



وزارة البيئة والمياه والزراعة
Ministry of Environment Water & Agriculture

FROM INNOVATION TO IMPACT: Shaping the Future of Environment, Water, and Agriculture Sectors in KSA



A report issued by the Ministry of Environment, Water and
Agriculture on the occasion of World Creativity and Innovation Day

April 2026

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ



**The Custodian of the Two Holy Mosques
King Salman bin Abdulaziz Al Saud**

“The focus on science and innovation, technological advancement, and the development of human capabilities represents a key pillar of sustainable development.”



**HIS ROYAL HIGHNESS
PRINCE MOHAMMED BIN SALMAN**

“Our ambition for Saudi Arabia is to become a global leader in research, development, and innovation with an annual investment equivalent to 2.5% of GDP in 2040. This will diversify and add 60 billion Saudi Riyals (USD 16 billion) to the economy in 2040 while creating high-value jobs in science and technology.”



His Excellency Eng. Abdulrahman Abdulmohsen AlFadley

Minister of Environment, Water, and Agriculture

“The Kingdom’s vision places strong emphasis on advancing research and innovation as key drivers of a resilient knowledge economy and a diversified future. Within this framework, the Ministry of Environment, Water, and Agriculture is committed to fostering collaboration across the innovation landscape, ensuring the adoption and localization of technologies that strengthen sustainability and create lasting impact in its core sectors.”



His Excellency Eng. Mansour bin Hilal Al Mushaiti

Vice Minister of Environment, Water, and Agriculture

“Innovation serves as a core driver of success for the Environment, Water, and Agriculture sectors in the Kingdom, advancing the journey toward sustainability and enhancing the Kingdom’s position on the global stage. Empowered by our visionary leadership, the Ministry of Environment, Water, and Agriculture has launched strategic initiatives, including the creation of a dedicated Deputyship for Research and Innovation, to enable the development of forward-looking solutions that ensure sustainable natural resource management while driving economic growth and developmental progress.”

FOREWORD



Dr. Abdulaziz bin Malik Al-Malik

Deputy Minister for Research and Innovation

Research and innovation are recognized globally as essential engines for sustainable economic growth, driving competitiveness, enhancing productivity, and delivering practical solutions to pressing challenges. The Kingdom of Saudi Arabia has made significant strides in this area, demonstrating a strong commitment to advancing knowledge and technology across multiple sectors. Guided by a national vision that places environmental sustainability and the fulfillment of fundamental human needs at its core, the Kingdom is working to ensure sustainable access to water and food through modern agricultural practices and environmentally responsible technologies, reflecting a holistic approach to national development and well-being.

To reinforce its commitment to advancing research and innovation, the Ministry of Environment, Water, and Agriculture is working to enhance the readiness of its sectors by building an enabling environment for research and innovation, with a focus on developing national talents and advancing high-impact research partnerships.

Aligned with the national priorities outlined in the Kingdom's national EWA sectoral strategies and with the 2 national missions for food and water security, the ministry launched the RDI Executive Plan for the Environment, Water, and Agriculture sectors in 2024. The plan seeks to advance research and innovation across the environment, water, and agriculture sectors by guiding the ecosystem and implementing targeted tools that strengthen collaboration, facilitate technology adoption, and enhance the sector's responsiveness to emerging needs. The development of this plan was made possible through close integration and cooperation with a wide range of stakeholders, ensuring alignment with relevant national strategies across the environment, water, and agriculture, sectors. Together, through our shared commitment, we are advancing toward a future where research and innovation empower the Kingdom to achieve sustainability, ensure food and water security, and foster a thriving, resilient society for generations to come.

PURPOSE OF THE REPORT



In 2024, the Ministry of Environment, Water, and Agriculture (MEWA) launched an RDI Executive Plan comprising a series of initiatives and programs aimed at strengthening the Research and Innovation ecosystem across the Environment, Water, and Agriculture sectors. This plan aims to foster innovation, enhance collaboration, and promote the development and adoption of solutions that advance the Kingdom's strategic priorities in environmental sustainability, water preservation, and food security. By establishing a structured approach to innovation development, the plan positions MEWA as a catalyst for systemic transformation across these critical sectors.

The purpose of this report is to highlight the impact of the MEWA RDI Executive Plan over the past two years, showcasing the outcomes of the EWA ecosystem initiatives and programs. It illustrates how these programs have supported innovators, empowered stakeholders, and contributed to advancing the ecosystem in line with national sustainability objectives, particularly in the environmental, water, and agricultural sectors. Through evidence-based analysis, this report demonstrates the tangible value generated by strategic investments in research and innovation, underscoring the Ministry's role in building a knowledge-driven foundation for long-term sectoral excellence.



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1. ABOUT THE MINISTRY OF ENVIRONMENT, WATER, AND AGRICULTURE

The Ministry of Environment, Water, and Agriculture (MEWA) plays a pivotal role in the sustainable preservation of natural resources, ensuring water conservation, and contributing to long-term food security. Guided by its vision, mission, and national mandate, MEWA is dedicated to enhancing quality of life and fostering prosperity for the nation and future generations, through comprehensive policies and programs across its three sectors.



VISION

To achieve sustainability of environment and natural resources, in a manner that would ensure water security, contribute to achieving food security, and improve the quality of life in KSA.



MISSION

To maintain distinguished performance in developing and applying comprehensive policies and effective strategies, as well as promoting services by engaging the private sector and the competent authorities, with a view to achieving prosperity and sustainability of the environment, water, and agriculture sectors.

2. EXECUTIVE SUMMARY

Research and Innovation in EWA sectors

Research and innovation are fundamental to overcoming the critical challenges facing the sectors of environment, water, and agriculture. In a region with predominantly arid climates, limited water resources, and scarce arable land, combined with the growing impacts of climate change, population growth, rapid urbanization, and the unsustainable consumption of natural resources, the challenges are immense, and demand innovative and science-based solutions.

In the environment sector, research and innovation play a vital role in enhancing natural systems and supporting fragile ecosystems. One notable example is cloud seeding, an emerging technology that enhances rainfall by introducing environmentally safe materials into suitable clouds. Under suitable conditions, cloud seeding can increase precipitation by up to **20%**¹, helping replenish groundwater, support vegetation growth, and reduce the pressure on overexploited water sources.

Water management also stands as one of the most pressing priorities and addressing it requires innovative approaches. Among the most transformative of these is desalination, which has evolved from a costly last resort into a strategic pillar of water security. For instance, Saudi Arabia now produces about **70%**² of its drinking water through desalination and has become the world's largest desalinated-water supplier, responsible for **22%**³ of global output. Recent advancements have also made modern desalination plants significantly more efficient than in the past, reducing costs and environmental pressures while ensuring a reliable supply of clean water for households, industry, and agriculture.

In agriculture, genetically modified crops play a crucial role by increasing global yields by **22%**, reducing pesticide usage by **37%**, and lowering the environmental impact of insecticide and herbicide applications by **18%**⁴. Promoting climate-smart agricultural practices, including precision agriculture and agroecology, further enhances productivity while minimizing environmental harm. Saudi Arabia is increasingly at the frontier of such innovation. The Kingdom's private sector has demonstrated that advanced agricultural technology can thrive in arid conditions, with large-scale operations deploying automated climate control, AI-driven livestock monitoring, and precision irrigation systems adapted to desert environments⁵. In addition, at the national level, more than 1.2 billion SAR have been allocated to support projects that utilize modern technologies in the agricultural sector, with the aim of achieving food security⁶. These efforts reflect a broader shift toward food system self-sufficiency, increasingly driven by IoT, AI, and smart irrigation technologies in alignment with Vision 2030.

Recognizing the transformative potential of research and innovation, the Ministry of Environment, Water, and Agriculture has established a Deputyship for Research and Innovation to support and facilitate the development of solutions that balance resource sustainability with economic growth and advance national development objectives. This strategic commitment reflects the Ministry's vision to position research and innovation as cornerstone pillars for achieving long-term resilience and competitiveness in the environment, water, and agriculture sectors.

¹Britannica

²French Institute of International Relations, Asharq Al-Awasat

³Smart Water Magazine

⁴National Center for Biotechnology Information (NCBI)

⁵Ruminants

⁶Saudi Foodtech

MEWA RDI Executive Plan

To advance research and innovation across these sectors, the R&I Deputyship has developed a comprehensive executive plan for research, development, and innovation (RDI) (Figure 1). This plan aims to reinforce the broader RDI ecosystem across the environment, water, and agriculture sectors by addressing identified challenges in the ecosystem.

The RDI Executive Plan is structured around four strategic objectives:

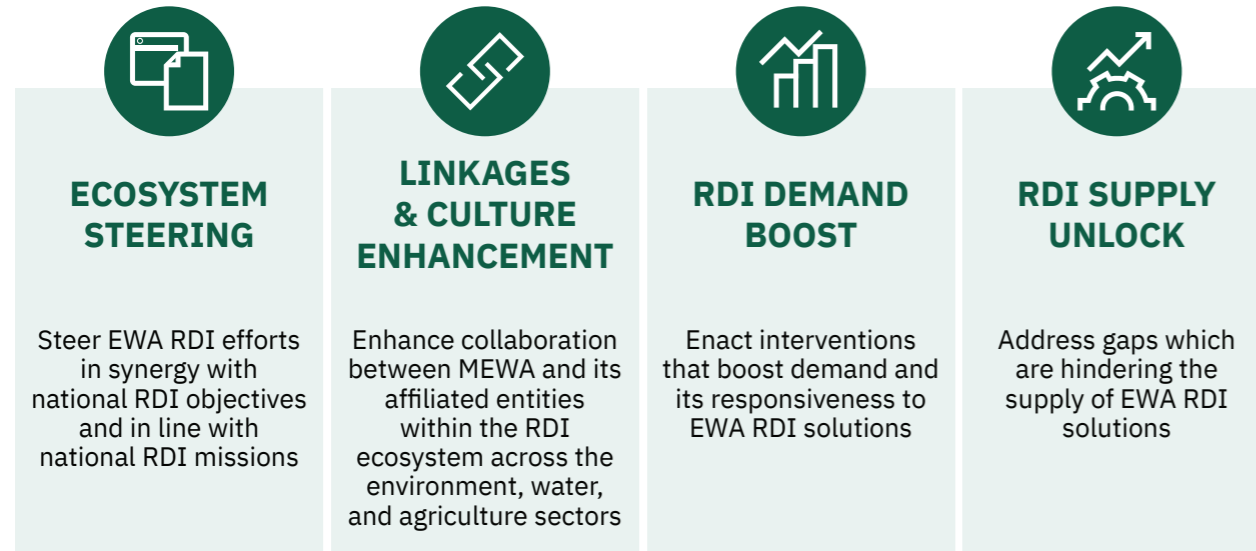


Figure 1: Official Launch of the MEWA RDI Executive Plan

Together, these objectives are achieved by enabling the ecosystem across five essential areas:



Impact Assessment of RDI Executive Plan

To assess the impact of the RDI Executive Plan, MEWA has launched an ecosystem-wide data collection exercise covering RDI programs across the EWA sectors. The exercise engaged more than 25 ecosystem entities and compiled over 1,400 data points. The assessment was carried out using a comprehensive four-stage framework composed of 4 main stages: Inputs, Outputs, Outcomes, and Impact.

- Inputs** refer to the 18 initiatives outlined in the RDI Executive Plan and the corresponding programs launched under each.
- Outputs** reflect the immediate results of these initiatives across the 4 strategic objectives.
- Outcomes** demonstrate how the initiatives contribute to the Key Performance Indicators (KPIs), reflecting the progress achieved toward the targets outlined in the RDI Executive Plan.
- Impact** is assessed in two dimensions:

 - **Impact on achieving national environment, water, and agriculture strategies' targets:** highlights how initiatives advance the National EWA sectoral strategies, the national RDI priority areas, and the National Biotechnology Strategy, demonstrated through contribution to their respective KPIs.
 - **Economic impact:** measures contributions to GDP, return on investment, sectoral production, trade balance, and job creation.

This framework provides a consolidated view of RDI efforts across the EWA ecosystem, demonstrating how the initiatives generate tangible economic value and support the Kingdom's national objectives.

Inputs: RDI Initiatives

The inputs consist of 18 RDI initiatives (Figure 2) comprising 280 programs under the four strategic objectives, representing the collective effort to advance research, development, and innovation across the environment, water, and agriculture sectors. These initiatives reflect a concerted commitment to building a knowledge-driven ecosystem that not only meets current sectoral needs but also positions the Kingdom at the forefront of regional excellence in environmental, water, and agricultural innovation.

Ecosystem Steering	Linkages & Culture Enhancement	RDI Demand Boost	RDI Supply Unlock
A.1: MEWA RDI Governance Framework	B.1: EWA RDI Partnerships Framework & Setup	C.1: EWA RDI Demand-Side Regulatory Sandboxing & Streamlining	D.1 EWA Technology Deployment Centers
A.2: EWA RDI Funding Steering Mechanism	B.2: EWA RDI National Digital Platform	C.2: EWA Technology Piloting & Demonstration	D.2: MEWA IP & Technology Management Framework
A.3: EWA RDI Ecosystem Health Monitoring	B.3: EWA RDI Awards & Grand Challenges	C.3: EWA RDI Demand Incentives & Guarantees	D.3: EWA RDI Talent Development
A.4: EWA Technology Scouting & Foresight	B.4: EWA RDI Awareness	C.4: EWA End-User Technology Adoption Support	
A.5: EWA Technology Deployment Roadmap	B.5: EWA Innovation Events		
A.6: EWA RDI Mission Planning & Coordination			

Figure 2: MEWA RDI Initiatives

Key Outputs

Since its launch, the RDI Executive Plan has delivered substantial outputs across all strategic objectives, demonstrating progress and tangible results that are reshaping the research and innovation landscape.

A ECOSYSTEM STEERING

- Establishment of a governance structure supported by **5** core R&I committees
- Development of a funding strategy for EWA RDI initiatives
- Launch of the National Platform for Research and Innovation Analytics for Sustainability (NPRAS)
- Development of **3** technology adoption roadmaps for EWA sectors
- Detailing of the national RDI Water Missions
- Publication of **4** EWA sectoral reports focusing on the most notable research and innovation trends in the EWA sectors

B LINKAGES & CULTURE ENHANCEMENT

RDI Sectoral Alliances:

- Launch of the Saudi Agricultural and Food Technology Alliance (SAFTA)
- Launch of the Water STRIP

Technology Valleys:

- Establishment of the International Water Research Center (IWRC)

Strategic Partnerships:

- Establishment of **6** strategic partnerships with leading private-sector and academic institutions
- Signing of an MoU with the Netherlands' Ministry of Agriculture, drawing investments exceeding SAR **1.5** billion

Awareness Promotion:

- 95+** RDI outreach and awareness activities delivered
- 4** national RDI award programs launched to incentivize students, researchers, and innovators

C RDI DEMAND BOOST

Launch of a regulatory sandbox program with **74** cases reviewed

333 innovative technologies supported across all value chain elements of the EWA sectors

D RDI SUPPLY UNLOCK

Restructuring of laboratories and research centers in the Kingdom, and the establishment of **4** key facilities

Development of a comprehensive intellectual property policy

Filing of **18** intellectual property assets by EWA ecosystem entities, including 10 plant varieties and 1 geographical indication under MEWA

4,200 supported individuals across the whole educational lifecycle, including 6 post-doctoral fellowships granted, both locally and internationally

Outcomes

The initiatives have generated significant outcomes across the RDI ecosystem, reflecting progress in innovation development, stakeholder engagement, and talent capacity building. This demonstrates how targeted programs and interventions are translating into tangible, measurable results, contributing directly to the Key Performance Indicators (KPIs) of the MEWA RDI Executive Plan and establishing new standards for integrated innovation excellence within the Kingdom's environmental, water, and agricultural sectors.



