Theory of Change

Nuapada - Onion Learning Lab

CGIAR Initiative on Gender Equality (HER+)
Harnessing Gender and Social Equality
for Resilience in Agri-food Systems

CGIAR INITIATIVE ON Gender Equality

SATTVA Delivering High Impact. IRRI CGIAR

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1. What is a Theory of Change (ToC)?

A theory of change (ToC) is a method that explains how a given intervention, or set of interventions, is expected to lead to specific development change, drawing on a causal analysis based on available evidence. It explains how activities undertaken by an intervention contribute to a chain of results that lead to the intended or observed impacts.[1] A sound ToC is driven by analyzing current program implementation, consultation with key stakeholders, and learning what works and what does not on the ground with the target groups.

A ToC helps identify solutions to effectively address the causes of problems that hinder progress/impact and guide decisions on which approach to take during implementation. It can help:

- develop better key evaluation questions
- identify key indicators for monitoring
- identify gaps in available data and processes
- prioritize data collection, and
- provide a structure for data analysis and reporting.

A ToC also helps identify underlying assumptions and risks that are vital to understand and revisit throughout the process to ensure that the approach contributes to the desired change.

2. Purpose: Why Should We Use a Theory of Change?

Implementing a complex project could be difficult due to the subjectivity that various factors, such as stakeholders, geographies, climatic conditions, and socio-cultural norms bring with them. For example, conducting capacity building training for farmers might not lead to them adopting the suggested cropping pattern, unless aspects such as their interests and actions change, the seeds are available and are market-oriented, and various other constraints are addressed. A ToC can help a project implementing agency think through the many underlying root causes systematically, and how they influence each other when determining what the team should address as a priority to maximize the outcomes of the intervention.

Additionally, a ToC provides a framework for learning within and between implementation cycles. It helps internal and external stakeholders gain a better context and understanding of how the intervention will bring about change. It can help make course corrections if the selected approach is not working, the anticipated risks materialize, or the assumptions don't hold. New learnings and lessons from monitoring and evaluation help refine assumptions and inform decisions on how an approach should be adapted to

[1]Theory of Change: UNDAF companion guidance, June 2017. https://unsdg.un.org/sites/default/files/UNDG-UNDAF-Companion-Pieces-7-Theory-of-Change.pdf.

deliver planned results. Adjustments to the ToC should also be made considering changing circumstances, especially in response to crises and shocks, as well as part of regular monitoring.

3. Context of IRRI HER+ Nuapada Learning Lab

Climate change is exacerbating uncertainty and risks for farmers and other food systems actors in unprecedented ways. They are grappling with more frequent and severe events such as floods and prolonged droughts, demanding greater resilience. Women and marginalized farmers are highly vulnerable as they usually encounter additional barriers in the form of constraining social and gender norms.

The adoption of adaptive technologies is vital as a response to climate change but also complex due to farmers' diverse needs and preferences, while farmers themselves are not a homogenous category. Additionally, technical innovations addressing climate change have low uptake by women, and evidence of their impact on women's empowerment and resilience has also been inconclusive. The persistent gender and social inequalities in global agrifood systems are added barriers to women's ability to build and enhance their resilience to climate change.

The CGIAR's Initiative on Gender Equality (HER+) aims to strengthen climate resilience of vulnerable women in food systems in the Global South. Together with partners, the initiative envisages to support women to increase their agency, and acquire and gain control over resources, which would facilitate their path towards empowerment, and help them adapt to climate change and be resilient to shocks and stresses through higher adaptive capacity. Additionally, the initiative aims to position women as partners and drivers of climate change solutions.

The goals of the HER+ initiative are achieved through four dimensions (addressed in 4 Work Packages). Work package 2, titled EMPOWER, is aimed at developing and testing context-specific bundles of social and technical innovations (STIBs[2]). The STIBs are designed with the objectives of achieving women's empowerment, climate resilience, and their engagement as partners and drivers of climate change solutions.

[2] Context-specific bundles of social and technical innovations (STIBs) are integrated solutions tailored to address unique challenges within a specific environment. Combining social innovations such as reforms of institutions and cultural practices with technical advancements such as new technologies or processes, these bundles aim to create comprehensive approaches that resonate with and effectively meet the needs of a particular context or community.

HER+ EMPOWER is setting up pilot Learning Labs (LLs)[3] -- multi-sectoral, multi-stakeholder, and multi-disciplinary spaces where practice and research interact, and learning occurs through the design and implementation of context-specific socio-technical innovation bundles (suite of activities/interventions).

This ToC narrative is for one such Learning Lab set up by the International Rice Research Institute (IRRI) in collaboration with the World Vegetable Center (WorldVeg). The Learning Lab will have various partners to support activities including research and operations. It is embedded within WorldVeg's Onion Value Chain Project supported by the Government of Odisha's Department of Agriculture and Farmers' Empowerment.

The activities identified for this LL are categorized into Social, Technical, and Technological[4], as described below:

- **Social**: Gender sensitization training for Research Technicians (RTs) (to enable and encourage household engagement and create conducive social norms for women's participation in the onion learning lab); identifying lead women farmers as knowledge brokers; and gender-responsive training and capacity building sessions;
- **Technical**: Capacity building in seed production; awareness about the hazards and right use of agrochemicals; training on Good Agricultural Practices (GAPs); preparing information, education and communication (IEC) materials on GAPs; capacity building in post-harvest practices for grading, curing, and storage; and linkages between traders and local input dealers and women;
- **Technological**: Women-friendly machinery, tools, and techniques (such as weeders, techniques for line sowing, technology for irrigation) for agronomic activities; alternatives to agrochemicals; digital tools (smartphones); and provision of best-fit climate-resilient onion varieties.

