Foundation for Agrarian Studies

CGIAR Standing Panel on Impact Assessment

MONASH University

The Dynamics of Agricultural Innovation in North India

Stocktake Process: Building the Longlist of CGIAR-related Innovations in North India

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Stocktake Process: Building the Longlist of CGIAR-related Innovations in North India

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1. Introduction

In 2025, the Foundation for Agrarian Studies (FAS), India, Monash University, Australia, and ICAR-National Bureau of Plant Genetic Resources (NBPGR), India, jointly undertook a research project titled *The Dynamics of Agricultural Innovation in North India*. The project is funded by the CGIAR-Standing Panel on Impact Assessment (SPIA). The project aims to comprehensively document CGIAR-related innovations in North India since 2000[1] and study the reach and adoption of selected innovations that have achieved scale. In this study, we define North India as comprising six states: Punjab, Haryana, Uttar Pradesh, Bihar, West Bengal, and Odisha.

The project consists of the following main components:

i. Longlist of Innovations: This component involves compiling a comprehensive longlist of CGIAR-related innovations in North India since 2000.

ii. Shortlist of Innovations: This involves preparing a shortlist of innovations derived from the longlist, based on scale of adoption and context-specific relevance.

iii. Socio-economic and Biophysical Surveys: This component involves conducting representative socio-economic surveys at the farm-household level across study areas, alongside the collection of relevant biophysical data to assess the reach and adoption of shortlisted innovations.

iv. Publication of reports, academic articles and policy briefs: The key findings will be disseminated.

The project constituted an advisory team of experts in the agricultural science and technology, agricultural economics, statistical systems in India, agriculture policy, climate change, and agriculture to provide advice and feedback at different stages of the project.

This document outlines the methodology adopted to compile a comprehensive longlist of CGIAR-related innovations in North India since 2000. We prepared the longlist using the stocktaking approach, which the SPIA Global Advisory Team (2025) defines as a systematic and iterative approach. Kosmowski et al. (2020) first introduced this approach in the Ethiopia Country Study, and several other country-level SPIA studies have since adopted it. This exercise enabled us to identify and document innovations in a methodical and structured manner.

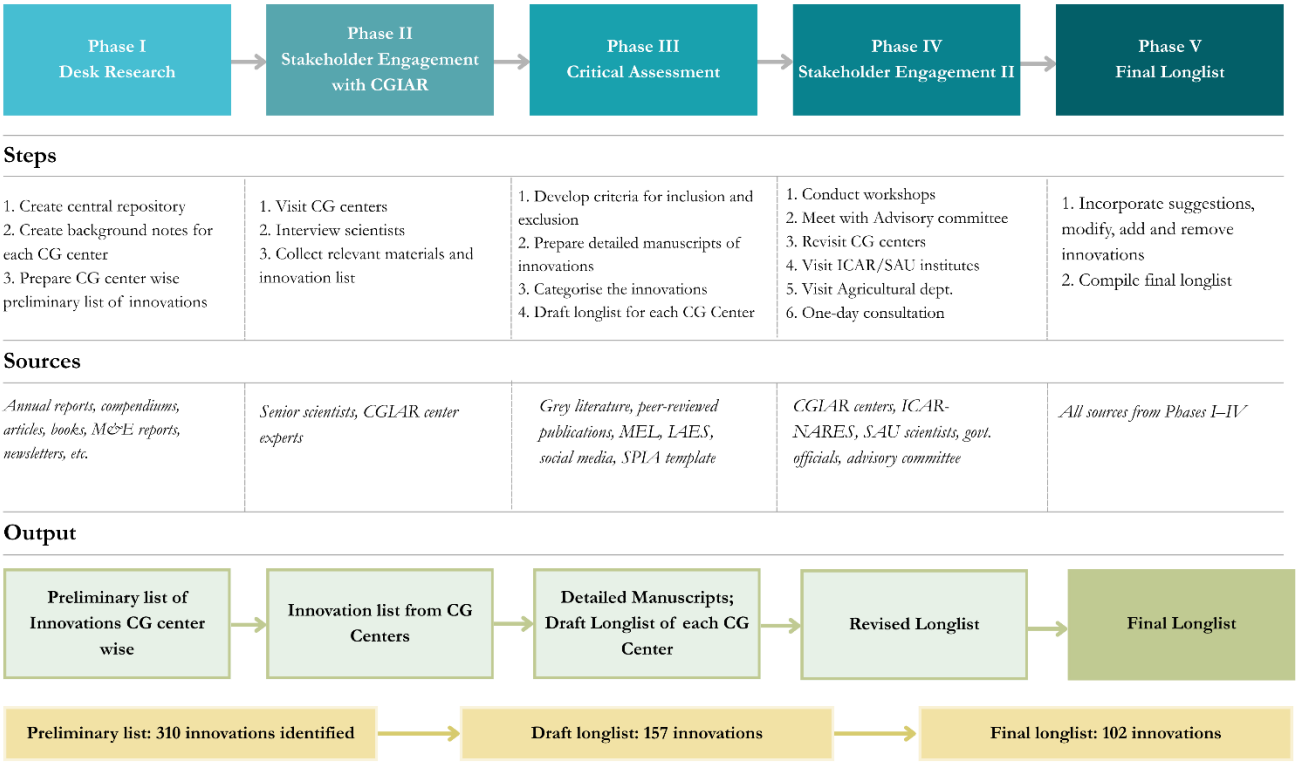
Currently, eleven CGIAR Centers operate in India: Alliance of Bioversity International and International Center for Tropical Agriculture (Alliance of Bioversity & CIAT), Center for International Forestry Research and World Agroforestry (CIFOR-ICRAF), International Maize and Wheat Improvement Center (CIMMYT), International Potato Center (CIP), International Center for Agricultural Research in the Dry Areas (ICARDA), International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), International Food Policy Research Institute (IFPRI), International Livestock Research Institute (ILRI), International Rice Research Institute (IRRI), International Water Management Institute (IWMI) and WorldFish. The International Institute of Tropical Agriculture (IITA), while not operating in India, has also