51 challenges

challenges addressed by active RDI projects



245 partners

actively engaged in RDI hubs and alliances



256,000+ individuals

individuals engaged through RDI outreach activities



127 technologies

deployed in line with the RDI Technology Focus Areas with offtaker support



27 companies

supported through the regulatory sandbox



18 protected R&I solutions

in the EWA sectors



426 solutions,

concepts, and ideas captured through programs



4,200+ individuals

graduated from RDI talent programs

 **Impact**

With respect to national objectives and targets, RDI initiatives and programs demonstrate impact on five national strategies, as reflected by contribution toward their KPIs, including the National Environment Strategy (9 KPIs), the National Water Strategy (16 KPIs), the National Agricultural Strategy (14 KPIs), the national RDI priority areas, and the National Biotechnology Strategy (4 KPIs).

Economic benefits are also evident. According to an economic input–output (I/O) analysis, the RDI initiatives and programs are estimated to generate approximately SAR 15 billion in Gross Value Added (GVA) in the water and agriculture sectors, reflecting a direct contribution to national GDP and yielding an average return of 3.7x for every SAR invested. This is expected to result in SAR 18 billion in sectoral output through increased production of water and agricultural products and services, a positive impact of SAR 14 billion on the trade balance, and the creation of over 18,000 jobs across these sectors⁷.

The broader impact on the national economy is even more significant. Through linkages with upstream and downstream industries, the EWA sectors stimulate activity across other parts of the economy, resulting in an estimated SAR 20 billion contribution to GDP, SAR 27 billion increase in total economic output, a SAR 10 billion improvement in the trade balance, and the creation of more than 36,000 jobs economy-wide. Notably, the positive impact on the trade balance at the total economy level is lower than that observed within the water and agriculture sectors. This is driven by the EWA sectors’ reliance on inputs from other industries, such as manufacturing and professional and technical services, which depend heavily on imported goods and services.



3.7x return generated for every SAR invested in RDI initiatives and programs within the EWA sectors

In recognition of its outstanding efforts to promote a culture of research, development, and innovation across the EWA sectors, MEWA has received the Innovation 360 accreditation and the GInI certification.

Looking Ahead

The Kingdom’s path to a sustainable future in agriculture, water, and the environment relies on bold innovation, with the Ministry of Environment, Water, and Agriculture (MEWA) leading this transformation by turning national vision into concrete initiatives. Through refining and expanding existing initiatives and programs and introducing new ambitious ones, MEWA will continue to shape the future of EWA sectors by empowering stakeholders, actively engaging the private sector to drive investment, collaboration, and technology adoption, creating new opportunities, and turning challenges into drivers of progress. By nurturing a vibrant and resilient innovation ecosystem, the Ministry seeks to preserve natural resources, enhance national strength, and drive economic and societal growth, ensuring that today’s efforts lay the foundation for prosperity for generations ahead.

⁷This represents the full expected impact of these RDI initiatives and programs, which may not be realized immediately but is expected to materialize over several years. The economic impact was developed using a custom input–output model, a widely adopted economic framework by leading global organizations such as the World Economic Forum and the OECD. Further details on the methodology are provided in the appendix.

3. INTRODUCTION

Research and innovation are central to addressing today's most pressing challenges in environment, water, and agriculture. In a region with limited water resources and arid climates, these tools provide the key to securing sustainable growth, safeguarding essential resources, and protecting ecosystems for generations to come. In the Kingdom, arable land makes up only **1.5%**⁸ of the total land area, yet the agricultural sector consumes **78%**⁹ of the nation's water resources. These figures underscore significant sustainability challenges and highlight the urgent need to address both water and food security.

Scientific research helps build a deeper understanding of local environmental conditions, such as soil health, water scarcity, and the effects of climate change. Innovation then transforms this knowledge into smart and modern solutions, whether through advanced irrigation systems, renewable water desalination, or the development of crops that can withstand heat and drought. By combining evidence-based insights with modern technologies, it becomes possible to achieve both environmental preservation while advancing food and water security. For instance, through innovative and advanced technologies, and despite the significant challenges, Saudi Arabia has become the largest food producer in the GCC region¹⁰. Furthermore, the Kingdom now produces around **50%**¹¹ of its water supply and stands as the world's leading producer of desalinated water, accounting for **22%**¹² of global production.

The benefits extend well beyond the present. By investing in research and encouraging innovative practices, the nation is ensuring that future generations inherit a landscape where resources are safeguarded and opportunities for growth continue to expand. Supporting this perspective, the most recent Nobel Prize in Economic Sciences recognized an economic model demonstrating that innovation drives long-term economic growth: it quantitatively confirms that technological advances and new innovative products continuously replace old ones in a dynamic, self-reinforcing cycle, which in turn leads to higher standards of living, improved health, and enhanced quality of life worldwide. Therefore, research and innovation are not optional, they are essential pathways to resilience, progress, and prosperity in vital sectors such as environment, water, and agriculture.

⁸ World Bank Data

⁹ General Authority for Statistics (GASTAT)

¹⁰ IndexMundi

¹¹ Arab News

¹² US Saudi Business Council

4. DRIVING THE FUTURE: HOW MEWA POWERS RESEARCH & INNOVATION

The Ministry of Environment, Water, and Agriculture stands at the forefront of safeguarding and sustainably developing natural resources while advancing national resilience and long-term prosperity. Acknowledging that research and innovation are critical drivers of progress in the environment, water, and agriculture sectors, MEWA has established a dedicated Deputyship for Research and Innovation to drive innovation and deliver transformative solutions. The R&I Deputyship is mandated to develop a competitive research and innovation ecosystem in the Kingdom's environment, water, and agriculture sectors, enabling the EWA RDI ecosystem to deliver innovative solutions that advance sustainability across these sectors and reinforce the Kingdom's leadership in evidence-based environmental stewardship, water resource management, and agricultural advancement.



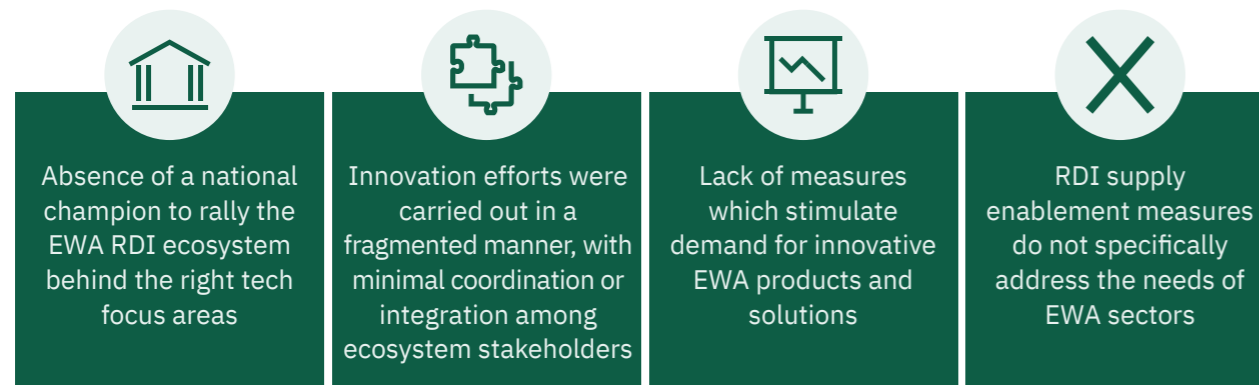
MEWA RDI Executive plan

To fulfill its mandate, the Research and Innovation Deputyship at the Ministry of Environment, Water, and Agriculture launched the MEWA RDI Executive Plan (Figure 3) in 2024.

Purpose:

To propel research and innovation in the environment, water and agriculture sectors through steering the ecosystem and through targeted instruments that enhance linkages, support the deployment of technologies, and increase the responsiveness of demand.

Furthermore, the plan is designed to advance research and innovation across the environment, water, and agriculture sectors, addressing 4 key ecosystem gaps that have been identified as fundamental barriers to achieving comprehensive innovation excellence and sustainable sectoral development:



In order to address these gaps, the RDI Executive plan is structured around four key strategic objectives:

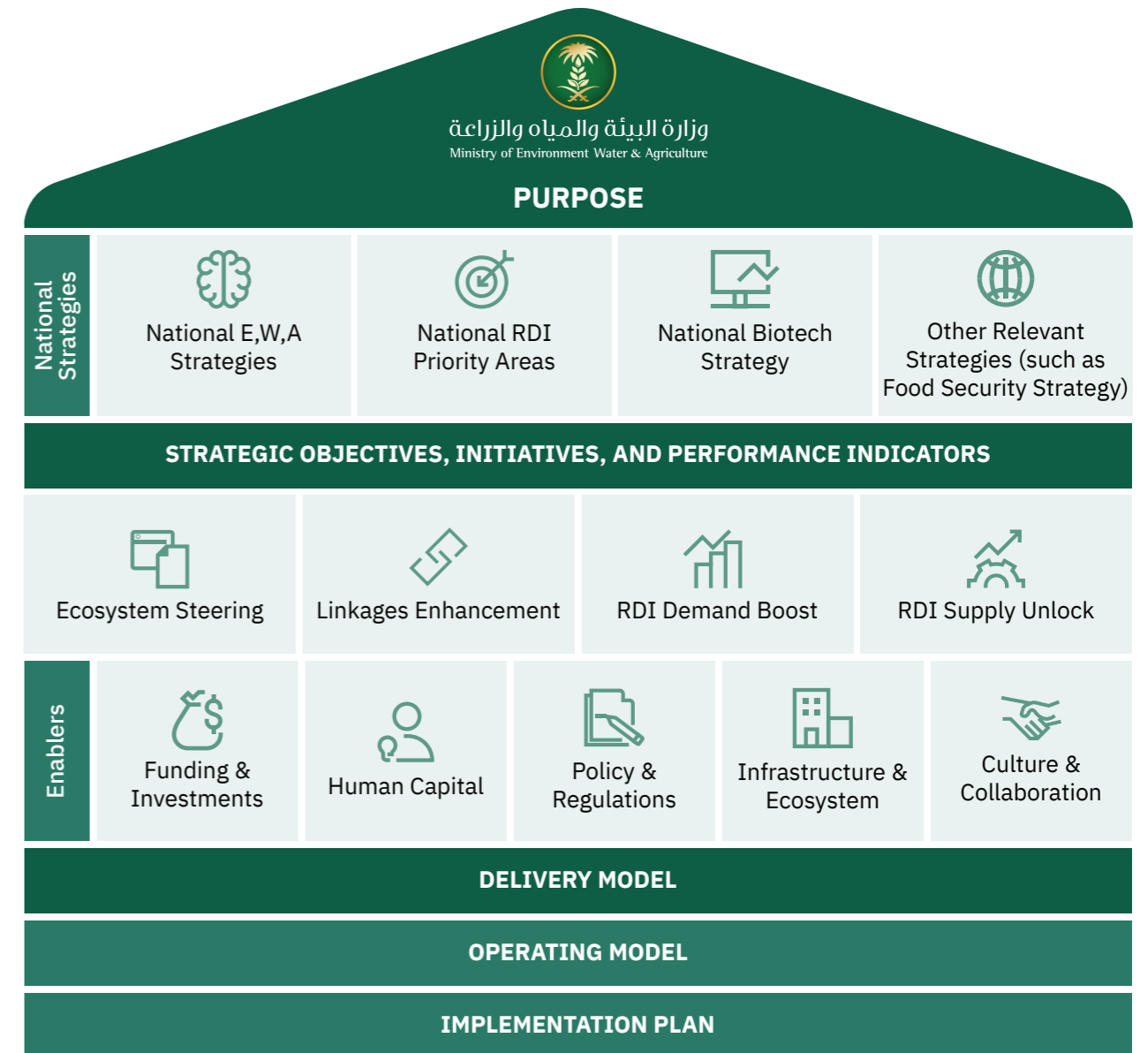
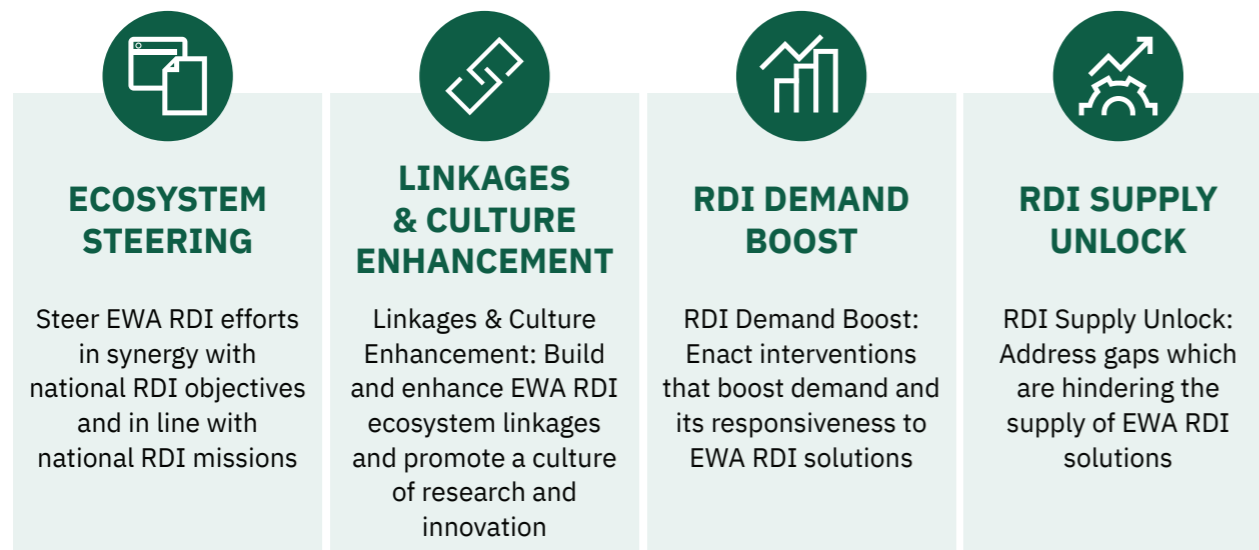


Figure 3: MEWA RDI Executive Plan

The RDI Executive plan comprises 18 initiatives (Figure 2) across the 4 objectives, designed to address the identified gaps and convert the initiatives into actionable efforts.

Ecosystem Steering	Linkages & Culture Enhancement	RDI Demand Boost	RDI Supply Unlock
A.1: MEWA RDI Governance Framework	B.1: EWA RDI Partnerships Framework & Setup	C.1: EWA RDI Demand-Side Regulatory Sandboxing & Streamlining	D.1: EWA Technology Deployment Centers
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A.5: EWA Technology Deployment Roadmap	B.5: EWA Innovation Events		
A.6: EWA RDI Mission Planning & Coordination			

Figure 4: MEWA RDI Initiatives

Together, these initiatives and programs form the backbone of MEWA’s RDI Executive Plan, aiming to strengthen and enable the ecosystem by addressing five key enablement areas and resulting in corresponding outputs:

- 
Funding and Investments
 Providing financial resources and investment opportunities to support research, innovation, and technology commercialization.
- 
Human Capital
 Developing skills, expertise, and talent through education, training, and capacity-building programs to drive innovation.
- 
Policy and Regulations
 Establishing clear policies, guidelines, and regulatory frameworks that facilitate innovation and technology adoption.
- 
Infrastructure
 Creating physical and digital facilities, laboratories, and technology platforms that support research, testing, and deployment of innovations.
- 
Culture and Collaboration
 Cultivating a collaborative, knowledge-sharing, and innovation-driven culture among stakeholders and reinforcing ecosystem connections through partnerships.

In order to effectively monitor and evaluate the 18 strategic initiatives of the RDI Executive Plan, Key Performance Indicators (KPIs) have been established. These indicators offer a comprehensive perspective on the plan’s progress by capturing how the ecosystem is being strengthened through funding, capacity building, and regulatory support, the extent to which innovative technologies with future potential are supported, and the level of engagement within the EWA RDI ecosystem through partnerships and outreach activities.

To orchestrate efforts across the ecosystem and ensure impact is being achieved, an operating model has been developed to define interactions among key ecosystem stakeholders (Figure 5). The Steering Committee for Research and Innovation at the Ministry and its affiliated entities, the three sectoral subcommittees for the development of innovative technological solutions across the Environment, Water, and Agriculture sectors, and the R&I Deputyship at MEWA, guide the EWA RDI ecosystem by engaging with governmental, private, and academic institutions to understand their needs and enable them to effectively execute their RDI programs and drive the advancement of the ecosystem.

