CGIAR Research Initiative on

Transforming Agrifood Systems in South Asia

Annual Technical Report 2023

Author: CGIAR Research Initiative on Transforming Agrifood Systems in South Asia

Title: Annual Technical Report 2023: CGIAR Research Initiative on Transforming Agrifood Systems in South Asia

Disclaimers

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Table of contents

CGIAR Technical Reporting 2023

CGIAR Technical Reporting has been developed in alignment with the CGIAR Technical Reporting Arrangement. This Initiative report ("Type 1" report) constitutes part of the broader CGIAR Technical Report. Each CGIAR Research Initiative submits an annual "Type 1" report, which provides assurance on Initiative-level progress towards End of Initiative outcomes.

The CGIAR Technical Report comprises:

- Type 1 Initiative, Impact Platform, and Science Group Project (SGP) reports, with quality assured results reported by Initiatives, Platforms and SGPs available on the CGIAR Results Dashboard.

- The Type 3 Portfolio Performance and Project Coordination Practice Change report, which focuses on internal practice change.

- The Portfolio Narrative, which draws on the Type 1 and Type 3 reports, and the CGIAR Results Dashboard, to provide a broader view on Portfolio coherence, including results, partnerships, country and regional engagement, and synergies among the Portfolio's constituent parts.

The CGIAR Annual Report is a comprehensive overview of CGIAR's collective achievements, impact and strategic outlook, which draws significantly from the Technical Report products above. For 2023, the Annual Report and Technical Report will be presented online as an integrated product.
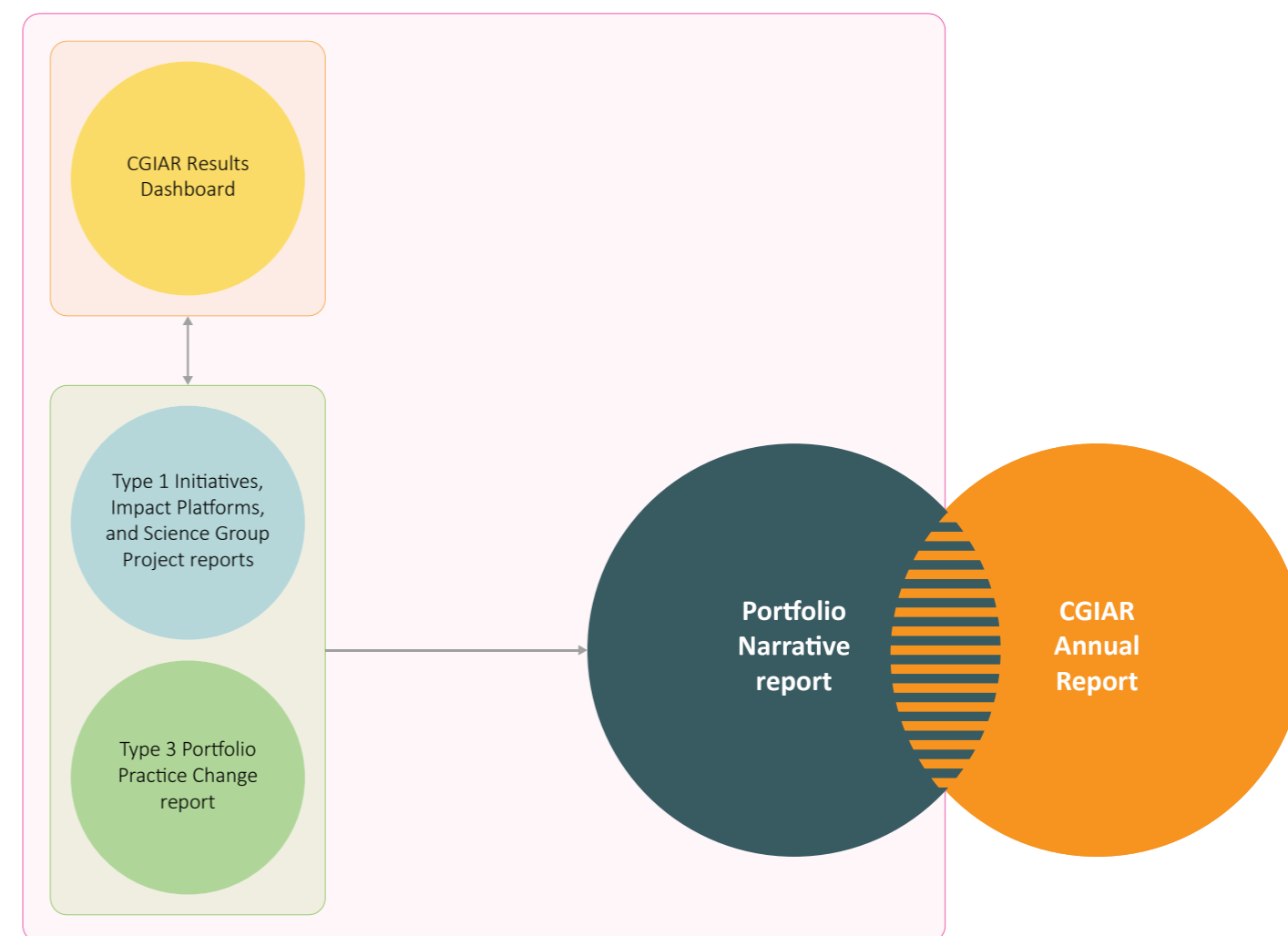
Section 1: Fact sheet and budget

Initiative name	Transforming Agrifood Systems in South Asia
Initiative short name	Transforming Agrifood Systems in South Asia (TAFSSA)
Initiative Lead	Timothy J. Krupnik (t.krupnik@cgiar.org)
Initiative Co-lead	Purnima Menon (p.menon@cgiar.org)
Science Group	Resilient Agrifood Systems
Start – end date	01/01/2022 – 31/12/2024
Geographic scope	**Region** South Asia **Countries** Bangladesh · India · Nepal · Pakistan
OECD DAC Climate marker adaptation score[1]	**Score 1: Significant** The activity contributes in a significant way to any of the three CGIAR climate-related strategy objectives (climate mitigation, climate adaptation, climate policy), even though it is not the principal focus of the activity.
OECD DAC Climate marker mitigation score[1]	**Score 1: Significant** The activity contributes in a significant way to any of the three CGIAR climate-related strategy objectives (climate mitigation, climate adaptation, climate policy), even though it is not the principal focus of the activity.
OECD DAC Gender equity marker score[2]	**Score 1B: Gender responsive** The Initiative/project includes at least one explicit gender equality outcome; the Initiative/project team has resident gender expertise or capacity. The Initiative/project includes indicators and monitors participation and differential benefits of diverse men and women.
Website link	https://www.cgiar.org/initiative/20-transforming-agrifood-systems-in-south-asia-tafssa/

[1] The Organisation for Economic Co-operation and Development (OECD) Development Assistance Committee (DAC) markers refer to the OECD DAC Rio Markers for Climate and the gender equality policy marker. For climate adaptation and mitigation, scores are: 0 = Not targeted; 1 = Significant; and 2 = Principal.

[2] The CGIAR Gender Impact Platform has adapted the OECD gender marker, splitting the 1 score into 1A and 1B. For gender equality, scores are: 0 = Not targeted; 1A = Gender accommodative/aware; 1B = Gender responsive; and 2 = Principal.

These scores are derived from Initiative proposals, and refer to the score given to the Initiative overall based on their proposal.

EXECUTIVE SUMMARY

In 2023, the CGIAR Research Initiative on Transforming Agrifood Systems in South Asia (TAFSSA) addressed the nexus of poverty, social inequities, malnutrition, environmental degradation, and climate change through research and innovation. Collaborating with 10 CGIAR Research Initiatives, engaging with five bilateral projects aligned with Initiative goals, and partnering with two CGIAR Platforms, TAFSSA improved farmer livelihoods and resilience, enhanced access to sustainable diets, and conserved regional environmental resources amid climate change challenges.

Multistakeholder engagement is central to TAFSSA. The Initiative worked with 189 demand, innovation, and scaling partners, and hundreds of public- and private-sector stakeholders. Scientists and partners developed and executed a first-of-its-kind integrated agrifood system assessment across five districts in Bangladesh, India, and Nepal. Data were collected from 4,000 households and 246 food markets on farm production, resource management, markets, and consumer habits, resulting in 40 research notes published in collaboration with partners, providing thorough baseline assessments of agrifood systems indicators, and offering research- and evidence-based policy recommendations.

The Initiative showcased its convening power at the Delivering for Nutrition in South Asia conference, attracting more than 1,200 participants and 159 research presentations. TAFSSA also co-supported wise use of groundwater and energy for irrigation, engaging 70 institutions from 16 countries in a landmark regional knowledge forum.

TAFSSA accelerates the pace at which scientific innovations move into large-scale development impact. Scaling research included participatory on-farm diversification trials in India, engaging 1,700 farmers in field days, and tested sociotechnical innovation bundles in Bangladesh with 640 farmers, focusing on crop diversification and nutrition training. Field days reached nearly 11,000 households across Bangladesh and Nepal, and 10,472 farmers in coastal Bangladesh mitigated extreme weather–induced loss and damage to mung bean through bundled climate service and agro-advisory innovations.

A key component focuses on increasing smallholder access to scale-appropriate farm machinery through public and private partnerships. Collaborations and support to strategically-aligned bilateral projects in CGIAR's portfolio resulted in 126,044 men and 30,575 women farmers accessing machinery services offered by rural entrepreneurs on an affordable fee-for-service basis. TAFSSA has been instrumental in fostering farm input and output aggregation models. In India, 8,375 farmers established Small Farmer, Large Field (SFLF) groups, resulting in profitable cultivation of chickpeas, maize, millet, mustard, potatoes, rice, vegetables, and wheat; in Bangladesh, action research engaged 50 farmer groups totaling 1,456 farmers, plus processors and traders, in the oilseed, pulses, and vegetable sectors, testing new farmgate business models. Collaboration with bilateral projects, 18 seed companies, postharvest milling companies, and more than 100 traders resulted in the harvesting of 134 tons of premium-quality biofortified rice (PQBR) seed by seed growers and 27,230 farmers.

TAFSSA's achievements, powered by science and innovation, included applying machine-learning to crunch data from 130,690 farmers in Bangladesh, identifying strategies to increase women's participation in agricultural training by more than 82 percent. Political economy research in Bangladesh and photovoice methods in India offered fresh perspectives on crop diversification and gender roles in food purchasing and preparation.

TAFSSA's 2023 achievements underscore strides toward sustainable, equitable, and resilient transformation in South Asia's agrifood systems, and established a benchmark for regional CGIAR engagement, combining excellence in science with deep stakeholder involvement to tackle and surmount pressing challenges in Bangladesh, India, Nepal, and Pakistan.

	2022 ▽	**2023** ▾	2024 ▽
PROPOSAL BUDGET ▷	$11.38M	**$14.10M**	$14.51M
APPROVED BUDGET [1] ▷	$4.24M	**$4.16M [2]**	$3.16M [3]

[1] The approved budget amounts correspond to the figures available for public access through the Financing dashboard.
[2] This amount includes carry-over and commitments.
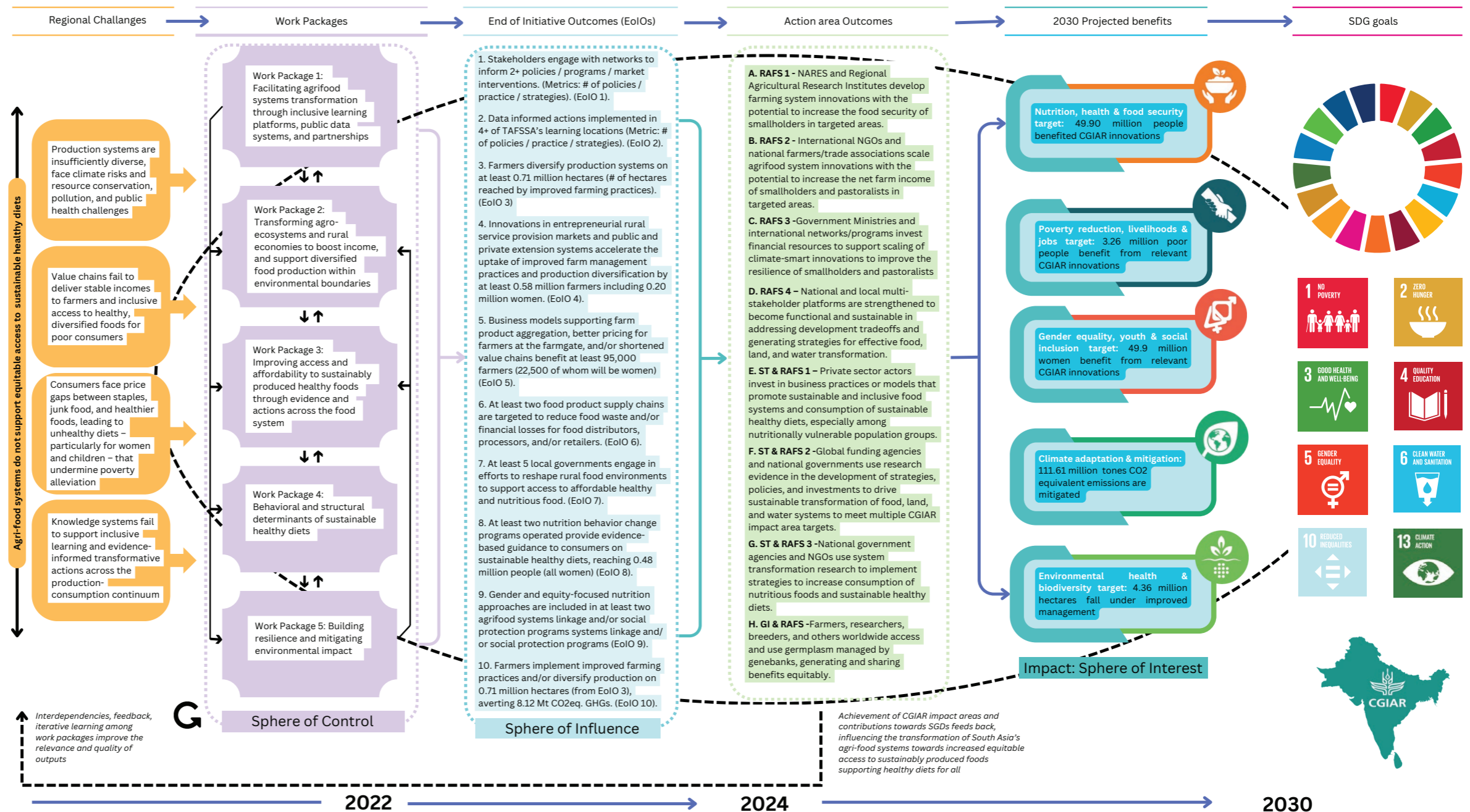[3] This amount is an estimation of the 2024 annual budget allocation, as of the end of March 2024.

