FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

Cereal Systems Initiative for South Asia

Semi-Annual Report

October 2023- March 2024

CSISA

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LIST OF ACRONYMS

A2F	access to finance
AKC	Agriculture Knowledge Center
AMD	Asian Mega Deltas
API	Application Programming Interface
BARI	Bangladesh Agricultural Research Institute
BRRI	Bangladesh Rice Research Institute
CIMMYT	International Maize and Wheat Improvement Center
CSISA	Cereal Systems Initiative for South Asia
CSISA–MEA	CSISA–Mechanization and Extension Activity
DAE	Department of Agricultural Extension
DSR	direct-seeded rice
FAW	Fall Armyworm
FtF	Feed the Future
GWRDB	Groundwater Resources Development Board
HRS	healthy rice seedlings
HSD	Honestly significant difference (test)
iDE	International Development Enterprises
IFPRI	International Food Policy Research Institute
IIDS	Institute for Integrated Development Studies
IGP	Indo-Gangetic Plains
IRRI	International Rice Research Institute
IVR	interactive voice response
IWM	integrated weed management
IWMI	International Water Management Institute
MoALD	Ministry of Agriculture and Livestock Development
MoLMAC	Ministry of Land Management, Agriculture and Cooperative
NARC	Nepal Agricultural Research Council
ODK	Open Data Kit
NPR	Nepali rupee
NSAF	Nepal Seed and Fertilizer project
PMAMP	Prime Minister Agriculture Modernization Project
SAAO	Sub-Assistant Agricultural Officer

SIMFS	Sustainable Intensification of Mixed Farming Systems
SP	Service provider
SAWTEE	South Asia Watch on Trade, Economics and Environment
TAFSSA	Transforming Agrifood Systems in South Asia
USAID	United States Agency for International Development
ZoI	Zone of Influence

EXECUTIVE SUMMARY

With the support of the United States Agency for International Development (USAID) and the Bill and Melinda Gates Foundation, the Cereal Systems Initiative for South Asia (CSISA) was established in 2009 with the goal of increasing the productivity and resilience of millions of farmers by the end of 2020. CSISA is led by the International Maize and Wheat Improvement Center (CIMMYT) and is implemented jointly with the International Food Policy Research Institute (IFPRI), the International Water Management Institute (IWMI) and the International Rice Research Institute (IRRI), in addition to numerous public and private sector partners. CSISA is about bridging the divide between research and impact. In rural Bangladesh, India and Nepal, CSISA works to increase the adoption of resource-conserving and climate-resilient agricultural technologies, and to improve farmers' access to market information and enterprise development

supports women farmers by improving their access and exposure to modern and improved technological innovations, knowledge and entrepreneurial skills collaborates with numerous strategic public, civil society and private-sector partners, aligning them in synergy with regional and national efforts.

USAID supports CSISA's activities in Nepal and Bangladesh, while Bill and Melinda Gates Foundation supports work ongoing in India. These efforts are made possible through the cooperation of a multidisciplinary team including agronomists, systems analysts, data scientists, behavioral economists, livestock specialists, agricultural engineers, sociologists, and pest and natural resources management experts, among others. Over time, CSISA has developed into a more comprehensive applied research-for-development program, with many additional and synergistic investments by USAID/Washington, the USAID Missions in Nepal and Bangladesh, and the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), in addition to Michigan State University's Borlaug Higher Education for Agricultural Research and Development (BHEARD) program, to deepen the scope and impact of CSISA's work. As such, CSISA has evolved well beyond its origins as a primarily agronomic research initiative to embrace interdisciplinarity as a prerequisite for understanding and efficiently responding to the challenges faced in South Asia's cereal-based farming systems.

This report focuses on the current third phase (2015–2021, CSISA III) of the 'base' or 'original' set of CSISA investments.[2] This phase focuses on USAID's support to activities in Nepal and Bangladesh, where CSISA supports partners in the public and private sectors to better contribute to sustained change by addressing systemic weaknesses. By addressing these areas and fostering new connections and collaborative efforts across the innovation system, CSISA is seeking to mainstream elements of its approach and ensuring a successful exit of some aspects of programming, although the Activity is in discussion with USAID about an anticipated extension into 2022.

[2] CSISA III is primarily referred to as 'the Activity' throughout this report.

I. Bangladesh – Achievements

A. INNOVATION TOWARDS IMPACT

A1. Reducing risk to facilitate uptake of sustainable intensification practices

A1.1 Direct-seeded rice (DSR) to address labor and energy constraints to precision rice establishment

During this close-down period, CSISA focused on hand-over processes for directly sown rice research activities with National partners. The Bangladesh Rice Research Institute (BRRI) also evaluated DSR performance under late winter season *boro* conditions and spring *aus*, and summer *aman* rice growing seasons throughout 2023. BRRI conducted DSR trials and demonstrations in different locations in Bangladesh, including Rangpur, Nilphamri, Rajshahi, and Hilly areas. BRRI is currently working with IRRI under the USAID and Bayer funded project ScaleDirect and one with CIMMYT and IRRI in the Sustainable Intensification of Mixed Farming Systems (SI-MFS) initiative, testing DSR in different locations under both actives. CSISA's established team of scientists has provided technical support to BRRI to establish these activities.

***Above**: During the DSR workshop on August 2023, breakout session team leaders presented to the group their discussions and findings on DSR adoption in Bangladesh (e.g., management options, research gaps, and scaling strategies of DSR in Bangladesh). Photo credit: Sharif Ahmed*

As part of the exit plan for the USAID/Washington funded portion of the project, CSISA organized a national-level workshop on August 29th, 2023, inviting stakeholders from research systems, universities, extension systems, private sectors, and policymakers. The objective of the workshop was to establish a common platform for DSR research in Bangladesh and present the CSISA-BRRI collaborative DSR research findings. Participants shared their experiences on DSR activities and showed keen interest in the common platform for further strengthening of DSR research and development in Bangladesh. With the leadership of BRRI scientists, engaging NARS, universities, international organizations, policymakers, and the private sector, participants agreed that a common platform would be established. This is now being followed up through the initiatives indicated above.

A2. Adding value to extension and agricultural advisory systems

A.2.1 Strengthening the foundations of agro-advisory through knowledge organization and data integration

Building farmers' resilience using actionable climate services: national partnerships result in large-scale use of the Agvisely decision support tool

Agvisely is an advanced agrometeorological service tool that empowers the Department of Agricultural Extension's (DAE) frontline officers, focusing mainly on the Sub-Assistant Agriculture Officers (SAAOs). Its primary goal is to provide a comprehensive climate information service nationwide, aimed at enhancing agricultural resilience against climate-related challenges in Bangladesh. Agvisely offers personalized, location-specific advice and guidance on ten major crops, including three seasons for rice (*aus, aman, boro*), and winter crops such as maize, wheat, potato, lentil, mung bean, and mustard, along with pre-monsoon maize. It provides crop phenological stage-wise, location-specific forecast-based agrometeorological advisory services for these crops with a 5-day lead period across all 492 sub-districts of Bangladesh. To date, Agvisely has successfully onboarded and supported over 8,500 Sub-Assistant Agriculture Officers (SAAOs) from DAE. A survey conducted by CSISA's monitoring and evaluation team previously revealed that 607,541 farmers implemented guidance provided by Agvisely on a seasonal basis, with advice applied by farmers following distribution through DAE via the application.

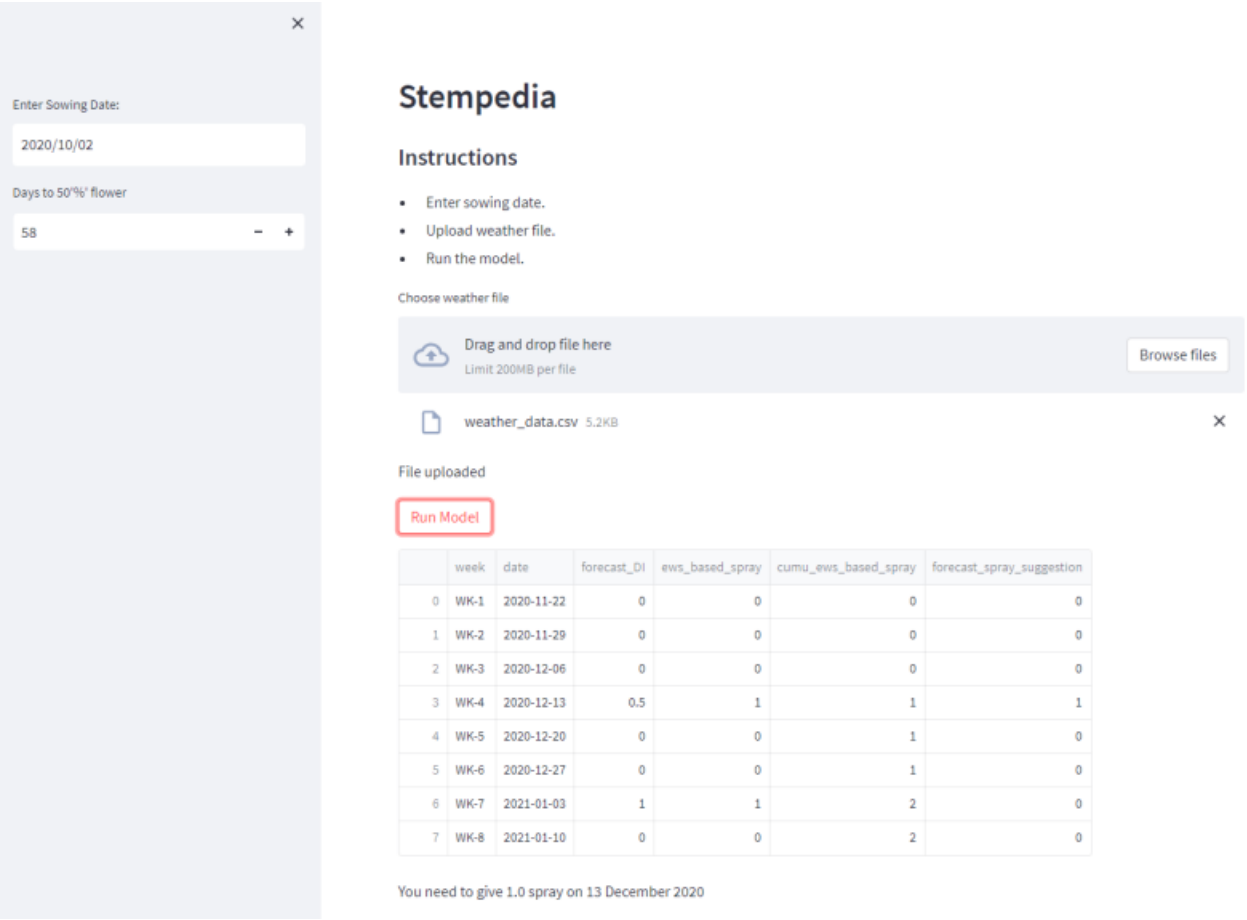
In the reporting period, Agvisely has broadened its focus to include climate advisories for livestock and poultry, recognizing the extensive requirements of the agricultural sector. Agvisely is also being upgraded to include the integration of Good Agricultural Practices (GAP) through integration of the advisory system in the Transforming Agrifood Systems in South Asia (TAFSSA) and Asian Mega Delta (AMD) Initiatives of the CGIAR. Lastly, Collaborating with microfinance institutions, social experiments were established by CSISA's research scientists in Bangladesh to assess women farmers' profits, willingness to pay, and the financial institutions' perspectives on co-investing in and scaling Agvisely more widely.

Stempedia: development of a weather forecast-driven early warning system for lentil crop diseases

As part of the CSISA's USAID/Washington supported activities, different steps have been taken to develop a weather forecast-based early warning system for lentil *Stemphylium* disease. This disease is especially harmful because Bangladesh's humid climate creates ideal conditions for fungal growth. It causes small, dark spots on leaves, stems, and pods, which can merge into larger dead areas, resulting in early leaf drop and significant yield losses. In Bangladesh, the disease is most common during the cooler months from December to February. High humidity, frequent dew, and dense plant cover worsen the situation during this time.

Initially, CSISA scientists developed Stempedia model, calibrated, and validated it using field data from Bangladesh and Nepal to forecast the weather-based risk of lentils. Then, the model was applied in farmers' fields to determine its validity for forecasting fungicide application requirements based on forecast weather. Finally, the Stempedia was developed into a weather forecast-based early warning system specifically for fungicide application advisory deployment for managing lentil Stemphylium disease (Lentil Stemphylium Advisory - LSA).

In the last year and during the reporting period, the CSISA team focused on the third step. This included finding a suitable partner in Bangladesh for developing and disseminating the LSA to key stakeholders, designing the LSA system architecture, and developing an LSA dissemination action plan. The Department of Agricultural Extension (DAE) expressed its interest in partnering to develop the LSA and disseminate it to key stakeholders. As a result, the early warning system for lentil Stemphylium disease has been further developed, with the first stage of the LSA system successfully tested. The next step involves running the system daily with daily historical weather data for 64 districts in a single platform. An R-program-based software has been newly developed for this purpose. Once completed, the third step will involve providing a weekly disease risk forecast based on forecast weather data.



Above: A computer screen shot of *the Lentil Stemphylium Advisory (LSA) system* interface under development.

The system requires gridded weather data and sowing time of crops to generate risk indices for each grid for the following week. The risk factors are translated into three categories - No, Low, and High - and provide three short advisories. The low and high-risk advisories are passed onto farmers via respective Sub-Assistant Agriculture Officers. The risk across the country will be presented by a risk map and updated on a weekly basis. As CSISA is in a close-down period, the team is negotiating with CGIAR's Plant Health Initiative to provide further support and complete development.

A.2.2 Building precision nutrient management approaches around scaling pathways

This activity was deemphasized by CSISA after funding shortfalls and delays experienced in 2017 and 2018 that resulted in the departure of scientific staff leading the research. Since then, only limited work on precision nutrient management has been conducted in Bangladesh. As such and as indicated in previous reports no major activities were undertaken in this work package during the reporting period.

