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LESSONS LEARNED STUDY

Insights gained from the Nexus Regional Dialogues Programme



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c/o Deutsche Gesellschaft für Internationale
Zusammenarbeit (GIZ) GmbH
Dag-Hammarskjöld-Weg 1-5
65760 Eschborn
Germany

E nexus@giz.de
I www.water-energy-food.org

Registered offices Bonn and Eschborn, Germany

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Authors

Adelphi



Co-Authors

GIZ Nexus Regional Dialogues Programme Phase II Staff.

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LIST OF ABBREVIATIONS

2iE	International Institute for Water and Environmental Engineering	MINARET II	MENA Region Initiative as a Model of Nexus and Renewable Technologies Project
ALRI	Agency of Land Reclamation and Irrigation	MWp	Megawatt-peak
CAREC	Regional Environmental Centre for Central Asia	NBA	Niger Basin Authority
CBA	Cost-benefit analysis	NIA	Nexus Impact Assessment
CoP	Community of Practice	NDC	Nationally Determined Contributions
COP	Conference of the Parties	NRD	Nexus Regional Dialogues
CRew+	Caribbean Regional Fund for Wastewater Management	NRP	Nexus Resource Platform
EEWS	Energy Efficient Water Sector	PV	Photovoltaic
EU	European Union	RSS	Royal Scientific Society in Jordan
GEF	Global Environment Facility	SADC	Southern Africa Development Community
GIS	Geographic Information System	SDG	Sustainable Development Goal
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH	SPIS	Solar Pumping Irrigation System
GNS	Global Nexus Secretariat	THC	Tuyamuyun Hydroelectric Complex
GWh	Gigawatt hours	ToT	Training of Trainers
GWPSA	Global Water Partnership - Southern Africa	TWG	Technical Working Group
IDB	Inter-American Development Bank	UASD	Autonomous University of Santo Domingo
IIGE	Instituto de Investigación Geológico y Energético	UN	United Nations
IUCN	International Union for Conservation of Nature and Natural Resources	UNCCD	United Nation Convention to Combat Desertification
IWRM	Integrated Water Resources Management	UNEP	United Nations Environment Programme
LAC	Latin America and the Caribbean	UNFCCC	United Nations Framework Convention on Climate Change
LDN	Land Degradation Neutrality	WEF	Water, Energy, Food (security)
M&E	Monitoring and Evaluation	WEFE	Water, Energy, Food, Environment
MARN	Ministry of Environment and Natural Resources	WWTP	Wastewater Treatment Plants
MENA	Middle East and Northern Africa		

EXECUTIVE SUMMARY

The Water, Energy, Food (WEF) Nexus is a comprehensive approach aimed at ensuring long-term resource accessibility by addressing the significant interdependencies between water, energy, and food security. The WEF Nexus advocates for an integrated approach to resource governance, planning, and management to enhance synergistic and efficient resource use across sectors.

The “Nexus Regional Dialogues Programme” (NRD), jointly funded by the European Union (EU) and the German Federal Ministry for Economic Cooperation and Development (BMZ) and implemented by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH from 2016 to 2023, sought to identify the most effective institutional arrangements, methodologies and tools to promote and ensure systematic cross-sector coordination in natural resource management. The programme has carried out policy dialogues, investment dialogues, and demonstration projects in five geographical areas: Central Asia, Latin America and the Caribbean, the Middle East and North Africa, the Niger Basin, and Southern Africa.

The policy dialogues established a forum for stakeholders across various sectors to exchange knowledge, experiences, and best practices in integrated natural resource management. The investment dialogues encouraged cross-sectoral policy making and secure integrated financing for water, energy, and food security. The demonstration projects have shown the benefits of the Nexus approach to natural resource management. In addition, the NRD programme developed standardised methods and tools to assess cross-sectoral impacts and business models. These tools are important for evaluating the effectiveness of Nexus projects and for ensuring their long-term sustainability. The programme also provided trainings and training materials for human capacity development.

Among the programme's highlights are:

- ➔ The **policy dialogues** promoted a deep understanding of the WEF Nexus approach among policymakers in all five regions. It successfully **mainstreamed the Nexus approach** in transboundary management processes, notably in the Niger Basin and in Southern Africa. The NRD also helped mainstreaming the Nexus approach at national level in Jordan through an inter-ministerial structure, and at municipal level in three MENA countries through integrated climate action plans
- ➔ The NRD programme fostered an environment conducive to **investments in WEF Nexus projects across five global regions**, notably through the establishment of the **WEF Nexus Accelerator Bootcamp** in the Niger Basin and **WEF Nexus Innovation Lab** in the Latin American and Caribbean Region. On top of this, financing dialogues were conducted in Southern Africa on the basis of the SADC **WEF Nexus Investment Project Evaluation Tool** and in Egypt through the Nexus Farm Initiative. These financing dialogues showed the potential of integrated WEF Nexus solutions to contribute to sustainable development, resource efficiency, and climate resilience from an investment and planning perspective
- ➔ The NRD programme successfully **implemented demonstration projects** showcasing the added value of **WEF Nexus technologies**, such as the afforestation project in Kazakhstan, solar-powered cocoa drying in Ecuador, and integrated wastewater treatment in the Dominican Republic. These projects demonstrated the success of the WEF Nexus approach in addressing pressing threats to local communities by improving resource efficiency, climate resilience, and livelihood enhancement. These demonstration projects played a pivotal role in **promoting awareness, and providing valuable learning experiences** on WEF Nexus approaches
- ➔ The **Human Capacity Development (HCD)** component of the NRD programme was an important factor to **empower future decision-makers and improve their understanding of WEF interlinkages in the NRD regions and beyond**. In Central Asia especially, integrating the Nexus Game into educational programmes proved very effective to enhance awareness and understanding of cross-sectoral solutions among universities, academies, and basin organisations, resulting in improved planning and cooperation on other WEF Nexus activities in the region. The newly developed Nexus training materials are now accessible to users at no cost and in multiple languages
- ➔ The **Nexus Resource Platform (NRP)** developed within the programme is now widely recognised as the premier global knowledge centre for managing and disseminating information on the Water, Energy, and Food Security Nexus. This **global knowledge hub** supports knowledge exchange for the international community of practice on the WEF Nexus and on innovative solutions for integrated and sustainable resource management
- ➔ The **Nexus Impact Assessment (NIA) Toolkit** is a comprehensive tool designed to **support decision-makers in assessing the potential impacts of policies and projects** following a WEF Nexus approach. The toolkit includes Nexus Principles for policy coherence, Nexus Criteria and Safeguards and the Nexus Indicator Framework to ensure the due consideration of possible synergies and trade-offs in policy planning and project designs, a Cost-Benefit Analysis for decision-making, and a financing mechanism study for identifying investment opportunities

The programme has led to an increase in the application of the WEF Nexus approach in planning, policy making, and implementation in countries belonging to the five target regions, as well as an increase in public and private investor interest in WEF Nexus projects. The insights gained from the NRD programme's activities have been disseminated through various platforms, including the Water, Energy & Food Security Resource Platform, and international events.

The Nexus Regional Dialogues Programme

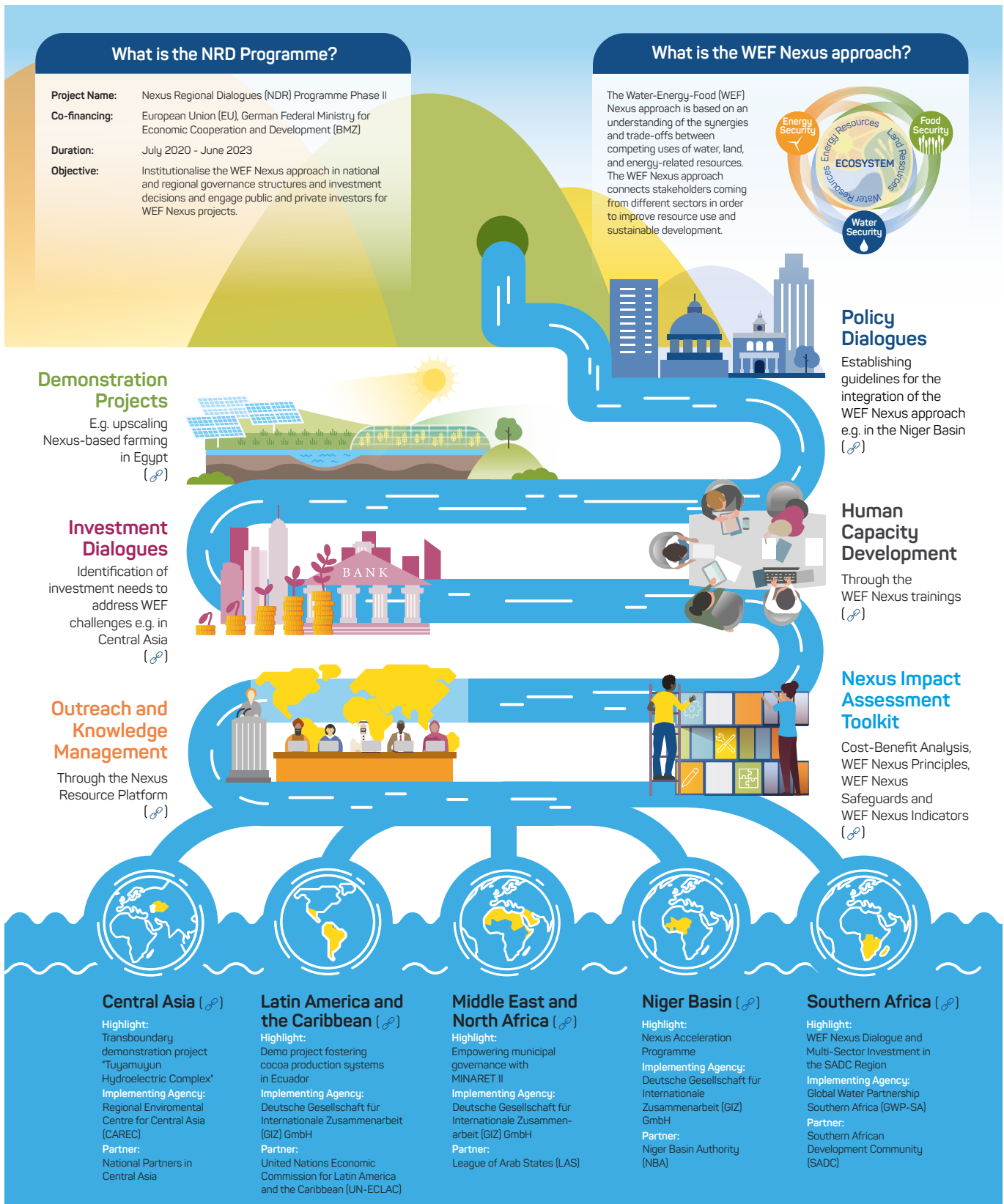


Figure 1: The Nexus Regional Dialogues Programme in a nutshell

1 MAIN STRATEGY, KEY ACHIEVEMENTS AND MILESTONES

1.1 General approach and vision

Global food and energy demands are anticipated to increase by 50% by 2050, while water demand could rise by as much as 30%. This is a result of factors such as population growth, economic development, urbanisation, and climate change. Presently, the sectors responsible for water, energy and land resources are managed separately, neglecting their interconnected nature. This “**silo thinking**” stems from separated institutional mandates, legal restrictions, traditional sector financing, short-term political goals, and self-sufficiency concerns (International Union for Conservation of Nature and Natural Resources (IUCN), 2019).

Recognising the significant **interdependencies between water, energy, and food security**, the Water Energy Food (WEF) Nexus offers a comprehensive approach aimed at ensuring long-term resource accessibility. This approach advocates for an integrated approach to resource governance, planning and management to enhance synergistic and efficient resource use across sectors.

The WEF Nexus seeks to equitably address the water, energy, and agricultural requirements that compete for limited resources. The approach focuses on balancing interests in resource use, managing conflicts, and identifying synergies without undermining human well-being and ecosystem health. In summary, the WEF Nexus serves to:

- Highlight **complex interdependencies** between the water, energy, and agriculture sectors
- Provide a **framework to determine trade-offs and synergies** between the sectors and to reconcile multiple and often conflicting interests and needs
- Promote **policy coherence and multi-sectoral and inclusive cooperation**
- Provide a tool to achieve global policy goals such as the **Sustainable Development Goals (SDG)**, in general, or e.g. climate change adaptation and mitigation as part of international climate policy agreements (Nationally Determined Contributions (NDCs))

“The WEF Nexus provides a holistic and integrated approach in order to secure access to water, energy and food in the long term.”

