



INITIATIVE ON
Mixed Farming
Systems



CGIAR Research Initiative on **Mixed Farming Systems**

Annual Technical Report 2023

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Disclaimers

This publication has been prepared as an output of the CGIAR Research Initiative on Mixed Farming Systems. Any views and opinions expressed in this publication are those of the author(s) and are not necessarily representative of or endorsed by the CGIAR System Organization.

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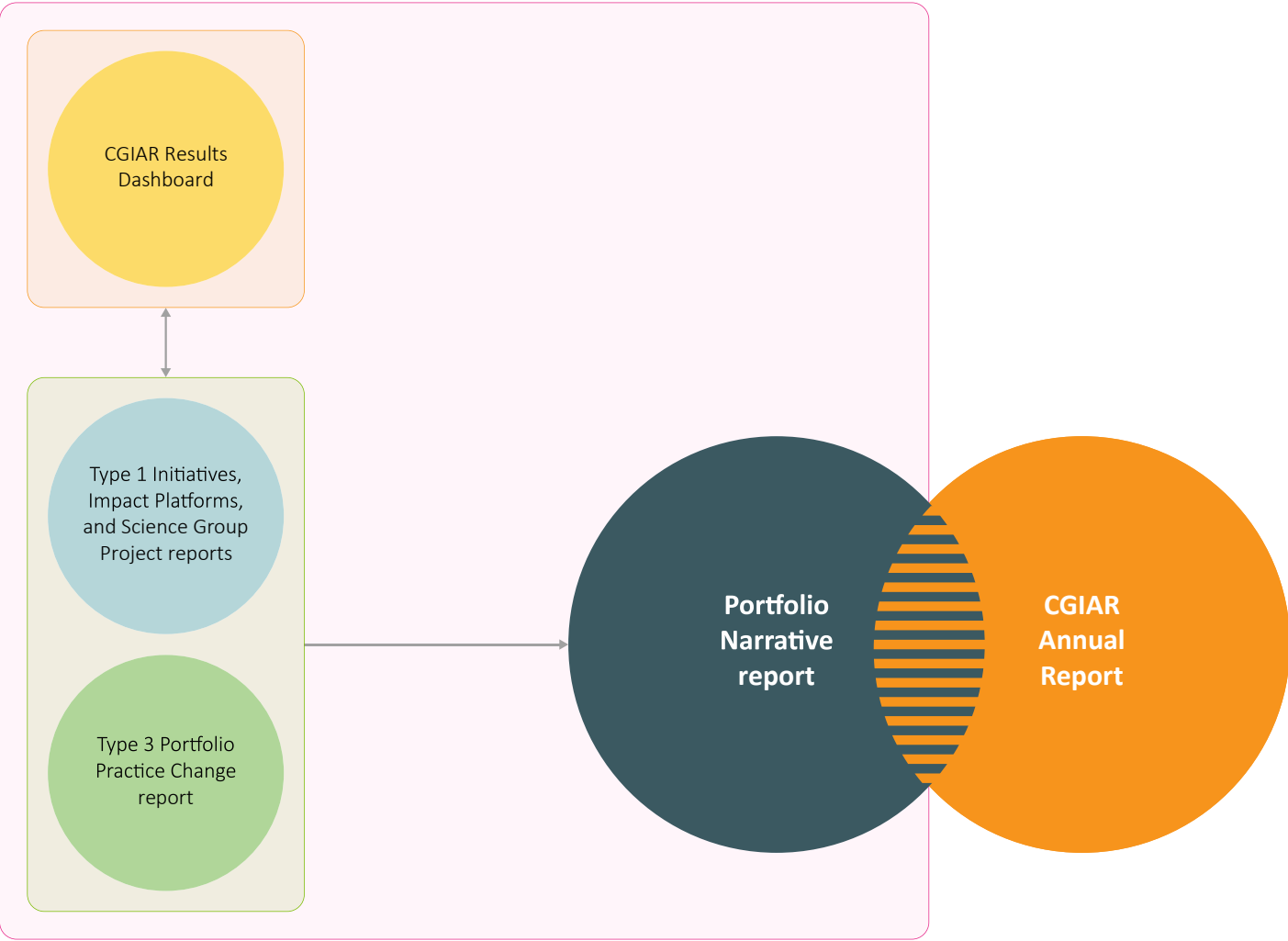
CGIAR Technical Reporting 2023

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

The [CGIAR Technical Report](#) comprises:

- Type 1 Initiative, Impact Platform, and Science Group Project (SGP) reports, with quality assured results reported by Initiatives, Platforms and SGPs available on the CGIAR Results Dashboard.
- The Type 3 Portfolio Performance and Project Coordination Practice Change report, which focuses on internal practice change.
- The Portfolio Narrative, which draws on the Type 1 and Type 3 reports, and the CGIAR Results Dashboard, to provide a broader view on Portfolio coherence, including results, partnerships, country and regional engagement, and synergies among the Portfolio’s constituent parts.

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



Section 1: Fact sheet and budget

Initiative name	Sustainable Intensification of Mixed Farming Systems
Initiative short name	Mixed Farming Systems
Initiative Lead	Mateete Bekunda (m.bekunda@cgiar.org)
Initiative Co-lead	Santiago Lopez-Ridaura (s.l.ridaura@cgiar.org)
Science Group	Resilient Agrifood Systems
Start – end date	01/04/2022 – 31/12/2024
Geographic scope	Countries Bangladesh · Ethiopia · Ghana · Lao People’s Democratic Republic · Malawi · Nepal
OECD DAC Climate marker adaptation score ¹	Score 1: Significant The activity contributes in a significant way to any of the three CGIAR climate-related strategy objectives – namely, climate mitigation, climate adaptation and climate policy, even though it is not the principal focus of the activity.
OECD DAC Climate marker mitigation score ¹	Score 2: Significant The activity contributes in a significant way to any of the three CGIAR climate-related strategy objectives – namely, climate mitigation, climate adaptation and climate policy, even though it is not the principal focus of the activity.
OECD DAC Gender equity marker score ²	Score 1A: Gender accommodative/aware Gender equality is an objective, but not the main one. The Initiative/project includes at least two explicit gender specific outputs and (adequate) funding and resources are available. Data and indicators are disaggregated by gender and analyzed to explain potential gender variations and inequalities.
Website link	https://www.cgiar.org/initiative/19-sustainable-intensification-of-mixed-farming-systems/

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

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

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

EXECUTIVE SUMMARY

Smallholder mixed farming systems dominate the global South. They consist of varied multifunctional factors in constant interactions, including food and cash crops, livestock species, pastures and forests, soils, landscape, and climate. Farmers’ experiences and knowledge have enabled them to manage these interactions over time, but the increasing rate at which many of the factors are changing is exceeding farmers’ capacity to maintain mixed farms sustainably. A predominantly commodity and biophysical research and development (R&D) approach has led to important improvements in single-system components (such as higher cereal grain yields through monocrop and high input use or higher milk yield through purchased feed). However, considering that smallholder mixed farms are multicomponent and multifunctional systems, the CGIAR Research Initiative on Mixed Farming Systems (MFS) has embraced a systems science approach in conducting its integrated R&D activities at the farm and farming system levels. The Initiative aims at generating sociotechnical innovation bundles (STIBs), assuming both technologies and institutional innovations are needed to better develop and scale alternatives for small-scale farmers. This necessarily involves multidisciplinary and multi-institutional collaboration.

During 2023, the Initiative established 44 cross-Initiative collaborations, and 15 CGIAR Centers contributed to producing 214 results from across the six target countries (Bangladesh, Ethiopia, Ghana, Lao People’s Democratic Republic [PDR], Nepal, and Malawi). The Initiative also established 147 formal and informal partnerships among national and international research institutions, and development agencies. Of the 214 results, 206 were research outputs achieved across the five Work Packages (WPs), and eight results related to the Initiative outcomes. About 59 percent of the outputs achieved were knowledge products, 17 percent were innovation development, 14 percent were capacity sharing for development, and 10 percent were other outputs. Seven of the Initiative outcomes were on innovation use, with one on other outcomes. These research outputs and outcomes will contribute to the five measurable End of Initiative outcomes (EOIOs) by 2025.

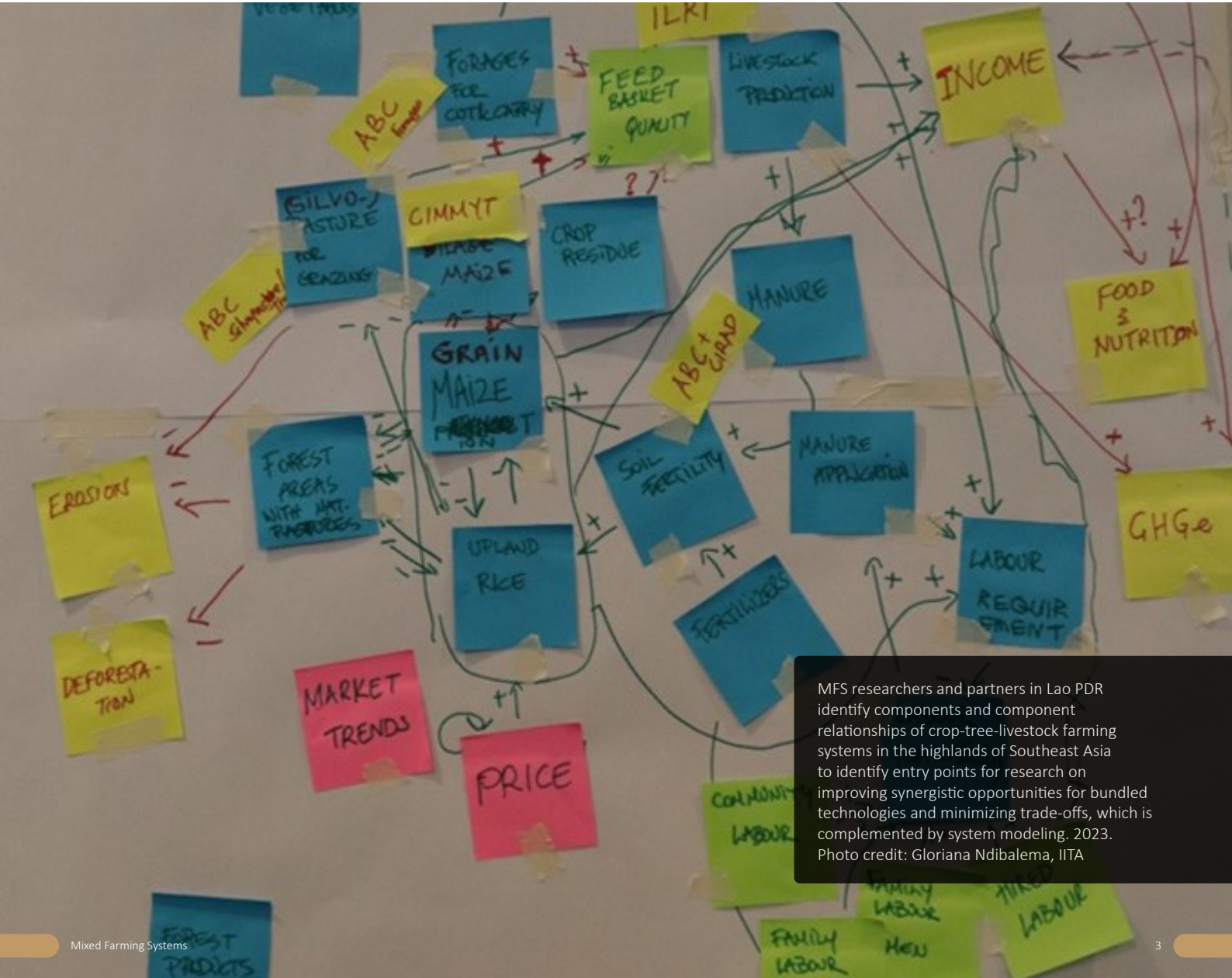
The monitoring, evaluation, learning, and impact (MELIA) team completed three baseline studies in Ethiopia, Ghana, and Malawi in 2023, which provide a necessary basis for measuring the progress of the EOIOs and five Impact Areas. The questionnaire for the studies was developed based on the indicators in the Initiative’s results framework, which are closely related to the sustainable intensification assessment framework (SIAF). A survey tool to track and quantify the progress of the EOIOs for 2024 was developed and is being implemented. Additionally, an impact assessment plan was designed in collaboration with the Standing Panel on Impact Assessment (SPIA) to measure impacts and projected benefits, as stipulated in the Initiative’s theory of change (TOC). The results of these activities indicate significant progress toward the EOIOs.

