste/energy interrelationship and the wastewater/energy interrelationship. A further significant nexus interrelationship exits between urban development and energy. Urban development and expansion directly interact with the energy sector in important manners. Construction of new buildings brings about scores of opportunities to lock-in long term reduction of energy consumption, while the existing building stock presents numerous opportunities for retrofitting. Reducing energy consumption through technical building codes and shaping compact settlement development via spatial planning regulations and merits an accentuated role in the context of the Urban Nexus Development Strategy. Table 2 shows specific urban nexus interrelationships:

Table 2 URBAN NEXUS INTERRELATIONSHIPS

Energy ↔ Wastewater	
Energy for Wastewater: • Transportation (pumping stations) • Sewage treatment plant	**Waste for Energy:** • Back water (separately collected from rainwater e.g. via vacuum sewer system) can be used for electricity production in anaerobic digesters • Sludge for fertilizer production
Energy ↔ Solid Waste	
Energy for Solid Waste: • Transportation ('waste miles') • Waste treatment facilities	**Solid Waste for Energy:** • Energy generation from landfills (landfill gas to energy)
Energy ↔ Urban Development	
Energy for Urban Development • Horizontal low density development • Urban sprawl • Preponderance of car usage • Loss of biodiversity • Loss of agricultural land	**Urban Development for Energy (Reduction of energy consumption -long term view)** • Compact city form • High density city (high rises) • Public transit • Bus rapid transit • Subway systems • Energy efficient buildings • Retrofitting existing building stock

Source: Martin Schreiner (2015)

Urban nexus interrelationships are affected by multi-jurisdictional governance issues, generating high levels of managerial-administrative complexity. Coping with urban nexus convolutions is hampered by the horizontal fragmentation of large urban areas into separate administrative municipal jurisdictions, by functional horizontal segmentation within city administrations, and by vertical fragmentation across different levels of government.

On the institutional level, these deficiencies frequently create frictions and inefficiencies, which lead to second-best outcomes. To avoid the latter, integrative approaches of urban development and urban resource management need to be taken together. Conditions within the urban domain forcefully call for the application of the urban nexus approaches. Furthermore, the urban nexus approach with its understanding of interrelated links between water, energy, solid waste, and land can facilitate required transitions to national economies increasingly based on circular flows.

03 METHODOLOGICAL APPROACH

Methodological approaches in the project are summarized as following: First approach is enabling multi-stakeholder participation and ensuring inclusiveness. Stakeholders from the city administrations, NGOs and technical experts supported by international mentors, elaborate integrated urban development concepts (IUDCs), which supplement the statutory urban land-use planning system. Second approach is striving for inter-municipal cooperation. It promotes coordination across sectors (horizontal integration) and improves communication between local authorities to implement urban nexus approaches. Third approach is engaging sub-national, regional, provincial level with national levels of government. Specifically, national, regional and provincial-level regulatory and policy frameworks are crucial factor for local and municipal decision making, regarding urban nexus initiatives. The project cities regularly share their experiences with the relevant ministry, thereby advancing the national reform process.

The next approach is preparing for linking projects to funding. Provincial and national finance, planning, and coordination ministries need to be prepared for the urban nexus approach so they are able to negotiate with international donors to get funding for multi-sectoral projects. Lastly, ranking of urban nexus Priorities is an important approach in the project, in the context of the program which supports jointly prioritized measures through pilot project, which make the complex task of urban planning visible for city administrations and citizens alike.

04 ACTIVITIES

Three partners (GIZ, ESCAP, and ICLEI) worked together to support creation of socially, economically and ecologically resilient cities. GIZ provided advisory services to local governments as a first step to improve their resource management in the areas of energy, water, food security/land use. They identified wastewater and solid waste as urgent concerns for several countries. Thus, the project mostly focused on wastewater and solid waste, promoting waste as a resource, which is align with the vision of a circular economy approach.

GIZ Urban Nexus collaborates with international experts and relevant stakeholders. They conduct pre-feasibility and feasibility studies to design cross-sectoral infrastructure solutions and build capacity. Additionally, they calculate capital expenditures and operating expenses and identify the importance of appropriate tariffs and fees to create an enabling environment for infrastructure investment. Investigating and analysing physical infrastructure, hardware and measures in the project cities include wastewater, water reuse, energy generation and application of nutrients for agriculture.

It improves wastewater and drinking water supply system improvements, including leakage detection and replacement of old, inefficient pumps. It also includes mechanical biological treatment system and incineration technologies (waste to energy) and promotes energy efficiency of buildings. Three partners also organized technical workshops for sharing knowledge, trainings and visiting study sites. There is benefit for particularly technical staff to new technologies and infrastructure. It also promotes coordination across sectors (horizontal integration). Through the workshops, communication between local authorities was improved, and peer-to-peer exchanges and South-South dialogues help to facilitate experience exchange.