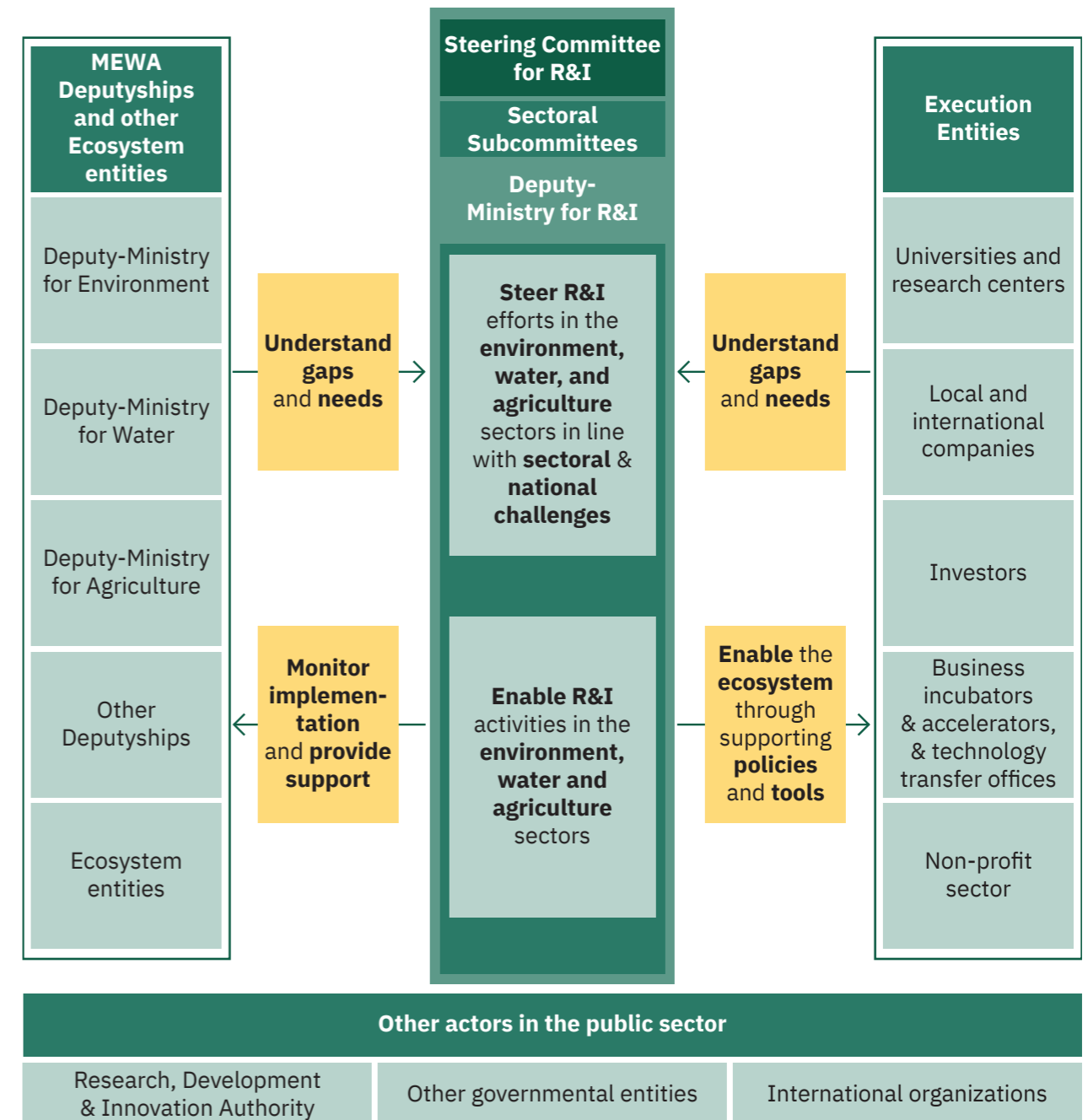


Figure 5: Operating Model

5. MEASURING THE IMPACT OF RESEARCH AND INNOVATION IN THE ENVIRONMENT, WATER AND AGRICULTURE SECTORS

5.1 - Methodology

To evaluate the impact of the RDI Executive Plan, a comprehensive assessment framework has been adopted (Figure 6). This framework consists of four main steps: Input, Output, Outcome, and Impact.

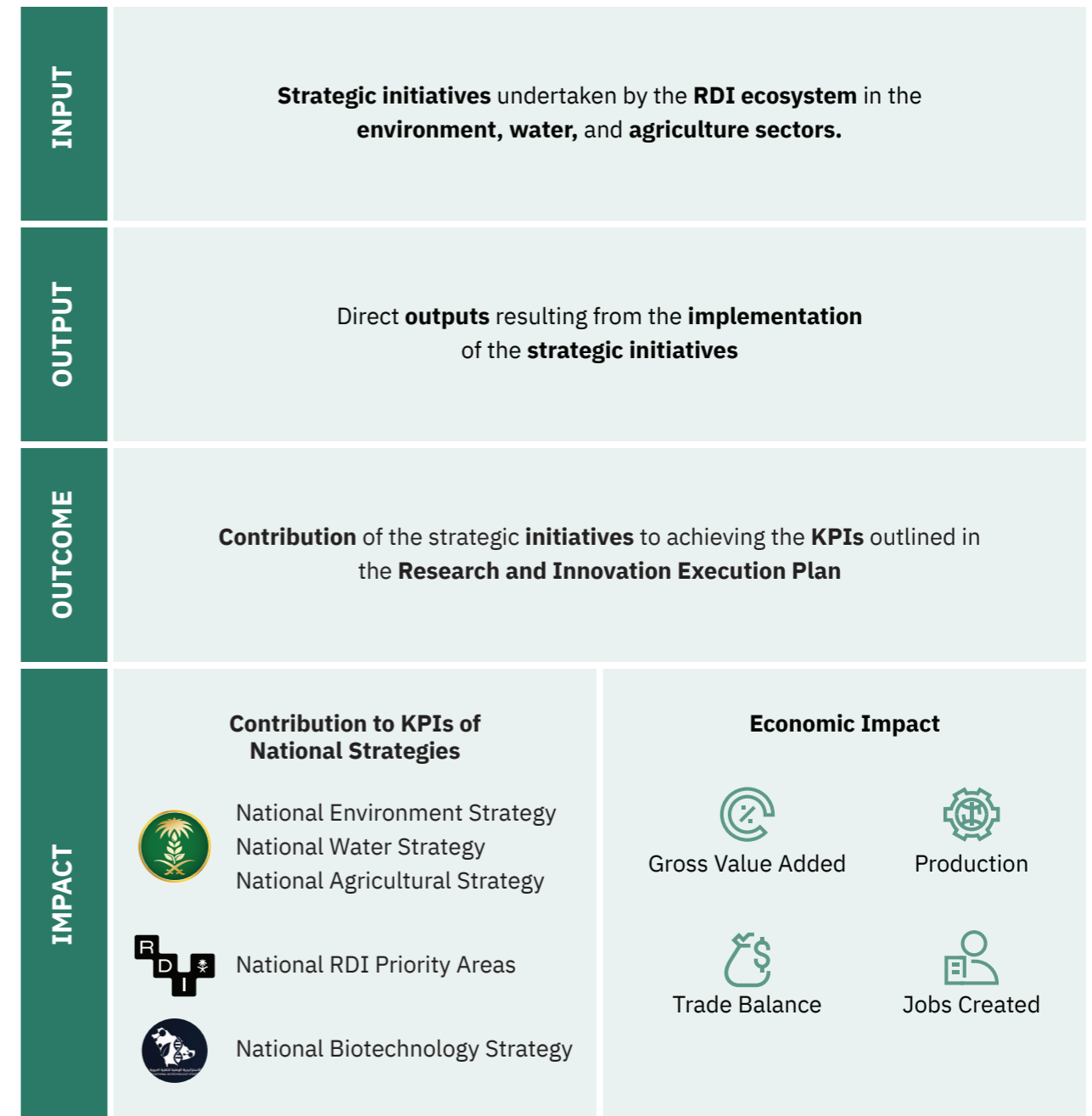


Figure 6: Impact Assessment Framework

5.2 - Strategic RDI Initiatives

A. Ecosystem Steering









Input

The R&I Deputyship is committed to ensuring that EWA's innovation initiatives support the Kingdom's national objectives through a structured and coordinated approach. To this end, a comprehensive governance framework has been established to guide decision-making and priority-setting, while a funding steering mechanism has been introduced to channel resources from multiple streams toward EWA RDI activities. Furthermore, technology roadmaps have been introduced to identify technology families across all technology Readiness Levels (TRLs) capable of addressing both current and emerging challenges, supported by a dedicated scouting and foresight platform to remain ahead of global trends. Together, these efforts ensure that innovation activities are strategically aligned with the Kingdom's long-term vision and priorities while responding to sectoral challenges.



Output

Key results to date include:

 <p>Establishment of a comprehensive governance structure consisting of the Steering Committee for Research and Innovation at the Ministry and its affiliated entities, and 3 sectoral subcommittees for the development of innovative technological solutions across the Environment, Water, and Agriculture sectors, in addition to specialized committees to address specific topics, such as the Executive Biotechnology Committee</p>	 <p>Development of a funding strategy supported by a detailed action plan with clearly defined roles and responsibilities</p>	 <p>Development of the National Platform for Research and Innovation Analytics for Sustainability (NPRAS), which highlights the latest innovations and technologies in the EWA sectors</p>
 <p>Development of 3 technology adoption roadmaps for the environment, water, and agriculture sectors, outlining sectoral challenges and mapping relevant technology families to address them</p>	 <p>Publication of 4 sectoral reports, including the Water and Agriculture Innovation Trends reports, as well as the Investment Trends in Research, Development, and Innovation for Sustainability report</p>	 <p>Detailing of the RDI Water Missions and formulation of the first-of-its-kind methodology in Saudi Arabia for mission design, engaging more than 60 experts in the process</p>



Outcome (KPIs)

Building on these achievements, the EWA ecosystem has also delivered concrete and measurable outcomes that demonstrate the effectiveness of these initiatives:



51 challenges challenges by active RDI projects



Impact

The impact of these efforts extends beyond strategic alignment, translating into measurable economic gains across the EWA sectors. Based on the impact assessment conducted, these initiatives and programs are estimated to generate additional sectoral output, increase gross value added (GVA), strengthen the trade balance, and create jobs, demonstrating tangible benefits for the ecosystem across the water and agriculture sectors.

In addition, these initiatives have contributed to national strategies, including the National Environment Strategy, the National Water Strategy, and the National Agricultural Strategy, by ensuring that innovation priorities are systematically mapped to sectoral challenges, and the national RDI priority areas, through fostering conditions for growth in research expenditure.



A.1 RDI Governance Framework (Initiative Overview)

Description: A transparent and effective governance framework which defines the required roles and mechanisms for setting EWA Tech focus areas in line with national and sectoral priorities, and for mobilizing EWA RDI ecosystem stakeholders through alignment of interests, exchange of information, and dynamic interactions.

4 Committees approved (Figure 8):

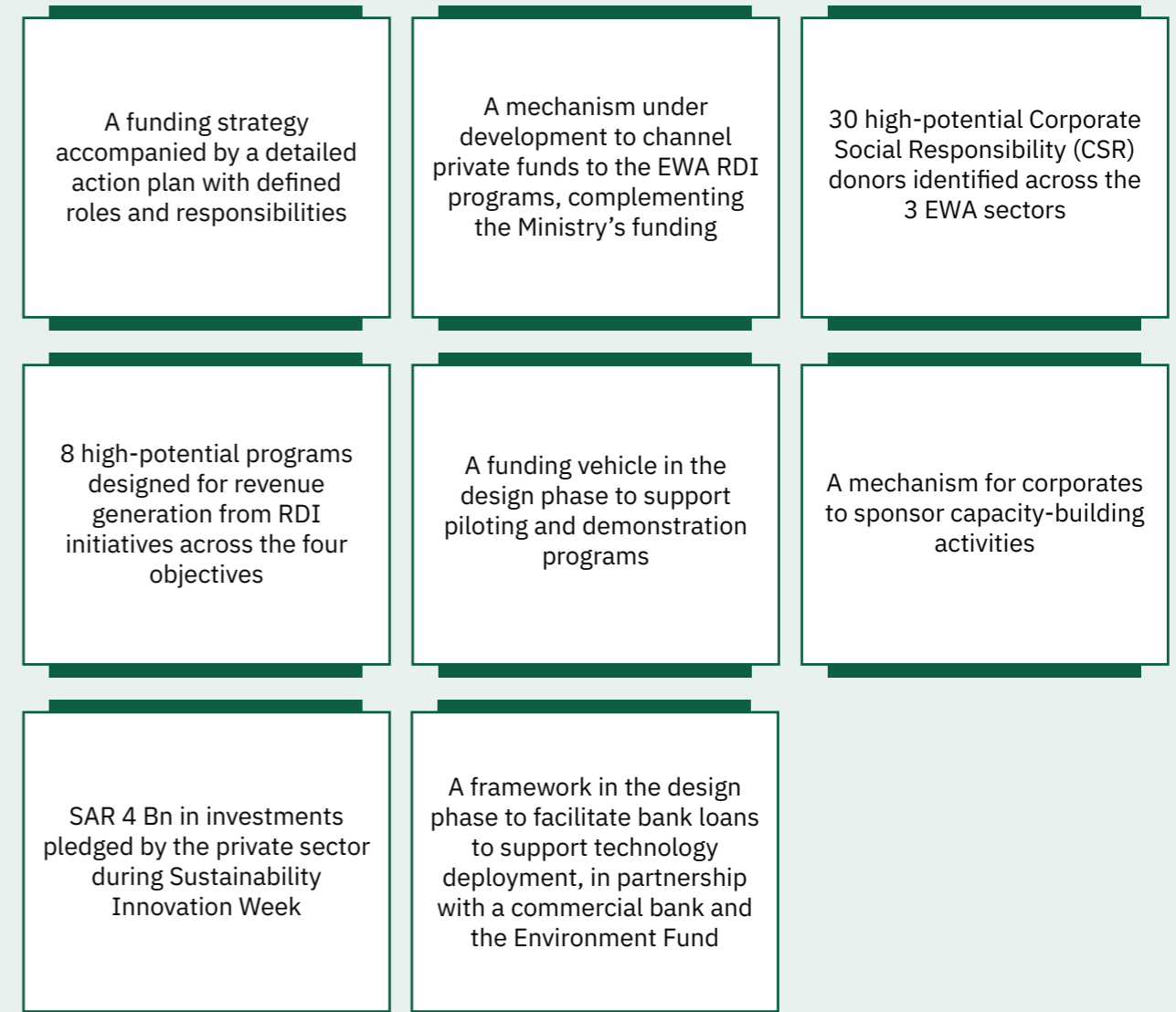


Figure 8: RDI Governance Framework for EWA Sectors

A.2 RDI Funding Steering Mechanism (Initiative Overview)

Description: A mechanism established to channel resources from diverse sources toward EWA RDI activities conducted by public and private ecosystem entities, prioritizing programs based on their potential and alignment with the EWA Technology Focus Areas.

The development of this mechanism began by benchmarking global RDI ecosystems to identify best practices, followed by comprehensive stakeholder engagement and mapping to evaluate existing mechanisms within Saudi Arabia. Drawing on these insights, key features and funding mechanisms tailored to the EWA RDI ecosystem were defined, and engagement models were then evaluated in terms of both ease of implementation and expected impact.



A.3 EWA RDI Ecosystem Health Monitoring (Initiative Overview)

Description: A robust system designed to measure and monitor the performance of the EWA RDI ecosystem, and to provide an accurate and transparent view of the state of RDI in EWA sectors with the aim of supporting informed decision-making.