The LL will be operating in two villages in Odisha's Nuapada district and will be targeted at small and marginal women farmers working in the onion value chain. The choice of commodity and location were driven by factors including climate change impacts, current high involvement of women, scope to introduce STIBs, and a quick turnaround in terms of outcomes and learnings. The current goal is to pilot context-specific STIBs in this Learning Lab, document the outcomes and learnings, and then replicate them with relevant adaptations in other relevant commodities and geographies.

[3] "Learning lab" refers to a place dedicated to work, to manufacture something, and a place dedicated to scientific experimentation. It refers to both practice (creating something) and research (experimenting with something) about learning. (Eric, S., Paukovics, E., Cheniti-Belcadhi, L., El Khayat, G., I Said, B., and Korbaa, O. What do you mean by learning lab? Education and Information Technologies (2022): 1-20.)

[4] (i) Social activities: Social norms and values attached to certain practices or social constructs attached to technologies; for example, if a woman can join a group, or whether she can access a phone/smartphone; (ii) Technical activities: Knowledge and skills required to perform a practice; for example, making pesticide mix, spraying pesticide (knowledge and skills associated with it); and (iii) Technological activities: Technologies such as line sowing of onion, improved varieties of onions, and smartphones.

Following thorough fieldwork and stakeholder consultations, an extensive list of activities was identified and their pathways to the intended impact was illustrated using the ToC framework (available here).

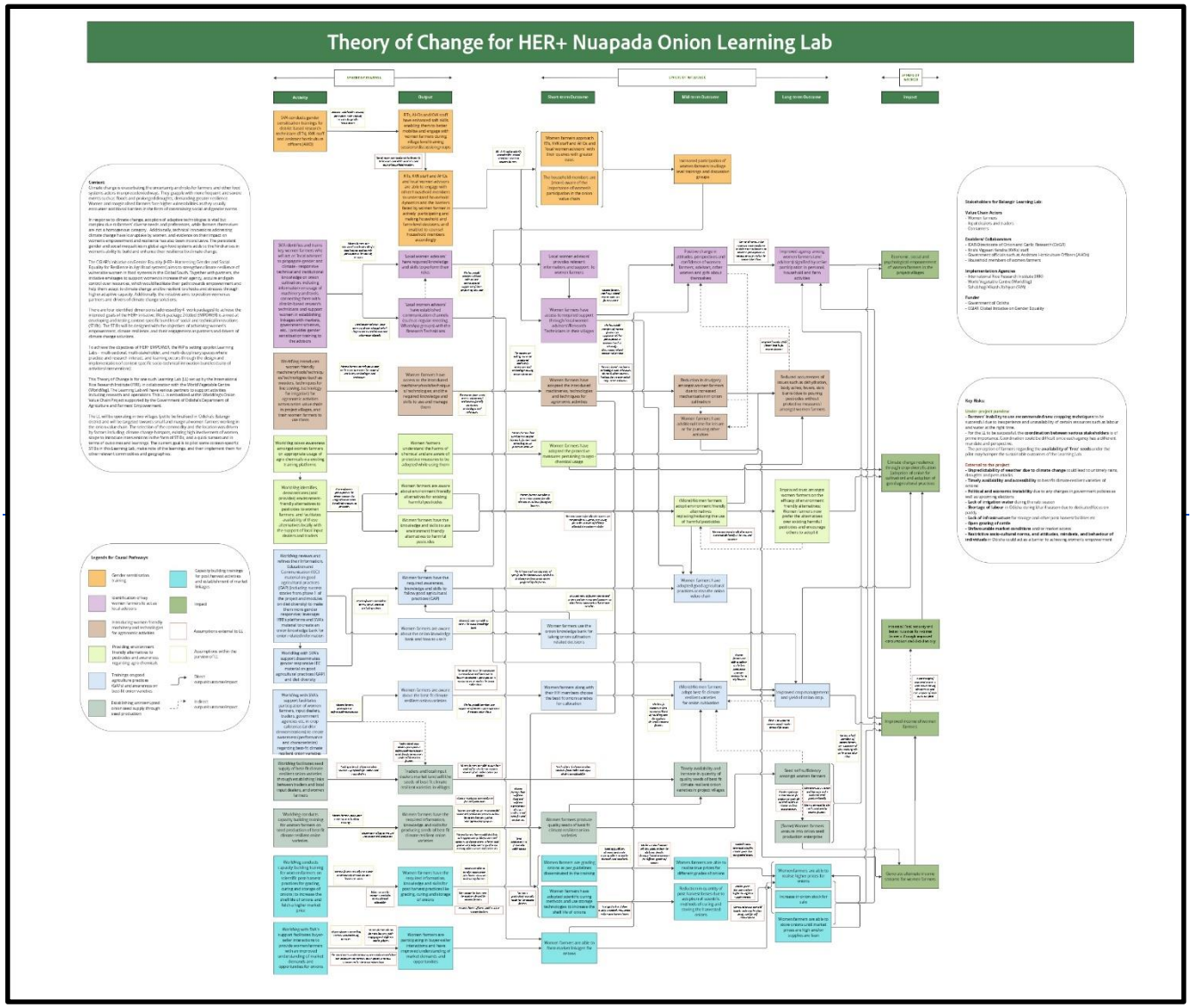

Figure 1: Theory of Change for the Nuapada Onion Learning Lab.

This Narrative Report lays out the key stakeholders of the LL (Section 4), the key risks (Section 5), and explains the pathways charted in the ToC (Section 6). It also outlines how the LL is aligned with CGIAR HER+ Impact Areas and the UN Sustainable Development Goals (Section 7).