A busy local vegetable market in Bihar, India.
Credit: Abdul Momin

Initiative-level theory of change diagram

This is a simple, linear, and static representation of a complex, non-linear, and dynamic reality. Feedback loops and connections between this Initiative and other Initiatives' theories of change are excluded for clarity.

EOI — End of Initiative outcome
AA — Action Area
IA — Impact Area
SDG — Sustainable Development Goal

Note: A summary of Work Package progress ratings is provided in Section 3.

Transforming Agrifood Systems in South Asia: Overall Initiative Theory of Change

| Regional Challenges | Work Packages | End of Initiative Outcomes (EoIOs) | Action area Outcomes | 2030 Projected benefits | SDG goals |

Agri-food systems do not support equitable access to sustainable healthy diets

Regional Challenges

Production systems are insufficiently diverse, face climate risks and resource conservation, pollution, and public health challenges

Value chains fail to deliver stable incomes to farmers and inclusive access to healthy, diversified foods for poor consumers

Consumers face price gaps between staples, junk food, and healthier foods, leading to unhealthy diets – particularly for women and children – that undermine poverty alleviation

Knowledge systems fail to support inclusive learning and evidence-informed transformative actions across the production-consumption continuum

Work Packages

Work Package 1: Facilitating agrifood systems transformation through inclusive learning platforms, public data systems, and partnerships

Work Package 2: Transforming agro-ecosystems and rural economies to boost income, and support diversified food production within environmental boundaries

Work Package 3: Improving access and affordability to sustainably produced healthy foods through evidence and actions across the food system

Work Package 4: Behavioral and structural determinants of sustainable healthy diets

Work Package 5: Building resilience and mitigating environmental impact

Sphere of Control

Interdependencies, feedback, iterative learning among work packages improve the relevance and quality of outputs

End of Initiative Outcomes (EoIOs)

1. Stakeholders engage with networks to inform 2+ policies / programs / market interventions. (Metrics: # of policies / practice / strategies). (EoIO 1).

2. Data informed actions implemented in 4+ of TAFSSA's learning locations (Metric: # of policies / practice / strategies). (EoIO 2).

3. Farmers diversify production systems on at least 0.71 million hectares (# of hectares reached by improved farming practices). (EoIO 3)

4. Innovations in entrepreneurial rural service provision markets and public and private extension systems accelerate the uptake of improved farm management practices and production diversification by at least 0.58 million farmers including 0.20 million women. (EoIO 4).

5. Business models supporting farm product aggregation, better pricing for farmers at the farmgate, and/or shortened value chains benefit at least 95,000 farmers (22,500 of whom will be women) (EoIO 5).

6. At least two food product supply chains are targeted to reduce food waste and/or financial losses for food distributors, processors, and/or retailers. (EoIO 6).

7. At least 5 local governments engage in efforts to reshape rural food environments to support access to affordable healthy and nutritious food. (EoIO 7).

8. At least two nutrition behavior change programs operated provide evidence-based guidance to consumers on sustainable healthy diets, reaching 0.48 million people (all women) (EoIO 8).

9. Gender and equity-focused nutrition approaches are included in at least two agrifood systems linkage and/or social protection programs systems linkage and/or social protection programs (EoIO 9).

10. Farmers implement improved farming practices and/or diversify production on 0.71 million hectares (from EoIO 3), averting 8.12 Mt CO2eq. GHGs. (EoIO 10).

Sphere of Influence

Action area Outcomes

A. RAFS 1 - NARES and Regional Agricultural Research Institutes develop farming system innovations with the potential to increase the food security of smallholders in targeted areas.

B. RAFS 2 - International NGOs and national farmers/trade associations scale agrifood system innovations with the potential to increase the net farm income of smallholders and pastoralists in targeted areas.

C. RAFS 3 -Government Ministries and international networks/programs invest financial resources to support scaling of climate-smart innovations to improve the resilience of smallholders and pastoralists

D. RAFS 4 – National and local multi-stakeholder platforms are strengthened to become functional and sustainable in addressing development tradeoffs and generating strategies for effective food, land, and water transformation.

E. ST & RAFS 1 – Private sector actors invest in business practices or models that promote sustainable and inclusive food systems and consumption of sustainable healthy diets, especially among nutritionally vulnerable population groups.

F. ST & RAFS 2 - Global funding agencies and national governments use research evidence in the development of strategies, policies, and investments to drive sustainable transformation of food, land, and water systems to meet multiple CGIAR impact area targets.

G. ST & RAFS 3 -National government agencies and NGOs use system transformation research to implement strategies to increase consumption of nutritious foods and sustainable healthy diets.

H. GI & RAFS -Farmers, researchers, breeders, and others worldwide access and use germplasm managed by genebanks, generating and sharing benefits equitably.

Impact: Sphere of Interest

Achievement of CGIAR impact areas and contributions towards SGDs feeds back, influencing the transformation of South Asia's agri-food systems towards increased equitable access to sustainably produced foods supporting healthy diets for all

2030 Projected benefits

Nutrition, health & food security target: 49.90 million people benefited CGIAR innovations

Poverty reduction, livelihoods & jobs target: 3.26 million poor people benefit from relevant CGIAR innovations

Gender equality, youth & social inclusion target: 49.9 million women benefit from relevant CGIAR innovations

Climate adaptation & mitigation: 111.61 million tones CO2 equivalent emissions are mitigated

Environmental health & biodiversity target: 4.36 million hectares fall under improved management

SDG goals

1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
10 REDUCED INEQUALITIES
13 CLIMATE ACTION

CGIAR

2022 → **2024** → **2030**

Objective: Deliver a coordinated program of research and engagement across the food production to consumption continuum to improve equitable access to sustainable healthy diets, improve farmer livelihoods and resilience, and protect land, air, and groundwater resources.

The context for agri-food systems transformation is shaped by economic development, trade, politics and resulting policies, institutional capabilities, the information environment, socio-cultural influences and change

A farmer Nalanda, India irrigating his land.
Credit: Shawn Sebastian

Summary of progress against the theory of change

Hosting a quarter of the world's population, of which one-fifth are youth, South Asia is the global epicenter of poverty and malnutrition. Facing immense challenges in poverty alleviation, social equity, climate change, and environmental sustainability, the region struggles to provide a diverse and affordable food supply for healthy diets. CGIAR's regional integrated Research Initiative TAFSSA directly addresses these issues through applied and participatory action research and innovation systems that enable transformation. By offering a coordinated research and engagement program spanning the entire food production-to-consumption spectrum, TAFSSA aims to ensure equitable access to sustainable healthy diets, enhance farmer livelihoods and resilience, and protect the region's land, air, and groundwater resources. TAFSSA's progress in 2023 is summarized below, with key outputs available online.

Progress in applied research for development

With a regional and nationally based approach, TAFSSA's research is inherently systems oriented, predicated on the idea that the transformation of agrifood systems demands transdisciplinary and highly collaborative multistakeholder efforts. TAFSSA's work focuses on multistakeholder platforms and data systems, transformation and diversification of agroecosystems, equitable markets, behavioral determinants of sustainable healthy diets, and natural resources and climate change management. The Initiative contributes to the generation of globally, regionally, and nationally pertinent public goods, facilitating progression toward more sustainable agrifood systems in South Asia, while contributing to global scientific and development discourse.

Major 2023 scientific highlights in multistakeholder platforms and data systems include:

- TAFSSA and national partners conducted a pioneering integrated agrifood systems assessment, including across five districts in Bangladesh, India, and Nepal. This assessment collected data on farm production, natural resource management, farmgate to food consumption information, and climate change adaptation, from adults and adolescents in representative households. Detailed data were collected on food outlets, food and vendor markets, and shopping behaviors to characterize rural and peri-urban food environments.

- Forty research notes coauthored with national partners were generated from this work to inform transformation processes in agrifood systems. Each data note details measurement of key agrifood systems indicators in clear charts for policymakers, outlines major insights, and suggests policy action research to support evidence-based engagement in South Asia.

- A major regional conference, Delivering for Nutrition in South Asia, that focused on equity and inclusion was co-organized by TAFSSA and 28 partners. It convened more than 1,200 researchers, development practitioners, donors, and policymakers, facilitating the exchange of research findings in 159 presentations and implementation experiences of agrifood systems and nutrition programs.

- TAFSSA, in collaboration with the Cereal Systems Initiative for South Asia (CSISA in Nepal, generated 12 monthly agrifood systems situation reports. These reports, which detailed fluctuations in prices of agricultural inputs and food commodities while offering policy insights, were extensively shared with stakeholders in the public and private sectors.

Major 2023 scientific highlights transforming and diversifying agroecosystems include:

- TAFSSA's partnerships with national research partners and farmers in Bangladesh, India, and Nepal tested sociotechnical innovation bundles of improved cropping system management practices and nutrition training in contribution to diversified and healthy food production, reduced environmental externalities, and increased agronomic and economic resilience to climate variability and change.

- In Bangladesh, research partnerships advanced the use of machine-supported decision-making in gender-equitable agricultural extension planning, providing strategies for how to boost women's participation in trainings by more than 82 percent.

- Researchers used political economy methods to identify pathways supporting crop diversification in Bangladesh. Using a political economy approach, historical reviews of agrifood system development trajectories were also completed for Bangladesh, Haryana in India, and Pakistan, each of which were widely disseminated through TAFSSA's webinars.

- Policy engagement briefs describing smallholders' dominant crop and livestock practices were also completed for Banke and Surkhet districts in Nepal, Nalanda in India, and Rajshahi and Rangpur in Bangladesh.

Major 2023 scientific highlights in equitable markets include:

- Innovative photovoice methods provided insights on how low-income households in India interact with their food environment. Research revealed gender-specific roles in food purchasing and preparation, highlighting the complex interplay between household gastronomy, market interactions, and sociocultural influences on food decisions.

- TAFSSA researched the price dynamics of 20 food commodities in Bihar's agricultural markets, uncovering concurrent price variations across markets. Researchers are now offering policymakers guidance for enhancing supply chain efficiency and supporting smallholder farmers, with broader implications for agricultural market strategies.

Major 2023 scientific highlights toward behavioral determinants of sustainable healthy diets include:

- In partnership with researchers and government counterparts in Bangladesh, India, Nepal, and Pakistan, TAFSSA reviewed social protection programs (SPPs) in South Asia and their potential to be nutrition sensitive. The research delineated characteristics (such as scale, entitled benefits, eligibility) of SPPs and offers suggestions for features to enhance nutrition sensitivity.

- TAFSSA collaborated with the Solar Irrigation for Agricultural Resilience (SoLAR) project, organizing a regional knowledge forum on energizing agriculture and enabling just energy transitions in South Asia. The forum attracted 189 participants from 16 countries, representing more than 70 stakeholder institutions worldwide, with participants from Africa, Central Asia, and South Asia.

- In collaboration with the CSISA project, which is aligned with TAFSSA, and Nepal's Groundwater Resources Development Board, the Initiative assisted the government of Nepal in the management of water for irrigation by expanding the number of observational locations for groundwater data collection, with real-time data upload and representation in an online dashboard.

- Agvisely is a digital climate service advisory tool developed by CSISA, TAFSSA and the Asian-Mega Deltas Initiative that bolsters agricultural resilience against climate risks. More than 8,000 extension officers have been trained in how to use its dynamic weather forecast-based crop advisories. Collaborating with microfinance institutions, social experiments were established to assess women farmers' profits, willingness to pay, and the financial institutions' perspectives on co-investing in and scaling Agvisely more widely.

- A methodology for groundwater modeling in Nalanda, India, was developed, and through participatory engagement, potential scenarios were identified by stakeholders to quantify groundwater use under past and projected climates and management practices.

TAFSSA brings together six CGIAR Centers, with nearly 95 percent of its scientists being of South Asian descent and/or long-term residents of the region. The Initiative works with more than 160 partners on activities that align with its theory of change (TOC), exploring multiple pathways to impact and aiming toward its End of Initiative outcomes (EOIOs).

In Nalanda, India, a woman energetically prepares nourishing meals for her family.
Credit: Shawn Sebastian

Progress by End of Initiative outcome

EOIO 1: Stakeholders engage with networks to inform at least two policies, programs, or market interventions. (Metrics: number of policies, practices, or strategies).

TAFSSA mapped knowledge networks in Bangladesh's agrifood systems using participatory methods, analyzing ways to transform them. This process identified key stakeholders and connections to facilitate knowledge transfer, innovation, and evidence-based decision-making. Research on the groundwater–energy nexus in Bangladesh catalyzed more than 70 institutions across 16 countries in knowledge-sharing on livelihoods, gender and inclusion, and groundwater linkages.

EOIO 2: Data informed actions implemented in at least four of TAFSSA's learning locations. (Metrics: number of policies, practices, or strategies).

Governmental officials from multiple sectors across agrifood systems were convened by TAFSSA in five districts across Bangladesh, India, and Nepal. Interactions disseminated integrated agrifood systems assessment findings; assessed drivers of dietary choices, and gender and social inclusion; and identified evidence required to inform bottom-up demands to fill crucial information and knowledge gaps. More than 100 officials participated across the three countries.

EOIO 3: Farmers diversify production systems on at least 0.71 million hectares (number of hectares reached by improved farming practices).