– Global Nexus Secretariat, 2020

Adopting a Nexus approach offers numerous advantages. By considering the interplay between the water, energy, and agriculture sectors, this approach can:

- **Mitigate sectoral trade-offs**, which are instances where actions in one domain may inadvertently harm another. For example, groundwater extraction for crop irrigation to promote food security can lead to unsustainable water resource depletion. Similarly, cultivating biofuel crops may provide renewable energy alternatives but may compete for valuable land and water resources with food production
- **Improve efficiency, maximising the utilisation of limited resources while minimising environmental impacts**. For example, multipurpose dams can address flood control while simultaneously generating hydropower and supporting irrigation. Such integration can significantly reduce costs for each sector and ensure that financial and human resources are allocated efficiently. Cross-jurisdictional and cross-sectoral collaboration creates opportunities to optimise resources allocation and derive mutual benefits
- **Enhance political legitimacy and stability** by involving decision-makers from multiple sectors in project planning and execution. This inclusive approach fosters broader perspectives, ensures diverse viewpoints are considered, and promotes collaborative decision-making

The Nexus approach has gained traction through international efforts, leading to the implementation of the **“Nexus Regional Dialogues (NRD) Programme”** from 2016 to 2023 by the Deutsche Gesellschaft für Internationale

Zusammenarbeit (GIZ) GmbH, Global Water Partnerships - Southern Africa (GWPSA) and the Regional Environmental Center for Central Asia (CAREC). Jointly funded by the European Union (EU) and the German Federal Ministry for Economic Cooperation and Development (BMZ), the programme seeks to identify the most effective institutional arrangements and methodologies/tools to promote and ensure systematic cross-sector coordination in natural resource management. The NRD collaborate with regional partner organisations in Central Asia, Latin America and the Caribbean, Middle East and Northern Africa, the Niger Basin, and Southern Africa.

The NRD unfolded in two phases: **Phase I (2016–2020)** primarily aimed to raise awareness of the Water, Energy, Food (WEF) Nexus concept, develop action plans, and initiate capacity development measures. Building on these outcomes, **Phase II (2020–2023)** focused on integrating the WEF Nexus approach into national and regional governance structures and investment decisions in all target regions. It showcased the added value of the WEF Nexus through demonstration projects and facilitated knowledge exchange and information dissemination via the Nexus Resource Platform (NRP) (www.water-energy-food.org).

1.2 Overall strategy and major milestones/products

Policy dialogues: Institutionalising the WEF Nexus approach in national and regional governance structures

The NRD Programme has carried out **policy dialogues at both regional and national levels** in five geographical areas (Central Asia, Latin America and the Caribbean, the Middle East and North Africa, the Niger Basin and Southern Africa). These dialogues assembled participants from diverse sectors to discuss ideas and collaborate on matters pertaining to the Nexus approach.

The policy dialogues aimed to establish a forum for stakeholders to exchange knowledge, experience, and best practices in integrated natural resource management. In the policy dialogues, the stakeholders also identified policy gaps and challenges while devising practical solutions. Through the policy dialogues, the programme has **effectively integrated the Nexus approach into relevant policy processes related to natural resource management**. Chapters 2.1 through 2.3 delve into the insights gained from incorporating the Nexus approach within regional, national, and local governance systems.

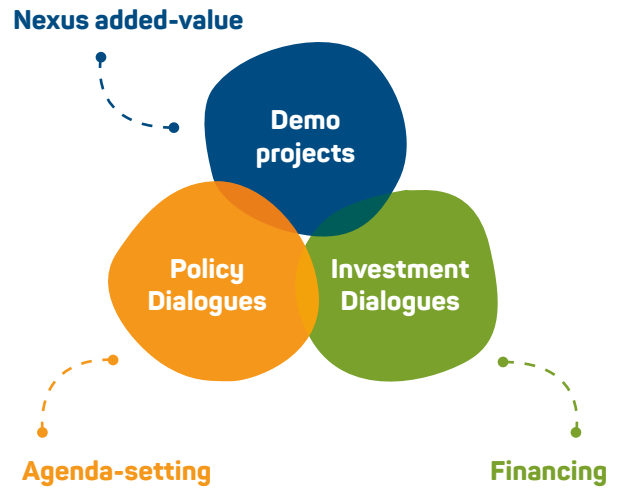


Figure 2: Activities in the five Nexus Regional Dialogues are structured around three main components.

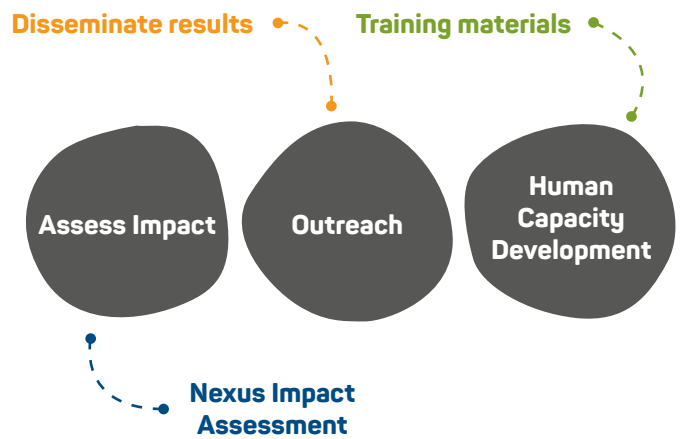


Figure 3: Activities of the Global Nexus Secretariat consist of three core pillars.

In addition, the NRD have formulated specifically adapted **Nexus guidelines and governance structures** for multiple regions. These resources aim to offer direction to stakeholders within these areas on implementing the Nexus approach for natural resource management.

Investment dialogues: Institutionalising the WEF Nexus in investment decisions

Recognising the difficulties to mobilise funding for Nexus projects, the investment dialogues aimed at raising global awareness through webinars and events. The NRD programme facilitated dialogues with public and private investors to showcase how locally implemented projects can contribute to the development of robust WEF Nexus business models. During Stockholm World Water Week 2021, the programme organised webinars involving policy makers, public and private project developers, and financial institutions. The sessions, titled “From Risks to Returns: WEF Nexus Solutions for Climate Resilience”, aimed to encourage cross-sectoral policy making and secure financing for water, energy, and food security. Additionally, a virtual workshop was conducted as part of the “Identifying Integrity Risks and Developing Integrity Guidelines on the WEF Nexus” initiative. Participants in the workshop examined the integrity prerequisites for successful fund mobilisation and pinpointed integrity enablers and obstacles within WEF Nexus Dialogues and WEF Nexus projects. Chapter 2.4 shows lessons learned from the NRD activities aimed at accelerating investment in the Nexus projects.

Demonstration projects: Showcasing how WEF Nexus can be operationalised on the ground

The NRD implemented demonstration projects in all five regions to gain practical insights on impacts of WEF Nexus approaches on the ground. At local level, several initiatives such as business accelerators and innovation labs have been launched and implemented to promote WEF Nexus projects. The projects were designed to demonstrate the benefits of the Nexus approach to natural resource management and to provide practical examples of how the approach can be applied in different contexts. The lessons learned from the demonstration projects are presented in Chapter 2.5. By learning from these experiences, stakeholders can improve the design and implementation of Nexus projects and promote sustainable development in their respective regions.

The NRD have developed standardised methods to assess

Nexus impacts and business models for the demonstration projects it carried out in various regions. These tools are important for evaluating the effectiveness of the projects and for ensuring their long-term sustainability.

WEF Nexus impact assessments are systematic tools that evaluate the potential positive and negative impacts of a project on the interconnected water, energy, and food systems. The purpose of WEF Nexus impact assessments is to identify potential risks and opportunities associated with the project and develop strategies to mitigate negative impacts and enhance positive impacts on the respective sectors. A WEF Nexus impact assessment can help identify trade-offs and synergies between these sectors, ensuring that the project supports sustainable and integrated WEF management. For example, an impact assessment for a water management project would evaluate its impacts on water availability, energy consumption, and food production in the affected area.

A WEF Nexus Business model is a framework used to ensure the long-term success and viability of WEF Nexus projects, by identifying opportunities for resource optimisation, revenue generation, and cost reduction. This model takes into account the interdependent nature of the WEF sectors and can be used to develop sustainable projects such as a solar-powered irrigation system that considers potential savings from reduced water consumption and improved crop yields, while identifying potential synergies with other sectors. Developing such models is important for ensuring the long-term viability of WEF Nexus projects.

Chapter 2.5 illustrates how they have been implemented and what insights can be drawn from them.

Further cross-cutting activities supported the five Nexus Regional Dialogues:

- ➔ Developing standardised methods to assess Nexus impacts – the [Nexus Impact Assessment \(NIA\) Toolkit](#) provides guidelines and practical tools to aid policy processes, as well as a monitoring and evaluation system
- ➔ Increasing [outreach and disseminating results](#) of the NRD activities, i.a. through the [Nexus Resource Platform \(NRP\)](#), an online global knowledge hub for managing and sharing resources on the Water, Energy and Food Security Nexus. The NRP has evolved into a well-known platform to facilitate and promote knowledge exchange and information dissemination amongst the international WEF Nexus community of practice. Beyond that, the NRD programme presented its activities at several international events, e.g. the Stockholm World Water Week, United Nations Framework Convention on Climate Change Conference of Parties (COP) 26, Global Landscapes Forum, International Conference on Sustainable Development, and others
- ➔ [Trainings and WEF Nexus training materials for Human Capacity Development](#), including training modules for Trainings of Trainer (ToTs) and a Nexus Game

The combined effects of all the above mentioned NRD activities have led to an increase in the application of the Nexus approach to planning, policy making, and implementation in countries belonging to the five target regions, as well as an increase in public and private investor interest in Nexus projects (financial institutions, private sector, multilateral and bilateral organisations, national treasuries). The following chapters of this study present good practices and lessons learned, as well as challenges arising while mainstreaming the Nexus approach within governance and investment structures at different levels. The study concludes with recommendations for future Nexus initiatives and application.

Image 1: Application of the interactive Nexus Game in Chile © GIZ



2 STRENGTHS AND GOOD PRACTICES

2.1 Fostering transboundary and regional cooperation with the WEF Nexus approach

The lack of coordination between the water, energy and food sectors is challenging already at the national level – but it even increases in **complexity within the transboundary or regional context** given the “diversity of scales and perspectives, importance of state actors and politics” (Keskinen et al., 2016). Uncoordinated national strategies can lead to friction between riparian and neighbouring countries and intense competition for shared natural resources, affecting livelihoods, agriculture, energy, and ecosystem health. Transboundary river basins can hence be a subject of political dispute. Shared resources, however, can also be a **source of cooperation**. The potential for transboundary or regional cooperation can be enhanced through a coordinated approach to managing the water, energy and land resources in a basin or region, focusing on the joint benefits derived by multiple sectors in riparian countries through reducing trade-offs, improving governance, and increasing efficiency and synergies.

A Nexus approach in a transboundary or regional context can facilitate policy coherence and co-management among the involved sectors and states through a **common vision for resource use, multi-level governance and benefit-sharing between the riparian countries**. By leveraging existing entry and anchoring points in regional institutions, such as river basin organisations (RBO) or regional working groups, the Nexus approach can be institutionalised in regional governance structures and investment decisions. The institutionalisation of the Nexus approach can facilitate the identification of policy measures and actions to alleviate tensions or conflicts and assigning clear responsibilities and mandates.

The following three case studies illustrate good practices of cross-sectoral policy making, project design and planning at the transboundary and regional level within NRD regions.

Implementing a cross-sectoral approach in basin programmes and projects through the Nexus Guideline *Case Study from the Niger Basin*

In the Niger Basin, NRD programme supported the Niger Basin Authority (NBA) in facilitating national and regional dialogue events in its nine member states to discuss how cross-sectoral coordination could facilitate transboundary water management in the basin through, for example, the use of an integrated approach in project development processes for joint infrastructure projects (e.g. multipurpose dams). During the dialogues, national stakeholders also engaged in discussions regarding existing water, energy, and agriculture policies and investments, which served to enhance their capacities in planning, financing, policy development, and implementation. An interactive Nexus board game (so-called Nexus Game) helped simulate transboundary challenges and resources allocation, financial mechanisms and the economic potential of WEF Nexus projects, as well as the role and mandate of the NBA in developing programmes and projects. As a result of the policy dialogues and capacity development measures, the NRD programme helped develop **formal guidelines on the integration of the WEF Nexus approach**. Following a review

process on the draft guidelines involving representatives of all NBA member states and the Committee of Technical Experts of the NBA, the Council of Ministers officially approved the “Guidelines for the integration of the Water, Energy, Food Security, and Environmental Sustainability Nexus approach in the development of sustainable development programmes and projects in the Niger Basin” as an official document of the NBA in December 2022.

The transboundary Nexus guideline is the first of its kind and sets a **benchmark for similar transboundary organisations**. The comprehensive guideline specifically outlines principles for assessing WEF Nexus criteria in development programmes and projects, building upon the established principles of the NBA Water Charter and Integrated Water Resources Management (IWRM). Within the NBA context, the guideline allocates roles and responsibilities to various actors and organs, fostering improved governance coordination. It contains clear provisions for the involvement of different stakeholders, such as local authorities, the private sector, the media, and development partners, in the process of integrating the WEF Nexus approach. Additionally, the guideline sets out two methodological approaches, one quantitative and one qualitative,

to support policy and decision-makers in evaluating new projects. The quantitative approach, a simplified assessment, is applied to all projects, while a detailed assessment is strongly encouraged for projects with potentially significant adverse effects. By incorporating capacity building measures and promoting regional dialogue on the WEF Nexus, the guideline aims to facilitate the integration of this approach in development programmes and projects across the Niger Basin. A specific geographic information system (GIS)-based software supports the application of the methodologies in the basin.

The regional Nexus guideline holds the potential to strengthen links between existing NBA legal documents by promoting a comprehensive approach to managing the

Niger Basin's resources, building on established principles, defining stakeholders' roles, and providing methodological approaches. The guideline is intended to inform the upcoming NBA Operational Plan for 2024-2032, with the objective of enhancing the feasibility and bankability of proposed projects. By doing so, the Nexus guideline aims to **foster a balanced development approach within the basin**, ensuring that investments in one sector contributes to overall economic growth without causing substantial harm to other sectors.