4. Key Stakeholders

This section highlights the four broad categories of key stakeholders: (i) value chain actors, (ii) enablers/collaborators, (iii) implementation agencies, and (iv) funders and their roles in the Learning Lab.

Value Chain Actors

- Women farmers in the onion value chain are the target group for the Nuapada Learning Lab. They are active users of the STIBs promoted through this Learning Lab, participants in training and

awareness sessions, demonstrations, and crop cafeterias, and end users of best-fit climate-resilient onion varieties.

- Input dealers and traders are expected to participate in crop cafeterias/ demonstrations and market seeds of both best-fit (agro-ecologically viable and market-oriented) and climate-resilient onion varieties.
- Consumers are the end users of onions.

Enablers/Collaborators

- ICAR-Directorate of Onion and Garlic Research (DoGR) established under ICAR engages in R4D for enhancement of quality, export, and processing. DoGR is the supplier of seeds of best-fit climate-resilient onion varieties which will be distributed to farmers by WorldVeg.
- Krishi Vigyan Kendra (KVK) staff and Government officials such as Assistant Horticulture Officers (AHOs) are expected to participate in gender sensitization workshops and be better equipped to provide information to women farmers.
- Household members of women farmers are expected to participate in the training and reflection sessions designed for them and support women farmers to participate in the activities conducted within the LL.

Implementation Agencies

- International Rice Research Institute (IRRI)
- World Vegetable Center (WorldVeg) is the overall LL implementation lead on the ground. It will provide technical and technological innovation support such as machinery/equipment, training on GAPS, seeds of best-fit climate-resilient onion varieties and facilitate buyer-seller interactions to create market linkages, among other activities.
- Sahabhagi Vikash Abhiyan (SVA) is the LL partner who will provide social innovation support such as gender sensitization training to field staff and officers, identify local women advisors, and support WorldVeg in facilitating buyer-seller interactions, among other activities.

Funders

- Government of Odisha
- CGIAR Trust funders through the CGIAR Initiative on Gender Equality.

5. Key Risks

Risks outline the component of uncertainty within the ToC. These may or may not happen during the intervention. If they do happen, risks block the pathways of change and create roadblocks in achieving the desired outcomes and impact.

This section highlights some of the key risks identified, categorized into (i) Risks that can be mitigated by the Learning Lab, and (ii) Risks due to external factors and difficult to manage/mitigate.

Risks under the project purview that can be mitigated by the Learning Lab:

- Farmers' inability to use the recommended new cropping techniques successfully due to inexperience and the non-availability of resources such as labor and water at the right time.
- For the LL to be successful, coordination between various stakeholders is of prime importance. Coordination could be difficult since each agency has a different mandate and perspective.
- Farmers' perception regarding the availability of 'free' seeds under the pilot may hamper the sustainable outcomes of the Learning Lab.
- Risk of a backlash from the household/lack of support from households for women's involvement in LL activities.

Risks external to the project that are difficult to manage/mitigate:

- Unpredictability of weather due to climate change, which could lead to:
    - Untimely rains during the kharif season causing:
        - Crop losses, waterlogging, and difficulty in cultivation due to heavy rainfall
        - Soil damage and degradation which increases the risk of erosion
        - Increased frequency of pest and desert locust attacks in the state[5]
        - Reduced efficiency of fertilizers and pesticides applied.
    - Droughts during the rabi season causing[6]:
        - Crop losses[7]
        - Increased crop water requirement due to accelerated evapotranspiration[8].
- Timely availability and accessibility to best-fit climate-resilient varieties of onions:
    - Seed of the best-fit climate-resilient varieties are provided by DoGR and then distributed to farmers through the onion value chain project. Delays in the release of varieties or insufficient quantity supplied by DoGR can pose a risk to timely availability and accessibility of onion varieties.
- Political and economic instability due to any changes in government policies and upcoming elections.
- Lack of irrigation water during the rabi season.

[5] Swain, M., Swain, M., and Mohanty, A. Farmers' perceptions on drought and climate change. Drought Risk Management in South and South-East Asia (2020): 255.

[6] Pasupalak, S. Climate change and agriculture in Orissa. Orissa Review (2009): 49-52.

[7] ibid.

[8] Evapotranspiration is an estimate of the loss of water from both plants and the soil. The main drivers of evapotranspiration are sunlight, wind, humidity, and temperature. (Victoria Agriculture. What is evapotranspiration and how do I use it to schedule irrigations?" agriculture.vic.gov.au, December 2017.)

- Shortage of labor for onion cultivation due to migration. The diversion of available labor to paddy cultivation in project villages further exacerbates labor shortage.
    - The state is known to be one of the key sources of migrants[9,10]. There are insufficient livelihood opportunities and constant disruptions to lives and livelihoods due to natural calamities and people (especially youth) choose to move out to support their families, thereby causing a shortage of skilled and unskilled farm labor in Odisha and Nuapada district[11].
    - During the kharif season, paddy is the major crop[12] for farmers in the region. Thus, the diversion of even limited labor to paddy cultivation poses a significant risk to the project, specifically in small and marginal landholdings cultivated by family members without hired labor.
- Lack of infrastructure for storage and other post-harvest facilities etc., results in a significant income loss to farmers who tend to sell their produce at a lower price rather than storing it for sale during periods of high demand. For example, during 2016-17, of the total onion production in Odisha, less than 10% (35,000 MT[13] out of 3,78,670 MT) was stored while the rest was sold soon after harvesting due to the absence of storage facilities[14].
- Open grazing of cattle can lead to overgrazing, resulting in reduced ground cover and soil erosion. It could also lead to crop destruction during rabi if fields are not fenced. This is one of the reasons why farmers are reluctant to grow crops during the rabi season and the cropland remains fallow[15].
- Unfavorable market conditions and/or market access:
    - The project envisions increasing the income of women farmers engaged in the production of onion crop and onion seeds. To achieve this outcome, there is a heavy dependence on the functioning of markets, which depends on external variables outside the purview of the project.

