

# Connecting the dots across water–energy–food–ecosystems: A roadmap for strengthening Nexus solutions in Pakistan

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## Key messages

- Pakistan's water–energy–food–ecosystems (WEFE) challenges are interconnected, requiring holistic solutions that account for resource trade-offs while safeguarding environmental integrity. Strengthening coordination across the water, energy, agriculture and environment sectors is vital for sustainable resource management.
- The Nexus Capacity Scorecard (NCS) is a valuable tool for the self-assessment of individual and institutional capacity to implement WEFE Nexus solutions by highlighting strengths and pinpointing areas that need strategic investments and reforms.
- Findings from a scoping study in Pakistan highlight several systemic challenges, including limited data-sharing frameworks, weak political backing, insufficient collaboration mechanisms and inadequate capacity-building efforts.
- Despite these barriers, there is a promising level of interest among practitioners working within water, energy, agriculture and environmental organizations (hereby referred to as 'WEFE institutions') to work collaboratively. This suggests that the primary challenge lies not in stakeholder motivation but rather in inadequate institutional support, technical capacity, policies, and financing.
- Investing in specialized training programs, mentorship, and knowledge-sharing networks will create a skilled workforce capable of operationalizing Nexus solutions at scale. This includes embedding gender and youth empowerment in all capacity-building efforts.
- Strategic collaboration with donors – tailoring funding to capacity gaps, data infrastructure, and technological needs – can rapidly scale up successful pilot projects, fostering a more cohesive and impactful Nexus strategy.
- Instituting robust monitoring and evaluation (M&E) mechanisms, with regular assessments and transparent reporting, ensures lessons learned are quickly integrated into policy and practice. Linking these findings to budgetary decisions can further sustain momentum for WEFE Nexus initiatives.

# Pakistan's WEFE challenges

Pakistan's water, energy, food and environmental crises are deeply intertwined, creating a cycle of resource stress that disproportionately affects the most vulnerable communities. Around 95% of the country's water goes toward agriculture, yet irrigation inefficiencies, waterlogging and soil salinization erode productivity while driving up energy needs for pumping and treatment (Young et al., 2019). With nearly a third of its energy resources coming from fossil fuels, price fluctuations and supply gaps directly impact farmers' operational costs (and overall electricity costs) and the sustainability of water systems (Malik et al, 2020). In turn, reliance on fossil fuels contributes to environmental degradation, compounding agricultural and water challenges by accelerating climate impacts such as erratic rainfall patterns and extreme weather events, which are felt across both rural and urban settings. The inadequacy of supply chains is similarly problematic: estimates suggest 20-40 percent of agricultural products is lost post-harvest, wasting the embedded water and energy consumed in its production (ADB, 2024). Meanwhile, overextraction of groundwater threatens future water security, while 40% of the population lacks safe drinking water (WHO & UNICEF, 2019) – further underscoring how tightly water, energy and food systems are linked to public health and poverty.

These interconnected pressures highlight why a holistic Water-Energy-Food-Ecosystems (WEFE) Nexus approach is crucial for Pakistan's sustainable development. With 22% of the population living below the poverty line, repeated crop failures, high energy costs and contaminated water collectively push marginalized communities deeper into vulnerability (World Bank, 2024). When one sector falters, others bear the consequences, creating ripple effects that undermine overall resilience. Weak political will, fragmented data-sharing frameworks and limited collaboration mechanisms exacerbate these challenges, impeding integrated solutions that could optimize resource use and protect ecosystems. Often, overlapping policies and mandates among ministries result in institutional turf battles rather than synergy across sectors.

**These multifaceted challenges require holistic, integrated solutions that recognize and address these cross-sectoral interdependencies.** The WEFE Nexus is a useful framework for managing these interconnected resources, emphasizing the need for integrated approaches that minimize trade-offs and enhance resilience. Coordinated policymaking, robust institutional capacity and strategic investments in infrastructure and climate-smart technologies are fundamental. These efforts must be strengthened by strong collaboration mechanisms that facilitate cross-sectoral dialogue and action, ensuring that the various stakeholders can operate synergistically and that vulnerable populations are not left behind.

**However, the successful implementation of Nexus approaches hinges on the capacity of the institutions and stakeholders tasked with managing WEFE resources.** Enhancing these capacities is crucial for fostering sustainable resource management that not only improves efficiency but also addresses the needs of Pakistan's most vulnerable communities. Therefore, WEFE practitioners and policymakers must prioritize building and expanding stakeholder capacity through training, resource sharing, and supportive policies that encourage interdisciplinary collaboration. By doing so, Pakistan can transform its resource management practices, making significant strides towards sustainability, stability, and social equity.