ESCAP held expert group meetings engaging external expertise from various fields to solve problems. It also brought member States together to discuss issues of regional concern and share best practices. Through the meeting, ESCAP supported the policy shifts that needed to progress integrated resource management in cities, such as the Nexus approach into national initiatives. GIZ, ESCAP, and ICLEI also hosted National dialogues to improve coordination across government levels through approaching vertical integration, which is an important evolving policy reform. They also addressed local and national issues, including financing local infrastructure projects. Local and national actors as well as private sector entities, have participated in these forums which are aimed at supporting alignment of local, provincial and national strategies, creating acceptance for the Nexus approach and mobilizing finance for improved urban services. They also convened regional workshops that brought together project stakeholders in exchanging experiences and knowledge and enabling cross-sectoral, multi-stakeholder dialogues between cities, regional and national governments, associations and NGO, academia and research institutions, and the private sector.

05 RESULTS

The project steps toward global and regional outreach events to further disseminate the Urban Nexus approach, lessons learned, policy recommendations and project results reaching numerous local and national policymakers and other relevant stakeholders from around the world.

Successes of the project range from improving efficiency and reducing costs of drinking water supply systems to certifying a green, affordable housing design, with construction costs reduced by more than a third compared with conventional construction.

The project has carefully developed more than 55 projects with capital expenditures up to €600 million, also considering operating expenses. Proposed solutions include innovative solid waste management, vacuum sewer technology and wastewater reuse, building energy efficiency and renewable energy, efficiency improvements in energy, water and wastewater systems that leads to monetary savings.

At the seventy-first session of the Commission, ESCAP member States stressed the importance of the Urban Nexus approach. Furthermore, as a key sustainable development priority, the Commission emphasized sustainable management of water, energy and food, considering increased agreement among ESCAP member States on the importance of an integrated resource management.

The overall results are as follow: advancing the balanced integration of the three dimensions (Water, Energy, and Food) of sustainable development, achieving coherence across many of the proposed SDGs, and increasing awareness and understanding of the NEXUS and its relevance for urban development among national and local government officials, policy makers and decision makers, as well as citizens and the private sector.

06 CHALLENGES

The Project expected and experienced some challenges regarding limited participation of beneficiaries and their commitment to the Project. Those challenges were identified during the project period following as:

1. Challenges at Phase I (2013 – 2015)

- Challenges at Phase 1 were language barriers and travel restriction. In terms of language barriers, limited English language skills of local governmental officials was an issue, thus simultaneous interpretation was needed to provide for those officials. Extra cost for interpretation service was the problem since there was no budget indicating in the documents. Other barrier is a travel restriction since Chinese cities are not able to participate regularly in the regional workshop. The restrictive regulation exists for travel of Chinese officials, especially from local governments.

2. Challenges at Phase II (2015 – 2018)

There were difficulties handling occasional coordination and logistical problems while implementing the project. Encountering occasional coordination and logistical problems, including difficulties with securing speakers and panellists in events was one of the challenges. The procurement process for interpreters is lengthy, particularly with Chinese participants. Travel restriction was also a problem; some invited participants, particularly from China, India and Indonesia had challenges obtaining permission to travel and acquiring visas. Difficulties in scheduling events due to the holiday and election days was also a barrier managing the project. For example, elections (national and local) and holidays also posed challenges regarding scheduling of events. Language barriers were occasional issues in terms of planning simultaneous interpretation.

07 SUCCESS FACTORS AND LESSONS LEARNED

Although the targeted cities faced common challenges, they had different challenges in some aspect, including political will, socio-economics, and ability to coordinate across governmental levels and existing regulations.

The Nexus project provided tailored integrated management solutions to the unique circumstances of targeted cities. Successful factors and lessons learned were well described and captured in the project's final publication and presented at the project's Ninth Regional Workshop. Here, the successful factors and lessons learned are summarized following as:

Successful factors of the project are active engagement of national and local governmental officials, and increased awareness and understand of the NEXUS concept among the relevant multi-stakeholders. Sharing the information and experiences learned in different project sites at the regular regional workshop was helpful in implementing the project. GIZ precisely analysed problems and issues that the target cities had faced and provided effective solutions to address the issues. Three project partners were well acquainted of their roles and played accordingly in the project cities and did their jobs well.

There are several lessons learned from new forms of thinking, leadership and commitment to close to gaps that exist between how we mange those resources. Activities implemented in the course of the reporting period allowed identifying key challenges and opportunities, from planning to implementation, and came up with key policy recommendations required for its effective adoption in the region. Facilitating collaboration and communication between the participants and spaces was also a key lesson and sharing information and peer-learning activities from different project site took a big role for the project.