[1] An innovation or technology that was developed, introduced or disseminated after 2000.

been involved in developing agricultural technologies in the country. In India, these Centers work in close collaboration with the National Agricultural Research and Education System (NARES), including the Indian Council of Agricultural Research (ICAR), State Agricultural Universities (SAUs), Central and State governments, and private sector partners, to develop and promote agricultural technologies, tools, practices, and evidence-based policy/institutional building.

The stocktake exercise conducted for North India resulted in a final longlist of 102 CGIAR-related innovations, which was narrowed down from a preliminary list of 310 through a rigorous and methodical screening process (Figure 1). The stocktake process comprised five major steps: desk research; stakeholder engagement with CGIAR centers; critical assessment; stakeholder engagement II, comprising re-engagement with CGIAR centers, ICAR-NARES institutes and SAU scientists and officials; and final longlist. At each step, we undertook multiple activities and gathered relevant sources to refine the analysis. The process was iterative by design, with each phase informing and refining the subsequent one.

Figure 1. Stocktake Process



Note: CG = CGIAR. ICAR = Indian Council of Agricultural Research. NARES = National Agricultural Research and Education System. SAU = State Agricultural University. CGIAR-MEL = Monitoring, Evaluation, and Learning. IAES = Independent Advisory and Evaluation Service. SPIA = Standing Panel on Impact Assessment.

2. Steps of the Stocktake Process

2.1. Phase I: Desk research

The stocktake process began with comprehensive desk research, aimed at consolidating and reviewing the existing published and unpublished literature on CGIAR-related projects and publications in India.

2.1.1 Central Repository

The first step involved building a central repository of the relevant materials for all the CGIAR centers operating in India. We identified key sources, including CGIAR's open-access platforms such as CGSpace[2], CGIAR center-specific repositories[3] and official institutional websites. We compiled a wide range of study materials, including annual reports, peer-reviewed scientific articles, books, monitoring and evaluation reports, posters, pamphlets, policy briefs, brochures, handbooks, conference papers and presentations, newsletters and media-related content. We also collected information on announcements of CGIAR-related projects, programmes, and interventions from social media platforms such as X, LinkedIn, Facebook and YouTube accounts of CGIAR centers.

At this stage, only the documents published or relevant after 2000 were compiled. We systematically organised the collected materials by year of publication and thematic subject area, and further categorised into peer-reviewed publications and grey literature. This approach facilitated the creation of a comprehensive CGIAR center-specific repository of all materials, which formed a foundational archive for the subsequent tasks of the stocktake process.

2.1.2 Background note on each CGIAR center

Drawing on the compiled material, we developed a comprehensive understanding of each CGIAR center's institutional profile and key research domains. This involved the development of a background note on each Center that documented its historical engagement in India, including key research areas, important milestones, projects, and scientific innovations. We paid particular attention to CGIAR interventions and innovations from 2000 onwards.