	2022 ▼	2023 ▼	2024 ▼
PROPOSAL BUDGET ▶	11.46M	\$14.47M	\$14.06M
APPROVED BUDGET ¹ ▶	\$7.80M	\$9.02M ²	\$7.14M ³

¹ The approved budget amounts correspond to the figures available for public access through the [Financing dashboard](#).

² This amount includes carry-over and commitments.

³ This amount is an estimation of the 2024 annual budget allocation, as of the end of March 2024.

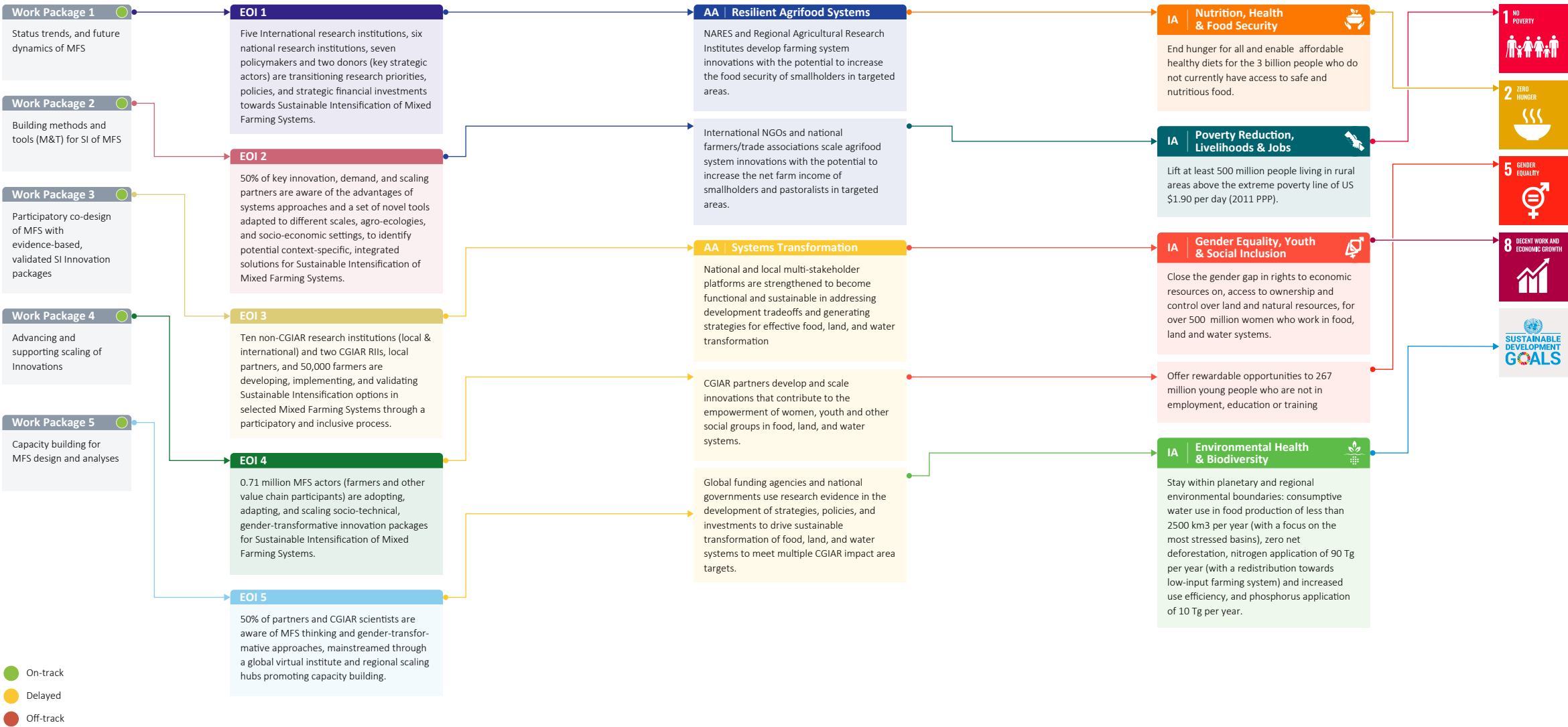


MFS researchers and partners in Lao PDR identify components and component relationships of crop-tree-livestock farming systems in the highlands of Southeast Asia to identify entry points for research on improving synergistic opportunities for bundled technologies and minimizing trade-offs, which is complemented by system modeling. 2023. Photo credit: Gloriana Ndibalema, IITA

Section 2: Progress on science and towards End of Initiative outcomes

Initiative-level theory of change diagram

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



EOIO | End of Initiative outcome
AA | Action Area
IA | Impact Area
SDG | Sustainable Development Goal

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



A woman farmer harvesting vegetables from a mixed farming system comprised maize, avocado, forage, and ensen in Lemo District, Ethiopia. Credit: Fikadu Te/Alliance Bioversity-CIAT

Summary of progress against the theory of change

The MFS Initiative aims to provide equitable, gender-transformative pathways for improving the livelihoods of farmers in seven prioritized mixed farming systems in Africa and Asia. The small-scale farming systems dominant in these regions are complex, not only because of their multiple intersecting components, but also because the whole system is geared toward multifunctionality, wherein income generation, food security, climate and market risk management, preservation of traditions and cultural values, and many other objectives drive the livelihood of families and the way they manage their complex agricultural system. MFS’s research approach thus aims to integrate both biophysical and socioeconomic metrics to gain an understanding of outcomes at the whole-farm or farming system levels, relying on the high-quality research from all different components of mixed farming systems. The cover photo demonstrates how components are identified and how multidisciplinary research (addressing drivers, opportunities, and challenges) is organized to address interactions between crop, tree, livestock, and social subsystems at the appropriate spatial and temporal scales by using systems analysis methods and tools and participatory approaches. A systems thinking modeling approach is applied to evaluate the resilience of the integrated components, as in the example of Ghana in the WP1 progress report. These types of activities address transitioning research priorities and policies of key strategic research actors towards systems science (EOIO 1 and 3) and create awareness among scaling partners of the advantages of context-specific, integrated solutions derived from systems research approaches (EOIO2).

The Initiative’s research activities are implemented in six countries (Bangladesh, Ethiopia, Ghana, Lao PDR, Nepal, and Malawi) and the [results reported in the CGIAR Performance and Results Management System \(PRMS\)](#) present a sum contribution from these countries. The results are presented by WP, but implementation of research activities is interlinked across WPs, as indicated in the TOC and

results framework. In 2023, the Initiative planned and continued implementing research activities for 214 results were achieved. Of these, 206 were research outputs achieved across the five WPs, and eight results related to the Initiative outcomes. About 59 percent of the outputs achieved were knowledge products, 17 percent were innovation development, 14 percent were capacity sharing for development, and 10 percent were other outputs. Seven of the Initiative outcomes were on innovation use, one on other outcomes, and none on policy change. These research outputs and outcomes are expected to contribute to the five measurable EOIOs by 2025.

During this reporting period, the Initiative established 44 cross-Initiative collaborations, and 15 CGIAR Centers contributed to producing the results. The Initiative also established 147 formal and informal partnerships among national and international research institutions, development agencies, donors, and regional state unions. This supports our assumption in the TOC that if these partners understand the benefits of sustainable intensification innovations generated by MFS toward CGIAR’s five Impact Areas, it will trigger genuine interest in supporting an integrated systems approach in the co-development and implementation of sustainable intensification options for mixed farming systems at scale.

To measure the progress of the EOIOs and five Impact Areas, the MELIA team completed three baseline studies in Ethiopia, Ghana, and Malawi in 2023. A questionnaire was developed based on the indicators in the results framework of the Initiative, which are closely related to the SIAF framework. Additionally, an impact assessment plan was designed in collaboration with SPIA to measure impacts and projected benefits, as stipulated in the Initiative TOC. Stakeholder consultations were also implemented in some of the WPs. The results below indicate significant progress on the EOIOs. The MELIA team developed a survey tool to track and quantify the progress of the EOIOs in 2024.

Progress by End of Initiative Outcome

EOIO 1: Increased prioritization of MFS by partners.

A total of 147 partnerships with national and international R&D organizations were established in 2023 to focus on sustainable intensification of mixed farming systems. MELIA has developed a survey tool to establish the extent to which these organizations, policymakers, and donors are transitioning their research priorities, policies, and financial investments toward sustainable intensification of mixed farming systems.

EOIO 2: Improved awareness of methods and tools for MFS.

Progress has been made in the development of tools and methods for systems analysis. National agricultural research systems (NARS) and CGIAR colleagues have been supported in using and applying these methods and tools.

EOIO 3: Increased implementation of MFS.

In 2023, around 147 partnerships with local and international partners (from extension, private, research, and others) worked with farmers and communities to co-develop, co-implement, and co-validate more than 45 context-specific sociotechnical innovations. These efforts were applied in various contexts such as the mid-hills of Nepal, maize-small ruminant systems in northern Ghana, and rice-livestock systems of 20 village hubs in Bangladesh. Extension agents and other relevant partners in at least three countries were also trained in systemic approaches to package, test, and disseminate these innovations.

EOIO 4: Increased adoption and scaling of MFS innovation packages.

During 2023, a total of 125,059 actors used the MFS Innovation Packages for sustainable intensification of the respective farming systems. Most of the actors were farmers (124,126), followed by extension staff (372) and researchers (85).

EOIO 5: Increased capacity for MFS.