Figure 3 **Lessons learned from "Urban Nexus"**

Source: author's compilation

Successful Case Study: Nakhon Ratchasima [Korat], Thailand

1. Success factors

I. The local government is aware of the increasing stress on natural resources and foresees the sustainable provision of water, energy and food to the people as a priority

II. From the beginning of the project, the mayor of Korat has been actively engaged, and several municipal departments, including water supply, public works, public health and social welfare, among others, worked in an integrated manner to collaborate with the GIZ Urban Nexus team and other consultative group

III. Collecting baseline data and reach to an agreement on how to implement solutions to their urban development problems

IV. The city was able to source funds to implement almost all of the proposed solutions, up to an investment of $1.5 million

V. GIZ Urban Nexus worked with the city on sustainable water management and innovative solid waste management solutions in an integrated approach

2. Background and Issues

I. Water pumping issue:

- The municipality pays 3 million baht (about $93,750) per month for Makham Tao Station to pump/distribute tap water to consumers. Pumping the water requires large amounts of electricity. However, half the pipe network leaks, which forces the plant to produce and pump more water into the network than is actually required.

II. Wastewater management system

- the project also sought improvements in Korat's wastewater management system. Korat's Central Waste Water Treatment Plant has a capacity of 75,000 m^3 per day. The average daily inflow, however, amounts to only about 21,000 m^3 per day and is therefore much lower than expected and only 28 per cent of the design flow. That plant is not functioning at its optimum efficiency because it receives and treats diluted water. Only septic tank overflow enters the sewer system. The activated sludge system's sludge scrapper machine constantly breaks down and therefore does not enable proper treatment processes.

III. Solid waste management system

- Korat's Solid Waste Management Facility (biogas plant and landfill) receives about 400 tons of municipal solid waste per day. Due to system failures and maintenance work, the amount of treated waste is 41 per cent of that amount, whereas 59 per cent is dumped directly into the landfill without separation. Some of the landfill cells are not up to sanitary standards, that is, they lack methane or leachate collection.

3. Solutions

I. Water pumping issue:

- As a result of system analysis, a rearrangement 44 and fine tuning of Makham Tao pumping station's operations was implemented. The adjustments enabled the municipality to save maintenance costs that were incurred by the station and reduce the formerly high levels of electricity consumption. The electricity bill has been reduced on average by 29 per cent, or more than 1 million baht per month

II. **Wastewater management system**

- One of the proposed measures for increasing the organic load was to collect the wastewater directly from neighborhoods near the plant by using a vacuum sewer collection and transport system. A comprehensive survey on vacuum sewer implementation was conducted in those neighborhoods jointly by the GIZ Urban Nexus team, Department of Public Works and Department of Social Welfare. The rehabilitation of the plant showcases practical and sustainable solutions that prompted the city to commit a budget to fix the problems, as recommended.

III. **Solid waste management system**

- After carefully analyzing, GIZ Urban Nexus recommended them to have an efficient biogas process with low disturbance potential. It would be possible to resolve the issues with the installation of 1) shredder and 2) agitator machines. Korat invested in a 1) shredder (18.3 million baht or about $572,000) and 2) agitators (about 8.9 million baht, or about $278,000) to improve the process of organic waste separation, biogas production and electricity generation.

4. Lessons learned from Korat Thailand

I. Increased awareness and understanding of the nexus and its relevance for urban development among national and local government officials, policy makers and decision makers, as well as citizens and the private sector.

II. Local administrations often need technical support to prove the viability of solutions, with conducting feasibility studies.

III. If decision makers are convinced that sustainability measures can improve people's livelihood, environmentally, socially and especially economically – sourcing for budget is not a big issue

Source: ESCAP et al. (2019)

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SOURCES

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UNESCAP website, https://www.unescap.org/

The Republic of Korea-UNOSSC Facility Phase 3

Part III

WEF Nexus in LAC

Review of WEF Nexus related projects
toward informing project pilot's delivery of SDG-impact

01 OVERVIEW[12)]

Overview of Case study of Water-Energy-Food Nexus in Korea and utilization for LAC countries

Following our research on the WEF NEXUS projects implemented by Korea, we agreed to conduct a research project requested by the Inter-American Development Bank (IDB) which was conducted by the Korea Water Resources Corporation (also known as K-water). This project, titled "Case study of Nexus in Korea and utilization for LAC countries", was scheduled to last for two years (The project was actually launched in July 2020 and scheduled to be completed in November 2022) at a cost of USD 470,000. The objective of the project is to contribute to an efficient planning and integrated management of water, energy, and food resources in the Latin America and the Caribbean (LAC) countries specifically Colombia and Uruguay to ensure water and food security, sustainable agriculture, and energy production, by applying the Nexus cases of Korea (such as multipurpose dams and floating photovoltaic power plants). The project also includes a comparative analysis of Korea's NEXUS, including centralized water management, and proposes ways of applying NEXUS in the target countries.