In India, TAFSSA collaborated with the Indian Council of Agricultural Research's Central Soil Salinity Research Institute (ICAR-CSSRI), ICAR's Indian Institute of Maize Research (ICAR-IIMR), and governments in Bihar (JEEViKA) and Haryana, as well as universities (Chaudhary Charan Singh Haryana Agricultural University [HAU], Panjab University [PAU], Dr. Rajendra Prasad Central Agricultural University [RPCAU]) and the Borlaug Institute for South Asia (BISA). These partnerships enabled participatory on-farm diversification trials benefiting more than 1,700 farmers. In Bangladesh, TAFSSA partnered with the Bangladesh Wheat and Maize Research Institute (BWMRI), Bangladesh Agricultural Research Institute (BARI), Department of Agriculture Extension (DAE), GJUS, Bangladesh Institute of Research and Training on Applied Nutrition (BIRTAN) to test sociotechnical innovation bundles focused on crop diversification and nutrition across Rajshahi and Rangpur. Field days in Bangladesh and Nepal reached 10,899 farming households across the region, and 10,472 farmers in coastal Bangladesh accessed climate services, enabling reduced risk in mung bean production.

EOIO 4: Innovations in entrepreneurial rural service-provision markets and public and private extension systems accelerate the uptake of improved farm management practices and production diversification by at least 0.58 million farmers, including 0.20 million women.

Partnership with JEEViKA in Bihar, India, has facilitated capacity-building and policy advocacy, enhancing farm machinery scheduling, access, and operations for farmers diversifying beyond cereal-based cropping systems. In Bangladesh and Nepal, partnerships with machinery manufacturers, dealers, and service providers, and alignment of strategic support with governmental programs supported farmers to access cost-saving mechanization services, supported TAFSSA, and aligned bilateral projects. In total, 126,044 men and 30,575 women farmers used innovative farm machinery on more than 5,550 hectares of land. This achievement was propelled by private-sector investment of US$ 3,528,350 in both countries to boost mechanization markets and services.

EOIO 5: Business models supporting farm-product aggregation, better pricing for farmers at the farmgate, and/or shortened value chains benefit at least 95,000 farmers (22,500 of whom are women).

TAFSSA facilitates farm input and output aggregation models to increase farmers' income and improve access to nutritious, affordable foods. In Odisha and Bihar, India, 8,375 farmers formed SFLF groups, profitably cultivating chickpeas, maize, millet, mustard, potatoes, rice, vegetables, and wheat. In Bangladesh, action research involved 50 farmer groups, processors, and traders in the oilseed, pulses, and vegetable sectors, where 1,456 farmers tested new farmgate business models. TAFSSA formed partnerships with bilateral donor and government market-development projects, 18 seed companies, postharvest milling companies, and more than 100 traders. A total of 134 tons of PQBR seed was cultivated by seed growers and subsequently planted by 27,230 farmers.

EOIO 6: At least two food-product supply chains are targeted to reduce food waste and/or financial losses for food distributors, processors, and/or retailers.

To combat food waste and financial losses, research in Bangladesh and India is generating value stream maps for essential cereal, fish, and vegetable supply chains. These maps highlight the product flow from farmers to consumers, pinpointing inefficiencies and improvement opportunities. Responding to stakeholder demand, TAFSSA collaborates with Initiatives and bilateral projects to address food safety in South Asia. Leveraging its broad network and sharing evidence with market and food safety planners across sectors, TAFSSA aims to enhance supply chain efficiency and foster healthier, sustainable food industry practices.

EOIO 7: At least five local governments engage in efforts to reshape rural food environments to support access to affordable healthy and nutritious food.

Data notes and ongoing engagement with district-level administrations inform and raise awareness about the factors influencing food choices and access to nutritious foods. Collaborating with the INFUSION project, TAFSSA is charting strategies to develop and enhance rural markets and improve women's access to nutritious food. Involvement with local governments is directed toward boosting access to and consumption of nutritious foods.

EOIO 8: At least two nutrition behavior-change programs provide evidence-based guidance to consumers on sustainable healthy diets, reaching 0.48 million people (all women).

In 2023, data generated from TAFSSA's integrated agrifood systems assessments were analyzed to generate the "plate-to-farm" analyses tracing food from consumers through value chains and back to farms. Research unpacked how diets differed between men, women, and adolescents. Studies also provided stakeholders with detailed insights informing policy action on unhealthy food shopping behaviors. TAFSSA also engaged the USAID-backed Suaahara project in Nepal, International Centre for Diarrhoeal Disease Research (ICCDR,B) in Bangladesh, the National Institute of Nutrition (NIN) in India, and Aga Khan University (AKU) in Pakistan, on a scoping review on nutrition behavior change communication (BCC).

EOIO 9: Gender- and equity-focused nutrition approaches are included in at least two agrifood systems linkages and/or SPPs.

In 2023, TAFSSA developed a novel tool for analyzing data on household food task allocation, including intra-household disaggregation, to inform large-scale SPPs. The analysis moved beyond the simple dichotomy of task division between men and women, delving into how tasks are distributed among different female members within South Asian households. Research was presented at CGIAR's gender conference in India. Work on cost of diets in India continued, with a perspective piece for engagement at the policy level in preparation. Looking forward, TAFSSA will continue research on social safety nets and diets using the integrated agrifood systems assessment data.

EOIO 10: Farmers implement improved farming practices and/or diversify production on 1.42 million hectares (from EOIO 3), averting 16.24 Mt CO2eq. GHGs.

In India, TAFSSA scientists documented the greenhouse gas (GHG) reduction benefits of cropping systems diversification away from rice and wheat. Research documented the shift from wet-season rice to maize cultivation in India, aiming to reduce GHG emissions and improve water use efficiency. This was supported by 150 on-farm demonstrations and maize field days, co-sponsored with the state government. Similarly, in Bangladesh, engagement with partners focused on diversifying from rice-based cropping systems to include maize as an option that generates income, consumes less water, and reduces GHG emissions.

Women working in fields.
Credit: Abdul Momin

Progress towards end of initiative outcomes (EOIOs)

EOIO 1
Stakeholders engage with networks to inform 2+ policies/programs/market interventions (Metrics: # of policies/practice/strategies)

TAFSSA worked to enhance knowledge networks in Bangladesh's agrifood systems, facilitating knowledge transfer, innovation, and evidence-based decision-making.

Catalyzed knowledge-sharing among over 70 institutions across 16 countries on livelihoods, gender and inclusion, and groundwater linkages through research on the groundwater-energy nexus in Bangladesh.

EOIO 2
Data-informed actions implemented in 4+ of TAFSSA's learning locations (Metric: # of policies/practice/strategies)

TAFSSA convened government officials across Bangladesh, India, and Nepal, facilitating dialogue on agrifood systems.

Discussions focused on assessment findings, dietary drivers, gender equity, and knowledge gaps where over 100 officials participated.
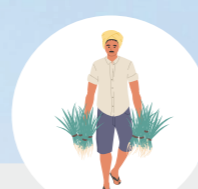
EOIO 3
Farmers diversify production systems on at least 0.71 million hectares (# of hectares reached by improved farming practices)

Collaborated with Indian institutions and governments for on-farm trials benefiting 1,700+ farmers.
In Bangladesh, partnerships tested innovation bundles benefiting 640+ farmers.

10,899 farm households participated in field days with government and private sector partners focusing on profitable and nutritious options for crop diversification.

EOIO 4
Innovations in entrepreneurial rural service provision markets and public and private extension systems accelerate the uptake of improved farm management practices and production diversification by at least 0.58 million farmers including 0.20 million women.

Partnership with JEEViKA in India boosted farm machinery operations and diversification.

In Bangladesh and Nepal, collaborations with manufacturers, dealers, and governments facilitated cost-effective mechanization services, benefitting 156,619+ farmers.

Private sector investment of $3,528,350 fueled the progress of mechanization markets and services in Bangladesh and Nepal.

EOIO 5
Business models supporting farm product aggregation, better pricing for farmers at the farmgate, and/or shortened value chains benefit at least 95,000 farmers (22,500 of whom will be women).

In India, 8,375+ farmers formed 'Small Farmer, Large Field' groups, cultivating nutritious crops profitably.

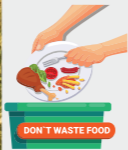In Bangladesh, 50+ farmer groups tested new business models.

Partnerships with donors, government projects, and companies ensured success, with 27,230+ farmers benefiting from premium quality rice seeds.

EOIO 6
At least two food product supply chains are targeted to reduce food waste and/or financial losses for food distributors, processors, and/or retailers.

Enhanced supply chain efficiency and reduced food waste in India and Bangladesh's vegetable, fish, and cereal sectors due to TAFSSA's research mapping.

Improved food safety practices through collaboration with stakeholders, leading to evidence-based enhancements in supply chain efficiency. Progress towards adoption of healthier, sustainable practices across South Asia's food industry through TAFSSA's findings, dissemination and collaboration with market and food safety planners.

EOIO 7
At least 5 local governments engage in efforts to reshape rural food environments to support access to affordable healthy and nutritious food.

Data and ongoing engagement with district-level administrations raised awareness on factors influencing food choices and access to nutritious foods.

Collaboration with the INFUSION project charted strategies to enhance rural markets and improve women's access to nutrition.

EOIO 8
At least two nutrition behavior change programs operated provide evidence-based guidance to consumers on sustainable healthy diets, reaching 0.48 million people (all women).

Research highlighted dietary variations among different types of rural households, men, women, and youth, informing policy.

Collaboration with USAID, ICDDR'B, and others addressed nutrition behavior change communication, fostering positive outcomes.

EOIO 9
Gender and equity-focused nutrition approaches are included in at least two agrifood systems linkage and/or social protection programs systems linkage and/or social protection programs.

TAFSSA introduced a pioneering tool in 2023 for analyzing household food task allocation, providing data and evidence to enrich large-scale social protection programs.

Future endeavors include utilizing integrated agrifood systems assessment data to advance research on social safety nets and dietary patterns.

EOIO 10
Farmers implement improved farming practices and/or diversify production on 0.71 million hectares.

TAFSSA scientists in India documented greenhouse gas (GHG) reduction benefits by diversifying cropping systems away from rice and wheat.

In Bangladesh, collaboration focused on diversifying from rice-based systems to maize, promoting income generation, reduced water consumption, and GHG emissions.
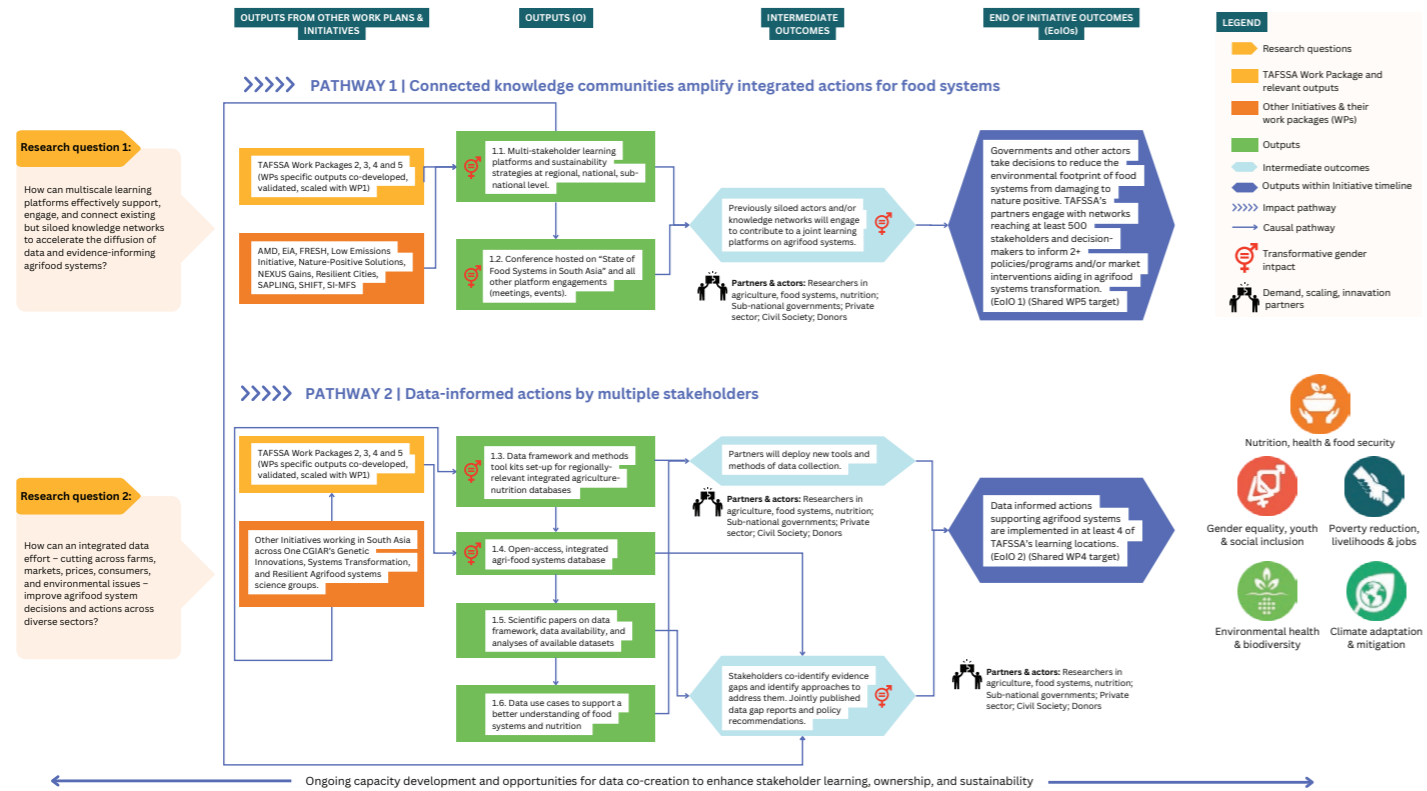
Diversified and climate-smart farming practices were popularized through 150+ on-farm demonstrations and maize field days, co-sponsored with the state government of India.