Progress has been made on the capacity assessment needs of MFS scientists through a rapid virtual survey. Site-specific capacity development on systems analysis, as well as on sustainable intensification practices for mixed farming systems, were conducted and will continue in 2024. Plans are also underway to develop tools and manuals for the creation of a virtual institute to promote the adoption of mixed farming systems thinking and gender-transformative approaches.



Fodder tree leaves harvested from a mixed farming farm serve as livestock feed. Credit: Nabin Baral/IWMI

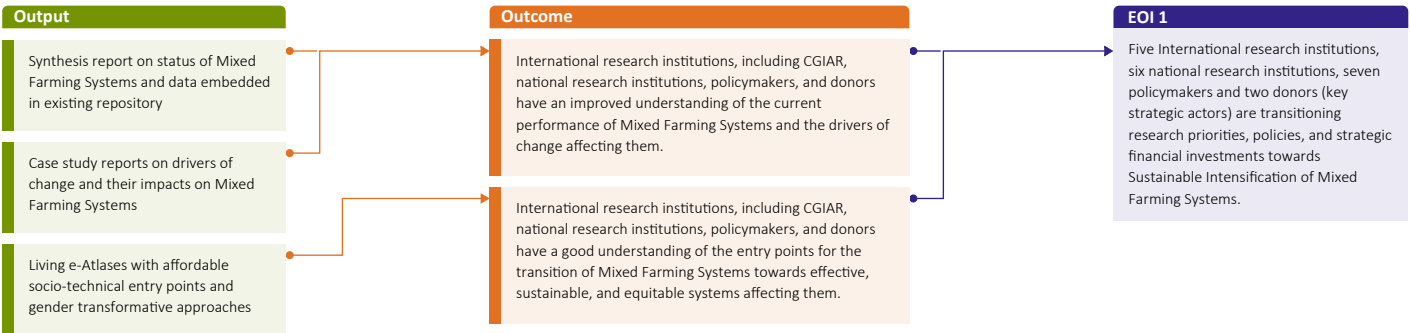


Lady in Lemo carrying mixed fodder to her dairy cows.
Credit: Anthony Whitbread/ILRI

Section 3: Work Package progress

WP1: Status trends, and future dynamics of MFS

On track



Work Package 1 progress against the theory of change

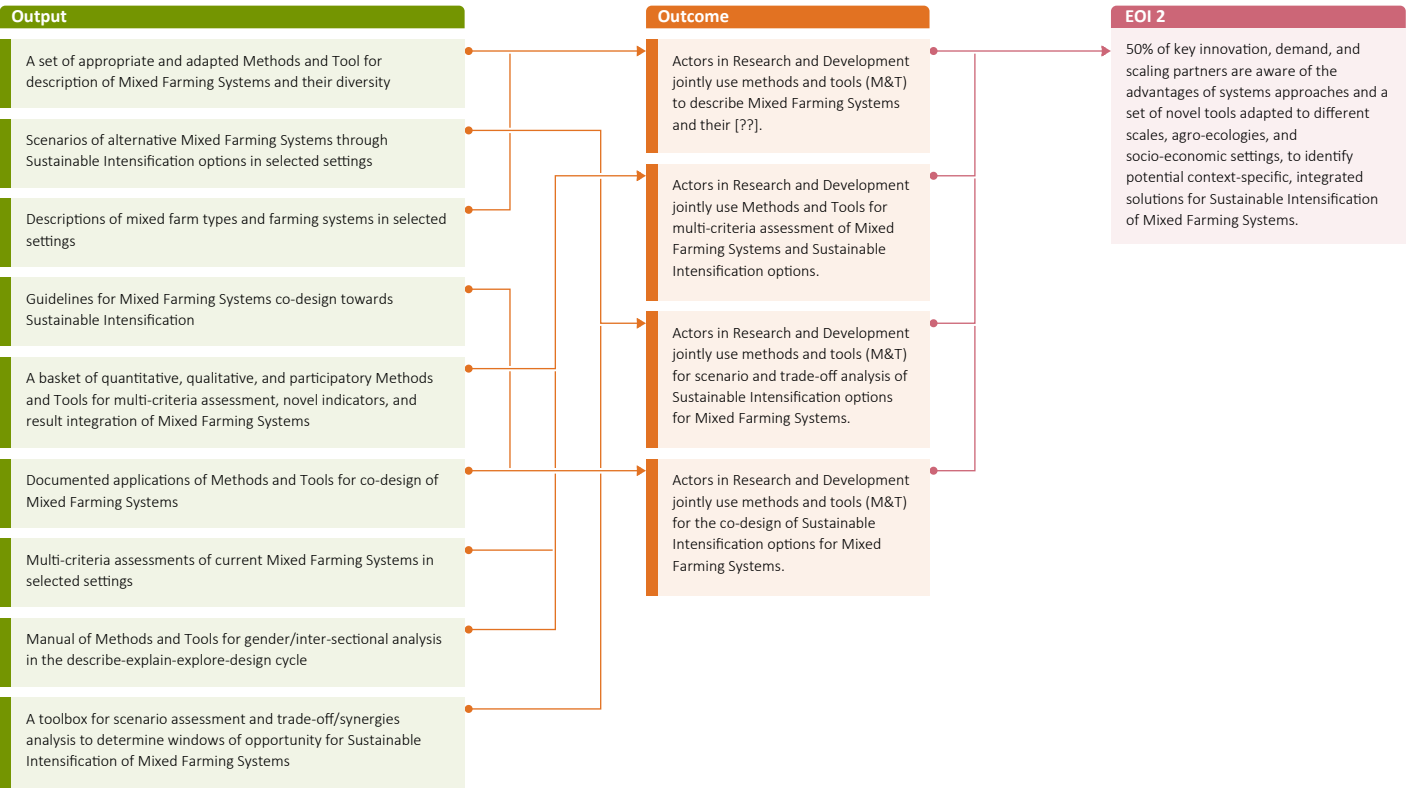
WP1 developed 31 products, leading to better understanding of the status and trends of mixed farming systems. A systematic scoping review was conducted to identify the status of integrated crop-livestock research in mixed farming systems in the [global South](#). Up-to-date household survey and remote sensing data were applied to characterize the status of the mixed farming systems in Bangladesh, [Ethiopia](#), [Lao PDR](#), and [Malawi](#). Most of these mixed farming systems are in rainfed areas, so satellite rainfall estimates were used to determine the variability and trends of rainfall seasonality indexes for [Ghana](#), [Lao PDR](#), and [Malawi](#). Plot-level mapping was used to validate farmers’ recall data collected during the baseline survey, particularly the estimation of acreage, crop yield, and the proportion of land under different management systems. Mobile phone-based tools were used to digitally measure parcel and plots sizes. Land

management practices and levels of land degradation were recorded in the field to verify the self-reported data recorded during the baseline surveys in Ghana and [Malawi](#).

A study in Ghana demonstrated that increased resilience capacity due to adoption of sustainable intensification practices [moderated or mediated the negative effects of heat stress](#) and drought on food security. The mediating role was more stable and stronger. Land-use and land-cover changes in Ethiopia were analyzed and [key drivers of change and their implications](#) were identified. A [system dynamics approach for assessing the resilience](#) of a smallholder livestock-maize-cowpea intercropping system in Ghana was developed to provide insights into how this intercropping system enables households to remain food secure, boost their income, and maintain natural resource capital.

WP2: Building methods and tools (M&T) for SI of MFS

On track



Work Package 2 progress against the theory of change

In WP2, 34 products aimed at developing, adapting, and applying new and existing methods and tools to analyze and design more sustainable mixed farming systems. These methods and tools are framed within the describe-explain-explore-design cycle for systems analysis and design.

Based on household surveys and multivariate statistics, robust methods and tools were developed and adapted to the conditions of the implementation sites, including [Bangladesh](#), [Ethiopia](#), Malawi, and [Nepal](#). Methods and tools to [describe mixed farming systems at higher aggregation](#) levels were also developed, such as at the landscape or administrative units.

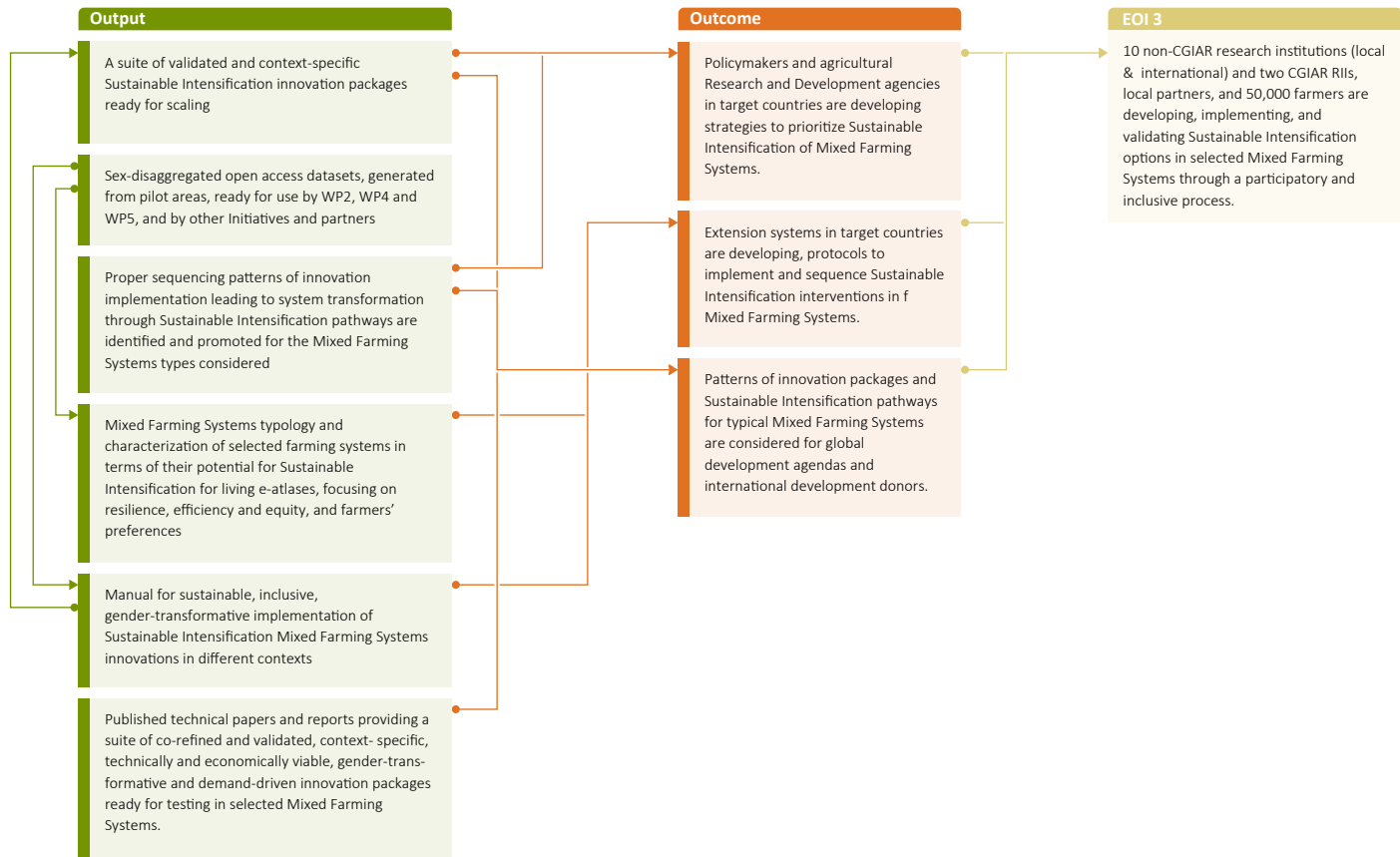
WP2 adapted and applied systems analysis methods and tools based on whole system modeling for the design of more sustainable mixed farming systems, including the [formalization of main objectives and preferences](#) relevant for different types of farming systems,

the [multicriteria assessment](#) of the contributions made by specific sustainable intensification interventions, and the assessment of [trade-offs associated to these interventions](#). Specific methods and tools to improve understanding and key components of mixed farming systems have been adapted and applied, such as the G-FEAST tool for improving livestock feeding options in [Ethiopia](#) and [Lao PDR](#).