Specifically, the project aims to analyse Korea's successful implementation of NEXUS, followed by existing NEXUS projects in Latin American and various Caribbean countries, in order to evaluate the demand in those countries. In addition, the project first aims to identify target regions for potential pilot projects and to analyze the NEXUS scenario in order to determine priority projects, and then to perform a final preliminary feasibility study of the pilot project to be conducted. This policy advisory project has been designed to help the LAC region coping with climate change and to suggest water management programs.

Figure 1 Map of Colombia

Source: Yi, Soohyeong. "(IDB) Korea NEXUS case study and LAC country application consulting business status." 2022 STEPI Seminar, 28 April 2022.

12) This report comprehensively cites presentations("(IDB) Korea NEXUS case study and LAC country application consulting business status.") from the April 2022 seminar and IDB official website, https://www.iadb.org/en/project/RG-T3427

02 BACKGROUND

As part of the national strategy for promoting new industry, technological innovation, and efficient use of resources, South Korea has been actively conducting projects and research on WEF Nexus. For example, the Korean government has built multipurpose dams since the 1960s for efficient use of water resources with limited financial resources. For the same reason, Korea recently put much effort into the Integrated Water Management System (IWRM) applying ICT technology and Floating Solar Photovoltaic (FPV) power plants. The Ministry of Trade, Industry and Energy (MOTIE) has developed knowledge in integrated energy management and energy efficiency by establishing the world's largest smart grid demonstration complex. The Ministry for Food, Agriculture, Forestry and Fisheries (MIFAFF) is actively promoting energy and water saving technologies in the production of agricultural products and bioenergy production technologies having the Nexus concept in mind.

Source: IDB official website, https://www.iadb.org/en/project/RG-T3427

03 METHODOLOGICAL APPROACH

The project was implemented mostly on the basis of literary research and a field survey. A feasibility study was performed based on the existing literature, including local statistics and higher plans. Following the project adjustment, a preliminary feasibility study is under way to improve the quality of water at the source in Cesar River, Colombia. The water in the upper reaches of the Cesar River and its tributary, the Gutapury River, is seriously polluted. Valledupar, a nearby city that secures the majority of its water intake from the Cesar and Gutapury Rivers is experiencing a water shortage.

The preliminary feasibility study consisted of the following six steps: 1) collection of the basic information, 2) survey of water uses, 3) assessment of the water demand forecast, 4) review of the plan for the development of new water resources, 5) review of the plans on water quality, and 6) identification of priority projects. The first step (collection of basic information) included a survey of the geographical location and the size of the river basin, and the water quality monitoring network. During the second step (survey of water uses), a survey was conducted on the current uses of the water of the water basin in order to estimate future water demand based on the survey findings and to determine the scope and target areas of the water supply plan. In addition, the demand for domestic water was determined based on the population served and the population by administrative district, and a factual survey was conducted based on farming and other needs.

The third step (assessment of the water demand forecast) is measuring the amount of water resources through calculating the average rainfall within the river basin and forecasting the outflow. During the phase of step 4 (review of the plan for the development of new water resources), K-water team

selected prioritized areas considering future demand growth avoiding duplication of ongoing projects by reviewing national development plans and selecting prioritized areas for future demand growth.

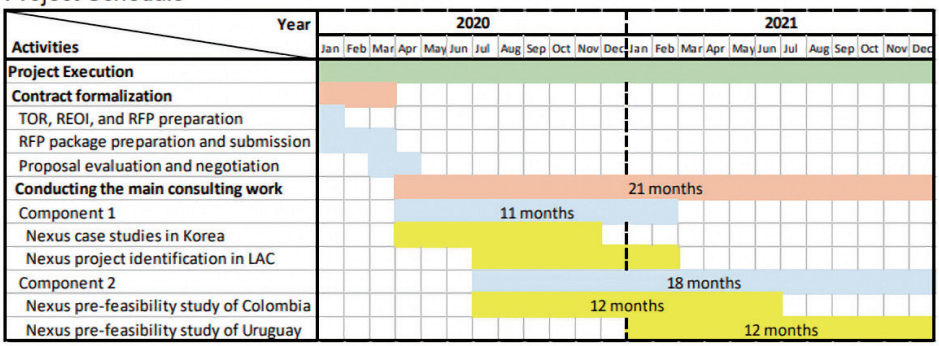
Step 5 involves a review of plans for sewage treatment and waste disposal as well as ways to enhance the operational efficiency of existing facilities and plans for the construction of new water quality enhancement facilities. The final step is an evaluation phase regarding whether or not a stable water supply will be possible based on efforts to improve water quality in the most efficient way, given the solutions that have been presented based on the outcomes of the review. Finally, a preliminary feasibility study was carried out to make a draft business plan and conduct a feasibility study.