B. SYSTEMIC CHANGE TOWARDS IMPACT

B1. Partnerships for inclusive growth around commercial pockets and neglected niches

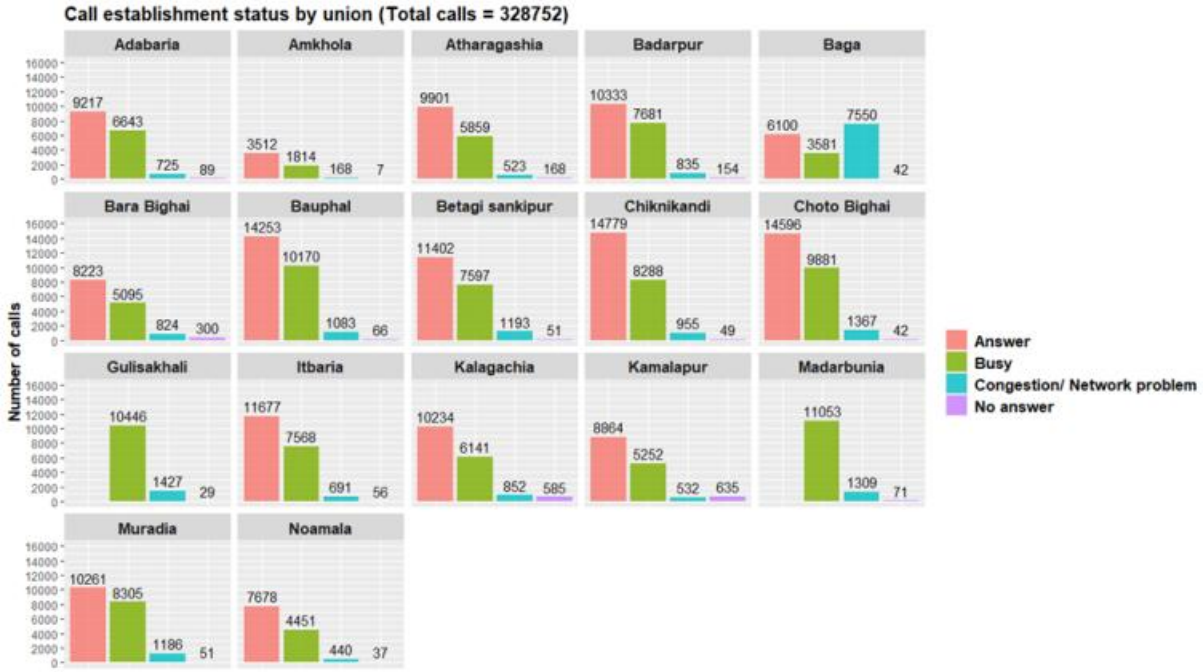
B1.1 Deployment of better-bet agronomic messaging through input dealer networks and development partners

B1.2 Building farmers' resilience to weather shocks and replacing fallow land with mung bean in Bangladesh: protecting against crop damage with climate services

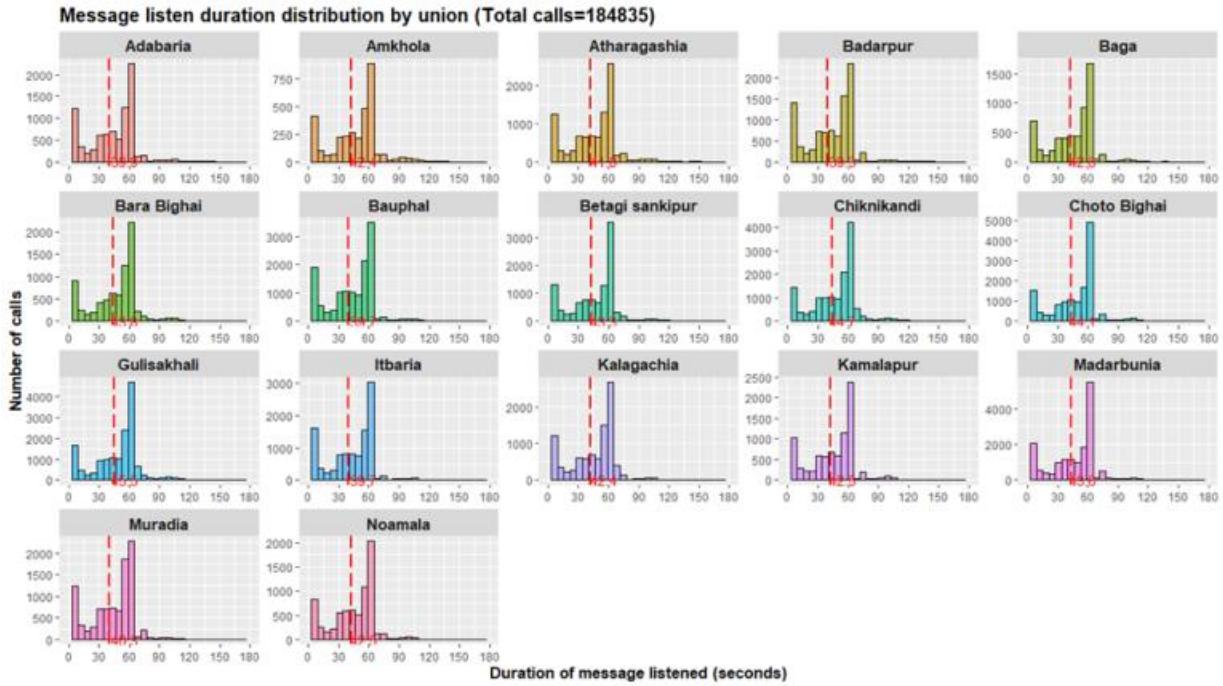
The central coastal area of Bangladesh is known for its easy-to-grow and potentially very profitable mung bean crop. However, heavy rain events during the harvesting period often cause significant yield losses for mung bean farmers. To address this issue, in 2019, the CSISA team developed an interactive voice response (IVR) system for farmers in the Patuakhali and Barguna districts. The IVR system provides real-time weather alerts, helping farmers prepare for any forecasted heavy rainfall that could damage their crop.

In the latest report, it was mentioned that M-World, a partner aggrotech firm, had decided to carry forward the IVR system from 2024. With co-finance from TAFSSA and AMD, the CSISA team is supporting them in understanding the dynamic system of the mung bean IVR system and deploying IVR calls. As a result, during the mung bean harvesting period from March 29 to June 06, 2023, M-World issued a total of 328,752 IVR outgoing calls to 10,472 mung bean farmers (including 668 women and 9,788 men), as well as officers and mung bean millers in 17 selected locations (known as unions).

The CSISA research team conducted an analysis of the IVR call data and discovered that out of 328,752 IVR outgoing calls, 184,835 (56%) were successfully received and listened to by the farmers. The remaining 143,917 (44%) failed to reach the end user due to no answer, number busy, and network issues. The below graphs show the total IVR messages listened to duration by the farmers who received the calls in selected seventeen (17) unions from March to June 2023. From the above graph, it is found that most of the calls listened to by the farmers were around 40 seconds on average, indicating that most farmers listened to the full call before hanging up.



***Above**: Number of IVR mung bean harvesting alerts provided to the farmers in seventeen (17 unions) during mung bean harvesting season, March 29 -June 06, 2023*



***Above**: IVR messages listening durations by the farmers in seventeen (17) unions from March 29- -June 06, 2023. The dotted vertical line of each histogram indicates the average duration of voice message listening by the farmers at that location in seconds.*

Sustainable business models for mung bean interactive voice response-based advisory services:

To ensure the long-term success of the mung bean IVR service, the CSISA team is working with AMD and TAFSSA initiatives to help M-world = develop a multi-revenue-stream business-to-business (B2B) model. The model aims to collaborate with microfinance institutions, processors, exporters, and others such as Grameen Egulena which exports mung bean to Japan. The most promising model explored is a loan-bundled model with Microfinance Institutions (MFIs) who can pay a subscription fee for the IVR service. This will help reduce the crop damage risk to their borrowers cultivating mung bean. The IVR service will act as a kind of insurance mechanism to the loans. Additionally, there is a possibility of using the platform for targeted advertisements. However, the key to success is enhancing the number of subscribers. 'Snowball' collection of mungbean farmers' phone numbers is planned to build a database of interested mung bean farmers. A hotline phone number for subscription is also available to be shared by the farmers. Increasing subscriptions through a promotional video campaign is in the pipeline. During the reporting period, the CSISA team engaged in productive meetings with key stakeholders such as the Grameen Euglena company and the Commercial Bank of Ceylon. Notably, Grameen Egulena has committed to funding the IVR service at a rate of BDT 200 per farmer per season, benefiting their substantial group of 300 mung bean farmers in 2024. They will extend the service to their 3,000 farmers if the initial 300 subscriptions in 2024 are proven to be beneficial.

C. ACHIEVING IMPACT AT SCALE

C1. Growing the input and service economy for sustainable intensification technologies

C1.1 Integrated weed management to facilitate sustainable intensification transitions in rice

As part of its end of year exit plan, CSISA organized a national-level workshop on Integrated Weed Management (IWM) on August 29th, 2023, inviting stakeholders from research and extension systems, universities, private sectors (including Bayer, Auto Crop Care, ACI, Syngenta, Haychem, and McDonald Bangladesh Ltd.), and policymakers. The aim of the workshop was to strengthen IWM practices at the farmer level. During the workshop, weed scientists from BRRI highlighted that the use of herbicides in rice is increasing rapidly, but without judicious use, there is a risk of environmental pollution and weed resistance development. They suggested that companies should market less toxic herbicides and train dealers on IWM practices. The participants at the workshop emphasized the importance of clean cultivation as a preventive measure and cultural weed management in reducing herbicide use. They also stressed the significance of weed-competitive varieties as a component of IWM. Some participants raised concerns about the current herbicide names used by companies and suggested that companies should use clear and simple names for their products so that farmers can easily understand them. All participants agreed that weed researchers, extensionists, and companies should meet at least once a year to further strengthen IWM practices in Bangladesh.

***Above**: Left side: group photos of the workshop participants, and right side: Bayer crop science presenting their IWM strategies for farmers. Photo credit: Sharif Ahmed*

C1.2 Commercial expansion of two-wheel tractor-based machinery and associated service provision models for reapers and seeders

CSISA III's synergistic support to the expanding CSISA Manufacturing and Extension Activity (CSISA-MEA)

Building on the successes of the CSISA-Mechanization and Irrigation (CSISA–MI) Activity, which ran from 2013–19 and which emerged from the set of USAID/Washington core investments in CSISA, the Feed the Future Bangladesh Cereal Systems Initiative for South Asia Mechanization Extension Activity (CSISA-MEA) began on 1 October 2019. CSISA-MEA is a five-year project, funded by USAID and implemented by CIMMYT and its partners: iDE and Georgia Institute of Technology (GT). The project aims to support the growth and expansion of agricultural mechanization in Bangladesh so that smallholder farmers can affordably access cost and resource-saving sowing, irrigation, harvesting, and other types of machinery. CSISA-MEA supports market actors along the entire value chain, including machinery manufacturers, ag-machinery importers and retailers, dealers, mechanics, spare parts vendors, and machinery "local service providers" who provide services directly to farmers.

Some of the key achievements of CSISA-MEA in the reporting period are described below[3]

- During the reporting period the Activity signed agreements with 140 new partner agriculture-based light engineering (ABLE) enterprises. Through these partnerships, it has facilitated training for staff and managers in metal-working and management skills and linked them to new markets and finance through meetings with dealers, MSPs, and financial service institutes (FSIs). This brings the number of ABLE enterprises the Activity has supported since its start in October 2019 to

[3] Monitoring and evaluation data are reported separately for CSISA Phase III, CSISA-MEA, and CSISA COVID-19 Response and Resilience. Although all part of the broader CSISA program, their quantitative data are reported to USAID independently each year.

647. ABLE enterprises partnering with the Activity made sales in the six months of this reporting period worth a total of USD 2,013,785.

- Technical support provided by CSISA–MEA, particularly when in collaboration with Bangladesh Agricultural Research Institute (BARI), resulted in the development and marketing of 25 new types of agricultural machine since the start of the Activity. One of the most successful of these is the onion blower that pulls air through bulk-stored onions, reducing storage losses caused by fungal diseases and dehydration. ABLE enterprises have already sold 80 of these machines since marketing began in January 2024.
- Between October 2023 and March 2024, 170 workforce staff, of which 52 percent were youth under 30 years and 12 percent were women, were provided with training in metal-working skills. This brings the total number trained in metal-working skills since CSISA–MEA's start to 2,399. Of those trained in this reporting period, 145 received training in machining skills and 80 in foundry skills. Specialist training was given to business managers in the use of software for inventory management, in training in engineering design and drawing, and the use of a welding simulator produced by Lincoln Electric, a USA company that produces welding equipment.
- Marketing events facilitated by the Activity have in part resulted in the sale to 218 CSISA–MEA-supported MSPs of machinery and spare parts worth USD 1,022,823. Combine harvester (59 units) sales accounted for 84.5% of these funds spent. Eight percent of the machines sold were purchased by women. During this reporting period, 37,235 farmers bought machinery services worth a total of USD 933,360 from 1,818 MSPs. Since the start of the Activity, of the 226,957 farmers who bought agricultural machinery services from MSPs, 11 percent were women. In this reporting period, of those buying mechanization services, 2 percent were women and 12 percent were youth under 30 years.

***Above**: A combine harvesting the winter season* boro *rice crop in Patuakhali, southern Bangladesh. Photo credit: Sharif Ahmed*

2. Nepal – Achievements

A. INNOVATION TOWARDS IMPACT

A1. Reducing risk to facilitate uptake of sustainable intensification practices

A1.1 Direct-seeded rice to address labor and energy constraints to precision rice establishment

Because efforts in Nepal during the 2021-22 reporting period pivoted to focus on accelerated implementation of CSISA's Response and Resilience Activity's Objective III (detailed in subsequent sections of this report), no major activities on directly sown rice were undertaken in the last year.

B. SYSTEMIC CHANGE TOWARDS IMPACT

B1. Partnerships for inclusive growth around commercial pockets and neglected niches

Scaling up of mechanized maize seeding in Nepal through adoption of precision maize planters

CSISA has been working with stakeholders in western Terai and foothills to expand the commercial maize sector by promoting cost-saving technologies. The Activity maintains a presence in Dang and has been collaborating with PMAMP Dang Maize Super Zone to disseminate improved technologies, such as the use of precision planters in maize sowing. During the reporting period, CSISA, along with the Prime Minister Agriculture Modernization Project (PMAMP) in Dang, a local custom hiring center run by Banghusri Farmer Group, and Swargadwari Agro Trade Link, organized targeted demonstrations of precision maize planters in Kapilvastu district. The demonstrations aimed to advertise the use of precision maize planters in collaboration with three municipalities - Shivaraj, Buddhabhumi, and Bijaynagar Rural.