WP1: Facilitating agrifood systems transformation through inclusive learning platforms, public data systems, and partnerships

● On track

TAFSSA WORK PACKAGE 1

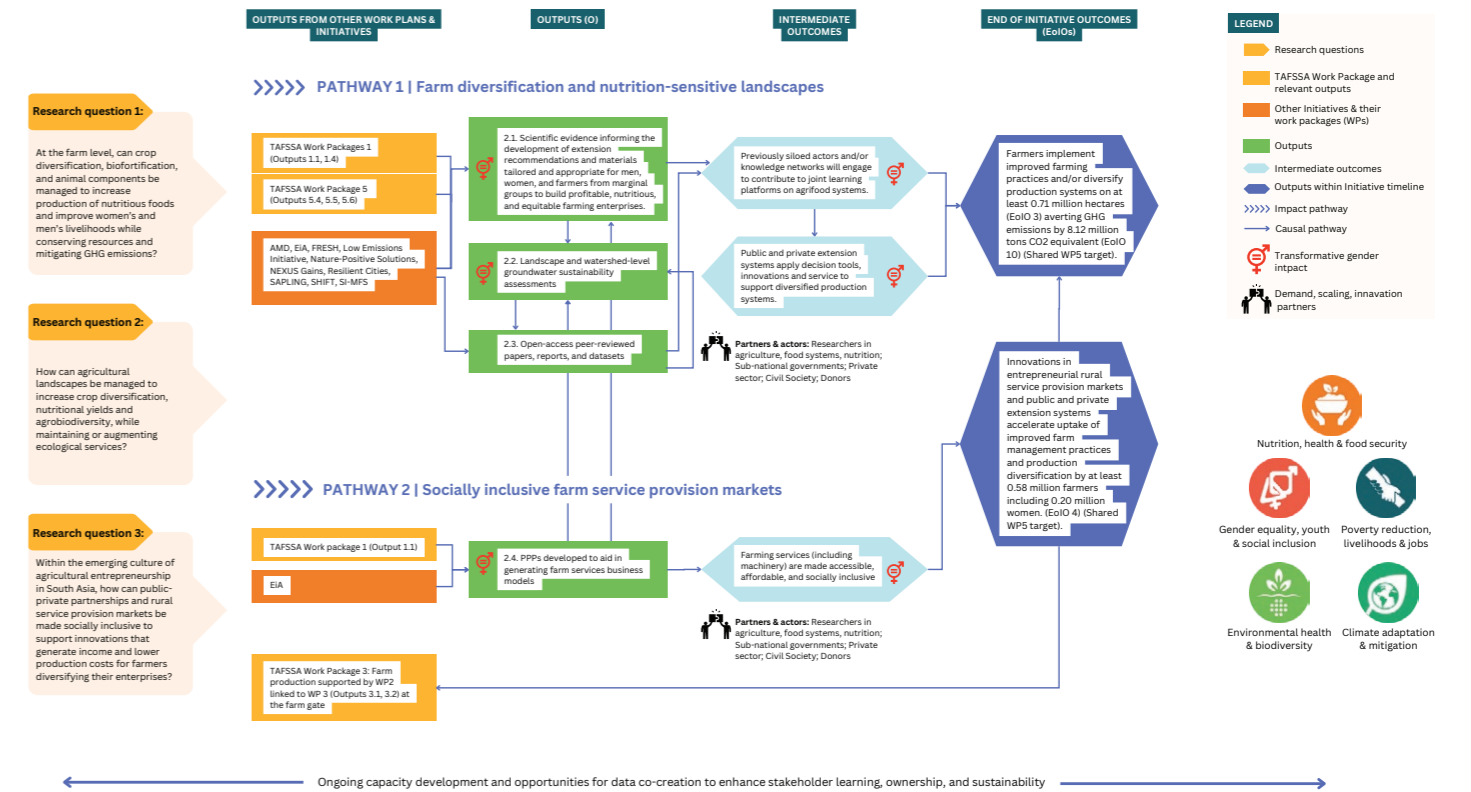### Work Package 1 progress against the theory of change

Work Package (WP) 1 cuts across all of TAFSSA's WPs and establishes the Initiative's first impact pathway by linking knowledge communities to enhance and integrate transformative actions within agrifood systems. WP1 united scientists from various disciplines—agronomy, data science, economics, gender studies, and nutrition—to create and conduct a pioneering integrated agrifood system assessment deployed in India, Bangladesh, and Nepal. Data collection and analyses focus on the interconnections between agricultural systems, markets and food environments, food purchasing and consumption behaviors, and the role of women, men, and adolescents in agrifood systems. Through this process, new tools were developed, adapted, and field-tested by TAFSSA to collect data on gendered and age group–specific dietary choices, actions, and aspirations from women, men, boys, and girls in these district-level agrifood systems assessments. The conceptual framework, survey instruments, and data collected by WP1 serve as a foundation for TAFSSA's subsequent WPs, the Initiative's convening and collaborations with other CGIAR Research Initiatives (such as Fruits and Vegetables for Sustainable Healthy Diets, Sustainable Healthy Diets, Resilient Cities), bilateral CGIAR projects (such as CSISA, POSHAN, RUPANTAR), and non-CGIAR partners (Institute for Integrated Development Studies [IIDS], Brac Institute of Governance and Development], ICDDR,B, and University of South Carolina).

WP1's second impact pathway facilitates data-informed actions by multiple stakeholders, including those within and outside CGIAR. TAFSSA's integrated agrifood systems surveys were administered across five districts and wards, gathering gender-disaggregated information from households, communities, and food and agricultural markets. Data were collected from a total of 10,000 men, women, boys, and girls from 4,000 households, 246 food markets, and hundreds of food shop owners and managers.

Crunching these data, TAFSSA and its partners produced 40 thematic research notes, detailing interconnections between farm production, market systems, and diets, with broad emphasis on natural resource management and climate change adaptation. Meetings with key district-level governmental officials, civil society, and private partners in each learning location were held to share research findings and support evidence-based decision-making in agricultural extension planning and in market and public policy at local levels. These activities have shaped TAFSSA's research and analysis plan for 2024, with work underway on a report on the state of South Asia's agrifood systems. In Nepal, TAFSSA also collaborated with CSISA and generated 12 monthly agrifood systems situation reports detailing fluctuations in agricultural input and food commodity prices, which were widely disseminated to public and private stakeholders.

WP2: Transforming agroecosystems and rural economies to boost income, and support diversified food production within environmental boundaries

● On track

TAFSSA WORK PACKAGE 2

Work Package 2 progress against the theory of change

Targeting areas affected by poverty, malnutrition, and environmental degradation, WP2 focuses on research and actions to transform South Asia's agroecosystems through two primary impact pathways. The first pathway creates inclusive strategies to enhance the production of diverse, profitable, and nutritious foods at the field, farm, and landscape levels, while linking farmers to markets through WP3. In 2023, TAFSSA continued partnerships and strengthened research collaborations with national partners in India (ICAR), Bangladesh (BWMRI, BIRTAN, DAE , BARI), and Nepal's Agricultural Research Council (NARC). Research efforts were intensified to develop robust outputs that could provide stakeholders with the evidence needed to support systemic change in agroecosystems. Coordinated work on farming systems diversification spanned agronomic, training, gender and extension research, data gap assessments, nutrition, groundwater modeling, and geospatial mapping activities.

In Bangladesh, TAFSSA continued scaling research in partnership with BWMRI, BARI, DAE, and BIRTAN in Rajshahi and Rangpur divisions. The Initiative evaluated the ways in which sociotechnical innovations, including participatory action research with more than 640 husband-and-wife farmers, on improved cropping systems, applied nutrition, and crop budget training can be bundled to scale out diversified and healthy food production. TAFSSA also investigated the political-economic challenges to achieving diversification to inform policy. Collaboration with the Mixed Farming Systems Initiative linked diversification with fodder production and sales, and demonstrated strategies to optimize fodder production. Across Bangladesh and Nepal, farmer field days reached 10,899 households. Field-level research on diversification in India with ICAR-CSSRI, ICAR-IIMR, state governments in Bihar and Haryana, universities (HAU, PAU, RPCAU), and BISA considered cropping systems sustainability, productivity, profitability, and nutritional diversity. Training and capacity-sharing efforts focused on maize involved more than 1,700 farmers.

TAFSSA's second impact pathway catalyzes public-private partnerships and aligns bilaterally funded projects in support of agricultural machinery service-provision markets to empower farmers to reduce production costs when diversifying cropping systems. Research documented how these approaches contribute to poverty reduction. Collaborations with more than 650 farm machinery manufacturers, dealers, and service providers, and synergies with governmental extension programs enabled 126,044 male and 30,575 female farmers to access cost-saving mechanization services on more than 5,550 hectares in Bangladesh and Nepal. Private sector investment of US $3,528,350 in these efforts, catalyzed scaling of mechanization markets and services.

WP3: Improving access to and affordability of sustainably produced healthy foods through evidence and actions across the postharvest value chain

On track

TAFSSA WORK PACKAGE 3

| OUTPUTS FROM OTHER WORK PLANS & INITIATIVES | OUTPUTS (O) | INTERMEDIATE OUTCOMES | END OF INITIATIVE OUTCOMES (EoIOs) | LEGEND |

>>>>> **PATHWAY 1 | Public-private partnership for collective action**

Research question 1: How to strategically link and improve the participation of hundreds of millions of small and marginal farmers, including women and youth in the agrifood value chain, while supporting the sustainable production of nutritious crop and animal-based foods?

TAFSSA Work Package 2 (Outputs 2.1, 2.2, 2.3)

AMD, EiA, FRESH, NEXUS Gains, Resilient Cities, SAPLING, SHiFt, SI-MFS

3.1. Evidence synthesis of viable output aggregation models to encourage diversification and sustainable production of nutritious foods by men, women, and marginal groups.

3.2. Smallholder aggregation models to encourage diversification, fallow intensification and landrace promotion

3.3. Business models for increased participation of marginal groups in local seed production for non-cereal crops

3.4. Value Stream Map of food supply chain

Farm product aggregation models and market linkages reduce costs and improve farmers' income from diversified production

Supply chain actors are aware about opportunity cost of food waste

Business models supporting farm product aggregation, better pricing for farmers at the farmgate, and/or shortened value chains benefit at least 95,000 farmers (22,500 of whom will be women). (EoIO 5)

At least two food product supply chains are targeted to reduce food waste and/or financial losses for food distributors, processors, and/or retailers (EoIO 6)

Partners & actors: Supply chain partners & actors, Women SFGs, private entrepreneurs; Farmers, local government, traders, private investors; Municipality, public and private investors, Women SGGs, Local govt., NGOs, FPOs/cooperatives

>>>>> **PATHWAY 2 | Enhanced knowledge to foster change in food environments**

Research question 3: Acknowledging that most of the food consumed in South Asia is bought in markets, and that research on food environments in the region is near absent, we ask what factors in the food environment influence access to and purchase of nutritious food for poor consumers — with emphasis on women — and how these environments can be improved?

TAFSSA Work Package 4. Farmgate aggregation, food value chain, and consumer behavior research in WP3 provides outputs and insights for WP4's focus on determinants of healthy diets.

3.5.Geospatial maps of consumer (specifically poor people) access to food environments delivering healthy and nutritious food in urban and rural markets

3.6. Tools for food retail design to increase consumer demand for sustainably produced and nutritious foods

3.7.Open-access peer-reviewed papers, reports, and datasets

Research evidence catalyzes a reshaping of rural food environments to support more equitable and inclusive access to affordable and sustainable healthy diets

At least 5 local governments engage in efforts to reshape rural food environments to support access to affordable healthy and nutritious food. (EoIO 7)

Partners & actors: Behavioural change programs, Nutrition programs, consumers, food distributors, food processors retailers, other researchers

Legend: Research questions; TAFSSA Work Package and relevant outputs; Other Initiatives & their work packages (WPs); Outputs; Intermediate outcomes; Outputs within Initiative timeline; Impact pathway; Causal pathway; Transformative gender impact; Demand, scaling, innovation partners; Nutrition, health & food security; Gender equality, youth & social inclusion; Poverty reduction, livelihoods & jobs

Ongoing capacity development and opportunities for data co-creation to enhance stakeholder learning, ownership, and sustainability

Work Package 3 progress against the theory of change

Building on the action research and innovation bundling of WP2 to scale farm diversification, WP3 focuses on post-farmgate actions and markets to improve gender-equitable access to sustainably produced, affordable nutritious foods in 2023. Focusing on public-private partnerships for collective action, WP3 supported SFLF business models, partnering in Bihar, Assam, and Odisha (the latter with Pragati) in India, and Bangladesh. A total of 8,375 farmers joined SFLF groups, with women making up 11 percent. These groups enhanced farmers' access to inputs and machinery services, and worked to boost farmers' agency and negotiating power at the farmgate, resulting in a 40 percent average profit increase for members. In Bangladesh and in partnership with BRRI, rice millers and 151 producer groups comprised of 4,404 farmers harvested 2,687 tons of PQBR, along with diversified crops including oilseeds, pulses, and vegetables.