## What is the Nexus Capacity Scorecard (NCS)?

The [Nexus Capacity Scorecard \(NCS\)](#) is a comprehensive tool designed for **self-assessment** of capacities of institutions and actors working across the water, energy, food/agriculture, and environment sectors ('WEFE sectors'). The NCS enables individuals and institutions to evaluate their readiness to adopt Nexus approaches, identify gaps and opportunities, and inform targeted capacity-building efforts. The scorecard includes a total of 20 questions which are organized across five assessment domains ( i) enabling WEFE ecosystem; ii) institutional mandates and strategies; iii) partnerships and collaboration; iv) adaptive learning and knowledge-sharing; and v) knowledge, skill, and interest in WEFE tools and approaches) and three capacity levels

(individual, organization, environment). The tool's adaptable and flexible nature allows for its application across various institutions, with a complementary version specifically tailored for academic institutions focused on Nexus education and research ([NCS – Education and Research](#))

For assessment, capacities related to the 20 indicators across the domains are scored on a 5-point (0–4) scale. The total score is the sum of the values assigned to each question. The overall score can range from 0–80, with the following cut-off values for analysis: No capacity (Score 0–20); Low capacity (Score 21–40); Moderate capacity (Score 41–60); and High capacity (Score 61–80). Details on implementing and analyzing the scorecard results are included in the NCS Guidance Note (Khalid and Elias 2024). Disaggregated analysis of each indicator and domain can provide valuable insights into specific capacity gaps and inform targeted capacity-building efforts.

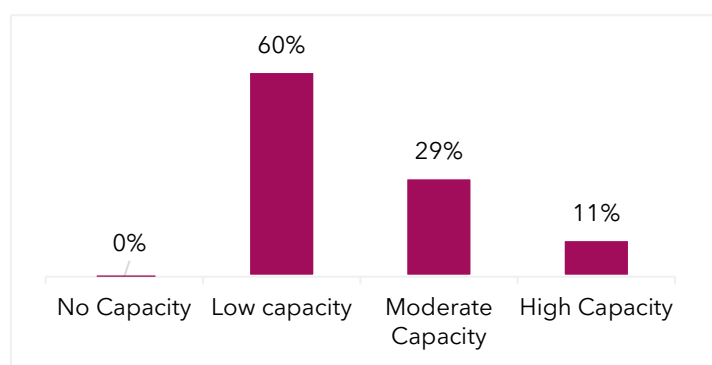
The tool was developed and piloted by the International Water Management Institute in Pakistan, under the [CGIAR Initiative on NEXUS Gains](#), as part of scoping study to identify current (self-reported) capacities and needs for implementing Nexus approaches. The findings from the pilot provide valuable insights into Pakistan's Nexus capacities, highlighting opportunities for improved collaboration, capacity strengthening, and informed decision-making to optimize Nexus solutions.

This technical note presents the study's findings, identifies capacity gaps and **recommends targeted interventions to enhance decision-making for researchers and practitioners.**

## Applying the NCS: Findings from a scoping study in Pakistan

The NCS was tested in Pakistan and administered through an online survey to relevant government institutions working across the water, energy, food, and environmental sectors. A total of 35 government respondents (27 men and 8 women) completed the survey, representing key government institutions at the federal (34%), provincial (57%) and district (9%) levels. They are predominantly technical specialists – researchers, scientific officers or senior officials (e.g., department heads) – from the Ministry of Water Resources (including the Federal Flood Commission and the Pakistan Council of Research in Water Resources), the Ministry of Climate Change and Environmental Coordination, and provincial and district Irrigation and Public Health Engineering Departments (PHED). Their years of experience range widely: 11% have under 5 years, 17% have 5–10 years, 23% have 11–15 years, 29% have 16–20 years and 20% have more than 20 years.

The average group score was 35, corresponding with an overall self-perceived low level of Nexus capacity. The majority of respondents (60%) fall under the low capacity category, indicating that most respondents within Pakistan's government institutions perceive their capacities for implementing Nexus solutions to be at a basic level (Figure 1). This highlights a critical need to enhance understanding and implementation of WEFE Nexus approaches.