In addition, we prepared a database of current and former personnel in leadership positions, along with a list of senior scientists across CGIAR centers in India. This was instrumental in the later stages.

2.1.3 Preliminary list of Innovation CG center wise

We systematically reviewed the annual reports and other materials from the central repositories of each CGIAR center from 2000 to develop a preliminary list of innovations in North India. These innovations ranged from crop-related technologies, that consists of the largest share of innovations, to innovations related to digital tools, machinery, agronomic practices, natural resource management, aquaculture and livestock.

At this stage, we included only innovations after 2000 which were specific to North India. A preliminary list of innovations with a brief description was prepared for all CGIAR centers.

In total, 310 innovations were identified (Table 1).

Table 1. Center-wise number of preliminary innovations

S. No.	CGIAR center	Number of innovations
1	Alliance of Bioversity International and CIAT (Alliance of Bioversity & CIAT)	20
2	Center for International Forestry Research and World Agroforestry (CIFOR-ICRAF)	10
3	International Maize and Wheat Improvement Center (CIMMYT)	40

[2] CGSpace is a repository and a collection of CGIAR and partner research reports and outputs.

[3] All CGIAR centers have their own repositories. This is CIMMYT's repository: https://repository.cimmyt.org/home

S. No.	CGIAR center	Number of innovations
4	International Potato Center (CIP)	27
5	International Center for Agricultural Research in the Dry Areas (ICARDA)	19
6	International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)	78
7	International Food Policy Research Institute (IFPRI)	20
8	International Livestock Research Institute (ILRI)	19
9	International Rice Research Institute (IRRI)	32
10	International Water Management Institute (IWMI)	28
11	WorldFish	17
	Total	**310**

This preliminary list of 310 innovations established the basis for subsequent validation, consolidation, and refinement in later stages of the process.

2.2. Phase II: Stakeholder engagement with CGIAR

As part of the stocktake process, we conducted an extensive stakeholder engagement over nearly a year. The first set of engagements focused on stakeholders from the CGIAR centers, including leadership, senior scientists, research and administrative staff.

We contacted identified leadership personnel, along with scientists from different research domains, and scheduled meetings with them. An additional effort to identify personnel with institutional memory of the respective CG centers was also made. This is important given the long span of the innovations. The two documents prepared during the desk research, the preliminary list of innovations and the background notes, served as crucial reference materials for these discussions. The meetings primarily focused on the Centers' major research areas, specific efforts in the development of various agricultural innovations and their reach and diffusion. Throughout the discussions, particular attention was given to distinguishing factual information from subjective opinions.

Following the discussions, we adopted a twofold approach to gather study materials from the CGIAR centers. First, all relevant literature, including published articles, internal reports, compendia, and other institutional materials, were collected from each Center.

Secondly, we developed and shared a structured stocktaking template with all the Centers. This template was designed to capture details pertaining to each specific innovation (including lists of varieties across crops, details of digital tools, policy/institutional building), that is, details of the project under which the innovation was developed or disseminated, and innovation-specific reference material, among others. The Centers were requested to share a list of innovations in which they had been involved since 2000.

We consolidated the responses received from the centres, which provided the basis for further validation and analysis in the next step.

2.3. Phase III: Critical assessment

In this step, we established the inclusion and exclusion criteria for the longlist of innovations. The materials received from the Centers and those identified through desk research were cross-checked and verified. We then applied the defined criteria to refine the list of innovations was refined. Each innovation was then critically assessed, and detailed manuscripts were prepared and internally reviewed by the project team to ensure consistency and rigour. The main output of this step was a refined version of the longlist of innovations.

2.3.1 Defining inclusion and exclusion criteria

We use Kosmowski et al.'s (2020) operational definition of a CGIAR innovation to set the inclusion and exclusion criteria. They define an innovation as "a technology, practice, decision support tool, or policy/institutional design that required input from research for its design and/or promotion and is novel to its users". We exclude capacity-building activities, training programmes, and similar efforts. Further, specific criteria were developed to define CGIAR involvement, identify end users, assess novelty, and determine the timeframe of the exercise (Table 2).