Image 2: Application of the interactive Nexus Game in the Niger Basin © GIZ



Image 3: Regional WEF workshop-SADC 10th Multistakeholder Dialogue held in Lesotho, in September 2022 © GIZ

Advancing Sustainable Development in SADC: The Role of the WEF Nexus Governance Framework Case Study from Southern Africa

To advance sustainable development, integration, and collaboration among the Southern Africa Development Community (SADC) Member States, the SADC Secretariat adopted the SADC WEF Nexus governance framework as a component of its regional transformation process. The framework, developed by the Global Water Partnership - Southern Africa (GWPSA) within the NRD programme, received approval from the ministers of all 16 SADC member states in October 2020. To develop the framework, a multi-stakeholder consultative process was undertaken, involving a number of analyses and stakeholder engagements at regional and country level. The framework aims to enhance WEF Nexus governance in the region by strengthening institutional coordination between the three sectors and aligning implementation of sectoral policies, as well as facilitating decision-making to ensure WEF security for integrated regional development.

The SADC Nexus framework is an organising mechanism aimed at fostering coordination between the water, energy, and food sectors to achieve their respective securities and improve resource use efficiencies. This was accomplished through the establishment of various coordinating

committees and working groups at different levels, such as the Joint WEF Ministers' Committee, Joint WEF Technical Committee, and SADC WEF Working Group. The framework also facilitates policy alignment and coherence, promoted investment, and managed trade-offs between sectors.

Building upon pre-existing SADC structures, the regional framework expanded the former water dialogue platform to include the energy and food sectors. A SADC WEF Working Group was established both to support the framework's development and as a framework output, providing a regional mechanism for technical coordination between the three sectors. Success factors were the high level of political support and ownership at SADC's Council of Ministers level, continuous multi-stakeholder dialogues, and a common understanding of integrated natural resource management. Furthermore, the WEF Nexus approach was incorporated into existing national planning processes, such as Nationally Determined Contributions.

Reviving Tuyamuyun Hydroelectric Complex: Sustainable Sediment Reuse for Economic and Environmental Benefits

Case Study from Uzbekistan and Turkmenistan, Central Asia

The Tuyamuyun Hydroelectric Complex (THC) is a transboundary water and energy infrastructure located on the Amu Darya River, bordering Uzbekistan and Turkmenistan. The THC plays a vital role in allocating water resources among riparian countries by regulating the lower stream of the Amu Darya. As such, it provides 1) water to 425,000 ha of irrigated land in Turkmenistan and 779,300 ha in Uzbekistan; 2) electricity to Uzbekistan; and 3) drinking water to Khorezm Region and Republic of Karakalpakstan (Uzbekistan). However, the massive **sediment build-up in the reservoir** posed a significant threat to WEF Nexus security for over five million people in Uzbekistan and Turkmenistan. Without intervention, the main channel reservoir capacity of the THC could be completely lost by 2040 in the territory in the lower part of Amu Darya River, where there is no other alternative for drinking and irrigational water. **Restoring the storage capacity of the Tuyamuyun** through dredging and reusing materials such as gravel, sand, silt, and clay could reintroduce these valuable resources into the economies of Uzbekistan and Turkmenistan. The global construction industry consumes approximately 50 billion tonnes of sand and gravel each year, with demand expected to increase by 300% by 2060 in low to middle-income countries. However, the world faces a shortage of sand, leading to widespread illegal extraction from rivers and marine ecosystems. By reusing the sediments accumulating in the THC, sales revenues could be generated.

The potential gross profit from selling sediment for construction purposes was anticipated to offset the costs associated with maintenance dredging and sediment disposal. **Reusing sediment was not only economically ad-**

vantageous but also environmentally responsible. Sand extraction from natural ecosystems can result in negative impacts, including erosion, salination, and broader effects on biodiversity, leading to serious social, economic, and environmental consequences. As such, this demonstration project explored how to solve traditional challenges with an innovative approach helping to secure WEF Nexus security in the long run. Based on the results of the demonstration project, an investment project proposal was developed calling for six million USD to implement a pilot project over a period of five years covering the cleaning and recycling of sediments with the engagement of the private sector, entailing the preparation for the massive cleaning after the results of the pilot phase.

The NRD programme played a vital role in pushing forward the implementation of this transboundary demonstration project by developing the scope project in consultation with riparian countries and engaging and coordinating the work of four consulting firms and six national experts. In addition, NRD established a Technical Working Group consisting of nominated members from Uzbekistan and Turkmenistan to consult the riparian countries on joint management of the reservoirs and promote the dialogue on management of the transboundary water resources. The innovative idea the NRD programme brought to the region was to **treat the sediments as a natural resources and commercial product, benefitting to the public and private sectors while increasing WEF security.** The idea that firstly stunned the stakeholders as a unnormal practice later received acknowledgement with the developed analytical works and pilot commercial products, backed up by global practice. Such projects promote a circular economy and foster transboundary cooperation, strengthening collaboration on the political and governance levels. The THC project could serve as a pioneering model, showcasing the importance of reservoirs in providing a sustainable supply of sand, preserving vital resources, and fostering regional collaboration.

Image 4: The Tuyamuyun Hydroelectric Complex © GIZ



LESSONS LEARNED

Policies across sectors and states at different levels are linked in complex ways. Nexus assessments can help understanding interlinkages to identify synergies and mitigate trade-offs as a basis for designing joint policies and projects. As shown within the NRD programme in the Niger Basin and Southern Africa, dialogue processes at the national and regional levels can support such assessments and assist governments in finding a common ground for cooperation. Furthermore, it is important to understand the overall development objectives countries and their ministries want to achieve and which incentives encourage them to engage in cross-sectoral work. The same applies to other stakeholders involved including relevant financial institutions and private sector entities, as well as local beneficiaries. Developing Nexus guidelines help to simplify such processes at transboundary levels, encouraging fair and equitable sharing of the benefits derived from shared resources and joint projects.

A key success factor behind NBA and SADC's adoption of their Nexus Guidelines was the institutionalisation of the Nexus approach within governance structures and investment decisions. This was facilitated by using existing entry points such as river basin organisations, as they already bring together relevant actors from different sectors. Moreover, cooperation and collaboration between countries proved to be essential in effectively implementing the Nexus approach in a transboundary context, which involved building trust, fostering dialogue, and establishing effective communication channels among all parties.

Economic actors, such as businesses, investors, and financial institutions also play a key role in institutionalising the Nexus approach in a transboundary or regional context. This involves engaging with businesses that promote sustainable practices and supply chain management supporting a Nexus approach, such as the sale of sediment done by the Tuyamuyun Hydroelectric Complex. Investment in cross-border infrastructure, such as water treatment plants or transmission lines, can help to facilitate the efficient use and sharing of resources between countries. However, it is important to ensure that the benefits of such infrastructure are shared equitably among all parties involved.

2.2 Mainstreaming the Nexus into national policies, strategies, and activities

Institutionalising the Nexus approach at national level requires coordination and **integration across sectors (horizontal) and levels of government (vertical)**, as well as investment decisions that consider resource use and demand of multiple sectors simultaneously. Mainstreaming a Nexus approach into national policies, strategies and activities involves developing a shared understanding and principles, thereby paving the way for a continuous process of changing values and perception, rather than viewing the Nexus as an outcome (Weitz et al., 2017). This can be achieved by:

- improving communication between decision-makers and sectors, e.g. through multi-sectoral working groups or dialogue and communication platforms
- adjusting the institutional structure to allow for multi-sectoral decision-making
- making changes in the procedural instruments, such as rules and standards for decision-making, e.g. through national Nexus guidelines and Nexus governance frameworks
- conducting capacity building and training programmes for government officials and stakeholders to enhance their understanding of the Nexus approach and its implementation
- promoting research and knowledge sharing on Nexus-related topics to inform evidence-based decision-making and policy formulation
- integrating the Nexus approach into existing national monitoring and reporting systems through the development of suitable metrics across sectors

The first step would be to **identify any existing cross-sectoral cooperation structures, rather than creating costly new arrangements**. If such structures already exist, they should be strengthened in order to promote the willingness to cooperate and trust across groups of actors belonging to different sectors and government levels – otherwise, such structures need to be created. Possible entry points for institutionalising intersectoral coordination at national level can be:

- Choosing one sector, e.g. the water sector, especially if programmes establishing an IWRM already exist or when a Nexus approach makes sense at the river basin scale – and building on the existing governance structures to bring in a Nexus approach. Depending on the national context, ministries working across sectors (e.g. ministry of planning) or entities above the sectoral level (e.g. prime minister level) could be chosen alternatively
- National processes established to fulfil international commitments such as the SDGs, NDCs, or climate change adaptation strategies and plans, as they will necessarily involve coordinating decisions from different sectors
- New infrastructure projects (such as multi-purpose dams) or policy instruments (e.g. Payment for ecosystem services) that require involving multiple sectors and thus can be a great opportunity to show how coordination between those sectors can help leveraging synergies and addressing trade-offs that might come up
- The following case studies illustrate good practices of how to mainstream the Nexus into national policies, strategies, and activities in the NRD regions

Enhancing Intersectoral Coordination for Sustainable Water and Energy Management in Jordan

Case study from Jordan, MENA Region

The Energy Efficient Water Sector (EEWS) project is an initiative implemented by GIZ in collaboration with the Ministry of Water and Irrigation in Jordan. The project aims to **reduce energy costs and greenhouse gas emissions associated with water supply and distribution** by improving energy efficiency and reducing energy consumption in the water sector in the country. EEWS in Jordan was supported by the NRD programme with technical expertise and financial support. At the same time, EEWS facilitated the development of the NRD programme's Nexus governance framework. Anchoring on an existing German-Jordanian project which had already established strong intersectoral coordination structures in the country proved to increase efficiency and impact to mainstream the Nexus at national level.

The collaboration between NRD and EEWS built on the existing **Water-Energy Technical Working Group, including high-level representatives** from the Jordanian Ministry of Energy and Ministry of Water and Irrigation. This working group supports projects aiming for win-win situations both for the energy and the water sector, such as microturbines, pump storage, etc. The group was also instrumental in supporting the establishment of the Water-Energy-Food-Environment (WEFE) Nexus governance framework that defined the structures for the collection of intersectoral data, the design of projects, and ultimately the alignment of sector strategies. The framework also contributed to a WEF Nexus indicator in the revised Water Strategy of Jordan 2022–2040.

The developed governance framework resulted from an iterative engagement process involving multiple rounds of interviews, as well as knowledge exchange meetings with diverse cross-sectoral stakeholders. The initial phases of engagement were focused on gaining insights into the specific challenges faced by each sector, identifying barriers to cross-sectoral cooperation, and gathering suggestions for improving governance structures and mechanisms. The feedback received was shared during engagement meetings, which involved key stakeholders and played a role in shaping the proposed **Water-Energy-Food-Environment (WEFE) governance framework**. It is proposed that improved WEFE Nexus governance can be achieved through a well-established WEFE entity with a robust mission and authority while collaborating with the Ministry of Finance and Ministry of Planning and In-

ternational Cooperation and other relevant ministries and entities. Drafts for mandates, reporting mechanisms, and decision-making flows for WEFE Nexus project planning and implementation have been developed, for discussion at the upcoming ministerial workshop.

The implementation of a WEFE Nexus governance framework fosters a **comprehensive, system-level approach**. This approach is guided by collective outcomes that contribute to achieving national-level goals, rather than focusing solely on sector-specific objectives. It also contributes to enhanced policy coherence, leading to better decision making and alignment of policies. Last but not least, it provides a platform for better stakeholder participation and engagement, ensuring that all needs and concerns are considered in decision-making processes.

The development of a **Photovoltaic (PV) Roadmap** exemplified further collaboration between EEWS and the NRD programme. The PV Roadmap project underscores the significance of renewable energy technologies as a method to reduce Jordan's water sector operating expenses – of which energy costs represent around 50% – and thus improve operational management in the sector. The PV Roadmap is a detailed techno-economic feasibility study that investigates the most economical and preferable business model for implementation.

Implementing large-scale PV projects for the water sector is nearly impossible due to a cabinet decision which implies restricting the maximum allowable capacity of each PV system. The roadmap takes this into consideration, besides other criteria such as high land availability and ownership of the available area by the water sector. This approach resulted in an estimated PV potential of 32.39 MWp (50.53 GWh/year) in 46 water facilities sites, which is equivalent to a 17,200 tons CO₂ emissions reduction in the first year of operations.

The development of PV Roadmap is directly contributing towards the acceleration of achieving the water sector's policy targets 2022–2040. It represents a successful collaborative project between both water and energy sectors, integrating renewable energy sources (which are less costly in the long-run) and increasing the share of renewables in the energy mix at both sector and country levels. In June 2023, it was announced that the PV Roadmap is part of a 250 million USD financing agreement of the World Bank and the Jordanian Ministry for Planning and International Cooperation dedicated to water efficiency projects.

**Promoting Climate Resilience and Sustainability:
The WEF Nexus Investment Screening Tool**
*Case Study from Lesotho and South Africa,
Southern Africa*

Under the NRD programme, SADC developed a WEF Nexus investment project screening tool and a prioritised project list to identify concrete cross-sectoral investment projects. Projects were initially screened for WEF Nexus relevance with a decision-tree. The screening tool then used WEF Security dimensions and Water-Energy-Land Resource Efficiency dimensions to evaluate project impacts through a multiple criteria decision analysis. This tool helps decision-makers identify and prioritise projects that optimise resource use, promoting integrated planning and sustainable, resilient projects for regional well-being.