In its second impact pathway, WP3 is transforming food environments by addressing the marketing of diverse farm products, emphasizing fish, oilseeds, PQBR varieties, pulses, and vegetables. Collaborating with CSISA and seed companies in 2023, TAFSSA
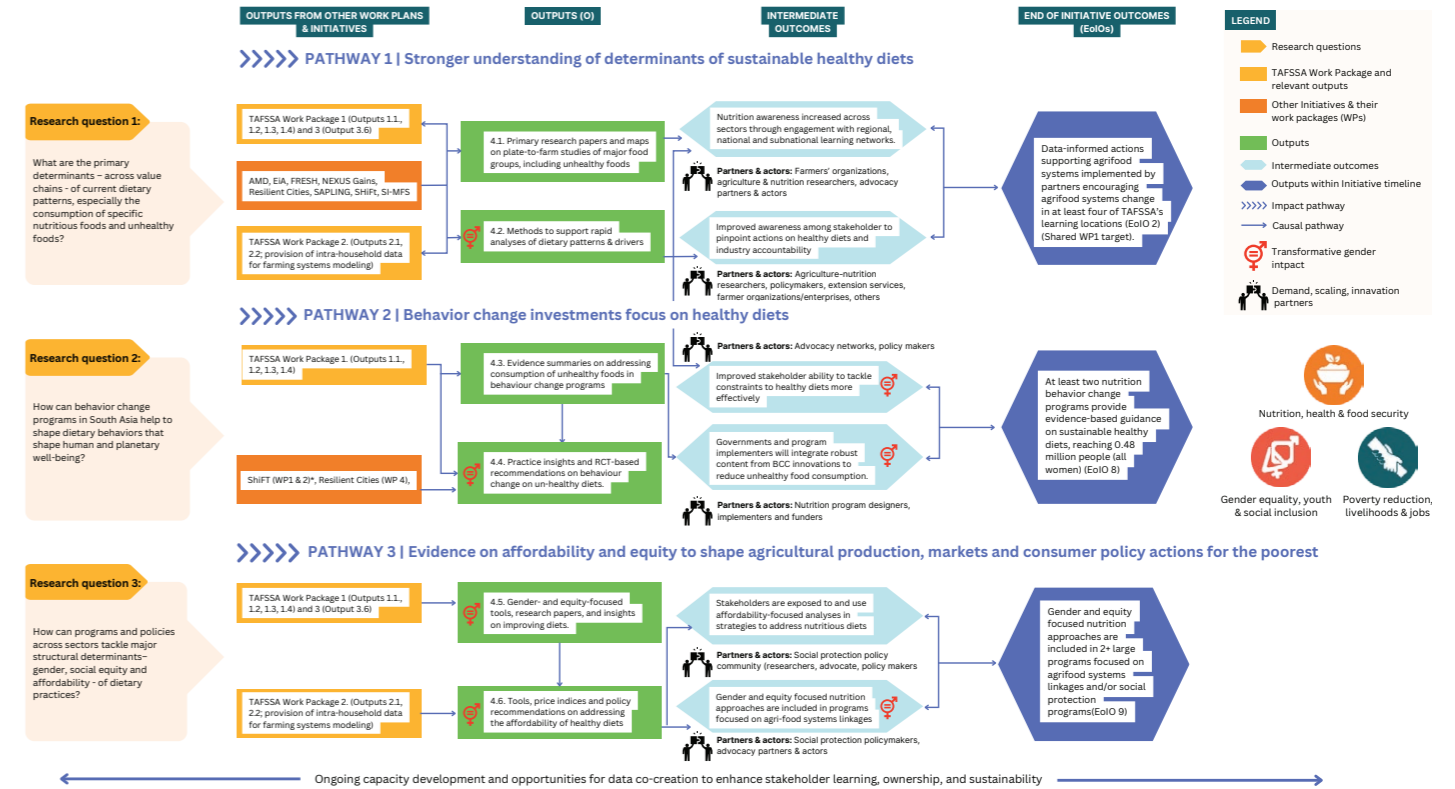
facilitated the sale of 134 tons of PQBR seed, aiding 27,230 farmers in growing PQBR. The Initiative also activated value chain actors and established 50 farmer groups to support the cultivation of non-rice crops.

TAFSSA worked with district governments in Bangladesh and India to create value-stream maps with ARU and carried out surveys of 246 food markets. These efforts generated data to inform policies for more efficient and equitable production-consumption systems. In 2023, TAFSSA initiated a new partnership with the INFUSION project in India and is working toward collaborative outputs. Collaboration with the Resilient Cities Initiative is expanding the use of photovoice methods initiated by TAFSSA to gain insights into how food safety perceptions influence urban consumers' food choices in Bangladesh. Overall, WP3 has been instrumental in gathering crucial information on agricultural markets and food purchasing patterns, establishing a foundation to guide public policy, the private sector, and civil society partners toward more equitable outcomes in South Asia's intricate agrifood market systems.

WP4: Tackling the behavioral and structural determinants of sustainable healthy diets

On track

TAFSSA WORK PACKAGE 4

| OUTPUTS FROM OTHER WORK PLANS & INITIATIVES | OUTPUTS (O) | INTERMEDIATE OUTCOMES | END OF INITIATIVE OUTCOMES (EoIOs) | LEGEND |

>>>>> **PATHWAY 1 | Stronger understanding of determinants of sustainable healthy diets**

Research question 1: What are the primary determinants – across value chains - of current dietary patterns, especially the consumption of specific nutritious foods and unhealthy foods?

TAFSSA Work Package 1 (Outputs 1.1., 1.2, 1.3, 1.4) and 3 (Output 3.6)

AMD, EiA, FRESH, NEXUS Gains, Resilient Cities, SAPLING, SHiFt, SI-MFS

TAFSSA Work Package 2. (Outputs 2.1, 2.2; provision of intra-household data for farming systems modeling)

4.1. Primary research papers and maps on plate-to-farm studies of major food groups, including unhealthy foods

4.2. Methods to support rapid analyses of dietary patterns & drivers

Nutrition awareness increased across sectors through engagement with regional, national and subnational learning networks.

Partners & actors: Farmers' organizations, agriculture & nutrition researchers, advocacy partners & actors

Improved awareness among stakeholder on healthy diets and industry accountability

Partners & actors: Agriculture-nutrition researchers, policymakers, extension services, farmer organizations/enterprises, others

Data-informed actions supporting agrifood systems implemented by partners encouraging agrifood systems change in at least four of TAFSSA's learning locations (EoIO 2) (Shared WP1 target).

>>>>> **PATHWAY 2 | Behavior change investments focus on healthy diets**

Research question 2: How can behavior change programs in South Asia help to shape dietary behaviors that shape human and planetary well-being?

TAFSSA Work Package 1. (Outputs 1.1., 1.2, 1.3, 1.4)

ShiFT (WP1 & ZI*, Resilient Cities (WP 4),

4.3. Evidence summaries on addressing consumption of unhealthy foods in behaviour change programs

4.4. Practice insights and RCT-based recommendations on behaviour change on un-healthy diets.

Partners & actors: Advocacy networks, policy makers

Improved stakeholder ability to tackle constraints to healthy diets more effectively

Governments and program implementers will integrate robust content from BCC innovations to reduce unhealthy food consumption.

Partners & actors: Nutrition program designers, implementers and funders

At least two nutrition behaviour change programs provide evidence-based guidance on sustainable healthy diets, reaching 0.48 million people (all women) (EoIO 8)

>>>>> **PATHWAY 3 | Evidence on affordability and equity to shape agricultural production, markets and consumer policy actions for the poorest**

Research question 3: How can programs and policies across sectors tackle major structural determinants– gender, social equity and affordability - of dietary practices?

TAFSSA Work Package 1 (Outputs 1.1., 1.2, 1.3, 1.4) and 3 (Output 3.6)

TAFSSA Work Package 2. (Outputs 2.1, 2.2; provision of intra-household data for farming systems modeling)

4.5. Gender- and equity-focused tools, research papers, and insights on improving diets.

4.6. Tools, price indices and policy recommendations on addressing the affordability of healthy diets

Stakeholders are exposed to and use affordability-focused analyses in strategies to address nutritious diets

Partners & actors: Social protection policy community (researchers, advocate, policy makers

Gender and equity focused nutrition approaches are included in programs focused on agri-food systems linkages

Partners & actors: Social protection policymakers, advocacy partners & actors

Gender and equity focused nutrition approaches are included in 2+ large programs focused on agri-food systems linkages and/or social protection programs(EoIO 9)

Legend: Research questions; TAFSSA Work Package and relevant outputs; Other Initiatives & their work packages (WPs); Outputs; Intermediate outcomes; Outputs within Initiative timeline; Impact pathway; Causal pathway; Transformative gender impact; Demand, scaling, innovation partners; Nutrition, health & food security; Gender equality, youth & social inclusion; Poverty reduction, livelihoods & jobs

Ongoing capacity development and opportunities for data co-creation to enhance stakeholder learning, ownership, and sustainability

Work Package 4 progress against the theory of change

In its first impact pathway, WP4 improved understanding of the linkages between diets, food environments, markets, and production through a set of novel "plate-to-farm" data notes generated from WP1's integrated food systems survey. Continuing engagement with the global Intake program, leaders of the Drivers of Food Choice program, and South Asian partners have contributed to this understanding of dietary challenges across five districts in Bangladesh, India, and Nepal.

Together with coauthors from ICCDR,B Bangladesh, NIN (India), AKU (Pakistan), and USAID-supported Suaahara/Helen Keller International (Nepal), TAFSSA completed a global BCC programs focusing on consumption of unhealthy foods affecting human and planetary wellbeing. The review identified major knowledge gaps and limitations, indicating only a few studies, policies, and program actions documented addressing unhealthy foods. This evidence base and documentation of data gaps paves the way to inform policies
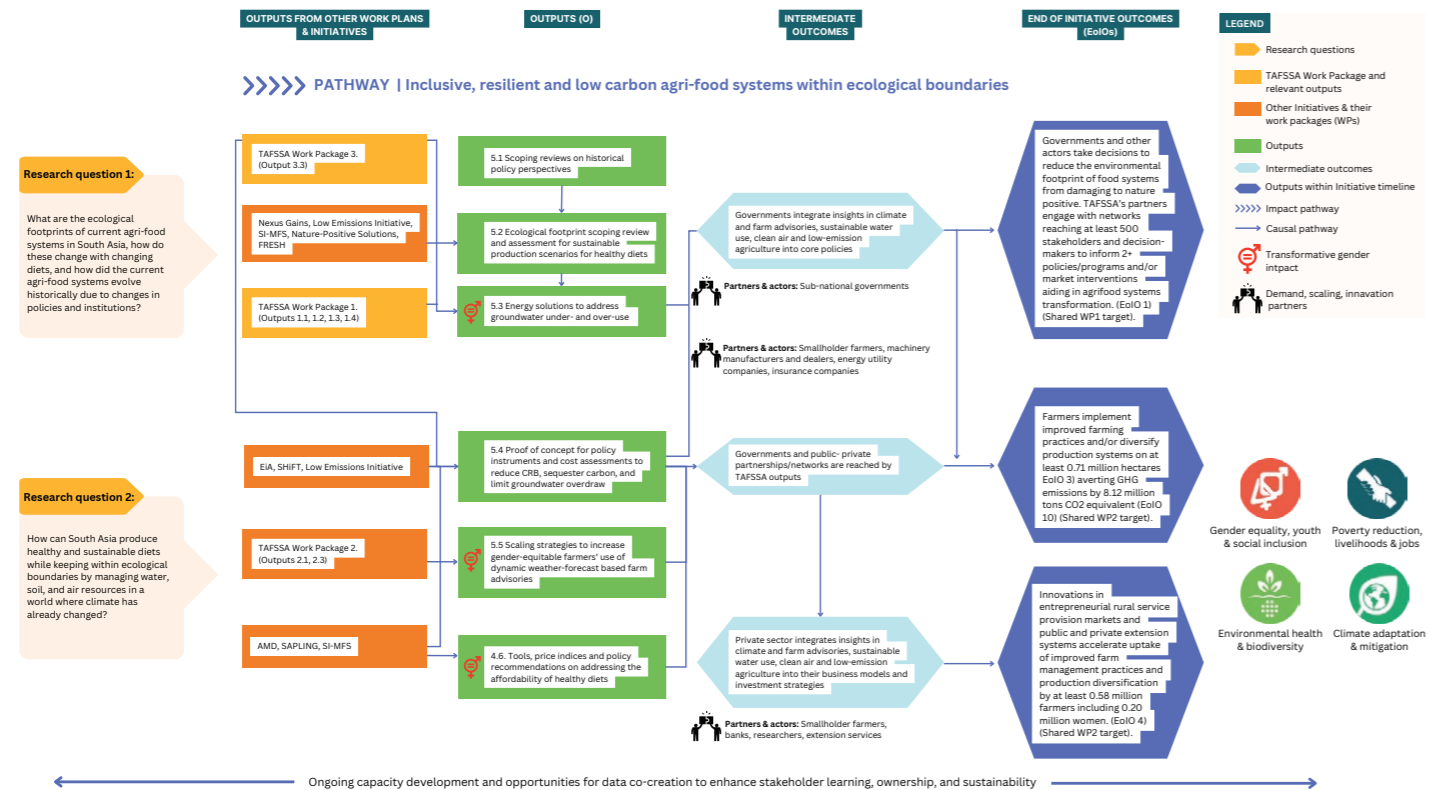
and programs, with TAFSSA's partners, as part of WP4's second impact pathway on behavioral change investments.

In WP4's final impact pathway, the focus is on supporting efforts to address structural gender, social equity, and affordability constraints to accessing nutritious diets. TAFSSA has brought new empirical evidence around a conceptual framework elucidating the social equity dimensions of intra-household food consumption decisions. Insights from surveys in Bangladesh, India, and Nepal on intra-household division of food systems tasks highlight the dominant gender, age, and power dynamics, this time from farm to plate. Aligned with TAFSSA, new findings from the ANGeL impact evaluation highlight that programs targeting men and women together can reshape gendered norms in food systems. These insights have informed TAFSSA's WP2 in the design of participatory action research assessing innovation bundles to support scaling of crop diversification by systematically including husbands and wives together in all research and extension efforts.

TAFSSA WORK PACKAGE 5

| OUTPUTS FROM OTHER WORK PLANS & INITIATIVES | OUTPUTS (O) | INTERMEDIATE OUTCOMES | END OF INITIATIVE OUTCOMES (EoIOs) | LEGEND |

>>>>> **PATHWAY | Inclusive, resilient and low carbon agri-food systems within ecological boundaries**

Research question 1:
What are the ecological footprints of current agri-food systems in South Asia, how do these change with changing diets, and how did the current agri-food systems evolve historically due to changes in policies and institutions?

Research question 2:
How can South Asia produce healthy and sustainable diets while keeping within ecological boundaries by managing water, soil, and air resources in a world where climate has already changed?