[Systemic approaches](#) and [integrated frameworks](#) for mixed farming systems' assessment and design were also applied, and methodological notes for [systems analysis](#) and [co-design](#) were produced, providing insights on the main challenges and opportunities for the application of systems sciences to improve mixed farming systems. Almost all of the activities have been implemented in collaboration with local partners to support the application of systems methods and tools by NARS. Data used has been made publicly available.

WP3: Participatory co-design of MFS with evidence-based, validated SI Innovation packages

On track



Work Package 3 progress against the theory of change

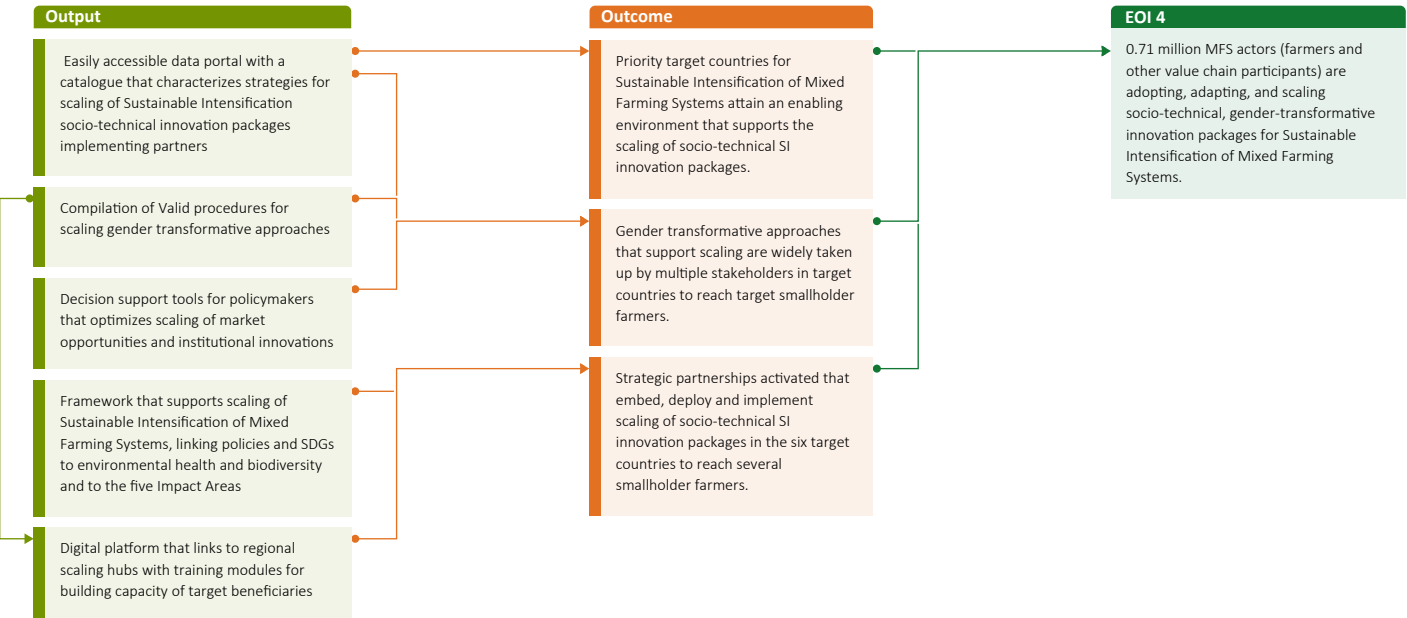
WP3 made progress in analyzing, testing, and piloting solutions for the sustainable intensification of mixed farming systems in implementing countries. Tested and piloted solutions were identified using a [systemic approach](#) to address low productivity, limited resources, and environmental degradation, while promoting resilience and sustainability. In Nepal, WP3 led the [identification of key entry points for sustainable intensification](#) in the mid-hills region. Participatory analysis and co-design were used to pilot relevant interventions, [including efficient water use practices](#) and fodder cultivation.

The integration of maize-small ruminant farming systems in northern Ghana addressed the challenges of low soil fertility and inadequate feed availability. Innovations, including mechanized maize cultivation, [watering practices](#), living cowpea mulch, and leaf stripping for livestock feed, were piloted to address the challenges.

In Bangladesh, WP3 [and partners](#) tested and piloted [innovative cropping systems](#) introduced to diversify and intensify crop rotations, improve [household vegetable](#) production to improve nutrition and income, provide [small mechanization](#) for women and youth, and include [livestock](#) and [relevant fodder crops](#) in [rice rotations](#). Efforts to increase the uptake of cereal-legume-livestock Innovation Packages in central Malawi in a [participatory way](#) have demonstrated the potential for integrated solutions, such the Mbili Mbili strip cropping, coupled with improvements in livestock management and soil conservation practices, to improve productivity and resilience. In Ethiopia, WP3 focused on [co-designing](#) solutions to address resource scarcity, poor management, and limited inputs. The [solutions piloted](#) include alternative feeds, small-scale mechanization, sheep fattening, [wheat and legume varieties](#), and home gardens. [Collaboration between CG Centers](#) in Ethiopia was very useful in packaging innovations.

WP4: Advancing and supporting scaling of Innovations

On track



Work Package 4 progress against the theory of change

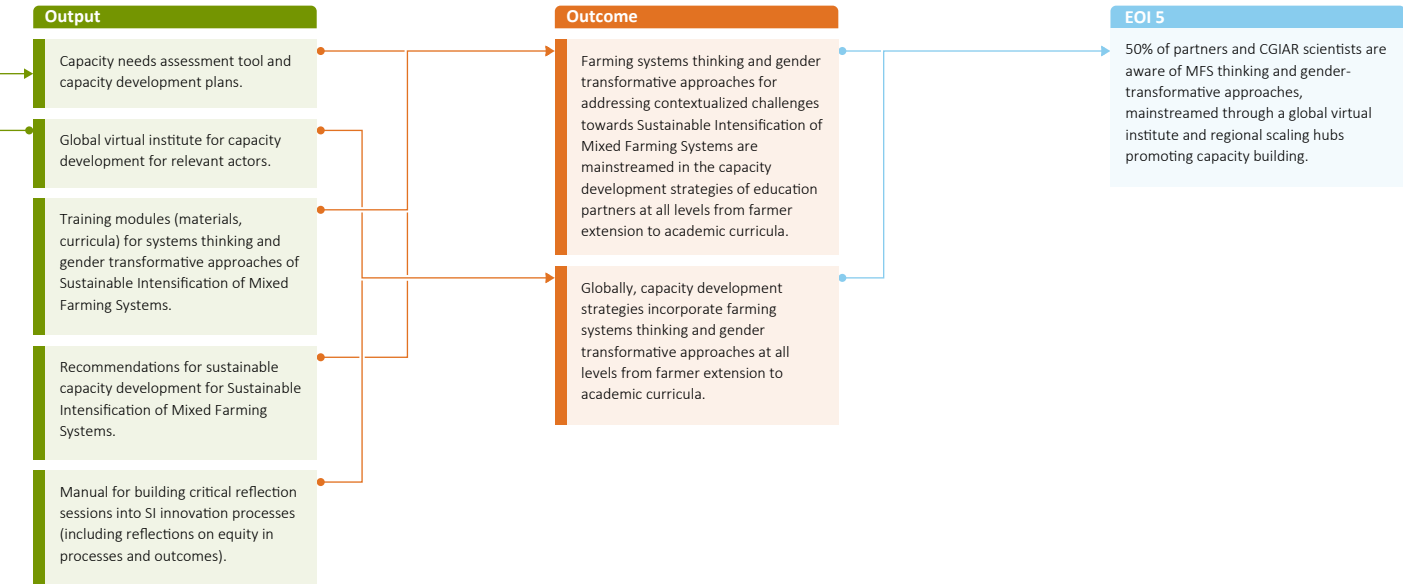
Our 2023 scaling work for WP4 was aligned with the Innovation Packaging and Scaling Readiness framework. A total of [35 innovations](#) were profiled; of these, 83 percent were technical, and the rest were policy and capacity development. Approximately 60 percent of the innovations targeted one or more of CGIAR's Impact Areas at a significant level and about 50 percent had a scaling readiness score of 5 or more. On scaling use, a total of six innovations were packaged. The first one is on commercialization of forage seed businesses in mixed farming systems of the [Ethiopian highlands](#). Two innovations packaged in Nepal focused on improving water use efficiency to increase agricultural productivity through micro-irrigation practices, and an inclusive multistakeholder knowledge-sharing platform on mixed farming system for farmers

and relevant stakeholders. In Ethiopia, another innovation packaging was conducted on the dynamic evolutionary populations of different [durum wheat and barley mixtures in the Ethiopian highlands](#). In Ghana, two innovation packaging exercises were conducted on basal nitrogen phosphorus and potassium fertilizer timing, cowpea living mulch, and leaf stripping for intensification of smallholder maize-livestock farming systems in northern Ghana.

We partnered with 60 scaling partners in six countries (Bangladesh, Ethiopia, Ghana, Lao PDR, Malawi, and Nepal) to contribute to achieving EO10 1. Accordingly, [actors](#) applied the Innovation Packages for sustainable intensification of the respective farming systems. Most of the actors were farmers (124,126), followed by extension staff (372) and researchers (85).

WP5: Capacity building for MFS design and analyses

On track



Work Package 5 progress against the theory of change

WP5 aims to build capacity for the analysis and co-design of mixed farming systems. It focuses on developing capacity on systems approaches for the co-design, implementation, evaluation, and scaling of STIBs.

The capacity needs of 120 MFS researchers were assessed through a rapid virtual survey. With these first insights, a generic framework was developed to inventory the capacity needs of relevant stakeholders, including national researchers, NGOs, government, private sector, and smallholder farmers. This [framework](#) was contextualized for each Initiative country and focuses on the skills, knowledge, and tools required by different types of actors for the co-design process (output 5.1). A methodology was also developed to assess various stakeholders' current capacities and skills.