Lesotho and South Africa are currently developing funding concept notes for a Climate Resilience Project to be submitted to the Green Climate Fund (GCF). The project will address land degradation and reduce the effects of climate change on agriculture, which have wide ranging impacts in the region. The National Department of Forestry, Fisheries and the Environment of South Africa led the process, supported by GWPSA, United Nation Convention to Combat Desertification (UNCCD) and the Agricultural Research Council under the UNCCD Land Degradation Neutrality – Transformative Projects and Programmes initiative. Through this initiative, UNCCD is supporting countries with their national Land Degradation Neutrality (LDN) target setting processes, including setting national baselines, targets, and associated measures to achieve LDN.

**Empowering Future Decision Makers: The Nexus Game
and its Impact on Education Programmes**
Case Study from Central Asia

As part of the NRD programme in Central Asia, members of the Network of Academic Societies and representatives of scientific institutes in Central Asia discussed opportunities for joint intersectoral research and initiatives to integrate the WEF Nexus approach into education programmes in universities. Besides educational modules and studying practical cases, a particular focus was put on gaining practical experience. For this, an interactive social simulation (“Nexus Game”) was chosen as a suitable capacity development approach. The Nexus Simulation Game was developed by the Polish organisation Centre for Systems Solutions in collaboration with the International Institute for Applied Systems Analysis and the “Sustainable Energy for All” Initiative. The game places participants in the roles of ministries with competing interests for water to satisfy national objectives. In this situation, players were encouraged to think outside the box to negotiate complex situations for devising regulations and policies that satisfy multiple demands for water while staying in balance with environmental limits. Within the framework of the NRD, CAREC introduced the Nexus Game in the Central Asian region in 2018. CAREC later delivered the ToT to public academies, universities, academies, basin organisations, media and distributed the Nexus Simulation Game to them for further integration. 17 academies and universities from five Central Asian countries expressed their interest to introduce the Nexus Game in their existing syllabus. The Nexus Game is now regularly practiced at regional trainings for universities from all five countries thus contributing to building capacities and awareness of future decision makers about WEF interlinkages and solutions.

Image 5: Application of the interactive Nexus Game in Central Asia © GIZ



Revamping Tajikistan's Pumping Stations: Energy-Efficient Technologies for Improved Food Security Case Study from Tajikistan, Central Asia

Over 90% of Tajikistan's territory is occupied by mountains, which requires mechanically lifting water from rivers and canals to irrigate farmland. The energy demand and costs of old and energy-intensive pumping stations threatened national food security. To address this challenge, NRD implemented a demonstration project for the Agency of Land Reclamation and Irrigation (ALRI) of Tajikistan, aiming to increase energy efficiency through digitalisation and monitoring of electricity consumption at pumping stations and modernisation of the Golodnostep pumping station in the Sughd Province of Tajikistan. To facilitate the communication between two competing agencies, NRD established a Technical Working Group (TWG) between ALRI and the Ministry of Energy and Water Resources of Tajikistan to consider the interest of two sectors.

Following a comprehensive audit of the existing metering, significant improvements in energy efficiency were observed at the upgraded pumping stations, leading to reduced energy consumption and operational costs. In addition, Grundfos (international manufacturer of the pumping stations) conducted technical audits through innovative method as *pampheromography* at operating aggregates in two pumping stations. The energy audits revealed lower water pump performance than what was declared and indicated in the technical specifications.

Based on the results of the demonstration project, two investment proposals were developed:

- 1) introduction of Automated Power Consumption Monitoring System at pumping stations (APCMS-PS) with a total cost of 764,500 EUR. Considering the estimated labour, fuel and energy savings, the system could allow savings of up to 100,680 EUR annually, thus setting the payback period at 7.62 years
- 2) modernisation of Golodnostep Pumping Station with aggregates using energy-efficient technology with a total cost of 32 million USD

Following the presentations by the ALRI and NRD, both investment proposals were accepted. The Ministry of Finance of Tajikistan allocated a budget of 450,000 USD to ALRI for the installation of smart metering and an online billing system in pumping stations. The second investment proposal was selected by the Eurasian Fund for Stabilisation and Development of the Eurasian Development Bank, financing an amount equivalent to 32 million USD for 20 years. The project is expected to run for five years. This project also served as an example for other regions in Tajikistan, highlighting the benefits of adopting energy-saving technologies and promoting intersectoral coordination between energy, water, and agricultural sectors. Consequently, the successful implementation of this demonstration project has contributed to improved national food security, resource management, and intersectoral cooperation, paving the way for similar initiatives in the future.

LESSONS LEARNED

Institutionalising the Nexus approach at national level requires coordination and integration across sectors (horizontal) and levels of government (vertical). It furtherly requires political commitment and support at the highest levels of government. This commitment should be reflected in policies, regulations, and investment decisions. To achieve this, it is necessary to mainstream the Nexus approach into decision-making processes and governance arrangements to promote policy coherence through optimal policy mixes and investment planning across sectors based on shared understanding and principles. This can be supported by governance frameworks such as cross-sectoral coordination bodies or guidelines for integrated planning and decision-making that account for the interlinkages and trade-offs between different sectors.

This can be achieved by establishing cross-sectoral structures such as Technical Working Groups (TWG) that involve representatives from different sectors to address particular issues. Such a TWG can provide technical expertise, raise awareness, and facilitate cooperation between different sectors. In order to have more impact, such TWG should have political legitimacy given through, for example, mandates of the ministries involved.

Another entry point is to incorporate Nexus thinking into processes designed to fulfil national cross-sectoral policy goals, such as Nationally Determined Contributions (NDCs). This involves setting targets for reducing greenhouse gas emissions and improving the efficiency of water and energy use, as well as identifying specific policies and programmes that will support the implementation of a Nexus approach.

Successful cross-sectoral cooperation and coordination in governance mechanisms requires a high level of trust between the actors involved to engage in a meaningful exchange of interests and to ultimately agree on a joint planning process. It is particularly important for all sectors to understand how interventions influence different parts of the WEF Nexus chain and come to joint solutions that benefit all sectors alike.

Capacity building programmes are necessary to build awareness on the benefits of integrated planning and decision-making and to train public administration officers suitable governance mechanisms, as it was done in Central Asia. Moreover, demonstration projects are useful in showcasing the benefits of the Nexus approach and building political support for its institutionalisation (see also Chapter 2.4). These projects should be designed to reflect the local context and involve stakeholders from multiple sectors.

2.3 Strengthening the capacities of local governance actors

Cities are major consumers of water, energy, and food resources due to their dense populations, economic activities, and infrastructure demands. **Municipalities, due to their proximity to the communities they serve, municipalities can influence resource consumption and promote sustainable practices at the local level.** By empowering municipalities to run environmental projects within the WEF Nexus framework through decentralised schemes, they can address challenges based on local context and priorities. Working with municipalities can be an effective way of increasing consumers' awareness of the importance of using natural resources efficiently and at the same time help explain related national policies.

Successful implementation of the Nexus approach at the local level requires local decision-makers from government and non-governmental organisations to understand the specific interconnections between water, energy, and food sectors in their locality. **Capacity building and educational initiatives can develop this understanding and promote integrated solutions** that maximise resource efficiency, environmental sustainability, and socioeco-

nomie benefits. Involving local stakeholders ensures context-specific, culturally appropriate solutions that garner support and adoption. Securing political support from higher administrative levels is crucial for allocating resources, establishing governance structures, and developing policies that promote the Nexus approach in local planning and decision-making processes (Jha, 2021).

The Nexus approach at the local level necessitates a **consistent legal framework for the water, energy, and food sectors across different levels of government. A cohesive legal architecture enables public and private organisations to plan and implement activities** considering the interconnectedness of these sectors. However, coordinating efforts can be challenging due to the complex legal framework and varying degrees of decentralisation. Therefore, strengthening the capacities of local government organisations and decision-makers to coordinate both horizontally and vertically is crucial to ensure that trade-offs and synergies in the Nexus approach are effectively addressed at the local level.

Empowering Municipalities through the Nexus Approach: The Role of the MINARET Initiative

Case study from Jordan, Tunisia, and Lebanon, MENA Region

The MINARET Initiative was implemented by the Royal Scientific Society in Jordan (RSS) in close coordination with NRD MENA and aimed at strengthening local communities' resilience to climate change by strengthening public service delivery related to the WEF sectors at local level.

The MINARET Initiative was carried out in three phases. In phase I, RSS accompanied five municipalities in the MENA region (two in Tunisia, two in Jordan and one in Lebanon) to carry out baseline assessments. Based on this evidence-based foundation, phase II was focused on providing technical assistance and organising policy

dialogues to support the municipalities in developing integrated Sustainable Energy and Climate Action Plans, which also looked at water and agricultural issues. As a result, the five municipalities became members of the international network of the Covenant of Mayors, which enables them to benefit from valuable information exchanges with municipalities the world over. In the final phase, which ran parallel to phase II, RSS provided a financing expert to train municipalities in finance readiness and inform them of financing opportunities. The initiative ended in a regional event in which the five municipalities each pitched Nexus projects in front of an audience consisting of regional initiatives targeted at WEF security and/or strengthening local governance structures.

Strengthening Female Empowerment by Engaging Local Communities for the WEF Nexus: Solar Pumping Irrigation System

Case Study from Niger, Niger Basin

In Kollo, Niger, the NRD programme has implemented the WEF Nexus approach in collaboration with the national coordination body for Niger River basin users. By providing a solar pumping irrigation system (SPIS) to a women's farming cooperative, the project addressed interdependencies between water, energy, and food resources. This approach promoted sustainable resource management across all three sectors, increasing the climate resilience of the cooperative. The innovative SPIS system comprised

solar-powered pumps and several water retention basins for storage. It enabled the cooperative to maintain their 1.2-hectare vegetable gardens throughout the year, even during extended dry spells caused by climate change.

The project provided capacity building for the women's cooperative through training on agricultural techniques, sustainable water management, and irrigation system maintenance. This led to increased water self-sufficiency, sustainable resource management, and enhanced climate resilience for the cooperative. Additionally, the project promoted collaboration and joint decision-making among cooperative members.



Image 6: The solar pumping irrigation system at the women's farming cooperative in Kollo © GIZ

LESSONS LEARNED

Working closely with municipalities or other community representatives is crucial for implementing Nexus projects at a local level. Allowing local governments to set their own development priorities at the provincial or district level ensures that local needs are taken into account in broader economic and sector considerations. Additionally, establishing new or building on existing appropriate local governance structures, including interdepartmental or interagency committees or cooperatives, will facilitate the integrated management of WEF resources.

Developing local capacities is essential for municipalities to successfully implement environmental projects within the Nexus framework. This can be achieved by offering training and technical assistance to municipal staff, as well as cultivating partnerships with academic institutions and other organisations. Through high-level policy dialogues between municipalities and national ministries, the MINARET initiative enabled stakeholders from different governance levels to better understand each other's challenges and opportunities. This in turn allowed the participating municipalities to get a better overview and understanding of potentially suitable financing programmes that already exist at national level and that could be tapped for their Nexus projects.

Community engagement plays a critical role in the success of the Nexus approach at the local level. By raising awareness about the importance of WEF resources and involving community members in project development and implementation, municipalities can foster a more robust connection to these initiatives. On the other hand, governance capacities of the municipalities on managing land and natural resources need to be strengthened. In particular, land tenure questions need to be clearly settled and both the municipal representatives and users should know and agree on the management of the soil or the extraction of water. The WEF Nexus project in Kollo, Niger, illustrates the significance of community engagement in the success of the Nexus approach at the local level. By providing a solar pumping irrigation system to a women's farming cooperative and offering capacity development, the project not only ensured sustainable resource management but also fostered collaboration and joint decision-making, strengthening the community's connection to the initiative.

2.4 Accelerating investment in Nexus projects

Demonstrating the Economic Added Value of Nexus solutions

Integrated approaches for Nexus projects and solutions can attract investment and are expected to even increase long term returns on investment opportunities. This results from the long-term sustainability of integrated projects and the nature of their income-generating activities. Income-generating activities refer to endeavours that create a steady flow of revenue for the involved parties, such as the sale of agricultural products or provision of services like clean energy access. Examples include small-scale solar-power systems that generate income through selling surplus electricity, or sustainable farming practices that improve crop yields and provide a stable income source for local communities. Nexus solutions often come with added economic value as they look at solutions more holistically, harness cross-sectoral synergies and avoid (unintended) externalities to other sectors. Nexus projects are also expected to have a bigger overall impact because social and environmental externalities are better integrated into their design and their benefits are shared across sectors. However, the clear added value of Nexus approaches needs to be demonstrated in order to accelerate investment in Nexus projects, as compared to traditional, sectoral approaches. One tool that can be employed for this purpose are cost-benefit analyses (CBA). The NRD programme developed a Nexus Impact Assessment (NIA) Toolkit that includes a Nexus Cost-Benefit Analysis: this tool compares costs to benefits considering socio-economic and environmental impacts in quantifiable and monetary values as far as possible. It serves as a decision-making tool for project development and investment purposes.

Mobilising finance to implement Nexus solutions

To accelerate investments in Nexus projects, it is also important to identify which financing sources are available to support multi-sectoral projects and how a Nexus approach helps mobilise financing. As part of the NIA Toolkit of the NRD programme, the RES4Africa Foundation (RES4Africa, 2022) developed a financing mapping study that reviews over 50 international, national and regional financing products and instruments provided by public and private actors for WEF projects with a regional focus on the Niger Basin countries and the MENA region.