CGIAR centers work closely with India's NARES, including ICAR, SAUs, Central and State governments, and private sector partners, to develop and promote agricultural technologies, tools, practices, and evidence-based policies in India. Accordingly, we identified different forms of CGIAR engagement and used them as criteria for the inclusion of innovations in the longlist. These engagements are broadly classified into i) initial contribution, such as supply of the germplasm; ii) end-to-end development, such as developing a digital application for the extension services; iii) customisation and/or dissemination involving the scaling-up of the adoption or improvement of the existing knowledge and technologies; and iv) collaborative efforts undertaken through projects, such as breeding a new crop variety in partnerships with ICAR or SAU scientists.

Table 2. Inclusion and exclusion criteria

Inclusion Criteria		
1	CGIAR involvement	Innovation must reflect at least one of the following CGIAR roles: (i) Initial contribution (ii) End-to-end development (iii) Customisation and/or dissemination (iv) Collaborative efforts through projects
2	End user	The primary end user of the innovation must be a farmer (with the exception of policy/institutional contributions, which we document for completeness)
3	Novelty	The innovation must be new to the end user at the time of introduction.
4	Timeline	The innovation must fall within the period 2000–2023.
Exclusion Criteria		
1	Stage of innovation	Innovation is excluded if it remains at the experimental or pilot stage.

Inclusion Criteria		
2	Capacity-building initiatives	Innovation is excluded if its primary focus is on training or capacity development rather than a deployable innovation, for example, a new technique.

2.3.2 Refining the innovation and manuscript preparation

Following a systematic review and by using the aforementioned inclusion and exclusion criteria, we refined the initial list of 310 innovations to a total of 157 innovations (Table 3). We subsequently prepared a detailed manuscript for each innovation. Resources and insights provided by the respective CGIAR centers were instrumental in ensuring a comprehensive documentation of each identified innovation.

While preparing the manuscripts, we adopted an innovation-centric approach, marking a methodological shift from the earlier centre-specific approach. Until this stage, we had organised and collected information according to CGIAR centers. Once the list of innovations was revised, we shifted our focus to individual innovations. Following it, we complied and documented relevant information and data on each innovation's development, dissemination, projects, developing partners' role and efforts, timeline, locations, and evidence of adoption.

In addition to the central repository compiled during the desk research phase, the following sources were examined:

a) Grey Literature: It includes annual reports, datasets, posters, pamphlets, policy briefs, brochures, handbooks, newsletter bulletins from CGSpace and center-specific repositories, Innovation-specific details from CGIAR Results Dashboard (2017-2024), the CGIAR Monitoring, Evaluation, and Learning (MEL) platform and evaluation reports from the CGIAR-Independent Advisory and Evaluation Service (IAES). Apart from these, internal reports, which are not publicly available, were collected from respective Centers.

b) Peer-reviewed Publications: Innovation-specific publications were compiled using Google Scholar, ScienceDirect, JSTOR and ResearchGate.

c) Social Media: Information regarding announcements and supplementary insights was collected from social media platforms such as X, LinkedIn, Facebook and YouTube of CGIAR and respective Centers.

Table 3. Center-wise number of manuscripts prepared

CGIAR Center	No. of detailed manuscripts prepared
Alliance of Bioversity International and CIAT	5
CIFOR-ICRAF	5
CIMMYT	20
CIP	13
ICARDA	15
ICRISAT	47
IFPRI	6

CGIAR Center	No. of detailed manuscripts prepared
ILRI	10
IRRI	16
IWMI	12
WorldFish	8
Total	**157**

The steps undertaken in the preparation of manuscripts for the different categories of innovations and a separate theme are outlined below:

i) Crop-related innovations: We identified the mandate crops of CGIAR centers in India, and they are rice, maize, wheat, potato, sweet potato, barley, grasspea, lentil, chickpea, groundnut, pearl millet, pigeonpea, cassava, and sorghum. As discussed earlier, CGIAR centers have historically collaborated with Indian institutions in various capacities (such as supplying germplasm, participating in the breeding programme, or providing support for dissemination) to develop and promote advanced crop-related technologies.

In the stocktake process, we adopted a trait-specific approach to classify crop-related innovations. The approach defines the specific characteristics of crop varieties, such as drought tolerance, disease resistance, nutritional value, or high yield potential. For instance, the innovation, submergence-tolerant rice, would include the rice varieties that are tolerant to submergence or possess that specific trait. The respective CGIAR centers provided a list of crop varieties to which they had contributed either through development or dissemination. All these varieties were classified into specific trait-based innovations.

