Sustainable Intensification of Mixed Farming Systems (SI-MFS)

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Proposal

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Note to readers: Please use the hyperlinks throughout the proposal for definitions, abbreviations, partners, references, etc.

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A list of abbreviations and acronyms used throughout the proposal can be found **here.**

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Initiative name	Sustainable Intensification of Mixed Farming Systems (SI-MFS)
Primary Action Area	Resilient Agrifood Systems (RAFS)
Geographic scope	Selected MFS in Africa (GH-Ghana, ET-Ethiopia, MW-Malawi) and Asia (BD-Bangladesh, NP-Nepal, LA-Lao People's Democratic Republic)
Budget	US$40,000,000 (2022/23: US$11,462,083; 2023/24: US$14,473,234; 2024/25: US$14,064,684)

1. General information

- **Initiative name:** Sustainable Intensification of Mixed Farming Systems (SI-MFS)
- **Primary CGIAR Action Area:** Resilient Agrifood Systems (RAFS)
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2. Context

2.1 Challenge statement

This Initiative addresses the Sustainable intensification (SI) of Mixed farming systems (MFS). By SI, we mean the production of more food on the same piece of land while reducing the negative environmental impact. MFS cover about 2.5 billion ha of land globally[1]. In the developing world, MFS supply around 75% of milk, 60% of meat, and 41–86% of cereals consumed[2]. These farming systems occur in nearly all agro-ecological zones, with an enormous variety of climatic and soil conditions[3] and livelihood patterns[4].

In MFS, livestock provides draft power for crop cultivation and manure to fertilize the soil, while crop residues provide livestock feed. Livestock is sold to compensate for low crop yields in unfavorable years. Mixed systems allow farmers to diversify risk from single crop production, use labor efficiently, access cash, and add value to products. Integrating crops and livestock has the potential to maintain ecosystem function and health, and to help prevent agricultural systems from becoming fragile by enhancing biodiversity and thus increasing capability to absorb shocks to the natural resource base[5].

Population growth, urbanization, water scarcity, soil degradation, climate change, evolving food consumption patterns, and food price volatility are pressures that act on these systems[6], deepening inequalities in resource access, and leading to conflict and migration[7]. Social inequalities are a persistent feature of agrifood systems including MFS. They relate to deeply entrenched inequitable norms that produce unfavorable outcomes— primarily for women, youth, and marginalized actors— and obstruct progress towards the Sustainable Development Goals (SDGs)[8].

Farmers' local experience and knowledge enable them to adapt to many challenges. However, the increasing speed at which many changes are happening will likely exceed their capacity[9].

The challenges can be mitigated through SI, which responds to the need to both feed growing populations and counteract environmental degradation[10]. Sustainable intensification requires integrated systems research to identify context-specific pathways towards resilient, scalable MFS that preserve natural capital, offer equitable benefits for all, and attract young people to venture into profitable agribusinesses. The components of MFS interact both with each other and with the external environment, including climate and landscape[11]. However, there are knowledge gaps on the biophysical and socio-economic interactions and dynamics[12], which can undermine many development-oriented interventions aiming at driving MFS towards SI.

A predominantly commodity and biophysical research approach has been leading to improvements in single system components, but frequently amplifies the trade-offs between different livelihood objectives if the interactions between crop, tree, livestock, and social sub-systems are not properly addressed at the appropriate spatial and temporal scales. This has affected the capacity to scale many of the technologies and practices promoted by CGIAR and partners in landscapes dominated by MFS.

Current research to support SI of MFS is often disconnected, falling short of the effectiveness and scale needed to achieve important global targets such as the SDGs. Also, attention to how SI may (re-)produce inequalities has remained low[13]. For One CGIAR to make significant contributions that result in multiple desired impacts at sufficiently large scales will require well-coordinated, prioritized, and focused efforts that strategically integrate multiple elements of the sub-systems in MFS. SI of MFS provides a viable avenue to achieve this.

2.2 Measurable 3-year (end-of-Initiative) outcomes

The Sustainable Intensification of Mixed Farming Systems (SI-MFS) Initiative aims to provide equitable, gender-transformative pathways for improving the livelihoods of 1.5 million female and male actors in seven prioritized MFS by 2024. This will have measurable impacts on livelihoods, food and nutrition security, and environmental health, particularly for women, young people, and marginalized farmers.

Specific three-year outcomes and targets are:

1. Five international research institutions, six national research institutions, seven policymakers, and two donors (key strategic actors) are transitioning research priorities, policies, and strategic financial investments towards SI of MFS.

2. 50% of key innovation, demand, and scaling partners are jointly using a systems approach and a set of existing and novel tools adapted to different scales, agro-ecologies, and socio-economic settings to identify potential context-specific, integrated solutions for SI of MFS.
3. Twelve research institutions (local and international), local partners, and 1.5 million farmers are developing, implementing, and validating SI options in selected MFS through participatory and inclusive processes.
4. 1.5 million MFS actors (farmers and other value chain participants) are adopting, adapting, and scaling socio-technical, gender-transformative innovation packages for SI of MFS.
5. 50% of partners (key strategic actors) and CGIAR scientists are adopting MFS thinking and gender-transformative approaches, mainstreamed through a global virtual institute for SI of MFS set up by the Initiative, and by regional scaling hubs promoting capacity building.

2.3 Learning from prior evaluations and impact assessments (IA)

The SI-MFS Initiative builds on earlier research that generated options for SI. These SI options were developed in CGIAR research programs: LIVESTOCK[14], MAIZE[15], WHEAT[16], RICE[17], GLDC[18], WLE[19]; and in bilateral projects: CSISA[20], Africa RISING[21], SIMLESA[22].

While contradictions appear to be more widespread than consensus, there is convergence around the following best practices and outcomes that this Initiative can build on:

- Integrating promising SI options such as agronomic and livestock management practices, developed in component-based CGIAR research programs and bilateral projects, to increase the overall efficiency and sustainability of MFS.
- Focusing on trans-disciplinary systems research that aligns with the realities faced by MFS.
- Maintaining a balanced perspective on the biophysical, social, and economic dimensions of SI and ensuring they are addressed in an integrated manner.
- Establishing and nurturing strong collaborative partnerships across the entire research–development continuum for SI of MFS.
- Balancing applied research, capacity building, scaling, and development activities appropriately for a desired set of outcomes.
- Bundling innovations at different scales of analysis and implementation in close collaboration with a wide range of MFS actors through action research (socio-technical innovation packages).
- Applying methods that allow trade-offs to be addressed and synergies to be amplified, at different levels, for coordinated action towards SI of MFS.

Independent impact assessments (IA) for SI are elusive, and each project or program calculates beneficiaries and impact levels differently. The SI-MFS Initiative will address this critical gap by establishing coherent indicators and metrics, and applying these to higher-level IA of previous activities.

2.4 Priority-setting

Priority science, innovations, and activities

The SI-MFS Initiative aims to identify sustainable options to allow MFS to become more resilient and equitable and continue to respond to the livelihood needs of the people who depend on them. The starting point for setting SI-MFS priorities is the economic, social, and environmental roles of MFS, and the pressures that act on them. Past research by CGIAR and others provides a good basis to build on in order to fill identified knowledge gaps related to the

interactions of system components and their consequences for the overall sustainability of MFS[23,24,25,26].

The nature of MFS 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 SI of MFS. A systems approach requires a holistic view on MFS, taking into account complex interactions between components or sub-systems, and allowing prioritized, focused efforts that strategically integrate multiple interventions at different scales. Systems analysis unlocks disciplinary knowledge gaps that will inform priority setting for thematic level initiatives.

Three Work Packages (WPs) of the SI-MFS Initiative have been defined to:

- Understand the current status and global trends, and identify main entry points for SI of MFS at **regional and global** levels (WP1)
- Co-design SI pathways for different types of MFS in selected agro-ecologies, at **local** level and in close partnership with farmers and other local MFS actors (WP3). This WP is the central research piece for implementing activities on the ground and generating primary data.
- Enhance the enabling policy, market, and institutional environments for scaling of SI interventions at **national and subnational** levels (WP4).

To support the activities and make links across levels of analysis, two WPs aim to:

- Develop multi-scale **methods and tools** for systems analysis (WP2).
- Increase efforts in **capacity development** and an actor-centered approach to support all actors at the different levels and accelerate SI of MFS (WP5).

Geographic prioritization

Geographic priority setting was achieved through a systematic process. First, MFS were identified that are representative of a wider geography, using the descriptions provided by Dixon et al.[27,28]. Then a matrix MFS type*Country was developed for 14 potential implementation countries representing the diversity of MFS at global level, and covering all regions of One CGIAR.

To narrow down the countries, basic socio-demographic figures were retrieved, including share of the rural population and of the agricultural area; poverty and malnutrition prevalence; and biophysical parameters that indicate need and potential for SI, such as livestock density and per capita land availability. We also considered past and existing investments from CGIAR and partners/donors and their interest in future investment, and the presence of known local partners.

Six target countries from four regions that represent seven MFS, cutting across several other countries, were selected for implementation in the first business cycle:

- GH-Ghana: Cereal–root crop mixed (West and Central Africa)
- ET-Ethiopia: Highland mixed (East and Southern Africa)
- MW-Malawi: Maize mixed (East and Southern Africa)
- BD-Bangladesh: Rice mixed (South Asia)
- NP-Nepal: Highland mixed (South Asia)
- LA-Lao People's Democratic Republic: Upland intensive mixed and Highland extensive mixed (South East Asia and the Pacific)

Neighboring countries in each region where similar MFS prevail are considered spill-over countries to be included in subsequent implementation cycles.

2.5 Comparative advantage

- Global experience of data-driven systems diagnosis and scoping to identify opportunities and implementation pathways for SI[29,30,31].
- Guiding and implementing upstream research in collaboration with International Agricultural Research Centers (IARCs) to develop methodologies for the characterization, quantification, and assessment of SI pathways[32,33,34,35,36,37].
- Formulation and implementation of interdisciplinary research programs that support integrated approaches to promoting SI[38,39,40].
- Research teams in which biophysical and social sciences are strongly integrated to ensure solutions are equitable and deliver across multiple SI domains[41,42,43,44].
- Broad capacity in systems research ensuring that SI innovations are inclusive, meet the multiple objectives of end-users, and are fit for purpose[45,46,47].
- Implementation of research into practice for specific cases including partnership building, capacity development, and support for scaling[48,49].
- Ensuring that SI innovations are designed with clearly defined impact pathways to provide evidence of the role and benefits of research[50,51].
- Global thought leaders on SI, SI knowledge generation, and its implementation and benefits[52].
- Opportunity to build on systems research in target MFS and countries[53,54,55].
- Existing partnerships with National Agricultural Research and Extension Systems (NARES) in target countries SI[56,57,58].

2.6 Participatory design process

The Initiative Design Team (IDT) for SI-MFS is engaged in ongoing discussions to ensure a representative and inclusive process, both internally and externally with several partners. The IDT has carried out seven national/sub-national stakeholder consultation surveys in the seven MFS across the six target countries (GH-Ghana, ET-Ethiopia, MW-Malawi, BD-Bangladesh, NP-Nepal, LA-Lao People's Democratic Republic). These resulted in responses from 55 stakeholders, including representatives of NARES, private sector actors, and national institutions. We have secured partner support statements from the six countries. During a preliminary design phase in early 2021, we consulted and brainstormed with donors and multiple partners to explore potential synergies and collaborations (e.g., with 285-IFAD, 1407-GIZ, and 156-USAID). Some of these discussions guided our prioritization approach on using a farming system perspective for SI in the selected geographies.

Efforts were conducted through a demand scoping of the Initiative in relation to alignment with country priorities. The SI-MFS IDT is well aligned with country development strategies, action plans, and priorities. For example, in LA-Lao People's Democratic Republic, areas already under intensive monoculture production with possible sustainability concerns (cassava, banana, maize, cabbage) offer potential for co-development of transitions to SI of MFS. In BD-Bangladesh, food security greatly depends on SI of cropping and MFS. Increasing the adoption of new technologies for SI and diversification will provide avenues for higher-value crops and better nutrition for smallholder farmers, offering an alternative path out of poverty. This storyline is similar for NP-Nepal, and for GH-Ghana, ET-Ethiopia, and MW-Malawi.

The guiding questions and narrative used in the stakeholder survey consultations facilitated:

- Better framing of the Initiative's Challenge statement (section 2.1), given the key drivers, constraints, and opportunities in the context of each country and farming system.

- Projected benefits estimations based on the innovations selected for each priority farming system.
- Better understanding of the demand for, and partners' perceptions of, the SI-MFS Initiative.
- Identification of potential partners for future collaboration.
- Identification of potential donor interest in investing in the SI-MFS Initiative.

Discussions within the IDT and with the national stakeholder focal points fostered continuing feedback on the development of Initiative-level components and WPs, enabling the expertise and knowledge of the prioritized countries to inform the Initiative design.

The Initiative responds to clear stakeholder demand and provides enhanced understanding of the status and trends around SI of MFS (WP1). Targeted development of methods and tools (WP2) is used to support the co-design of MFS (WP3) and their scaling (WP4). All five WPs in the Initiative are interlinked and well aligned to the demand for co-development of socio-technical innovation packages for SI while increasing the technical and institutional capacity of various stakeholders, including policymakers, private sector actors, and farmers (WP5).

The SI-MFS Initiative has held several interactive consultations with other global and regional initiatives, as well as in-country stakeholder engagements (e.g., GH-Ghana), to shape its design and ensure active linkages.

2.7 Projection of benefits

Impact areas	Indicator	Breadth: cumulative by 2030	Depth	Probability
1 Nutrition, health, food security	# people benefiting from relevant CGIAR innovations	13 million people i.e., about 3 million households	**Significant**: 100% of annual income or 10% permanent impact on income	**High certainty:** 50–80% expectation of achieving these impacts by 2030, at this point
2 Poverty reduction, livelihoods, jobs	# people benefiting from relevant CGIAR innovations	13 million people i.e., about 3 million households	**Significant**: 100% of annual income or 10% permanent impact on income	**High certainty:** 50–80% expectation of achieving these impacts by 2030, at this point
	# people assisted to exit poverty	0.6 million people i.e., about 0.1 million households	No depth category/weight is required for poverty reduction projections	**Medium certainty**: 30–50% expectation of achieving these impacts by 2030, at this point
33 Gender, youth, social inclusion	# women benefiting from relevant CGIAR innovations	5 million women	**Transformative:** Constraining gender norms and dynamics are shifted and reduced, and norms and dynamics which support gender equality are strengthened, leading to greater gender equality	**Medium certainty:** 30–50% expectation of achieving these impacts by 2030, at this point
	# youth benefiting from relevant CGIAR innovations	3 million youth (indirectly)	**Significant**: 100% of annual income or 10% permanent impact on income	**Medium certainty:** 30–50% expectation of achieving these impacts by 2030, at this point
		Including 0.06 million youth (directly)	**Significant**: 100% of annual income or 10% permanent impact on income	**High certainty:** 50–80% expectation of achieving these impacts by 2030, at this point
4 Climate change, GHG reductions	# people benefiting from climate-adapted innovations	13 million people i.e., about 3 million households	**Significant:** 100% of annual income or 10% permanent impact on income	**Medium certainty:** 30–50% expectation of achieving these impacts by 2030, at this point
5 Environmental health, biodiversity	# ha under improved management	1.6 million hectares	**Transformative:** Where improved management delivers improvements in soil health and fertility, delivers biodiversity gains, and provides additional ecosystem service improvements	**Medium certainty:** 30–50% expectation of achieving these impacts by 2030, at this point

Nutrition, health and food security

"The projections below transparently estimate reasonable orders of magnitude for impacts which could arise as a result of the impact pathways set out in the Initiative's Theories of Change. Initiatives contribute to these impact pathways, along with other partners and stakeholders.

For each impact area, projections consider breadth (numbers reached), depth (expected intensity of effect per unit), and probability (a qualitative judgement reflecting the overall degree of certainty or uncertainty that the impact pathway will lead to the projected order of magnitude of impact).

Projections will be updated during delivery to help inform iterative, evidence-driven, dynamic management by Initiatives as they maximize their potential contribution to impact. Projected benefits are not delivery targets, as impact lies beyond CGIAR's sphere of control or influence".

 # people benefiting from relevant CGIAR innovations

Considering our experiences from the existing SI projects Africa RISING, SIMLESA, and CSISA[59,60,61], it is projected that the adoption of SI-MFS innovations in our target areas will significantly improve the nutrition, health, and food security of about 13 million people i.e., about 3 million households [SI-MFS benefits projections]. This corresponds to an increase in 100% of annual income or 10% permanent impact on income, with high certainty (50–80%) expectation of achieving these impacts by 2030. To estimate the number of beneficiaries, we first used the logistic growth function to project the adoption of SI-MFS innovations to 2030 (i.e., 11%) and multiplied it by the rural population number (derived from UN population data[62]) in each SI-MFS target area. We adjusted the rural population number using the country-specific shares[63,64,65,66,67,68] of rural landlessness and non-agricultural population to obtain the number of smallholder farmers. High certainty that these numbers can be attained is based on empirical evidence from similar farming systems that the adoption and scaling of SI-MFS innovations can increase incomes for smallholder farmers by, on average, 48% in MW-Malawi[69], 40% in ET-Ethiopia[70], and 20–41% in South Asia[71].