The results show that grants and concessional loans were the most common types of funding offered to support WEF Nexus projects by financing institutions, followed by equity. However, the majority of the funds lack Nexus-specific targets. The study also highlights how WEF projects are perceived to be small-scale projects, such as irrigation systems, off-grid cold storage technologies or clean cooking. In these cases, sectoral financing mechanisms can be an entry point to accelerate investment in Nexus solutions. Establishing WEF-specific funding criteria within existing financing mechanisms would ultimately help reducing fragmentation of funding and facilitate financing of cross-sectoral approaches.

At the level of policy actions and plans, an important pre-condition to plan Nexus investments and to access adequate financing is greater coherence to build common understanding and mutual trust (United Nations Economic Commission for Europe (UNECE), 2021). Capacities of institutions need to be strengthened as their understanding of how the financing of multisectoral projects work may be limited and attention to multisectoral solutions is rather recent. However, if the political will to cooperate and coordinate is given, then it can motivate investors to engage with Nexus projects and thus contribute to closing financial gaps.

The national and regional dialogues led to the formation of institutional structures such as the national WEF Nexus TWGs that are able to identify investment opportunities and to support them by demonstrating the business case for WEF Nexus projects. More specifically, the TWGs supported the preparation of stakeholder and investment opportunity mappings, preliminary country assessments, identification of projects to generate a working draft pipeline of projects, scoping calls with potential investors, pre-feasibility studies, and project proposals.

The case studies below show how NRD supported demonstrating the business case of promising WEF Nexus solutions, helped innovative WEF Nexus approaches come to market and mobilising finance to implement Nexus solutions.

Demonstrating the Business Case of WEF Nexus Projects: A Cost-Benefit Analysis
Case study from Peru, Latin America

In the *San Pedro de Casta WEF Nexus project* in Peru the added value of the Nexus approach was demonstrated within the NRD programme. The community in San Pedro faces several challenges related to water, including diminishing water resources that are available for growing food and feeding livestock, which has resulted in growing numbers of malnutrition and decreasing livelihoods of community members. The project hence focused on **improving food, water, and energy security in the San Pedro de Casta community**, located near Lima in the Andes, through the rehabilitation of an **ancestral lagoons**, the establishment of a **bio-orchard**, a **composting facility**, as well as a **solar-powered guinea pig rearing yard** (guinea pigs being a common food supply in Peru and other Andean countries). The CBA of the project, part of the NIA Toolkit, focused on the assessment of enhanced incomes that were expected as a major project outcome. As the WEF Nexus project infrastructure had not yet been in-

stalled at the time of the cost-benefit analysis, the expected future impacts had to be quantified using project documentation and expert interviews, while the counterfactual ‘without-project’ baseline income was assessed using a household income survey. While limited in scope (only focusing on improvement of income), the CBA demonstrated that the project is expected to produce net benefits considering a 30-year period (using a 4.0% discount rate), whereby **expected benefits will amount to approximately USD 2.5 for every dollar invested**. The project process and outcomes have been shared and have gained considerable interest among a number of similar communities in the region.

While this specific economic cost-benefit analysis was an important step, future assessments should also account for additional benefits that this Nexus projects produce, including improved disaster risk resilience through improved groundwater security or improvement of community members’ health, to make the case for Nexus projects even more compelling.

Image 7: The solar powered guinea pig rearing yard in San Pedro de Casta © GIZ



**Empowering WEF Nexus Start-ups:
Accelerating Innovation and Impact**
Case Study from the Niger Basin

The International Institute for Water and Environmental Engineering (2iE), within the framework of the NRD programme, organised a **competition between high-impact start-ups and companies operating within the WEF sectors in the nine NBA Member States**. Out of 160 applicants, 12 outstanding start-ups were selected based on the WEF Nexus selection criteria toolbox, which identified projects that foster positive synergies across the three WEF sectors without adverse effects.

These 12 start-ups participated in a **five-day WEF Nexus Accelerator Bootcamp** at the 2iE Campus in Ouagadougou, Burkina Faso. The bootcamp included workshops, training, and individual coaching on building successful

business models, entering the market, and supporting fundraising efforts. Participants learned about investor expectations, developed impactful pitches, and connected with potential investors. RES4Africa delivered a presentation on demonstrating the economic value of Nexus projects and mobilising financing for their implementation based on the RES4Africa study which is an integral part of the financing mapping tool of the NIA Toolkit developed by the NRD programme.

The participating start-ups showcased their business models and ideas, which were centred on various integrated aspects of the WEF Nexus, particularly emphasising solar power solutions, natural fertilisers, and digitalisation. Examples of these innovative concepts included transforming agricultural waste into natural fertiliser and biochar, manufacturing and installing solar-powered products such as refrigerators and solar irrigation kits and operating a digital platform for crowdfunding and technical support aimed at agricultural projects.

Building on the **success of the WEF Nexus Accelerator in the Niger Basin**, a grant agreement is currently being developed to create a WEF Nexus Innovation Lab that will involve youth entrepreneurs from the Latin America and Caribbean region, further expanding the project's impact.

Image 8: Members of one of the contesting start-ups at the bootcamp © GIZ

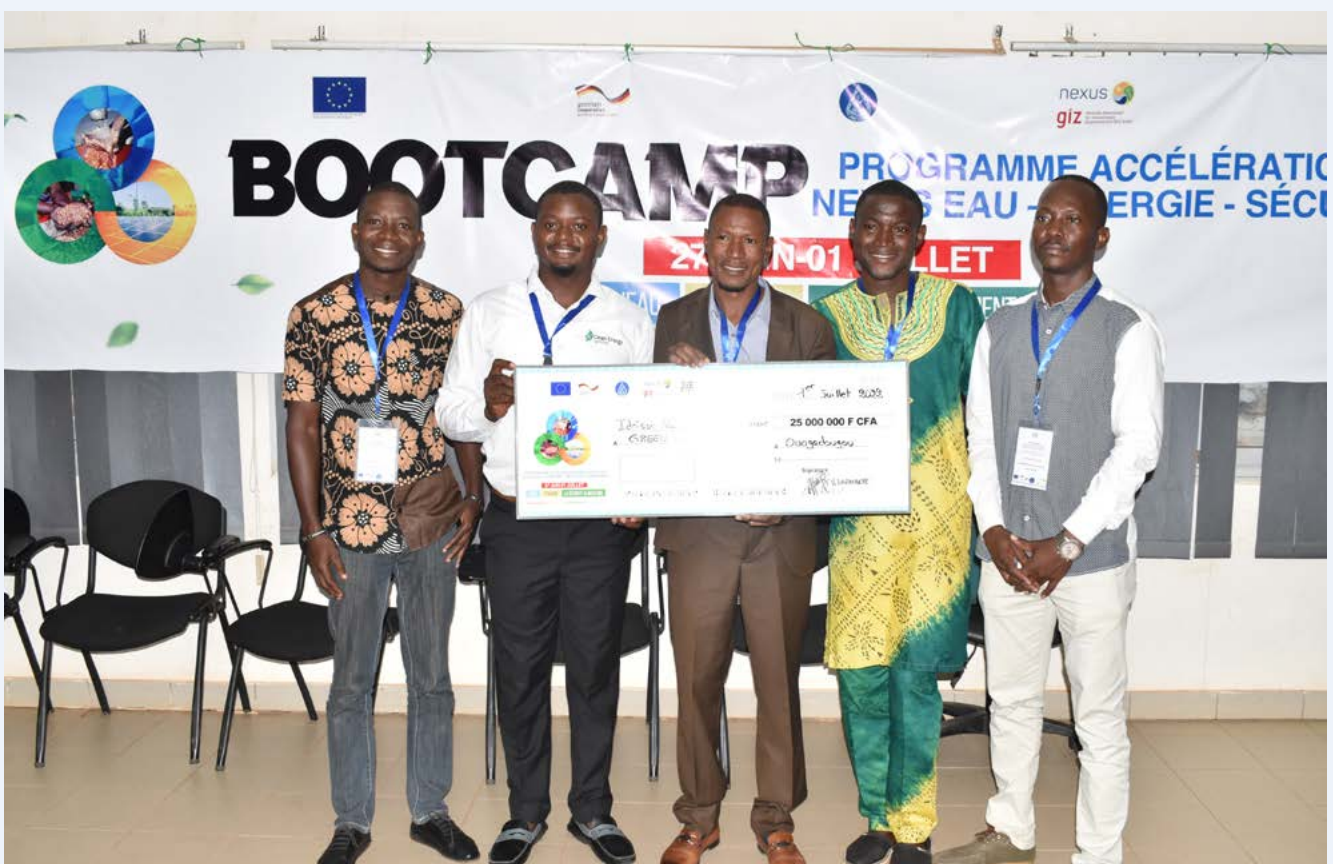




Image 9: Dr. Victor Kongo
GWP-Tanzania Executive Director
speaking at the country's
WEF Nexus Dialogue
© GWP Tanzania

**SADC’s WEF Nexus Investment Project Evaluation:
Fostering Multi-purpose Water Infrastructure Solutions
Case Study from Southern Africa**

SADC fostered a conducive environment to facilitate implementation of Nexus investment projects, with a focus on multi-purpose water infrastructure. For this purpose, SADC designed a WEF Nexus Investment Project Evaluation and Appraisal Tool, which was employed in the assessment of 15 investment projects.

The tool evaluated projects for WEF Nexus using a decision tree model based on the question of whether they contribute to better water use efficiency. Subsequently, the assessed projects underwent an impact evaluation and prioritisation using a multi-criteria decision support

framework. The projects’ relative impact on the WEF sectors was determined by weighting the parameters. The SADC WEF Nexus evaluation tool has been integrated into the Regional Infrastructure Development Master Plan Short Term Action Plan (STAP) II Water Chapter, a strategic document that guides the development and implementation of water-related projects in the SADC region. This integration aims to assist in shortlisting potential STAP II projects through a WEF Nexus approach, ensuring the selection of projects that effectively address water, energy, and food security challenges.

Integrating circular economy into the WEF Nexus approach

Approximately 80% of global wastewater is released into the environment without treatment or reuse, posing significant threats to ecosystems and wasting valuable resources like water, materials, and energy. By adopting a circular economy approach and incorporating the Nexus approach, we can minimise waste and avoid negative externalities in the water, energy, and food sectors while preventing the shifting of burdens across sectors (Parsa et al., 2021).

Circular economy minimises resource use by transforming waste from one process into inputs for other processes, promoting the reuse, repair, and recycling of products. Applying a circular economy perspective to the water

sector involves water reuse, nutrient recovery from sewage, and energy generation from sewage sludge. Closing resource loops at various scales, from households to cities and basins, can enhance water, energy, and food security, creating synergies within the WEF Nexus. Moreover, it protects ecosystems by reducing nutrient and organic matter discharge and recharging natural water storage systems like aquifers and wetlands.

Integrating the circular economy approach into Nexus thinking requires considering the interconnectedness of water, energy, and food systems and creating closed-loop systems that enhance resource efficiency and reduce waste.

WEF Nexus Study on Circular Wastewater Treatment Plants in Latin America and the Caribbean *Knowledge product in coordination with UN-ECLAC, LAC Region*

Many countries in the region still lack access to safe drinking water, access to sewage systems and wastewater treatment facilities. Only 41% of households have household access to safe wastewater treatment systems. Circular economy thereby presents an opportunity to support wastewater treatment with added environmental, economic, and social benefits. Opportunities for circular economy in wastewater treatment plants are identified in various stages of the process, including reuse of treated water, energy recuperation through heat or methane recovery, and nutrient extraction. Both direct and indirect benefits are also identified and characterised. Direct economic benefits include the sale of treated wastewater, swaps or intersectoral water transfers, sale of biogas, fertilisers, or phosphates; reduction in waste end-products; reduction in the cost of providing treated water; and reduction in costs associated to water contamination. Environmental benefits of implementing a circular economy approach in wastewater treatment plants include mitigation of greenhouse gas (GHGs), improvements in aquatic ecosystems, and energy savings. As far as social benefits, these include improved public health and the creation of green jobs.

WEF Nexus Integrated Farming Systems for Climate Change Resilience *Case Study from Egypt, MENA Region*

In the frame of the NRD in the MENA region, GEBAL Egypt has pioneered the development and testing of integrated farming systems to address the challenges posed by climate change and make their techniques more accessible and applicable to a wider range of users. The NRD programme has contributed to this initiative by providing technical support, fostering collaboration, and facilitating knowledge exchange. The initiative sought to help Egyptian farmers increase agricultural outputs and reduce water and energy consumption, thereby enhancing food security in the face of changing climate conditions. Building on previous projects, where GEBAL installed solar-powered greenhouses to control the interior climate and combined it with a fishpond for conventional aquaculture.

Fish waste served as an organic nutrient source for plants, promoting sustainable crop production and water conservation. By integrating fish and crop production through a circular water management system, the project ensured efficient water use (more crop per drop), diversified farming outputs (fish and vegetables), and improved local access to nutritious food.