In this context, in order to assess the impact of the initiatives under the RDI Executive Plan, an ecosystem-wide data collection exercise was conducted, covering all RDI programs in the environment, water, and agriculture sectors launched by ecosystem entities:

- **25+** entities engaged across all three sectors (Figure 9)
- **1,400** data points compiled
- **280** RDI programs analyzed

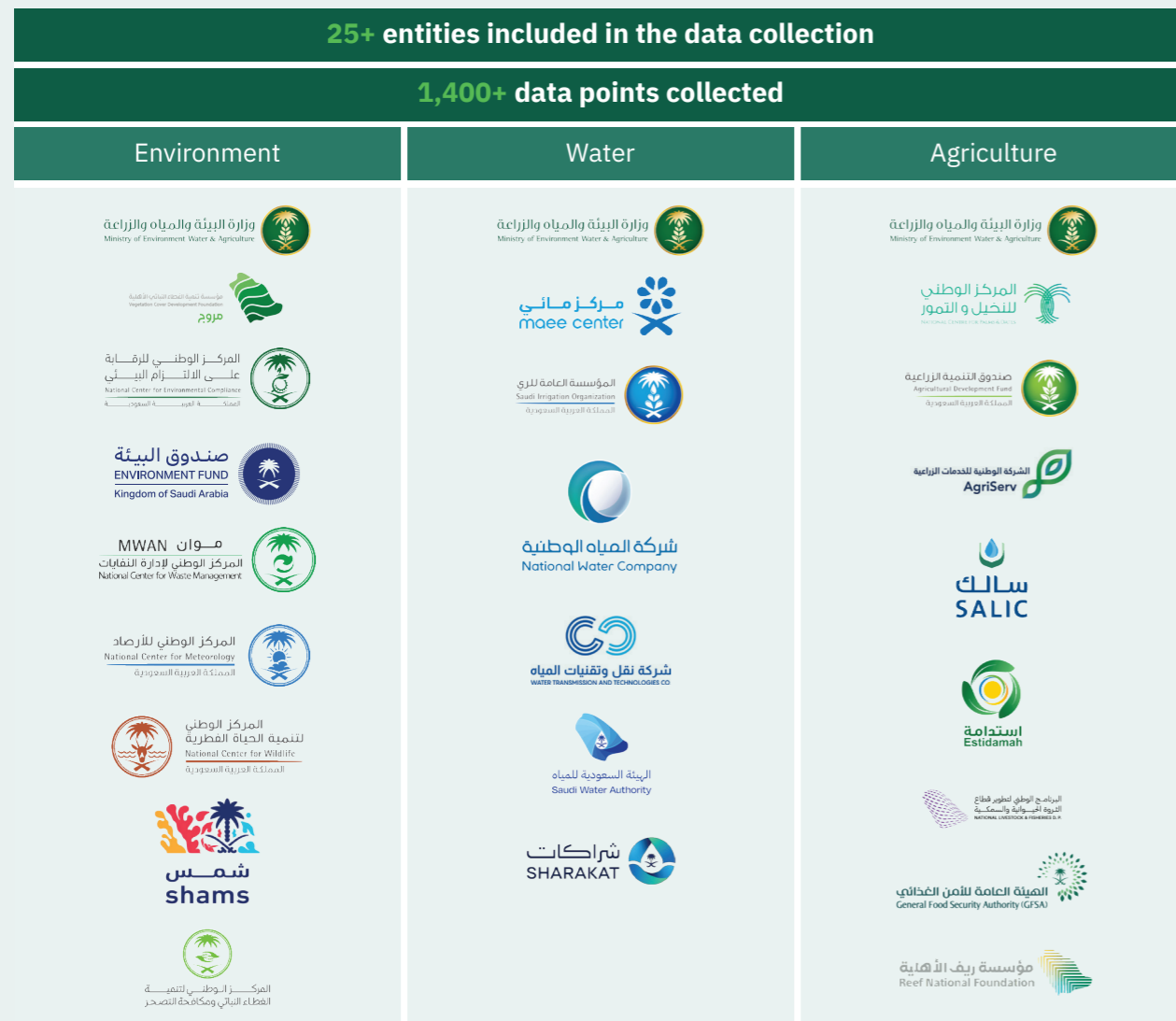


Figure 9: Stakeholders engaged in Data Collection

A.4 Technology Scouting & Foresight (Initiative Overview)

Description: A technology foresight initiative aiming to provide a regular view on promising RDI solutions, technologies, policies, and investment trends suited for addressing EWA challenges and opportunities, while supporting the ecosystem through advisory services.

- Launch of the NPRAS platform (National Platform for Research and Innovation Analytics for Sustainability) (Figure 10), to showcase the latest sectoral innovations and technologies, and provide advisory services to ecosystem stakeholders
- Publication of 4 sectoral reports, including the Water and Agriculture Innovation Trends reports, as well as the Investment Trends in Research, Development, and Innovation for Sustainability report, and 6 Innovation Brief Newsletters on Majarra and the NPRAS Platform
- Impact study of R&D efforts in agricultural and desalination technologies



Figure 10: Launch of the NPRAS platform

CASE STUDY:**NATIONAL PLATFORM FOR RESEARCH AND INNOVATION ANALYTICS FOR SUSTAINABILITY (NPRAS)****Objectives:**

- Anticipate research and innovation trends in the environment, water, and agriculture sectors
- Support decision-making through data-driven analysis and monitoring
- Attract investments and the efficient adoption of emerging technologies

Key features:

- Provides 100 million accurate and up-to-date data points
- Issues periodic reports
- Uses artificial intelligence and big data analytics to deliver future insights
- Relies on 10,000 sources for data collection

Beneficiaries:

- Investors
- Leaders, policymakers, and decision-makers
- Researchers and scientists
- Innovators and entrepreneurs

A.5 EWA Technology Deployment Roadmap (Initiative Overview)

Description: 3 roadmaps that identify, prioritize, and develop the deployment timeline for technologies within the EWA Focus Areas in line with sectoral challenges and opportunities. The roadmaps provide a structured approach to guide technology adoption, ensuring that investment and innovation efforts are directed towards high-impact areas (Figure 11 - See link in Appendix 3 for further details).

Methodology Overview: The roadmaps were developed through a rigorous, data-driven process, engaging over 100 stakeholders, including policymakers, researchers, and sector experts. The approach combined demand-side analysis, by identifying 51 EWA sector challenges, and supply-side mapping, by scanning 350 relevant technologies globally, followed by an evaluation to determine impact and ease of adoption.

- 51 sectoral challenges identified in (25 in environment, 16 in water, 10 in agriculture)
- 350 technologies identified to address sectoral challenges grouped into 60 technology families (Figure 12, Figure 13, Figure 14)
- 30 technology families selected for support from 60+ identified technology families, with 14 prioritized in the first wave



Figure 11: Technology Deployment Roadmaps

Process Followed: As such, the process was carried out following four key steps:

- 1. Challenge Identification:** Mapping environmental, water, and agricultural challenges through consultations and strategy analysis.
- 2. Technology Screening:** Reviewing global and local technology databases to identify innovative and deployable solutions.
- 3. Evaluation & Prioritization:** Assessing technologies based on impact (technology's ability to address sectoral challenges), and ease of adoption (how quickly a technology could be deployed).
- 4. Roadmap Design:** Structuring short-, medium-, and long-term deployment timelines and defining enablers for each wave.

BIODIVERSITY		LAND, VEGETATION & DESERTIFICATION			WASTE MANAGEMENT		POLLUTION CONTROL AND COMPLIANCE			METEOROLOGY
Terrestrial ecosystems	Marine & coastal ecosystems	Range-lands	National Parks	Forests	Medical	Industrial	Air pollution	Water pollution	Soil pollution	
					Municipal	Others				
1. Conservation techniques		4. Plant improvement technology (biotechnology)			11. Collection devices, systems and vehicles improvement technology (biotechnology)		16. Air pollution prevention and mitigation	17. Water pollution prevention and mitigation	18. Soil pollution prevention and mitigation	20. Data acquisition methods and monitoring
2. Protected areas management		5. Horticulture technology			12. Automated sorting					21. Weather and climate forecasting
3. Ecosystem monitoring		6. Support for Natural Regeneration of vegetation cover			13. Waste Treatment (incl recycling, composting and energy recovery)		19. Pollution monitoring			22. Weather augment technology
		7. Protection from desertification			14. Disposal technology					
		8. Innovative irrigation for wild trees and shrubs			15. Waste monitoring					
		9. Grazing land management								
		10. Land monitoring								

Figure 12: Technological Framework for the Environment Sector

SUPPLY		TRANSMISSION & DISTRIBUTION	WASTEWATER TREATMENT & REUSE	DEMAND
Desalination & alternative supply technologies	Groundwater & freshwater technologies	10. Smart sensors	13. Wastewater treatment and reuse	17. Innovative water consumption in homes
1. Advanced RO	6. Surface water preservation technology	11. Smart materials	14. Recovery technology	18. Innovative water consumption in industry
2. New desal methods (excl. RO)		7. Groundwater technology	12. Smart leakage management	15. Innovative treatment
3. Brine mining	8. Watershed management, monitoring & forecasting			16. Innovative water testing
4. Renewable desalination				
5. Alternative supply		9. Water purification		
20. Smart water control systems				

Figure 13: Technological Framework for the Water Sector

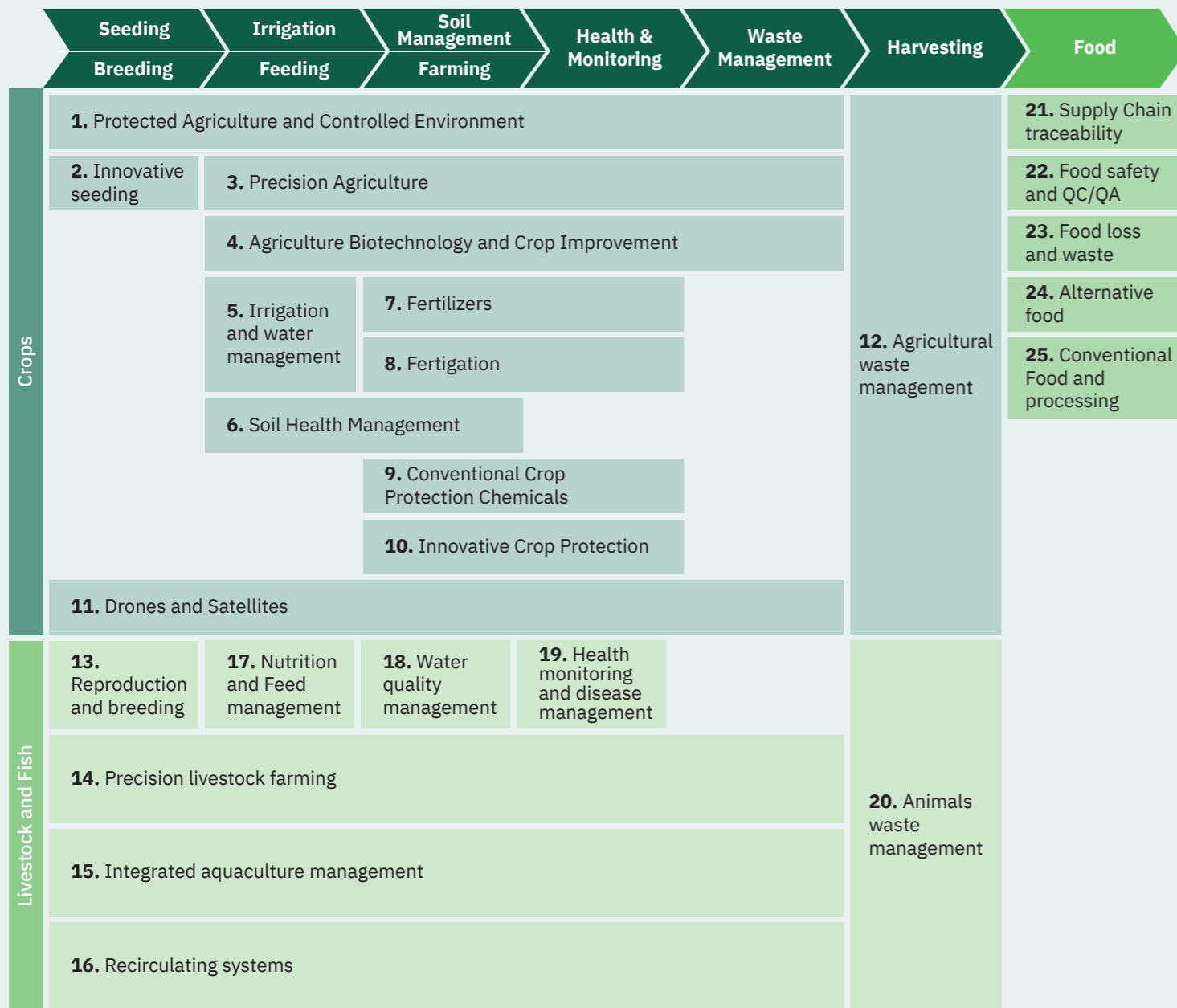


Figure 14: Technological Framework for the Agriculture Sector

14 priority technology groups were hence determined.

Environment	1. Ecosystem monitoring
	2. Grazing land management
	3. Waste management
	4. Innovative irrigation techniques for trees and wild plants
Water	1. Advanced reverse osmosis systems
	2. Smart leakage management
	3. Wastewater treatment and reuse
	4. Innovative irrigation
	5. Innovative water consumption in homes
Agriculture	1. Irrigation and water management
	2. Integrated aquaculture farm management
	3. Protected agriculture and controlled environment
	4. Food preservation and valorization of waste
	5. Unmanned aerial vehicles (drones) and satellite imagery

A.6 EWA RDI Mission Planning & Coordination (Initiative Overview)

Description: An initiative to develop detailed execution plans for national RDI missions under MEWA's custodianship, align and integrate these plans with the national RDI priority areas, operationalize coordination mechanisms with execution entities in line with the MEWA RDI Governance framework, and monitor and report on mission progress and delivery performance.

Major accomplishments to date:

- Establishment of a dedicated department for Planning and Coordination of National R&I Missions and Committees
- Detailing of the RDI Water Missions and development of Saudi Arabia's first methodology for mission design, engaging more than 60 experts in the process

B. Linkages & Culture Enhancement



Input

Strong linkages and a culture of collaboration are essential to advancing research and innovation across all sectors. Within EWA in particular, success relies on robust partnerships between governmental entities, universities, research centers, and both the public and private sectors.








To foster this collaborative ecosystem, MEWA and its affiliated entities are building strategic alliances, establishing innovation clusters, and creating hubs that connect key stakeholders. The flagship Saudi AgriFood Tech Alliance (SAFTA) stands as a leading example of this approach, uniting prominent national and international institutions to accelerate knowledge transfer and drive the localization of advanced solutions. Through SAFTA and similar initiatives, the ecosystem is creating replicable models for collaboration that amplify collective impact and position the Kingdom as a hub for innovation partnerships in the region.

Furthermore, strong emphasis has been placed on awareness initiatives. Through targeted campaigns, dynamic hackathons, impactful events, and insightful publications, these efforts have reached a wide audience, engaging diverse groups, sparking creativity, and building momentum for sustained participation in research and innovation activities. These awareness-building efforts complement partnership development by ensuring that innovation opportunities are visible, accessible, and inclusive across the entire EWA ecosystem.



Output

Key results to date include:

 <p>Launch of SAFTA, a dedicated innovation and technology alliance in the agriculture sector, with over 140 active members from 12 countries</p>	 <p>Launch of the Water STRIP, a dedicated water innovation cluster designed to serve as a hub for collaborative research and innovation, technology piloting, and the promotion of public-private partnerships</p>	 <p>Establishment of the Partnership Coordination Office (PCO) to manage the collaboration between MEWA and KAUST on research, development, and execution of projects across the EWA sectors</p>	 <p>Signing of a Memorandum of Understanding between MEWA and the Ministry of Agriculture, Fisheries, Food Security, and Nature of the Netherlands to promote cooperation in adopting and localizing advanced innovations and technologies across EWA sectors, contributing to the attraction of investments exceeding 1.5 billion SAR</p>
 <p>Delivery of more than 95 outreach activities, including public events, exhibitions, workshops, seminars, and publications</p>	 <p>Organizing 25 webinars to raise awareness on RDI in the EWA sectors</p>	 <p>Development of 4 award programs by ecosystem entities designed to promote research and innovation culture across the EWA sectors</p>	

Outcome (KPIs)

As a result of these programs, the ecosystem has delivered significant outcomes that demonstrate the breadth of engagement across the EWA sectors.