For the Virtual Institute for Systems Analysis, a mechanism to connect system-related thinkers and practitioners, an [online structure](#) and the attributes of its different components were developed (output 5.2.). In addition, steps were taken to link the systems thinking approach of MFS to systems approaches in other CGIAR Initiatives and beyond (such as with European universities through the Euroleague of Life Sciences).

Various training modules for capacity development have been developed and implemented, contributing to output 5.3. Feedback is being gathered on their impact, which will feed into output 5.4. To avoid missing important indicators and in conjunction with the MELIA team, a monitoring capacity development approach is being developed. This will also feed into a manual on including gender and social inclusion in the sustainable intensification innovation processes (output 5.5).

Work Package progress rating summary

WORK PACKAGE	PROGRESS RATING & RATIONALE
1	Progress rating The status and trends of mixed farming systems in all target countries were characterized by current data obtained from household surveys, remote sensing, and literature surveys. Advanced tools and algorithms were applied to identify drivers of changes in the targeted mixed farming systems.
2	Progress rating On track technically, with important advances in the development and application of systems methods and tools in all sites in collaboration with International Advanced Research institutions (IARIs), National Agricultural Research Systems (NARS) and other CGIAR Initiatives.
3	Progress rating On track, with more than 45 sociotechnical innovations identified (for crops, livestock, soil management, and irrigation, among others). As guided by the TOC, innovations were co-designed, packed, tested, and are being evaluated in a participatory way and in all the Initiative’s countries.
4	Progress rating Various scaling and demand partners have shown keen interest in adapting, adopting, or taking the innovations to scale. This has aligned the WP toward realizing the outputs planned, leading to greater likelihood of achieving the EOIO target.
5	Progress rating On-track technically, with important advances in outputs 1 and 2 all being implemented in the respective target countries.

Definitions

On track Annual progress largely aligns with Plan of Results and Budget and Work Package theory of change. Can include small deviations/issues/ delays/risks that do not jeopardize success of Work Package.	Delayed Annual progress slightly falls behind Plan of Results and Budget and Work Package theory of change in key areas. Deviations/issues/delays/risks could jeopardize success of Work Package if not managed appropriately.	Off track Annual progress clearly falls behind Plan of Results and Budget and Work Package theory of change in most/all areas. Deviations/issues/delays/risks do jeopardize success of Work Package.
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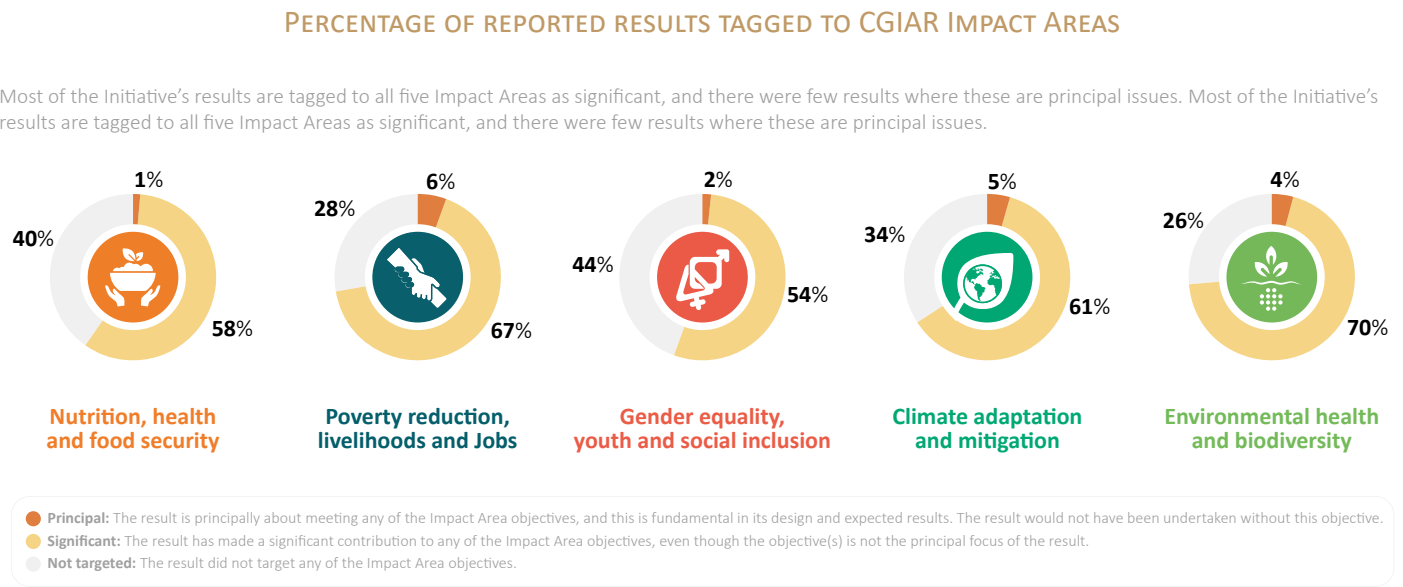
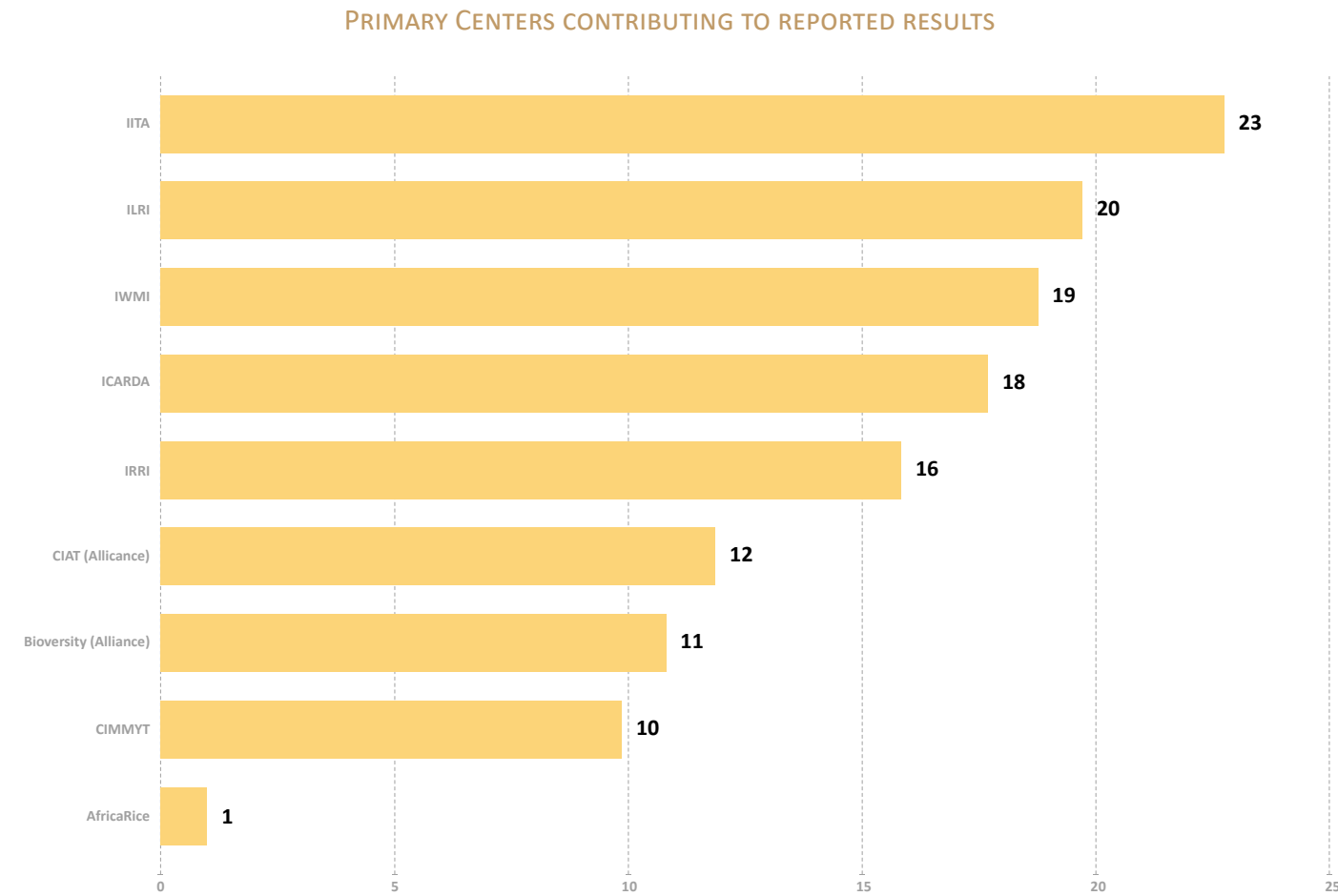
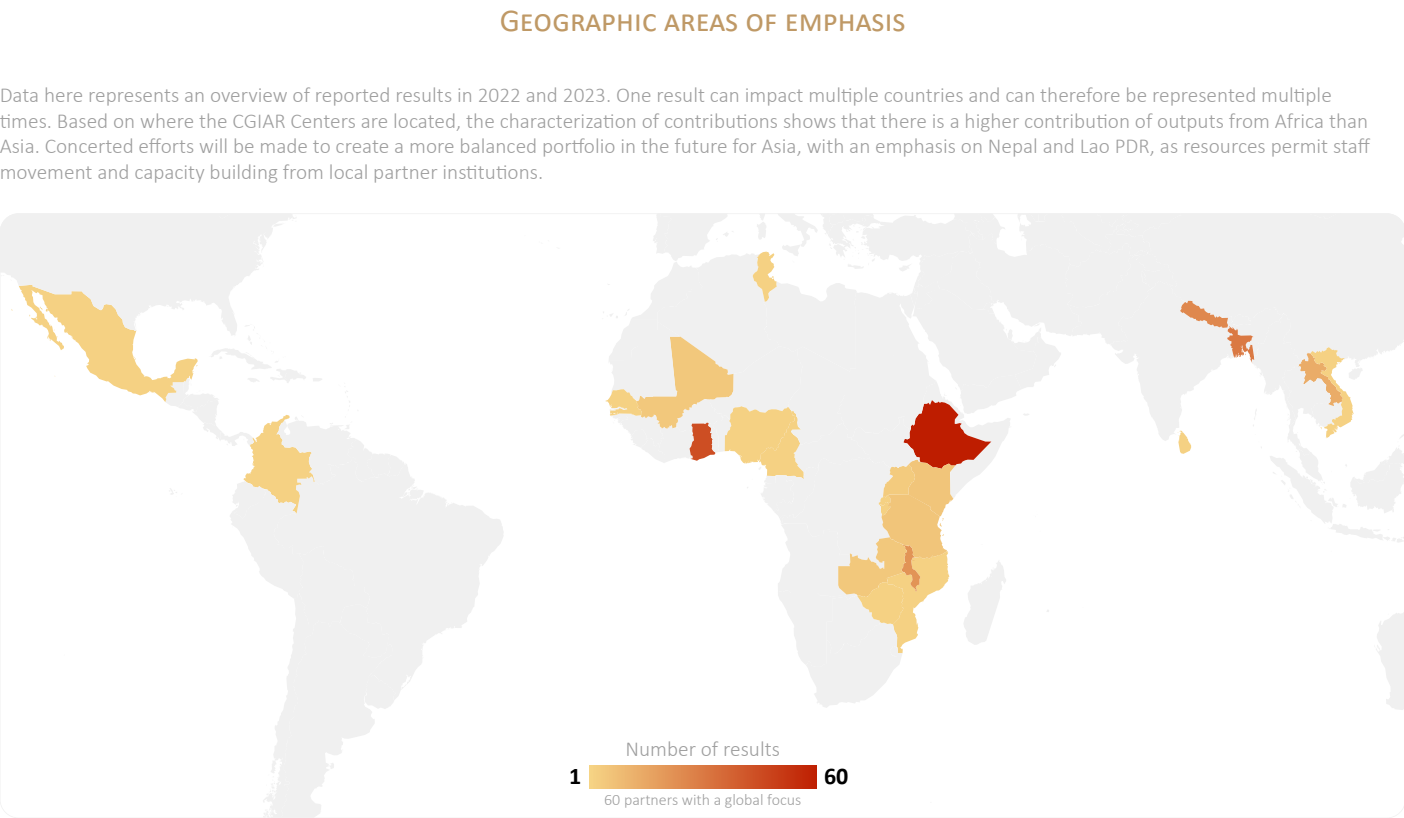
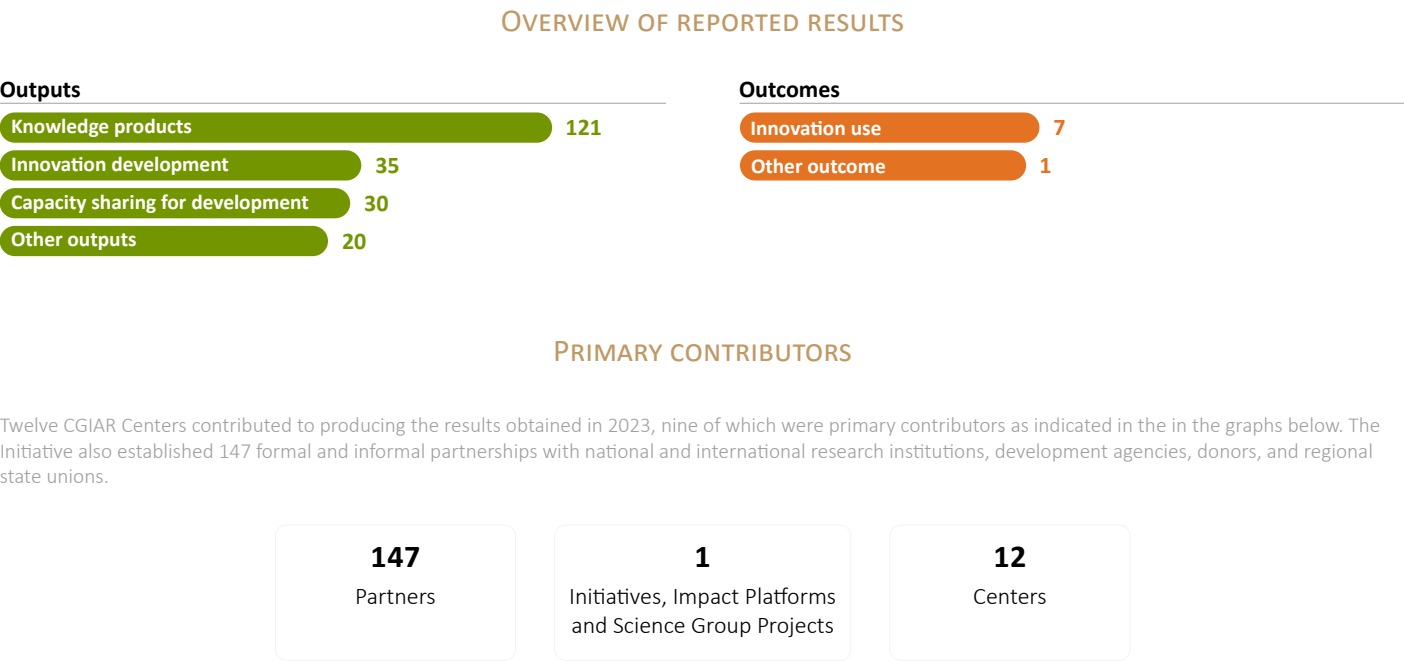