Poverty reduction, livelihoods, jobs

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 # people benefiting from relevant CGIAR innovations

Improved SI-MFS innovations are expected to benefit 13 million people i.e., 3 million households in the target countries, which is equivalent to 100% of annual income or 10% permanent impact on income with a medium certainty (30–50%) expectation of achieving these impacts by 2030 [SI-MFS benefits projections]. We estimated the number of beneficiaries based on the projected adoption rates (11% adoption rate to 2030) and the size of the rural population in the target farming systems after adjusting for landlessness or rural non-farm occupations. Given our hypothesized impact pathway, we expect that the adoption of SI-MFS innovations will increase crop and livestock productivity, farm incomes, and household incomes, ultimately resulting in poverty reduction[72,73,74]. Studies on the adoption of these innovations in similar farming systems indicate that the adoption of improved SI-MFS innovations can reduce the probability of being poor by 14–36% in ET-Ethiopia[75] and 27–40% in ZM-Zambia[76], and can increase employment[77]. To achieve these targets, the Initiative will

facilitate smallholder farmers' access to SI socio-technical packages (WP3); and scale improved SI innovations and services through (i) public-private partnerships, (ii) enhanced market systems, (iii) enabling policies and institutions (WP4); and (iv) build human, institutional, and technical capacity (WP5) in the target areas.

 # people assisted to exit poverty

The adoption of improved SI-MFS innovations is expected to lift 0.6 million people i.e., 0.1 million households out of poverty in the target countries, with a medium certainty (30–50%) expectation of achieving these impacts by 2030. This takes into consideration that poverty impacts take some time to be realized, and that few rigorous studies are available on income-based poverty and jobs [SI-MFS benefits projections]. Estimated poverty reduction rates due to the adoption of SI technologies, based on US$1.9/day at 2011 purchasing power parity levels, are 4% in MW-Malawi[78], 5% in NG-Nigeria[79,80], 2–13% in the Great Lakes (CD-Democratic Republic of Congo, RW-Rwanda, and BI-Burundi)[81], and 5% (based on asset poverty) in south Asia and Africa[82]. We estimated the number of people assisted to exit poverty by first projecting the number of beneficiaries based on projected adoption rates (11% adoption rate in 2030); then multiplying the estimated number of beneficiaries by the poverty reduction rates (i.e., a conservative rate of 4.5% across the target countries).

Gender, youth, social inclusion

The projections below transparently estimate reasonable orders of magnitude for impacts which could arise as a result of the impact pathways set out in the Initiative's Theories of Change. Initiatives contribute to these impact pathways, along with other partners and stakeholders.

For each impact area, projections consider breadth (numbers reached), depth (expected intensity of effect per unit) and probability (a qualitative judgement reflecting the overall degree of certainty or uncertainty that the impact pathway will lead to the projected order of magnitude of impact).

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 # women benefiting from relevant CGIAR innovations

It is projected that the SI-MFS Initiative will benefit about 5 million women in target countries with a medium certainty (30–50%) expectation of achieving these impacts by 2030 [SI-MFS benefits projections]. The number is estimated based on the share of women in the total rural population of the target countries (average 50%)[83] and on the condition that at least 40% of the beneficiaries will be women. Women have a lower probability of adopting improved agricultural technologies, mainly because of social norms embedded in wider socio-cultural settings that constrain their access to resources[84,85]. The Initiative will implement gender-transformative approaches focusing on institutional and systemic barriers to change at scale. The Initiative will follow suitable action research and participatory engagement approaches, and will identify socio-technical innovation packages that have a high likelihood of resulting in transformative outcomes where existing gender-constraining norms are shifted to norms that support greater gender equality. Since changes in social norms usually take a long time to occur, we expect that the transformative outcome will be realized with medium certainty by 2030.

 # youth benefiting from relevant CGIAR innovations

The SI-MFS Initiative is expected to benefit about 3 million young people [SI-MFS benefits projections]. The number is estimated based on the share of youth (aged 15–24) in the target countries' populations, and the total projected beneficiaries of the Initiative (indicator #1). 60,000 of these 3 million young people will benefit through direct engagement in selected SI-MFS Initiative activities (e.g., capacity building on agricultural entrepreneurship; use of digital decision support tools); the remainder will benefit indirectly through their beneficiary households (indicator #1). Direct benefits are projected to be significant (100% of annual income or 10% permanent impact on income) with a high certainty (50-80%) expectation of achieving these impacts by 2030. Impacts on indirect beneficiaries will also be significant (100% of annual income or 10% permanent impact on income), but with medium certainty (30–50%) expected achievement since benefits in some households may not trickle down to their young members. The Initiative will learn from the experience of previous youth-centered programs implemented by CGIAR (e.g., SAIRLA, IITA Youth Agripreneurs, ENABLE-TAAT[86,87,88]).

Climate change, GHG reductions

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 # people benefiting from climate-adapted innovations

The SI-MFS Initiative is expected to benefit an estimated 13 million people i.e., about 3 million households in the target countries [SI-MFS benefits projections]. This assumes that all the SI-MFS innovations promoted by the Initiative will be climate-smart, ensured through multi-criteria assessments of innovations for scaling. For example, the Initiative will use or adapt previously developed multi-criteria tools (e.g., the Sustainable Intensification Assessment Framework[89]) to identify climate-smart innovations. Many SI-MFS socio-technical innovation packages contribute to the three pillars for climate-smart agriculture: productivity, adaptation, and mitigation. Adoption of SI-MFS innovations is expected to improve smallholder farmers' resilience to weather-induced shocks, resulting in significant improvements in their welfare (i.e., equivalent to 100% of annual income or 10% permanent impact on income). We assume that significant improvement in farmers' welfare will be realized with medium certainty (30–50%) expectation of achieving these impacts by 2030, given that climate-related outcomes are less likely to be achieved in the short run. SI-MFS technologies increase the adaptive capacity of smallholder farmers to climate change and contribute to a more stable income[90,91,92].

Environmental health, biodiversity

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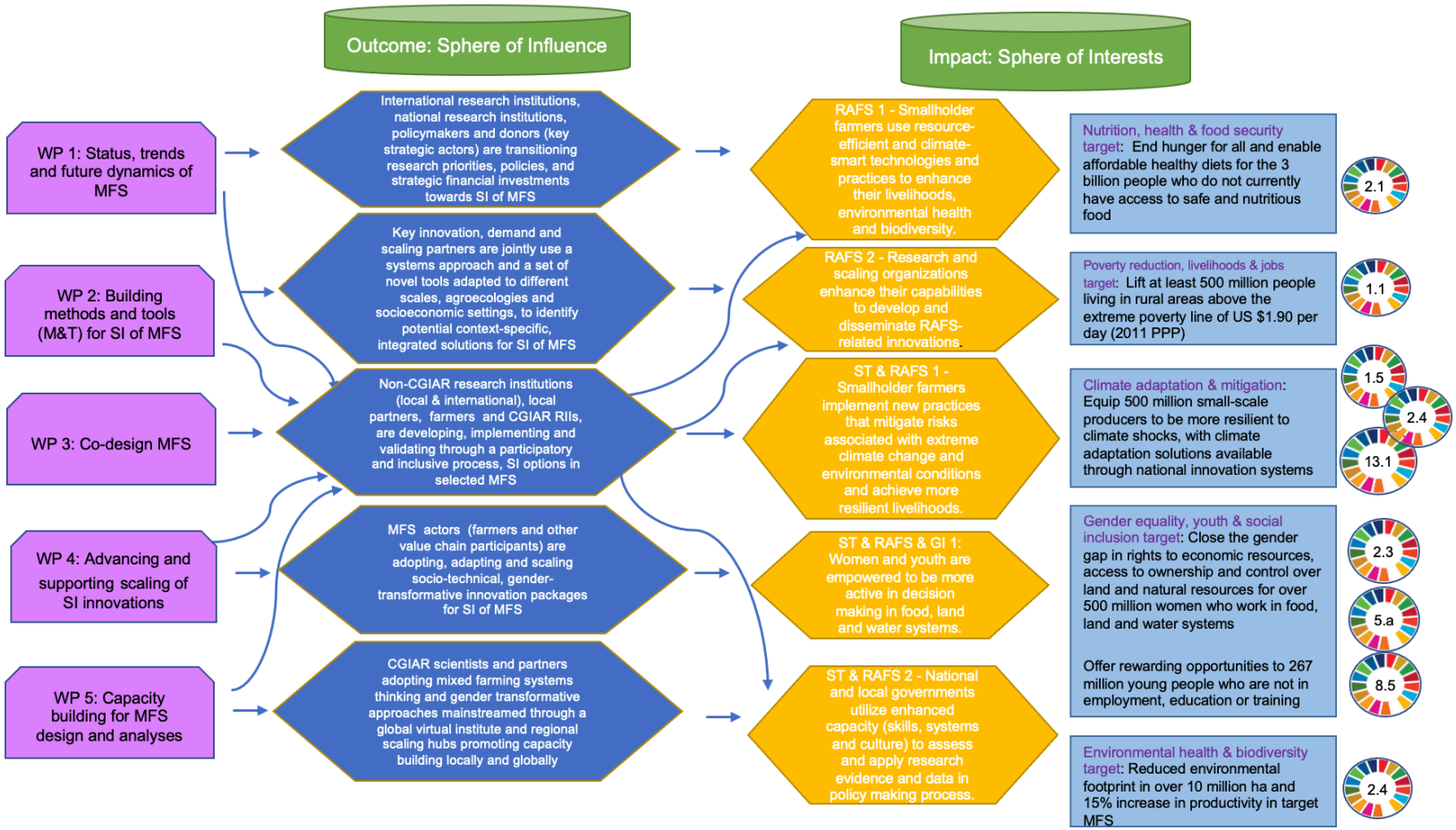
 # ha under improved management

An estimated 1.6 million hectares of land will be cultivated under improved management by 2030 [SI-MFS benefits projections]. This quantity is projected based on the total area under the indicative crops in the Initiative's target farming systems (collected from FAOSTAT and adjusted for the target farming system based on spatial GIS data at 10 km resolution[93]), and the predicted adoption rate of SI-MFS innovations by 2030. This is expected to result in substantial benefits to beneficiary farm households arising from improvements in soil health and fertility, biodiversity gains, and additional ecosystem service improvements. The change can be realized with high certainty (50–80%) expectation of achieving these impacts by 2030. The projection is based on growing evidence of positive effects of SI practices on environmental outcomes such as soil carbon, improved soil pH, and available nutrients[94,95,96], and the experience gained by CGIAR centers in implementing SI-focused R4D projects (e.g., Africa RISING, SIMLESA)[97,98].

3. Research plans and associated theories of change (TOC)

3.1 Full Initiative TOC

3.1.1 Full Initiative TOC diagram



3.1.2 Full Initiative TOC narrative

Agricultural production in the global South takes place mostly in mixed farming systems (MFS). Several drivers of change put these systems under pressure, and they will likely become unable to respond to the needed sustainable increase in food production for a growing global population. The SI-MFS Initiative will address these challenges through sustainable intensification (SI) of these mixed crop-tree-livestock systems to deliver more productive and equitable livelihoods for current and future actors, along with a reduced environmental footprint. This requires an integrated systems approach that maximizes the synergies between different components of MFS.

The Initiative builds on the achievements and best practices of previous and ongoing research programs (e.g., Africa RISING, SIMLESA, CSISA). Best practices and outcomes from previous research that the Initiative can build on include (i) focusing on trans-disciplinary systems research that aligns with the realities faced by MFS; and (ii) maintaining a balanced perspective on the biophysical, social, and economic dimensions of SI and ensuring they are addressed in an integrated manner.

SI-MFS will conduct research activities under five interlinked work packages (WP). WP1 identifies system drivers, constraints, and opportunities, and directly feeds information into WP2 on methods and tools (M&T); WP1 uses those M&T for MFS analysis and foresight. The M&T developed by WP2 support the co-design of MFS (WP3) and their scaling (WP4) in specific cases through capacity development (WP5). WP3 will prioritize, fine tune, and validate socio-technical SI innovation packages for WP4. WP4 will co-design gender-transformative approaches with the prioritized innovation packages for scaling partners to implement. WP5 uses the knowledge gaps identified by other WPs to provide capacity development of the key strategic actors and guide their investments in capacity building on SI of MFS. WP5 also provides feedback to other WPs on these actors' needs and on the capacity building progress.

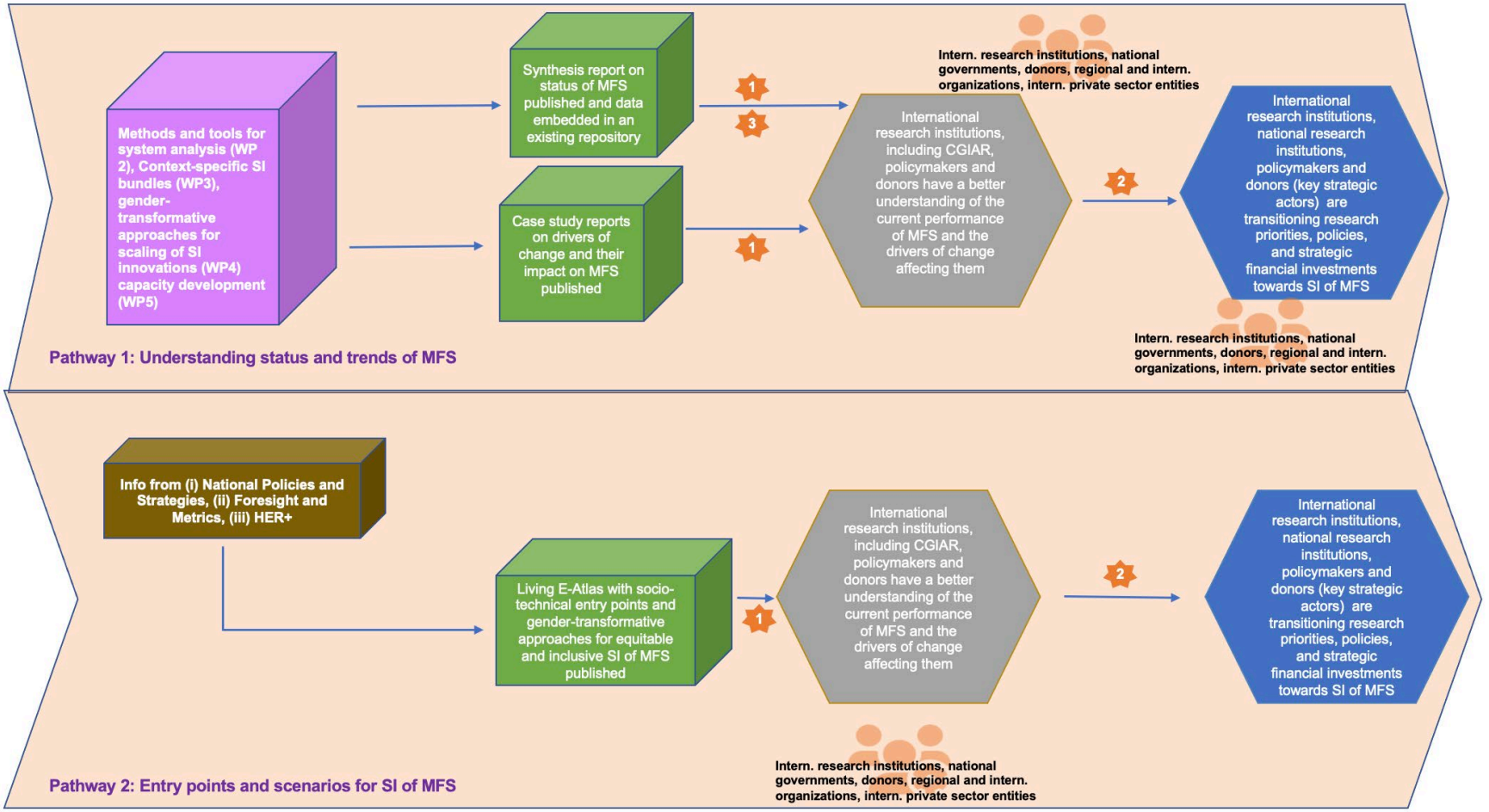
The specific research outputs outlined under each WP TOC will result in five measurable three-year Initiative research outcomes by 2024, detailed in the WP TOCs and section 2.2.

We assume that national and international research institutions, development agencies, donors, regional state unions, and CGIAR understand the benefits that SI of MFS generate for the five impact areas of CGIAR, and that this understanding will trigger genuine interest in supporting an integrated systems approach in the co-development and implementation of SI of MFS at scale. The SI-MFS Initiative will provide new trans-disciplinary knowledge, evidence, and capacity in support of this. The Initiative will facilitate smallholder farmers' access to and scaling of improved SI-MFS innovations and services through public-private partnerships, enhanced market systems, and enabling policies and institutions in the target areas. This will empower smallholder famers to implement new practices in SI of MFS and to achieve increased productivity and more resilient livelihoods.

By 2030, SI-MFS Initiative outcomes will lead to the One CGIAR RAFS Action Area outcomes, as detailed in diagram 3.1.1. By 2030, these Action Area outcomes will lead to the five One CGIAR Impact Areas, contributing to realizing several UN Sustainable Development Goals. SI-MFS is engaging with other Initiatives, and these discussions will continue during the first three months of the implementation phase.