To validate the list and trait-specific information, two approaches were undertaken. First, the list of released varieties published by the respective All India Coordinated Research Projects (AICRP)[4] for each crop was compiled. The AICRP reports provided detailed information on traits, year of release, recommended locations of release, and names of the collaborative partners, such as ICAR Institutes, SAUs and private firms, for all released varieties. The CGIAR variety list was then cross-verified with the AICRP variety list to compile the information. Scientific articles were also referred to during this exercise.

Secondly, the pedigree[5] details of all varieties were compiled from published AICRP reports and peer-reviewed publications. Pedigree analysis[6] was used to examine and validate the contribution of CGIAR germplasm to crop improvement over time.

ii) Other categories of innovations: Beyond crop-related innovations, CGIAR centers have made contributions to other agricultural technologies and agronomic practices such as agricultural machinery, wa-

[4] All India Coordinated Research Projects (AICRP) is a network of projects launched by the ICAR for the development, testing, and identification of technologies through multi-location trials. It is a nationally coordinated research mechanism through which ICAR institutes and SAUs conduct trials under diverse agro-climatic conditions across India together. The AICRP reports are a compilation of annual or periodic research findings, experimental data, and technological advancements.

[5] Pedigree refers to a breeding method that maintains detailed records of the ancestry, parentage and important traits of plants.

[6] Pedigree analysis is a method employed to trace the ancestry and genetic relationships among different crop lines, enabling an understanding of how specific traits are transmitted across generations.

ter-saving technologies, management practices, and digital advisory tools. In addition, dedicated Centers within CGIAR systems (ILRI and WorldFish) have focused their research and development efforts on innovation pertaining to animal resources and aquaculture systems.

We undertook a review of the innovations across each category using collected materials. This was supplemented by a targeted web search, in which the name of each innovation was queried in conjunction with the term "CGIAR" or the name of the respective CGIAR centers. Together, this exercise yielded significant information on each innovation, including the project name, implementation timelines, relevant CGIAR research programmes, geographic coverage, and collaborative NARES and private sector partners.

iii) Policy intervention: One major objective of CGIAR centers operating in India is to inform policy through the generation of evidence-based research. IFPRI and all other CGIAR centers, working in close collaboration with national partners and administrative institutions, support the formulation and implementation of agricultural, environmental, and nutritional strategies at both national and state levels.

These efforts were identified by tracing the trajectory of CGIAR centers' engagement in the policy process. This included examining distinct pathways such as evidence generation through research studies, participation as knowledge or technical partners, and direct involvement in policy formulation processes. For this analysis, we identified and reviewed policy briefs published by the CGIAR centers, along with official policy documents issued by relevant government authorities.

iv) Mapping CGIAR's specific contribution: This exercise is particularly significant given that CGIAR centers work closely with national partners in various capacities to develop and promote innovations and generate evidence-based policies in India. Therefore, efforts were made to identify the specific contributions of the CGIAR centers by mapping their roles across the successive stages of "innovation development" for different categories of innovations. For instance, in the case of crop-related innovations, CGIAR centers may have contributed by supplying germplasm or through collaborative projects focused on plant breeding, dissemination, and scaling up. In the case of agronomic or natural resource management (NRM), CGIAR engagement may have taken the form of promoting adoption by identifying and bundling practices into integrated packages. Similarly, with respect to digital advisory tools, CGIAR centers may have developed a range of tools under different projects or customised existing tools to address specific local needs. The details of these efforts are presented in Appendix Table 1.

Following these rigorous steps, we prepared manuscripts for a total of 157 identified innovations across CGIAR centers in accordance with the format suggested by the Standing Panel on Impact Assessment (SPIA) (2023, 2025) and Kosmowski (2025), modified for the Indian context. After preparing the manuscripts, the innovations were categorised as described in the following section.

2.3.3 Defining innovation category

We subsequently categorised the innovations into crop improvement, aquaculture, seed production technique, digital advisory tools, scientific management for NRM practices, machinery and agronomic practices, and policy/institutional building.