Farmers carry maize back home to mix with other feedstuff (forages, pumpkin, banana trees) for their cattle @ Nonghet District, Xiengkhouang Province, Lao PDR. Credit: Mienmany, S./CIAT

Section 4: Key results

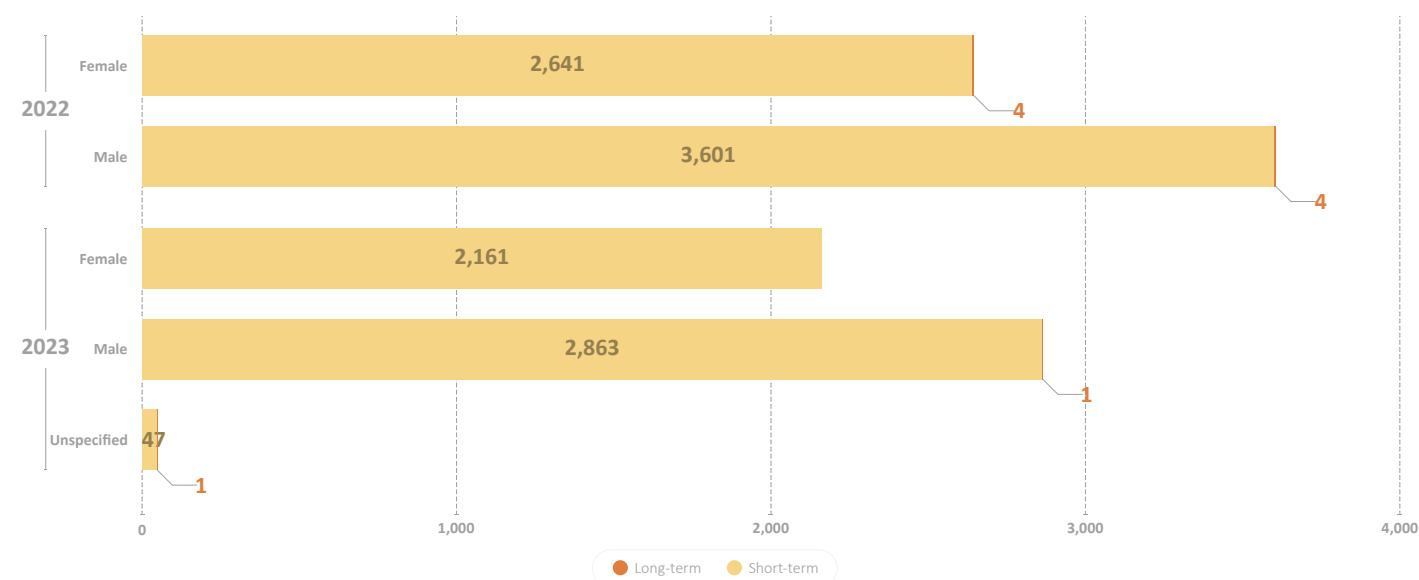
This section provides an overview of results reported by the CGIAR Research Initiative on Mixed Farming Systems in 2023. These results align with the CGIAR Results Framework and Mixed Farming Systems’ theory of change. Source: *Data extracted from the [CGIAR Results Dashboard](#) on 29 March 2024.*

The Initiative research activities implemented in the six target countries (Bangladesh, Ethiopia, Ghana, Lao PDR, Nepal, and Malawi) led to 214 results reported in the PRMS (see graphs below). Of these results, 206 were research outputs achieved across the five WPs, and eight were results related to the Initiative outcomes. About 59 percent of the outputs achieved were knowledge products, 17 percent were innovation development, 14 percent were capacity sharing for development, and 10 percent were other outputs. Seven of the Initiative outcomes were on innovation use, one on other outcomes, and none on policy change.



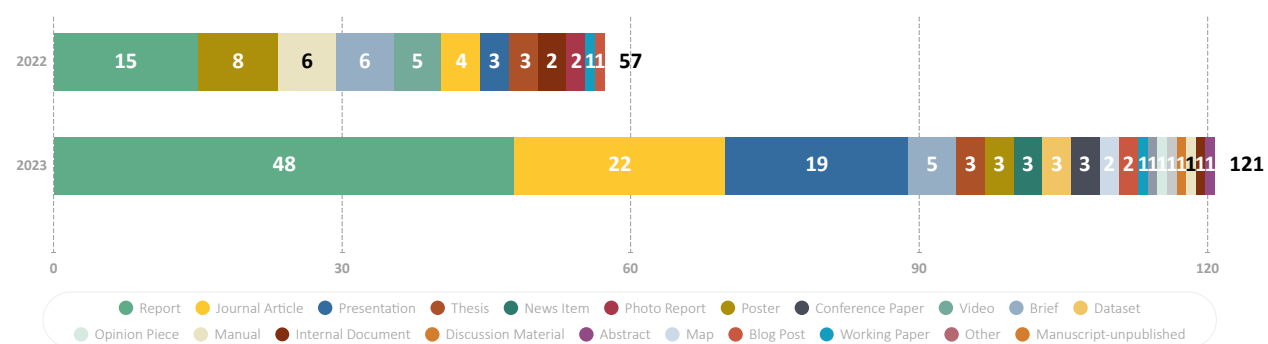
INITIATIVE-WIDE TRAINING

Data here represents an overview of reported results in 2022 and 2023. One result can impact multiple countries and can therefore be represented multiple times. There was a slight decrease in the number of short-term trainees during 2023 compared to 2022, and the proportion of male trainees was still higher (57 percent) than of female trainees. There is a need for more women's representation in future trainings, although the current balance is not alarming. The long-term trainee number dropped from eight during 2022, to only two during 2023. It is believed that the uncertainty of long-term funding during Portfolio 25 discouraged recruitment in this trainee category.



KNOWLEDGE PRODUCTS BY CATEGORY

Data here represents an overview of reported results in 2022 and 2023. One result can impact multiple countries and can therefore be represented multiple times. As expected, knowledge products increased significantly during 2023, as compared to 2022, which was the first year of implementing activities. It is anticipated that, with time, journal articles will form the core foundational product from which most of the other knowledge products can be derived, such as blogs, technical briefs, and videos.