3.2 Work Package TOCs

3.2.1 Work Package 1: Status, trends, and future dynamics of MFS



3.2.2 Work Package research plans and TOCs

Work Package title	***WP1: Status, trends, and future dynamics of MFS***
Work Package main focus and prioritization	WP1 analyses status, trends, and adaptations in mixed farming systems (MFS) — beyond those selected — to improve livelihoods. This entails identifying their present economic, social, and environmental roles at different scales, and the key drivers of change (climate, population pressure, consumer behavior), also taking account of social inequalities. The assessment identifies entry points for equitable sustainable intensification (SI) to mitigate negative impacts of change and seize emerging opportunities. It generates knowledge and evidence needed by decision-makers for informed policy development and strategic financial investments. WP1 brings SI of MFS to the forefront of the global development agenda through identifying innovative, gender-transformative SI strategies and implementation pathways.
Work Package geographic scope (global/region/country)	Global; Regional

The science

1. WP research questions, associated scientific methods and key outputs

WP1 research questions	Scientific methods	Key outputs
RQ1. What is the current status of MFS in the different CGIAR regions (economic, social, environmental, geographic distribution, basic performance)?	- Secondary data analysis; literature review - Geospatial mapping and analysis - Focus group discussions (FGD) and key informant interviews with regional and global policymakers, environmental groups, civil society representatives (including women and youth), research institutions	1.1 Synthesis report on updated status of MFS published, and easily accessible data embedded in an existing repository (tbd) for enhanced decision making by policymakers
RQ2. What novel trends (intensification, extensification, diversification, specialization) and associated socio-economic and environmental consequences can be projected in these MFS, given past, existing, and emerging drivers of change?	- Literature review; secondary data analysis - Geospatial mapping and analysis of land-use and land-cover change in MFS - Stakeholder consultations	1.2 Case study reports on emerging drivers of change and their impacts on MFS published for policymakers
RQ3. What affordable entry points can be identified for the transition of these MFS towards sustainably intensified	- Suite of qualitative and quantitative methods (multi-scalar stakeholder consultations, multi-scalar	1.3 Living e-Atlas with affordable socio-technical entry points and gender-transformative approaches for

systems that mitigate any negative impact and harness opportunities presented by the drivers of change?	scenario assessment modelling)	equitable and inclusive SI of MFS published for implementation by partners, donors and policymakers
RQ4. What lessons do current and past interventions hold for innovative strategies to make SI gender-transformative and socially inclusive in MFS?	- Literature review - Key informant interviews with implementers of interventions	

The theory of change

2. The causal processes — including approach to scaling (e.g., capacity development; communications, multi-stakeholder processes; policy engagement) — which link research outputs to end-of-Initiative outcomes

WP1 fills existing knowledge gaps on SI of MFS along two pathways. Pathway 1 (Understanding most current status and trends of MFS) takes stock of the status of existing MFS and documents updates, identifies key drivers of change affecting these systems at global and regional levels, and identifies novel current trends. It makes this new knowledge available and accessible to key strategic actors (international research institutions, national research institutions, policymakers and donors.). The outputs, if used, enlighten these actors regarding the impending threats and their impact on MFS, as well as the potential opportunities that MFS offer.

Pathway 2 (Entry points and scenarios for SI of MFS) uses the increased awareness among key strategic actors to co-identify intervention entry points for SI, co-develop multi-scale scenario options for the transition of MFS towards gender-transformative SI, and co-develop appropriate implementation strategies and pathways. As this is a participatory process that reveals options to reverse negative trends in MFS and takes advantage of opportunities, key strategic actors will embed these insights into policies, research agendas, and future investment plans to enhance the efficiency, resilience, and sustainability of MFS (WP1 outcomes). This will enable millions of people who depend on MFS to improve their livelihoods (WP1 impact).

3. Key demand, innovation and scaling partners

Demand and scaling partners	Innovation partners
• Regional and international organizations: 69-FAO, 1078-FARA, 194-ECOWAS, 1089-African Union, 862-ASEAN, 144-ASARECA, 2005-SAC • National governments: ministries of agriculture, food, planning, environment, rural development • Donors: e.g., 156-USAID, 154-BMGF, 285-IFAD, 318-European Union, 1407-GIZ, development banks • 1-WEnR, 218-IIASA, 156-USAID Innovation Labs, CGIAR Initiatives and Centers • International research institutions including CGIAR • International private sector entities: e.g., 190-Bayer Crop Science, 1668-Syngenta Foundation for Sustainable Agriculture, 5316-The Coca-Cola Foundation	• CGIAR Initiatives and Centers • International agricultural research institutions including 1-WEnR and 218-IIASA • 156-USAID Innovation Labs • NARES

4. Key WP TOC assumptions and risks

- Up-to-date evidence of the status of MFS and the trends happening in these systems due to different drivers of change will create interest among key policymakers, donors, and research institutions in sustainable and equitable intensification of MFS as a long-term response to development challenges triggered by present and future drivers of change (A1).
- Through our concerted, strategic, and regular interactions (including capacity development) with policymakers, donors, and research institutions, they will build the new research insights provided by this WP into policies, research agendas, and investment plans, respectively (A2).
- Because we will work closely with national and international research institutions to produce new high-quality data on SI of MFS, institutions holding global databases will embed our data into these repositories for wider accessibility and use (A3).

5. Interdependencies and synergies with other Work Packages (and other Initiatives if relevant)

WP1 sets the scene for future trajectories of change within MFS, informing WPs 2–5. Identification of system drivers, constraints, and opportunities directly feeds information into WP2 on methods and tools (M&T); WP1 uses those M&T for MFS analysis and foresight. WP3 co-designs and validates socio-technological SI innovation packages building on insights from WP1 (at different scales) and provides examples of locally co-designed MFS to inform global, regional, and national actors. Findings of WP1 guide the efforts of WP4 to identify enabling environments for scaling, and WP4 provides scaling examples for global actors. WP5 uses the knowledge gaps identified by WP1 to provide capacity development for global actors and guide their investment in capacity building on MFS.

WP1 uses information and outputs from Systems Transformation Initiatives, particularly (i) NPS, (ii) Foresight and Metrics; (iii) Ukama Ustawi (U2), (iv) HER+, and shares with them insights and perspectives.

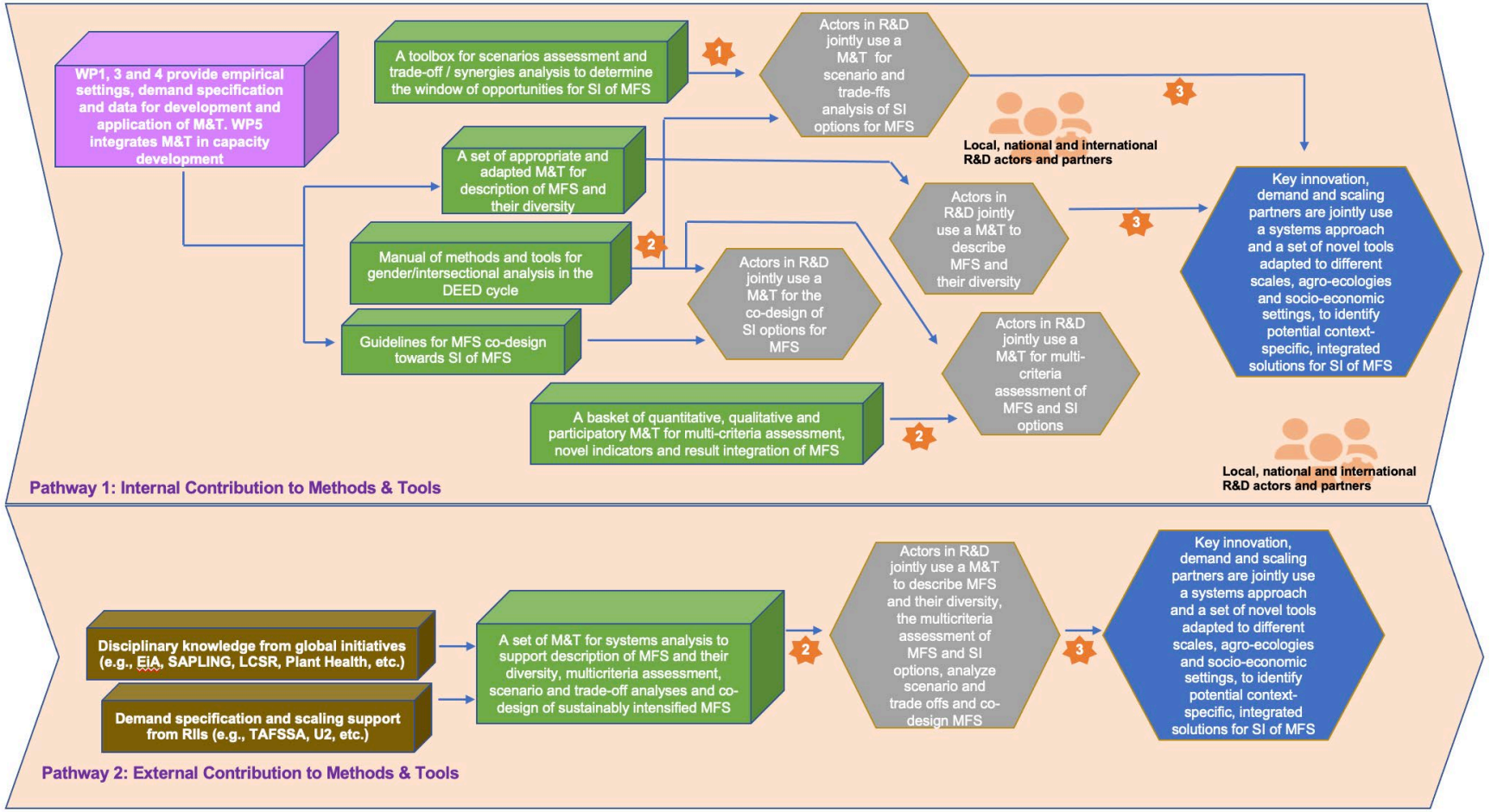
WP1 is implemented in collaboration with TAFS-WCA, U2, and TAFSSA and will use documented evidence from target regions as case studies.

WP1 analysis and outputs will inform the agendas and priority setting of the RAFS Initiatives EiA and SAPLING.

6. Links to Innovation Package and Scaling Readiness Plan

WP1 generates data and knowledge for the development of innovative products, tools, strategies, interventions, and policies by WPs 2–5 in order to achieve the Initiative's outcomes and impacts at scale.

3.2.1 Work Package 2: Building methods and tools (M&T) for SI of MFS



3.2.2 Work Package research plans and TOCs

Work Package title	***WP2: Building methods and tools (M&T) for SI of MFS***
Work Package main focus and prioritization	The set of M&T developed in WP2 supports decisions on what kind of sustainable intensification (SI) might work where, and for whom, in specific contexts. WP2 develops, adapts, and applies new and existing M&T for the analysis of current mixed farming systems (MFS), and the design of more intensified and sustainable systems. Quantitative, qualitative, and mixed M&T provide the basis for prioritization, foresight, targeting, and implementation of SI innovation packages in the process of co-designing sustainably and equitably intensified MFS in specific agro-ecological and socio-economic settings.
Work Package geographic scope (global/region/country)	Global; Regional; Country: GH-Ghana, ET-Ethiopia, MW-Malawi; BD-Bangladesh, NP-Nepal, LA-Lao People's Democratic Republic

The science

1. WP research questions, associated scientific methods and key outputs (narrative, or tabular format if preferred)

WP2 activities are organized around the roles M&T play within the describe-explain-explore-design (DEED) cycle, a proven systems approach to facilitate science-based SI pathways for MFS.

WP2 research questions	Scientific methods	Key outputs
RQ1. What M&T allow the description of MFS and their diversity in support of identification, prioritization, and targeting of specific types of MFS for SI?	- Primary (from WP3) and secondary data analysis and literature review - Statistical, qualitative, and participatory M&T for typology building and gender analysis - Dynamic models and fuzzy cognitive mapping	2.1 A set of appropriate and adapted M&T for description of MFS and their diversity for local partners and WPs 1-5 of the Initiative 2.2 Descriptions of mixed farm types and farming systems in selected settings published and disseminated
RQ2. What M&T allow us to conduct multi-criteria assessment of MFS and explain their performance using multiple sustainability indicators?	- Primary (from WP3) and secondary data analysis and literature review - Application and assessment of quantitative, qualitative, and participatory assessment M&T - Farming systems modelling and trade-off analyses	2.3 A basket of quantitative, qualitative, and participatory M&T for multi-criteria assessment, novel indicators, and result integration of MFS for local partners and WPs 3-5 of the Initiative 2.4 Multi-criteria assessments of current MFS in selected settings published and disseminated

RQ3. What M&T support the exploration of plausible scenarios of SI of MFS at different scales, and describe/assess the trade-offs and synergies associated with those scenarios?	- Farming systems modelling and trade-off assessment - Application and assessment of ex-ante analysis of M&T for SI of MFS Participatory modeling with different MFS actors	2.5 A toolbox for scenario assessment and analysis of trade-offs/synergies to determine windows of opportunity for SI of MFS for local partners and WPs 1-5 of the Initiative 2.6 Scenarios of alternative MFS through SI options in selected settings published and disseminated
RQ4. What M&T can support the design of different pathways towards MFS that address several sustainability objectives in selected settings?	- Quantitative and qualitative analyses of SI options - Stakeholder consultation and participatory approaches	2.7 Guidelines for MFS co-design towards SI to be used by local partners and WPs 3-5 2.8 Documented applications of M&T for co-design of MFS
RQ5. What M&T can be woven into the describe-explain-explore-design (DEED) cycle to better understand and measure inequalities and promote social justice in SI of MFS?	- Evaluation of M&T for gender and intersectional analysis in the DEED cycle	2.9 Manual of M&T for gender/intersectional analysis in the DEED cycle

The theory of change

2. The causal processes — including approach to scaling (e.g., capacity development; communications, multi-stakeholder processes; policy engagement) — which link research outputs to end-of-Initiative outcomes

The vision of success for WP2 is widespread use of systems analysis M&T by MFS actors and partners for the description, assessment, and design of more sustainably intensified MFS. Novel and adapted M&T will allow MFS actors to formalize the knowledge co-created to improve the overall sustainability of MFS in the selected settings. Through the application of these M&T at different scales (WP1, WP3 and WP4) in close collaboration with MFS actors and partners, they will engage in a process to jointly describe current MFS and identify the main challenges and opportunities for their SI. Continuous review of M&T and their results will allow transparent discussions with partners for further adaptation, and will improve the confidence of MFS actors on the use of M&T and the results they generate. Capacity development (WP5) will allow partners in the different countries to internalize the development and application of M&T, ensuring their short- and long-term implementation for improved sustainability of MFS.

3. Key demand, innovation and scaling partners

Demand partners	Innovation partners	Scaling partners
• Donors: e.g., 156-USAID, 1354-ACIAR, 125-World Bank, 285-IFAD, 69-FAO, 154-BMGF, 1407-GIZ • NARES • Local development agencies, departments, ministries	• IARCs: e.g., 1-WUR, 1398-Cornell University, 1270-CIRAD, 145-IRD, 218-IIASA, 433-INRA • 156-USAID Innovation Labs	• NARES • Local NGOs • Farmer groups • Local governments

• Local and international NGOs: e.g., 3174-Helvetas, 111-CRS • Private sector: e.g., local input/output dealers, value chain actors	• CGIAR Initiatives and Centers • NARES	

4. Key WP TOC assumptions and risks

- Results from M&T applied will appeal to partners and donors and increase their engagement to support their further development and application for SI of MFS (A1).
- Systems approaches for analyzing MFS and their results will increase the engagement of actors and their willingness to shift paradigms towards systems principles for their SI, and to apply appropriate M&T generated by WP2 to assess SI options and co-design more sustainable MFS (A2).
- Integrated analyses of MFS will increase partners' willingness to integrate disciplinary knowledge into a systems approach, through M&T developed by WP2, for SI of MFS (A3).

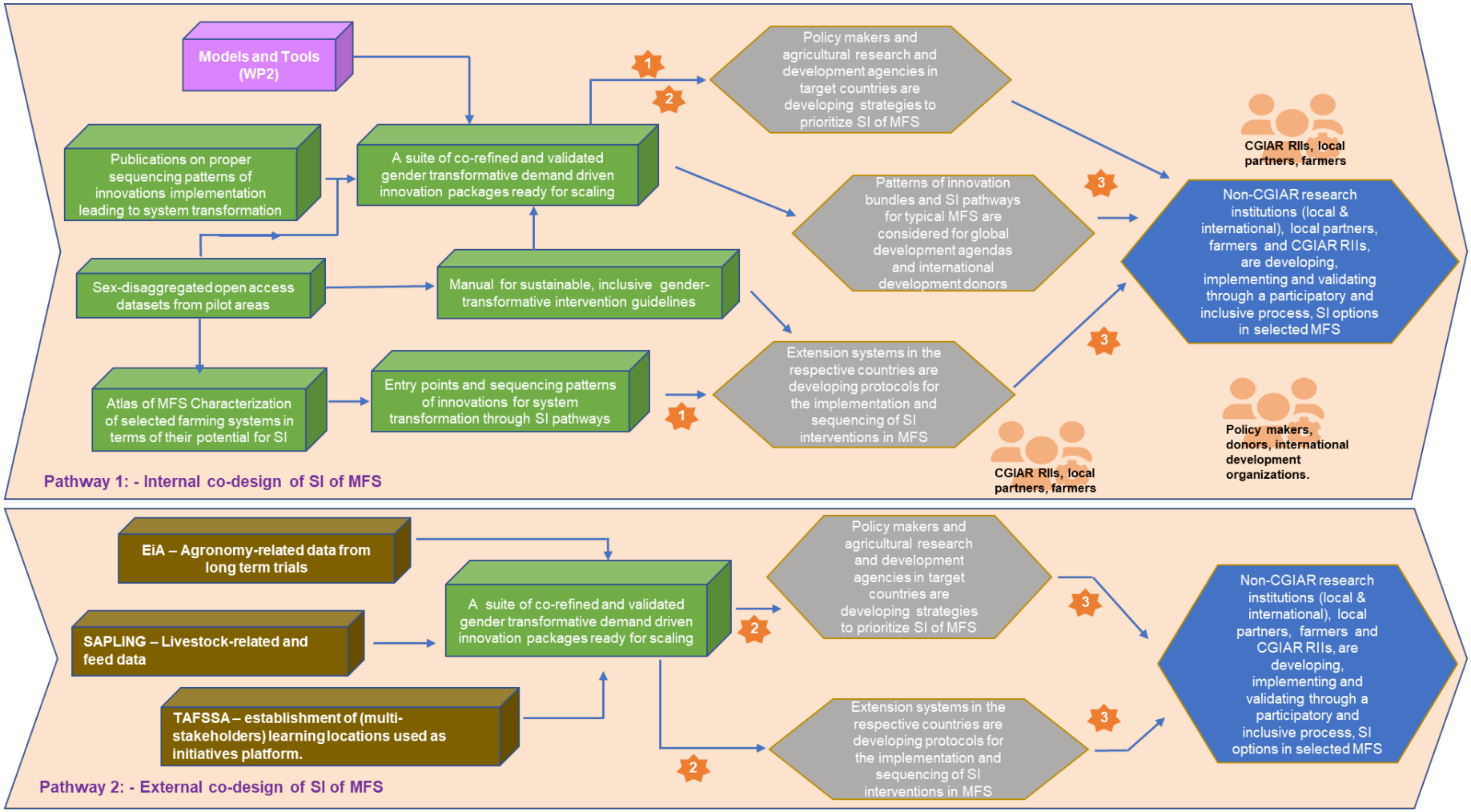
5. Interdependencies and synergies with other Work Packages (and other Initiatives if relevant)

WP2 links to all WPs in this Initiative. M&T will be used through capacity development (WP5) supporting the co-design of MFS (WP3) and their scaling (WP4) in specific cases. The M&T developed, and their application in case studies of MFS in different regions, allow mainstreaming of both SI of MFS, and the M&T (WP1). Interactions with other RAFS, ST, and RII Initiatives will be formalized, as innovation platforms, knowledge hubs, and learning modules are used to adapt, develop, and apply M&T and integrate local and disciplinary knowledge into a systems perspective to address the main challenges faced by SI of MFS.