**Figure 1.** Average Nexus capacity levels (% respondents)

Source: Survey Data

## Capacity levels across each domain

Table 1 outlines the five domains and corresponding indicators under each domain. While the overall average capacity level is low, across the domains the self-reported capacity levels vary from low to moderate (Figures 2-6). While some domains exhibit moderate levels of capacity, there is still a clear need for comprehensive policy interventions, institutional reforms and targeted capacity-building initiatives to enable effective cross-sectoral collaboration.

**Table 1. Scorecard analysis domains and corresponding indicators**

| Domain                                                          | Indicators                                                                                                                                           |
|-----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1) Enabling WEFE ecosystem                                      | 1.1. National mandates prioritizing cross-sectoral WEFE cooperation and planning                                                                     |
|                                                                 | 1.2. Political will and support for cross-sectoral cooperation and planning at national level                                                        |
|                                                                 | 1.3. Political will and support for cross-sectoral cooperation and planning at provincial/state level                                                |
|                                                                 | 1.4. Institutions championing application of WEFE Nexus approach at national level                                                                   |
|                                                                 | 1.5. Belief in applicability of Nexus approach implementation                                                                                        |
| 2) Institutional mandates and strategies                        | 2.1. Institutional plans and strategies for implementing Nexus solutions                                                                             |
|                                                                 | 2.2. Availability of financial resources to implement Nexus approaches                                                                               |
|                                                                 | 2.3. Capacity for effective human resource mobilization to implement Nexus approaches                                                                |
|                                                                 | 2.4. Representation of women and youth in leadership and decision-making roles                                                                       |
| 3) Partnerships and collaboration                               | 3.1. Level of interest in [country, province, district] for working collaboratively towards integrated WEFE Nexus solutions                          |
|                                                                 | 3.2. Extent of cross-sectoral partnerships to implement Nexus solutions                                                                              |
|                                                                 | 3.3. Extent of intra-sectoral collaboration                                                                                                          |
| 4) Adaptive learning and knowledge sharing                      | 4.1. Availability of standardized data across sectors                                                                                                |
|                                                                 | 4.2. Extent of cross-sectoral data and information sharing                                                                                           |
|                                                                 | 4.3. Mechanisms for monitoring, evaluation, reporting, and cross-sectoral learning                                                                   |
| 5) Knowledge, skills, and interest in WEFE tools and approaches | 5.1. Understanding of WEFE Nexus approach                                                                                                            |
|                                                                 | 5.2. Motivation to plan and implement Nexus approaches                                                                                               |
|                                                                 | 5.3. Ability to develop models, scenarios and/or other decision support tools that enable integrated planning and implementation of Nexus approaches |
|                                                                 | 5.4. Ability to integrate gender and social inclusion (GESI) considerations in Nexus approaches                                                      |
|                                                                 | 5.5. Mechanisms for training, mentoring, and learning to attract and maintain staff with skills to implement Nexus approaches                        |

1. Enabling WEFE ecosystem

Capacity assessments reveal that the overall environment for fostering cross-sectoral WEFE cooperation remains weak (Figure 2). Existing national policies and mandates partially acknowledge Nexus approaches, but they are insufficiently integrated or enforced. Stakeholders believe in the applicability of the Nexus approach, yet they often lack the high-level support and clear policy directives needed to promote cohesive, multi-sector strategies. Political transitions and changing leadership priorities can further disrupt continuity in Nexus-related interventions, as newly appointed officials may reprioritize institutional goals. Moreover, sub-national governance structures – particularly at the provincial and district levels – may not be fully equipped or incentivized to implement national directives, leading to uneven uptake of WEFE principles across different regions. Consequently, reported weak coordination among regulatory bodies and insufficient advocacy for integrated planning continue to be major barriers to widespread adoption of WEFE approaches.