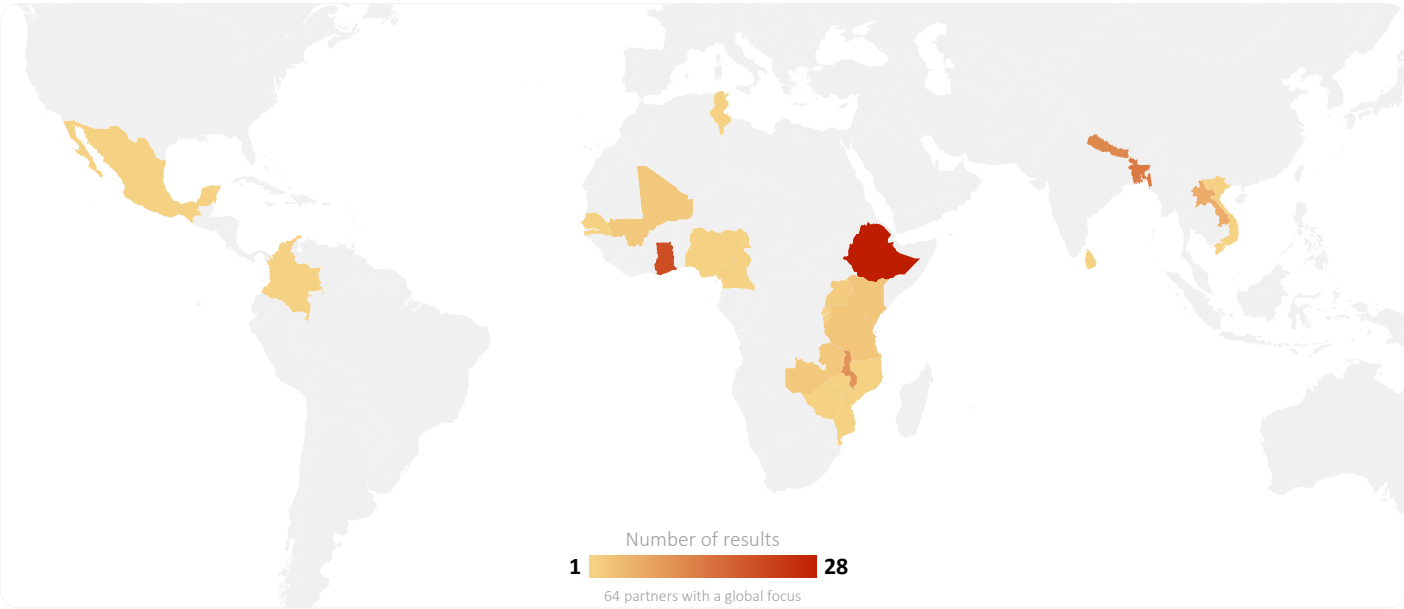


Evaluating fodder for improving the integrated food-fodder and forestry seen in the background. Credit: Rein van der Hoek/ Alliance Bioversity-CIAT

Section 5: Partnerships

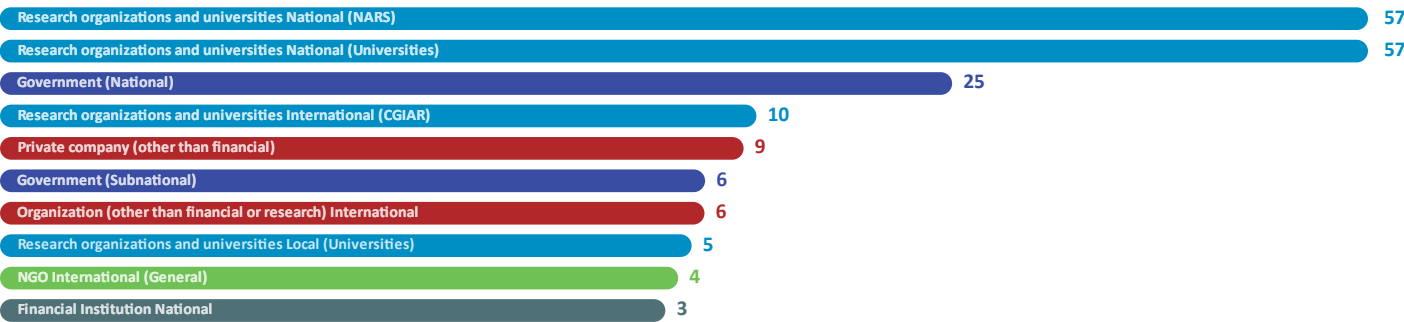
EXTERNAL PARTNERS CONTRIBUTING TO RESULTS, PER COUNTRY

The bar graph shows that national partners played a critical role, representing about 58 percent of the Initiative’s partnership engagement. However, this distribution appears related to the presence of CGIAR Centers that readily engage each other. Universities, NARS, and government institutions dominate the national partnerships. The external partner engagement highlights a key gap—a clear lack of private sector involvement in the work being conducted. The engagement of private sector entities will allow the Initiative to take the products from WP1 and WP2 to scale, as well as the STIBs developed in WP3.



Colors represent the number of different partners which collaborated on results achieved in a specific country. One result can impact different countries and therefore the same partner can be associated with more than one country. Source: Data extracted from the [Results Dashboard](#) on 29 March 2024.

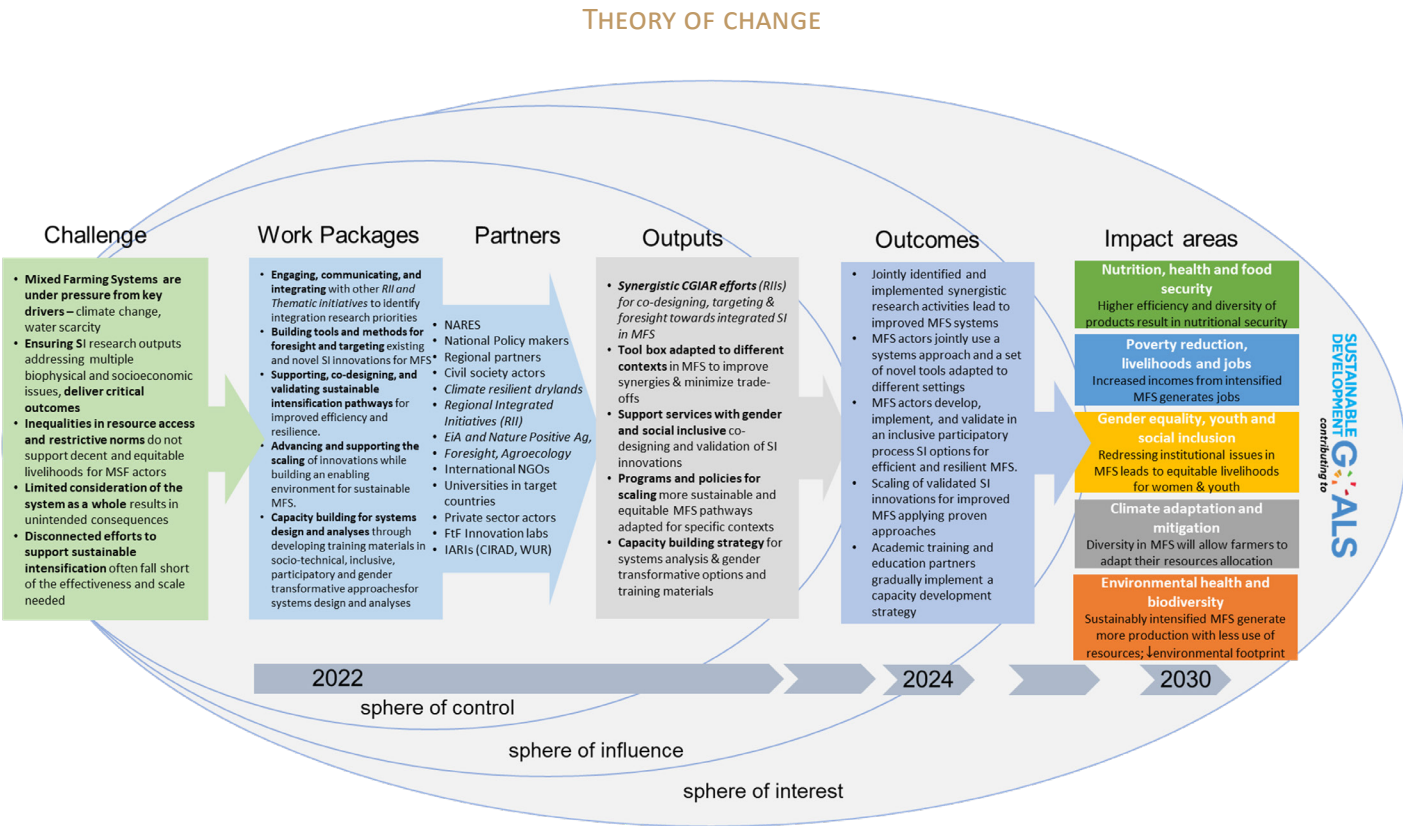
TOP 10 PARTNER TYPOLOGIES THAT CONTRIBUTED TO DELIVERING 2023 RESULTS



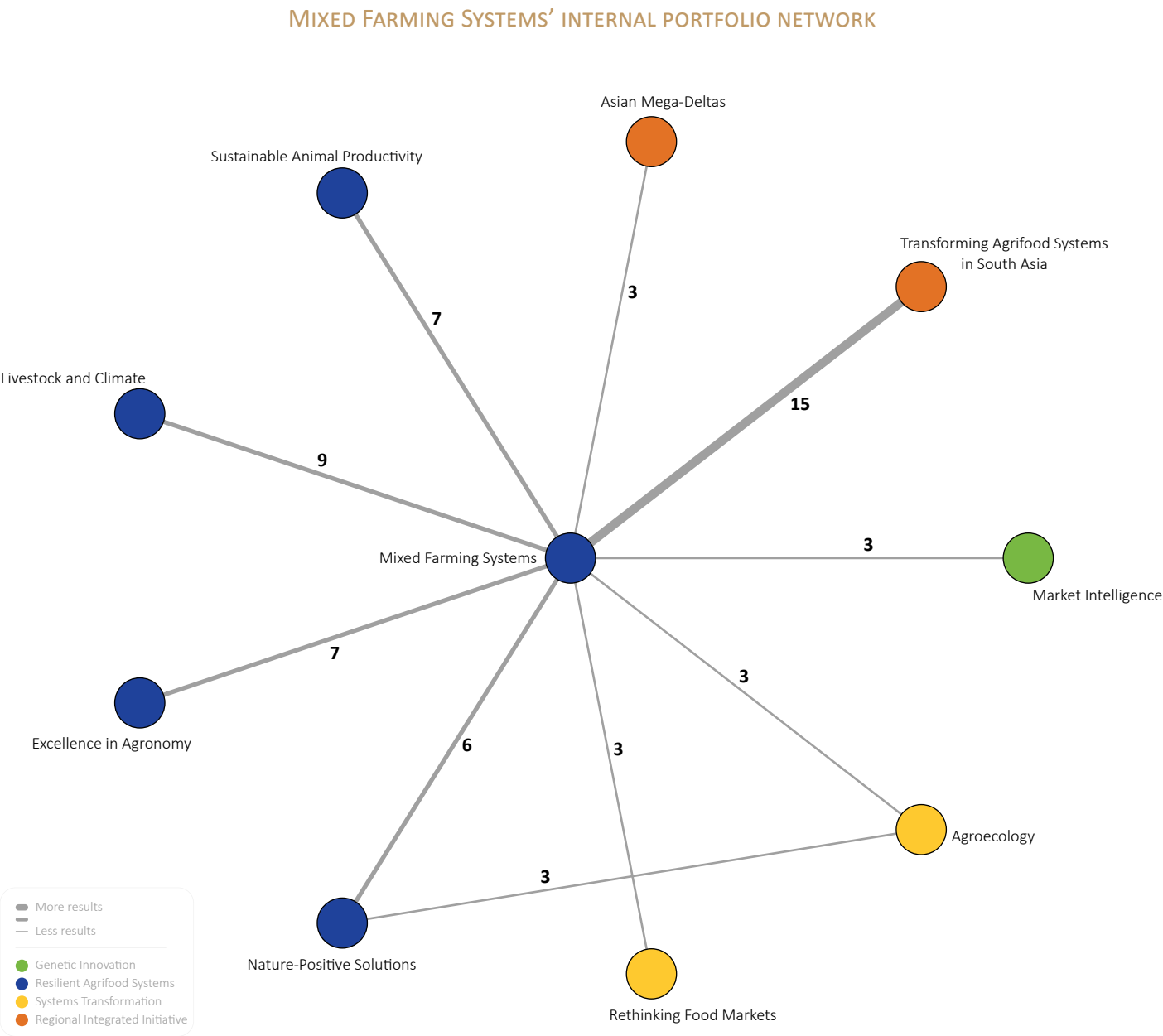
Partnerships and Mixed Farming Systems’ impact pathways