In collaboration with NRD, GEBAL conducted a study on the business models for two greenhouses, evaluating factors such as payback periods, and provided training for local farmers and partners on relevant topics, including climate change, water scarcity, greenhouse-controlled agriculture, and financial management for farmers. In parallel, GEBAL supported a dialogue process between local farmers and banks to bridge the gap existing between financial products currently proposed by banks and the farmers' needs. The aim was to develop a financial product that is more easily accessible to farmers by removing barriers such as uncertainties regarding

their revenue, insurance issues and uncertainties regarding risks of crops due to climate change. GEBAL presented the results of this local dialogue process also at the national level in order to discuss it with policymakers and national financing institutions, further emphasising the importance of cross-sectoral collaboration and the WEF Nexus approach. The project is currently developing a Nexus Loan Product in close cooperation with banks that sets itself apart from existing agricultural loans in Egypt by targeting through one loan product better water management, the use of renewable energies and an increase of agricultural productivity.



Image 10: Crop cultivation in a solar-powered greenhouse © GIZ

LESSONS LEARNED

The economic case for WEF Nexus investment needs to be systematically assessed and documented in order to attract investment. Nexus projects involve multiple sectors, stakeholders, and interests, making them complex to design and implement. This complexity can lead to high transaction costs and uncertainty, which may discourage potential investors. Reducing the complexity of Nexus projects can make them more attractive to investors. This can involve simplifying project designs, streamlining approval processes, and providing clear guidelines for project implementation. Investing in thorough ex-ante and ex-post impact assessments and improving the availability and reliability of statistical data for the planning and designing of WEF projects is key to demonstrate their economic added value. The economic case for WEF Nexus investment can be better understood through examples such as the San Pedro de Casta WEF Nexus project in Peru, which employed a cost-benefit analysis to demonstrate the long-term economic benefits of Nexus solutions, and the GEBAL Egypt project in the MENA region, which increased agricultural outputs while reducing water and energy consumption, showcasing the financial viability and benefits of integrated farming systems. These case studies exemplify the importance of systematically assessing and documenting the economic benefits of Nexus projects to attract investment and overcome the complexities and uncertainties that may discourage potential investors.

While integrated projects can attract finance, they also face the challenge that existing financing schemes are sometimes inadequate for their implementation and scale-up. This partially stems from the landscape of conventional financial institutions known for investment siloes and risk aversion among donors. Many investors may have a short-term outlook and may not see the long-term benefits of investing in Nexus projects. Aligning incentives between investors and other stakeholders can help overcome short-term thinking. This can involve developing financial instruments that incentivise long-term investment, such as green bonds or impact investments. On a local level, this can also involve engaging with financial institutions to develop financial products that align with the Nexus goals, as it was done within NRD and Gebal to upscale solutions for small and medium-sized farms in Egypt.

Multi-sector investment can reduce the pressure on ministry budgets through shared cost, better risk identification and joint mitigation – benefits that should be highlighted (RES4Africa Foundation, 2016). This is key to develop a supportive policy and regulatory framework that promotes the WEF Nexus and provides clear guidelines that can encourage investment.

2.5 Demonstrating and upscaling the Nexus

Demonstration projects provide the opportunity to test integrated solutions. They help showing how to leverage synergies and avoid trade-offs between sectors where any intervention in one area can have significant impacts on the others. By testing Nexus solutions in demonstration projects, we can better understand these interlinkages and design more effective and sustainable interventions. Demonstration projects can help to **build awareness, generate support, and attract funding for innovative solutions, while also providing valuable learning and feedback** to refine and improve the approach.

Demonstration projects can also help to build consensus and stakeholder support around Nexus approaches, as they provide a visible and tangible example of how the various sectors can work together in practice. Furthermore, **successful demonstration projects can be scaled up and replicated** in order to improve water, energy and food security. This section highlights successful demonstration projects proving the added value of the Nexus in the NRD context.

WEF Nexus in Action: Successful Demonstration Project for Afforestation in the Aral Sea Region *Case Study from Kazakhstan, Central Asia*

In collaboration with the NRD programme, a pilot project was implemented in Kazakhstan, Central Asia, focusing on the afforestation of the dry bed of the Aral Sea using innovative solutions. This demonstration project aimed to **ensure a high survival rate of planted saxauls and efficient water, energy, and human resource management.**

This project has been implemented at the national touristic centre “Eco-Aral.” Two greenhouses and a shade cloth structure with a total area of 150m² were built, along with a drip irrigation system. Approximately 2,000 black saxaul seeds were planted using a closed root system, which contributed to the **retention of 8,000 tons of sand and afforestation of ten hectares of the Aral Sea’s dry bottom.** This intervention aimed to reduce the massive dust transfer across Central Asia and beyond, ultimately contributing to the improvement of the environmental situation in the Aral Sea region.

The saxaul seedlings in the closed root system demonstrated the best survival rate compared to other methods (over 50%). It was observed that dried saxaul can wake up after some time and begin to grow from the root under the closed root system. Given positive results, one of the national saxaul nurseries in Kazakhstan committed to introducing the closed root system in massive saxaul replanting in the dried bottom of Aral Sea.

The success of this pilot project highlights the importance of the NRD programme in fostering innovative solutions that address interconnected challenges in water, energy, and food security. Through its cross-sectoral nature, this demonstration project showcases the WEF Nexus elements in action, highlighting the importance of integrated solutions to tackle interconnected challenges.



Image 11: Plantation of saxauls in greenhouses © GIZ

Innovation meets Tradition: Implementing a Solar Cocoa Dryer for the Kallari Association

Case Study from Ecuador, Latin America and the Caribbean

Drying of harvested crops is one of the most energy-intensive processes in agriculture. In Ecuador, the NRD designed a WEF Nexus project in collaboration with local stakeholders and the Instituto de Investigación Geológico y Energético (IIGE) to support the Kallari Association in the Tena region, aiming to enhance their cocoa bean drying process. Traditionally, the association's farmers relied on conventional greenhouses for drying, often using diesel heaters or biomass burners to supplement drying during days with low sunshine and to expedite the process. In response to these challenges, the **IIGE and local stakeholders developed an innovative solar-powered dryer system.**

This new system features solar collectors on the greenhouse roof and two axial fans at the rear of the greenhouse. The solar dryers are equipped with temperature,

solar radiation, humidity, and airflow sensors, all connected to a control and monitoring system that optimises the dryer's operation based on climatic conditions.

The **implementation of this cutting-edge solar-powered technology has resulted in several benefits.** The drying time has been significantly reduced and calibrated to exactly six days, which is the optimal duration for achieving the highest cocoa quality. Moreover, the addition of an electric backup to the solar technology enabled cocoa drying during night-time or rainy periods. This optimisation has led to increased production and, combined with higher quality products fetching higher market prices, boosted the income of farmers. Furthermore, the new system reduced pollutant and greenhouse gas emissions and eliminated the risk of contamination or damage to the beans from high-temperature combustion gases. This clean solution to traditional grain drying methods is highly replicable throughout the country for drying a wide variety of agricultural products including quinoa, coffee, sugar cane, rice, fruits, tea, guayusa and others.

Collaboration between CReW+ and NRD: Linking the WEF Nexus Approach to ongoing GIZ Projects
Case Study from the Dominican Republic, Latin America and the Caribbean

A key strategy for scaling up the WEF Nexus approach is to incorporate it into other bilateral or multilateral GIZ projects. This integration can broaden the knowledge and experience of practitioners and ultimately increase the impact of these projects. In the LAC region, the NRD collaborated with the CReW+ project component implemented in the Dominican Republic to demonstrate such an approach.

CReW+ is a cooperative project funded by the Global Environment Facility (GEF) and jointly implemented by the Inter-American Development Bank (IDB) and the United Nations Environment Programme (UNEP) in 18 countries within the Wider Caribbean Region, including the Dominican Republic.

In the Dominican Republic, CReW+ is executed by GIZ in partnership with the Ministry of Environment and Natural Resources (MARN). After in-depth consultations, GIZ teams from both the CReW+ and NRD projects decided to collaborate and design two wastewater treatment facilities, applying the Nexus approach.

The collaboration focused on rehabilitating the wastewater treatment plants in Sabana Yegua, Azua province, and the Autonomous University of Santo Domingo (UASD), Santiago Campus, Santiago province. Informed by the Nexus approach, a design study was carried out for each wastewater treatment plant. Both design plans incorporated a variety of circular economy solutions, including water reuse options for irrigating agricultural crops, forests, and other plants. Furthermore, both plans integrated energy recovery from biogas through an Anaerobic Up-flow Reactor, exemplifying a comprehensive WEF Nexus approach to wastewater management.



Image 12: Banana crops to be irrigated with treated water from the domestic wastewater treatment plant in Sabana Yegua
 © GIZ/Antony Torres

LESSONS LEARNED

Demonstration projects play a vital role in assessing various approaches and optimising them, ultimately enhancing the efficacy and sustainability of Nexus solutions. By facilitating a deeper comprehension of interlinkages among stakeholders and sectors, these projects contribute significantly to promoting awareness, gathering support, and securing funding for innovative interventions. Moreover, they offer indispensable learning opportunities and feedback for refining the strategies involved. Notably, demonstration projects excel in manifesting the added value of the Nexus, particularly at the local level.

Carrying out demonstration projects proved especially important in the WEF Nexus context, as designing and implementing integrated solutions is complex and requires the coordination of multiple stakeholders, sectors, and disciplines. Demonstrating the feasibility and effectiveness of integrated approaches can be challenging but is an important step to show their added value and their potential of scaling up if they prove to be successful.

Developing evidence-based solutions within the various Nexus sectors necessitates dependable and precise data. Nevertheless, data availability and quality can pose significant challenges in certain regions. Demonstration projects can occasionally bridge this gap on a smaller scale, serving as replicable examples. A prime illustration of this is the collaborative effort between the WEF Nexus approach and other bilateral or multilateral GIZ projects, which has effectively expanded knowledge and experience for practitioners, amplifying the overall impact.

The implementation of demonstration projects can be expensive, and securing funding can be a challenge. Additionally, demonstration projects may not be attractive to traditional funding sources due to their short-term and localised nature. A solution to this challenge can be to look for other existing programmes where a demonstration project can be added to show the added value of adopting a WEF Nexus approach, as it was done with the CReW+ programme in the Dominican Republic.

Engaging with multiple stakeholders, including communities, policymakers, and practitioners is essential for the success of demonstration projects. Ensuring the long-term sustainability of demonstration projects can be a challenge. This includes securing funding for the operation and maintenance of the project, as well as ensuring the continued engagement and support of stakeholders.

2.6 Awareness raising and operationalising the Nexus

Through its activities, the NRD programme has largely contributed to establishing an international Community of Practice (CoP) on the WEF Nexus. The NRD programme has built both enthusiasm and capacity for multi-sectoral WEF Nexus decision-making and investment planning. It has developed hands-on tools, guidelines and best practices to take the WEF Nexus approach from theory to practice at various scales. This section highlights products, tools and activities carried out by the NRD programme to raise awareness on the Nexus approach and increase capacities for cross-sectoral decision-making and investment planning in its target regions and beyond. These activities can be clustered around the topics of knowledge management, outreach and capacity development.

They are critical components of the NRD programme, as they facilitate the exchange of information, enhance stakeholder capacity, and promote the adoption of integrated approaches.

2.6.1 Knowledge management and outreach

The WEF Nexus is a multifaceted and interdisciplinary field, necessitating the integration of diverse knowledge domains. Effective knowledge management is crucial in ensuring that the most relevant information and data are available and can be utilised to inform decision-making processes. For the NRD programme, this involves establishing mechanisms for sharing experiences and lessons learned across regions. Such exchanges occur through regular meetings and collaborative formats with representatives from the NRD regions and via the Nexus Resource Platform (NRP), where resources, events and activities on the Water, Energy and Food Security Nexus are shared (www.water-energy-food.org).

In addition to information and knowledge management within the WEF Nexus, the NRD programme seeks to promote the adoption of integrated approaches across WEF Nexus sectors. This entails engaging with representatives from these sectors at various levels to raise awareness of the application and operationalisation of the WEF Nexus. Outreach activities, including workshops and conferences, serve as valuable platforms for raising awareness about the programme’s objectives and accomplishments. By engaging with stakeholders, these events facilitate discussions on potential solutions and foster collaborative efforts towards addressing the complex challenges within the WEF Nexus.