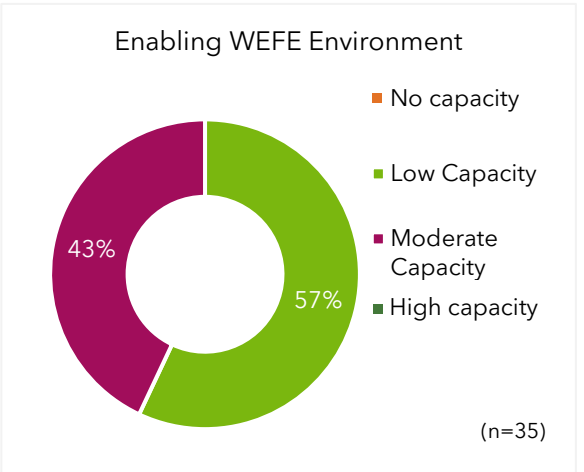


Figure 2. Capacity level across Domain 1 (% respondents)  
Source: Survey Data

2. Institutional mandates and strategies

Although a little more than half of the respondents rated themselves as having moderate capacity in this domain (Figure 3), operationalizing institutional mandates for Nexus implementation remains a challenge. Many institutions have strategic frameworks on paper, but they are frequently under-resourced – both financially and in terms of human capital – limiting their impact. Further complicating matters is the misalignment between high-level policy directives and on-the-ground operational guidelines, which can create confusion about roles and responsibilities, as well as duplication of efforts among different agencies. A reported low representation of women and youth in decision-making also underscores the need to strengthen inclusivity within institutional structures. Without comprehensive institutional reforms, clarified roles and better budgetary prioritization, existing frameworks may continue to be implemented only partially, leading to piecemeal and unsustainable progress in mainstreaming Nexus approaches.

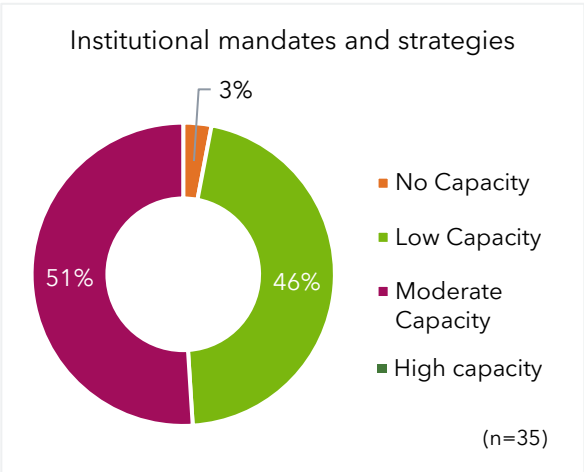
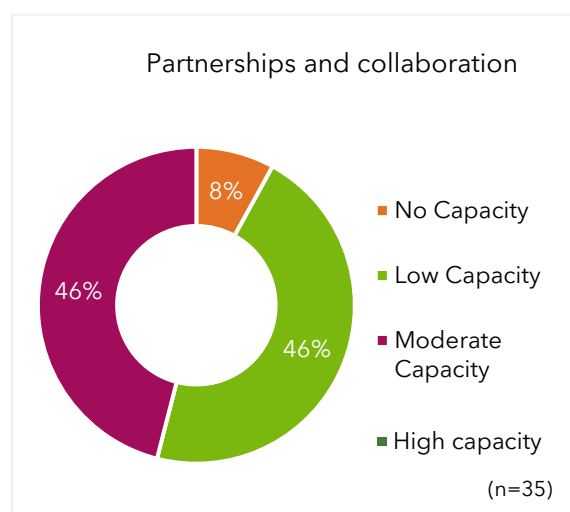


Figure 3. Capacity level across Domain 2 (% respondents)  
Source: Survey Data

### 3. Partnerships and collaboration

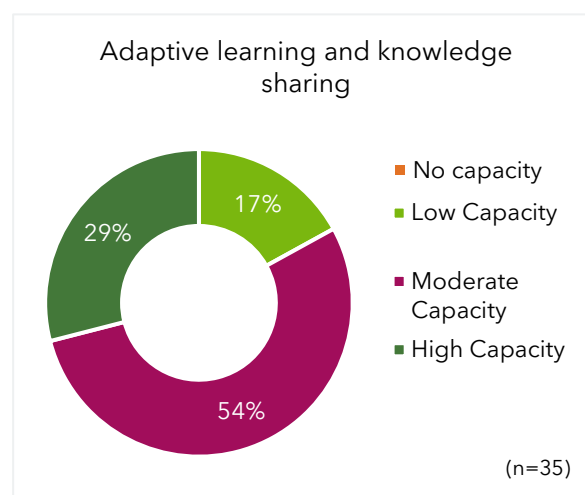
Close to half of the respondents self-reported moderate capacity, which suggests a growing interest in cross-sectoral collaboration (Figure 4). However, concrete and sustained collaborative frameworks are still underdeveloped. Existing partnerships often function on a project-by-project basis rather than through institutionalized arrangements. Limited incentives and mechanisms for interagency coordination – such as formalized networks or joint funding – impede seamless cooperation, leaving many opportunities for synergistic approaches to WEFE challenges untapped. More than half of the stakeholders reported a moderate to high willingness to engage in integrated WEFE Nexus efforts, suggesting that many actors are prepared to collaborate if given the right conditions. The remaining who reported limited or no interest may reflect external constraints, such as insufficient resources, a weak enabling environment or the absence of practical tools for collaboration – rather than a fundamental reluctance to adopt Nexus approaches. This highlights the importance of addressing systemic barriers – including policy gaps, limited financing and lack of collaborative platforms – to unlock the latent interest across institutions.