During the three-day period (21-23 February), six demonstrations of precision maize planters were conducted in strategic locations, including Shivaraj-1, 2, and 9, Buddhabhumi-1, and Bijaynagar-2 and 6. The events were observed by 145 farmers and representatives from related stakeholders, including local governments, machinery dealers, elected representatives, and agriculture technicians from other projects. The activity generated awareness among the stakeholders, and the municipality agriculture office pledged to budget for precision maize planters in their future support programs.

Following the demonstration, Shivaraj Municipality endorsed the decision to support precision maize planters in the current fiscal year. They published a notice inviting eligible farmers, entrepreneurs, and farmer groups to apply for their demand-based support program. The campaign was successful in generating awareness and promoting cost-saving technologies in the commercial maize sector.

***Above**: CSISA Engineer describes how the precision maize planter works to the participants of a demonstration at Bankattwa, Shivaraj-1, Kapilvastu on 21 February 2023. The participating representatives of Shivaraj Municipality praised the machine and pledged to keep it on their priority list while budgeting for the next fiscal year. Photo credit: Lekh Nath Adhikari*

Utilizing the remote sensing approach for area and yield estimation in Dang and its potential uptake by government stakeholders

During the reporting period, CSISA has maintained contact with the Ministry of Agriculture and Livestock Development (MoALD) Planning and Development Cooperation Coordination Division, which is responsible for endorsing and implementing activities related to crop mapping and establishing links with development partners. Additionally, Kathmandu University's allied department is working jointly with CSISA on the crop mapping exercise. On July 31, 2023, MoALD and CSISA organized a workshop on "Crop Mapping and Crop Area Estimation using Earth Observation" at Hotel Everest, New Baneshwor, Kathmandu. The workshop had 25 in-person and seven virtual participants, mostly from MoALD's various entities engaged in crop mapping and responsible for maintaining an agricultural statistical national database.

The workshop's main objectives were to share MoALD and CSISA's work on utilizing remote sensing in crop area and yield estimation, discuss the challenges and opportunities in the workstream, and determine possible ways of collaboration among stakeholders to address the challenges and take advantage of the

opportunities in using remote sensing for crop area and yield estimation to inform national statistical collection processes.

The workshop identified the need for collaboration in capacity building activities, familiarizing interdisciplinary teams with remote sensing tools, introducing new methods in crop area/yield estimation (e.g., Sen4Stat tool), and enhancing communication and coordination among existing stakeholders working in the remote sensing field. Both CSISA and MOALD agreed to have regular communication in the future to mainstream the remote sensing tool for crop mapping in cereal crops by addressing the issues of capacity and information gaps in the area.

***Above**: participants of crop mapping workshop organized on 31st July 2023 at Hotel Himalaya. Lalitpur. Photo credit: Nabin Maharjan*

C. ACHIEVING IMPACT AT SCALE

C1. Growing the input and service economy for sustainable intensification technologies

C.1.2 Accelerating the emergence of mechanized solutions for sustainable intensification

C1.3 Commercial expansion of scale-appropriate machinery and associated service provision models for reapers and seeders in Nepal

The CSISA Response and Resilience Activity has taken on much of the work on scaling mechanization services in Nepal. Further details and progress can be read in "Objective III: Supporting rapid response and building resilience" found later in this semi-annual report.

3. Policy Reform – Achievements

D1. SEED SYSTEMS

As described in the 2018-19 Annual Report, activities in Bangladesh around seed system policy reform were phased down due to transitions in the CSISA's leadership within the International Food Policy Research Institute (IFPRI) and Activity funding uncertainties. These are described in the Executive Summary and 'Challenges Faced During the Reporting Period' sections of previous CSISA reports. Conversely, o new activities were carried out around seed system policy reform in Nepal in this reporting period.

D2. SCALE-APPROPRIATE MECHANIZATION

During this reporting period, the CSISA team focused on addressing reviewer comments and finalizing a paper that examines the factors determining smallholder farmers' ownership and use of agricultural machinery in Bangladesh, as well as the service provision for these machines. The paper is expected to be published as a journal article in late 2024. Study findings revealed considerable diversity in how socio-economic factors impact ownership and service provision of various machines. Factors such as age, education, risk-taking willingness, and livestock ownership showed positive associations with owning, servicing, and hiring decisions for most machines. However, the results concerning factors like farm size, off-farm income, household members contributing to farming, wealth score, and communication scores were inconclusive and warrant further investigation.

D3. SOIL FERTILITY MANAGEMENT AND FERTILIZER MARKETS

No new activities were carried out around soil fertility management and fertilizer markets in Nepal in this reporting period. These activities were suspended several reporting cycles ago in preference of USAID/Nepal's support for the Feed the Future Nepal Seed and Fertilizer Activity.

D4. AGRICULTURAL RISK MANAGEMENT

The findings from a research paper assessing the effectiveness of phone-based extension approaches in building farmers' knowledge on the diagnosis and management of Fall Armyworm (FAW) were presented at the Asian Economic Development Conference 2023, organized by the Asian Development Bank, the Asian Development Bank Institute, and the University of Tokyo, held between 15-16 July 2023 in Tokyo, Japan. Results from the experiment can inform a variety of stakeholders, including the Government of Nepal, research institutions, and civil society, on designing more effective extension approaches that address the specific needs of maize farmers, particularly smallholder farmers, during periods of crisis. Further results from the study will help communicate to policymakers the impact and feasibility of deploying ICT tools to enhance agricultural extension systems in the country.

Objective III: Supporting rapid response and building resilience to Nepal's second COVID–19 wave

Background: From April to late September 2021, Nepal experienced its second large and then a third minor wave of COVID-19, resulting in additional and significant threats to agri-food systems and livelihoods. These have occurred due to lockdowns, transportation and marketing disruption, social distancing (which decreased the ability of farmers and value chain actors to interact with each other), and increased infection rates (which significantly reduced crucial farm labor availability, especially among marginal and women farmers). At the same time, small and medium scale enterprises throughout the FtF Zone have suffered economically. National food/nutrition security has been undermined by increased costs for imported staples, the unreliability of cross-border trade, and shortfalls in national production both before and during the crisis. The pandemic and resulting lockdowns have also exacerbated the need for reliable and timely information about input and output market access, crop diseases and pests, and insurance and credit while recognizing the inequalities that limit women's and marginalized groups' access to information and their disproportionate economic burden.

In response, USAID/Nepal provided an additional USD 3 million buy-in as part of the wider CSISA portfolio to support rapid response and continued resilience building in Nepal's agri-food systems. These activities include, firstly, immediate response activities being put into place from September 2021 until June 2023, aiming to rebuild effectively key elements of the country's agri-food systems and marginalized groups in the FtF zone which were disproportionately affected by COVID–19's second wave.

Key areas of intervention focus on providing access to finance for small- and medium-scale agricultural input and services provision businesses, recovery and response in the post-harvest value chain, with emphasis on financial products to benefit businesses involved in perishable farm product marketing and distribution, and expansion of digital banking services supporting socially distanced agricultural finance transactions. Interventions also focus on scaling-out agricultural mechanization services through geographical expansion to new districts in which CSISA is not currently working as part of Objective I activities, while also working to increase national food security and bolster agricultural economies in times of crisis. Lastly, Objective III works to focus on assuring small enterprises that recovery from the shock of COVID–19 is complete, while at the same time building the resilience of key elements of the agri-food system to better withstand future shocks, including but not limited to COVID–19.

WORK PACKAGE 1: ASSURING SMALL- AND MEDIUM-SCALE INPUT AND SERVICES PROVISION BUSINESS RECOVERY AND REHABILITATION THROUGH ACCESS TO FINANCE

Background: Work Package I develops customized business models for financing, and facilitates rapid access to response and recovery loans from financial institutions to mitigate effects of the second and third COVID–19 waves, with emphasis on specialized products for women and marginalized groups. The agreements with banks held on behalf of CSISA, developed as part of Objective I, are being leveraged to provide quick opportunities to facilitate access to finance for other agricultural businesses. These include

agrovets, agricultural machinery dealers and businesses associated with agricultural inputs or services owned or operated by women or members of marginalized groups who have suffered because of lockdown and COVID–19-induced loss. As such, CSISA is deepening these relationships to develop customized economic crisis response business models, and the provision by banks of input business support loans to small- and medium-scale agricultural inputs, machinery-dealing businesses, or agriculture-oriented businesses owned by women or members of marginalized communities (or which employ these groups).

1.1 Develop customized business models for financing and facilitate rapid access to response and recovery loans to mitigate effects of the second wave of COVID–19, with emphasis on specialized products for women and marginalized groups

Above: *Dil Kumari Chaudhary, owner of Sahara Agrovet Center Bansgadhi municipality, Bardiya district in 2023. Dil Kumari Chaudhary, owner of Sahara Agrovet Center, experienced a revival in her business after securing a subsidized loan of NPR 1 million from CSISA in 2021. Daily transactions increased by 30%, reaching NPR 15,000, and the business expanded its outreach to 700 farming households. CSISA also provided training in business management and agriculture practices, enhancing Ms. Chaudhary's entrepreneurial expertise. Photo credit: Salin Acharya*

CSISA has facilitated the obtainment of loans for 95 agrovets from various financial institutions during the reporting period, supporting them in expanding their businesses and meeting farmer demands. The Activity also provided business skills development and training covering customer identification, sales, bookkeeping and financial management. In addition, 198 community business facilitators (CBFs) were developed and trained in sales skills and technical knowledge across seven districts, facilitating connections between agricultural input suppliers and farmers. CSISA also sensitized agricultural inputs suppliers to practice gender equality and social inclusion (GESI)-responsive service provision and supported the dissemination of contact information of local agrovets to women vegetable producer groups. Furthermore, the Activity advocated the hiring of female students for on-the-job training in coordination with technical colleges.

The Activity saw significant financial improvement, enabling strategic investments in agricultural inputs in those agrovet after the support. This support aided agrovets in overcoming COVID–19-induced financial challenges and enhancing their capacity to provide services to farmers. Before CSISA's support, the average monthly revenue for agrovets working with the Activity was NPR 99,404 (USD 760) with a net monthly profit of NPR 20,220 (USD 154). During lockdown but before connecting with CSISA, revenue decreased to NPR 76,207 (USD 583) with a net profit of NPR 15,225 (USD 116). After beginning collaboration with the Activity, their average monthly revenue increased to NPR 167,000 (USD 1,278) with a net profit of NPR 38,994 (USD 298), highlighting the positive impact of involvement with CSISA. The number of farmers served by agrovets however fluctuated due to economic uncertainties brought

about by the pandemic. However, after receiving support from CSISA, agrovets' average monthly customers (that is, farmers) increased from 356 to 460 in 2022, and again to 828 in 2023, indicating sustained growth.

In CSISA working districts, agrovets supported by the Activity reported an increase in women farmers seeking agricultural inputs. Among 95 agrovets, 69 engage CBFs, 58 of which integrate women CBFs into their business and three of which employ female staff. These efforts reflect a commitment to GESI and its role in empowering women in the agrovet sector. The engagement of female and male CBFs in sales facilitation indicates a balanced representation, with 34 men and 46 women CBFs in 2022, and 23 men and 36 women CBFs in 2023. This proactive approach promotes GESI, leveraging diverse perspectives to enhance sales and economic opportunities.

WORK PACKAGE 2: SPECIALTY FINANCIAL PRODUCTS AND SERVICES TO REDUCE POST-HARVEST LOSSES IN AT-RISK PERISHABLE FARM PRODUCT VALUE CHAINS

Background: Work Package 2 addresses the aftermath of COVID–19's second wave and its effects on farmers and businesses involved in the production, distribution and sale of perishable and nutritious commodities. Its primary focus lies in forging and executing specialized financial services, in collaboration with financial institutions such as banks, cooperatives, and microfinance institutions tailored to cater to the distinctive needs of perishable value chains. Five Activity businesses are involved in producing, distributing and selling perishable and nutritious commodities.

Within this Work Package, targeted efforts are directed towards supporting vulnerable businesses, particularly those owned by women and members of marginalized communities. These businesses operate across five sectors: pickle production (e.g., chili, mixed vegetable, garlic), sauce production (chili, tomato, mixed vegetable and soybean sauces), dairy processing (milk, curd, ghee, cake, sweets), spice processing (turmeric powder, ginger powder, dried ginger/turmeric, dried chili, cumin, black pepper, coriander, Szechuan pepper), and agricultural processing and drying (vegetable collection and transport, cold storage, fruit juice). Focusing on these sectors and catering to specialized financial solutions, this Work Package aims to strengthen the resilience and recovery of businesses that contribute to a pivotal role in the production, processing, packaging, and distribution of products. Through these efforts, Work Package 2 strives to mitigate the adverse impact of the pandemic on both livelihoods and food security.