6. Links to Innovation Package and Scaling Readiness Plan

Some M&T for systems analysis, at different scales and for different purposes (e.g., to describe, explain, explore, and design more sustainable MFS), are sufficiently robust and flexible to be used by MFS actors depending on the choice of SI socio-technical innovation packages. As M&T are utilized along with novel methods and adaptations to specific settings, through capacity development (WP5) partners will immediately be able to implement some WP2 outputs, leading to more sustainable MFS and a paradigm change for agricultural R&D.

3.2.1 Work Package 3: Participatory co-design of MFS with evidence-based, validated SI innovation packages



3.2.2 Work Package research plans and TOCs

Work Package title	***WP3: Participatory co-design of MFS with evidence-based, validated SI innovation packages***
Work Package main focus and prioritization	WP3 focuses on the participatory design, implementation, critical reflection, and monitoring of approaches and interventions for SI of MFS in specific socio-ecological contexts. It targets, field-tests, and pilots specific SI options that are responsive to improving efficiency, equity, and resilience, in regions where MFS dominate the landscape. WP3 assesses demand and refines SI options through data from a network of pilot sites. It identifies, characterizes, and validates the features of innovation packages that are likely to propel users along SI pathways. It will generate strong evidence that promotes adoption and highlights aspects contributing to uptake, thus closing the knowledge gaps for tackling delivery at scale.
Work Package geographic scope (global/region/country)	Country: GH-Ghana, ET-Ethiopia, MW-Malawi; BD-Bangladesh, NP-Nepal, LA-Lao People's Democratic Republic

The science

1. WP research questions, associated scientific methods and key outputs (narrative, or tabular format if preferred)

WP3 research questions	Scientific methods	Key outputs
RQ1. In selected MFS, what are the opportunities, constraints, and preferred entry points for improving equity, resilience, and efficiency along SI pathways? (Co-diagnostics)	- Primary data collection for system characterization, stakeholders' preferences, gender analysis, farmers' behavior, etc. - Participative diagnostics and facilitation for local development of MFS through innovation platforms/Living Labs (operated by other initiatives in the actions sites/countries if existing, and installed by the SI-MFS Initiative if not)	3.1 Sex-disaggregated open access datasets, generated from pilot areas, ready for use by WP2, WP4 and WP5, and by other Initiatives and partners 3.2 MFS typology and characterization of selected farming systems in terms of their potential for SI for living e-Atlas (1.3), with a specific focus on resilience, efficiency, and equity, and on farmers' preferences (based on sex-disaggregated open access datasets generated through mixed methods)
RQ2. Which features of socio-technical innovation packages for SI of MFS enhance uptake and improve sustainability,	- Stakeholder consultations through existing innovation platforms (e.g., Living Labs, Scaling Hubs) for validation of the full range of issues and decision criteria on MFS	3.3 Published technical papers providing a suite of co-refined and validated, context-specific, technically and economically viable, gender-transformative

resilience, and equity of MFS? (Participatory bundling in selected farming systems)	- Participatory methods and social relations analysis (institutional analysis): stimulate engagement of diverse stakeholder groups and scientists in a transdisciplinary process of matching package components including the use of ranking and scoring - Participatory SWOT analysis (e.g., vision journey from Gender Action Learning System)[99]	and demand-driven innovation packages ready for testing in selected farming systems
RQ3. Which are the most scalable SI innovation packages that improve sustainability, resilience, and equity in the selected MFS? (Co-evaluation)	- Monitoring and evaluation - Impact assessment about social learning and behavioral change - Stakeholder validation, participatory monitoring ensuring balanced participation of various social groups	3.4 Published technical papers providing a suite of validated and context-specific SI innovation packages ready for scaling 3.5 Publications on proper sequencing patterns of innovation implementation leading to system transformation through SI pathways are identified and promoted for the MFS types considered 3.6 Published manuals for sustainable, inclusive, and gender-transformative implementation of SI-MFS innovations in different contexts

The theory of change

2. The causal processes — including approach to scaling (e.g., capacity development; communications, multi-stakeholder processes; policy engagement) — which link research outputs to end-of-Initiative outcomes

WP3 informs understanding of how SI functions in different MFS and the bottlenecks (trade-offs), including social inequalities. Under pathway 1, WP3 pilots SI solutions through identification and validation of innovation packages relevant to SI of MFS. Open access sex-disaggregated datasets from pilot areas and demonstrations will be collected to characterize the selected MFS and their scope/potential for SI. Gender-oriented and socially inclusive solutions for accelerating SI of MFS will be identified through participative gender analysis of women's empowerment and diagnosis of gender-related constraints in MFS. Through multi-stakeholder processes (including existing Living Labs and other innovation platforms) these intermediate outputs will lead to (i) co-refined and validated sustainable innovation packages for the different MFS; (ii) identified entry points and sequencing patterns of these innovations for system transformation throughout SI pathways; (iii) combinations of context-specific gender-transformative intervention guidelines. These outputs will be used by the WP4 working group to encourage policymakers and agricultural R&D agencies in target countries to develop strategies prioritizing SI of MFS, based on existing demand from partners and stakeholders, to support MFS transformation through co-delivery of SI innovations at scale (A2).

Under pathway 2, the outputs from other initiatives (e.g., EiA, SAPLING, TAFSSA, HER+) will be used by the WP4 working group to encourage policymakers and extension systems to prioritize and implement SI of MFS in response to demand from partners and stakeholders to

support MFS transformation. Interest from a wider network in co-developing and implementing SI of MFS at scale will enhance participatory development, implementation, and validation of SI options in selected MFS (A3). This will incentivize smallholder farmers to implement new SI of MFS and achieve more resilient livelihoods.

3. Key demand, innovation and scaling partners

Demand partners	Innovation partners	Scaling partners
• NARES, universities • Local and international NGOs: e.g., 3174-Helvetas, 111-CRS, 1271-CARE International, 87-OXFAM, 1683-UN Women • Farmers' associations • Agricultural administrations	• NARES, universities • NGOs • Farmers' associations • IARCs: e.g., 1-WUR, 1398-Cornell University, 1270-CIRAD, 145-IRD, 2209-KIT	• National governments/ agricultural administrations • Policymakers • NARES • NGOs • Farmers' associations • Private sector: e.g., local input/output dealers, value chain actors • 7408-MoGCSP

4. Key WP TOC assumptions and risks

- Early engagement of local, regional, and national actors of different backgrounds motivates them to take part in a demand-driven process for co-consultation, co-design, and co-implementation of SI of MFS innovations (A1).
- The options offered by SI of MFS generate demand from partners and stakeholders for MFS transformation through co-delivery of SI innovations at scale (A2).
- The options offered by SI of MFS generate interest from wider networks in co-developing and implementing SI of MFS at scale and engaging in a scaling process that may involve different types of partnerships and arrangements (A3).

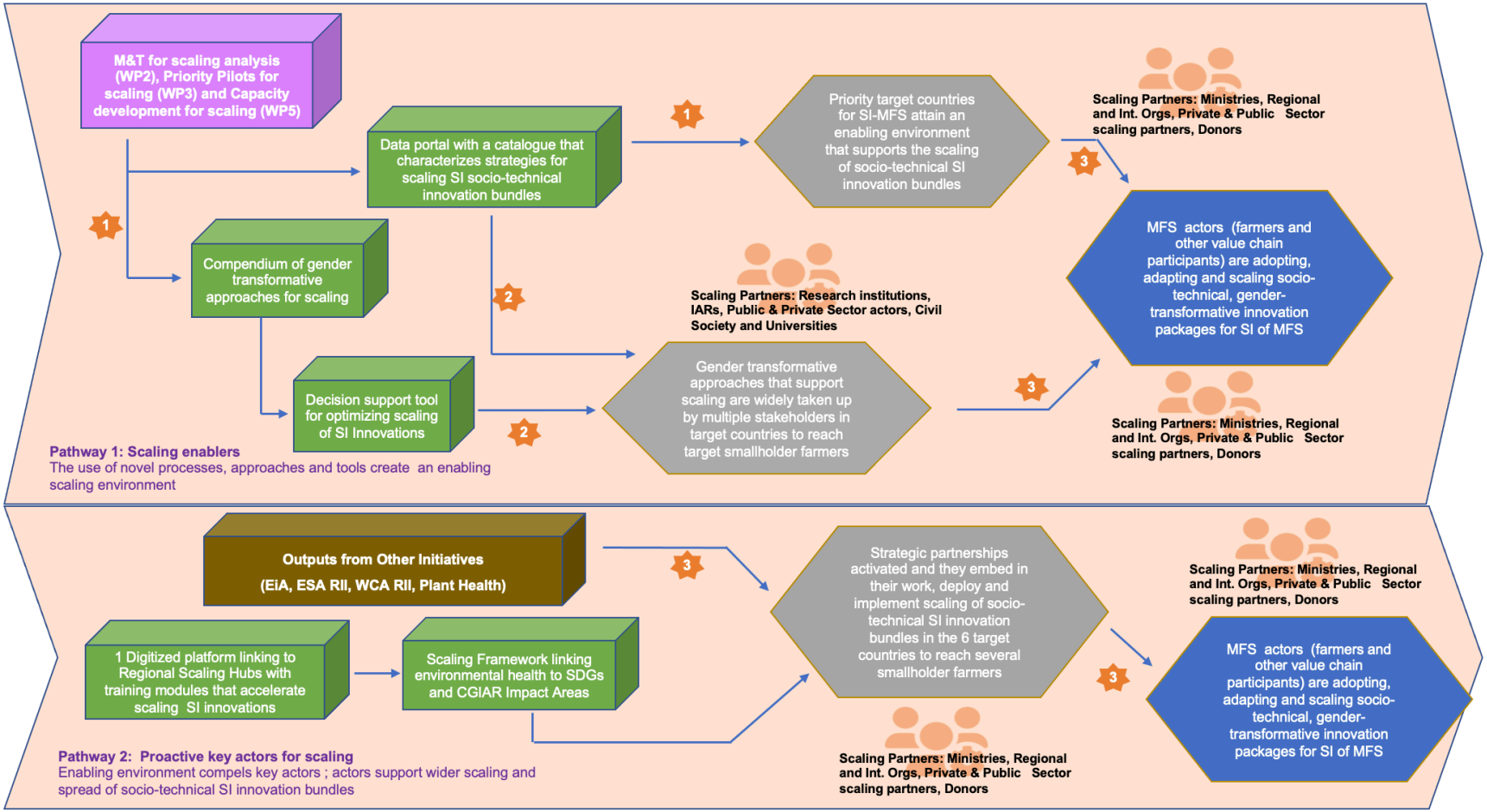
5. Interdependencies and synergies with other Work Packages (and other Initiatives if relevant)

WP3 provides empirical settings, demand specifications, and data to develop/adapt and apply M&T from WP2, and empirical evidence on SI options for further consideration from WP1 and WP4. Methodological support to WP3 for the co-design process will be provided by WP2. With support from WP4, WP3 will generate evidence on enabling environments for scaling and will support the related capacity development (WP5). WP3 will engage in pilot sites where other Initiatives are operating (e.g., Foresight & Metrics, EiA, SAPLING, TAFSSA).

6. Links to Innovation Package and Scaling Readiness Plan

WP3 will co-refine, co-design, and adapt innovation packages for the target pilot areas. WP3 will help to identify the core innovations for MFS, which will then be packaged using the Scaling Readiness Approach[100]. WP3 will offer support for implementation of the Scaling Readiness Approach, and prioritize actions and interventions needed for each innovation package in different contexts. WP3 will be responsible for the implementation and coordination of key local and landscape-level components of the scaling strategies developed using this approach.

3.2.1 Work Package 4: Advancing and supporting scaling of innovations



3.2.2 Work Package research plans and TOCs

Work Package title	***WP4: Advancing and supporting scaling of innovations***
Work Package main focus and prioritization	WP4 seeks to enhance the enabling environment for scaling of socio-technical SI innovation packages for the priority MFS at multiple levels, in and beyond the target pilots. It will accomplish this through strategic partnerships and building the capacity of relevant actors in scaling approaches. WP4 generates and helps define the nature of those context-specific socio-technical SI innovation packages that have inclusive support mechanisms (policy, governance, market integration, extension services, and other institutional support) to amplify the synergies of MFS components and enhance their scalability. A gender-transformative approach will be central to all innovation and scaling design to enhance equity.
Work Package geographic scope (global/region/country)	Country: GH-Ghana, ET-Ethiopia, MW-Malawi; BD-Bangladesh, NP-Nepal, LA-Lao People's Democratic Republic

The science

1. WP research questions, associated scientific methods and key outputs (narrative, or tabular format if preferred)

WP4 research questions	Scientific methods	Key outputs
RQ1. What are the constraints and drivers that will affect the scaling of SI innovations over the coming decade, and what opportunities can be harnessed to build more adaptability into the socio-technical SI innovations that the Initiative will promote?	- MFS systems analysis with decision support tools - Mixed methods to establish relevant strategies for scaling of SI innovations in MFS - Stakeholder consultation/FGD, key informant interviews - Institutional and policy analysis to identify constraints and scaling opportunities for SI innovations	4.1 Easily accessible data portal developed, with a catalogue that characterizes strategies for scaling of SI socio-technical innovation packages for implementing partners
RQ2. What are contextually relevant scaling approaches for inclusive, gender-transformative SI innovations, and how can these approaches complement each other at multiple scales (household, community, sub-national)?	Testing combinations of a selected number of outreach and replication models for upscaling gender-transformative, inclusive change (e.g., drama, pyramid sharing, experience-sharing sessions, multi-stakeholder value chain platforms, transformative agribusiness partnerships, inclusion of extension training in national curricula, messaging through social media platforms)	4.2 Compendium of validated approaches for scaling gender-transformative approaches published and widely shared with target beneficiaries

RQ3. What potential market governance and institutional innovations can ensure the scalability of relevant, gender-transformative SI strategies in MFS?	- Policy dialogues and market analysis - Participatory approaches to test institutional innovations and market governance arrangements	4.3 User-friendly decision-support tool for policymakers, that optimizes scaling of market opportunities and institutional innovations, developed and widely shared
RQ4. What are the inclusive and demand-driven capacity building needs for scaling the promotion and implementation of SI innovations that support environmental health and resilience, and biodiversity?	- Use of the Sustainable Intensification Assessment Framework[101] to evaluate sustainability of SI innovations in MFS - Implementing digital methods for SI innovations to reach thousands of beneficiaries in MFS	4.4 Digital platform developed that links to regional scaling hubs with capacity building training modules to accelerate scaling of SI socio-technical innovation packages for target beneficiaries 4.5 Framework that supports scaling of SI of MFS, linking policies and SDGs to environmental health and biodiversity and to the five Impact Areas, published and disseminated to target beneficiaries

The theory of change

2. The causal processes — including approach to scaling (e.g., capacity development; communications, multi-stakeholder processes; policy engagement) — which link research outputs to end-of-Initiative outcomes

WP4 involves two impact pathways: (1) the use of novel processes and tools with multiple stakeholders will enhance an enabling environment for scaling; (2) this compels key strategic actors to be more proactive and to support uptake, wider scaling, and spread of socio-technical SI innovation packages beyond the target pilot sites.