Impact

The impact of these efforts extends beyond awareness and collaboration, generating concrete economic and sectoral benefits. Based on the impact assessment conducted, these initiatives and programs are estimated to drive additional sectoral output, increase gross value added (GVA), improve the trade balance, and support job creation across the water and agriculture sectors. Moreover, these initiatives support key national strategies, namely the National Environment Strategy, the National Water Strategy, and the National Agricultural Strategy through advancing local content indicators and supporting the creation of direct job opportunities for Saudi citizens, and the national RDI priority areas by fostering growth in university-industry collaboration.

B.1 RDI Partnerships Framework & Setup (Initiative Overview)

Description: A partnerships framework that promotes the active engagement of EWA ecosystem entities in outcome-driven partnerships such as industry alliances, academic collaborations, bilateral private sector partnerships, and intergovernmental alliances.

<p>190 partners actively engaged across all RDI initiatives and programs, including hubs and alliances</p>	<p>An innovation and technology alliance, SAFTA, launched in the agriculture sector, with over 140 members from 12 countries (Figure 15)</p>	<p>Launch of the Water STRIP, a dedicated water innovation cluster designed to serve as a hub for collaborative research and innovation, technology piloting, and the promotion of public-private partnerships</p>
<p>Establishment of 6 strategic partnerships with leading private-sector and academic institutions, most notably the strategic partnership with King Abdullah University of Science and Technology (KAUST) to advance research, development, and innovation projects across the environment, water, and agriculture sectors</p>	<p>Signing of a Memorandum of Understanding with the Ministry of Agriculture, Fisheries, Food Security, and Nature of the Kingdom of the Netherlands to promote cooperation in adopting and localizing advanced innovations and technologies across EWA sectors</p>	

Furthermore, in recognition of its initiatives to strengthen implementation mechanisms and promote innovative governance and partnerships, MEWA has received the Global Sustainability Award (Figure 15) for SDG 17 “Partnerships for the Goals”.



Figure 15: Saudi AgriFood Tech Alliance (SAFTA)



Figure 16: Global Sustainability Award

TESTIMONIAL:

“At Dutch Greenhouse Delta, we highly value SAFTA’s dedication to advancing sustainable agrifood solutions in Saudi Arabia. Their commitment to fostering innovation and collaboration aligns seamlessly with our mission to support the region’s food security and water management goals. We look forward to continued partnership in driving impactful and future-proof agricultural solutions.”



CASE STUDY:**MEWA–KAUST STRATEGIC PARTNERSHIP**

As part of its partnership plan with the academic sector, the R&I Deputyship established a strategic collaboration with King Abdullah University of Science and Technology (KAUST) to advance RDI projects across the environment, water, and agriculture sectors. These projects span applied research and studies, technology development, testing and piloting in dedicated facilities or plants, and deployment of successfully proven solutions.

Projects Portfolio**Projects Highlights:****Development of Algal Biotechnology in the Kingdom of Saudi Arabia (DABKSA)**

This project aims to establish an algal biotechnology industry in the Kingdom, utilizing indigenous microalgae and macroalgae (seaweeds) to produce animal feed.

Key Results:

- First industrial plant in the GCC spanning **4.2 hectares** with a production capacity of up to **100 tons**
- Contribution to food security with an expected **3.16 million tons** of animal feed raw material by 2030
- Environmental impact with an estimated absorption of **32,120 tons** of CO₂ by 2030
- Capacity building through more than **10** training programs

Transforming Climate Science into Strategic Readiness for the Kingdom's Future: The Project of Establishing the Climate Change Centre (CCC)

The Climate Change Center (Figure 17) serves as the Kingdom's national hub for climate science, integrating monitoring, forecasting, and research to strengthen resilience across water, energy, agriculture systems, and infrastructure sectors, as well as critical national infrastructure.

Objectives:

- Deliver robust climate data with real-time forecasts and early warnings for KSA
- Support decision-making by guiding governmental and private sector actions for public safety and sustainability
- Drive research and innovation by advancing climate change studies and developing weather models
- Enhance environmental leadership through initiatives such as Saudi and Middle East Green Initiatives

Key Results:

- **14+** science-informed studies
- **22** publications in high-impact journals
- **14** specialized training courses with 194 participants
- National workshops and global outreach events showcasing Saudi Arabia's climate leadership
- A drought monitoring system and sub-seasonal forecasting system, along with regional climate projections, to provide reliable climate information



Figure 17: Climate Change Center (Launch Event)

B.2 RDI Awards & Grand Challenges (Initiative Overview)

Description: An initiative offering incentive prizes, competitions, and recognition awards to promote innovation, foster a culture of RDI, and highlight success stories in the EWA sector.

- 4 ecosystem award programs designed to promote research and innovation culture across the EWA sectors.

CASE STUDY:

SUSTAINABILITY INNOVATION CHALLENGE



3 winning teams recognized in the Sustainability Innovation Challenge (SIC), which engaged 623 young talents from Saudi universities to develop innovative solutions for the EWA sectors

VisiGround: an innovative system for precise pipeline leak detection



Figure 18: VisiGround Robot

Overview

VisiGround (Figure 18) is an innovative system designed to accurately locate buried pipelines and detect leaks without excavation, using advanced subsurface imaging technologies. It offers an efficient, cost-effective solution for water infrastructure maintenance.

How does it work?

The system employs a central robot that transmits signals underground, while one or more surrounding robots capture the return signals as receivers (Figure 19). Data is processed and visualized on a PC or smartphone. With a scan speed of 2.5 meters per minute, the system can inspect 1 km of pipeline in approximately 6.7 hours with one unit, or 3.3 hours with two units.

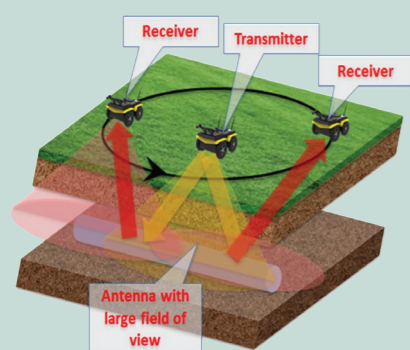


Figure 19: Working Principle of the VisiGround Robot

Anticipated Benefits

- 1 Water Conservation:** Detects leaks early, preventing water loss
- 2 Cost Efficiency:** Reduces repair and maintenance expenses
- 3 Operational Continuity:** Avoids disruptions from excavation, such as road closures
- 4 Environmental Protection:** Minimizes soil and green-space disturbance
- 5 Resource Optimization:** Improves efficiency of inspection and maintenance processes
- 6 Community Safety & Wellbeing:** Reduces impact on daily life and enhances public safety

TESTIMONIAL:

A participant in the Sustainability Innovation Challenge:

"It has been an exceptional journey, as this program has provided us with extensive opportunities to research, develop ideas, and transform them from mere concepts into remarkable, tangible results. Our sincere thanks go to the Ministry of Environment, Water, and Agriculture for granting us this valuable opportunity".



B.3 RDI Awareness (Initiative Overview)

Description: An awareness initiative, developed in collaboration with key ecosystem entities, leveraging targeted campaigns and events to foster a culture of innovation and highlight success stories across the EWA sectors.

<p>95+ outreach activities conducted, including public events, exhibitions, workshops, seminars, and publications</p>	<p>25 webinars conducted to raise awareness on RDI in the EWA sectors (Figure 20)</p>
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Participated as a strategic partner in 3 international conferences: the Green Technologies Conference, the MENAT Summit 2025 for Regenerative Agriculture, and the Conference on Creativity, Technology, and Sustainability.

TESTIMONIAL:

A participant in the webinar “Innovation in the Water Treatment Sector: The Future of Wastewater Treatment and Reuse in the Kingdom”

“I would like to extend my sincere thanks to the Ministry of Environment, Water, and Agriculture, represented by the Deputyship of Research and Innovation, for organizing the valuable seminar titled “Innovation in the Water Treatment Sector: The Future of Wastewater Treatment and Reuse in the Kingdom”, which provided significant scientific and knowledge-based contributions. I would also like to express my deep appreciation to the R&I Deputyship for its continuous support of such initiatives, which help enhance awareness and promote sustainability in the Kingdom.”



Figure 20: Webinars

B.4 EWA Innovation Events (Initiative Overview)

Description: Technology forums and conferences to provide a platform for global EWA technology developers to showcase their products to investors, buyers, and the public, fostering partnerships, promote innovation, and accelerate the adoption of advanced EWA technologies.

CASE STUDY: SUSTAINABILITY INNOVATION WEEK

Sustainability Innovation Week (Figure 21), held during COP16 in Riyadh, brought together visionary policymakers, sustainability leaders, distinguished academics, and forward-thinking investors to advance dialogue and collaboration in sustainability.

Key Themes:

Food Security

- Precision Agriculture
- Crop & Soil Management
- Controlled Environment
- Pest & Disease Control
- Food Waste & Loss
- Aquaculture
- Alternative Foods

Water Security

- Water Conservation & Efficiency
- Novel Water Production
- Water Management
- Desalination
- Water Treatment
- Smart Irrigation

Target Audience

- Sustainability Leaders
- Entrepreneurial Innovators
- Scientists & Researchers
- Policy Leaders & Innovators
- Investors



Figure 21: Sustainability Innovation Week

C. RDI Demand Boost



Input

The EWA ecosystem entities have launched a series of programs designed to stimulate market demand and accelerate the adoption of innovative products and solutions, creating pathways from research to real-world application. These include a regulatory sandbox targeting SMEs and large corporations, which provides a flexible environment for technology development and testing while overcoming regulatory challenges. In addition, a piloting and demonstration initiative has been introduced to provide both technical and financial support, enabling the testing and validation of mature and promising technologies. Together, these demand-side interventions are bridging the gap between innovation development and commercialization, ensuring that promising solutions can reach the market more efficiently and generate tangible impact.



Output

Key results to date include:



Launch of a regulatory sandbox program, which contributed to the regulatory review of **74** cases and supported multiple projects across all EWA sectors, with the first cohort completed and the second currently underway



Contributed to the development of standards for biochar and greywater



Support provided to **333** innovative technologies across all value chain elements of the environment, water, and agriculture sectors



Outcome (KPIs)

Collectively, these interventions have enabled successful testing and deployment of a wide range of innovative technological solutions, facilitating their progression from development to operational implementation with the EWA sectors:



Impact

The impact of these efforts is most visible in the acceleration of innovation from development to deployment across the EWA sectors. Beyond the economic gains estimated through the impact assessment, including additional sectoral output, increased gross value added (GVA), a strengthened trade balance, and job creation, these initiatives have contributed to national strategies, such as the National Environment, Water and Agriculture Strategies, by supporting the testing and deployment of technologies that enhance irrigation efficiency, promote the adoption of alternative water sources, and strengthen environmental sustainability; and the national RDI priority areas, through the progression of research outputs toward commercial applications.

C.1 EWA RDI Regulatory Sandboxing (Initiative Overview)

Description: A regulatory sandbox that addresses the roadblocks facing demand for EWA RDI technologies and solutions, both directly and through advocacy with relevant policymakers.



Launch of a regulatory sandbox program, which contributed to the regulatory review of **74** cases and supported **27** projects across all EWA sectors, with the first cohort completed and the second currently underway

Contributed to the development of standards for biochar and greywater

CASE STUDY:

EDAMA'S REGULATORY SANDBOX JOURNEY

Edama provides an innovative waste-to-soil solution that transforms organic waste into high-quality compost and soil conditioners that support desert agriculture and improve crop yields in arid environments.



Challenges Faced

- Difficulty navigating multiple authorities involved at different stages of the value chain in waste collection, processing, and final product approval
- Lack of clarity on the full sequence of licenses and certifications required for operating a waste-to-soil-enhancer facility
- Additional complexity due to Edama's facility being located inside KAUST, which created unique permitting considerations
- Fragmented regulatory requirements for entities connected to research centers

Sandbox Interventions

- Conducted detailed engagements with all relevant regulators to map end-to-end approval pathway
- Identified precise sequence of permits, certifications, and licenses required across each stage of the value chain
- Provided clear recommendations to harmonize requirements for research-related facilities
- Developed complete step-by-step roadmap to guide Edama through the approval process

A Successful Resolution

The regulatory pathway was clarified, barriers were removed, and Edama successfully obtained a compost production permit from the Agriculture Deputyship, allowing it to operate its facility and bring products to market.

C.2 EWA Technology Piloting & Demonstration (Initiative Overview)

Description: A regulatory sandbox that addresses the roadblocks facing demand for EWA RDI technologies and solutions, both directly and through advocacy with relevant policymakers.

An initiative that enables innovators to test and validate new technologies in real-world EWA settings, bridging the gap between research and large-scale deployment. Supported by MEWA and ecosystem entities, the initiative provides institutional backing, access to operational sites, and technical collaboration. Current pilot projects include innovative solutions for Red Palm Weevil management, Aerobic Granular Sludge (AGS) technology for greywater treatment, and the use of desalinated water for agricultural purposes.

333 innovative technologies supported across all value chain elements of the environment, water, and agriculture sectors (Figure 22, Figure 23).