**Figure 4.** Capacity level across Domain 3 (% respondents)  
Source: Survey Data

### 4. Adaptive learning and knowledge-sharing

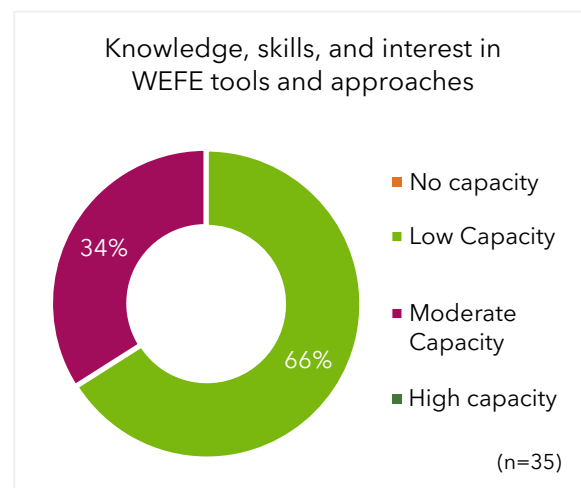
Although nearly a third of stakeholders perceive themselves as having high capacity in this domain (Figure 5), challenges persist in the broader landscape of data and information sharing across WEFE institutions. This indicates a split between the ability to perform well in certain aspects of adaptive learning – like evaluating and reporting – and the capability to effectively share and coordinate data across different sectors. The moderate and high capacity reported suggests that well-developed capabilities may exist within individual institutions or sectors, which have not yet been effectively scaled or extended to a cross-sectoral context. Thus, despite “pockets of excellence,” the network as a whole struggles to operate cohesively due to the lack of integrated data-sharing mechanisms. To address these challenges and leverage the existing high capacity where it exists, clear data-sharing protocols and centralized data platforms are needed to ensure that all relevant stakeholders have the access they need.



**Figure 5.** Capacity level across Domain 4 (% respondents)  
Source: Survey Data

## 5. Knowledge, skills, and interest in WEFE tools and approaches

Results under Domain 5 reveal a significant gap in both institutional and individual self-reported capacities for implementing Nexus solutions (Figure 6). Many practitioners lack advanced competencies in scenario development, modeling and decision-support systems essential for integrated planning. Although motivation to learn and apply Nexus concepts exists, the absence of structured training programs and mentorship opportunities holds back progress. Additionally, respondents note that gender and social inclusion considerations remain under-integrated, stressing the need to embed these dimensions more fully in capacity-building efforts. Without a skilled and well-trained workforce, institutions will struggle to design, implement and sustain effective Nexus strategies, which require interdisciplinary knowledge and expertise. Furthermore, without continuous learning and professional development, institutions will find it difficult to adapt to evolving challenges, such as those posed by climate change.



**Figure 6.** Capacity level across Domain 5 (% respondents)  
Source: Survey Data

## Recommendations for researchers and practitioners

The scoping study revealed significant gaps in (self-evaluated) institutional capacity, including limited collaboration across sectors, insufficient political will and lack of infrastructure for data-sharing. To address these challenges, the following five recommendations are essential for researchers and practitioners working across the water, energy, food and environment sectors:

### 1. Strengthening institutional coordination

Pakistan must establish **formal and systematic mechanisms** for inter-sectoral coordination across the WEFE sectors. While many institutions have strategic frameworks in place, their impact is often limited by inadequate resources and a misalignment between policy directives and on-the-ground guidelines. To address this, ministries should **clarify roles and responsibilities** among different agencies, ensuring that each entity's contribution to Nexus objectives is well-defined. This could include creating dedicated **Nexus committees** at the national, provincial and district levels. These committees – comprising representatives from relevant ministries, civil society, academia and the private sector – should align sectoral policies, share data and pool resources to ensure **synergistic rather than contradictory interventions**. A coordinated approach will enable more efficient planning, reduce redundancies and maximize the impact of resources. Furthermore, **earmarking specific budget lines** for Nexus-related work – and ensuring these funds are readily accessible – can help move from policy statements to concrete actions. Greater **inclusion of women and youth** in decision-making roles is also critical, requiring deliberate recruitment and leadership pathways to strengthen institutional diversity.