Through pathway 1, methods and tools (M&T) from WP2 that inform feasible scaling options, along with pilot prioritization options from WP3 and capacity building efforts for scaling from WP5, will contribute to a data portal that characterizes strategies for scaling. This provides policy guidance that is aligned with agricultural country priorities on key institutional innovations, and a compendium of gender-transformative approaches that support scaling. These outputs contribute to two WP-level outcomes: an enabling environment that supports scaling of SI innovation packages (assumption 1); and gender-transformative approaches that support scaling to be taken up by multiple stakeholders (assumption 2). The use of SI innovation packages aligned to national agricultural priorities results in increased production and income (demonstrated by WP3 pilots). These changes incentivize and result in an overall enhanced enabling environment and interest in the adoption, adaptation, and scaling of SI innovations (assumption 3). Pathway 2 of WP4 will combine with outputs from other Initiatives (e.g., EiA through the Deliver WP; WCA and ESA RIIs; Plant Health Initiative), contributing to learning alliances through a digital platform that links to a CGIAR-wide regional scaling hub to accelerate scaling.

3. Key demand, innovation and scaling partners

Demand partners	Innovation partners	Scaling partners
• Regional and international organizations: 69-FAO, 1078-FARA, 2138-IGAD, 194-ECOWAS, 3438-SADC, 274-COMESA, 1683-UN Women • NGOs: e.g., 87-OXFAM, 1271-CARE International • Smallholder farmers, public and private sector entities, local implementing partners • Donors: e.g., 156-USAID, 1407-GIZ	• CGIAR Centers • IARCs • Universities • 156-USAID Innovation Labs • NARES • Civil society	• Ministries of agriculture and gender (e.g., 7408-MoGCSP • Public and private sector partners • Civil society, organizations that advocate for women farmers' or young farmers' rights: e.g., 7408-NCWD (Ghana), 7413-GENET (Malawi), 7445-NETRIGHT

4. Key WP TOC assumptions and risks

- Participatory engagement with relevant actors on attractive SI packages contributes to an environment that promotes enabling conditions and policies to further support the scaling of socio-technical SI innovation packages (A1).
- SI innovations are aligned to national agricultural priorities so that SI-related research findings are co-developed and packaged in a way that addresses demand for SI innovations and supports scaling (A2).
- Evidence of increased production and income triggers further interest from wider networks to adopt and adapt SI of MFS at scale (A3).

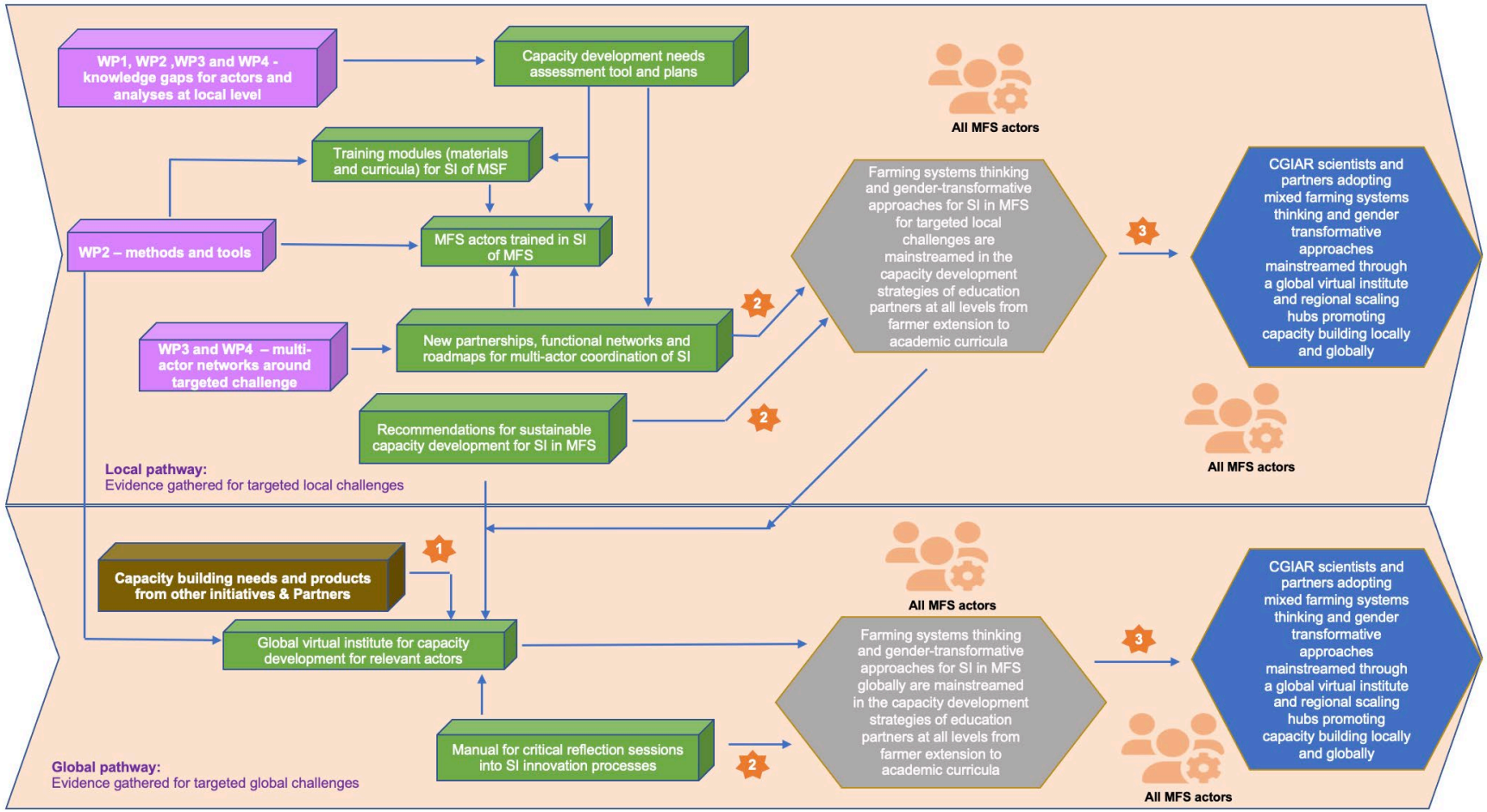
5. Interdependencies and synergies with other Work Packages (and other Initiatives if relevant)

WP4 is cross-cutting and links to all SI-MFS Initiative WPs. Evidence generated by WP1 on system drivers and opportunities, and M&T from WP2, will be used to assess the scalability of innovations. WP3 will prioritize SI socio-technical innovation packages, which will then be used by WP4 during the co-design of gender-transformative approaches for scaling partners to implement. WP5 will design the capacity building modules used by WP4 to develop strategies and implementation options tailored for scaling empowerment. Outputs from WP1 of HER+ will be integrated. The EiA Initiative, and ESA and WCA RIIs, will be potential receivers of SI socio-technical innovation packages for embedding in sites for further scaling.

6. Links to Innovation Package and Scaling Readiness Plan

WP4 will use socio-technical SI innovation packages, multi-criteria toolboxes, and decision support to conduct evidence-based assessment of scaling readiness.

3.2.1 Work Package 5: Capacity building for MFS design and analyses



3.2.2 Work Package research plans and TOCs

Work Package title	***WP5: Capacity building for MFS design and analyses***
Work Package main focus and prioritization	WP5 builds capacity of relevant actors in socio-technical, inclusive, participatory, and gender-transformative approaches for systems' design and analyses. By doing so, WP5 supports the understanding of context-specific challenges and opportunities for equitable system intensification with suitable socio-technical SI innovations packages, identified in WP3. WP5 makes the connection between what is available and needed to mainstream systems thinking and system-level assessments and understanding among relevant actors. A key component of WP5 is the promotion of continuous critical reflection on system actors' demand for, and on processes and outcomes of capacity development to support its long-term impact on university and college students, scientists, extension agents, farmers, private sector, policymakers and development actors.
Work Package geographic scope	Global; Regional; Country: GH-Ghana, ET-Ethiopia, MW-Malawi; BD-Bangladesh, NP-Nepal, LA-Lao People's Democratic Republic

The science

1. WP research questions, associated scientific methods and key outputs (narrative, or tabular format if preferred)

WP5 research questions	Scientific methods	Key outputs
RQ1. How can assessment tools capture actors' multiple capacity development needs and priorities for effective engagement in, and analysis of, SI innovation processes (including gender and intersectional analysis)?	- Stakeholder consultations - Desk reviews - Key informant interviews - Surveys - Co-learning approaches	5.1 Capacity needs assessment tools and capacity development plans 5.2 Global virtual institute for capacity development for relevant actors
RQ2. How does improved capacity for systems analysis influence cross- and transdisciplinary and multi-stakeholder ways of collaboration in SI innovation processes, and vice-versa?	- Bayesian networks - Decision-making analysis - Multi-actor role games, co-learning approaches - Participatory, transdisciplinary approaches - Agricultural systems modelling	5.3 New partnerships, functional networks, and roadmaps for multi-actor coordination for SI of MFS
RQ3. How can actor-centered capacity development, conceptualized at the agricultural innovation system level, influence the identification of problems and of sustainable and inclusive	- Contextualization of materials and tools: stakeholder consultations, desk reviews, key informant interviews - Efficient training methods	5.4 Training modules (materials, curricula) for SI of MFS 5.5 MFS actors trained in SI of MFS

solutions, and prompt positive change in MFS sustainability?	- Assessment of MFS sustainability changes: impact evaluation, contribution analysis	
RQ4. How can continuous critical reflection on processes and outcomes from systems approaches support sustainable capacity development and the inclusion of less represented MFS actors in agricultural systems assessment and design?	- Monitoring and evaluation methods, including contribution analysis - Participatory monitoring, evaluation and learning approaches	5.6 Recommendations for sustainable capacity development for SI in MFS 5.7 Manual for building critical reflection sessions into SI innovation processes (including reflections on equity in processes and outcomes)

The theory of change

2. The causal processes — including approach to scaling (e.g., capacity development; communications, multi-stakeholder processes; policy engagement) — which link research outputs to end-of-Initiative outcomes

WP5 proposes two pathways to achieve outcome 5, based on evidence gathered: (1) a local pathway for targeted local challenges; (2) a global pathway for targeted global challenges. Through pathway 1, a capacity assessment toolbox is designed together with stakeholders from each of the prioritized farming systems and geographies, building on the outputs from WPs 1–4. Through feedback loops between needs assessments and the monitoring and evaluation of progress, capacity development plans are regularly adapted in close interaction with WP4 on scaling and policy.

WP5 recognizes the impact, interplay, dependence, roles, and power between different actors. Capacity building approaches are developed around specific challenges that need to be addressed through coordinated action, such as the management of shared natural resources, and that need coordination between institutions and individuals, across scales, using multi-actor platforms. These multi-actor networks are established with WP3 on the co-creation of MFS. Role games for mixed groups of actors are used to gain a common understanding of needs, improve dialogue between stakeholders, and support co-development of action roadmaps. The activity investigates which capacity development measures are needed to ensure the participation of social actors who were previously excluded from cooperation, planning, and decision-making. The equitable representation of actors (gender, ethnicity, age, etc.) is emphasized to consider differential needs and create fair outcomes.

Capacity building activities are tailored for each group of actors, and include tools and approaches for various scales (farm to landscape) developed in WP2. Training materials developed range from paper leaflets to digital apps supporting decision-making, and video tutorials. Curricula for academic and training institutions are developed with partners.

The learning from this process culminates in the creation of a global virtual institute for all relevant actors (pathway 2). Extension services use novel training materials to build capacity of their agents in participatory approaches to farming systems design and analysis. A strategy for investment in capacity building for SI of MFS is developed.

3. Key demand, innovation and scaling partners

Demand, innovation, and scaling partners are the same due to the participatory nature of WP5. Capacity building activities are tailored according to demand from actors at different levels, who in turn are taking part in the process of innovation and scaling of capacity building.

Organization type	Organizations
Universities (global)	7409-l'Institut Agro, 1-WUR, 1398-Cornell University, 2535-University of Bern
National institutions	572-NAFRI, 268-MONRE, 1096-BARC, 1113-BRRI, 141-BARI, 3564-BWMRI, 2980-DAE, 28-NARC, 4180-CSIR, 143-EIAR, 1990-MOAIWD
Farmers' networks	e.g., 7410-Lao farmers' network, 1542-Bangladesh Seed Association, 2350-NASFAM, 6614-ACDEP, 7412-FARMS
Regional networks	1909-ALiSEA, 2005-SAC
NGOs	3174-Helvetas, 111-CRS, 3673-TLC, 1271-CARE International, 87-Oxfam, 1683-UN Women, 7445-NETRIGHT
Donors	156-USAID, 1354-ACIAR, 125-World Bank, 285-IFAD, 1878-AfDB, 644-SDC, 69-FAO, 320-ADB, 1902-JICA, 154-BMGF
International agricultural research institutions	1270-CIRAD, 145-IRD, other CGIAR initiatives
International private sector	e.g., agro-industry, agro-dealers, food companies

4. Key WP TOC assumptions and risks

- Because farmers want to increase production, students want to learn about SI of MFS for their future career, and scientists want to keep agricultural production within planetary boundaries and understand and communicate sustainable development pathways, these and other actors are interested in learning and collaborating with each other (A1).
- Because capacity development strategies are co-developed, training and education partners will implement them (A2).
- Because a systems approach to SI of MFS supports multi-actor analysis and design, change in MFS will be accelerated (A3).

5. Interdependencies and synergies with other Work Packages (and other Initiatives if relevant)

WP5 uses the knowledge gaps identified by WP1 to provide capacity development of global actors and guide their investment in capacity building on MFS. Locally, actors from WP3 networks are trained using methods and tools developed by WP2, responding to needs identified in WP4. WP5 provides feedback to WPs 1–4 on actors' needs and on capacity building progress. Learning alliances with other initiatives are sought, especially in the frame of the global virtual institute for capacity development.

6. Links to Innovation Package and Scaling Readiness Plan

WP5 will contribute to the development and scaling of innovation packages related to capacity development. These will include, among others, guidelines for gender-responsive communication, a gender training manual for farming systems action research and extension, and training materials supporting SI of MFS. WP5 will support scaling readiness assessment for these and other innovations and will define the interventions needed for each innovation to be packaged for different contexts.

4. Innovation Packages and Scaling Readiness Plan

4.1 Innovation Packages and Scaling Readiness Plan

The SI-MFS Initiative builds on a strong foundation of innovations generated under CGIAR research programs (e.g., LIVESTOCK, WHEAT, MAIZE, GLDC) and specific SI projects (e.g., Africa RISING, CSISA, SIMLESA). Innovations for SI of MFS include, among others, the diversification of cropping systems with multipurpose crops; improved forages and supplemental feeding of livestock; and crop residue and manure management; as well as tools for assessing and targeting MFS innovations.

An initial set of co-identified innovations for SI of MFS have been widely tested and validated, and are ready for effective bundling into scalable innovation packages using the Scaling Readiness Approach[102]. SI-MFS will apply scaling readiness to 26–50% of its total innovation portfolio. Most innovation packages will be on Wave 2 backstopping with Light Track commencing in Q3-2022 and Standard Track by Q2-2023.

At least 12 scaling readiness assessment studies (six Light Track and six Standard Track) will be published by 2025. These will (i) provide a detailed characterization of core SI-MFS innovations; (ii) diagnose their current readiness and use (WP2, WP3); and (iii) lay the foundation for strategies to overcome bottlenecks for scaling. WP3 and WP4 will capitalize on these studies to provide guidance for prioritization of scaling opportunities and implementation investments.

SI-MFS has allocated US$779,581 to conduct scaling readiness in the various Initiative locations (2022/23: US$258,581; 2023/24: US$470,315; 2024/25: US$50,684). Dedicated activities, deliverables, indicators, and line-items are included in the Management Plan, MELIA, and Budget sections. Scaling readiness assessment within MFS will be coordinated with other initiatives (SAPLING, EiA, LCCR, HER+) to enhance synergies.

5. Impact statements

5.1 Nutrition, health and food security

Challenges and prioritization

Due to demographic and climate pressures, more food needs to be produced on less land to meet the planet's dietary requirements[103,104]. Food security for all is possible only if agricultural production is intensified in a sustainable way. A wider range of mixed farming systems (MFS) targeted to specific locations will lead to more diverse food and healthier diets. These goals are at the core of the SI-MFS Initiative. By focusing on countries with high food insecurity and malnutrition, all five WPs contribute directly to ending hunger and enabling affordable, healthy diets for the 107 million people without access to safe and nutritious food. This will be achieved through accelerated innovation on assessing, co-creating, and enabling new MFS. Higher efficiency and diversity of products generated by MFS will provide more and diversified food and nutritional security to rural and urban households through healthy and affordable diets, contributing to SDGs 2 and 3.

Research questions

As all research questions of this Initiative address aspects of sustainable intensification, they all deliver on nutrition, health, and food security. One key example is selected from each WP:

- WP1, RQ3. What affordable entry points can be identified for the transition of these MFS towards sustainably intensified systems [for improved nutrition, health, and food security] that mitigate any negative impact and harness opportunities presented by the drivers of change?
- WP2, RQ4. What M&T can support the design of different pathways towards MFS that address several sustainability objectives [including nutrition, health, and food security] in selected settings?
- WP3, RQ2. Which features of socio-technical innovation packages for SI of MFS enhance uptake and improve sustainability, resilience, and equity of MFS [supporting nutrition, health, and food security]?
- WP4, RQ1. What are the constraints and drivers that will affect the scaling of SI innovations over the coming decade, and what opportunities can be harnessed to build more adaptability into the socio-technical SI innovations that the Initiative will promote?
- WP5, RQ3. How can actor-centered capacity development, conceptualized at the agricultural innovation system level, influence the identification of problems and of sustainable and inclusive solutions, and prompt positive change in MFS sustainability [including in nutrition, health, and food security of MFS actors]?