TAFSSA Work Package 3. (Output 3.3)

Nexus Gains, Low Emissions Initiative, SI-MFS, Nature-Positive Solutions, FRESH

TAFSSA Work Package 1. (Outputs 1.1, 1.2, 1.3, 1.4)

EIA, SHIFT, Low Emissions Initiative

TAFSSA Work Package 2. (Outputs 2.1, 2.3)

AMD, SAPLING, SI-MFS

5.1 Scoping reviews on historical policy perspectives

5.2 Ecological footprint scoping review and assessment for sustainable production scenarios for healthy diets

5.3 Energy solutions to address groundwater under- and over-use

5.4 Proof of concept for policy instruments and cost assessments to reduce CRB, sequester carbon, and limit groundwater overdraw

5.5 Scaling strategies to increase gender-equitable farmers' use of dynamic weather-forecast based farm advisories

4.6. Tools, price indices and policy recommendations on addressing the affordability of healthy diets

Governments integrate insights in climate and farm advisories, sustainable water use, clean air and low-emission agriculture into core policies

Partners & actors: Sub-national governments

Partners & actors: Smallholder farmers, machinery manufacturers and dealers, energy utility companies, insurance companies

Governments and public-private partnerships/networks are reached by TAFSSA outputs

Private sector integrates insights in climate and farm advisories, sustainable water use, clean air and low-emission agriculture into their business models and investment strategies

Partners & actors: Smallholder farmers, banks, researchers, extension services

Governments and other actors take decisions to reduce the environmental footprint of food systems from damaging to nature positive. TAFSSA's partners engage with networks reaching at least 500 stakeholders and decision-makers to inform 2+ policies/program and/or market interventions aiding in agrifood systems transformation. (EoIO 1) (Shared WP1 target).

Farmers implement improved farming practices and/or diversify production systems on at least 0.71 million hectares (EoIO 3) averting GHG emissions by 8.12 million tons CO2 equivalent (EoIO 10) (Shared WP2 target).

Innovations in entrepreneurial rural service provision markets and public and private extension systems accelerate uptake of improved farm management practices and production diversification by at least 0.58 million farmers including 0.20 million women. (EoIO 4) (Shared WP2 target).

LEGEND
- Research questions
- TAFSSA Work Package and relevant outputs
- Other Initiatives & their work packages (WPs)
- Outputs
- Intermediate outcomes
- Outputs within Initiative timeline
- Impact pathway
- Causal pathway
- Transformative gender impact
- Demand, scaling, innovation partners

Gender equality, youth & social inclusion
Poverty reduction, livelihoods & jobs
Environmental health & biodiversity
Climate adaptation & mitigation

Ongoing capacity development and opportunities for data co-creation to enhance stakeholder learning, ownership, and sustainability

Work Package 5 progress against the theory of change

WP5's main impact pathway focuses on producing evidence to support decisions that lead to socially inclusive, climate-resilient, and low-carbon agrifood systems. Research in 2023 detailed the historical evolution and environmental consequences of agrifood systems development in Bangladesh, Haryana (India), and Pakistan. TAFSSA widely disseminated findings and encouraged policy action through three webinars (Nepal, Odisha in India, Pakistan). WP5 investigated policies affecting groundwater over- and under-use, with the SoLAR project engaging 189 stakeholders representing more than 70 institutions across 16 countries to support socially equitable investments in groundwater management. A research brief also highlights the challenges associated with groundwater irrigation in Nepal and outlines potential opportunities for future policy pathways.

Based on TAFSSA's integrated agrifood systems surveys, district-level briefs were developed capturing the experience of and responses to climate shocks and household-level adaptive capacity in Bangladesh (Rajshahi and Rangpur districts), and Nepal (Banke and Surkhet districts). WP5 initiated a proof of concept for farming carbon credits through case studies in India, and editorial engagements highlighting policy relevance. Through a comprehensive literature review supplemented with primary data collection, WP5 is also synthesizing

the scale, drivers, and environmental and economic implications of crop residue burning in India to assist in air pollution abatement. A database for quantification of the environmental footprint of major food production systems in Bangladesh and India will be completed in 2024 to identify cost-effective GHG, water, and energy use reduction options in both countries.

As part of WP5's impact pathway, TAFSSA worked to scale out farmers' access to climate forecasts and services in 2023. Partnering with Asian Mega-Deltas and CSISA in coastal Bangladesh, 10,472 farmers gained access to real-time interactive voice advisories to reduce production risks for mung bean. WP5 also partnered with GJUS to test innovation bundling of the Agvisely climate services system, which is driven by a systematic literature review to quantify crop thermal stress thresholds, with microfinance and women-led farmer-to-farmer extension. Further collaboration with the Asian Mega-Deltas and Aquatic Foods Initiatives quantified climate-induced economic losses in Bangladeshi aquaculture. Additional collaboration with Asian Mega-Deltas estimated loss and damage risks across chili, dairy, mung bean, rice, and watermelon value chains in Bangladesh and identified climate services–based adaptation options. TAFSSA also supported Excellence in Agronomy in to pilot the PAiCE tool in India and Bangladesh.

Vigorously managing her goats, a farmer in Surkhet, Nepal tends to her livestock. Credit: Abdul Momin

Work Package progress rating summary

WORK PACKAGE	PROGRESS RATING & RATIONALE
1	🟢 **Progress rating** Progress made in 2023 largely matches the outlined Plan of Results and Budget, as well as the WP's TOC. However, funding limitations have restricted the deployment of agrifood systems assessments to fewer districts. Integrated agrifood systems assessments were not carried out in northwestern India or Pakistan due to financial constraints.
2	🟢 **Progress rating** 2023 progress for TAFSSA largely stayed on track with the PORB and the WP's TOC. Reduced funding allocation continued to pose challenges for WP progress: The number of TAFSSA's living laboratories remained curtailed, as in 2022, affecting the Initiative's ability to meet its original plans. Research on diversified alternatives to rice-fallow cropping sequences could not be initiated in Bangladesh or India, and interactions in Pakistan remained minimal. Contingent on future funding levels being restored to the amounts requested in TAFSSA's investment proposal, work toward these outcomes can be resumed. TAFSSA strategically adjusted to these challenges by aligning with bilateral projects that have similar impact pathways to generate significant outcomes from research, despite funding shortfalls.
3	🟢 **Progress rating** TAFSSA research is on track and responding to challenges identified in 2022's progress rating. Price transmissions were completed by TAFSSA to enhance WP congruence. At the same time, due to inadequate funding, WP3's commitment to engage with five local governments will be reduced to three. Persistent funding shortfalls will prevent the implementation of research on postharvest food waste in value chains within TAFSSA. Contingent on future funding levels being restored to the amounts requested in TAFSSA's investment proposal, work toward these outcomes can be resumed.
4	🟢 **Progress rating** Work is on track but significant funding shortfalls to the Initiative and this WP made changes to the TOC necessary, with two outcomes removed (outcome 4.4: Governments and program implementers will integrate robust content from BCC innovations to reduce unhealthy food consumption, and outcome 4.6: Gender- and equity-focused nutrition approaches are included in programs focused on agrifood systems linkages) Contingent on future funding levels being restored to the amounts requested in TAFSSA's investment proposal, work toward these outcomes can resume.
5	🟢 **Progress rating** 2023 progress largely aligns with the PORB, with WP-level TOC assumptions largely holding. Slight changes were made to the detailed outputs planned due to a change in WP leadership, minorly delaying only one output. All other outputs remain on track.

Definitions

🟢 **On track**

☑ Annual progress largely aligns with Plan of Results and Budget and Work Package theory of change.

☑ Can include small deviations/issues/delays/risks that do not jeopardize success of Work Package.

🟡 **Delayed**

⚠ Annual progress slightly falls behind Plan of Results and Budget and Work Package theory of change in key areas.

⚠ Deviations/issues/delays/risks could jeopardize success of Work Package if not managed appropriately.

🔴 **Off track**

❌ Annual progress clearly falls behind Plan of Results and Budget and Work Package theory of change in most/all areas.

❌ Deviations/issues/delays/risks do jeopardize success of Work Package.

Two farmers in Dinajpur meticulously ready rice seedlings for transplanting. Credit: Abdul Momin

Section 4: **Key results**

This section provides an overview of results reported by the CGIAR Research Initiative on Transforming Agrifood Systems in South Asia in 2023. These results align with the CGIAR Results Framework and Transforming Agrifood Systems in South Asia's theory of change. Source: *Data extracted from the* CGIAR Results Dashboard *on 29 March 2024*.
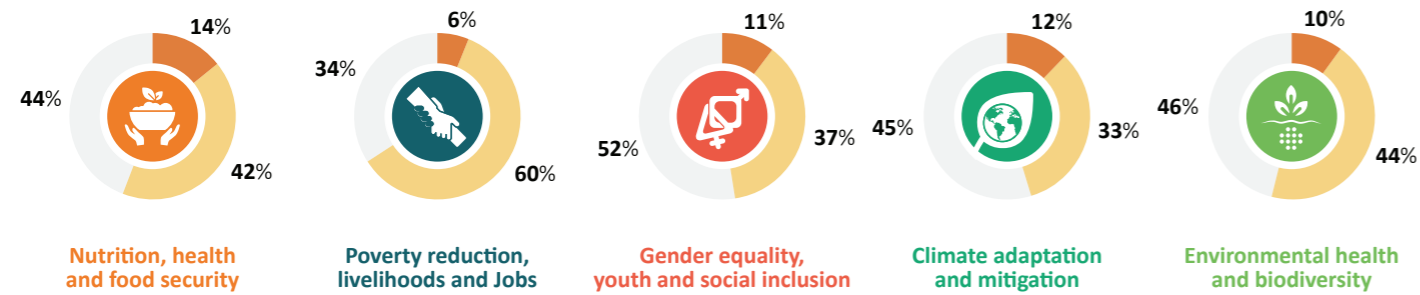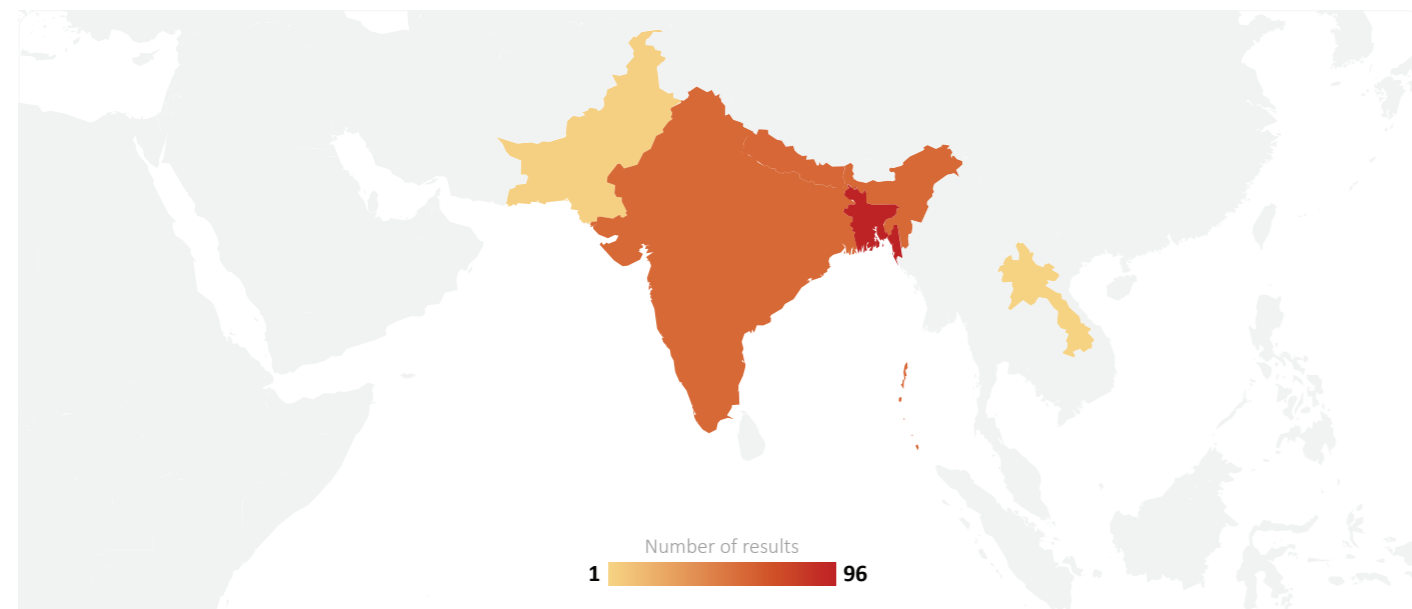
OVERVIEW OF REPORTED RESULTS

Outputs

Knowledge product	133
Innovation development	31
Capacity sharing for development	27
Other output	25

Outcomes

Innovation use	13
Other outcomes	3

PERCENTAGE OF REPORTED RESULTS TAGGED TO CGIAR IMPACT AREAS

Nutrition, health and food security — 44%, 14%, 42%

Poverty reduction, livelihoods and Jobs — 34%, 6%, 60%

Gender equality, youth and social inclusion — 52%, 11%, 37%

Climate adaptation and mitigation — 45%, 12%, 33%

Environmental health and biodiversity — 46%, 10%, 44%

- **Principal:** The result is principally about meeting any of the Impact Area objectives, and this is fundamental in its design and expected results. The result would not have been undertaken without this objective.
- **Significant:** The result has made a significant contribution to any of the Impact Area objectives, even though the objective(s) is not the principal focus of the result.
- **Not targeted:** The result did not target any of the Impact Area objectives.

NUMBER OF RESULTS BY COUNTRY

Data here represents an overview of reported results in 2022 and 2023. One result can impact multiple countries and can therefore be represented multiple times.