### 2. Building political will

Effective implementation of Nexus approaches requires **strong political commitment**. Practitioners should advocate for the inclusion of Nexus principles in national and provincial development plans, while proactively communicating

the socioeconomic and environmental benefits of cross-sectoral cooperation to decision-makers at all levels. This can be accomplished through **targeted advocacy campaigns, evidence-based policy briefs, and multi-stakeholder dialogues** that showcase the tangible returns – such as improved resource efficiency, enhanced climate resilience and equitable access to services – stemming from Nexus approaches. Additionally, relevant national and provincial WEFE institutions could create **legal or regulatory provisions** that mandate inter-sectoral collaboration and **provide incentives** (e.g., dedicated funding, performance metrics) for institutions demonstrating effective Nexus integration. Strengthening political will is also critical in securing the necessary investments and long-term support for Nexus-related initiatives. By bolstering political will and embedding these commitments within legislative and budgetary frameworks, Pakistan can secure the necessary investments and long-term support to ensure the Nexus approach remains a priority, even amid leadership transitions.

### 3. Investing in training and mentoring to strengthen capacities

One of the key findings of the NCS is the need for improved capacity to plan and implement Nexus solutions. Leaders of relevant WEFE institutions and policy/program implementers should prioritize **investment in training programs** for technical staff and knowledge-sharing platforms for researchers, academics, policymakers and government officials. These programs should focus on building skills in integrated resource management, data analytics, modelling (climate, hydrological, socio-economic), gender and social inclusion and climate-resilient planning. **Formal partnerships with universities** or research organizations to develop structured training and mentorship programs can streamline this process and ensure that future WEFE researchers and leaders are being trained before entering the workforce. This will create a **sustainable pipeline of skilled professionals** capable of driving WEFE integration at all levels of governance.

### 4. Promoting donor engagement

The NCS highlights institutional gaps that can be effectively addressed through strategic donor support. WEFE practitioners and researchers should engage donors to align funding with the most critical needs identified from the survey – particularly capacity-building programs, technological innovations and data-sharing mechanisms. Key interventions could include funding for **advanced training programs** for technical staff within WEFE departments, provisioning **state-of-the-art analytical tools and software** and establishing **user-friendly data-sharing platforms** like interactive dashboards. Development partners can further **formalize collaborative platforms**, such as inter-agency committees, roundtables or joint funding mechanisms that bring together government, civil society, academia and the private sector in a sustained manner. Engaging donors in this way will help scale up successful initiatives and create a more cohesive, long-term strategy for WEFE Nexus solutions.

### 5. Monitoring and tracking progress

To ensure that progress is made in implementing WEFE solutions, practitioners must institutionalize the monitoring and evaluation (M&E) of Nexus capacity. Building on the NCS as an **initial baseline**, regular assessments can capture self-perceived changes in coordination, data-sharing and technical expertise across institutions. Equally important is the **creation of feedback and adaptive management mechanisms** to enable strategy adjustment as challenges arise and new opportunities are identified. Transparent reporting on progress will help build accountability and ensure that all stakeholders remain engaged and motivated. Furthermore, **linking M&E findings to budgetary decisions** can help direct resources more effectively, ensuring sustained momentum toward comprehensive WEFE solutions.

# Conclusion

Implementing WEFE Nexus solutions in Pakistan calls for a multi-pronged strategy that tackles institutional weaknesses, ensures policy coherence and develops the required technical capacities. The Nexus Capacity Scorecard pilot results highlight both untapped potential and ongoing challenges, revealing pockets of strong capacity amidst broader reported needs for institutional reforms, data-sharing mechanisms and a skilled workforce. By fostering coordinated efforts among government, civil society, academia and the private sector, Pakistan can move away from fragmented initiatives and toward integrated resource management – ultimately enhancing resilience, inclusivity and sustainability. The recommendations outlined above offer a clear roadmap for strengthening the WEFE Nexus in Pakistan and preparing the country to address emerging threats such as climate change, resource scarcity and inequalities. Embracing these strategies will reinforce cross-sectoral collaboration, secure more efficient resource allocation and ensure that Pakistan’s water, energy, food and environmental sectors are managed in a way that benefits all citizens now and in the future.

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