2.1 Increase response and recovery from the second wave of the COVID-19 crisis for farmers and businesses involved in the production, distribution and sale of perishable and nutritious commodities

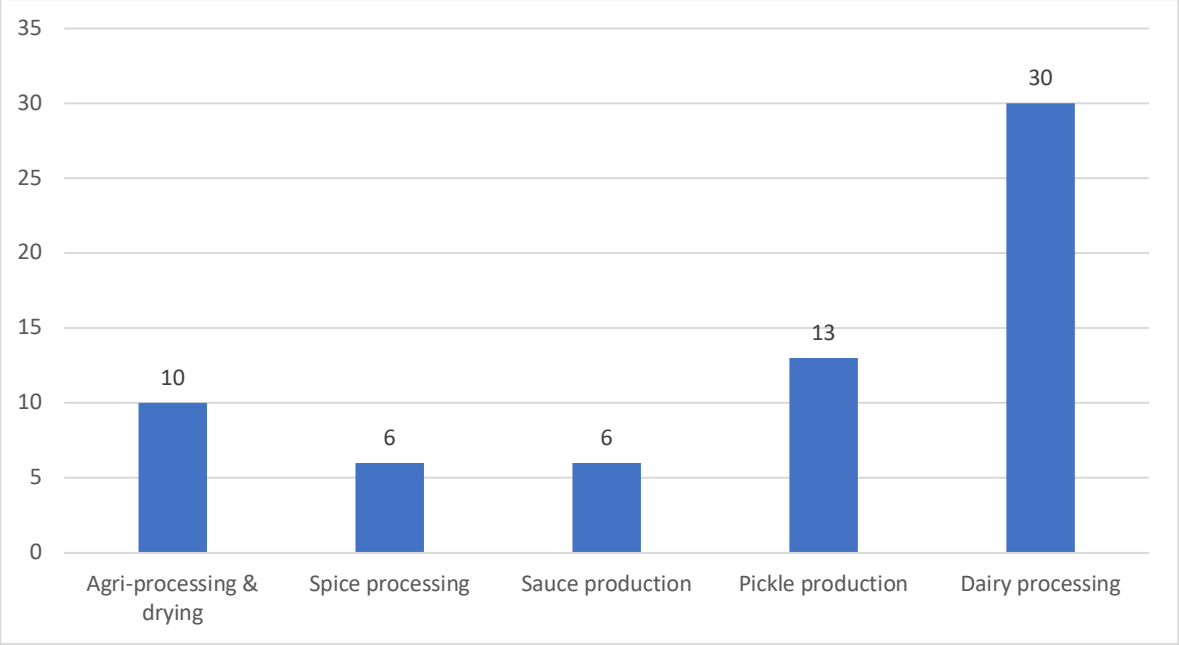
CSISA is actively involved in activities aimed at supporting post-harvest businesses. These include facilitating access to finance, guiding post-harvest enterprises (PHEs) through the business registration process, supporting them to obtain food manufacturing, safety and processing certificates (DFTQC[4] number), and providing support to develop comprehensive business plans. The main goal is to establish

[4] Department of Food Technology and Quality Control (DFTQC)

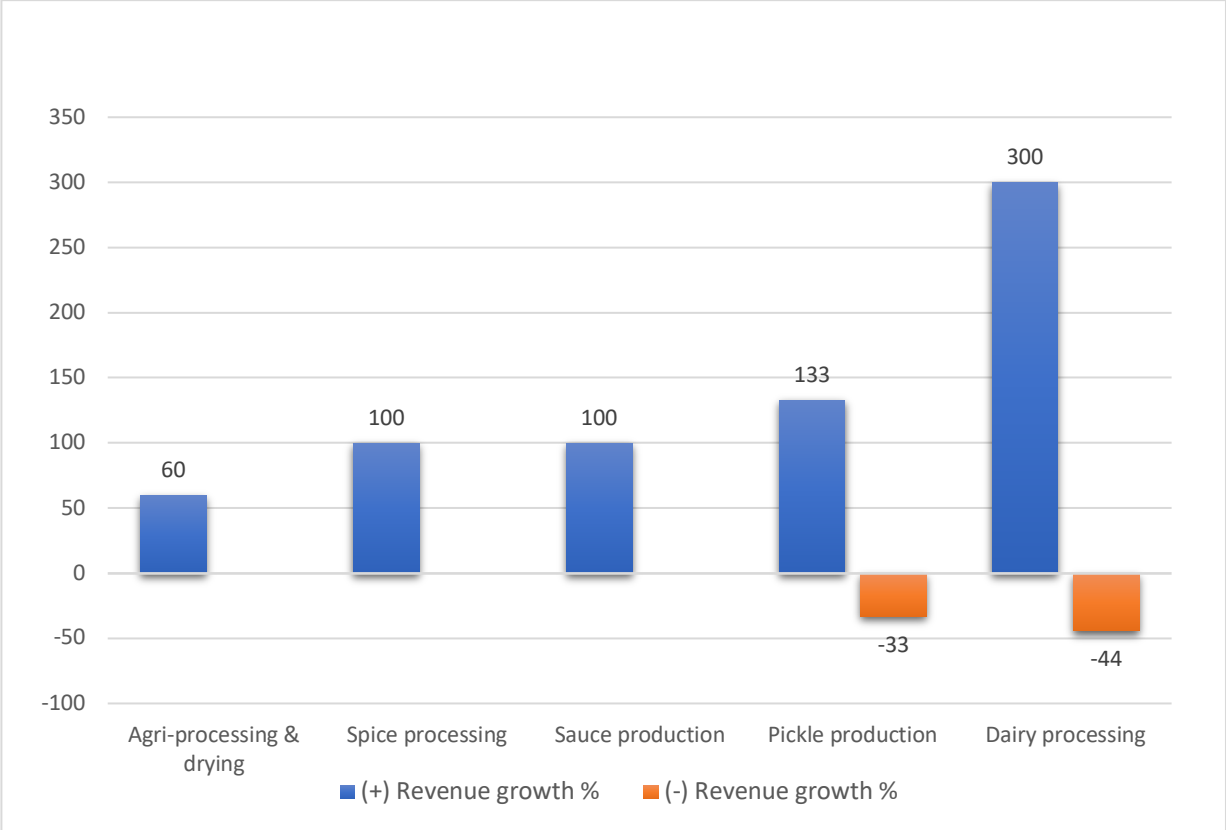
strong connections with financial institutions, enabling enterprises to secure loans, and enhancing their capacity for growth and success in the post-harvest sector.

During this reporting period, 65 out of CSISA's 86 post-harvest MSMEs were actively running a business. These enterprises span various sectors, including dairy processing, pickle production, spice processing, sauce production, and vegetable processing and drying. The Activity played a crucial role in fostering connections between these MSMEs and financial institutions such as banks and cooperatives, thereby facilitating their access to much needed financial resources. It also provided essential business development services, connected enterprises to relevant stakeholders, and offered capacity building and training programs to further strengthen their capabilities.

These efforts ensured that 29% of beneficiaries were from marginalized communities (Dalit, Janajati, Madhesi) and 59% were women. The inclusive approach adopted by the Activity provided training and business linkage support, not only aiding businesses to overcome challenges but also contributing to their growth and the empowerment of marginalized communities. Revenue growth among them ranged from 5% to 300%. Similarly, a total of 2,332 farmers/beneficiaries benefited from CSISA's activities under Work Package 2. Of these, 41% are from marginalized communities and 30% are women.



Above: *Number of post-harvest enterprises actively operating in the Activity's working districts (2023/24).*



***Above**: Range of increment and decrement in annual revenue in NPR for post-harvest enterprises (2023/2024). (Note: annual revenue growth ranges from -44% to 300%)*

2.2 Build resilience to the second wave of the COVID–19 crisis for farmers and businesses involved in the production, distribution and sales of perishable and healthy commodities

Interaction among post-harvest enterprises and sharing workshops

Four interaction and learning-sharing workshops among PHEs were conducted in October 2023, according to key product type (e.g., pickle, dairy chowmein/sauce). Participants (16 on pickling in Dhangadhi, 26 and 12 on dairy and chowmein and sauces in Nepalgunj, respectively, and 10 on dryers and cold storage in Dang) carried out a strength, weaknesses, opportunities and threats (SWOT) analysis based on their business health checkup conducted in the previous month. They also shared their experiences of business plan development, product diversification, stock management, marketing and customer relationship management.

These interactions built cohesive relationships among the different PHEs, encouraging them learn from each other's experiences. After discussions on the challenges and opportunities encountered by particular industries, PHE representatives expressed that the interaction had been very beneficial and would support them to run their businesses more effectively in the future.

Above: *participants and trainers in the interaction program for pickle enterprises, facilitated by CSISA at Dhangadhi, Khailili district. October 12–13, 2023. Photo: Surya Khadka, CIMMYT*

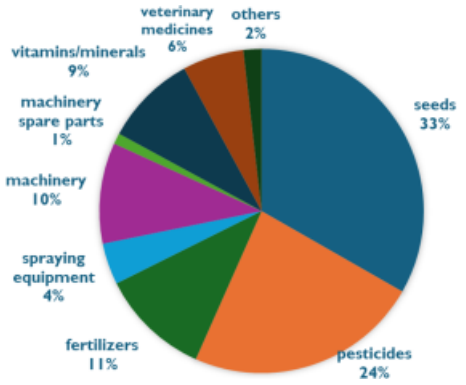
Support for post-harvest enterprises

Above: *post-harvest enterprise owners with digital weighing scales the are now trained to use in Nepal November, 2023. Photo credit: Chandrabir Tharu*

In November 2023, the Activity provided a total of 12 PHEs (9 chowmein/sauce enterprises, 3 pickle enterprises) from Banke and Bardiya districts with a digital weighing machine each as material support to enable them to increase their business efficiency. The weighing machine has enabled the PHEs to measure raw materials accurately and improve product sales. This initiative aligns with the Activity's results chain by providing crucial tools to empower MSMEs, promoting better control over ingredients and supporting the continuous advancement of their businesses.

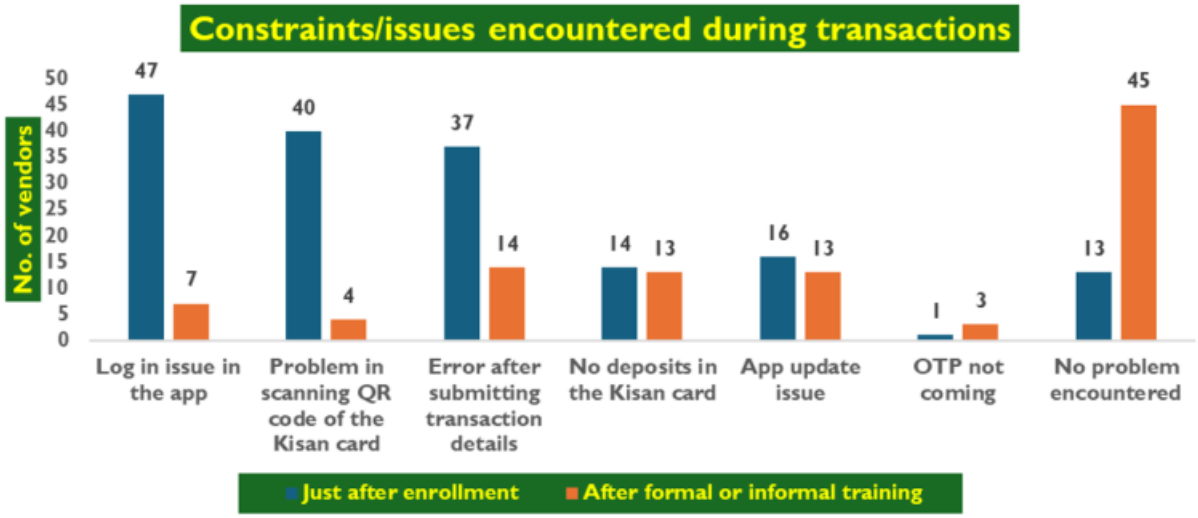
WORK PACKAGE 3: DIGITAL BANKING SERVICES TO SUPPORT IMMEDIATE RESPONSE TO BUSINESSES AND CONSUMERS AFFECTED BY THE COVID–19 CRISIS

3.1 Rapidly increase agrovet access to digital tools enhancing the sale and purchase of agricultural inputs and commodities in key locations suffering from the economic shock of the second wave of COVID–19 in the Feed the Future Zone



***Above**: Purchases reported by farmers using the Kisan card*

CSISA has continued to support activities to Kisan cardholder farmers and associated vendors in its working districts through a partnership with Nepal Investment Mega Bank (NIMB) and R&D Innovative Solutions. In the reporting period, follow-up activities were prioritized as part of the initiative to empower farmers and vendors through access to banking, with visits to support them in their use of the Kisan card system. A survey of Kisan cardholder farmers towards the end of 2023 indicated that they used the card to purchase agricultural inputs (seeds, pesticides, fertilizers, machinery), as presented in the following figure.



***Above:** Issues reported by users during Kisan card transactions during the reporting period, many of which are now resolved*

As the Kisan card is a new tool, there have been some technical issues in the effective implementation of the system at the bank, vendor and farmer level. The survey of vendors revealed several challenges which decreased dramatically after vendors received formal or hands-on technical training by the bank in collaboration with CSISA. This provided a clear indication that training needs to be an integral part of the

digital banking initiative, not only at the farmer but also the vendor level. In February 2024, a new mobile application (the NIMB Krishi app) was made available by NIMB to registered vendors via the Google PlayStore, after which a number of technical issues related to the application itself were eliminated.

3.2 Scale-out access to digital tools enhancing the sale and purchase of agricultural inputs and commodities in the Feed the Future Zone

Production of animated videos promoting the Kisan card

Although facilized by the Activity, the Kisan card is a relatively new approach, and farmers and stakeholders have very limited information about it. During the reporting period, CSISA collaborated with banking partners to produce four animated videos promoting Kisan cards to raise awareness about the card and its uses. The videos include information on how to use the Kisan card from the farmer's perspective, the Kisan card, and how to use the card from the vendor's perspective. The videos are being used by NIMB, R&D Innovative Solutions and other vendors on their social media platform and through other channels. As communication products, the videos are an asset for banks providing the Kisan card and will be used to generate awareness of different stakeholders working in the access to finance services.

Deployment of branchless banking agents

One of the challenges in the effective implementation of the Kisan card scheme is the distance of most farming households from the bank branch where they hold their account, impacting their savings and ability to utilize banking services to the full. To resolve this, the Activity facilitated NIMB to establish seven Kisan card vendors as branchless banking (BLB) agents across districts where CSISA has introduced the card, and NIMB-appointed business correspondents known as BLB agents to carry out transactions on behalf of the bank. BLB agents are equipped with point-of-sale machines and triple authentication (VISA card, QR code, biometrics) to complete transactions. Farmers have begun conducting transactions through agents, benefiting particularly as agents are established in areas where banking services are not available. In seven municipalities of Activity districts, farmers can now deposit and withdraw money from their accounts, saving substantial time.

Above: *BLB agents at an inauguration event, Raptisonari Rural Municipality, Banke district. December 20, 2023. Photo: Raj Kishore Ray*

Financial literacy training for Kisan card farmers

Above: *Kisan cardholders participating in financial literacy training delivered by CSISA in Chaukidanda, Godawari 3, Kailili district. October 2, 2023, Photo: Surya Bahadur Khadka*

During the reporting period, the CSISA Dhangadhi hub conducted five financial literacy training sessions for Kisan card farmers in different locations of Kailali district. A total of 61 farmers (42 women, 19 men) participated, learning about the proper usage of Kisan cards, how to maintain daily income and expenditure records, and the nature of financial institutions and agricultural insurance. Topics included setting financial goals, exploring alternative income sources, and promoting a savings culture. Participants were provided with a *Mero Khata* ("My book") record book to support them in managing their daily finances. The training events, organized in collaboration with NIMB, also included insights from bank representatives on policy updates and best financial management practices. The training equipped farmers with the knowledge to make effective use of the Kisan card to purchase agricultural inputs and to adopt sound financial practices, contributing to CSISA's envisioned impact. Similarly, the CSISA Dang hub conducted two financial literacy orientation trainings in Lamahi Municipality, Dang district and Shivraj Municipality, Kapilvastu district. These targeted Kisan card recipient farmers, with total participants numbering 43 farmers (13 women, 30 men). The core objective was to orient farmers on the importance of saving and its potential to increase future investment capacity.