The feasibility study includes technical-physical analysis and economic analyses. Technical-physical analysis is an integrative model of Water-Energy-Food resources or Nexus analytical tool that will be applied to assess water availability of the target region and its surrounding area based on alternative analysis for infrastructure planning (i.e. hydrological modelling, water balances, energy demands, land use, food production, environmental data, etc).

Economic analysis is consisted of elements that can be quantified by analytical frameworks. This activity covers demand-benefit-cost estimations and analysis, economic feasibility evaluation, and financial feasibility analysis. While an economic feasibility analysis measures the costs and benefits of a public project from the perspective of an entire nation or society, financial feasibility emphasizes actual monetary costs and cash flows from the perspective of individual parties responsible for a project. Ways to attract private investment and the potential of Public-Private Partnerships (PPPs) will be assessed in this activity.

Figure 2 Project Schedule and Milestones

6.1. Project Schedule



6.2. Milestones

Milestone #	Milestones	Due date
1	Submit the consultancy work plan in 5.1	Mar 1, 2020
2	Submit the Nexus report in 5.2	Feb 1, 2021
3	Submit the pre-feasibility study plan for 5.3	Jun 1, 2020
4	Submit two pre-feasibility reports in 5.4	Dec 31, 2021

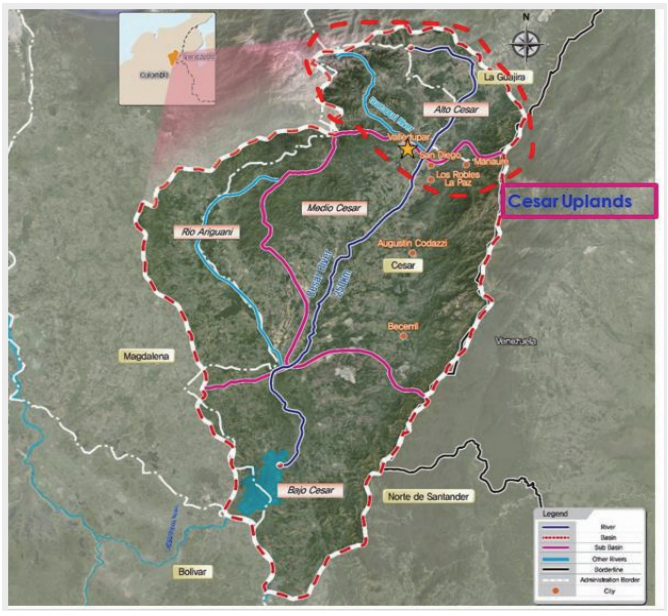
Source: retrieved from Terms of Reference, IDB, 2019

04 ACTIVITIES

In March 2019, the project was launched with the establishment of the basic plan. Senior government officials from the IDB and those from the LAC region carried out a program to enhance water management capabilities from June to December 2019, and discussed the concept of NEXUS. On February 15, 2020, they submitted the Expression of Interest (EOI), came up with a short list, and published the Request for a Proposal (RFP). In the process, seven countries including Colombia formed a consortium to meet the criteria.

In April 2019, technical proposals and price proposals were submitted, and K-water finally selected as the project manager. Three months later, in July, the IDB and K-water signed a contract and held a business launching event targeting Colombia and Uruguay. However, the scope of the project was changed in January 2021 by the request of the Colombian government. In March 2021, Korea's NEXUS case report was submitted to the IDB. Cases of NEXUS implementation in the LAC region were studied, and K-water, together with local Colombian companies, conducted a preliminary field survey of the Cesar River in Colombia from September 2021 to April 2022. K-water submitted the existing NEXUS project survey report of LAC countries to the IDB during the preliminary field survey period. In May, K-water, together with the participating companies including local partners, conducted a field survey on the target areas and held a session to report the interim results of the Colombian project. K-water presented the outcomes of both the preliminary feasibility study and the feasibility study to the IDB and complete the project in November 2022.

Figure 3 Cesar Uplands



Source: Yi, Soohyeong. "(IDB) Korea NEXUS case study and LAC country application consulting business status." 2022 STEPI Seminar, 28 April 2022.

05 RESULT

The project was initially scheduled to be completed in November 2022, but it was delayed and closed in July 2023. Since the project has just ended, the results will be analyzed at a later date.