Number of results: 1 — 96

CONTRIBUTIONS TO THE UN SUSTAINABLE DEVELOPMENT GOALS

- 1 NO POVERTY: 205
- 2 ZERO HUNGER: 224
- 3 GOOD HEALTH AND WELL-BEING: 198
- 4 QUALITY EDUCATION: 200
- 5 GENDER EQUALITY: 197
- 6 CLEAN WATER AND SANITATION: 201
- 7 AFFORDABLE AND CLEAN ENERGY: 6
- 8 DECENT WORK AND ECONOMIC GROWTH: 11
- 10 REDUCED INEQUALITIES: 187
- 12 RESPONSIBLE CONSUMPTION AND PRODUCTION: 24
- 13 CLIMATE ACTION: 224
- 14 LIFE BELOW WATER: 3
- 15 LIFE ON LAND: 10
- 16 PEACE, JUSTICE AND STRONG INSTITUTIONS: 3
- 17 PARTNERSHIPS FOR THE GOALS: 5

NUMBER OF KNOWLEDGE PRODUCTS BY TYPE (TREND OVERVIEW, 2022-2023)

Data here represents an overview of reported results in 2022 and 2023. One result can impact multiple countries and can therefore be represented multiple times.

2022: 50, 13, 4, 3, 3, 2, 2, 1, 1, 1, 1
2023: 32, 24, 24, 17, 9, 8, 6, 5, 3, 2, 2

Legend: Data Paper, Report, Brochure, Journal Article, Video, Brief, Working Paper, Infographic, News Letter, Book Chapter, Blog Post, Manual, Conference Paper, Presentation, News Item
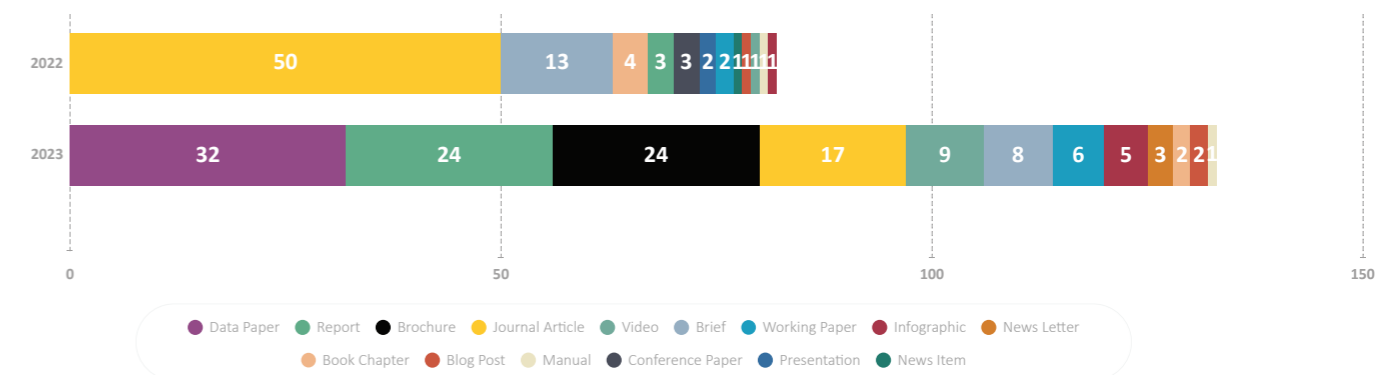
Number of individuals trained by the Initiative (trend overview, 2022-2023)

2022
- Female: 901
- Male: 1,623
- 2,524

2023
- 1
- Female: 1,507
- Male: 2,076
- 3,583

● Long-term ● Short-term
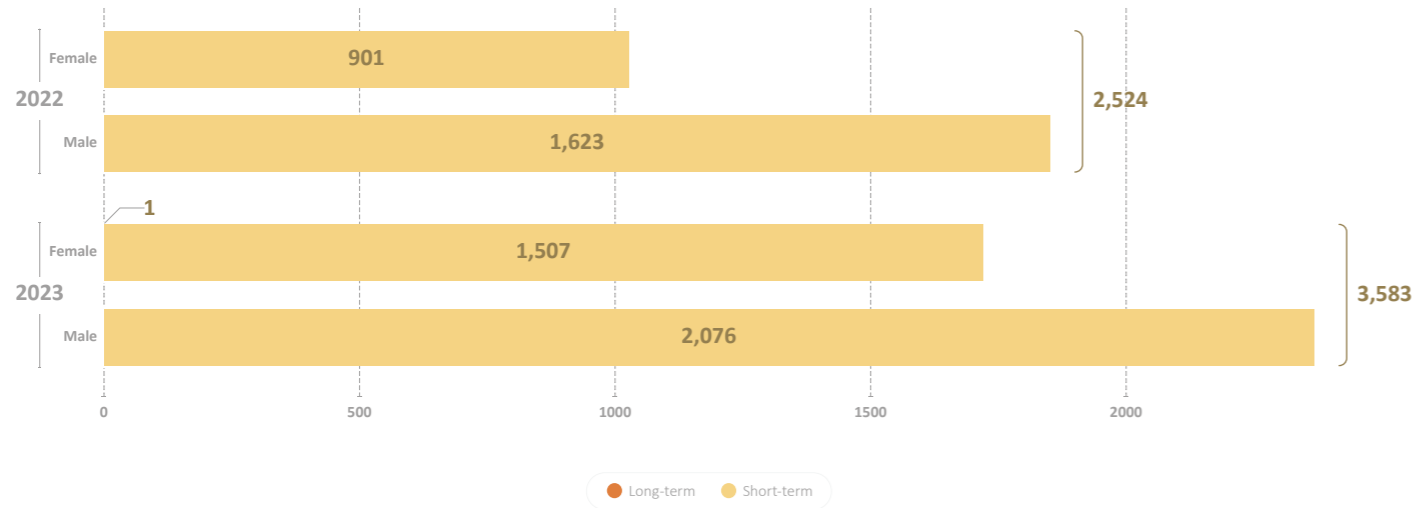
Number of innovations by readiness level

Pipeline overview
# of innovations

Level		#
9	**PROVEN INNOVATION** The innovation is validated for its ability to achieve a specific impact under uncontrolled conditions	11
8	**UNCONTROLLED TESTING** The innovation is being tested for its ability to achieve a specific impact under uncontrolled conditions	3
7	**PROTOTYPE** The innovation is validated for its ability to achieve a specific impact under semi-controlled conditions	5
6	**SEMI-CONTROLLED TESTING** The innovation is being tested for its ability to achieve a specific impact under semi-controlled conditions	0
5	**MODEL/EARLY PROTOTYPE** The innovation is validated for its ability to achieve a specific impact under fully-controlled conditions	1
4	**CONTROLLED TESTING** The innovation is being tested for its ability to achieve a specific impact under fully-controlled conditions	6
3	**PROOF OF CONCEPT** The innovation's key concepts have been validated for their ability to achieve a specific impact	3
2	**FORMULATION** The innovation's key concepts are being formulated or designed	1
1	**BASIC RESEARCH** The innovation's basic principles are being researched for their ability to achieve a specific impact	1
0	**IDEA** The innovation is at idea stage	0

A farmer in Nalanda, India digs into the earth, harvesting potatoes with skilled precision.
Credit: Shawn Sebastian

Section 5: **Partnerships**
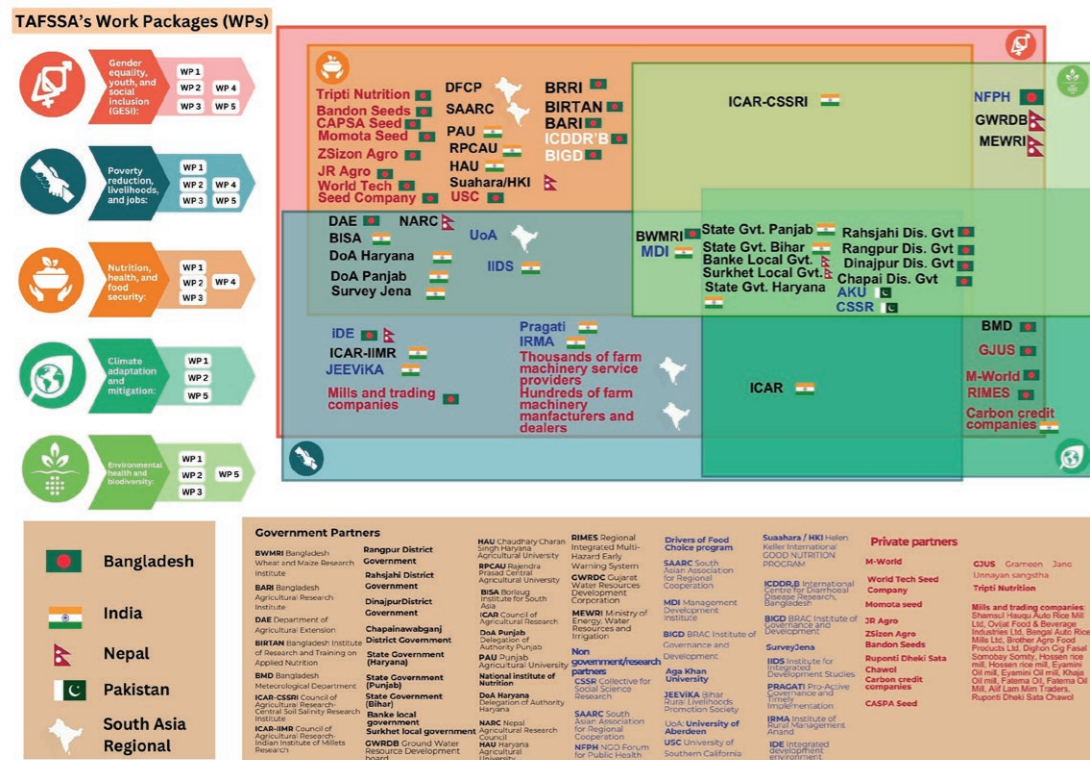
Left: Relationship between CGIAR's action areas with TAFSSA Work Packages. **Right:** Relationship between CGIAR action areas and govt. and non govt. action partners with boxes showing action area overlaps with different partners TAFSSA is currently collaborating with. Flags indicate where that partner works. Interconnecting relationships between CGIAR action areas. Note that the size of the boxes does not necessarily represent the size, scope, or intensity of collaborations or work; rather, the boxes show overlapping areas of collaboration considering the range of partners, CGIAR action areas, and TAFSSA. Abbreviations for partners can be found including small and medium entrepreneurs (SMEs).

Partnerships and Transforming Agrifood Systems in South Asia's impact pathways

TAFSSA engaged 18 demand, 122 innovation, and 49 different scaling partners to generate reported results supporting the Initiative's impact pathways across CGIAR's five Impact Areas in 2023. Hundreds more public and private partners collaborate more broadly with TAFSSA to scale research outputs into outcomes.

Nutrition, health, and food security:

In 2023, TAFSSA collaborated with 36 major public- and seven private-sector organizations across South Asia, including top-notch national nutrition-focused partners in four countries. Partnerships were deepened with district-level governments and large-scale nutrition behavior change programs including Hellen Keller International's programs in Nepal, alongside seven seed companies and postharvest processing operations in Bangladesh. The latter supports PQBR and diversified, nutritious crops. Progress has been made toward institutional adoption of TAFSSA's innovations: the Agrifood Situation Reports in Nepal, initially spearheaded by CSISA and TAFSSA, are now led by the IIDS. Similarly, the Institute of Rural Management, Anand is adopting photovoice methods.

Poverty reduction, livelihoods, and jobs:

Private-sector partnerships represent a crucial impact pathway for TAFSSA. Synergizing efforts with bilateral projects like CSISA and collaboration with the NGO iDE engaged hundreds of farm machinery manufacturers AND dealers, and service providers in Bangladesh and Nepal supported out-scaling. Twelve new food-processing companies helped to link farmers to markets for diversified crops in Bangladesh. Research was supported by the Bangladesh Agricultural Research Council and ICAR line agencies and NARC in Bangladesh, India, and Nepal, respectively, while the Collective for Social Science Research in Pakistan helped study agrifood systems evolution.

Gender equality, youth, and social inclusion (GESI):

TAFSSA actively involves all partners in addressing GESI. Its innovation collaborators focus on social inclusivity by generating data and evidence. Actions are also tailored toward empowering women employees in small- and medium-scale enterprises and enhancing access to farm machinery services for marginalized groups in Nepal. In India, new collaborations with JEEViKA in Bihar are enabling marginalized women through women-focused self-help groups, while in Odisha, Pragati is spearheading SFLF models in potato with emphasis on women's empowerment. Collaboration with Michigan State University demonstrated how to harness machine-supported decision-making for gender-equitable agricultural planning, boosting women's participation in agricultural trainings by more than 82 percent.

Climate adaptation and mitigation:

TAFSSA's 2023 climate services and carbon markets research and scaling in Bangladesh and India included 13 public partners and two private companies. Innovative new research on climate services innovation bundling to assess scalability and women's empowerment was piloted with GJUS, a private voluntary organization working in coastal Bangladesh. Business models expanding farmers' access to early warning systems to avert crop loss and damage to mung bean in the coastal region were co-designed with the Bangladeshi company M-World.

Environmental health and biodiversity:

Nineteen public partners across South Asia collaborated in TAFSSA's research in this Impact Area. A workshop with 189 stakeholders representing more than 70 institutions across 16 countries was convened by TAFSSA and the SoLAR project. Continued collaboration with Nepal's Ministry of Energy, Water Resources and Irrigation and USAID supported research on groundwater management, conjunctive water use, and data-driven water resources management for sustainable irrigation development in Nepal. Research with ICAR supported work on the environmental sustainability, productivity, profitability, and nutritional diversity of cropping systems in India.