Partnerships, especially those developed with local institutions, allow the Initiative to fill the staffing gap that CGIAR Centers face in implementing all that is described in the TOC. Some target countries have very limited resident staff from CGIAR. The WPs are interlinked, but the associated interlinkages occur through a partnership matrix that operates at different levels, depending on context. For example, WP5 uses the knowledge gaps identified within other WPs to provide capacity development for key strategic actors and guide their investments in capacity building on mixed farming systems. WP4 has significant NARES involvement, which is also linked with WP2 and WP3. These operate primarily within the sphere of scaling. WP3 prioritizes, finetunes, and validates sociotechnical Innovation Packages for WP4, while WP4 co-designs gender-transformative approaches with the prioritized Innovation Packages for scaling partners to implement and advance from the sphere of control to the sphere of influence.

Policy makers are critical, since they make decisions that enable policies and institutions in the target areas, thus impacting both the sphere of influence and sphere of control. The Initiative continues to facilitate smallholder farmers’ access to, and scaling of, improved innovations and services through public-private partnerships. This will empower smallholder famers to implement new practices in mixed farming systems to achieve increased productivity and more resilient livelihoods, but also develop sufficient local capacity for systems science research. By 2030, the MFS Initiative’s outcomes will lead to the CGIAR Resilient Agrifood Systems Science Group outcomes, as detailed in the diagram below. By 2030, these Science Group outcomes will lead to the five CGIAR Impact Areas, contributing to realizing several UN Sustainable Development Goals.



Section 6: CGIAR Portfolio linkages



Portfolio linkages and Mixed Farming Systems' impact pathways

The MFS Initiative is closely linked with the Sustainable Animal Productivity, Livestock and Climate, and Excellence in Agronomy Initiatives, as well as the regional integrated Initiatives on Diversification in East and Southern Africa (Ukama Ustawi) and Transforming Agrifood Systems in South Asia. These linkages are conceivable given that 1) systems analysis at different scales is the center of the MFS Initiative and requires input from several Initiatives that implement component research, and 2) some of the MFS Initiative's sites are co-located with the other Initiatives and share staff resources, which allows for potential integration of key results that contribute to nutrition, health, and food security, as well as environmental health and biodiversity. Included in the linkage matrix is a private institution project on sustainable intensification in the Sudano-Sahelian zone, which was a partner of Africa RISING in West

Africa, a project whose legacy outcomes MFS builds upon. MFS plans to seek and strengthen linkages with similar partners in East and Southern Africa, as well as the Ethiopian highlands projects of Africa RISING due to their already developed capacity. Stronger linkages will be sought with the Asian Mega-Deltas and Sustainable Animal Productivity Initiatives in those countries where MFS is present. MFS is also partnering with the Nature-Positive Solutions Initiative, but with marginal linkages on landscape sciences. Efforts will also be targeted toward linkages with the Nexus Gains and Agroecology Initiatives, since we have not yet collaborated with them and doing so can help contribute to CGIAR Impact Areas on gender equality, youth, and social inclusion, as well as climate adaptation and mitigation.

Section 7: Adaptive management

RECOMMENDATION	SUPPORTING RATIONALE
Strengthen linkages within and across WPs for integration of work, cross-regional learnings, and portfolio harmonization, as a sustained process.	The nature of mixed farming systems calls for a systems approach. Different components interact at different levels, so activities at different scales of analysis need to be articulated within a coherent whole for sustainable intensification within mixed farming systems to happen. A systems approach requires a holistic view on mixed farming systems that considers complex interactions between components and allows for prioritized, focused efforts that strategically integrate multiple interventions at different scales. This will help unlock disciplinary knowledge gaps to inform priority-setting for other thematic-level Initiatives. However: • There are still opportunities to clarify the linkages within each WP, specifically how different activities support or leverage others. This lack of clarity then carries through to the inter-WP linkages. • This can be plausibly institutionalized by asking about the level of effort or resources committed to ensuring that these interactions take place, and by ensuring coordinated planning within each WP and across different WPs. • Efforts to address this need are being conducted, but, unfortunately, resources available to elicit these critical linkages are limited.
Address the imbalance between human resource gaps and the need to have sufficient operational resources to achieve desired impacts.	More than 130 staff from different CGIAR Centers implement the Initiative's activities. The weakness with this involvement is their degree of commitment to the Initiative's activities given the limited, and sometimes very low, full-time equivalent appropriated to the Initiative. In particular, weak and limited staffing demographics, especially of gender, limit the strengthening of these components during innovation bundling and application. We have engaged consultants to fill this gap, but this is not sustainable in the long term. Efforts to develop bilateral projects are underway as well as to strengthen analysis of mixed farming systems in the Mega Programs' portfolio under development.
Build better collaboration and interlinkages with other CGIAR Initiatives.	The MFS Initiative aims to identify sustainable options to allow mixed farming systems to become more resilient and equitable, and to continue responding to the livelihood needs of the people who depend on them. Linkages with other CGIAR Initiatives will be critical to realizing this goal. For example, there is a need for intentional dialogues, instituted at the RAFS level, that facilitate a coordinated approach in how the different Initiatives attain their impact pathways toward the five CGIAR Impact Areas. Cross-Initiative interactions will provide a basis for linkages to address identified knowledge gaps related to the interactions of system components and their consequences for the overall sustainability of mixed farming systems. It will take some time and effort to overcome Initiative interests that override action on systems thinking. As part of this effort, we are organizing an international expert workshop on systems science in partnership with French research institutions and with the participation of several CGIAR Research Initiative scientists.

Section 8: Key result story

Empowering women and youth

Mbili Mbili improves nutrition and incomes of women and youth in East and Southern Africa.



A field technician in a maize and doubled-up legume field implements the Mbili Mbili innovation in Malawi. Credit: Emmanuel Mwale/IITA

The Mbili Mbili innovation improves nutrition, income, climate resilience, and empowerment in mixed farming systems by encouraging farmer collaboration and gender-responsive production to benefit the overall well-being of more than 1,000 farm families in East and Southern Africa.

Women and youth in East and Southern Africa face many challenges due to limited access to land, reliance on maize monocropping on inherently poor soils, and the impacts of climate change, which require livelihood diversification.

To improve the productivity of legumes in maize-dominated systems, the Mbili Mbili cropping innovation was developed through the Africa RISING project in Tanzania. In 2022, 329 farmers implemented Mbili Mbili on farmer-managed trials, with 44 percent women and 10 percent youth participation, respectively.

Economically, Mbili Mbili has proved to be the most profitable and stable cropping system, generating US\$130 higher net returns than common cereal-legume intercropping. It also produced about 0.5 tons per ha more of legume grain and significantly more stover per unit of land, improving diets as farmers consume what they produce.

In 2022, in Malawi, the Alliance of Bioversity International and CIAT in partnership with the national agricultural research and extension system under the MFS Initiative introduced an adaptation of Mbili Mbili. This involved 330 farm households, with 47 percent women and 16 percent youth participating. This innovation has helped secure women’s land and integrated women’s legumes without compromising maize yields, which are typically male dominated.

Mbili Mbili provides agronomic solutions by increasing the production of multiple crops per unit area, benefiting farmers facing land constraints, declining soil fertility, and low crop productivity. In Malawi, women farmers often manage poorer quality soils. Targeting them improves soil fertility and builds soils through legume residue retention, composting, and manure, benefiting these disadvantaged farmers. In rural districts of Malawi, preference rankings by women and youth farmers prioritized Mbili Mbili over sole maize and doubled-up legumes for harvesting more from several crops on the same plot.

Based on scoping studies, farmer field days in Kasungu and Mzimba with about 850 farmers, and stakeholder consultations, the Initiative identified entry points for complementary innovations to inform the co-design process, including the inclusion of soya and groundnuts as important food and cash crops, soil and water conservation techniques, tied ridges and contour farming, multipurpose forages, low-cost soil fertility amendments amid soaring fertilizer prices, and organic and inorganic components to rebuild soil organic matter and enhance nutrient use efficiency. These innovations aim to enhance the effectiveness of Mbili Mbili, especially in dry years, and promote climate resilience, nutrition, and crop diversification, while improved biomass from residues combined with forages will enhance manure production to replenish soil fertility, promoting nutrient cycling and income diversification through livestock.

Scaling Mbili Mbili using an agribusiness mindset, while making financial products and services available to rural communities, will enable Malawi’s smallholders to reap the full benefits from this innovation.

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The Mbili Mbili innovation makes it possible for farmers to use the very same small land sizes to produce more consolidated cereal and legume yields, and at the same time, crop diversification hedges them against the failure of one crop or another, while contributing to improvements in soil fertility from nitrogen-fixing legume crops.

Mr. Lloyd Phiphira, Head of Farm Services National Smallholder Farmers’ Association of Malawi

Primary Impact Area



Other relevant Impact Areas targeted



Contributing Initiative

Mixed Farming Systems

Contributing Centers

Alliance of Bioversity International and CIAT · IITA

Contributing external partner

Department of Agricultural Research Services (DARS)

Geographic scope



Countries: Tanzania · Malawi



Front cover photo

Water buffalo graze aquatic grasses amidst rice fields in a diversified landscape of Southern Bangladesh.
Credit: S. Lopez-Ridaura (CIMMYT)

Back cover photo

A mosaic landscape of mixed farming system (crops, trees and livestock) at Phonxay District, Luang Prabang Province, Laos PDR.
Credit: Mienmany, S./CIAT



INITIATIVE ON
Mixed Farming
Systems