[9] Labour Directorate, Government of Odisha. Inter State Migrant Workman Act (ISMW) | Labour Directorate." n.d. Accessed September 22, 2023. https://labdirodisha.gov.in/?q=node/63%27%3B

[10] Planning and Convergence Department, Directorate of Economics and Statistics. (2023) Odisha Economic Survey 2022-23.

Bhubaneswar: Government of Odisha. Retrieved from https://pc.odisha.gov.in/publication/economic-survey-report

[11] Journey without a choice – A Report on Reverse Migration in Odisha. BAIF Institute for Sustainable Livelihoods and Development – Odisha, 2021. https://baif.org.in/wp-content/uploads/2021/01/Migrant-report_Odisha.pdf

[12] Odisha Agriculture Statistics 2018-19. Department of Agriculture & Farmers' Empowerment, June 2021. https://agri.odisha.gov.in/sites/default/files/2022-10/ODISHA%20AGRICULTURE%20STATISTICS%202018-19.pdf.

[13] Metric ton.

[14] Monthly Onion Report - September 2017. Horticulture Statistics Division, Department of Agriculture and Farmer Welfare, September 2017. https://www.nhb.gov.in/statistics/Reports/Monthly%20Report%20on%20Onion%20for%20September%202017.pdf.

[15] Saksena, D., Yeggina, P.K., Srivastava, A., and Puskur, R. Enhancing food security and profitability of Odisha farmers through rice fallow intensification. Rice Today (2020).

6. HER+ Nuapada Onion Value Chain ToC

The Theory of Change for the HER+ Nuapada Onion Learning Lab comprises the following eight causal pathways, each of which outlines the intricate processes by which intended outcomes are achieved through activities conducted by WorldVeg and other LL partners:

1. Gender sensitization of field staff and officers (research technicians, assistant horticulture officers, and KVK staff).
2. Identifying and training women farmers to act as 'local advisors' in their villages.
3. Introducing women-friendly machinery, technologies, and techniques for agronomic activities.
4. Raising awareness regarding agrochemicals while demonstrating and providing environment-friendly alternatives to harmful pesticides.
5. Creating awareness about and training in best-fit onion varieties and good agricultural practices.
6. Ensuring the uninterrupted supply of onion seed through input dealers and seed production by women farmers.
7. Capacity building training for post-harvest activities and establishing market linkages between women farmers and buyers.

6.1. Causal Pathways 1 & 2 - Gender sensitization of field staff and officers (Research Technicians, AHOs, and KVK staff); and the identification and training of key women farmers to act as 'local advisors'.

The onion value chain program currently employs research technicians in every district who conduct trainings and raise awareness on onion cultivation. While trainings are held regularly, the participation of women farmers remains low due to the need to travel to the training centers, household chores and childcare responsibilities, hesitation to actively participate in sessions, lack of support from other household members, etc. The RT to farmer ratio also remains low, which leads to logistical difficulties in providing personalized attention to individual farmers' concerns and queries. The gender composition of the RTs is another deterrent; most of them are male and women farmers do not feel comfortable interacting with them independently.

Currently, farmers in the district are highly dependent on local input dealers and shopkeepers for advice on agrochemicals, seed purchases, and equipment knowledge. Given that the advice by local shopkeepers is driven by profit motive, there remains a high probability of misinformation being disseminated among farmers. While RTs provide training to combat any misinformation, the limited availability of RT makes local input dealers the primary and preferred point of contact for most farmers.

The Learning Lab aims to tackle this by providing gender sensitization training to field staff and officers and identifying local women in each project village who can act as 'local advisors' (the title of the advisors is yet to be confirmed) to women farmers.

The advisors are meant to propagate climate-responsive technical and institutional knowledge to other women farmers. This includes information on the use of machinery and tools for onion cultivation, existing government schemes and policies for women farmers on a real time basis as well as assisting them with establishing linkages with markets. These women are also expected to be the influencers/change agents/first movers in the project villages, inspiring others to adopt recently introduced onion cultivation practices.

The 'local women advisors' are also expected to support with establishing direct communication channels (through regular meetings, and WhatsApp groups) between district-based research technicians and women farmers to allow for more personalized solutions to farm-based queries. They are also expected to attend gender sensitization training, helping to engage with women farmers and household members.

The gender sensitization training will be conducted for both district-based RTs and 'local women advisors' and be extended to KVK staff and AHOs since they are also an active point of contact for women farmers. The training aims to enhance their soft skills, enabling them to better mobilize and engage with women farmers during training sessions/discussion groups. Improved engagement with women farmers is expected to enable RTs and AHOs to engage with other household members, including the spouse and in-laws, to understand household dynamics and the barriers faced by women farmers in actively participating and making decisions in households and on farms. The knowledge of household dynamics is expected to assist them in understanding the challenges women farmers might face while attending training sessions (or acting as 'local advisors') and enable them to counsel household members accordingly. Engagement with household members will enable the RTs to involve men along with women in sessions where they discuss women's roles and participation in the LL.

Regular engagement with RTs is expected to lead to behavior change and an increased understanding of the significance of women's participation in onion cultivation among household members. This could encourage household members to be more supportive of women farmers attending training sessions and discussion groups and acting as 'local advisors' in their community.