Components of Work Packages

All outputs contribute to achieving the increased food production needed to support the growing global population without compromising the needs of future generations, and the diversity needed for healthier diets.

Measuring performance and results

Sustainably intensified and equitable MFS are co-designed and adopted by farming households, contributing to increased food security, nutrition, and health.

Food security, food availability, and household diet diversity score (HDDS) are standard indicators used to assess farming systems performance and are used in all five WPs.

Partners

All partners listed for this Initiative.

Human resources and capacity development of Initiative team

All staff listed for this Initiative.

5.2 Poverty reduction, livelihoods and jobs

Challenges and prioritization

Over 550 million people in extreme poverty (on <$1.90 PPP/day) live in rural areas, and two-thirds derive their livelihoods from agriculture[105]. In the six focus countries of the SI-MFS Initiative, over 80 million people are in extreme poverty, and half depend on agriculture[106]. The main cause of rural poverty is low productivity in agricultural systems (land, labor, capital). Growth originating from agriculture has been two to four times more effective at reducing poverty than growth originating from other sectors[107]. Agricultural development towards diversified MFS (food and cash crops, fisheries, livestock), alongside other rural development, can increase food supply, reduce food prices, raise incomes, create jobs, and increase demand for goods and services, with positive impacts on SDGs 1, 2, 5, and 8. The SI-MFS Initiative will prioritize smallholders' access to improved technologies and services; stronger market systems and value chains; enabling policies and institutions; public-private partnerships; and capacity development.

Research questions

- WP1, RQ2. What novel trends (intensification, extensification, diversification, specialization) and associated socio-economic and environmental consequences [including income, jobs, and livelihoods] can be projected in these MFS, given past, existing, and emerging drivers of change?
- WP2, RQ3. What M&T support the exploration of plausible scenarios of SI of MFS at different scales, and describe/assess the trade-offs and synergies associated with those scenarios [including impacts on poverty reduction, jobs, and livelihoods]?
- WP3, RQ2. Which features of socio-technical innovation packages for SI of MFS enhance uptake and improve sustainability, resilience, and equity of MFS [to reduce poverty, create jobs, and improve livelihoods]?
- WP4, RQ3. What potential market governance and institutional innovations can ensure the scalability of relevant, gender-transformative SI strategies in MFS [that improve income, jobs, and livelihoods]?
- WP5, RQ3. How can actor-centered capacity development, conceptualized at the agricultural innovation system level, influence the identification of problems and of sustainable and inclusive solutions, and prompt positive change in MFS sustainability [including in poverty reduction, jobs, and livelihoods]?

Components of Work Packages

The outputs of WPs 1, 3, and 4 will innovate and catalyze new solutions for SI of MFS, which have the potential to create more jobs in agrifood systems and reduce poverty by improving livelihoods of MFS actors, especially for women, youth, and marginalized farmers. The outputs of WPs 2 and 5 will also generate positive impacts on poverty reduction, livelihoods, and jobs. These impacts will be realized at scale in the medium to long term when new solutions are scaled by partners and adopted by end-users.

Measuring performance and results

The adoption, adaptation, and scaling of SI options for MFS in the target domain will lead to (i) improved livelihoods of people through higher incomes, and (ii) increased on-farm and off-farm jobs, which will (iii) lift people out of poverty.

Partners

All partners listed for this Initiative.

Human resources and capacity development of Initiative team

Implementation of the activities to achieve this outcome will require a team of socio-economists. Staff will be trained in the required knowledge and skills.

5.3 Gender equality, youth and social inclusion

Challenges and prioritization

Social inequalities are a persistent feature of agrifood systems, including mixed farming systems (MFS). They relate to deeply entrenched inequitable norms that produce unfavorable outcomes, primarily for women, young people, and marginalized actors, and obstruct progress towards the SDGs[108]. Inequalities are compounded by large-scale processes such as climate change, population pressure, and the COVID-19 pandemic[109,110]. Sustainable intensification (SI) responds to the need to feed growing populations and to counteract environmental degradation[111]. Yet attention to how SI may (re-)produce inequalities has remained low[112]. The SI-MFS Initiative aims at embedding social justice and inclusion into SI. Addressing inequitable norms will result in fairer allocation of benefits to women and men farmers. Transformative and technical innovations will be packaged, tested, and assessed for their potential for scaling. Results will inform development actors on transformative SI strategies.

Research questions

- WP1, RQ4. What lessons do current and past interventions hold for innovative strategies to make SI gender-transformative and socially inclusive in MFS?
- WP2, RQ5. What M&T can be woven into the describe-explain-explore-design (DEED) cycle to better understand and measure inequalities and promote social justice in SI of MFS?
- WP3, RQ3. Which features of socio-technical innovation packages enhance uptake and improve sustainability, resilience, and equity of MFS [supporting gender equality, youth and social inclusion]?
- WP4, RQ2. What are contextually relevant scaling approaches for inclusive, gender-transformative SI innovations, and how can these approaches complement each other at multiple scales (household, community, sub-national)?
- WP5, RQ4. How can continuous critical reflection on processes and outcomes from systems approaches support sustainable capacity development and the inclusion of less represented MFS actors in agricultural systems assessment and design?

Components of Work Packages

Compendium of strategies and approaches that builds equity and social inclusion within MFS in selected regions (WP1); Manual of methods and tools for gender/intersectional analysis in the DEED cycle (WP2); Repertoire of context-specific gender-transformative and inclusive innovations for SI packages in selected farming systems (WP3); Compendium of validated

approaches for scaling gender-transformative and inclusive change within SI innovation processes in MFS (WP4); Manual for building critical reflection sessions into SI innovation processes (including reflections on equity in processes and outcomes) (WP5).

Measuring performance and results

SI of MFS will empower women and other marginalized groups, including their objectives and aspirations, and increasing their capacity and role in decision making.

Partners

1271-Care International, 285-IFAD, 87-Oxfam, 1407-GIZ, 2209-KIT, ministries of agriculture, 7408-MoGCSP, 762-IDRC, 69-FAO, 7445-NETRIGHT, 1683-UN Women, 143-EIAR.

Human resources and capacity development of Initiative team

The gender team of the Initiative includes a senior gender researcher, who will conduct a capacity assessment of core staff and partners and offer continuous training.

5.4 Climate adaptation and mitigation

Challenges and prioritization

Without adaptation, climate change may depress global growth in agriculture yields up to 30% by 2050, and around 500 million small farms will be most affected[113]. We are set to pass 1.5ºC warming by 2040,[114]. SI of MFS is key to climate change adaptation and mitigation, building resilience and reducing greenhouse gas (GHG) emissions through resource-use efficiencies. For example, using waste generated by one component as a resource for another minimizes use of external inputs (fertilizers, water, energy), reducing carbon footprints and GHG emissions[115]. The MFS approach provides system-level solutions that, when scaled up, lead to transformative adaptation and co-benefits of mitigation.

Research questions

- WP1, RQ2. What novel trends (intensification, extensification, diversification, specialization) and associated socio-economic and environmental consequences [including climate adaptation and mitigation] can be projected in these MFS, given past, existing, and emerging drivers of change [notably those related to climate change]?
- WP2, RQ3. What M&T support the exploration of plausible scenarios [including those associated with climate change] of SI of MFS at different scales, and describe/assess the trade-offs and synergies associated with those scenarios [in relation to climate adaptation and mitigation]?
- WP3, RQ2. Which features of socio-technical innovation packages for SI of MFS enhance uptake and improve sustainability, resilience, and equity of MFS [enhancing climate adaptation and mitigation]?
- WP4, RQ4. What are the inclusive and demand-driven capacity building needs for scaling the promotion and implementation of SI innovations that support environmental health and resilience [including climate adaptation and mitigation], and biodiversity?

Components of Work Packages

Secondary data analysis and stakeholder consultations in WP1; application and assessment of ex-ante analysis of M&T for SI of MFS in WP2; engagement of diverse stakeholder groups and scientists in a transdisciplinary process of matching package components including

ranking and scoring in WP3; and a game changer for digital transformation of agriculture to reach thousands of beneficiaries through ICT approaches, including human and institutional capacity support to equip scaling partners, in WP4. These will lead to case studies in major MFS on direct and indirect drivers of change and their impacts on the future role, relevance, and performance of MFS to inform their optimization; a toolbox for scenario assessment and trade-off/synergies analysis to determine the windows of opportunity for SI of MFS; and a suite of co-refined and validated context-specific, technically and economically viable, demand-driven innovation packages and SI scaling modules for use by development partners.

Measuring performance and results

Participatory implementation of SI of MFS by CGIAR RIIs, local partners, and farmers, and uptake by global donors, improves resilience to climate change for millions of farmers. (i) Climate-induced productivity losses in MFS reduced; and (ii) large-scale adoption of SI innovations reduce GHG emission intensities (CO_2eq).

Partners

All partners listed for this Initiative. Scaling partners listed in WP4 will have a key role.

Human resources and capacity development of Initiative team

The Initiative has expertise in climate change adaptation and mitigation. Staff will be trained in other specific skills.

5.5 Environmental health and biodiversity

Challenges and prioritization

Mixed farming systems (MFS) often have fragile environments and are vulnerable to land degradation[116]. Climate variability, particularly temperature and precipitation extremes, exacerbate the situation and result in crop failures, further threatening future production. Although sustainable intensification (SI) offers opportunities to overcome these challenges, current disconnected efforts to support SI fall short of the effectiveness and scale needed to achieve important environmental health and biodiversity targets by 2030[117]. The lack of coordinated policies and capacity to conduct SI within MFS results in degeneration of soil fertility with diminished biomass for food, feed, and fuel[118]. The combination of crops and livestock within MFS offers opportunities to maintain ecosystem function and health, and to help prevent agricultural systems from becoming fragile, by enhancing biodiversity and increasing resilience. Establishing the underlying causes of diminished environmental health and biodiversity provides policymakers with tools needed to develop appropriate response options, socio-technical innovation packages, and policies that help optimize benefits from MFS.

Research questions

- WP1, RQ3. What affordable entry points can be identified for the transition of these MFS towards sustainably intensified systems that mitigate any negative [environmental] impact and harness opportunities presented by the drivers of change?
- WP2, RQ4. What M&T can support the design of different pathways towards MFS that address several sustainability objectives [including environmental health and biodiversity] in selected settings?
- WP3, RQ2. Which features of socio-technical innovation packages for SI of MFS enhance uptake and improve sustainability, resilience, and equity of MFS [enhancing environmental health and biodiversity]?

- WP4, RQ4. What are the inclusive and demand-driven capacity building needs for scaling the promotion and implementation of SI innovations that support environmental health and resilience, and biodiversity?
- WP5, RQ3. How can actor-centered capacity development, conceptualized at the agricultural innovation system level, influence the identification of problems and of sustainable and inclusive solutions, and prompt positive change in MFS sustainability [including in environmental health and biodiversity]?

Components of Work Packages

This work builds on WP1 and seeks to harness opportunities of the drivers of change at global and regional levels. WP2 will assess trade-offs associated with environmental health in order to prioritize and co-design pilots with sustainably intensified MFS; in collaboration with WP3, different pathways that address several sustainability objectives will be determined. WP4, in collaboration with WP5, will promote SI innovations that foster scaling and capacity building needs for environmental health and biodiversity.

Measuring performance and results

By 2024, we anticipate that the SI-MFS Initiative will allow MFS actors to harness benefits for environmental health and biodiversity through the SI of MFS.

Partners

All partners listed for this Initiative

Human resources and capacity development of Initiative team

Selected project staff highlighted in the component WPs will contribute to this.

6. Monitoring, evaluation, learning and impact assessment (MELIA)

6.1 Result framework

CGIAR Impact Areas				
Nutrition, health and food security	**Poverty reduction, livelihoods and jobs**	**Gender equality, youth and social inclusion**	**Climate adaptation and mitigation**	**Environmental health and biodiversity**
Collective global 2030 targets				
The collective global 2030 targets are available centrally here to save space.				
Common impact indicators that your Initiative will contribute to and will be able to provide data towards				
# people benefiting from relevant CGIAR innovations	# people benefiting from relevant CGIAR innovations	# women benefiting from relevant CGIAR innovations # youth benefiting from relevant CGIAR innovations	# people benefiting from climate-adapted innovations	# ha under improved management
SDG targets				
2.1	1.1	2.3, 5.a, 8.5	1.5, 2.4, 13.1	2.4
Action Area title (Systems Transformation/Regional Agrifood Systems/Genetic Innovation)				

Action Area outcomes	**Action Area outcome indicators**
RAFS 1 Smallholder farmers use resource-efficient and climate-smart technologies and practices to enhance their livelihoods, environmental health, and biodiversity	RAFSi 1.1 Number of resource-efficient and climate-smart technologies at stage IV (uptake by next user), disaggregated by type
RAFS 2 Research and scaling organizations enhance their capabilities to develop and disseminate RAFS-related innovations	RAFSi 2.1 Number of organizations

ST & RAFS 1 Smallholder farmers implement new practices that mitigate risks associated with extreme climate change and environmental conditions, and achieve more resilient livelihoods	STRAFSi 1.1 Number of smallholder farmers who have implemented new practices that mitigate climate change risks, disaggregated by gender and type of practice
ST & RAFS 2 National and local governments utilize enhanced capacity (skills, systems, and culture) to assess and apply research evidence and data in policymaking processes	STRAFSi 2.1 Number of policies, strategies, laws, regulations, budgets, investments, curricula (and similar) at different scales that were modified in design or implementation, with evidence that the change was informed by CGIAR research
ST & RAFS & GI 1 Women and youth are empowered to be more active in decision making in food, land, and water systems	STRAFSGIi 1.2 Number of women, youth, and people from marginalized groups who report input into productive decisions, ownership of assets, access to and decisions on credit, control over use of income, work balance, and visiting important locations

Initiative and Work package outcomes, outputs, and indicators

Result type (outcome or output)	Result	Indicator	Unit of measure-ment	Geographic scope	Data source	Data collection method	Frequency of data collection	Baseline value (outcome only)	Baseline year (outcome only)	Target value	Target year
END-OF-INITIATIVE OUTCOMES											
Outcome 1	5 International research institutions, 6 national research institutions, 7 policymakers and 2 donors (key strategic actors) are transitioning research priorities, policies, and strategic financial investments	Number of organizations disaggregated by international and national research institutions	#	Global, regional, national (six target countries) *	Primary	Stakeholder consultation and documentation	Annual	N/A	N/A	11	2025
		Number of key policymakers	#	Global, regional, national (six target countries) *	Primary	Stakeholder consultation and documentation	Annual	N/A	N/A	7	2025
		Number of major donors	#	Global, regional, national (six	Primary	Stakeholder consultation and documentation	Annual	N/A	N/A	2	2025

	towards SI of MFS			target countries) *							
Outcome 2	50% of key innovation, demand, and scaling partners are jointly using a systems approach and a set of novel tools adapted to different scales, agro-ecologies, and socio-economic settings, to identify potential context-specific, integrated solutions for SI of MFS	Change in the capacity of innovation, demand, and scaling partners disaggregated by gender	%	Global, regional, national (six target countries) *	Primary	Survey, FGD	Annual	N/A	N/A	50	2025
Outcome 3	10 non-CGIAR research institutions (local & international) and 2 CGIAR RIIs, local	Number of organizations disaggregated by non-CGIAR research institutions, CGIAR RIIs	#	Global, regional, national (six target countries) *	Primary	Stakeholder consultation and documentation	Annual	N/A	N/A	12	2025

	partners, and 1.5 million farmers are developing, implementing, and validating SI options in selected MFS through a participatory and inclusive process	Number of local partners and farmers disaggregated by gender	#	Global, regional, national (six target countries) *	Extrapolation based on survey data and secondary data	Household survey, key informant interviews, stakeholder documentation	Annual	N/A	N/A	1.5 M	2025
Outcome 4	1.5 million MFS actors (farmers and other value chain participants) are adopting, adapting, and scaling socio-technical, gender-transformative innovation packages for SI of MFS.	Number of beneficiaries using the innovation disaggregated by gender	#	Global, regional, national (six target countries) *	Primary	Household survey, FGD, key informant interviews, stakeholder documentation	Annual	N/A	N/A	1.5 M	2025

Outcome 5	50% of partners and CGIAR scientists are adopting MFS thinking and gender-transformative approaches, mainstreamed through a global virtual institute and regional scaling hubs promoting capacity building	Change in the capacity of partners and CGIAR scientists adopting MFS thinking and gender-transformative approaches	%	Global, regional, national (six target countries) *	Primary	Survey, key informant interviews, stakeholder documentation	Annual	N/A	N/A	50	2025
WP1 OUTPUTS											
Outcome 1.1	International research institutions, including CGIAR, national research institutions, policymakers, and donors have a better understanding of the current performance of MFS and the drivers of change affecting them	Number of organizations disaggregated by international and national research institutions	#	Global, regional, national (six target countries) *	Primary	Stakeholder consultation and documentation	Annual	N/A	N/A	11	2025
		Number of key policymakers	#	Global, regional, national (six target countries) *	Primary	Stakeholder consultation and documentation	Annual	N/A	N/A	7	2025
		Number of major donors	#	Global, regional, national (six target countries) *	Primary	Stakeholder consultation and documentation	Annual	N/A	N/A	2	2025