Above*: The owner of Pulami Feed Centre, receiving a banner and display card, as part of promotional materials provided by CSISA, Surkhet district. November 20, 2023. Photo: Mohan Raskoti*

Marketing activities to encourage increased use of digital banking

During the reporting period, the CSISA team in Surkhet district facilitated the effective marketing of products and services for 20 newly onboarded Kisan card vendors, supporting them to build their brand and attract customers, and contributing to their business growth. The Activity partnered with the vendors to develop and use promotional materials (display cards and banners) to increase

their visibility and advertise their business. This activity supported CSISA's results chain by directly skilling vendors to use the Kisan card effectively, and aligns with the Activity's overarching goal of fostering business success and growth through strategic promotion and marketing efforts.

Improved agriculture practice and technology training for farmers

In October 2023, CSISA conducted five one-day Improved Agriculture Technology Training events in Godawari municipality, Kailali district, in Wards 3 and 10 of Chaukidanda and Khamaura villages, respectively. A total of 61 female participants, including 12 marginalized and 15 youth, were engaged in capacity building in newly improved agricultural technologies. The training covered topics such as zero tillage, machinery utilization, compost manure application, and methods of controlling straw burning. Participants also received orientation on agriculture phone apps such as *Geo Krishi* and *Krishi Guru*, and engaged in discussions on climate change and integrated pest management techniques. The overarching purpose was to encourage farmers to adopt these improved practices by using Kisan credit cards and Kisan debit cards, fostering coordination between agricultural input suppliers and farmers for enhanced agricultural productivity. The CSISA Dang Hub also delivered training on agriculture technologies, with 42 farmers (11 female, 31 male) participating.

***Above**: farmers during a practical session promoting conservation agriculture, preparing liquid fertilizers in the improved agriculture technology training at Khamaura, Godavari 10, Kailali district. October 13, 2023. Photo: Surya Khadka*

Capacity-building for community business facilitators on digital advisory services

A one-day orientation on digital advisory services conducted in Nepalgunj Hub, November 6–7, 2023, was a significant capacity-building event for CBFs from Banke, Bardiya and Surkhet districts. The training focused on the practical aspects of the Farm Better phone app, emphasizing its utility for both CBFs and

farmers. A total of 39 CBFs successfully installed and used the Farm Better app, gaining insights into digital record-keeping and its direct benefits for farmers. In addition, sessions on Kisan credit cards and banking literacy provided the CBFs with crucial information on banking processes, card distribution, and marketing strategies. As a result, CBFs are now equipped with the knowledge and skills to utilize the Farm Better app effectively, thereby benefiting both extension workers and farmers, while also understanding the use and marketing of Kisan cards.

***Above**: participants of the capacity building workshop organized at Nepalgunj. November 6–7, 2023. Photo: Raj Kishor Ray*

Kisan credit card: learning and sharing workshops

***Above:** panel discussion during the workshop organized in Far Western Province, Chatakpur, Dhangadhi 3, Kailali district. November 26, 2023. Photo credit: Surya Bahadur Khadka*

On November 24 and 26, CSISA organized two learning and sharing workshops, in Dang district with 11 female and 40 male participants, and in Dhangadhi district with 11 female and 59 male participants. The objective was to ensure the sustainability of the Kisan credit card by raising awareness, exchanging knowledge, experiences and best practices, addressing challenges, identifying solutions, and collaborating with stakeholders to enhance farmer access to the Kisan credit card.

Both workshops, chaired by the mayor of the respective municipalities, started with a brief presentation by CSISA on its work and the Kisan card, as well as the issues, challenges and learnings regarding its use. A representative from NIMB's central office then presented the performance of the Kisan card to date, based on the available database of transactions. A representative from R&D Innovative Solutions shared a brief history of the card and her experience working with different entities to increase access to finance for smallholder farmers. R&D also facilitated a panel discussion with contributions from vendors, farmers and bank officials, and representatives of different tiers of government sharing their views on smallholder access to credit and the challenges associated with it. The workshops highlighted the role of close coordination, collaboration and cooperation among relevant stakeholders in sustainably implementing the Kisan card scheme after CSISA withdraws.

Kisan credit card guidelines enacted by local government in Dang: a milestone in ensuring sustainability of digital banking in Nepal


किसान केडिट कार्ड कार्यान्वयन
कार्यविधि

Above: *a snapshot of the first page of the 'Kisan Credit Card Implementation Guidelines', a legal document enacted by Tulsipur Sub-metropolitan City, Dang district.*

Followed by the Kisan credit card provision by CSISA and its banking partners to 13 farmers and Kisan debit card to 40 farmers of Ward No. 16 in Tulsipur Sub-metropolitan City, Dang district, the Activity worked closely with local government to enact a new legal framework, the 'Kisan Credit Card Implementation Guidelines'. Through regular meetings with representatives of local government and the agriculture office, CSISA drafted the guidelines and shared them with the municipal executive council meeting for endorsement.

The finalized and approved guidelines were duly signed by the mayor of the Tulsipur Sub-metropolitan City, Mr. Tikaram Khadka, in February 2024. As local government has a crucial role in providing services and is directly associated with the welfare of the people in its jurisdiction, it also has the capacity to resolve many problems linked with the sustainability of the KCC approach. An issue impacting the intervention is the challenges in trust between financial institutions and those taking out loans, due to the regularity of the latter defaulting on non-collateral loans. Municipalities can act as guarantors for farmers, enabling them to take out subsidized interest loans through the KCC. With the Guidelines in place as a legal document, the municipality and banks providing the KCC scheme can now devise a joint action plan.

WORK PACKAGE 4: GEOGRAPHICAL EXPANSION OF SOCIALLY DISTANCED AND COVID–19-SAFE AGRICULTURAL MECHANIZATION SERVICES

4.1 Horizontally expand socially distanced and COVID–19-safe agricultural mechanization services in the Feed the Future Zone

CSISA has undertaken extensive training initiatives during the reporting period, with a focus on capacity building for mechanics. A total of 181 individuals were intensively trained in hands-on, experiential oriented learning trainings including 125 women, aimed at developing their skills in machinery maintenance and repair. During the period covered by this report, follow-up assessments with mechanics revealed the need for additional training to enhance their capabilities. In response, CSISA organized three training sessions, tailored to address specific needs.

Capacity-building for mechanics in Surkhet

Mechanics reported encountering challenges when attempting to repair Indian mini tillers, resulting in some machines in Surkhet staying unrepaired for more than six months. To address this, CSISA in collaboration with local machinery dealer businesses organized training between March 19–24, 2024.

Twenty mechanics participated, including one woman. By the end of the training, 14 of the 20 expressed confidence in their ability to repair the machine, with the remaining 6 requiring further support.

***Above**: Activity trainees learning to repair and maintain the Indian mini tiller at Mehalkuna, Gurbhakot 8, Surkhet. April 20, 2024. Photo: Amrit Gurung*

Women's specific training in agricultural machinery repair

The Activity conducted two female-focused training sessions in power tiller and mini tiller repair, in Dang from March 13–15, 2024, and Bardiya district, from April 9–14, 2024. The primary objective was to enhance the capacity of women machinery operators in identifying and resolving common issues associated with power and mini tillers. This support is crucial because women in Nepal often face barriers to effective learning in mixed-gender trainings, where male trainees can be domineering. Providing custom training sessions ensures that women receive the focused attention and support needed to develop their skills and confidence in operating and maintaining farm machinery.

A total of 11 women participated in the training, both of which were conducted in collaboration with local machinery dealers Naya Kisan Ghar in Dang and Swastik Traders in Bardiya. As most of the participants had previously acquired some skills in operating agricultural machinery, the training's primary aim was to deliver skills in basic engine repair and tiller servicing. By the end of the training, participants could confidently repair a power tiller brought in by a customer. Following the training, ten of the 11 women began offering general operation, repair, and machinery maintenance services as part of their informal businesses. They demonstrated the ability to start the engine and basic repairs, reflecting the effectiveness of the training.

***Left**:*

Sita Tharu, a trainee from Rajapur, Bardiya district, in Nepal assembling a rocker arm on a power tiller engine block. April 12, 2024.

Photo: Sankalpa Adhikari

4.2 Deepen socially distanced and COVID–19-safe agricultural mechanization services scaling

Promoting agricultural machinery expansion in Surkhet: demonstrating the reaper and row seeder

Expanding agricultural machinery use in Surkhet involves challenges due to the geography of the district, being a hilly region. While tillage machinery has been widely adopted where feasible, potential remains for the take-up of other machinery for seeding and harvesting. To address this, CSISA took the initiative to introduce and promote additional machinery in Surkhet through two key activities:

Mechanized reaper demonstration

The mechanized reaper, a popular harvesting machine in Nepal's Terai region, is relatively new in the mid-hill and hilly regions. To increase awareness and promote its usage in Surkhet district, the Activity facilitated five demonstrations between October 16, 2023 and 1 November 1, 2023, with a total of 124 farmers (38% women) participating.

***Above**: demonstrating a reaper attached to a mini-tiller operated by Gyan Bahadur Chaudhary at Gusra-10, Manikapur, Surkhet. [December 2023] Photo credit: Shibaji Mahato*

Demonstration of a manually-operated row seeder

In collaboration with the Nepal Seed and Fertilizer (NSAF) Activity, CSISA conducted four maize seed sowing demonstrations using a manual row seeder. These demonstrations took place in four locations in Surkhet district (Birendranagar, Bheriganga, Panchapur, Barahatal) between February 9–24, 2024, with a total of 65 participants (41 female, 24 male). This initiative aims to empower small landholders by providing them with easy-to-use and portable equipment suitable for seed sowing, thereby reducing farmers' cultivation costs and saving time.

***Above**: farmers attending a demonstration of a manually-operated row seeder, Surkhet district. February, 2024. Photo: Dil Bahadur Chaudhary*

Challenges during the reporting period

Challenges specific to the CSISA-COVID–19 Response and Resilience activity – Objective III

- There are challenges in adopting digital banking due to liquidity issues in the banking sector and mergers among financial institutions. These factors have resulted in delays in loan approvals and the distribution of Kisan cards in targeted locations. For instance, in Surkhet, only 15 out of 36 farmers who applied for Kisan Credit Cards (KCC) received them, and of those 15, only 6 have used them. Additionally, farmers face difficulties in replenishing their loans through regular deposits due to high transaction costs and limited access to banks. To address this issue, the Activity has established 10 branchless banking (BLB) points at 10 KCC vendor agrovets, enabling KCC holders to deposit money through these BLB vendors.

- Agri-businesses seeking to expand their product sales through marts and supermarkets must comply with Nepal Government's food quality control standards. This requires registering their business with relevant government agencies and adhering to proper preparation and packaging rules, which can increase production costs. Although the Activity provided technical training and material support to enhance product quality, competition with similar products, particularly those from India due to the porous border, remains a significant challenge.

- Farmers and businesses in the FtF zone are seeking loans to expand their operations, despite affordable interest rates offered by banks. However, the loan approval process can be time-consuming. Consequently, farmers are managing this situation in two ways. First, they are accessing loans from cooperatives and micro-finance institutions, which often have higher interest rates, sometimes double those of banks, and require membership in the cooperatives to be eligible for loans. Second, some farmers are choosing to manage their businesses without seeking loans, despite their ambitions to scale up.

- As the project approaches its end, there is increasing demand for additional training on machinery repair and maintenance. To address this challenge, the Activity has collaborated with partners in both the public and private sectors to provide the necessary training. Further collaboration with other USAID Implementing Partners could potentially support improvements in this area.

1. Russia–Ukraine crisis response: building food system resilience to global supply chain and climate shocks in Nepal

This Activity responds to the complex and urgent challenges emerged due to the climate change and ongoing Russia-Ukraine war. The activities have been implemented as part of the Cereal Systems Initiative for South Asia (CSISA) Activity, to deliver a rapid and coordinated response to the effects of global supply chain distortions and their implications for smallholder farming households and poor consumers in Nepal. The Activity has two major development objectives.

Objective I. USAID/Nepal and development partners' ability to respond to agrifood systems crises improved through data-driven insights and strategic guidance.

The outputs of Objective 1 will provide USAID and policymakers with a solid evidence base from which to assess potential agricultural productivity at a seasonal time-step. It will also assess the economic and national food security consequences of the Russian–Ukrainian conflict and effects of ongoing price volatility on Nepal's agricultural economy and its smallholder farmers and poor consumers. Strategic use of the Activity's outputs by USAID and its partners is anticipated to enhance development activities which contribute to increased agrifood systems resilience in Nepal. This evidence base will be informed by CSISA's state-of-the-art agricultural and economic forecast modeling to provide monthly agrifood systems situation reports and insights on "best bet" development investment and policy options, to mitigate the effects of global supply chain disruption on smallholder farmers and poor consumers.

Objective II. Smallholder farmers' resilience to economic shocks and climate change improved through sustainable and inclusive irrigation development.

Irrigation is a cornerstone for efforts to increase yields and build farmers' resilience to climate variability and economic shocks such as those associated with the Russia–Ukraine conflict. Building on support provided by USAID Nepal to foster irrigation development and enhance farmers' resilience in the face of the COVID–19 crisis, this activity will continue to support the public and private sectors in sustainable and inclusive irrigation development, including the scaling-out of a previously piloted digital groundwater monitoring system for Nepal. Activities under Objective II will develop locally targeted irrigation scaling strategies, management advisories, and gender-equitable business models, including access to finance for irrigation pumps (with a focus on, but not limited to, solar irrigation). By coordinating and sequencing these actions, CSISA's efforts in irrigation development will build further resilience in Nepal's agricultural systems to economic and climatic shocks, including recent fuel and agricultural commodity price volatility.