Combined with household support, the availability of information in real-time through 'local women advisors' and sensitized RTs can lead to positive changes in the attitudes, perspectives, and confidence of women farmers. A similar outcome is expected among 'local women advisors', and other women and girls in the village. Assuming that community-level social norms are supportive of women and the advisors, these changes are expected to lead to increased agency for both women farmers and local women advisors through greater participation in personal, household, and farm activities.

Positive changes in attitudes, perspectives, and confidence are also expected to lead to women having leisure time and/or pursuing additional income generating activities as explained in Section 6.2.

Increased participation in personal, household, and farm-related activities is expected to impact the economic, social, and psychological empowerment of women farmers and 'local advisors' in the project villages. However, restrictive cultural norms can counteract the gains achieved and pose a risk to achieving improved agency and empowerment of women.

The following underlying assumptions for these pathways can be partially monitored and mitigated by the Learning Lab:

- Relevant stakeholders actively participate in the gender sensitization trainings.

- Research technicians, KVK staff, and AHOs provide effective and timely assistance to women farmers.
- Household members of women farmers support their participation in activities (such as training, discussions) related to the onion value chain.
- Women farmers are motivated to take on the role of a local advisor and actively participate in the training sessions.
- 'Local women advisors' have access to devices through which they can access and disseminate information digitally.
- Household members of local advisors are accepting and supportive of their role.
- Women farmers reach out to local women advisors for assistance.

The following other assumptions for this pathway which are influenced by numerous variables external to the HER+ project purview, directly feed into the risks of the project:

- The social norms are conducive for research technicians, KVK staff, and AHOs to access and counsel household members.
- The social norms in the community are conducive and there are no barriers to women's participation in various activities within the onion value chain.

6.2. Causal Pathway 3 – Introducing women-friendly weeders (machinery), line sowing (technique), and irrigation facilities for agronomic activities across the onion value chain in the project villages; and training women farmers to use them

Women farmers in horticulture (including onions) are often involved in farming activities that require more physical labor such as sowing, transplanting, weeding, harvesting, and post-harvest operations including shelling, cleaning, and grading[16]. Among these activities, transplanting and weeding involve the most drudgery, requiring women to bend for lengthy stretches of time without any protection from heat and/or rain[17]. This results in severe body aches and increases musculoskeletal disorders[18] among women farmers[19].

WorldVeg aims to provide women-friendly machinery/ tools/ techniques/ technologies (such as weeders, techniques for line sowing, and technology for irrigation) for agronomic activities across the onion value chain in the project villages and train them in their use. Once the women farmers have the required knowledge and skills to use them, an expected outcome is a reduction in drudgery, which is expected to

[16] Indian Council of Agricultural Research (ICAR) n.d. Accessed September 22, 2023. https://krishi.icar.gov.in/jspui/bitstream/123456789/10529/2/COMPENDIUM%202015.08.01-10%20J.%20Nayak%20Short%20Course.pdf#page=171.

[17] ibid.

[18] Musculoskeletal impairment/disorders comprise more than 150 different diseases/conditions characterized by impairments in the muscles, bones, joints, and adjacent connective tissues leading to pain (often persistent) and limiting mobility and dexterity. It thereby reduces people's ability to work and participate in society. (World Health Organization. 2022. Musculoskeletal conditions. Who.int. World Health Organization: WHO. July 14, 2022. https://www.who.int/news-room/fact-sheets/detail/musculoskeletal-conditions.)

[19] Jatinder, K., and Rana, A. Ergonomic interventions in weeding operations for drudgery reduction of hill farm women of India.Work 41, no. Supplement 1 (2012): 4349-4355.

lead to reduced occurrences of dehydration, body aches, and fever[20]. Assuming that this results in improved health and a better quality of life, it could also lead to positive changes in attitudes, perspectives, and confidence of women farmers, as explained in Section 6.1.

Moreover, increased mechanization in the entire cultivation process is also expected to reduce labor time. This would imply additional time which women could use to focus on other activities, including income-generating pursuits or for leisure. Reduction in drudgery together with positive changes in attitudes, perspectives, and confidence also contribute to this outcome. If women farmers opt to pursue other income-generating activities, it is expected that they will witness an improvement in their income.

The following underlying assumptions for this pathway can be partially monitored and mitigated by the Learning Lab:

- Women farmers actively participate in the training sessions on the use of machinery, technologies, and techniques.
- The women have timely access to functional and women-friendly machinery, technologies, and techniques.
- The women are willing to use the introduced machinery, techniques, and technologies in onion cultivation.

There are other assumptions for this pathway which are influenced by variables external to the Learning Lab, making them difficult to be mitigated. These assumptions directly feed into the risks of the project:

- The introduced machinery, technologies, and techniques do not displace women's livelihoods or incomes which may increase distress.
- Improvement in health outcomes leads to improved quality of life (better health) for women farmers.

6.3 Causal Pathway 4a - Raising awareness on the right use of harmful agrochemicals.

Weeding is another women-dominated[21] activity often undertaken after the application of agrochemicals. As per recommended practices, farmers are cautioned to not venture into the field for a specific duration of time (ranging from 10 days to more) to avoid inhaling residues. However, as per the learnings from the stakeholder consultation workshop, manual weeding is undertaken within 2-3 days of spraying. As the agrochemicals are sprayed on the roots of the plant, women farmers are in direct contact with agrochemical residues while uprooting weeds.

During the process of mixing and applying agrochemicals, farmers are advised to use protective gear like gloves, masks, eye and face protection, and wear covered clothing for body protection[22]. However, the

[20] Issues related to drudgery-intensive activities as reported by women during the stakeholder consultation workshop.