Outcome 1.2	International research institutions, including CGIAR, national research institutions, policymakers, and donors have a good understanding of the entry points for the transition of MFS towards effective, sustainable, and equitable systems affecting them.	Number of organizations disaggregated by international and national research institutions	#	Global, regional, national (six target countries) *	Primary	Stakeholder consultation and documentation	Annual	N/A	N/A	11	2025
		Number of key policymakers	#	Global, regional, national (six target countries) *	Primary	Stakeholder consultation and documentation	Annual	N/A	N/A	7	2025
		Number of major donors	#	Global, regional, national (six target countries) *	Primary	Stakeholder consultation and documentation	Annual	N/A	N/A	2	2025
Output 1.1	Synthesis report on status of MFS and data embedded in existing repository	Number of full reports on status of MFS produced and disseminated to MFS actors and partners	#	Global, regional	Secondary	Literature review, FGD, key informant interviews with stakeholders	Once	N/A	N/A	7	2023
		Databases populated	#	Global, regional	Secondary	Secondary data analysis, geospatial mapping and analysis	Semi-annual	N/A	N/A	1	2025
Output 1.2	Case study reports on drivers of change and	Number of case studies published	#	Global, regional	Primary and secondary	Secondary data analysis, geospatial mapping and analysis of land-use and	Semi-annual	N/A	N/A	7	2025

	their impacts on MFS					land-cover change in MFS, stakeholder consultations					
Output 1.3	Living e-Atlas with affordable socio-technical entry points and gender-transformative approaches for equitable and inclusive SI of MFS for implementation by partners, donors and policymakers	Number of people accessing the e-Atlas	#	Global, regional	Primary and secondary	Secondary data analysis, multi-scalar scenario assessment modelling, stakeholder consultations	Semi-annual	N/A	N/A	TBD	2025
WP2 OUTPUTS											
Outcome 2.1	Actors in R&D jointly use methods and tools (M&T) to describe MFS and their diversity	Number of actors in R&D using M&T to describe MFS and their diversity disaggregated by gender	#	Global, regional, national (six target countries) *	Primary	Survey, FGD	Annual	N/A	N/A	TBD	2025
Outcome 2.2	Actors in R&D jointly use M&T for multi-criteria assessment of MFS and SI options	Number of actors in R&D using M&T for multi-criteria assessment of MFS and SI options	#	Global, regional, national (six target countries) *	Primary	Survey, FGD	Annual	N/A	N/A	TBD	2025
Outcome 2.3	Actors in R&D jointly use	Number of actors in R&D	#	Global, regional,	Primary	Survey, FGD	Annual	N/A	N/A	TBD	2025

	M&T for scenario and trade-off analysis of SI options for MFS	using M&T for scenario and trade-off analysis of SI options for MFS		national (six target countries) *							
Outcome 2.4	Actors in R&D jointly use M&T for the co-design of SI options for MFS	Number of actors in R&D using M&T for the co-design of SI options for MFS	#	Global, regional, national (six target countries) *	Primary	Survey, FGD	Annual	N/A	N/A	TBD	#
Outcome 2.5	Actors in R&D jointly use M&T to describe MFS and their diversity, for multicriteria assessment of MFS and SI options, to analyze scenarios and trade-offs, and to co-design MFS	Number of actors in R&D using M&T for multi-criteria assessment	#	Global, regional, national (six target countries) *	Primary	Survey, FGD	Annual	N/A	N/A	TBD	#
Output 2.1	A set of appropriate and adapted M&T for description of MFS and their diversity	A set of M&T for description of MFS published	#	Global, regional, national (six target countries) *	Primary and secondary data	Models, statistical analyses, stakeholder consultation	Semi-annual	N/A		1	2025
Output 2.2	Descriptions of mixed farm types and farming	Characterizations of MFS and their	#	Global, regional, national (six	Primary and secondary data	Models, statistical analyses,	Semi-annual	N/A	N/A	4 (selected MFS)	2025

	systems in selected settings	diversity published		target countries) *		stakeholder consultation					
Output 2.3	A basket of quantitative, qualitative, and participatory M&T for multi-criteria assessment, novel indicators, and result integration of MFS	A basket of M&T for multi-criteria assessment published	#	Global, regional, national (six target countries) *	Primary and secondary data	Models, statistical analyses, stakeholder consultation	Semi-annual	N/A	N/A	1	2025
Output 2.4	Multi-criteria assessments of current MFS, in selected settings	Multi-criteria assessments published and disseminated	#	Global, regional, national (six target countries) *	Primary and secondary data	Models, statistical analyses, stakeholder consultation	Semi-annual	N/A	N/A	4 (selected MFS)	2025
Output 2.5	A toolbox for scenario assessment and trade-off/synergies analysis to determine windows of opportunity for SI of MFS	A toolbox for scenario assessment	#	Global, regional, national (six target countries) *	Primary and secondary data	Models, statistical analyses, stakeholder consultation	Semi-annual	N/A	N/A	1	2025
Output 2.6	Scenarios of alternative MFS through SI options in selected settings	Scenario studies published and disseminated	#	Global, regional, national (six target countries) *	Primary and secondary data	Models, statistical analyses, stakeholder consultation	Semi-annual	N/A	N/A	4 (selected MFS)	2025

Output 2.7	Guidelines for MFS co-design towards SI	Information product (a set of guidelines for co-design MFS)	#	Global, regional, national (six target countries) *	Primary and secondary data	Models, statistical analyses, stakeholder consultation	Semi-annual	N/A	N/A	1	2025
Output 2.8	Documented applications of M&T for co-design of MFS	Number of information products (co-designs processed supported by M&T documented)	#	Global, regional, national (six target countries) *	Primary and secondary data	Models, statistical analyses, stakeholder consultation	Semi-annual	N/A	N/A	4 (selected MFS)	2025
Output 2.9	Manual of M&T for gender/inter-sectional analysis in the DEED cycle	Information product (manual for gender/inter-sectional analysis)	#	Global, regional, national (six target countries) *	Primary and secondary data	Models, statistical analyses, stakeholder consultation	Semi-annual	N/A	N/A	1	2025
WP3 OUTPUTS											
Outcome 3.1	Policymakers and agricultural R&D agencies in target countries are developing strategies to prioritize SI of MFS	Number of policies/strategies developed	#	Global, regional, national (six target countries) *	Primary	Stakeholder consultation and documentation	Annual	N/A	N/A	TBD	2025
		Number of agricultural R&D agencies developing strategies	#	Global, regional, national (six target countries) *	Primary	Stakeholder consultation and documentation	Annual	N/A	N/A	TBD	2025
Outcome 3.2	Extension systems in target countries are developing protocols to implement and	Number of extension systems in target countries	#	Global, regional, national (six target countries) *	Primary	Stakeholder consultation and documentation	Annual	N/A	N/A	TBD	2025

	sequence SI interventions in MFS	developing protocols									
Outcome 3.3	Patterns of innovation packages and SI pathways for typical MFS are considered for global development agendas and international development donors	Number of partners considering innovation packages for global development agendas and international development donors	#	Global, regional, national (six target countries) *	Primary	Stakeholder consultation and documentation	Annual	N/A	N/A	TBD	2025
Output 3.1	Sex-disaggregated open access datasets generated from pilot areas ready for use by WP2, WP4, and WP5 and other initiatives and partners	Number of other information products (open access databases)	#	Global, regional, national (six target countries) *	Primary and secondary data	Project record, evaluation of open access databases	Semi-annual	N/A	N/A	7 (one per MFS)	2025
Output 3.2	MFS typology and characterization of selected farming systems in terms of their potential for SI for living e-atlas (1.3), focusing on resilience,	Number of MFS typologies included in e-Atlas	#	Global, regional, national (six target countries) *	Primary and secondary data	Publication tracking, participatory modeling, stakeholder consultation	Semi-annual	N/A	N/A	4	2025

	efficiency and equity, and farmers' preferences										
Output 3.3	Published technical papers providing a suite of co-refined and validated, context-specific, technically and economically viable, gender-transformative and demand-driven innovation packages ready for testing in selected MFS	Number of innovations	#	Global, regional (six countries) *	Primary and secondary data	Gender analysis, participatory modeling, publication tracking	Semi-annual	N/A	N/A	4	2025
Output 3.4	A suite of validated and context-specific SI innovation packages ready for scaling	Number of innovations	#	Global, regional (six countries) *	Primary and secondary data	Impact assessment about social learning and behavioral change, publication tracking	Semi-annual	N/A	N/A	4	2025
Output 3.5	Proper sequencing patterns of innovation implementation leading to system	Number of innovations	#	Global, regional, national (six target countries) *	Primary and secondary data	Participatory monitoring, stakeholder validation, publication tracking	Semi-annual	N/A	N/A	4 selected MFS	2025

	transformation through SI pathways are identified and promoted for the MFS types considered										
Output 3.6	Manual for sustainable, inclusive, gender-transformative implementation of SI-MFS innovations in different contexts	Number of information products (manuals)	#	Global, regional	Primary and secondary data	Project record, participatory monitoring, stakeholder validation	Semi-annual	N/A	N/A	1	2025
WP4 OUTPUTS											
Outcome 4.1	Priority target countries for SI-MFS attain an enabling environment that supports the scaling of socio-technical SI innovation packages	Number of priority countries	#	Global, regional, national (six target countries) *	Primary	Stakeholder consultation and documentation	Annual	N/A	N/A	6	2025
Outcome 4.2	Gender-transformative approaches that support scaling are widely taken up by multiple stakeholders in target countries to	Number of gender-transformative approaches taken up by multiple stakeholders	#	Global, regional, national (six target countries) *	Primary	Stakeholder consultation and documentation	Annual	N/A		TBD	2025

	reach target smallholder farmers										
Outcome 4.3	Strategic partnerships activated that embed, deploy, and implement scaling of socio-technical SI innovation packages in the six target countries to reach several smallholder farmers	Number of beneficiaries using the innovation, disaggregated by gender	#	Global, regional, national (six target countries) *	Primary,	Documentation of stakeholder consultation	Annual	N/A	N/A	TBD	2025
Output 4.1	Easily accessible data portal with a catalogue that characterizes strategies for scaling of SI socio-technical innovation packages for implementing partners	Data portal developed	#	Global, regional, national (six target countries) *	Primary and secondary data	Project record, evaluation of data portal	Semi-annual	N/A	N/A	1	2025
		Number of beneficiaries accessing the data portal disaggregated by gender	#	Global, regional, national (six target countries) *	Primary and secondary data	Project record, evaluation of data portal	Semi-annual	N/A	N/A	TBD	2025
Output 4.2	Compendium of validated approaches for scaling	Compendium published and widely shared	#	Global, regional, national (six	Primary and secondary data	Publication tracking	Semi-annual	N/A	N/A	1	2025

	gender-transformative approaches	with target beneficiaries		target countries) *							
Output 4.3	Decision-support tools for policymakers that optimizes scaling of market opportunities and institutional innovations	Number of Decision support tools developed	#	Global, regional, national (six target countries) *	Primary and secondary data	Project record	Semi-annual	N/A	N/A	6 selected MFS	2025
Output 4.4	Digital platform that links to regional scaling hubs with training modules for building capacity of target beneficiaries	Number of digital platforms	#	Global, regional, national (six target countries) *	Primary and secondary data	Evaluation of online digital platform	Semi-annual	N/A	N/A	6	2025
Output 4.5	Framework that supports scaling of SI of MFS, linking policies and SDGs to environmental health and biodiversity and to the five Impact Areas	Framework published and disseminated to target beneficiaries	#	Global, regional, national (six target countries)	Primary and secondary data, stakeholder consultations	Project records, documentation of stakeholder consultation	Annual	N/A	N/A	1	2025

WP5 OUTPUTS											
Outcome 5.1	Farming systems thinking and gender-transformative approaches for SI of MFS for targeted local challenges are mainstreamed in the capacity development strategies of education partners at all levels from farmer extension to academic curricula	Number of education partners mainstreaming farming systems thinking and gender-transformative approaches for SI of MFS for targeted local challenges.	#	Global, regional, national (six target countries) *	Primary	Survey, key informant interviews, documentation of interviews	Annual	N/A	N/A	TBD	2025
Outcome 5.2	Farming systems thinking and gender-transformative approaches for SI in MFS globally are mainstreamed in the capacity development strategies of education partners at all levels from framer extension to	Number of education partners mainstreaming farming systems thinking and gender-transformative approaches for SI of MFS for targeted global challenges.	#	Global, regional, national (six target countries) *	Primary	Survey, key informant interviews, stakeholder documentation	Annual	N/A	N/A	TBD	2025

	academic curricula										
Output 5.1	Capacity needs assessment tool and capacity development plans	Number of capacity needs assessment tools applied	#	Global, regional, national (six target countries) *	Primary and secondary data	Project record	Semi-annual	N/A	N/A	7	2025
Output 5.2	Global virtual institute for capacity development for relevant actors	Global virtual institute established for capacity development for SI of MFS	#	Global	Primary and secondary data	Project record	Annual	N/A	N/A	1	2025
Output 5.3	New partnerships, functional networks, and roadmaps for multi-actor coordination for SI of MFS	Number of packages that include functional networks, partnerships and roadmaps i	#	Global, regional, national (six target countries) *	Primary and secondary data	MFS stakeholder survey	Semi-annual	N/A	N/A	7	2025
Output 5.4	Training modules (materials, curricula) for SI of MFS	Number of training modules developed	#	Global, regional, national (six target countries) *	Primary and secondary data	Project record	Semi-annual	N/A	N/A	7	2025
Output 5.5	MFS actors trained in SI of MFS	Number of actors trained on SI of MFS disaggregated by gender and country	#	Global, regional, national (six target countries) *	Primary and secondary data	MFS actors survey	Semi-annual	N/A	N/A	50% of key actors	2025

Output 5.6	Recommendations for sustainable capacity development for SI of MFS	Number of information products published	#	Global, regional, national (six target countries) *	Primary and secondary data	Publication tracking	Semi-annual	N/A	N/A	7	2025
Output 5.7	Manual for building critical reflection sessions into SI innovation processes (including reflections on equity in processes and outcomes)	Number of information products (manuals) developed for critical reflection on SI innovation processes	#	Global, regional, national (six target countries) *	Primary and secondary data	Project record	Semi-annual	N/A	N/A	1	2025
INNOVATION PACKAGES AND SCALING READINESS											
Output (Light Track)	CGIAR and partner capacity on innovation and scaling strengthened	Core innovations	#	Global, regional, national (six target countries) *	Initiative report	N/A	Once in 2022–2024	N/A	N/A	6	2022 (4), 2023 (2)
Output (Standard Track)	Resource allocation, prioritization, and scaling strategy at innovation package level are evidence-based	Innovation packages	#	Global, regional, national (six target countries) *	Scaling readiness assessment study	N/A	Once per year	N/A	N/A	6	2022 (1), 2023 (5)

*Six target countries: GH-Ghana, ET-Ethiopia, MW-Malawi; BD-Bangladesh, NP-Nepal, LA-Lao People's Democratic Republic.

6.2 MELIA plan

a. Narrative for MEL plans

The MEL plan takes into consideration all the TOCs, activities, outputs, and outcomes of the WPs and Result Framework, and proposes a roadmap for effective and efficient MEL. Based on the Result Framework, the Initiative will design data collection methods, tools, and templates to monitor the progress of all indicators (outputs, outcomes, and impacts), including those related to scaling readiness. The plan will include development of methods and tools (M&T) to track the progress of activities and deliverables in the WP workplans. We will collect MEL data from WPs on a semi-annual basis to track progress of the indicators, using tools such as the CGIAR Results Dashboard (MEL system) and electronic platforms (e.g., Ona/ODK). The data collected will be analyzed and used in crafting MEL progress reports for the Initiative management, One CGIAR, and accountability to donors.

The MEL team will contribute to a baseline study as detailed in the impact assessment plan and conduct an internal process evaluation using qualitative and quantitative approaches and techniques (stakeholder consultations, focus group discussions, key informant interviews, household surveys, etc.). Participatory approaches will be used to deepen our qualitative methods, and to improve and adapt the SI-MFS Initiative. The evaluation will follow the One CGIAR stage-gates review processes. The Initiative will conduct annual reflection and learning sessions on the performance of indicators (outputs, outcomes), assumptions, and risk data at Initiative and WP levels. We will review and revise the TOCs and impact pathways annually and adjust and prioritize based on evidence collected. Lessons learned and best practices will be documented for annual reporting.

We will manage end-line evaluation in collaboration with the CAS and SMO to measure progress of within- and end-of-initiative outcomes by comparing indicator results at baseline with those at the end-line to determine impact and judge the overall performance of the Initiative.

Evaluation/learning questions:

- How do SI-MFS approaches and novel adapted M&T lead to research institutions, policymakers, and donors transitioning research priorities, policies, and strategic financial investments towards SI of MFS?
- How do SI-MFS approaches and novel adapted M&T lead to identification of potential context-specific, integrated solutions for SI of MFS? What is the overall system productivity in the targeted MFS?
- How are CGIAR, SI-MFS partners, and wider networks applying and integrating trans-disciplinary knowledge into a systems approach to co-develop and implement SI of MFS at scale?
- How do the SI-MFS socio-technical, gender-transformative innovation packages lead to adoption, adaptation, and scaling of SI of MFS in target countries?
- How are CGIAR scientists and partners mainstreaming MFS thinking and gender-transformative approaches, and promoting learning in target MFS?

b. Narrative for impact assessment research plans

The following IA studies will be conducted. See Annex for details of planned IA studies.

1. Baseline studies will collect data on existing practices of farmers and stakeholders in the six target countries. Surveys will be designed within the Randomized Control Trial framework.
2. Adoption studies will identify the factors constraining/enabling scaling and adoption, and intensity of use, of the SI-MFS innovations.

3. Impact studies based on panel survey data will assess intermediate and long-term impacts of SI technologies on adopters.
4. Tracking studies through digital data-sharing platforms will monitor new developments among implementing partners concerning Initiative activities.
5. Qualitative studies will assess behavioral changes among smallholder farmers and stakeholders.