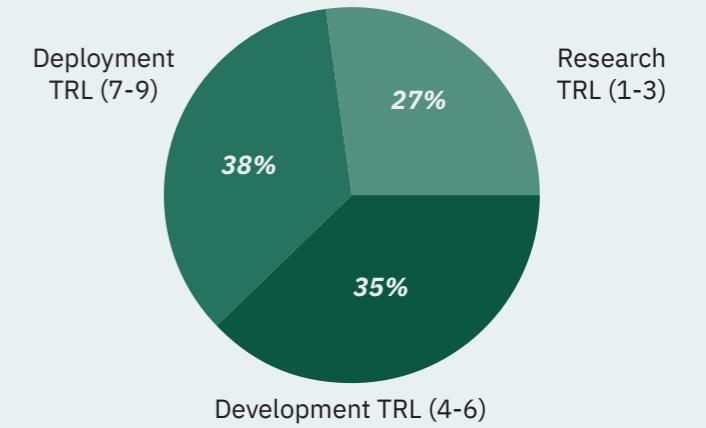


Figure 22: Technology distribution across TRL levels

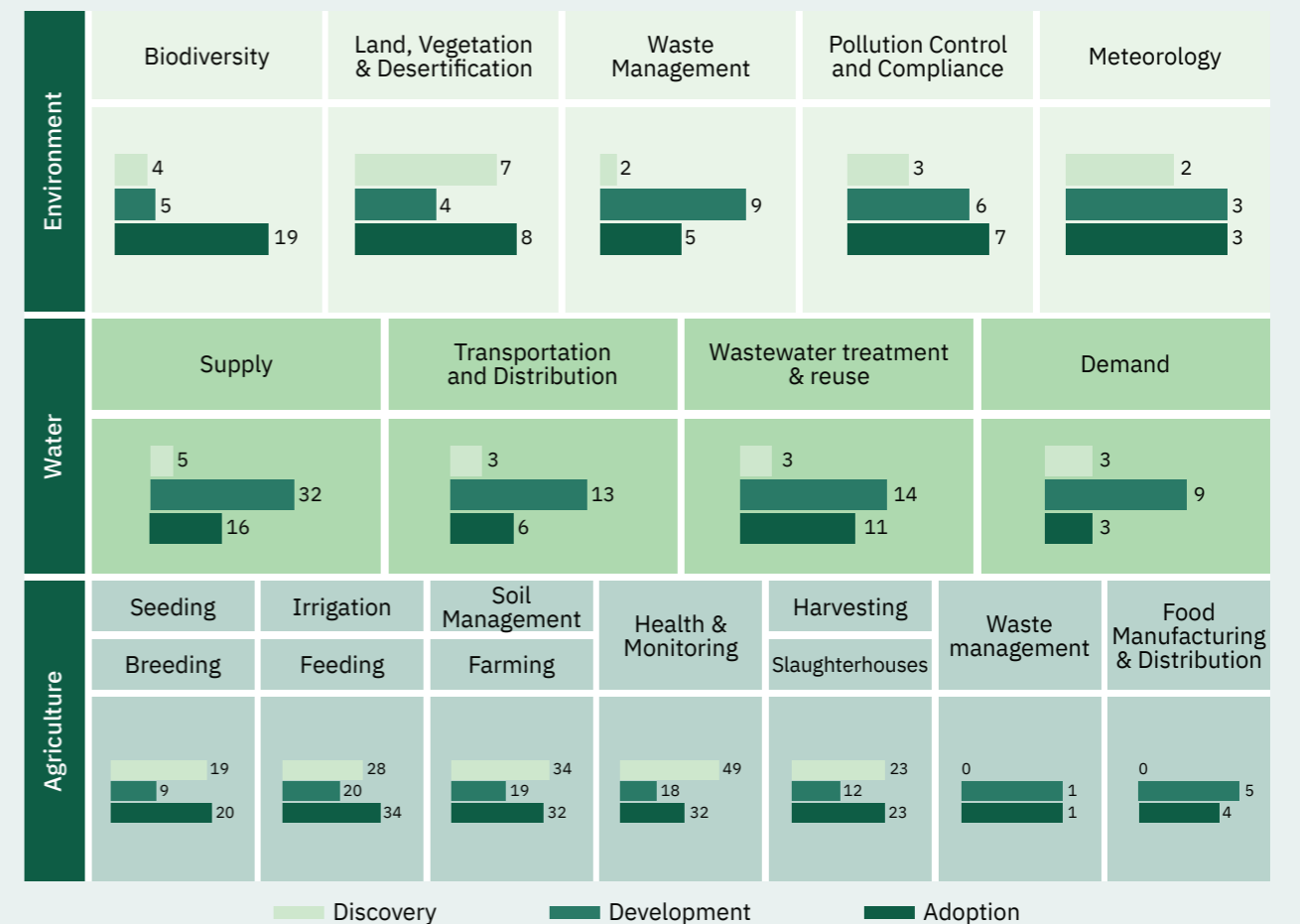


Figure 23: Technology distribution across EWA sectors and value chain elements, and TRL levels

CASE STUDY:

DEVELOPING OF INNOVATIVE SOLUTIONS FOR THE CONTROL OF RED PALM WEEVIL INFESTATION IN KSA

What is Red Palm Weevil?

The Red Palm Weevil (RPW) is a destructive pest that attacks palm trees by laying eggs inside the trunk. The larvae bore through the tree, feeding on its tissues and disrupting water and nutrient flow. This weakens the tree, causing wilting, yellowing fronds, and eventually structural collapse (Figure 24). If untreated, RPW can destroy the tree completely, making early detection vital.

This poses a significant problem for the Kingdom, which is home to an estimated 34 million date palm trees and ranks second globally in date production, putting this vital sector at risk.



Healthy Palm Tree

8 years
for seed to **mature** & produce **commercial harvest**

66 Kg
annual yield of dates **per palm tree**

SAR 30
 average retail price per kg

Start of Infestation

Leaf **deformation & yellowing**
Visible RPWs **excretions**

RPWs **feed** on the tree from **inside** the **trunk** and **can't be visible** on the outside

A single female weevil can lay over **200 eggs** during **8 to 10 weeks** and fly at a speed of **50 Km/day**

Advanced Infestation

6-12 months
for RPWs to **kill** a date palm

SAR 18,600
 Total value destruction

Figure 24: Red Palm Weevil Infestation Stages

Technologies Identification

In response to this challenge, a thorough analysis was conducted to identify potential solutions.

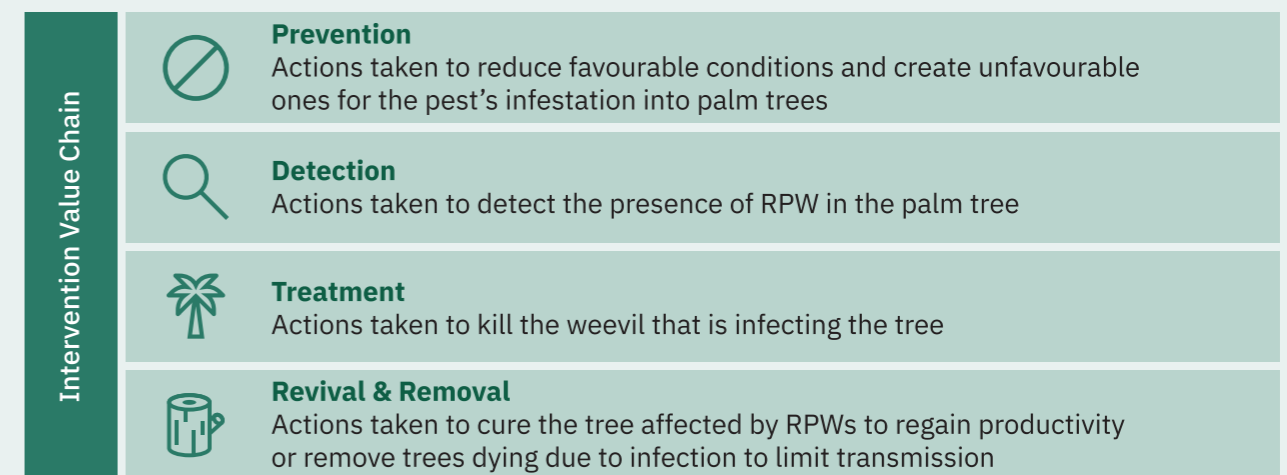


Figure 25: Red Palm Weevil Intervention Value Chain

Four Key Workstreams

Based on the identified technologies and their respective Technology Readiness Levels (TRL), four workstreams were established to ensure a comprehensive and integrated approach:

- 1. R&D Workstream (TRL 1–6):** Advancing technology research in RPW control through the establishment of two specialized Research Consortia:
 - Biocontrol Research Consortium: Focused on developing environmentally sustainable biocontrol solutions
 - AI and Decision-Making Solutions Consortium: Aimed at building a centralized AI platform to predict RPW spread and recommend interventions.
- 2. Technology Deployment Workstream (TRL 7–9):** Piloting technologies capable of controlling the RPW infestation through the Innovation Deployment Program (IDP)
- 3. Adoption & Localization Workstream (TRL 9+):** Supporting market-ready technologies through financial and operational enablers through the Innovation Adoption Program
- 4. Systemic Enablement Workstream:** Empowering seamless execution of initiatives through robust support across various programs, including but not limited to, the IP Program Launch and Regulatory Sandbox

Accordingly, the following actions are underway:

- Incorporation of seven research themes into the two research consortia
- Piloting of four prioritized technologies to evaluate their efficacy for potential national deployment
- Adoption of four technologies that have demonstrated proven effectiveness through pilot studies in KSA

C.3 EWA RDI Demand Incentives & Guarantees (Initiative Overview)

Description: An incentive initiative designed to create schemes and policies that boost demand for EWA RDI technologies and solutions within the identified EWA technology focus areas.

CASE STUDY:

ADVANCING WASTEWATER TREATMENT & REUSE USING MODIFIED AEROBIC GRANULAR SLUDGE (AGS) TECHNOLOGY

Aerobic Granular Sludge (AGS) technology (Figure 26) is a water treatment method that uses small, round clumps of bacteria to clean water. It works faster, is more efficient, takes up less space, uses less energy, and produces less waste than traditional methods.

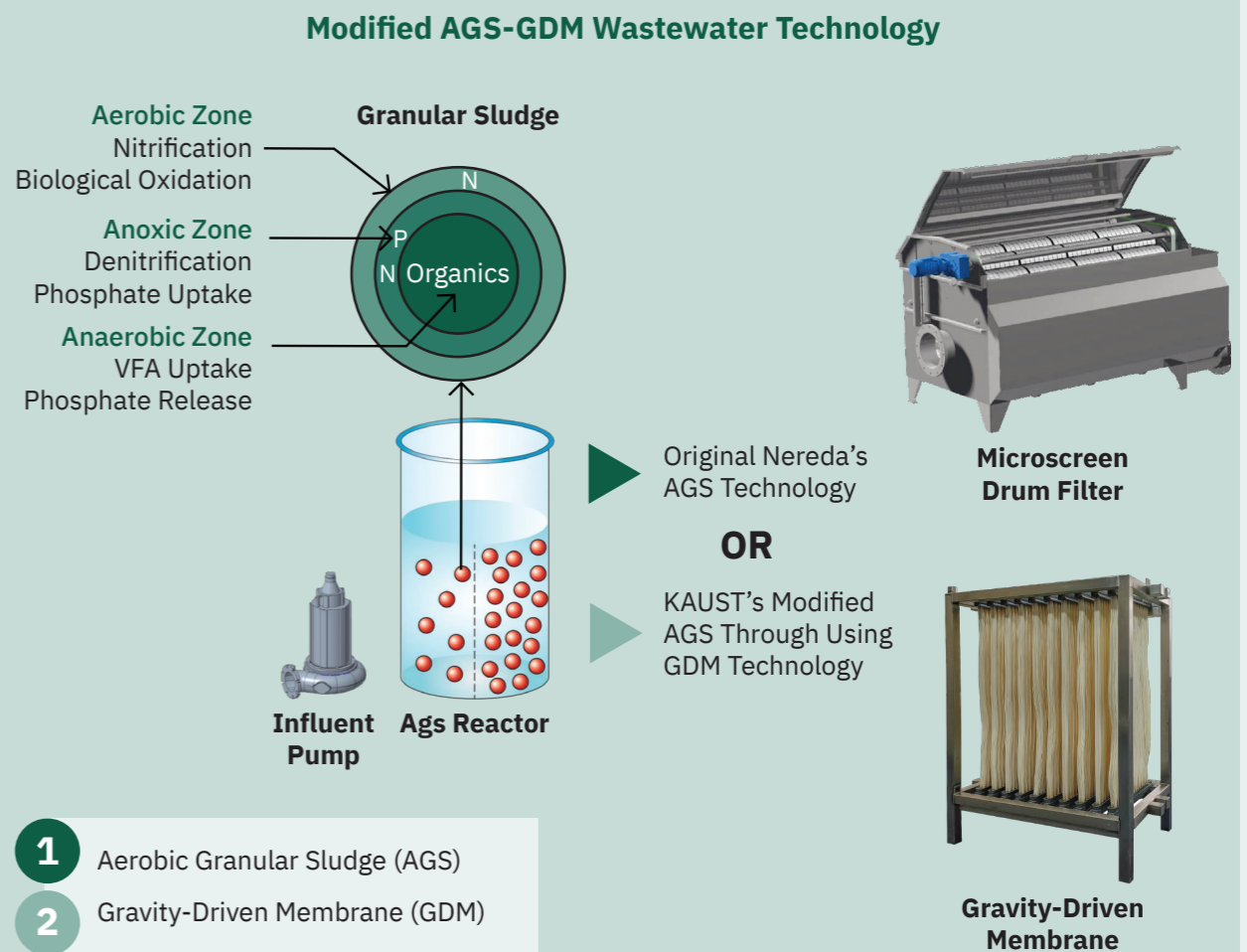


Figure 26: Modified AGS-GDM Wastewater Technology








D. RDI Supply Unlock

Input

On the supply side, the EWA RDI ecosystem is actively addressing systemic gaps that limit research and innovation capacity and constrain scaling efforts. This includes initiatives such as the IP & Technology Management Framework, which has supported innovators in registering and filing patents, thereby protecting and facilitating the commercialization of their innovations and reinforcing the sector’s growing reputation for scientific leadership. In tandem with these efforts, and recognizing the critical importance of building a strong human capital base in these sectors, a capacity building initiative targeting both MEWA employees and the broader ecosystem has been launched. This initiative includes multiple programs offering training, sponsored education, and fellowships, designed to equip participants with advanced skills and expertise needed to drive innovation and to empower a new generation capable of shaping the future of the Kingdom’s environment, water, and agriculture landscape.

Output

Key results to date include:

		
Establishment of the International Water Research Center (IWRC) in partnership with KAUST, serving as a hub for applied R&D, capacity building, policy support, and cross-sector collaboration	Restructuring of laboratories and research centers in the Kingdom, and the establishment of 4 key facilities to support the development and deployment of EWA technologies	Development of a comprehensive IP policy
		
Registration of 18 patents in the EWA ecosystem, including 10 plant varieties and 1 geographical indication under MEWA	Training in intellectual property provided to over 100 employees in the ecosystem	150 MEWA employees trained in institutional innovation, with certifications from global institutes
	6 post-doctoral fellowships granted, both locally and internationally, aimed at reskilling individuals in EWA sectors	

A Multi-Component Incentive Scheme

In order to support the development and potential adoption of AGS technology in the Kingdom, MEWA has supported this project through a combination of **BOOT (Build-Own-Operate-Transfer) and AMC (Advanced Market Commitment)** schemes.

Under this model, MEWA provides support to Nurain, the entity responsible for building, owning, and operating the project for a predetermined period, after which ownership and intellectual property rights are transferred back to MEWA.

Additionally, through an off-take agreement, MEWA **commits to purchasing** the treated water at a price above the prevailing market rate, capped at no more than 3 times the market price.

Next Steps

- Develop a sustainable business model to ensure the validated scalability of AGS technology
- Launch a 1,000 m³ commercial pilot at the National Water Company Rabigh facility
- Scale up and deploy the technology for reuse across the Western Region

Stakeholders Involved

- **Ministry of Environment, Water and Agriculture:** Oversee implementation and ensure treated water meets quality standards, and grant approved incentives to Nurain
- **National Water Company:** Provide access to the approved pilot site and offer compliance-monitoring support during scale-up
- **Saudi Water Partnership Company:** Disburse payments for treated water supplied by Nurain, review technical reports, and evaluate scalability
- **Nurain and King Abdullah University of Science and Technology (KAUST):** Build, finance, and operate the pilot plant (capacity 1000 m³/day), and submit a quarterly report to NWC including compliance and operational data



TESTIMONIAL:



General Manager of NuRain

“Our experience working with the Deputyship has been extremely positive. They have provided Nurain with continuous support and many opportunities to successfully demonstrate our technology.”

Outcomes-KPIs

These efforts have led to the identification of a wide range of innovative solutions, while also supporting talent development within the ecosystem:



Impact

The impact of these efforts lies in the depth of capability being built across the EWA ecosystem, from protected innovations to a growing pipeline of skilled researchers. Though their full economic contribution will materialize over time, these initiatives also contribute to five major national strategies, including the National Environment Strategy, the National Water Strategy, and the National Agricultural Strategy, through growth in R&D budget allocation and the upskilling of individuals in the sectors, the national RDI priority areas, by driving measurable increases in the number of researchers, patents by origin, and scientific and technological outputs, and supporting the broader pipeline of STEM talent pursuing careers in research and innovation, and the National Biotechnology Strategy, through the registration of plant varieties and the development of locally owned intellectual property that lays the groundwork for future breakthroughs in genetic engineering and bio-based solutions.

D.1 Technology Deployment Centers (Initiative Overview)

Description: An initiative to establish Technology Deployment Centers that serve as platforms for collaborative EWA RDI projects, strengthen the capabilities of EWA-focused research centers, and support the development of technology valleys, technology transfer offices, and other intermediaries.

Among these centers is the International Water Research Center (IWRC), established in partnership with King Abdullah University of Science and Technology (KAUST). The center functions as a hub for applied R&D, capacity building, and policy support, while fostering collaboration among government agencies, academic institutions, international partners, and the private sector. Occupying approximately 4,000 square meters, the center is equipped to facilitate the testing, adaptation, and large-scale deployment of technologies, ensuring alignment with MEWA's RDI roadmap and water-related SDGs.