[21] Indian Council of Agricultural Research. ICAR. n.d. Accessed September 22, 2023. https://krishi.icar.gov.in/jspui/bitstream/123456789/10529/2/COMPENDIUM%202015.08.01-10%20J.%20Nayak%20Short%20Course.pdf#page=171.

[22] Fishel, F. Personal protective equipment for working with pesticides. University of Missouri, MU Extension. n.d. Accessed September 22, 2023. https://extension.missouri.edu/publications/g1917

adoption of these measures remains low among farmers (especially women farmers[23]) in Odisha. As per a study[24] conducted in West Odisha, reasons for the low adoption of protective equipment include a lack of interest in wearing protective clothes, discomfort while wearing protective cover, and a belief that "it is unnecessary to wear protective cover", among others. The study concluded that farmers and their families who don't use protective covering are at high risk of developing health problems like nausea, headaches, and long-term ailments such as paralysis, cancer, and neurological disorders[25].

As revealed during stakeholder consultation workshops, although men in the project villages have started using some protective measures, no such change has been reported in women farmers as the latter are considered to not directly be involved in the spraying process. Women are thus exposed to these chemicals both during their application and during weeding, adding to their health concerns.

To tackle the issue, WorldVeg with SVA's support intends to create awareness on the harmful effects and appropriate use of agrochemicals through their existing training platforms. With greater awareness, women farmers are expected to understand the hazards associated with agrochemicals and adopt protective measures. In the long run, this is expected to lead to a reduction in skin burns, body aches, and other health-related concerns. The pathway also increases climate resilience among women farmers by their adoption of GAPS related to agrochemical application.

The following underlying assumption for this pathway can be partially monitored and mitigated by the Learning Lab and its partners:

- Women farmers have timely access to gear that works for them and are willing to use protective measures.

6.4. Causal Pathway 4b - Providing alternative environment-friendly alternatives to harmful pesticides.

WorldVeg additionally intends to supplement the awareness sessions by identifying, demonstrating, and providing environment-friendly alternatives to harmful pesticides and also facilitate their availability locally with the support of local input dealers and traders.

With the expectation that the increased awareness and accessibility of alternatives will lead to women farmers adopting them and trusting their efficacy, it is anticipated that a ripple effect will be created, and other farmers will start adopting the less harmful alternatives.

Adoption of environment-friendly alternatives together with appropriate use of agrochemicals (outlined in section 6.3) form a part of the GAPs that the project aims to disseminate (elaborated in section 6.5). In the long run, the activities are expected to improve climate change resilience among women farmers.

[23] During the stakeholder workshops, it was revealed that the adoption of protective equipment while handling agrochemicals remains low among women farmers in Nuapada. One of the reasons was their low (direct) involvement in the application process. However, it is important to note that the women are involved in creating the agrochemical mixture and refilling the application units, thereby making their adoption of protective gear vital.

[24] Seth, P., and Mahananda, M.R. Impact of pesticides on farmer's health of western Odisha. International Journal of Environmental & Agriculture Research 2, no. 12 (2016): 101-107.

[25] ibid.

The following underlying assumptions for this pathway can be partially monitored and mitigated by the Learning Lab and its partners:

- Women farmers participate in the demonstrations on the use of environment-friendly alternatives to harmful pesticides.
- Women farmers are able to access environment-friendly alternatives to pesticides without facing any barriers.

There are other assumptions for this pathway influenced by variables external to the Learning Lab that are difficult to be mitigated and that directly feed into the risks of the project:

- Environment-friendly alternatives are comparable or superior to existing pesticides in terms of efficacy, affordability, and accessibility.
- Environment-friendly alternatives are available locally in the required quantity.

6.5. Causal Pathways 5a and 5b - Awareness and training on best-fit onion varieties and Good Agricultural Practices

One of the challenges in the agricultural sector in Odisha is the timely availability of quality seeds of farmer-preferred onion varieties in the required quantity, thereby making them expensive, and increasing dependence on other states[26].

Apart from availability, knowledge gaps often prevent farmers from differentiating between season-specific onion varieties. The use of inappropriate varieties in different seasons can lead to high germination failure and wastage of inputs.

To spread awareness regarding the best-fit (agro-ecologically viable and market oriented) climate-resilient varieties, WorldVeg aims to organize crop cafeterias and/or demonstrations on the performance and different characteristics of various onion varieties. It will also encourage the participation of input dealers and traders in these activities.

Since the adoption of best-fit climate-resilient varieties cannot improve yields without the adoption of GAPS, the Learning Lab will also review and refine their information, education and communication (IEC) materials on GAPs to be more accessible and gender responsive to women farmers. The IEC materials would be accompanied by success stories from phase 1 of the WorldVeg Onion Value Chain project and modules on diet diversity. WorldVeg also aims to leverage IRRI's knowledge platforms and SVA's content on onion cultivation to create an onion knowledge bank that will be accessible to all the relevant stakeholders which is expected to create awareness on GAPs among women farmers.

Improved knowledge of best-fit varieties can increase the participation of women farmers in selecting suitable best-fit climate-resilient onion varieties within their households. The combined knowledge on GAPs and best-fit onion varieties is expected to encourage women to adopt both in the medium term.

In the long term, it is expected that there will be an increase in onion yields. Adoption could also improve overall crop management. As women farmers under the project witness an increase in yield, it is expected

[26] *Findings from the field visits conducted by the project partners.*

that they will influence other farmers to adopt the best-fit varieties. The improved yields are expected to make women farmers in the region more climate-resilient through crop diversification and adoption of sustainable GAPs, as well as increase their income. Assuming that this additional income is invested in improving their food consumption patterns and dietary choices, it is expected to have a positive impact on food and nutrition security.