06 CHALLENGES

Some changes were made to the project due to the client's (IDB) insufficient negotiation with the target countries in the project planning phase, resulting in changes to the contract. This is due to a lack of understanding of the overall project direction on the part of the local governments concerned. It appears that the IDB placed an incorrect order due to the lack of negotiations. Although the project was developed by a government official, i.e. a director general of a government ministry who was sent to the IDB, it is not clear how the IDB or the official negotiated with the two target countries. Considering that it took almost one year to change the scope of the project, it seems that they had difficulties building consensus with these countries.

One of the reasons for the change in the scope of work was the difference between the business areas of the ministry and the business areas proposed by the participating institutions. The project was cancelled in Uruguay due to a reorganization of the government ministries. Initially, the project included Uruguay and Colombia, but later only Colombia decided to carry it out. Another obstacle arose in that the project period had to be changed due to a delay in proceeding with the project amid the global spread of the Covid-19 pandemic. It took much longer than initially expected to find local companies and experts to perform the field surveys and conduct the literary research and to work out a contract with them.

07 SUCCESS FACTORS AND LESSONS LEARNED

It is too early to analyse the success factors as the project has been finished recently. Nevertheless, there are some lessons to be learned. First, it is necessary to have sufficient discussions and negotiations so as to ensure that the governments of developing countries understand the basic concepts of the project (i.e. NEXUS in this project) and to establish specific implementation plans. It is crucial to establish clear goals in the planning phase, as this can help communicate effectively with the recipient countries. For example, the Colombian government maintains NEXUS in the title, yet it demands the construction of houses, which is not consistent with the initial purpose of the project. In addition, developing countries are facing urgent challenges in dealing with individual resources, therefore, seek to gain as much as possible once they get an opportunity. That being the case, it is necessary to set clear goals before embarking upon a project. Ideally, a project should include all three resources, such as water, energy, and food, but if it is not feasible in reality, a realistic alternative would be to include only two of them, i.e. energy and food or water and food.

It is necessary to plan infrastructure investments and incentives, including subsidies and tax policy, taking into consideration the interdependence of water, energy and food.[13] In fact, countries that experience water shortages actually export water in a virtual sense by exporting their agricultural products. These countries or regions need to understand that agricultural subsidies can exacerbate their water shortage and pose an obstacle to their long-term economic growth. Most developed countries are encouraging technological innovation in the water-energy-food NEXUS and taking measures to reduce water consumption in the energy sector.

If the government ministry in charge of the project cannot cover all three resources, i.e. water, energy, and food, it is likely to focus on just one or two of them. We suggest that although the scope of their roles and responsibilities may vary from country to country, there should be a common thread running through the government ministries of the different countries to be designated as project managers so as to ensure the smooth implementation of the project.

13) K-water(December 2017), Water-Energy-Food Nexus Technology Development Plan, p. 53.

08 FOCAL POINT

- This project is being executed and monitored by the IDB through the Water and Sanitation Division (INE/WSA) under the supervision of Raul Muñoz Castillo (raulmu@iadb.org).
- For more information, please visit the project website (https://www.iadb.org/en/project/RG-T3427).

Sources

K-water(December 2017), *Water-Energy-Food Nexus Technology Development Plan,* p. 53.

Yi, Soohyeong. *(IDB) Korea NEXUS case study and LAC country application consulting business status.* 2022 STEPI Seminar, 28 April 2022.

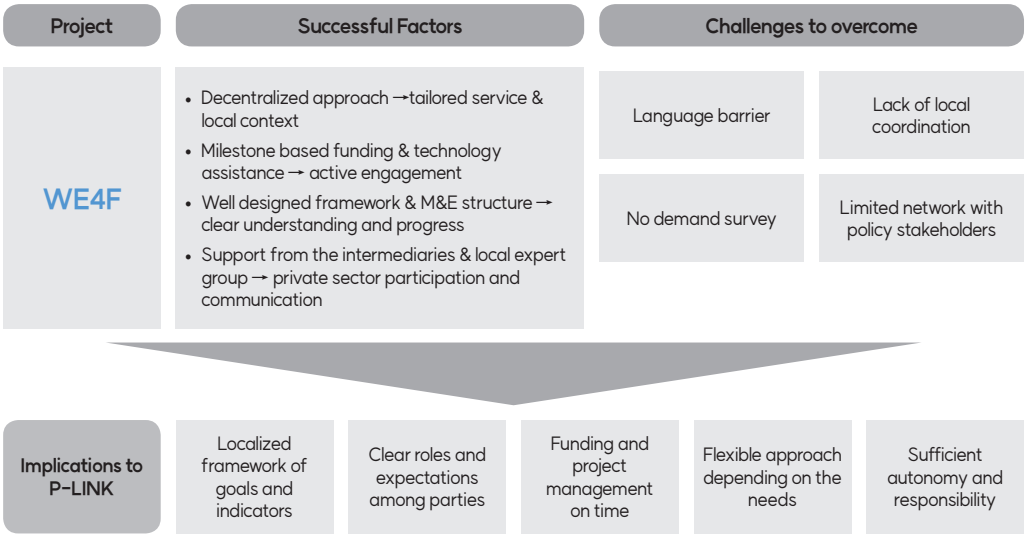
Inter-American Development Bank, Terms of Reference, 23 August 2019, https://www.iadb.org/en/project/RG-T3427