Moreover, 4 key facilities have been established to support the development and deployment of EWA technologies:

- A **Forest Research Center** dedicated to research on wild and mountainous tree species, focusing on seed conservation, health assessments, and genetic studies
- A **Climate Change Center** aimed at enhancing climate intelligence, providing localized data, and supporting accurate forecasting to strengthen national climate adaptation efforts
- An **advanced Rose Seedling Laboratory** fully equipped to produce uniform, disease-free rose seedlings, supporting local supply chains, improving agricultural quality, and promoting sector sustainability
- A **biosafety Level-3 Vaccine Laboratory** constructed to meet international standards, enabling high-level research and production of vaccines in a safe and controlled environment

Furthermore, EWA research centers under MEWA have been reorganized administratively and technically, with clearly defined roles to streamline RDI efforts and ensure effective operational synergy across the ecosystem.



Figure 27: HEM's visit to the research centers

D.2 IP & Technology Management Framework (Initiative Overview)

Description: An initiative focused on building MEWA's Intellectual Property (IP) capacity and creating technology transfer frameworks (Figure 28) in coordination with Saudi Authority for Intellectual Property (SAIP). It aims to strengthen innovation in the EWA sectors, incentivize EWA-affiliated innovators, and procure technology licenses to spur technology deployment in the EWA ecosystem.

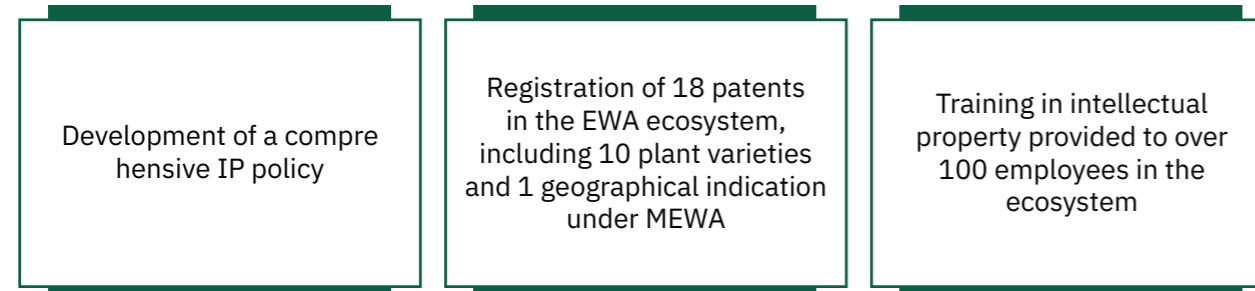
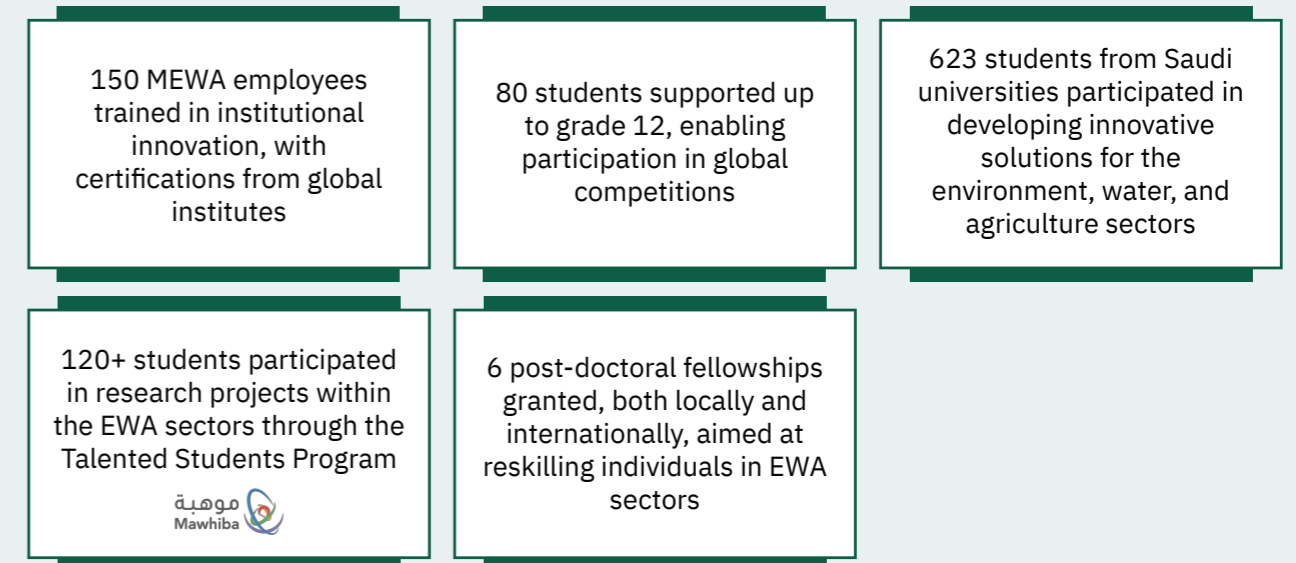


Figure 28: MEWA IP Launch Event

D.3 RDI Talent Development (Initiative Overview)

Description: A set of programs designed to nurture and upskill RDI talent across the EWA sectors, supporting students, researchers, and EWA ecosystem employees through education sponsorships, fellowships, specialized training, and certifications from leading institutes, while also providing opportunities to engage with global platforms.



TESTIMONIAL:

A participant in one of MEWA's Innovation Courses:

"I am pleased to share that the training programs provided by the Research and Innovation Deputyship have had a significant impact on my career. They enabled me to become a certified Chief Innovation Officer and inspired me to participate in several programs, including the Innovation Project Management program at the Saudi Electronic University, which I recently completed, and the "Building and Sustaining Innovative Organizations" program at the University of Illinois, USA. Thanks to these programs, I have become an active member of the innovation ecosystem through my involvement with the Saudi Innovation Club and the Saudi chapter of the Global Innovation Institute."










5.3 - EWA Sector-Wide Impact

In summary, this section highlights the outputs and outcomes of the EWA RDI initiatives and programs, their contribution to national strategies, and their economic impact on the environment, water, and agriculture sectors. Collectively, these results demonstrate how investments in research and innovation are translating into measurable progress that advances the Kingdom’s sustainability priorities while generating substantial economic value and reinforcing sectoral competitiveness.

Input

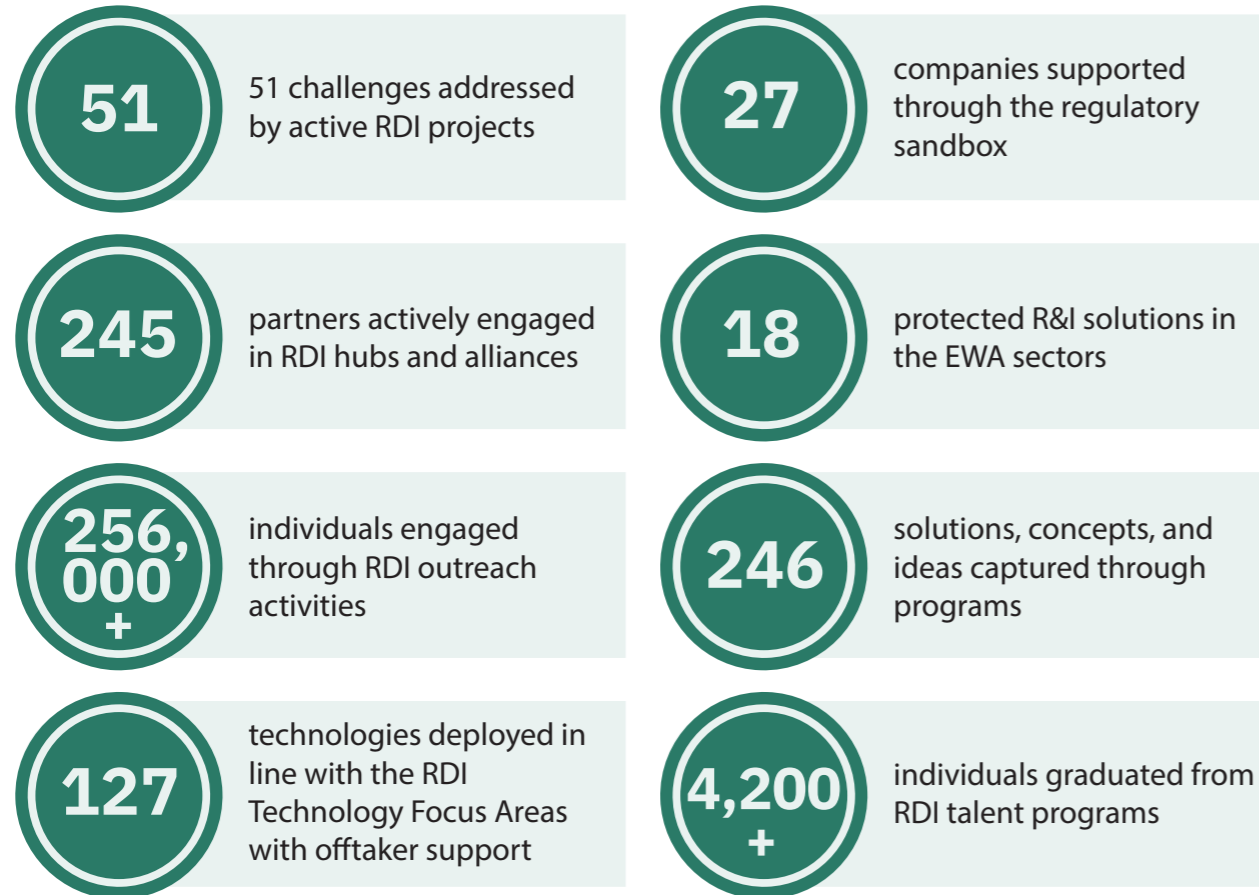
18 initiatives encompassing over 280 distinct programs launched by ecosystem entities across the environment, water, and agriculture sectors.

Output

 Establishment of a comprehensive governance structure consisting of the Steering Committee for Research and Innovation at the Ministry and its affiliated entities, and 3 sectoral subcommittees for the development of innovative technological solutions across the Environment, Water, and Agriculture sectors, and the Executive Biotechnology Committee	 Development of a funding strategy supported by a detailed action plan with clearly defined roles and responsibilities	 Development of the National Platform for Research and Innovation Analytics for Sustainability (NPRAS), which highlights the latest innovations and technologies in the EWA sectors
 Development of 4 technology roadmaps for the environment, water, and agriculture sectors, outlining sectoral challenges and mapping relevant technology families to address them	 Publication of 4 sectoral reports, including the Water and Agriculture Innovation Trends reports, as well as the Investment Trends in Research, Development, and Innovation for Sustainability report	 Launch of SAFTA, a dedicated innovation and technology alliance in the agriculture sector, with over 140 active members from 12 countries
 Organization of more than 95 outreach activities, including public events, exhibitions, workshops, seminars, and publications	 Signing of a Memorandum of Understanding between MEWA and the Ministry of Agriculture, Fisheries, Food Security, and Nature of the Netherlands to promote cooperation in adopting and localizing advanced innovations and technologies across EWA sectors	 Launch of the Water STRIP, a dedicated water innovation cluster designed to serve as a hub for collaborative research and innovation, technology piloting, and the promotion of public-private partnerships

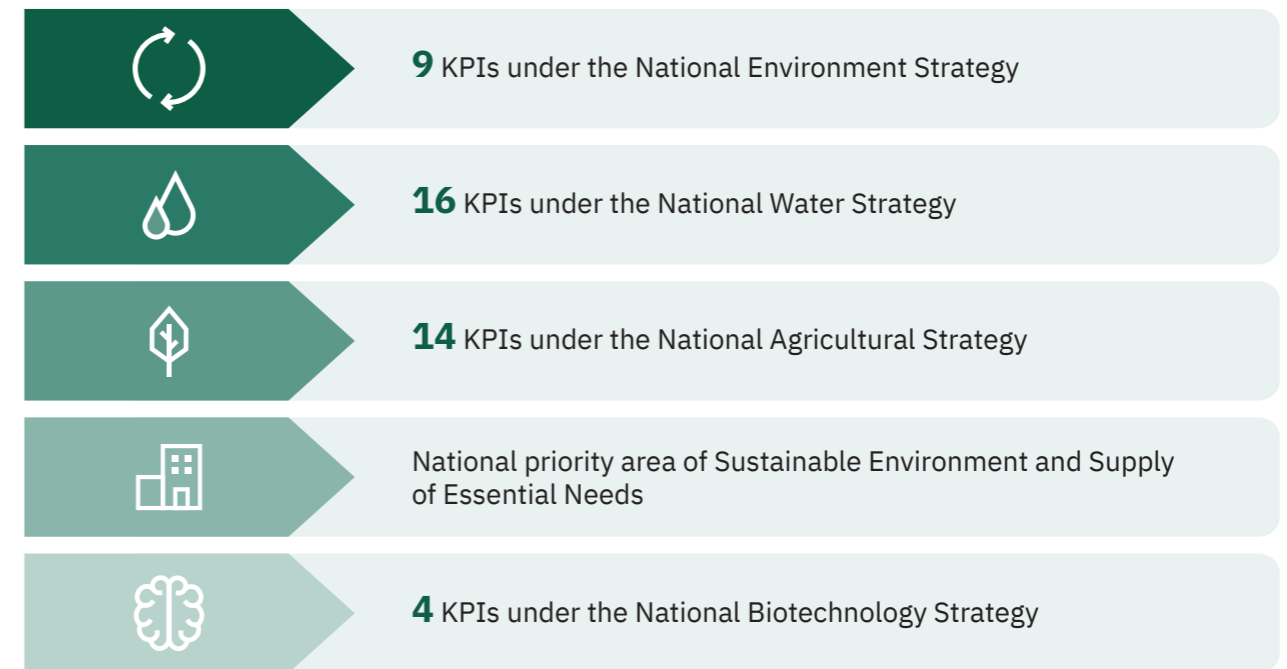
 Development of 4 award programs by ecosystem entities designed to promote research and innovation culture across the EWA sectors.	 Launch of a regulatory sandbox program, which contributed to the regulatory review of 74 cases and supported 27 projects across all EWA sectors, with the first cohort completed and the second currently underway	 Support provided to 333 innovative technologies across all value chain elements of the environment, water, and agriculture sectors.
 Restructuring of laboratories and research centers in the Kingdom, and the establishment of 4 key facilities to support the development and deployment of EWA technologies	 Development of a comprehensive IP policy	 Registration of 18 patents in the EWA ecosystem, including 10 plant varieties and 1 geographical indication under MEWA
 Training in intellectual property provided to over 100 employees in the ecosystem	 150 MEWA employees trained in institutional innovation, with certifications from global institutes	 623 students from Saudi universities participated in developing innovative solutions for the environment, water, and agriculture sectors
 120+ students participated in research projects within the EWA sectors through the Talented Students Program	 6 post-doctoral fellowships granted, both locally and internationally, aimed at reskilling individuals in EWA sectors	

Outcomes



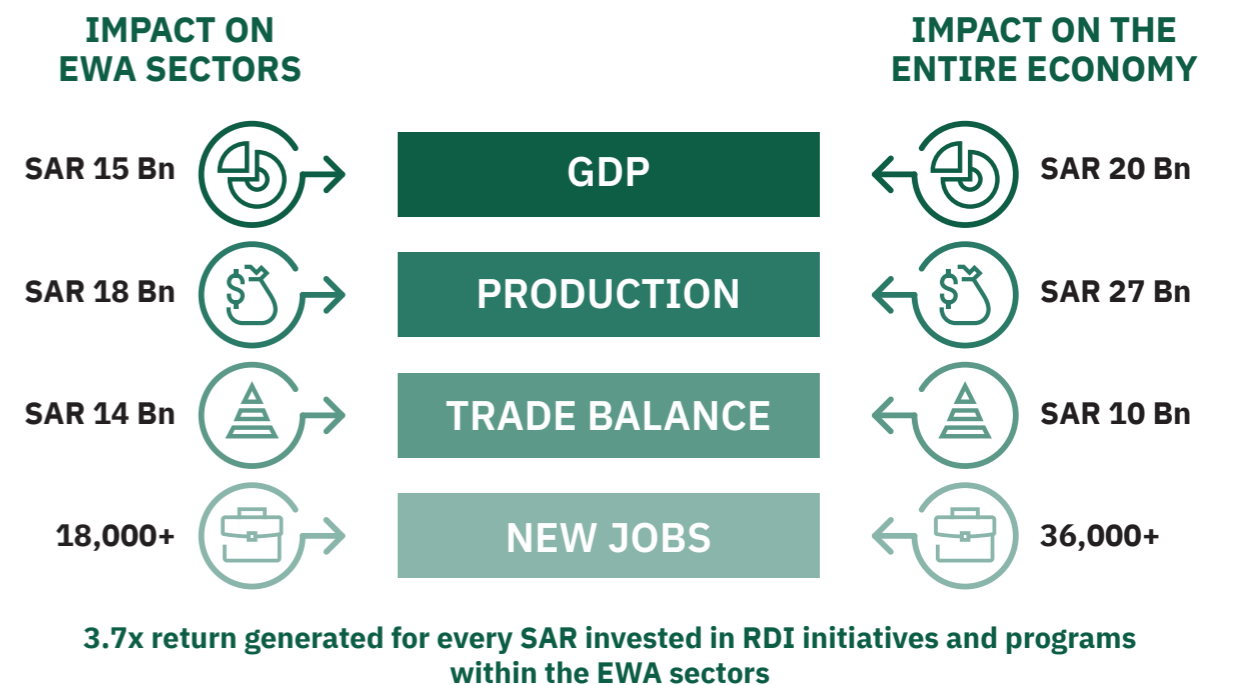
Impact

Contribution to KPIs of National Strategies



Economic Impact¹³

The economic impact of the initiatives and programs on the water and agriculture sectors, as well as on the broader economy:



In recognition of its outstanding efforts to promote a culture of research, development, and innovation across the EWA sectors, MEWA has received the Innovation 360 accreditation and the GInI certification.