Certain underlying assumptions for these pathways can be partially monitored and mitigated by the Learning Lab:

- Women farmers are able to access the IEC materials (including videos).
- The IEC materials are aligned and specific to the characteristics of the best-fit climate-resilient onion variety preferred by the farmer.
- A critical mass of farmers accepts and understands these improved practices so that they can positively influence one another.
- Women farmers are able to access the onion knowledge bank.
- Women farmers participate in cafeterias/demonstrations.
- Household members are supportive of women's participation in the onion value chain.
- The best-fit climate-resilient varieties offered by WorldVeg meet the qualities desired by women farmers.
- Women farmers are able to adhere to the best production practices without facing any barriers.

There are other assumptions for these pathways influenced by variables external to the Learning Lab that are difficult to monitor and mitigate and that directly feed into the risks of the project:

- The social norms in the community are conducive and there are no barriers to women's participation in various activities within the onion value chain.
- Traders/local input dealers participate in cafeterias/demonstrations and identify the varieties preferred by women farmers.
- There is a sustained interest in and market demand for onion.

6.6. Causal Pathways 6a and 6b - Establishing uninterrupted onion seed supply through input dealers and seed production by women farmers

Timely availability of quality seeds is a concern among farmers in Odisha, resulting in low onion production. Hence, it is necessary to train women farmers in scientific seed production technology to ensure self-reliance in terms of seed availability.

WorldVeg intends to conduct capacity building training on technical skills for seed production of best-fit climate-resilient onion varieties among women farmers. The sessions aim to assist women farmers in producing quality seeds by themselves and limit their dependence on input dealers, traders, and WorldVeg. Additionally, WorldVeg aims to establish linkages between women farmers and input dealers and traders to ensure seed supply of selected onion varieties to women farmers.

With women farmers' engagement in seed production, it is expected that seed will be available on time and the quantity of quality seeds of best-fit climate-resilient onion varieties will increase. This is also expected to lead to seed self-sufficiency in the long term. Further, improvement in seed availability will allow more women farmers to adopt best-fit climate-resilient onion varieties.

In the long run, women farmers with access to resources could venture into onion seed production enterprises.

In addition to these outcomes, the pathway is expected to improve women farmers' agency, signified by active participation in household and farm activities resulting in their economic, social, and psychological empowerment.

The following underlying assumptions for these pathways can be monitored and mitigated by the Learning Lab to some extent:

- Women farmers participate in capacity building trainings.
- Women are willing to venture into onion seed production.
- Farmers are able to use recommended onion seed production practices without facing any barriers such as shortage/quality of inputs.
- Women farmers have established links with appropriate public/private seed agencies, and government schemes and policies that help them capitalize on existing infrastructure and processes.
- Seed production is a financially viable option.
- Household members of the women farmers are supportive of their evolving role in the onion value chain.

The other assumptions for this pathway are influenced by variables external to the HER+ project, and the Learning Lab may not be able to monitor and/or mitigate them. Assumptions similar to these directly feed into the risks of the project:

- Trading in best-fit climate-resilient varieties is profitable for traders and input dealers.
- Traders/local input dealers participate in cafeterias/demonstrations and identify the varieties preferred by women farmers.
- Women farmers are able to purchase seeds of best-fit climate-resilient varieties from traders and input dealers.
- Seeds of best-fit climate-resilient varieties from traders and input dealers are affordable.
- Climatic conditions are conducive to seed production.
- Women farmers have sufficient land and sufficient agency/control to set aside a small area for seed production.
- Market conditions are conducive to the production and sale of seeds of best-fit climate-resilient onion varieties.

- The community is aware and has trust in the quality of seeds produced locally.
- There is demand for the seeds produced by women farmers.

6.7. Causal Pathway 7a - Capacity building training for post-harvest activities

Post-harvest activities encompass curing, sorting, grading, and storage of onions for sale in markets. The motivation for these activities comes from the resulting increase in the shelf life of onions and better prices realised by farmers. Post-harvest activities hold great significance when market conditions make immediate sales unfavorable for farmers.

WorldVeg intends to conduct capacity building training for women farmers on scientific post-harvest practices like grading, curing, and storage of onions. Once they have the required knowledge and are curing, sorting, and grading onions as per the guidelines, they can be expected to eventually realise the true price for different grades of onions.

The adoption of scientific storage practices is another crucial step to improve the shelf life of onions after harvest. This can reduce post-harvest losses (occurring due to moisture, pest attacks, and rotting), allowing women farmers to store their onions until the market price is high and supply is low.

In the long term, this will allow women to realise the true and presumably improved price of onions. Reduction in post-harvest losses can also increase the onion stock available both for sale and consumption.

Assuming that the improved income as a result of better prices is invested by women to improve their food consumption patterns and dietary choices, it is expected to have a positive impact on food security and nutrition, and lead to enhanced climate resilience.

Certain underlying assumptions for this pathway can be partially monitored and mitigated by the Learning Lab:

- Women farmers actively participate in the training sessions.
- Women are able to conduct appropriate post-harvest activities without any barriers.
- Grading guidelines disseminated in the training are in sync with and adhere to market demand and standards.

The other assumptions for this pathway influenced by variables external to the HER+ project, may not be monitored and/or mitigated by the Learning Lab. Assumptions similar to these directly feed into the risks of the project:

- Infrastructure for storage is available, accessible, and affordable.
- The storage facilities meet the qualities desired by women farmers.
- Farmers have sufficient yield to use the storage facilities.
- Storing is profitable/financially viable for the women farmers.
- Storage facilities follow quality standards required to reduce post-harvest losses.