CONCLUSION

In conclusion, we present the main lessons learnt from the three case studies as they are useful to inform the P-LINK project implementation strategy and application. Each case study shows its unique characteristics in terms of structure and implementation process. Yet, we can categorize each of three cases into successful factors, challenges to overcome and implications to P-LINK. It will be useful for readers to compare those cases in the conclusion section by displaying main analysis results including the implications of three cases.

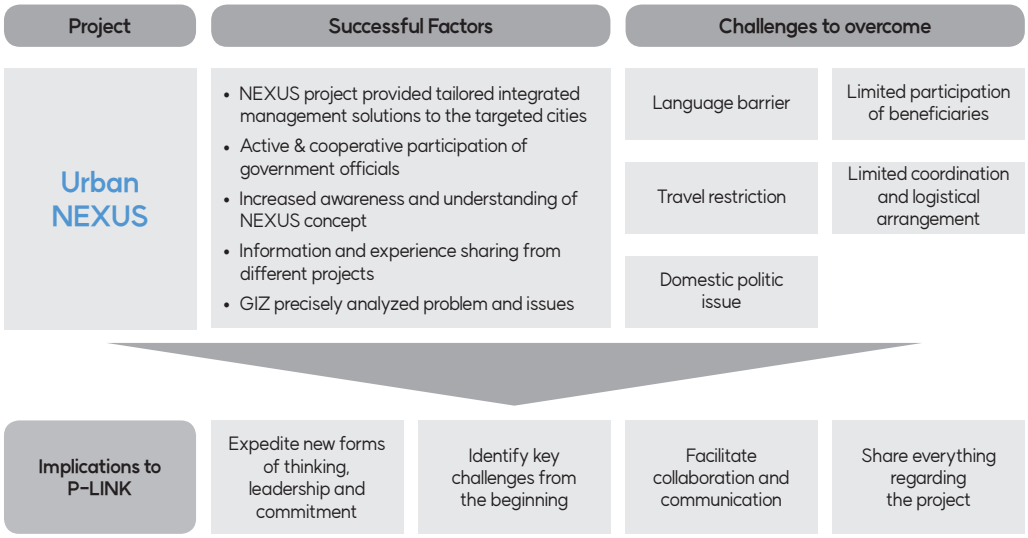
First, WE4F case exhibits various successful factors and challenges to overcome. The decentralized approach of the WE4F project enables customized services that are tailored to the local context. The establishment of milestones tied to funding and technology assistance fosters active engagement, while a well-designed framework promotes clear comprehension and tangible progress. The involvement of intermediaries and local expert groups further encourages robust participation from the private sector, contributing significantly to the project's success. However, the WE4F project has faced several challenges that need to be addressed to ensure its effectiveness. These challenges include language barriers, a lack of local coordination, absence of demand surveys, and limited networking with policy stakeholders. Addressing and resolving these challenges will be crucial for the project's success moving forward. Implications of conclusions drawn from WE4F for the P-LINK project are underscoring the importance of ensuring a localized framework of goals and indicators, outlining clear roles and expectations among parties, keeping funding and project management on time, maintaining a flexible approach depending on the needs, and providing sufficient autonomy and responsibility.