¹³This represents the full expected impact of these RDI initiatives and programs, which may not be realized immediately but is expected to materialize over several years. The economic impact was developed using a custom input-output model, a widely adopted economic framework by leading global organizations such as the World Economic Forum and the OECD. Further details on the methodology are provided in the appendix.

6. CLOSING MESSAGE

As we reflect on the progress achieved, it is evident that innovation is central to securing the Kingdom's sustainable future in food, water, and environmental management. The Ministry of Environment, Water, and Agriculture, in collaboration with ecosystem entities, continues to serve as a key enabler of advancement across the EWA sectors, contributing directly to the Kingdom's Vision 2030 through initiatives that support national objectives and targets.

Two years after the launch of the RDI Executive Plan, supported by a structured governance framework for RDI activities, strengthened internal expertise, and demonstrated outcomes, the ecosystem is now well-positioned to further advance research, development, and innovation across the EWA sectors. These accomplishments have established a benchmark for research and innovation excellence within the Kingdom, demonstrating how strategic planning, coordinated execution, and evidence-based decision-making can create a model ecosystem that delivers measurable impact.

Looking ahead, MEWA will build on the strong foundation established in recent years. The coming period is expected to see significant growth, with new initiatives and programs launched, existing ones scaled, and, most importantly, the continued leadership of the RDI EWA ecosystem to drive deeper engagement with ecosystem stakeholders. As part of these efforts, MEWA's R&I Deputyship will continuously monitor ecosystem needs, identify opportunities, provide targeted support, and inform strategic decision-making, ensuring that innovation efforts remain coherent, aligned, and impactful.

Together, we will cultivate a dynamic and resilient innovation ecosystem, one that preserves natural resources, strengthens national resilience, and unlocks new opportunities for economic and societal growth. With unwavering commitment, the Ministry will remain at the forefront of sustainable innovation, generating meaningful impact today and securing a prosperous future for generations to come.

7. APPENDIX

Appendix 1: Input–Output Model Case Studies

In order to evaluate the economic impact of the RDI initiatives to date, an economic input–output (I/O) model was employed.

An input–output (I/O) model is a recognized analytical framework that integrates empirical data with established economic theories and principles to simulate and forecast the economic impact of an activity. These effects are captured through multiple economic parameters, providing a comprehensive overview of how spending on RDI initiatives generates impact, with particular focus on the water and agriculture sectors.

Why Input–Output (I/O) Model?

1

Transparent and globally recognized methodology

2

Quantifies direct and indirect impacts of economic activities

3

Shows how shocks in one sector ripple through the wider economy

4

Captures interactions across multiple sectors, including Water and Agriculture sectors

5

Provides clear measurement of tangible impacts

6

Ensures local relevance using KSA-specific data

In fact, Input–Output (I/O) models have been widely adopted by reputable international institutions to assess the impact of their innovation programs.

For instance, NASA (Figure 25) has applied an I/O model to evaluate the outcomes of its Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs, which provide awards to support research, innovation, and technology projects across multiple sectors. This analysis quantified the programs' impact in terms of additional value of goods and services produced, government tax revenues, and employment generated.

Similarly, Canada's Digital Technology Supercluster (Figure 29) has utilized an I/O model to measure the economic impact of partnerships aimed at developing digital technologies across various sectors. The assessment captured contributions to GDP, additional employment income, and incremental sales generated as a result of these collaborative initiatives.











PROGRAM OWNER		SMALL BUSINESS INNOVATION RESEARCH AND SMALL BUSINESS TECHNOLOGY TRANSFER (SBIR/STTR)	
SCOPE		Measure impact from small business innovation and commercialization	
IMPACT ASSESSMENT TOOL		Input-Output models	
SECTORS OF RELEVANCE		Aerospace	Life Sciences R&D
		Space Technology	Engineering
IMPACT METRICS		2,412 jobs created	\$57M tax revenue
		\$474M total production generated	
PROGRAM OWNER		CANADA'S DIGITAL TECHNOLOGY SUPERCLUSTER	
SCOPE		Measure impact resulting from partnerships to develop digital tech	
IMPACT ASSESSMENT TOOL		Input-Output models	
SECTORS OF RELEVANCE		Digital Health	Data Analytics
		Artificial Intelligence	Advances Manufacturing
IMPACT METRICS		\$441M total sales generated	\$268M GDP contribution
		\$167M employment income	2,280 jobs created

Figure 29: Input-Output Model Real Life Applications

A Custom Input–Output (I/O) Model for EWA RDI Initiatives

RDI initiatives and programs generate economic impact in two ways. First, through the expenditure required to implement and operate the programs, which directly contributes to various economic sectors, particularly the water and agriculture sectors. Second, through the outputs generated by the programs, which create an additional value that can be quantified and translated into measurable economic impact, often significantly exceeding the effects generated by the programs' expenditures.

While a standard input–output (I/O) model can measure the economic impact of such programs, it has several notable limitations. It typically assesses only one program at a time, focuses primarily on expenditures without capturing the additional value generated by program outputs, and relies on a limited number of economic impact metrics, thereby constraining a comprehensive evaluation of the programs' overall contribution. To overcome these limitations, a custom I/O model (Figure 30) has been developed specifically for EWA RDI programs. This model serves as a centralized tool for all RDI programs, measuring 10 economic impact metrics and enabling a comprehensive assessment of their overall economic contribution.

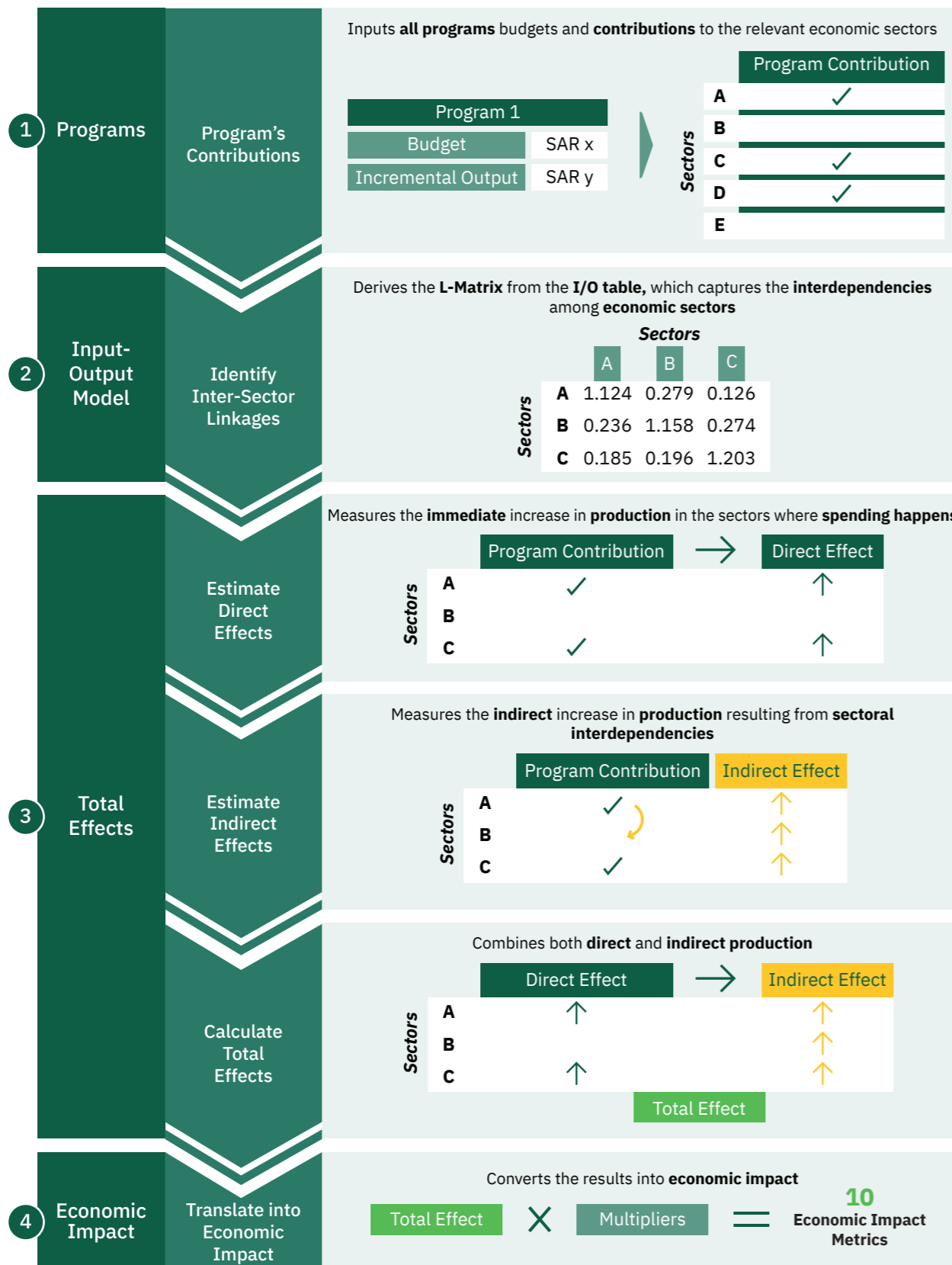


Figure 30: Input-Output (I/O) Model Process

For example, when innovative EWA technologies are supported through piloting and demonstration programs, the expenditure on these technologies constitutes a direct economic contribution to various sectors. Beyond this immediate effect, the outputs of these programs, such as the adoption of the tested technologies, can generate a substantially larger impact within the EWA sectors. This impact can be quantified by accounting for factors such as the success rate of piloted technologies and the potential benefits they deliver, including cost reductions and increases in sectoral production of goods and services.

However, it is important to note that the custom model is subject to two key limitations. First, it does not capture the economic impact on the environmental sector, as the environment is not represented as a distinct ISIC sector in the input–output tables and therefore cannot be treated as an independent economic activity. Second, the model does not specify the timeframe over which impacts materialize; impacts may be realized immediately or may unfold over several years, depending on the nature of each program. Despite these limitations, the model remains among the most robust tools available for economic impact assessment, enabling a comprehensive evaluation of the RDI Executive Plan while accurately reflecting the specific characteristics and uniqueness of each program.

Appendix 2: Contribution to National Strategies' KPIs

This appendix outlines the KPIs of national strategies advanced through the RDI initiatives and programs.

National Environment Strategy	<ol style="list-style-type: none"> 1. Economic sustainability of the Environment sector 2. Share of national strategies that incorporate climate-change adaptation 3. Saudi Arabia's rank in the Environmental Performance Index 4. Sustainable grazing 5. Share of agricultural water consumption out of total renewable water 6. Percentage of treated wastewater compliant with environmental standards 7. Diversion rate from landfills and dumpsites 8. R&D budget for the Environment and Meteorology sectors 9. Environmental education design
National Water Strategy	<ol style="list-style-type: none"> 1. Water consumption in the agricultural sector 2. Number of strategic storage days 3. Volume of water stored through groundwater storage and recovery 4. Compliance of treated wastewater quality with local standards 5. Consumption of non-renewable groundwater 6. Share of non-renewable groundwater from municipal supply sources 7. Share of non-renewable groundwater from total supply sources 8. Share of alternative sources from total supply sources 9. Collected treated wastewater 10. Wastewater return rate 11. Rate of treated wastewater reuse 12. Irrigation efficiency 13. Share of renewable water in total agricultural water demand 14. Percentage of purified water production via strategic partners 15. Local content in capital and operational projects 16. Total expenditure on water in the urban sector
National Agricultural Strategy	<ol style="list-style-type: none"> 1. Use of Non-Renewable Groundwater in Agriculture 2. Use of Renewable Groundwater in Agriculture 3. Use of Treated Renewable Water in Agriculture 4. Irrigation Efficiency 5. Cultivated Land Area 6. Global Food Security Index 7. Loss and Waste Across the Value Chain 8. Self-Sufficiency in Caloric Intake 9. Average Household Income of Smallholder Farmers 10. Number of New Direct Job Opportunities for Saudi Citizens 11. Average Unemployment Rate Among Saudis in Rural Areas 12. Agriculture Sector Contribution to GDP 13. Local Content in the Sector 14. Red Palm Weevil Infestation Rates

National priority area of Sustainable Environment and Supply of Essential Needs

In pursuit of eliminating the global challenges of water scarcity and food security, and building on the Kingdom's world-leading position in desalinated water production and its stewardship of major environmental conservation initiatives, Saudi Arabia, through the "Sustainable Environment and Supply of Essential Needs" priority, aspires to become a global model in environmental preservation and the sustainable provision of humanity's essential needs: water, food, and energy. This is to be achieved through the development of eco-friendly water provision and desalination technologies, advanced and sustainable food production technologies, expanded green spaces, carbon capture, utilization and storage technologies, as well as low-cost sustainable electricity generation technologies.

National Biotechnology Strategy

1. Number of genetic engineering companies establishing an R&D presence in KSA
2. Global ranking in publications on genetically engineered seeds for arid and semi-arid climates
3. Number of proof of concepts with localized intellectual property in genetic engineering
4. Percentage of food imports (of total spend) replaced with domestic production enabled by genetically engineered seeds

Appendix 3: Supporting Documents

This appendix provides resources highlighting the various RDI efforts undertaken by the Ministry of Environment, Water, and Agriculture and its affiliated entities in the EWA sectors.



Water Innovation Trends:
Wastewater Treatment & Reuse



Agriculture Innovation
Trends Report



Investment Trends in Research,
Development, and Innovation
for Sustainability



Innovation in the Environment
sector in Saudi Arabia:
Technology Adoption Roadmap



Innovation in the Water sector
in Saudi Arabia: Technology
Adoption Roadmap



Innovation in the Agriculture
sector in Saudi Arabia:
Technology Adoption Roadmap



SAFTA Annual Report
2024-2025



Establishment of Tech-Enabled
Pest Management Framework,
the Case of the Red Palm Weevil



MEWA-KAUST Strategic
Partnership Report 2024-2025



Water STRIP Launch



SAFTA Annual Forum

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