Section 6: **CGIAR Portfolio linkages**
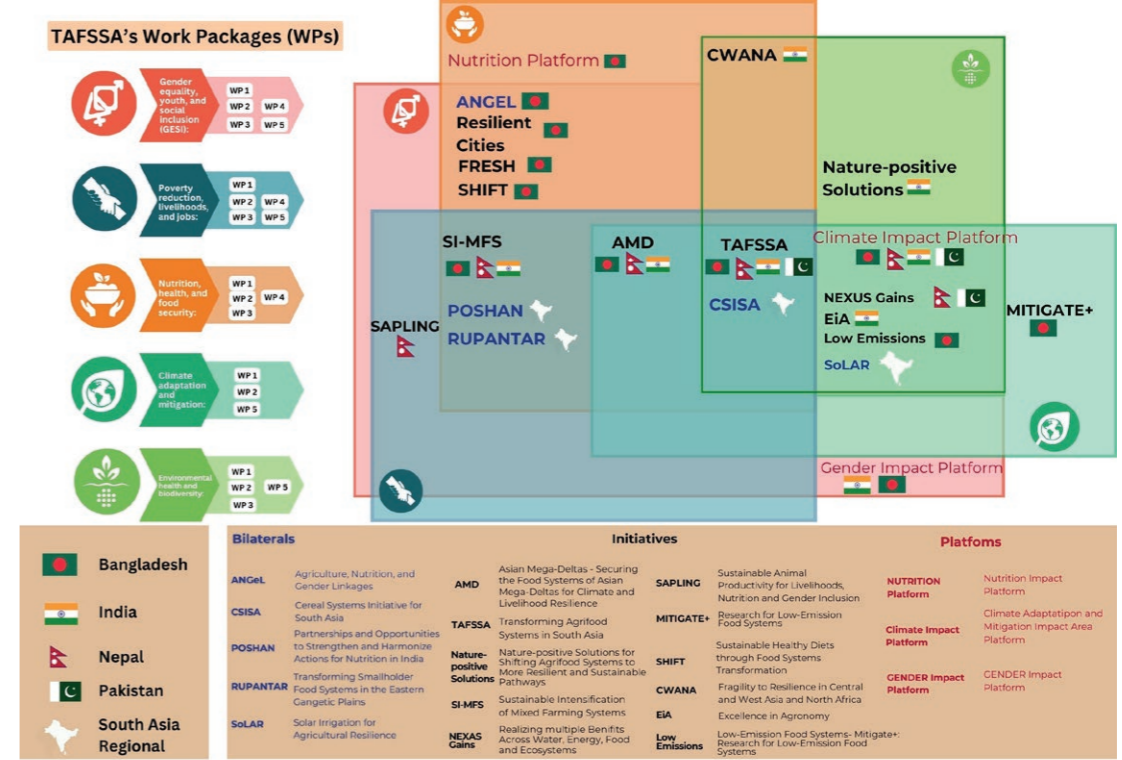
Left: Relationship between CGIAR's action areas with TAFSSA Work Packages. **Right:** Relationships between CGIAR action areas and initiatives with boxes showing action area overlaps with the different Initiatives TAFSSA is currently collaborating with. The flags indicate the countries where these initiatives or projects work. Note that box size does not necessarily indicate size, scope, or intensity of work; rather, boxes show overlapping areas of collaboration considering CGIAR Impact Areas and Countries. Font color black indicates initiatives, blue indicates bilateral projects and red indicates CGIAR platforms. Abbreviations for projects and initiatives are given in the bottom.

Portfolio linkages and Transforming Agrifood Systems in South Asia's impact pathways

Continuing in its convening role, TAFSSA collaborated with 10 CGIAR Research Initiatives, engaged with five bilateral projects aligned with Initiative goals, and partnered with two CGIAR Platforms in 2023. These collaborations generated knowledge products, capacity sharing, and the scaling of innovations across CGIAR's five Impact Areas. Key achievements are outlined below.

Nutrition, health, and food security:

In 2023, TAFSSA continued engagement with a collaborative research network centered around retail food environments, aligning with the Sustainable Healthy Diets, Fruits and Vegetables for Sustainable Healthy Diets, and the Resilient Cities Initiatives. The latter Initiative has also adopted TAFSSA's photovoice methods to understand how food safety perceptions influence poor consumers' food choices. TAFSSA researchers also co-designed nutrition and gender research in Bangladesh with the Asian Mega-Deltas Initiative. TAFSSA spearheaded efforts weaving together these Initiatives, POSHAN, and the global Drivers of Food Choice program. TAFSSA also collaborates deeply with the Agriculture, Nutrition, and Health Academy to strengthen knowledge platforms for nutrition and food security in the region.

Poverty reduction, livelihoods, and jobs:

TAFSSA actively engaged with the Mixed Farming Systems Initiative in Bangladesh and Nepal in 2023, investigating fodder production optimization to support farm diversification with livestock and to generate a series of farm typology analyses. Collaboration with Excellence in Agronomy in India supported long-term experiments supported by WP2 with ICAR Karnal and BISA Bihar that generate evidence on the profitability of diverse cropping systems. TAFSSA's alignment with the RUPANTAR project supported policy research on the livelihoods implications of farm diversification.

Gender and social inclusion (GESI): TAFSSA's work on GESI is connected to the CGIAR Gender Platform, particularly enhancing WP1 and WP4's impact pathways to transform local agrifood systems and support large-scale nutrition programs. The Initiative engages all of its partners and WPs in GESI. Collaborations with CSISA facilitate the expansion of business models in Bangladesh and Nepal, broadening access to farm machinery services for women and individuals from marginalized social castes and ethnicities.

Climate adaptation and mitigation:

TAFSSA's collaboration the Asian Mega-Deltas Initiative and CSISA continued the enhancement and expansion climate advisories, while research partnership with the Aquatic Foods Initiative identified options for cost-saving climate services in Bangladesh. In 2023, TAFSSA also supported Excellence in Agronomy to develop and pilot the PAiCE tool in India, while work with Low-Emission Food Systems helped develop an environmental footprint database in Bangladesh and India. Co-funding with the Fragility to Resilience in Central and West Asia and North Africa Initiative supported planning of an international training on conservation agriculture to lower energy use and emissions from farming systems.

Environmental health and biodiversity:

During 2023, continued collaboration with the Nexus Gains Initiative focused on improving ground water management in Bihar. Additionally, both TAFSSA and Low-Emission Food Systems partner with the SoLAR project on the environmental ramifications of groundwater management in South Asia. A new collaboration with the National Policies and Strategies Initiative identified policy constraints and options for improving groundwater management in Nepal. Finally, continued collaboration with the Nature-Positive Solutions Initiative in India supported student research on pollination services.

TAFSSA researcher Dr. Kajodmal Choudhary working with farmer Rajmani in zero- tillage wheat field, Nalanda, Bihar. Credit: Abdul Momin

Section 7: **Adaptive management**

RECOMMENDATION	SUPPORTING RATIONALE
TAFSSA's Pause and Reflect exercise identified the need to create greater awareness among stakeholders, encourage more widespread use of the integrated agrifood survey and situation report approaches, and expand them to new locations.	TAFSSA's district agrifood assessment survey tools and agrifood systems situation reports have generated attention from stakeholders interested in generating data and encouraging use of evidence-based decisions and actions in South Asia and other low- and middle-income countries, particularly through CGIAR's regional integrated Initiatives. Greater engagement with different actors interested in evidence-based action in different agrifood systems domains will lead to greater use of methodological innovations by TAFSSA and generate more impact from this Initiative. Furthermore, streamlining survey modules and assessment designs will enable more frequent surveys and assessments across additional districts, enhancing the adoption of the comprehensive assessment approach and specific survey modules by researchers and stakeholders alike. However, developing streamlined approaches requires securing additional resources to fund new surveys rounds in both existing and new locations, drawing on insights from the initial round conducted in 2022–2023.
Funding limitations necessitate a streamlining of research and engagement in WPs 3, 4, and 5.	Due to funding constraints, WP3 will need to limit the number of local governments with which it engages. Research on food waste across value chains envisioned in the TAFSSA investment proposal will have to be dropped. WP4 must streamline its research and engagement efforts, resulting in the removal of two planned outcomes: (1) the integration of robust content from BCC innovations by governments and program implementers to reduce unhealthy food consumption, and (2) the inclusion of gender- and equity-focused nutrition approaches in agrifood system programs. These goals have become unattainable due to budget shortfalls impacting the resources available for BCC randomized control trials. As a response, TAFSSA is seeking to strengthen partnerships with governments and BCC program implementers to suggest new and relevant research avenues. WP5 will further consolidate research under a single output in its TOC (Improving adaptive capacity to climate change through assessments of household capacities, increased use of dynamic weather-based farm advisories by farmers, adaptation research and extension prioritization, and planning tools by national research institutions through participation, partnership, and scaling strategies). WP5 outcomes 2 and 3 have been reformulated as "insights in climate and farm advisories, sustainable water use, clean air and low-emission agriculture inform core policies of the government, business models, and private-sector investment strategies."

Section 8: **Key result story**

Empowering Bangladesh's mung bean farmers to overcome climate risk–induced loss and damage

A leap forward with real-time interactive voice-response weather advisories.

A farmer in Patuakhali, Bangladesh, explaining to her father how TAFSSA-supported IVR climate services to avert extreme weather–induced loss and damage to mung bean crops can be received at the click of a button on any smartphone. Credit: Foyjul Hasan Babu

Coastal Bangladesh, part of a low-lying deltaic region, is one of the most climate risk–prone regions of the world. Climate change, variability, and extreme weather threaten the agricultural systems supporting the livelihoods of more than 30 million smallholder farmers. Difficult-to-predict extreme weather events can cause extensive crop loss and damage, pushing farmers into a poverty trap. Nevertheless, they strive for resilience, and in Bangladesh's central coast, farmers increasingly grow mung bean after the rice harvest, selling it in emerging markets at favorable prices. However, mung bean is highly vulnerable to heavy rainfall events during harvesting, which can result in waterlogging, rotting of pods, and even complete loss of crop quality and quantity.

In south-central Bangladesh, TAFSSA is bundling climate service advisories with innovations in mobile phone–based interactive voice-response (IVR) services to transform mung bean farming. This service provides free, timely automated weather forecast–based harvesting advisories as voice calls in Bangla, safeguarding mung bean farmers against extreme rainfall events. In climate risk–prone Bangladesh, the service supported 10,472 farmers in 2023 to take action and save their crops from weather-induced loss and damage. The service is inclusive, as it is accessible to farmers with or without smartphones or the ability to read.

TAFSSA's mung bean climate-advisory IVR service provides a beacon of change in Bangladesh's climate risk–prone coastal belt. Through high-resolution weather forecasts and automated advisory voice calls, farmers receive crucial weather updates, enabling them to make informed decisions, protect mung bean from yield losses, and secure livelihoods against extreme climate-induced risks.

As the mainstay of livelihoods for poorer segments of Bangladesh's society, the agricultural sector faces an ongoing battle with weather variability. Mung bean is an increasingly popular and profitable crop in the country's climate-risk coastal zone. Popular varieties are indeterminant, and flower and produce pods multiple times over several weeks. Mung bean is extremely vulnerable to significant yield losses due to untimely heavy rainfall during its maturation phase, when precipitation can result in waterlogging, pod rot, and even complete loss of crops. To respond to this urgent challenge, TAFSSA is catalyzing collaborations with the Bangladesh Meteorological Department (BMD), DAE, Asian Mega-Deltas, CSISA, and M-World to bundle innovations in weather forecasting with an IVR service to advise farmers on how to avoid climate-induced loss and damage.

Integrating high-frequency and hyper-local weather forecasts, this service delivers location-specific rainfall risk alerts and harvesting advisories as voice calls directly to farmers' mobile phones. IVR allows farmers to take timely action by expediting pod picking, which tends to be performed by women, or arranging field drainage. In 2023, the system empowered 10,472 farmers to avert loss and damage. In addition to safeguarding local food security by enhancing the supply of protein-rich mung bean, the IVR service also helps to avoid profit losses for smallholder farmers in the coastal zone.

More than 1 million IVR calls have been sent so far. A typical advisory might state, "Greetings, dear mung bean farmer (sister or brother), and welcome to 'Mungdhal Sheba!' According to the BMD, there is a possibility of light rain in your location tomorrow. Heavy rain is likely to occur the day after tomorrow. After that, very heavy rainfall may occur during one of the next three days. Heavy or excessive rainfall can damage your mung bean crop. If your mung bean field is close to mature or mature, you may want to harvest without delay. If you placed harvested mung bean out in the sun to dry, consider moving it to a dry place as soon as possible." After the prerecorded message, IVR recipients have the option to choose from a menu with additional voice advisories on mung bean agronomy, nutrition, and marketing, all at the push of a button.

This IVR-based climate service has not only mitigated the risk of weather-induced crop damage but also fostered a sense of security and empowerment among farmers in coastal Bangladesh. Once at the mercy of the weather, farmers now find themselves equipped with science-based knowledge to confront challenges head-on.

> The interactive voice response climate service for mung bean has been a game-changer for us. Knowing when the rain will come allows us to plan better and protect our hard work. Before this service, we were farming in the dark, guessing what the sky might bring. Now, we farm with the confidence that comes from being informed and prepared.
>
> Rahima, mung bean farmer, Amtali, Barguna, Bangladesh

Primary Impact Area

Other relevant Impact Area targeted

Geographic scope

Region: South Asia

Country: Bangladesh

Contributing Initiative
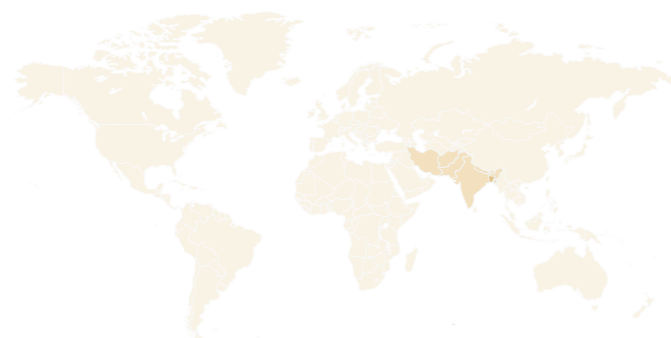
Asian Mega-Deltas

Contributing Center

CIMMYT

Contributing external partners

The Department of Agriculture Extension · The Bangladesh Meteorological Department · M-World

Front cover photo

Gaumaya Oli Khatri collects tomatoes from her fields in Surkhet, Nepal, where TAFSSA is working to improve crop diversification and support farmers growing a range of crops crucial for sustainable healthy diets.
Credit: Abdul Momin

Back cover photo

Krishna Mohan selling his vegetables in local market Dhang, Nepal.
Credit: Abdul Momin