Figure 1 Lessons learned and implications from the WE4F case



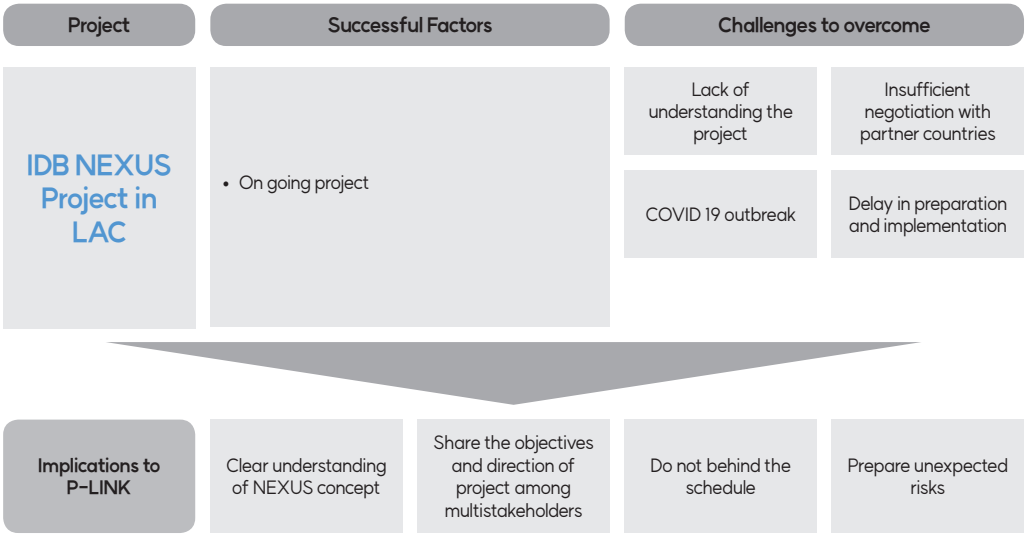
Second, Urban NEXUS also presents several successful factors and challenges. It is crucial to identify and overcome key challenges such as language barriers, travel restrictions, and domestic political issues risen during the project's implementation. The project also experiences limited participation of beneficiaries and limited coordination and logistical arrangement. Nevertheless, the Urban NEXUS displays many positive aspects to reach the successful project implementation. This case offers customized and integrated management solutions to the designated cities. Among the factors that contributed to the project's success was the active engagement of government officials. Furthermore, a heightened awareness and comprehension of the NEXUS concept proved beneficial in executing the Urban Nexus project. Valuable insights and experiences shared across various projects also played a pivotal role. When considering the implications from the Urban Nexus project that are relevant to P-LINK, we find out that the Urban NEXUS deliver several implications from different aspect that the previous case, WE4F. This project expedites new forms of thinking, leadership and commitment. It is great to identify key challenges from the beginning of the project and facilitate collaboration and communication. It is also definitely essential to share everything regarding the project with all stakeholders.

Figure 2 Lessons learned and implications from the Urban NEXUS case



In the case of the IDB NEXUS project in LAC, there were a lot of challenges rather than successful factors. Because it is still an on-going project, we are not able to mention the successful factors at this moment. They alert P-LINK that an upfront clear understanding of the WEF NEXUS concept, and preparing for unexpected risks should be built into the project's plans. As worse, it seems that the project gets impacts from the COVID19 outbreak. We recognize that there was insufficient negotiation with partner countries, which causes delay in preparation and implementation. We can draw various implications from the case. It is critical to have the clear understanding of NEXUS concept and share the objectives and direction of the project among the multistakeholders. In addition, do not behind the schedule and need to prepare all unexpected risks in advance.

Figure 3 Lessons learned and implications from the IDB NEXUS project in LAC case



Finally, several key implications and lessons are drawn to contribute to the successful implementation of the P-LINK. First, "Prepare all". It is necessary to prepare everything at the beginning of the project such as identifying key challenges, clear understanding of NEXUS concept and any unexpected risks. Second, "Localizing demand and responsibility". The goals, indicators and approach need to be localized depending on the local needs and voice. Each stakeholder is required to have the clear roles and expectation, sufficient autonomy and responsibility. Third, "Sharing and communicating the project". We expect to share everything regarding the project with every members including the objectives and direction of the project, so that all stakeholders can stand on the same line of the same page. Also, we need to try to facilitate collaboration and communication among the stakeholders. Fourth, "Moving together". Even though there are many obstacles and barriers that are not expected, it is certainly important for the project not to behind the schedule. Additionally, funding and project management on time are essential. Fifth, "Creating and Innovating". One of the key characteristics of P-LINK is that it is embedded with applying innovative technology to solve the challenges. It means that we are in pursuit of new forms of thinking, leadership and commitment throughout the project's implementation.

The P-LINK contains various stakeholders such as the central and local government, communities, research institutes, civil society and more of partner countries, the national Mekong River Committees, MRCS, MI and Korean partners throughout the project. Each member is encouraged to keep the implications suggested above in mind. The pilot projects in the P-LINK should be carefully designed to ensure technical applicability and economic viability within each local context, allowing for transition from pilot to large scale. Like all cases, emphasis should be put on developing appropriate indicators for each pilot project in the P-LINK to regularly monitor and evaluate baseline and target values by activity, output, outcome and impact. After the closure of the P-LINK, P-LINK can be

utilized as a bridge program to scale up to broader region and bigger size. As a result, it will be possble to secure sustainability in terms of effectiveness and expandability in scale.

Figure 4 Suggestions to P-LINK