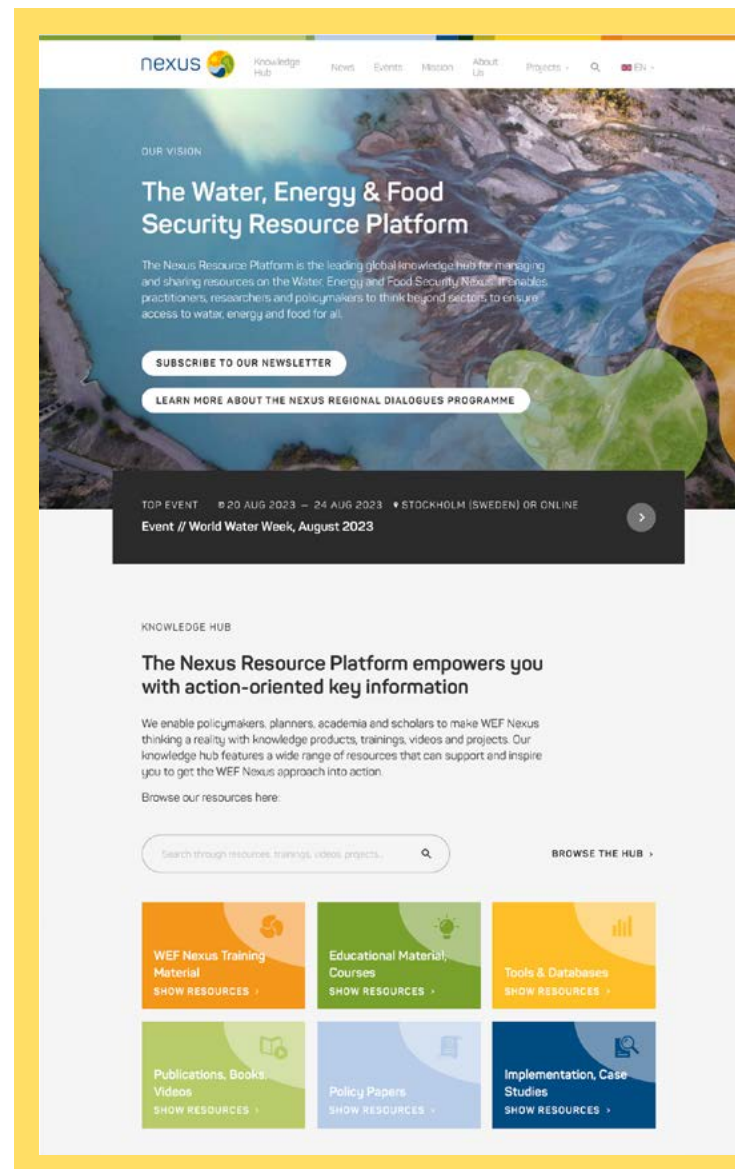


Image 13: Screenshot of the NRP © GIZ: www.water-energy-food.org/

Nexus Resource Platform

The NRP is widely recognised as the premier global knowledge centre for managing and disseminating information on the Water, Energy, and Food Security Nexus. The platform consists of two primary components:

1) a knowledge hub and 2) a Nexus project page section.

1) The knowledge hub serves as an online repository for a vast array of WEF Nexus-related resources, which are accessible to users at no cost. It includes WEF training material, educational material and courses, tools and databases, publications, books, videos, policy papers and case studies. The Nexus project page section provides detailed information on context, objectives, activities, milestones, achievements, as well as related articles and events involving the programme. While the majority of content is available in English, publications, reports, and tools specific to NRD programme regions are also offered in their original languages, such as French, Spanish, Arabic and Russian.

2) The Nexus Resource Platform proves to be an invaluable asset for a diverse range of target groups, including the international CoP on the WEF Nexus. Key participants in this CoP consist of academia and international organisations primarily based in the northern hemisphere, where the NRP enjoys significant usage. This vital stakeholder group holds the potential to generate funding or financing for Nexus projects.

Throughout Phase II of the NRD programme, the NRP has demonstrated continued growth and development as a leading platform for WEF Nexus resources. This progress is evident in the platform's key statistics:

- ➔ 61,000 unique visitors
- ➔ 143,000 unique page views
- ➔ 6,500 unique downloads
- ➔ 54% of visitors from North America
- ➔ 33% of visitors from Europe

As the Nexus Resource Platform evolves, it remains a crucial tool for stakeholders in various sectors, including academia, international organisations, policymakers, and practitioners. By fostering knowledge exchange and collaboration, the platform ultimately contributes to the advancement of sustainable solutions for water, energy, and food security challenges.

Events and Workshops

The NRD programme feeds results from the regional policy dialogues into international agenda-setting and promotes the WEF Nexus concept and its key accomplishments as well as its products and tools at various international events and conferences. For instance, NRD programme organised webinars on the challenges and opportunities involved in institutionalising the WEF Nexus and participated in panel discussions of renowned international conferences to raise awareness of the application of multi-sectoral natural resources management. These events included the Stockholm World Water Week 2021; the UN Climate Change Conference 2021 (COP 26) and the World Humanitarian Forum 2021.

2.6.2 Capacity Development

The NRD programme provides training and capacity building activities to stakeholders at various levels, including policymakers, practitioners, and local communities in the NRD regions. In the WEF context, capacity development aims at raising awareness and enhancing the understanding of the interlinkages between the water, energy, and food sectors, as well as the skills required to implement integrated approaches. WEF Nexus training materials and especially the Nexus Game are a useful way to engage with representatives from different sectors and to respond to the interest from the regions.

Human Capacity Development

The Human Capacity Development (HCD) component of the NRD programme aims to build the capacity of individuals and institutions in the water, energy, and food sectors, and to promote sustainable and integrated approaches to resource management by providing training and capacity building activities. This can help to ensure that decision-makers have the skills and knowledge necessary to make informed and evidence-based decisions, and to implement policies and projects that contribute to sustainable development. Training and capacity building activities that have been conducted so far include:

WEF Nexus Trainings:

- ➔ **WEF Nexus Masterclass/WEF Nexus Trainings** - This is a comprehensive training programme that provides participants with an understanding of the interdependencies between water, energy, and food sectors. It serves a diverse range of stakeholders, including policymakers, practitioners, and researchers, and is designed to promote the adoption of integrated resource management strategies. The format of the masterclass/WEF Nexus trainings includes lectures, case studies, and group exercises
- ➔ **WEF Winter School or short courses** designed specifically for Southern Africa - These short courses provide targeted training for professionals working in the water, energy, and food sectors in Southern Africa. They cover topics such as integrated resource management, policy implementation, and project development. The format includes lectures, workshops, and group discussions
- ➔ **Youth entrepreneurship training in Southern Africa** - This activity focuses on empowering young people in Southern Africa by providing them with the skills and knowledge necessary to develop sustainable businesses in the water, energy, and food sectors. The training programme consists of workshops, mentoring sessions, and networking events
- ➔ **Training of Trainers (ToT)** - This training primarily targets policy planning officers, public and private project developers, financial institutions, and other NRD Nexus project beneficiaries. A modular approach to the training enables the programme to address different target groups and needs with appropriate training contents and formats, such as lectures, workshops, and case studies
- ➔ **Massive Open Online Course (MOOC)** - This is an online platform that offers free and open courses on a variety of topics related to the water, energy, and food sectors. The courses are available to participants worldwide and can be accessed at any time, allowing for flexible learning opportunities

Nexus Game:

- ➔ This social simulation exposes players to Nexus challenges connected to transboundary water management and encourages them to take decisions in a simulated scenario. The Nexus Game has been for example carried out at the 5th Targeted Regional Workshop for GEF in Gaborone. The Nexus Game was also used successfully and with positive feedback from participants in other regions, e.g. at all nine national dialogue events in the Niger Basin and at four events in Latin America. The latter included participants from the Ministry of Energy and the Ministry of the Environment in Ecuador, as well as with the Ministry of External Relations, the Ministry of Agriculture, the Forestry Institute and the General Water Authority of Chile. The game serves as a training tool for policymakers and stakeholders, fostering cooperation and communication among participants while raising awareness about the complexities of resource management

The Nexus Impact Assessment (NIA) Toolkit

The NIA Toolkit has been designed to promote integrated approaches to the management of water, energy, and food resources by helping decision-makers to assess the potential impacts of policies and projects on the Nexus between these sectors. This can help to identify potential synergies and trade-offs between the sectors, and to develop policies and projects that consider the interactions between them. The toolkit contains the following items:

- ➔ The **Nexus Principles**: A description of conditions or main principles that need to be in place to ensure coherence and coordination between the WEF sectors in a given policy and/or project. The Nexus Principles can be applied for policymaking, project designing and implementation and guide a successful application and operationalisation of the WEF Nexus approach in different levels and regions
- ➔ The **Nexus Safeguards**: The Nexus Safeguards enable public and private project developers to determine whether a project or set of interventions are improving WEF security and if the resources are safeguarded. A WEF Nexus compliant project serves to improve synergies between at least two WEF sectors or improve the resource-use efficiency of at least one WEF sector, without compromising another WEF sector. The safeguards matrix should lead to a critical assessment of intended and unintended impacts on the environment and other externalities

- The **Nexus Indicators**: The catalogue contains a list of indicators to measure the different desired impacts resulting from Nexus projects categorised according to the three WEF sectors as well as ecosystem services. The list of indicators serves the purpose of supporting the establishment of a Monitoring and Evaluation (M&E) system to measure impacts of a WEF Nexus action. The indicator table is accompanied with a description that outlines the key elements of a M&E system, including the recommended steps, the basics of the theory of change, how to structure data collection activities and develop appropriate M&E indicators
- The **Nexus Cost-Benefit Analysis (CBA)**: The CBA compares costs to benefits considering socio-economic and environmental impacts in quantifiable monetary values as far as possible. It serves as a decision-making tool for project development and investment purposes
- **Financing mapping study**: Complemented by region-specific investment opportunity studies, the Italian foundation RES4Africa carried out a market analysis for promising Nexus business models including scoping over potential 50 financing mechanisms in the Niger Basin and the MENA region

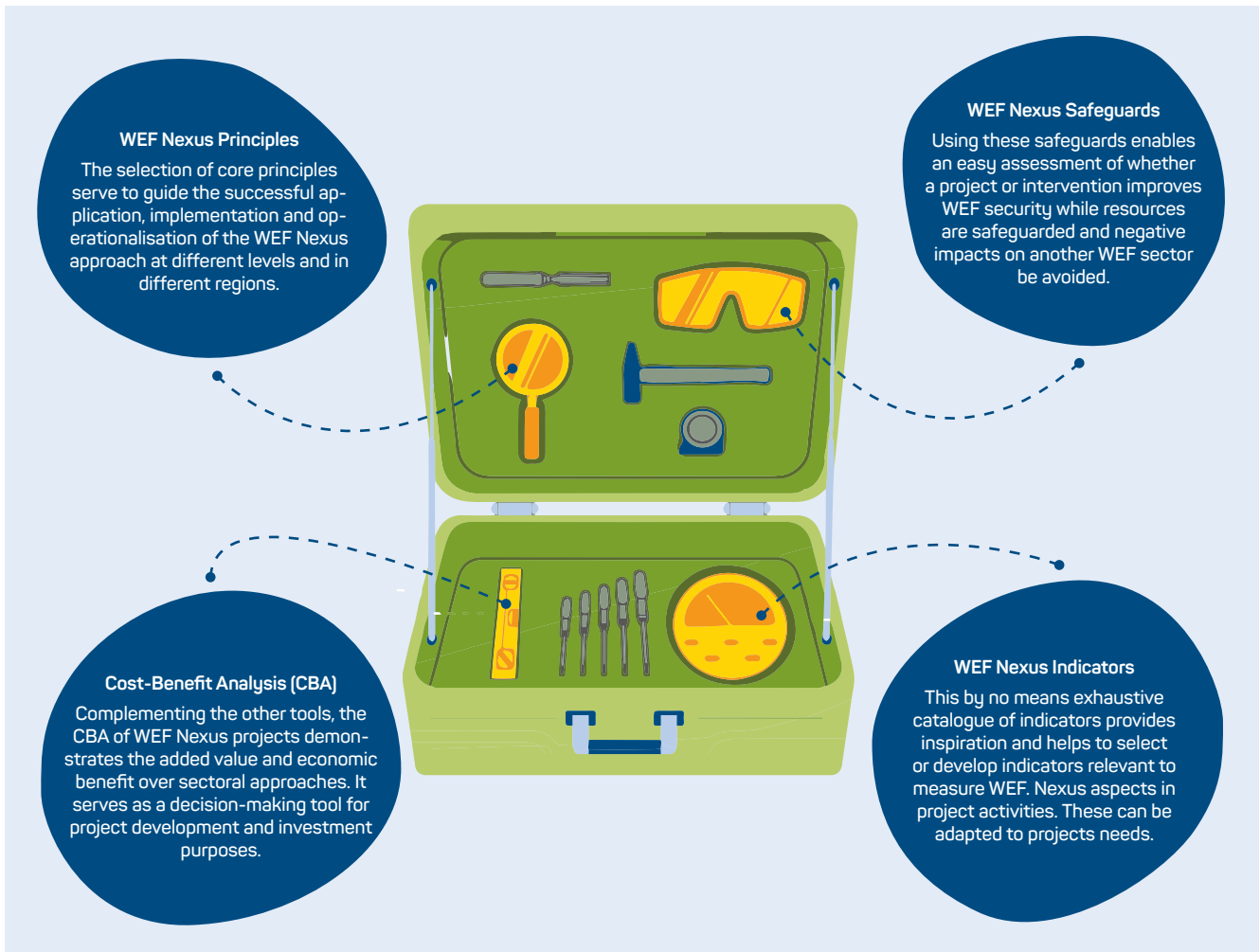


Figure 4: Key components of the Nexus Impact Assessment (NIA) Toolkit

LESSONS LEARNED

Through its knowledge management and outreach activities, the NRD programme provides an important platform for different stakeholders to share their knowledge and experiences on the WEF Nexus. This is an important contribution to establishing a WEF Nexus community of practice and helps identifying best practices, lessons learned, and innovative approaches that can be replicated and scaled up across different regions. By bringing together diverse actors, including policymakers, planners, researchers, and practitioners, this community of practice can foster learning and exchange knowledge in different domains. This helps improve the understanding of the interconnections between water, energy, and food systems, and identifying new opportunities for collaboration and integration.

By offering training, mentoring, and peer-to-peer support, the NRD programme also helps build the capacity of various stakeholders to address the complex challenges of the WEF Nexus. These activities were often based on a co-creation principle, involving different stakeholders in joint problem-solving and decision-making. This can help ensure that solutions proposed to address WEF Nexus challenges are context-specific and tailored to the needs and priorities of different stakeholder groups.