6.3 Planned MELIA studies and activities

Type of MELIA study or activity	Result or indicator title that the MELIA study or activity will contribute to	Anticipated year of completion	Co-delivery of planned MELIA study with other Initiatives	How the MELIA study or activity will inform management decisions and contribute to internal learning
1. Baseline study	To establish baseline data for end-of-initiative outcome and within-initiative outcome indicators	2022	Regional initiatives (six countries in Asia and Africa), Foresight Initiative	To track progress and contribute to impact indicators
2. Scaling readiness assessment	Outcome 2 (Output 4.1)	2022	EiA and other partners	In collaboration with CGIAR scaling team and stakeholders
3. Adoption or diffusion and impact study	Outcomes 2, 3, 4	2024	TBD	Information generated used to make decisions on long-term impact studies
3. Tracing of scaling activities and policy advice as a base for long-term, large-scale impact studies	Outcome 4, WP1 RQ3	2024	WCA & ESA scaling hubs, EiA and Plant Health	Information generated used to make decisions on long-term, large-scale impact studies
4. Qualitative outcome study: - Stakeholder consultations - Participatory gender-transformative studies	Facilitates learning among stakeholders Outcome 4, WP3 RQs 2 & 3	2024	HER+ and regional initiatives	Adaptive learning for better Initiative management decisions
5. Internal process evaluation (internal)	All outputs/ outcomes in Section 6.1	2023	With regional initiatives and selected MFS and CAS	Supports Initiative teams to adapt learning for better management decisions
6. End-line evaluation (external)	All outputs/ outcomes in Section 6.1	2025	With regional initiatives and selected MFS and CAS	To make judgements on overall performance of the Initiative
7. Other MELIA activity: MEL data collection to measure progress at output/outcome levels	All outputs/ outcomes in Section 6.1	2024	With digital and regional initiatives	Semi-annual data collection to track progress of indicators at WP and Initiative levels and take course correction measures if needed

7. Management plan and risk assessment

7.1 Management plan

The SI-MFS Initiative will be managed by a Leadership Group (LG) consisting of the Initiative leader and co-leader, the WPs, and MELIA leaders and country representatives. The LG will include members from other Initiatives that contribute technologies, tools, and innovations, and to which SI-MFS will provide research findings that will inform their priority-setting. The LG will comprise scientists with sufficient time to dedicate to the Initiative; multiple responsibilities are expected for some members. The LG will hold monthly online briefings and meet twice a year to assess the Initiative's and WPs' TOCs, the MELIA, and the scaling readiness plans. It will adjust and adapt TOCs, activities, targets, assumptions, and plans to ensure that milestones are reached, and outputs are delivered in a timely manner. A communications specialist will be in charge of internal and external strategic communication and knowledge management. Financial and administrative support will be ensured by the CGIAR SMO. An External Advisory Board (EAB) will be constituted for yearly revisions of progress towards outcomes and to provide strategic advice for adapting TOCs. The EAB will comprise partners and stakeholders as permanent and ad-hoc members (including leads of other CGIAR Initiatives), who will participate in the annual meetings. These meetings will also advise on strengthening synergies between the SI-MFS Initiative and other Initiatives and bilateral projects.

7.2 Summary management plan Gantt table. A more detailed Gantt chart can be accessed HERE.

Initiative start date	Timelines												Description of key deliverables
	2022			2023				2024				2025	
Work Packages	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	
WP1: Regional and global status, trends, and dynamics of MFS				**1**	**2,3**			**3**				**3**	**1**. Synthesis report on status of MFS published and data embedded in existing repository; **2**. Case study reports on drivers of change and their impact on MFS published; **3**. Living e-Atlas with socio-technical entry points for equitable and inclusive SI of MFS
WP2: Building methods and tools (M&T) for SI of MFS				**1**			**2**					**3**	**1**. Report on existing M&T: description of MFS, diversity, main methodological challenges, proposed application plans; **2**. Trade-off assessment of MFS, main methodological challenges, proposed application plans; **3.** Applications of M&T for co-designing SI of MFS
WP3: Participatory co-design of MFS with evidence-based, validated SI innovation packages				**1**				**2**				**3**	**1**. Sex-disaggregated open access datasets generated from pilot areas ready for internal and external use; **2**. MFS typologies and characterization of selected MFS for e-Atlas; **3**. Technical reports with suite of validated, context-specific SI innovation packages ready for scaling
WP4: Advancing and supporting scaling of innovations				**1**				**1,2,3**				**1,2,3**	Preliminary and consolidated versions of **1.** Data portal with a catalogue of strategies for scaling of SI socio-technical innovations; **2**. Compendium of validated approaches for scaling gender-transformative approaches; **3**. Decision-support tools for policymakers that optimize scaling of market opportunities and institutional innovations
WP5: Capacity building for systems design and analyses		**1**					**2**					**3**	**1**. Capacity needs assessment tool and related plans for SI of MFS challenges; **2**. Report on new partnerships and functional networks, and coordination roadmaps for successful implementation of systems approaches; **3**. Global virtual institute for capacity development established for all relevant actors
Innovation packages and scaling readiness		**1**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**2**	**2**	**2**	**1**. Documented scaling ambition, vision of success, and roadmap for use of scaling readiness for selected priority core innovations; **2**. Evidence-based scaling readiness assessment reports and related scaling strategies for innovation packages

MELIA		**1**		**2**			**3**	**2**				**2,3**	**1**. Baseline study on initiative outcomes and outputs; **2.** Annual reports on qualitative outcome studies; **3**. Mid-term and final report on adoption studies
Project management	**1**				**2**				**2**			**2**	**1.** Inception and kick-off report; **2**. Annual technical and financial reports

7.3 Risk assessment

The Initiative Design Team has undertaken a risk assessment exercise to identify and evaluate the main risks and mitigating actions for the SI-MFS Initiative. Risks considered include those around science, cohesion (including intended and unintended consequences of technologies/innovations for natural resources, GHG emissions, and social and economic aspects), legacy work, partnerships, talent, operational, ethical and legal, and other. In this phase, the risk assessment is used to highlight areas of concern and improvement recommendations for the Initiative. It also provides visibility to different bodies that is needed from a good governance perspective in line with the Risk Management Framework of the CGIAR System. Following the Initiative's approval, the risk assessment will be integrated into the Initiative's workplan for continuous monitoring and management.

Main risks identified are as follows:

Top 5 risks to achieving impact	**Description of risk**	**Likelihood**	**Impact**	**Risk score**	**Mitigations**
		Rate from 1–5	**Rate from 1–5**	Likelihood x impact	
The SI-MFS Initiative relies on the assumption of stable funding for 3 years (WPs 1–5)	The long-term impact of SI-MFS and its outcomes requires engagement with sufficient funding to complete the co-design and scaling process.	3	3	15	SI-MFS will lobby traditional and non-traditional donors to attract funding, including through bilateral arrangements.
Topics that could benefit multiple Initiatives are not embedded throughout the One CGIAR portfolio (digital technologies, foresights, trade-off dialogues), impacting the Initiative's efficiency and decision making (WPs 1–5)	Because of its integrative nature, SI-MFS plays a "hub" role in the CGIAR Initiative portfolio. Its success depends on integration and uptake of knowledge and technical outputs within the Initiative and across other initiatives. Failure to consolidate dialogue across initiatives might result in reduced impact.	3	4	12	Continuation of the dialogue begun with other initiatives (e.g., EiA, Plant Health, SAPLING, Nature-positive Solutions) and RIIs.
Partners do not have sufficient skills for systems analysis and design (WPs 1–3)	SI-MFS aims to increase total factor productivity in MFS, not just the productivity of a single component. Seeing SI of MFS from a systems perspective and taking a systems approach to SI is not mainstreamed in most NARES and IARCs.	3	4	12	SI-MFS benefits from existing national and international research partnerships (e.g., with Africa RISING, CSISA) in all but one target country (LA-Lao PDR); partnerships can be extended to Lao PDR. WP5 of SI-MFS will provide capacity development to NARES and IARCs in using M&T for systems analysis and design.
Failure to attract, engage, develop and retain subject-related talent (WPs 1–5)	Participatory, gender-transformative systems approaches for co-designing and scaling socio-technical innovation packages require trained mindsets to go beyond disciplinary research. Such	3	4	12	Beyond promoting the high relevance and broad scope of research in SI of MFS to attract talent, the Initiative will provide career opportunities for young, motivated researchers through staff development measures,

	talent is scarce in the research arena and highly demanded by other institutions and initiatives within CGIAR. Failure to get the right researchers might hamper impact.				regularly review incentive programs, and develop a staff succession plan.
Lack of feasibility to identify the contributions of SI to MFS level outcomes (WPs 2–5)	Considering the scale at which SI-MFS is implemented (beyond plot/field/herd level, but at farm, farm household, landscape levels), uncoordinated MELIA studies across initiatives might fail to understand the impact of SI at MFS level, making learning and attribution of impact difficult to calculate.	4	2	8	SI-MFS will liaise with other initiatives operating in the same MFS (e.g., SAPLING, EiA, Plant Health) to agree a coordinated approach to MELIA studies.

8. Policy compliance, and oversight

8.1 Research governance

Researchers involved in the implementation of this Initiative will comply with the procedures and policies determined by the System Board to be applicable to the delivery of research undertaken in furtherance of CGIAR's 2030 Research and Innovation Strategy, thereby ensuring that all research meets applicable legal, regulatory, and institutional requirements; appropriate ethical and scientific standards; and standards of quality, safety, privacy, risk management, and financial management. This includes CGIAR's CGIAR Research Ethics Code, and the values, norms, and behaviors in CGIAR's Ethics Framework and Framework for Gender, Diversity and Inclusion in CGIAR's workplaces.

8.2 Open and FAIR data assets

Researchers involved in the implementation of this Initiative shall adhere to the terms of the Open and FAIR Data Assets Policy.

The SI-MFS Initiative will align with the OFDA Policy's Open and FAIR requirements, ensuring:

- Rich metadata conforming to the CGIAR Core Schema to maximize findability, including geolocation information where relevant.
- Accessibility by utilizing unrestrictive, standard licenses (e.g. Creative Commons for non-software assets; General Public License (GPL)/Massachusetts Institute of Technology (MIT) for software), and depositing assets in open repositories.
- Wider access through deposition in open repositories of translations and requiring minimal data download to assist with limited internet connectivity.
- Interoperability by annotating dataset variables with ontologies where possible (controlled vocabularies where not possible).
- Adherence to Research Ethics Code (Section 4) relating to responsible data (through human subject consent, avoiding personally identifiable information in data assets, and other data-related risks to communities).

9. Human resources

9.1 Initiative team

Category	*Area of expertise*	*Short description of key accountabilities*
Research	Agronomy	Identification, collection of evidence, and analysis of potential recommendation domains for SI innovations for MFS and coordination of piloting and local participatory implementation (WP1, WP3, WP5)
Research	Agronomy	On-ground piloting and participatory/action research for co-design of SI options for MFS (WP3)
Research	Crop-Livestock	Identification, collection of evidence, and analysis of potential recommendation domains for SI innovations for MFS and coordination of piloting and local participatory implementation (WP1, WP3, WP5)
Research	Crop-Livestock	On-ground piloting, data collection, and participatory/action research; integrated management of crop-livestock systems for co-design of SI options for MFS (WP3)
Research	Participatory methods	Convening and actor engagement, role-playing games for stakeholder situational analysis, and group buy-in on action research for development (WP3, WP4, WP5)
Research	Regional and (sub)national GIS	Spatially explicit quantification and characterization of MFS at regional, national, and subnational levels, identification of development and extrapolation domains (WP1, WP2, WP5); support for MELIA studies and identification of regional and national entry points for SI of MFS (WP1, WP3)
Research	(Sub)national and local GIS and remote sensing	Spatially explicit characterization and analysis of MFS in local geographies; support for MELIA studies and identification of regional and national entry points for SI of MFS (WP2, WP3, WP5)
Research	Sociology/gender and social inclusion	Methodology development, capacity development, and implementation of gender-transformative approaches at different scales (WPs 1–5)
Research	Sociology/gender and social inclusion	Local partnership and implementation of gender-transformative approaches for co-design and scaling of socio-technical SI innovations (WP3, WP4)
Research	Policy analysis	Analysis of existing supportive and hampering policies for an MFS systems approach, and identification of institutional innovations conducive for an enabling environment and scaling of options for SI of MFS (WP1, WP4, WP5)
Research	Economy	Economic analysis of MFS, markets, and value chains, and analysis of performance and trade-offs in SI of MFS (WPs 1–5)
Research	Scaling science	Design and development/implementation of scaling pathways for SI of MFS (WP1, WP4, WP5)
Research	Scaling science	Scaling readiness assessments and development/implementation of local scaling pathways (WP4)
Research	Capacity development	Design, coordination, and overall implementation of capacity development plan (WP5)
Research	Capacity development	Implementation of capacity development strategy at local level (WP5)
Research	Data science management	Design and implementation of data collection, integration, analysis, visualization, and management strategy (WPs 15)
Research	Data management	Data integration and management; support for MELIA in project dashboard development (WPs 1–5)
Research	Systems analysis	Design of new and adaptation of existing systems analysis approaches, methods, and tools for description, assessment, and trade off-analysis of MFS at different scales (WP2)

Research	Quantitative systems analysis	Development and application of systems analysis tools for description, assessment, and trade-off analysis for the co-design of SI of MFS (WPs 1–5)
Research	Sociology/ qualitative systems analysis	Development and application of systems analysis tools for qualitative description and assessment of MFS and co-design of SI options and socio-technical innovation packages (WPs 1–5)
Research	MEL	Design and implementation of MEL studies and analyses
Research	Impact assessment	Design and implementation of IA studies and update of benefits projection
Support	Field coordination	On-ground logistics and implementation of activities, data collection, reporting, and follow-up of local partnerships for co-design and scaling SI options for MFS (WP3, WP4, WP5)
Support	Communication	Strategic communication and knowledge management including support to publications (WPs 1–5)
Support	Communication and ICT	Development and deployment of information and communication technologies for communicating and scaling of socio-technical SI innovation packages (WP4)

9.2 Gender, diversity and inclusion in the workplace

The SI-MFS Initiative is unlikely to meet the target of 40% women in professional roles but comprises individuals of diverse backgrounds. To strike a better gender balance, we will consciously consider recruiting professional women and female graduate students. Three of the five WPs are led by individuals from the South. Two out of six country focal points are women, three are individuals from the South.

Women, minorities, and other under-represented groups will hold leadership roles in the Initiative team wherever possible, and we will make sure that their voices are heard and captured in our work. The Initiative will support representation of under-represented groups by:

- Providing leadership development training and mentoring opportunities to women, minorities, and other under-represented groups so that they will be better represented in leadership positions going forward.
- Ensuring there is fair allocation of leadership activities and accountabilities among the team when assigning roles and decision rights.
- Requiring all our team members to take CGIAR's Panel Pledge and actively include under-represented colleagues.
- Actively seeking representation and inclusion of women leaders and influencers, such as women's groups, in the various activities that will be implemented by the Initiative (e.g., WPs 3, 4, 5).

9.3 Capacity development

The SI-MFS Initiative is committed to increasing the capacity of all relevant actors: farmers, policymakers, value chain participants, and those from research and academic institutions (including CGIAR and the Initiative itself), NARES, and the public and private sectors. Capacity building activities (detailed in WP5) aim to increase actors' capacity in using inclusive, participatory, and gender-transformative approaches for systems design and analyses. A key component will be the promotion of continuous critical reflection on processes and outcomes from systems approaches, and how they can support (i) the sustainability of capacity development; and (ii) the inclusion of less represented MFS actors in systems assessment and design. As well as developing actors' capacity, key outputs will include a global virtual institute for capacity development, capacity assessment tools, training materials, curricula, recommendations for sustainable capacity development, and a manual for building critical reflection sessions into SI innovation processes. On the institutional level, the Initiative will pay particular attention to providing development opportunities for junior level members and partners (especially young women). Within three months of launch, team leaders and managers will complete training on inclusive leadership. Within six months of launch, Initiative team members will complete training on gender, diversity, and inclusion, including on whistleblowing and how to report concerns. The Initiative kick-off will include an awareness session on CGIAR's values, code of conduct, and range of learning opportunities available.

10. Financial resources

10.1 Budget

10.1.1: Activity breakdown

USD	2022/2023	2023/2024	2024/2025	Total
Crosscutting across Work Packages	1,155,000	1,443,600	1,541,540	4,140,140
Work Package 1	1,617,000	1,587,960	1,261,260	4,466,220
Work Package 2	1,617,000	1,587,960	1,261,260	4,466,220
Work Package 3	2,656,500	3,609,000	4,064,060	10,329,560
Work Package 4	2,079,000	2,887,200	2,942,940	7,909,140
Work Package 5	2,079,000	2,887,200	2,942,940	7,909,140
Innovation packages & Scaling Readiness	258,580	470,315	50,685	779,580
Total	11,462,080	14,473,235	14,064,685	40,000,000

10.1.2: Geographic breakdown

USD	2022/2023	2023/2024	2024/2025	Total
Global (not specific country)	4,647,580	5,089,835	4,114,745	13,852,160
ESA Region	2,425,500	3,320,280	3,503,500	9,249,280
WCA Region	1,039,500	1,443,600	1,541,540	4,024,640
SEA Region	577,500	866,160	980,980	2,424,640
SA Region	2,772,000	3,753,360	3,923,920	10,449,280
Total	11,462,080	14,473,235	14,064,685	40,000,000

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