Objective 1: USAID/Nepal and development partners' ability to respond to agrifood systems crises increased through data-driven insights and strategic guidance

WORK PACKAGE I: GENERATE MONTHLY SITUATION REPORTS AND FORECASTS ON THE IMPLICATIONS OF GLOBAL PRICE VOLATILITY ON POOR CONSUMERS AND SMALLHOLDER FARMERS

1.1 Agrifood systems situation report

As part of this Work Package, each month CSISA collects and obtains primary and secondary data through regular field surveys by USAID Nepal's implementing partners: Integrated Institute of Development Studies (IIDS), Government of Nepal officials, Nepal Rastra Bank, and World Food Program. The data are used to analyze the dynamics of agrifood situations and generate monthly situation reports on the state of Nepal's agrifood systems. The reports assess the implications of current and future price volatility for smallholder farmers and economically disadvantaged consumers. They present the overall micro- and macro-economic situation of Nepal, including prices of major agricultural inputs and outputs. They also include results from analysis of changes in the monthly and year-on-year prices, with the interpretation focusing on the potential positive and negative impacts on the well-being of consumers and smallholder farmers. In November 2023, the Activity conducted a workshop in Nepal to present and widely disseminate these reports to a range of stakeholders.

***Above**: participants in the dissemination workshop, "Bringing data and evidence to inform decision-making and policy change in Nepal's Agrifood Systems: Integrated Agrifood Systems Situation Reports". Lalitpur, November 3, 2023. Photo: Nabin Maharjan*

To date, CSISA has completed 16 monthly agrifood situation reports, presenting comprehensive insights into price trends of key agricultural input and output prices, associated changes and their potential effects on farmers and consumers in the Feed the Future (FtF) Zone of Influence (ZoI). A Nepali version of the

reports has also been published in collaboration with TAFSSA, enabling a wider reach to stakeholders across Nepal.

To gain an better understanding and ground-truthing of the data, the Activity team (IIDS, IFPRI and CIMMYT) also started high frequency surveying of rural households in the FtF ZoI. Two rounds of data collection were completed successfully, involving 812 households from 10 districts, representing 4 provinces within ZoI. The last round is underway. The Activity is now using the data extensively to prepare monthly situation reports on Nepal's agrifood systems. The market study also included the market center in Kathmandu Valley and surveyed 280 traders to gather food price information. CSISA has now been largely working with IIDS to handover swiftly processes associated with the Activity's achievements. All publications from this work over the reporting period can be downloaded here.

1.2 Agrifood systems situation dashboard

To provide up-to-date information on food markets and food security in Nepal to USAID and other stakeholders, CSISA is in the process of completing an online Nepal Food Security Dashboard. In November 2023, CSISA presented the first draft of the dashboard at a workshop organized by the Activity. Participants representing different stakeholders were invited to contribute to a Word Cloud poll on the dashboard's value and features they would like to see included in it. They were from a range of government decision makers at the national, provincial and local levels, including the National Planning Commission (NPC), Nepal Rastra Bank (NRB), Ministry of Finance (MoF), Ministry of Agriculture and Livestock Development (MoALD), Nepal Agricultural Research Council (NARC), and the Central Bureau of Statistics. Also represented were the private sector such as the Federation of Nepalese Chambers of Commerce and Industry (FCCI), agrovets and farmers, as well as relevant national and international development organizations, NGOs, donors, multilateral lenders, and UN agencies, as well as independent researchers from academic institutions and thinktanks who are working on similar themes, including Agriculture and Forestry University, Tribhuvan University, Kathmandu University, and Policy Research Institute. Based on this feedback, in December 2023 CSISA prepared a list of 10 major suggested improvements to the dashboard and circulated the relevant stakeholders, including USAID for comments and feedback.

Most of these improvements have now been incorporated into a new version of the dashboard due to be released in June, 2024. This version will contain eight sections, providing:

- the objectives, background of the dashboard, and acknowledgements
- summary statistics for selected food prices in Nepal, including nominal prices, real (inflation-adjusted) prices and price indices
- production, trade and net import dependence ratio for user-selected food commodities
- average contribution to caloric intake of each food in the Nepali diet
- seasonality of the prices of user-selected foods
- maps showing poverty and vulnerability in Nepal by province
- a calendar showing the planting and harvest times for major food crops
- monthly bulletins generated by the Activity, in a viewable and downloadable form.

After this upgrade, team scientists are primed to prepare a Nepali version of the dashboard and train the IIDS team to host and maintain the website. Using an application programming interface (API) will allow the dashboard to be automatically updated each month with new price data.

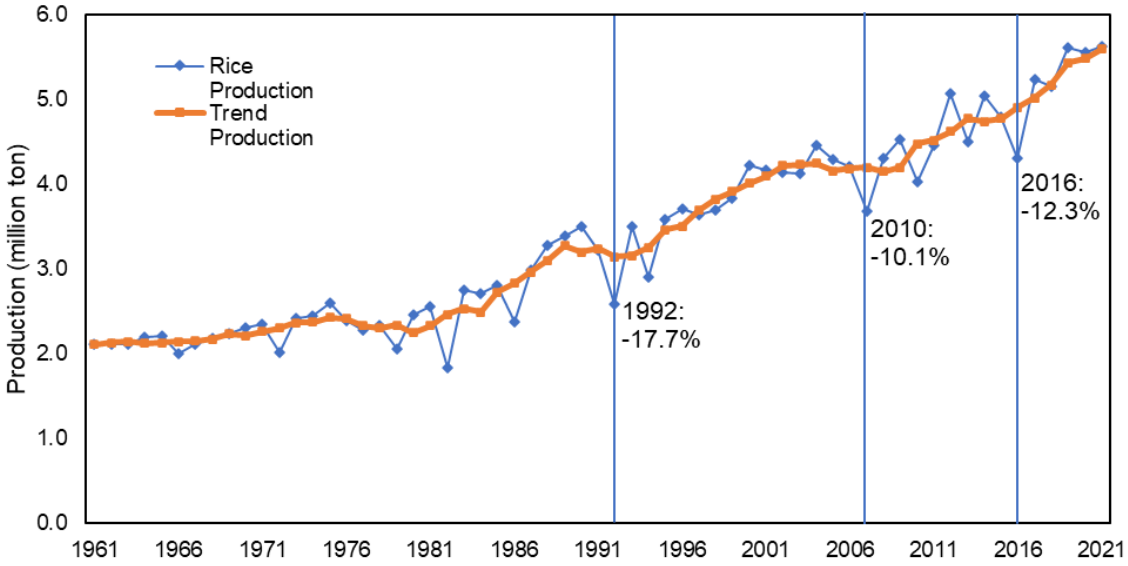
***Above**: results of the Word Cloud Poll, illustrating participants' interests and expectations about information and features on the dashboard. The poll was taken at a workshop of agrifood systems stakeholders, organized by CSISA. Kathmandu. November 2024.*

1.3 Agrifood systems policy guidance notes

During the reporting period, and at the request of USAID, CSISA generated and published short-run and medium-run policy simulations, by assessing the potential effectiveness of hypothetical policy interventions on the well-being of smallholder farming households and poor consumers. These simulations provide quantitative estimates of the policy and market interventions that may be required to mitigate the financial effects of economic shocks on poor consumers and smallholder farmers' well-being. In doing so, the Activity is identifying and suggesting how both USAID Nepal and Government of Nepal may need to respond to maintain and improve livelihoods and agrifood systems productivity.

The first short-run and medium-run policy simulations considered climate and economic shocks experienced in 2023, with a specific emphasis on the ongoing *El Niño* year and its potential impacts on Nepal's food systems. The results indicate that the potential adverse effects of an *El Niño*-related drought in Nepal could be significant. Simulations suggest that rice and wheat production in Nepal could fall by 17.7 percent and 7.5 percent, respectively, relative to trend production in the last major *El Niño* drought year, which was 1992. If 2023–4 productivity losses are in the range of those in other El Niño years, model simulations of the productivity shock equal to the average of the last three major shocks indicate that gross domestic product (GDP) could fall from 1.2 percent to 2.2 percent, with an average of 1.8 percent) even without world price shocks, potentially resulting in a high degree of poverty. The findings accentuate the significance of initiatives aimed at promoting rainfed varieties of rice and other natural resource management technologies suitable for drought conditions. The Government of Nepal recently published rice production estimates for this year that are being compared to the simulation outputs. The Activity is

now focused on further simulations by considering the government's new production estimates and analyzing how government fertilizer subsidies will affect various categories of farmers and consumers in the context of relatively dry weather.



***Above**: Rice production (actual vs. trend with five-year cantered moving average) from 1961 to 2021. The years indicated are those which had major El Niño events. **Source**: Authors' calculations using FAOSTAT (2023) data (Food and Agriculture Organization of the United Nations, 2018).*

1.4 Capacity development and improved self-reliance

Two individuals from the Activity partner organization IIDS have been empowered through CSISA activities and are now significantly contributing to regular data collection and drafting monthly situation reports, with input from IFPRI and CIMMYT. The team leads the analysis of price data collected by the World Food Program. Through CSISA, IIDS also coordinates the dissemination of the monthly situation reports via social media and other channels. IIDS, a Nepali think tank, is now capable of preparing these reports without CSISA's support. The IIDS team also designed and implemented the second and third rounds of household surveys and is currently analyzing the data to generate new insights into food security, diet quality, coverage of social safety net programs, access to agricultural inputs, and other key indicators. IIDS has expertise in conducting similar reviews to produce relevant policy recommendations. After June 2024, the team members are planned to engage in dashboard operationalization. By the end of the Activity in June 2024, IIDS is expected to be ready to independently maintain the food security dashboard.

WORK PACKAGE II: IMPROVING POLICIES AND PROGRAMS TO MITIGATE THE IMPACTS OF PRICE SHOCKS ON SMALLHOLDER FARMERS AND POOR CONSUMERS

2.1 Evidence generation on trans-border informal trade in inputs and outputs

Agrifood trade is the largest component of Nepal's trade, yet it is not well understood, especially the distribution between formal and informal trade. To gain insights into agrifood trade, particularly the extensive informal trade, CSISA's partner the South Asia Watch on Trade, Economics and Environment (SAWTEE) conducted a survey as part of Work Package II. This survey aimed to gather information on informally traded products at various locations and to understand the nature of informal trade, including its conduct, the agents involved, organizational structure, and the role of policies in both countries. Primary respondents included traders, processors, wholesalers, retailers, agrovets, customs agents, clearing agents, and government officials at customs and other border points. A total of 74 key informants were interviewed at five major border points: Birgunj, Bhairahawa, Biratnagar, Birtamode, and Kakarvitta. To identify the drivers of informal trade and the role of policy choices in determining its distribution relative to formal trade, the team analyzed formally recorded trade data at the disaggregated 8-digit level for the pre- and post-COVID periods. The first draft of the trade study was submitted to CIMMYT in April 2024, and the revised report has been shared with USAID for review and comments. The full report will be provided in the next CSISA Annual Report.

Major findings and challenges: Trans-border trade in agricultural inputs, particularly seeds and fertilizers, is primarily driven by price disparities and the timely availability of products in specific locations. Delays in accessing approved seed varieties and insufficient knowledge among farmers regarding their proper utilization can lead to pest infestations. Fertilizers, in particular, show significant price variations, largely due to subsidies in India. In some border villages, as much as 70-80% of farmers' fertilizer requirements are met through Indian markets. This dependency on cross-border supplies can affect smallholder farmers by making them vulnerable to fluctuations in availability and price changes in neighboring countries, potentially leading to increased production costs and reduced crop yields.

Informal trade in rice and vegetables between India and Nepal involves households and traders of varying scales. India's domestic policies, such as the food subsidy system and its modifications, are key factors influencing the informal rice trade. Policy shocks, like India's ban on rice exports, have immediate and discrete effects on this trade. Nepal's domestic rice mills struggle to compete, further contributing to informal trade. Unlike rice, the trade in vegetables exhibits a two-way flow, as seen during India's 2023 tomato crisis.

For smallholder farmers, these dynamics mean they must navigate an unpredictable market environment where policy changes and supply disruptions can directly impact their livelihoods. Consumers, on the other hand, may experience fluctuations in the availability and prices of essential food items, influencing food security and dietary quality. The reliance on informal trade channels can also limit the effectiveness of regulatory measures aimed at ensuring food safety and quality.

Quantifying informal agrifood trade is neither impractical nor impossible, though it may not be error-free. In this context, the key questions revolve around understanding the drivers of informal trade and the allocation between formal and informal trade. The primary effects of informal trade are significant in terms of policy ineffectiveness, which can undermine government policy choices in both countries.

2.2 Evaluate and generate recommendations to improve social safety nets

A significant portion of its population in Nepal is highly vulnerable to various economic shocks. Strong and effective Social Safety Nets are essential to reduce vulnerability and help lift more people out of poverty. The Activity reviewed the design, coverage, budget allocation, and implementation mechanisms of major Social Safety Net programs in Nepal and identified areas for improvement. The Government of Nepal has heavily invested in expanding the scope and coverage of Social Safety Nets over the past decade. Currently, they cover almost one-third (32%) of households, accounting for nearly 2 percent of the country's GDP and 5–6 percent of its annual budget. Expanding Social Safety Nets would require addressing several financial constraints, detailed below.

The Government of Nepal implements more than 45 Social Safety Net programs and 42 additional social protection programs. Social Safety Net reform in Nepal should consider consolidating these programs to reduce their total number. This consolidation would support the expansion of Social Safety Nets coverage and ensure more effective utilization of transferred resources by beneficiaries.

Means testing is not used as part of targeting. Instead, most Social Safety Net programs in Nepal target specific categories of individuals (such as those aged ≥ 60 years, widows, people with disabilities, children) and geographic areas. The CSISA survey conducted in rural areas of the FtF ZOI shows that more than 90 percent of all older women and men, both poor and non-poor, received cash transfers. Means-based targeting of old-age allowances may free up significant resources, redirecting them to those with greater needs for state support. Moreover, two-thirds of total cash assistance under Social Safety Net programs accrues to senior citizens, compared to only 7 percent allocated to children, despite the incidence of poverty being twice as high among children. The government should consider allocating more resources to Social Safety Net programs aimed at supporting children.

The lack of recent data on the incidence of poverty (no poverty data has been published by the Government of Nepal since 2010) poses a challenge in designing effective safety nets and assessing the impact of existing programs. Investing in the regular collection and analysis of household data would help deploy scarce financial resources for Social Safety Nets more effectively. Lastly, the COVID-19 pandemic revealed that Nepal's Social Safety Net was not equipped to deal with such a crisis. Given that large parts of Nepal are prone to natural disasters, the Government needs to invest in preparing a roster of the most vulnerable households and enhancing the state's capacity to scale up existing programs during times of crisis. These investments and preparations need to be undertaken during normal times.