- Markets in which women sell their produce have the ability to identify, distinguish, and compensate for different grades of onions.
- Market prices fluctuate and are higher during lean supply seasons.
- Stored onions are mostly sold in the market rather than self-consumed.
- A percentage of additional income is spent on increasing diet diversity and consumption more nutritious food.

6.8. Causal Pathway 7b - Establishing market linkages

As per the farmer interactions in the stakeholder consultation workshops, women farmers in the region have substantially lower levels of participation in marketing and selling activities. This leads to lack of knowledge and awareness regarding the nature of markets and the factors that influence sales decisions. The resulting impact is lower agency in making financial decisions and accessing income, with restricted mobility among women farmers.

To address the issue, WorldVeg with SVA's support, intends to facilitate buyer-seller interactions between women farmers and sellers. This is expected to improve their understanding of the market demand for onions and opportunities for growing them.

Greater awareness about markets is expected to aid women in connecting with potential onion traders/buyers and understanding their demands, buying capacity, etc., thereby enabling them to form improved market linkages and to realise a better price for their produce.

In the long run, the intended impact of the activity follows a similar path as explained in Section 6.1. The pathway is also expected to improve the income of women farmers through improved market linkages.

The underlying assumption for this pathway can be partially monitored and mitigated by the Learning Lab and its partners:

- Women farmers are willing to enter into marketing activities.

The other assumptions for this pathway are influenced by variables external to the Learning Lab, making it difficult to be mitigated. The assumptions directly feed into the risks of the project:

- Women farmers do not face any barriers while engaging with different market players.
- The social norms in the community are conducive and there are no barriers to women's participation in various activities within the onion value chain.

7. Alignment with CGIAR HER+ Impact Areas

The activities within this LL are strategically designed to make significant contributions to the five key impact areas envisioned by the CGIAR. This section succinctly outlines how these activities align with the impact areas.

1. **Nutrition, health, and food security (SDG: Target 2.1)**[27]

   The Odisha LL on onions strives to enhance and broaden women's incomes through a range of strategic interventions including capacity building on the use of climate-resilient varieties, seed production, and post-harvest technologies. With the underlying assumption that the supplementary income generated will be directed by women towards enhancing their dietary preferences and consumption habits, the increased income is expected to yield positive outcomes in terms of bolstering food security and nutrition. Consequently, the LL aligns with the impact area of Nutrition, health, and food security under the HER+ initiative.

2. **Poverty reduction, livelihoods, and jobs (SDG: Targets 1.5; 5.5)**[28]

   The activities within this LL are designed to result in an increase and/or diversification of women's income, offering potential relief to their financial standing. Moreover, the LL is actively engaged in fortifying women's resilience to climate change-related challenges and equipping them to confront climatic shocks more effectively. By doing so, the LL seeks to mitigate the risk of financial crises that could otherwise lead to impoverishment. This multifaceted approach aligns with the overarching impact areas of Poverty reduction, livelihoods, and jobs, as part of the broader HER+ initiative.

3. **Gender equality, youth, and social inclusion (SDG: Targets 5.1; 5.4; 5.a; 10.2)**[29]

   All the activities in the LL are carefully crafted to be gender-responsive. Additionally, the LL strives to build a conducive environment for women within both households and communities. Each activity is purposefully designed to actively promote gender equality and empowerment, thereby contributing to the impact area of Gender equality, youth, and social inclusion of the HER+ initiative.

[27] SDG Target 2.1: By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round.

[28] SDG Target 1.5: By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters; and

SDG Target 5.5: Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life.

[29] SDG Target 5.1: End all forms of discrimination against all women and girls everywhere;

SDG Target 5.4: Recognize and value unpaid care and domestic work through the provision of public services, infrastructure, and social protection policies, and the promotion of shared responsibility within the household and the family as nationally appropriate;

SDG Target 5.a: Undertake reforms to give women equal rights to economic resources, as well as access to ownership and control over land and other forms of property, financial services, inheritance, and natural resources, in accordance with national laws; and

SDG Target 10.2: By 2030, empower and promote the social, economic, and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status.

4. **Climate adaptation and mitigation (SDG: Targets 1.5; 13.1; 13.3)**[30]

   Through activities such as the dissemination of climate-responsive technical and institutional knowledge on onion cultivation, promoting alternatives to agrochemicals, sharing IECs on GAPs, and promoting best-fit climate-resilient onion varieties, the LL seeks to enhance climate resilience among women. Improved climate resilience is expected to lead to improved climate adaptation and mitigation. These activities are strategically aligned with the impact area of Climate adaptation and mitigation of the HER+ initiative.

5. **Environmental health and biodiversity (SDG: Target 12.4)**[31]

   The LL aims at providing training to women on the correct use of agrochemicals while also introducing them to viable alternatives. Wide-scale adoption of these practices holds the potential to enhance soil health, thereby making a meaningful contribution to the initiative's impact area on Environmental health and biodiversity. Promoting the adoption of GAPs and best-fit onion varieties is also expected to have positive outcomes on the environment and contribute to this impact area.

[30] SDG Target 1.5: By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social, and environmental shocks and disasters;

SDG Target 13.1: Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries; and

SDG Target 13.3: Improve education, awareness-raising, and human and institutional capacity on climate change mitigation, adaptation, impact reduction, and early warning.

[31] SDG Target 12.4: By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release into the air, water, and soil in order to minimize their adverse impacts on human health and the environment.

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