In the context of the NRD programme, contributing to establishing a WEF Nexus Community of Practice has also helped to build a network of experts and practitioners who are committed to advancing integrated and sustainable management of natural resources. It has facilitated learning and exchange of experiences across different regions, and has contributed to the development of innovative tools and approaches that can be scaled up and replicated.

3 CONCLUSIONS AND LESSONS LEARNED

Keeping in mind the strengths and good practices highlighted from the NRD programme in Chapter 2, we will now look at challenges that typically come with institutionalising and mainstreaming the WEF Nexus approach. This section provides a structured overview on challenges encountered in the context of the NRD programme and reflects on opportunities to overcome some of them.

3.1 Challenges related to the WEF Nexus approach

Broadness of the WEF Nexus concept

The WEF Nexus concept is often perceived as very broad. There is a need to clearly demarcate the WEF Nexus approach and define it as opposed or in relation to other international policies related to natural resources management, especially the concept of integrated water resource management (IWRM). Communication work promoting a Nexus approach needs to meet the challenge of being concise and concrete, while still including all the different Nexus angles that can be tackled and addressed by the approach – from the security to the resource perspective, the local to the regional and global level, and from policy making to planning and project implementation.

Shifting the WEF Nexus concept from theory into practice

Shifting the WEF Nexus concept from theory into practice means going beyond defining a commonly understood concept to comprehending the various needs, trade-offs, benefits, and synergies in concrete and quantifiable terms. A WEF Nexus assessment can help understand these different aspects by quantifying the interlinkages between different sectors, which requires available and accessible data. Often however, the needed data is not available, or the methodology and comprehensive analytical tools to quantify the interlinkages and benefits gained from the Nexus approach are missing.

The WEF Nexus concept has important social dimensions, as it can have significant impacts on livelihoods, access to resources, and social equity. To address these dimensions, it is important to consider the social and cultural contexts in which the WEF Nexus operates and ensure that planning and decision-making processes are inclusive and participatory. It is also important to note that, depending on the context, the Nexus concept has to go beyond water, energy, food and ecosystems to get the full picture of the situation at hand. Including further dimensions such as land, climate and fragility contexts can be crucial to find solutions that are viable and acceptable.

Implementation within governance structures

In many cases, governance structures that support vertical and horizontal coordination are missing, resulting in sector-based policies and regulatory mechanisms and divergent sectoral institutional frameworks that hinder an integrated cross-sectoral approach. Unequal distribution of power and capacities between the sectors can further entail a lack of willingness to cooperate and lack of trust across groups of actors belonging to different disciplines and government levels. In such cases, a major challenge for implementing the Nexus approach is to overcome the lack of a clear joint strategy towards sustainable development among institutions. This complicates implementing cross-sectoral legislative processes, or even entirely new policy regulations that will harmonise legal requirements of different sectors. Another challenge is to understand the overall objectives of actors from different sectors or levels of administration, such as riparian countries or sectorial ministries and what could be incentives for them to engage in cross-sectoral work.

Coordination structures across or within government departments at the local, national and transnational level, such as technical working groups, can be an entry point for introducing a Nexus approach. However, if their function should go beyond raising awareness about interlinkages, political legitimacy is needed for more impact. For the work to be effective, it is helpful to have clear and ideally high-level mandates for coordination and cooperation that sectoral agencies can act upon.

Securing sustainable financing

The finance readiness of the projects developed in cross-sectoral processes facilitated by the NRD programme varies across the regions but remains an overall challenge. The WEF Nexus approach does add value to project proposals in that it proposes a shift from narrow, single-sector solutions to more integrated cross-sectoral solutions. Such solutions should be more appropriate to address the complexities inherent to climate resilience and bring additional co-benefits in both social and environmental aspects.

However, implementing an integrated approach can entail higher initial investment costs than conventional methods. Therefore, Nexus projects may require a longer time horizon to be financially viable. This may make them less attractive to private investors, and thereby hampers the uptake of demonstration projects in private investment portfolios. Moreover, the economic benefits and revenue streams of cross-sectoral projects are often less clear or uncertain (e.g. when benefits are related to

environmental and social aspects that are difficult to assess in monetary terms, or when revenues streams are to be generated through reliance on ecosystem service payments). Hence, acquiring the necessary funding for realising multi-purpose infrastructures in a Nexus context can prove more difficult than classical sector-based or sector-focused investments.

Due to their dependence on natural resources, Nexus projects can further involve a higher degree of risk due to factors such as climate variability, water scarcity, and market fluctuations. Managing such risks is critical to attracting investment. This can involve developing risk management strategies, including risk-sharing mechanisms, insurance, and contingency planning.

3.2 Opportunities and Recommendations

Framing the WEF Nexus approach as a tool to achieve sustainability goals, complementing integrated resource management

A major opportunity of the WEF Nexus approach lies in its capacity to coordinate synergies and trade-offs between three sectors that are of major relevance for achieving overarching goals such as sustainable development, climate resilience, or addressing conflict and fragility caused by natural resource issues. The WEF Nexus concept and the required coordination across WEF sectors, therefore, **should not be perceived or communicated as a goal in itself, but as a means to identify and address interlinkages between the relevant sectors**, and therefore as a means to more efficient and sustainable achievement of development goals, e.g. by leveraging synergies between SDGs or preventing so called mal-adaptation.

A strong topic of discussion in the NRD programme was the relation between the WEF Nexus approach and IWRM, which is a key concept to promote the sustainable management of water resources. While the IWRM approach and the WEF Nexus approach have different foci, they are not mutually exclusive, and in fact, they can be complementary. The WEF Nexus can enhance the IWRM approach by going beyond a water-centred perspective: The WEF Nexus approach can provide a broader framework for understanding the complex interrelationships between water, energy, and food, while the IWRM approach can provide more specific guidance on the management of water resources at the basin and local level. By combining these approaches, stakeholders can achieve a more comprehensive and integrated approach

to water resources management that addresses the social, economic, and environmental dimensions of water use, while also addressing challenges beyond the water sector related to resource scarcity, climate change, and population growth.

In a well-developed IWRM context, building on existing structures (coordination and steering structures, sub-basin bodies) and strengthening the involvement and ownership of other ministries is recommended, particularly with respect to decision-making. This should serve to mitigate the risk that decisions on the joint management of resources are not taken up by the other sectors.

Establish cross-sectoral coordination mechanisms, using existing structures as an entry point

Ineffective governance across the WEF sectors is often the result of a lack of appropriate practical mechanisms, strategic guidance, or legally binding requirements to coordinate sectoral governance to achieve a shared development agenda. This can be supported by **integrating the WEF Nexus perspective into national plans and other ongoing initiatives**. An important step in fostering coordination can be developing clear guidelines for implementing cross-sectoral governance mechanism at different scales and defining related needs for human and institutional capacity building. Efforts to establish cross-sectoral coordination should start from an analysis of existing mechanisms, such as cross-sectoral working groups, or coordination mechanisms that have been established in support of cross-sectoral initiatives, such as **sustainable development plans and climate resilience strategies**. Existing coordination mechanisms, even if not comprehensive in scope, provide an opportunity to introduce a Nexus perspective and institutionalise coordination without adding to the often already complex and fragmented institutional landscape.

When strengthening cross-sectoral coordination, including through existing mechanisms, power imbalances between stakeholders in the water, energy, and food sectors can create barriers to collaboration and can lead to inequitable outcomes. To address this, it is important to identify and address power imbalances and ensure that all stakeholders have an equal voice in decision-making processes. Such participatory processes might take more time than lean top-down decisions. However, to ensure an effective application of strategies and guidelines, an inclusive and comprehensive elaboration is necessary. To ensure trust is established in cross-sectoral coordination mechanisms or policy dialogues, it can be

helpful to appoint a special actor that is in the position to be perceived as a neutral broker and has convening power to bring the relevant sectoral actors together.

Technical cooperation as a starting point for Nexus institutionalisation

In order to institutionalise the Nexus approach, organisations and institutions that manage water, energy, and food resources must incorporate its principles into their policies, strategies, and practices. Collaborating on technical aspects related to the WEF Nexus, or cooperating on concrete initiatives, such as implementing infrastructure projects or introducing new policy instruments, can provide a starting point for establishing wider and more strategic cross-sectoral coordination. In this sense, technical working groups (TWGs) can facilitate the institutionalisation of the Nexus approach, by providing technical expertise and facilitating cross-sectoral exchange. The TWGs in Jordan and in Central Asia have been set up successfully, emphasising the need for change within institutions involved, and also played a strong role in defining the sediment management project in the Tuyamuyun Hydroelectric Complex. In SADC, an organisation similar to that in Jordan and in the Central Asian countries was formed at the regional level within the SADC Secretariat. National TWGs were then formed to support Nexus initiatives in the member countries. While the process of institutionalisation varies, the principles remain the same, emphasising the importance of cooperation between sectors. Learnings from these cases provide opportunities for replication and could be translated into guidelines for transferring knowledge to other countries.

Access existing cross-sectoral funding sources

Much of the existing funding sources follow a sector-specific logic and are thus not easy to access for WEF Nexus projects. However, there are some funding sources that do promote integrated projects, providing co-benefits in different sectors. This refers specially to funding sources targeted towards sustainable development and climate resilience. These provide opportunities for securing investment into Nexus projects or for explicitly introducing a WEF nexus perspective into funding requirements thus strengthening funding for Nexus projects in the future.

At a recent Green Climate Fund (GCF) workshop organised by the NRD Programme, it was highlighted how vital good governance is to secure climate funding for projects. The workshop focused on two governance issues: cross-sectoral coordination and integrity readiness. GCF presented its funding criteria and stressed the impor-

tance of the Nexus approach to encourage more projects to address both adaptation and mitigation issues. The GCF's investment requirements for Nexus projects reflect the need for projects to be aligned with sustainable development goals, to be financially sustainable, and to be designed to build local capacity and create long-term benefits. By meeting these investment requirements, Nexus projects can contribute to achieving sustainable development outcomes and help to address the challenges of resource scarcity, climate change, and population growth.

Strengthen private sector engagement

Private sector involvement can bring additional expertise, resources, and perspectives to cross-sectoral dialogues, and help to identify and implement practical solutions to the challenges facing the water, energy, and food sectors. Also, the EU and other donors have a strong interest in promoting private sector involvement, recognising the important role that the private sector can play in promoting sustainable development, which opens potential sources of funding for related activities.

Similar to the WEF Nexus Accelerator Bootcamp in the Niger Basin, the NRD programme, and in cooperation with SAFEEM and SEEDSTAR, organised a WEF Nexus Innovation Lab with youth entrepreneurs in LAC. This included a one-week workshop for ideation of WEF Nexus solutions, a WEF Nexus academia for project development, and a matchmaking/demo-day workshop. The Innovation Lab initiative took place from January to March 2023 and offered a range of support services to stakeholders, including technical assistance, project financing, and networking opportunities. The Lab also provided a platform for sharing knowledge and best practices, and for engaging with stakeholders from different sectors and levels of governance. Building on these regional experiences provides an important opportunity for future activities to implement Nexus projects on the ground. Promoting private sector involvement, however, needs capacity development of entrepreneurs as well as improving the enabling environment for cross-sectoral financing. Accelerator programmes should therefore be complemented with activities addressing financing criteria and capacities in funding institutions.

Stakeholder-specific recommendations

Private and public sector

- ➔ **Develop a clear business case:** A well-developed business case is essential for securing funding for WEF Nexus projects. The business case should clearly demonstrate the expected benefits, costs, and return on investment of the project
- ➔ **Explore alternative financing mechanisms:** There are many alternative financing mechanisms that can be used to secure funding for WEF Nexus projects, such as impact investment, green bonds, and crowdfunding. These options should be explored, and the most appropriate financing mechanism should be identified for the project
- ➔ **Use data to demonstrate impact:** Data is critical for demonstrating the impact of WEF Nexus projects, and can be used to show the economic, social, and environmental benefits of the project. It is important to collect and analyse data throughout the project, and to use this data to communicate the impact of the project to potential funders

Local, national, regional stakeholders

- ➔ **Integration into policy frameworks:** One potential future for the WEF Nexus concept is its integration into policy frameworks at the local, national, regional levels. By incorporating the WEF Nexus concept into policy frameworks, decision-makers can provide strategic guidance to address the interrelationships between water, energy, and food resources, and work towards more integrated and sustainable management of these resources
- ➔ **Collaboration among stakeholders:** Collaboration among stakeholders in the water, energy, and food sectors will continue to be a key component of the future of the WEF Nexus concept. By developing institutional mechanisms that promote cooperation and coordination, decision-makers can facilitate sectoral actors working together to identify and address shared challenges. This will also help building the capacity and relationships necessary to support more integrated and sustainable resource management

Academic institutions and research

- ➔ **Incorporate the Nexus topic in university curriculum and professional training more systematically:** Capacity building is a key aspect of implementing the WEF Nexus concept, as it requires stakeholders to develop new skills and knowledge to work collaboratively across sectors. To do so, it is important to provide training and education programmes, promote knowledge-sharing, and support research and development
- ➔ **Innovation in technology and management practices:** Advances in technology and management practices can help to promote the WEF Nexus concept by providing new tools and approaches for integrated resource management. For example, the use of smart grid technologies can help to better balance the demand and supply of energy and water resources, while precision agriculture can help to optimise water and nutrient use in food production

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Note: This study has also made extensive use of various internal documents provided by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH Nexus Regional Dialogues (NRD) Programme. These documents have informed the analysis and discussion but are not publicly available for citation.





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