Objective II: Building smallholder farmer resilience to economic shocks and climate change through sustainable and inclusive irrigation development

The ongoing conflict in Ukraine initially and considerably impacted Nepal's food systems, particularly through rising food and fuel prices, though trends have largely stabilized. Nepal's agricultural production is already severely constrained by climate change and low levels of irrigation use, despite the availability of groundwater resources. High fuel and fertilizer costs constrain productivity and raise production costs for farmers, creating a double-negative impact with significant consequences for struggling farmers. Timely and adequate irrigation can help smallholders achieve optimum returns on their increasingly costly fertilizer investments. Solar pumps, more efficient diesel pumps, and irrigation services can enhance productivity and resilience for smallholder farmers, though irrigation must be coupled with good agronomic management practices. This is especially crucial during the dry season when vegetables, wheat, and edible oils are produced, but irrigation can also boost resilience during late monsoon rains or dry spells that affect rice and maize grown during the rainy season. However, smallholder farm households, especially those from marginalized groups, will likely require access to finance to afford investments in irrigation technologies. Concurrently, the capacity for sustainable groundwater management needs enhancement to ensure the conservation of critical ecosystems, such as national parks containing river dolphins, tigers, and rhinoceros populations, as irrigation use intensifies.

Objective II builds resilience in Nepal's agrifood system by investing in sustainable and inclusive irrigation development to increase domestic crop production and protect productivity gains against climate and economic shocks while also conserving and managing groundwater. This is achieved by prioritizing the most promising irrigation-scaling opportunities in partnership with public and private sector partners and by focusing on developing irrigation business models with access to finance and solar irrigation. To keep irrigation use within an environmentally safe operating space, Objective II's first Work Package expands the coverage of the previously piloted digital groundwater monitoring system and build government capacity for sustainable groundwater management. Work Package II focuses on scaling sustainable and inclusive irrigation. Progress in both Work Packages over the reporting period are detailed below.

WORK PACKAGE I: COMPREHENSIVE EXPANSION OF DIGITAL GROUNDWATER MONITORING IN NEPAL TO GUIDE IRRIGATION INTENSIFICATION THAT BOOSTS RESILIENT AGRICULTURAL PRODUCTION, ESPECIALLY FOR STAPLES AND EDIBLE OILS

1.1 Scaled-out groundwater monitoring system

The groundwater monitoring system developed by CSISA with the Government of Nepal now holds details of wells in 20 districts—nine in the west (Kanchanpur, Kailali, Bardiya, Banke, Dang, Kapilbastu, Rupandehi, Nawalparasi West, Chitwan) and 11 in the east (Saptari, Siraha, Dhanusha, Mahottari, Sarlahi, Rautahat, Bara, Parsa, Jhapa, Morang, Sunsari)—and a total of 283 shallow tubewells and 41 deep tubewells

across the 25 districts in the FtF zone. The Activity has trained data collectors (or enumerators) who are collecting monthly datasets from each well and has contacted each data collector in every district individually to ascertain their confidence in completing the survey form. Additionally, further data points were collected from five eastern districts to calculate the default measuring point of the wells, a crucial parameter in the dataset.

As a part of the Activity's digital groundwater monitoring collection effort, a Digital Data Collection for Groundwater Monitoring: Enumerator Manual was officially release on October 11, 2023, in a meeting chaired by Mr. Gopal Sigdel, Secretary of the Ministry of Energy, Water Resources and Irrigation (MoEWRI) and attended by Ms. Sarita Dawadi of the Water and Energy Commission Secretariat (WECS), Mr. Bishnu Belbase of Groundwater Resources and Development Board (GWRDB), Mr. Churna Bahadur Wali from Department of Water Resources and Irrigation (DWRI) and CIMMYT. The manual will empower and educate data collectors with the methodology for digitally collecting groundwater data.

***Above**: Secretary of MoEWRI Mr. Gopal Sigdel (second from left) and Ms. Sarita Dawadi (third from left), formally presenting the "Digital Data Collection for Groundwater Monitoring: Enumerator Manual" at its official launch, Kathmandu. October 11, 2023. Photo: Deepa Woli*

During this phase of the Activity, a key challenge has been ensuring the continuity of data collection amid the transition of the groundwater monitoring work from the Ground Water Resources Development Board (GWRDB) to a new institution. CSISA helped the Government of Nepal to engage enumerators from 20 districts until the end of the Activity to support this transition. Concurrently, the Activity has been in discussions with the Ministry of Energy, Water Resources, and Irrigation (MoEWRI) to identify who will take responsibility for this work moving forward and to promote its continuation.

Based on these discussions, the Water and Energy Commission Secretariat (WECS) has been proposed as the agency to continue monitoring and overseeing the operation and maintenance of a groundwater monitoring system dashboard (see section 1.2 for details). Although the Cabinet has not yet approved this proposal, CSISA has continued to showcase its work on groundwater. This includes presenting the groundwater dashboard and several case studies describing the use of groundwater monitoring data for research purposes at the 12th Annual Groundwater Symposium, titled "Challenges and Opportunities for Sustainable Development and Management of Groundwater," held in Kathmandu on March 18, 2024.

1.2 Groundwater monitoring system upgraded to improve features of the system/dashboard

CSISA is working with the Government of Nepal to enhance the groundwater monitoring system dashboard in alignment with the Activity's digital data collection strategy for groundwater monitoring. Regular, comprehensive upgrades have introduced several new features aimed at improving usability and functionality. A notable feature is the digital library section, which provides convenient access to a repository of 324 PDF reports for researchers, students and other stakeholders.

The administrator interface now includes additional functionality that allows for the addition of wells and the management of data through create, read, update, and delete (CRUD) operations, a crucial feature for the data pipeline. This enhancement enables data collectors to easily upload new data without requiring coding expertise, thereby streamlining the data management process. The Activity will also add a "Contact Us" page to facilitate the submission of queries and feedback to the administrator. These enhancements are poised to make the Activity's groundwater monitoring system dashboard even more robust and user-friendly, ensuring it continues to meet the evolving needs of its stakeholders.

The recent update to the data storage policy of KoboToolbox's community plan has capped the free tier (which used to offer unlimited data storage) at one gigabyte. While the account remains free of cost, this new cap on data storage presents some limitations as the groundwater monitoring data continues to grow. CSISA has manually removed the old data stored on the KoboToolbox server, after backing it up to make space for incoming data. The Activity is also making efforts to automate this process, ensuring that new data is smoothly integrated into the system.

1.3 Data and evidence for natural resources management policies

Along with upgrading and scaling out the groundwater monitoring system developed by the Ground Water Resources Development Board (GWRDB) with CSISA, this work package (Activity III) generates data and evidence to inform natural resource management policies. Work is aimed at informing integrated and sustainable groundwater management by utilizing data and analytics from the groundwater monitoring system to guide decision-making and planning. In this context, two province-level stakeholder consultation workshops were conducted in February 2023 to gather insights from various stakeholders on planned irrigation development priorities in Lumbini and Sudurpaschim provinces, with a particular focus on groundwater management. Based on the workshop discussions, a detailed report outlined the need to explore perspectives of different farmer groups on current and preferred information channels. This exploration aims to inform and devise future advisory content and appropriate delivery mechanisms for piloting crop-specific and season-oriented irrigation advisories.

Based on the findings, season-oriented irrigation advisories were developed for the rice and wheat growing seasons using various dissemination mechanisms such as distribution of factsheets, interactive voice response (IVR), and SMS-based advisories (see section 2.2.A for more details). Similarly, qualitative research was undertaken in Banke and Kailali districts to explore farmer perspectives on current irrigation management practices and future preferences for irrigation-related advisories (see section 2.1 for details

of the research methodologies and preliminary findings). A third workshop is planned for June 2024 to share findings from both the advisories and the qualitative study.

WORK PACKAGE II: ACCESS TO RESILIENCE ENHANCING AND INCLUSIVE IRRIGATION INCREASED

2.1 Actionable and targeted irrigation partnership and scaling strategies

The limited research on groundwater irrigation, information sources, and mechanisms is largely based on survey data, with minimal qualitative exploration of the constraints farmers face when making decisions about groundwater irrigation management practices at the local level. To fill this research gap, the Activity conducted a qualitative study titled "Constraints and Opportunities in Irrigation-Led Agricultural Intensification in Rice Production Systems: Farmer Perspectives from Nepal" in four localities in Kailali and Banke districts. In each district, two villages were selected (two in Kailari and Joshipur municipalities, Kailali district, and two in Khajura and Duduwa municipalities, Banke district) based on their responsiveness to irrigation intensity.

During the initial field visit, the Activity conducted a mapping exercise in each village to gain a spatial and holistic understanding of the study sites, involving men and women village leaders who were knowledgeable about the village. A second field visit employed a snowball sampling method to conduct 14 semi-structured interviews in each village, capturing diverse farmers' perspectives based on their current irrigation management practices and pump set ownership/usage. Participant selection was based on three typologies of farmers (always the household head) who practice varying irrigation intensities (high, medium, low). There were a total of 56 semi-structured interviews, of which 15 were with women. The research also explored the intra-household gendered division of agricultural labor and household decision-making regarding irrigation management practices.

Preliminary study findings indicate that smallholder farmers face various physical, financial, informational, and human resource-related constraints when making decisions about irrigation intensification. The research aims to support both policymakers and researchers by providing in-depth insights into farmer practices and perspectives. Currently, the understanding of farmers' perspectives on irrigation management practices is limited. The findings are expected to enhance understanding of current constraints in irrigation management practices, thereby supporting future scaling strategies for irrigation-led intensification. The initial findings were presented at the 12th Groundwater Symposium, "Challenges and Opportunities for Sustainable Development and Management of Groundwater," in Kathmandu, on March 18, 2024. Conference proceedings can be found here.

2.2 Consolidating management practices

2.2.A Policy briefs and adaptive irrigation management manuals

During the reporting period, CSISA co-developed factsheets on efficient irrigation management for wheat and spring maize. CSISA also co-invested with agriculture knowledge centers, local government

agricultural offices, and cooperatives to disseminate context-specific irrigation advisories in the Terai region of Lumbini and Sudurpaschim provinces. Through this effort, a total of 9,500 printed advisories for wheat and 2,850 printed advisories for spring maize were distributed via commonly used information channels such as agrovets, cooperatives, and machinery dealers across the Terai districts.

The Activity also utilized IVR calls to raise farmers awareness and enhance knowledge of efficient irrigation management during dry periods. CSISA also coordinated with local governments and agriculture knowledge centers to involve them in developing and mainstreaming irrigation advisories into their programs. These provided information on critical irrigation, and the urea (nitrogenous fertilizer) requirement stage for wheat, which contribute to increasing and stabilizing crop yields. Preliminary monitoring evaluation results suggest that IVR messaging helped to improve judicious use of fertilizer, especially urea, and management of irrigation. Alongside these benefits, IVR calls conversely also associated with some initial challenges for farmers, for whom unfamiliarity with the voice messages and technology created some confusion. Low literacy levels and language barriers were the major issues, addressed by delivering messages in local languages – Awadhi, Tharu, and Nepali – to the targeted audience in irrigation-responsive areas. In addition, SMS notifications were sent to targeted farmers prior to IVR calls, supporting them to allocate ample time to listen to the message. This also facilitated the option to listen to the message in a family or in a group. The Activity also utilized the existing network of cooperatives and agrovets to reach a large number of farmers, and digital media such as IVR to increase access to information for rural farmers.

2.2.B Consolidate irrigation and natural resources in Rani Jamara and Kulariya Irrigation Scheme (RJKIS) in Kailali district

Training in irrigation scheduling for irrigation system managers and engineers

***Above**: participants on the last day of the training delivered by CSISA to irrigation system managers held at Nepalgunj, October 2–6, 2023. Photo: Basanta Parajuli, CIMMYT.*

An irrigation scheduling training was held from October 2–6 in Nepalgunj, with the participation of engineers from the RJK, Babai, Mahakali and Banganga irrigation projects, and CSISA. The training focused on soil–plant–climate interactions and management at the farm scale, with the aim of enhancing participant capacity to apply sustainable water management practices and tools under different agronomic conditions and contexts, while at the same time taking into consideration management, engineering and environmental issues. The 26 participants included six women engineers from irrigation projects, government agencies and research organizations. The majority of trainees were water resource engineers, followed by agricultural engineers.

The program successfully enhanced trainees' capacity to apply sustainable water management practices, focusing on utilizing FAO AquaCrop to improve crop productivity. By the end of the workshop, participants gained theoretical knowledge of crop water requirements, learned to deploy the FAO AquaCrop software to evaluate optimized irrigation schedules, and improved their understanding of how small-scale farmers can adapt irrigation scheduling to increase crop yield and water productivity.

Training to farmers and water user associations

From January 3–4, CSISA facilitated training on irrigation scheduling using the Chameleon Soil Water Sensor for farmers of the Jamara Sub-branch Water User Association (WUA) at the WUA committee office in Tikapur, Kailali district. The Chameleon Soil Water Sensor is a tool designed to measure soil moisture at different depths, helping farmers manage irrigation more effectively. It consists of a series of color-coded sensors that change color based on the moisture level in the soil, providing a visual indication of whether the soil is too dry, adequately moist, or too wet. This simple and inexpensive device is meant to aid farmers in making informed decisions about when and how much to irrigate, ultimately improving water use efficiency and crop productivity. CSISA has been engaged in testing the sensor's appropriateness in Nepal over the last season.

***Above**: Nirman Shrestha, trainer, explaining the Chameleon Soil Water Sensor and demonstrating its use to farmers at the Jamara Sub-branch Canal Committee office, Kailali district. January 2024. Photo: Jibesh K.C.*

The training covered the basic principles behind the sensors and included practical sessions on their installation and use. Forty-three farmers (including six women and four youth) and seven other stakeholders (including two females and two youths) participated in the two-day event. As part of the field visit, 21 Chameleon sensors were installed in farmers' fields and field staff were trained to collect data from them.

***Below:** Number of Chameleon Soil Water Sensors installed with canal sub-branch water user groups under the Jamara network*

Canal sub-branch water user group (WUG)	Number of Chameleon sensors installed for testing
Motinagar canal sub-branch WUG	5
Gyani canal sub-branch WUG	7
Patrabit canal sub-branch WUG	1
Rampur Katanpur canal sub-branch WUG	1
Dharampur canal sub-branch WUG	7

The training program exposed farmers to new methods to measure soil moisture levels and conduct action research in their fields. By the end of the workshop, participants had acquired basic knowledge of soil moisture and its optimal levels for agriculture, skills to use the Chameleon card reader to measure soil water levels with the sensor, and an improved understanding of how to adapt irrigation scheduling to increase crop yield and water productivity.

To systematically understand how the adoption of Chameleon sensors enables improved irrigation scheduling and ultimately higher yields, CSISA is conducting experiments with two main treatments: a baseline group and an intervention group. Additionally, three associated treatments are implemented to consider any spillover effects from the intervention. In the control treatment, farmers do not use Chameleon sensors and irrigate their crops according to conventional knowledge. Farmers in the intervention group adopt the sensors. Data on crop yields, irrigation practices, sensor readings, and other household characteristics are currently being collected for analysis. This analysis will evaluate the extent and direction of the impact of using the Chameleon sensor on irrigation intensity and yield, compared to the control group. The findings, which will be provided in the Annual Report, will offer insights into the effectiveness of irrigation scheduling on irrigation intensity and crop yield, with potential opportunities for expanded sensor use.

Assessment of groundwater irrigation needs (including solar-powered irrigation) and gaps within canal areas (including in Kailali)

The main objective of this assessment was to gain a broad understanding of the status of groundwater needs and the access to groundwater for agriculture among smallholder farmers, women, and marginalized groups, with a particular focus on access to energy for pumping groundwater. The findings and recommendations from the assessment are expected to support the CSISA Activity, its partners, and the service providers of agricultural mechanization and inputs in better understanding and addressing critical groundwater access issues. These issues prevent smallholder farmers, including women and marginalized groups, from engaging in and benefiting from agricultural production. The information in the assessment report will also help conceptualize and develop inclusive business models for groundwater access in the RJKIS command area. The study was desk-based and qualitative, involving a literature review followed by a field visit to the RJKIS command area. During the field visit, the research team conducted semi-structured interviews with women and men farmers, as well as key stakeholders, including government officials, Water User Associations (WUAs), machine and irrigation pump suppliers, and agrovets.

Key findings indicate that groundwater availability in parts of the Western Terai can support efforts to improve food and nutrition security. Approximately half of Kailali district's arable land is irrigated with surface water, while the rest has potential for combined surface water and groundwater use. Economic barriers, including high initial costs for installation, energy expenses, and the absence of government financial support, disproportionately affect marginalized and smallholder farmers in accessing groundwater for irrigation. Groundwater, as a shared resource, is predominantly accessible to landowners, and existing water policies do not adequately address groundwater ownership separately. Policy barriers such as eligibility requirements for agriculture meters, loans, and subsidies—including proof of land ownership or

lease agreements and citizenship—perpetuate social and economic disparities. Women and marginalized farmers frequently encounter obstacles in meeting these criteria, as they often lack necessary information and vital documents, and face language barriers. The absence of guidance exacerbates their struggle to access these resources, widening the gap. Additionally, farmers without their own wells or boreholes, or those with fragmented parcels of land, depend on neighbouring fields for well or borehole access. Informal reciprocal agreements and the lack of standardized pricing for fuel, pumps, and water add complexity to pricing structures, furthering unequal access and control over groundwater among farmers.

Recommendations emerging from this preliminary study include considering a well-designed business model as a strategy to mitigate disparities in groundwater access by establishing standardized pricing and formalizing water trade between farmers in the communities. Lessons learned from Nepal's participatory natural resource management can be adopted for groundwater management. Establishing effective market linkages would ensure satisfactory revenue generation from agricultural production and encourage farmers to invest in groundwater extraction. Tailored training and capacity building should be prioritized for women farmers and agricultural entrepreneurs, focusing on new, climate-resilient agricultural technologies.

2.3 Business models for irrigation expansion and intensification co-developed with public and private sector partners

2.3.1 Target group meetings

Above: *Mr. Bishal Bista, Field Supervisor, conducting a TGM in Kailali district, October, 2023. Photo: Surya Bahadur Khadka*

During this reporting period, CSISA facilitated seven target group meetings (TGMs) in Kailali and Kanchanpur districts. The TGM helps to identify the potential and interest of irrigation entrepreneurs who need Activity support to enhance skills and knowledge to grow and expand their businesses. TGMs also contribute to understanding the basic needs, interests and motivations of the irrigation entrepreneurs.

***Below**. Disaggregated information of participants in target group meetings held by CSISA to identify the interest and potential of irrigation entrepreneurs*

Date	Target group meeting location	Participants		
		Male	Female	Total
Kailali district				
Oct 8, 2023	Ghodaghodi 11 Sisaiya	16	0	16
Oct 14, 2023	Ghodaghodi 11 Sisaiya	16	0	16
Oct 15, 2023	Joshipur 2 Joshipur	10	1	11
Oct 17, 2023	Janaki 4 Munuwa	24	0	24
Kanchanpur district				
Nov 7, 2023	Krishnapur 1 Sundariphanta	5	17	22
Nov 8, 2023	Laljhadi 2 Kanja	12	11	23
Nov 9, 2023	Belauri 6 Richaha	8	7	15

2.3.2 Development of business model for water entrepreneurship and other irrigation related enterprises

During the reporting period, CSISA co-developed business models in coordination with government line agencies, the Activity team, machinery dealers, service providers, and banking and financial institutions. A rapid market study, three stakeholder dialogue meetings, and two interaction meetings with financial institutions were conducted to identify and validate a desirable, viable, and feasible business model in irrigation-related businesses. These efforts identified three types of businesses—pump rental, repair and maintenance, and tubewell drilling—as potential irrigation service providers. These businesses aim to cater to smallholder farmers, improving the accessibility, affordability, and reliability of irrigation services.

***Above**: stakeholders at an interaction workshop facilitated by CSISA discussing business models for irrigation entrepreneurs. [location? date?]. Photo: Bijay Pokhrel*

Stakeholders emphasized the importance of these irrigation-related businesses, highlighting the urgent need to strengthen irrigation entrepreneurs. Formalizing these businesses through official registration was

deemed crucial, given their current informal operations. Two interaction workshops with banking and financial institutions validated the irrigation entrepreneur service business model and discussed access to services. Participants stressed the necessity for formal business registration to facilitate access to government and non-government benefits and banking services. The study also highlighted the prevalence of cash transactions and limited digital literacy among entrepreneurs, underscoring the need for enhanced digital education.

***Below**. List of business model validation workshops conducted by the Activity during the reporting period*

Date	Venue	Participants
December 17, 2023	Lamahi, Dang	35 participants representing government offices (AKC, PMAMP, agriculture division of the municipality/rural municipality) and other stakeholders and private sector organizations (e.g., agrovets, machinery dealers/suppliers, cooperatives, FNCCI representatives, and individual entrepreneurs offering services including tubewell drilling, repair and maintenance) and farmers from Dang and Kapilvastu districts
January 3, 2024	Nepalgunj, Banke	24 participants representing government offices, municipality and other stakeholders from Banke and Bardiya districts
January 4, 2024	Dhangadhi, Kailali	30 participants representing government offices, municipality and other stakeholders from Kailali and Kanchanpur districts

***Below**. List of interaction events with financial institutions and other stakeholders to discuss access to better irrigation services through irrigation entrepreneurship*

Date	Venue	Participants
January 5, 2024	Dhangadhi, Kailali	20 participants representing banks, agriculture cooperatives, machinery dealers, cooperatives, microfinance, repair and maintenance entrepreneurs and other relevant stakeholders from Kailali and Kanchanpur districts.
January 26, 2024	Nepalgunj, Banke	15 participants representing banks, agriculture cooperatives, machinery dealers, cooperatives, microfinance, repair and maintenance entrepreneurs and other relevant stakeholders from Kailali and Kanchanpur districts.

2.3.3 Capacity building training to irrigation entrepreneurs

Business management and basic irrigation pump repairs trainings

The Activity facilitated six business management training sessions for 128 irrigation entrepreneurs, empowering them in critical aspects of business: how to enhance transaction volume, capture target

customers through effective segmentation, and leverage branding and marketing channels for sustained growth and quality service delivery.

***Above**: an irrigation entrepreneur presenting her business plan for feedback as part of training facilitated by CSISA, Kanchanpur district. December 2024. Photo: Sudip Birkram Karki*

CSISA also delivered nine basic repair and maintenance training events to irrigation entrepreneurs during the reporting period. These trainings aimed to educate 125 entrepreneurs on the importance of pump servicing, scheduling, and proper engine maintenance for longevity. Participants received light coaching from expert mechanics and engaged in hands-on practice. The training covered various servicing procedures, including changing lubricants, cleaning air and oil filters and nozzles, fuel pump repair, governor setting, piston ring checks, changing crank bearings, adjusting the timing gear and cam gear, engine head repair, adjusting valve clearance, inspecting and repairing the sparking system, cleaning the carburetor, and inspecting and solving coupling, pump seal, and impeller issues.

Intensive technical training for repair and maintenance entrepreneurs

During the reporting period, the Activity facilitated three hub-wise technical trainings for a total of 31 irrigation entrepreneurs who deliver repair and maintenance services. They engaged in five days of intensive technical repair and maintenance training for electric motor pump sets. The training built confidence in participants to expand their service offerings beyond basic diesel/petrol engine repair, creating potential additional income streams, fostering business growth and sustainability, and serving more smallholder farming families. By addressing the growing demand for pump repair services, the trained individuals are now equipped to contribute to timely and high-quality service delivery, fulfilling the specific needs of customers and supporting agricultural

***Above**: pump set mechanics repairing electric motors during intensive technical training. Nepalgunj 19, Banke district. March 2024. Photo: Shreya Malla*

productivity in their communities. Their ability to provide prompt and efficient repair and maintenance services locally is paramount for ensuring uninterrupted irrigation for smallholder farmers. By bridging the gap in service provision, these entrepreneurs not only facilitate improved agricultural productivity but also significantly contribute to enhancing food security within their communities.

Mechanical tubewell drilling training for tubewell drilling mechanics

The Activity facilitated three days of training for 16 tubewell drilling mechanics, enabling them to enhance their skills and gain practical knowledge of mechanical tubewell drilling using a power tiller, a machine widely available among agricultural households in Nepal. Given the limited availability and high cost of labor in Nepal, developing capacity for mechanical drilling services reduces reliance on manual labor and complex drilling equipment. This training boosted the confidence and efficiency of tubewell drilling mechanics, empowering them to support smallholder farmers effectively by facilitating access to and usage of mechanical systems for tubewell drilling.

***Above**: tubewell drilling mechanics enhancing their skills and building confidence during advanced training facilitated by CSISA. Rajapur 5, Bardiya district. March, 2024?. Photo: Shreya Malla*

2.3.4. Support to irrigation entrepreneurs

Marketing of irrigation services

To support irrigation entrepreneurs in expanding their businesses in Activity districts, CSISA and its private partners produced and distributed various advertising materials. A total of 13,500 visiting cards, 121 signboards, 60 danglers, and 121 data record books were provided to 121 irrigation entrepreneurs during training events, door-to-door visits, and small group meetings. Before engaging in CSISA's marketing and promotion activities, these small enterprises had limited familiarity with self-promotion. The collaboration has significantly improved their business visibility. The support provided by the Activity heightened awareness of their irrigation services among local farming communities, prompting them to distribute business cards to farmers, cooperatives, and other stakeholders.

***Above**: handing over a sign board to mechanic Bishnu Maya Regmi (right), Kapilvastu district. January 28, 2024. Photo: Binod Dhakal*

Business registration

Irrigation service provision businesses remain unacknowledged as formal businesses by key stakeholders such as local government bodies, financial institutions, and pump suppliers and retailers. Consequently, these enterprises face challenges registering with governmental sectors and establishing themselves as legitimate entities. However, due to the Activity's rigorous follow-up with irrigation entrepreneurs, coordination with local bodies, and documentation support, 16 irrigation entrepreneurs successfully registered with local government and began operating as formal businesses. This registration opens up additional opportunities for these enterprises, such as eligibility to participate in bidding processes and to apply for loans from financial institutions.

Challenges during the reporting period

Challenges specific to the CSISA–Ukraine response Activity

- Engaging irrigation engineers and irrigation system managers in farming and agriculture-related endeavors was challenging due to their primary focus on structural development activities. Despite the Activity's attempts to involve irrigation engineers in training for farmers and with WUAs in soil moisture measurement, they did not participate. There is room for improvement in how to include them in such endeavors.
- A third workshop under Objective 1 was planned to combine the handover of the GWRDB dashboard with the dissemination of research findings. The delay in the transition of GWRDB to WECS has hampered this, but the expectation is that by mid-June the Activity will be in a better position to conduct the workshop before it ends in June.
- To support the transition and to ensure the continuity of groundwater data collection, enumerators from 20 districts have been hired till the end of April 2024. After April 2024 there will be an interruption in data collection unless the transition of GWRDB is finalized.
- The Activity faced delays in conducting research into soil moisture measurement using Chameleon sensors due to the delay in finalizing the protocol, while the process of importing the sensors from the US took longer than envisioned. The Activity's irrigation advisories received an overwhelmingly positive response from farmers. However, we realized that with water scarcity as a recurring issue for most of them, they will benefit more if we couple this with weather forecasting. To achieve this, CSISA will collaborate with the hydromet unit of Nepal Agricultural Research Council (NARC). The Activity has also added a toll-free number to the advisories so that farmers can easily request additional information from Ministry of Agriculture and Livestock Development (MoALD) and NARC.
- Irrigation entrepreneurship, especially tubewell drilling, is a long standing and traditional business in Nepal. With the increasing demand for groundwater, local governments are sourcing out drilling businesses through the bidding process. This is a huge business opportunity for irrigation entrepreneurs; however, to participate in the bidding process they need to be registered with the municipalities. Similarly, without a formal business status, small business owners are losing out on the opportunity to access bank loans. It was a two-step process, first to motivate irrigation entrepreneurs to get registered and second to support them with the paperwork for the registration process.
- Similarly, the Nepal government has delayed its decision about who will continue groundwater monitoring work after its decision to dissolve GWRDB last year. This risks the timely handover of the groundwater monitoring dashboard, including the sharing of research findings.