The distinct categories of innovations have been defined as follows:

i) Crop improvement: This includes innovations that advance crop productivity, resilience, and tolerance to biotic and abiotic stress through improved germplasm or breeding techniques. As mentioned earlier, a trait-based approach was adopted to classify crop improvement innovations, such as disease-resistant rice or bio-fortified wheat. Such an innovation encompasses multiple varieties exhibiting the specified trait. Crop improvement innovations broadly fall under five major trait categories:

- Cultivation duration adjustment: These varieties have been bred to mature within a shorter span, which allows farmers to manage their cropping cycles and minimise harvest losses arising from seasonal constraints. This includes short-duration varieties.
- Biotic stress management: These varieties were developed to resist or tolerate a range of insect pests and diseases, thereby reducing yield loss. This includes disease-resistant and pest-tolerant varieties.
- Abiotic stress management: These varieties were bred to sustain productivity under adverse physical conditions, including heat stress at critical growth stages, flooding, salinity, and moisture deficit. These include drought-tolerant, submergence-tolerant, salt-tolerant, and heat-tolerant varieties.
- Nutrition management: These varieties are developed to carry enhanced concentrations of essential micronutrients to address prevalent nutritional deficiencies. This includes biofortified varieties.
- Multi-trait and dual-purpose varieties: These varieties incorporate a combination of multiple desirable traits within a single genotype, such as drought- and disease-resistant varieties, and short-duration, disease-tolerant varieties.

ii) Aquaculture: This category includes advancements in the breeding, rearing, and harvesting of fish species. It includes genetically improved fish strains and the introduction of hatchery techniques for the production of vitamin-rich fish species in India.

iii) Seed production technique: This involves improved techniques aimed at producing high-quality, genetically pure, and high-yielding seeds. This category includes techniques that improve potato seed production, namely, True Potato Seed (TPS) and Apical Root Cutting (ARC).

iv) Digital Advisory Tools: This category includes new or improved digital tools, services, platforms, and data-driven approaches that address challenges in crop production and farm management. These tools were developed to deliver a range of services, including field-specific advisory information on crop and nutrient management, insect pest and disease diagnostics, details of inputs, and feed solutions, and real-time climate and weather-based advisories disseminated to farmers in the form of alerts and notifications.

v) Scientific Management of NRM Practices: This category encompasses water conservation and harvesting practices that enable farmers to manage resources more effectively. While these practices have existed prior to CGIAR's involvement, they have been customised through more rigorous scientific approaches and introduced as an integrated package. For instance, the construction of ponds to augment groundwater reserves is not a new practice in itself; however, the strategic placement of ponds in hydrologically critical locations to facilitate the inflow of surplus water may be a distinct contribution to NRM practice. Such an integrated package may serve the dual purpose of mitigating flood events and addressing groundwater shortages.

vi) Machinery and Agronomic Practices: This category includes agricultural machinery and equipment designed to perform specific farming tasks, alongside agronomic practices that improve crop yield, maintain soil health, and promote environmentally sustainable agricultural systems. These practices have been integrated with appropriate machinery and introduced to farmers as a bundled package. For instance, crop residue management is an important post-harvest activity; however, its integration with zero tillage (a technique that involves no-tillage of soil before sowing) with machines like Happy Seeders could enhance the practice. This bundled approach demonstrates that the incorporation of appropriate mechanisation into existing agronomic practices may yield greater benefits.

vii) Policy/Institution Building: This category includes evidence-based recommendations to reform policies and institutions. CGIAR centers work with Indian partners in various capacities as follows:

a) Institution building: CGIAR has claimed to have supported, strengthened, and facilitated the establishment of organisations and governance structures that oversee or manage agricultural systems. For instance, the IRRI convened the Direct-Seeded Rice Consortium (DSRC) with the aim of promoting DSR practices by consolidating diverse stakeholder groups.

b) Policy framework design: CGIAR centers conduct evidence-based research and pilot interventions, and evaluate existing policies and policy frameworks. On the basis of their findings, these Centers develop new frameworks or recommend changes to policies, legislation, regulations, and strategies, and also function as knowledge partners within national administrative systems. For instance, IWMI conducted studies to assess groundwater extraction in Gujarat and recommended policies to address the interrelated challenges of electricity consumption and groundwater overextraction. Similarly, ILRI conducted studies on vaccine availability in India and contributed to the development of a national strategy for the Classical Swine Fever (CSF) control programme of the Government of India. In addition, CIFOR-ICRAF supported the development of India's National Agroforestry Policy.

c) Technical support: CGIAR centers also provide technical guidance to national partners through the provision of evidence, data, and specialised expertise. For instance, WorldFish provided technical assistance to the Government of Odisha in the formulation of policies pertaining to fisheries management. Similarly, IFPRI served as the technical partner to the Technical Support Unit (TSU) within NITI Aayog, Government of India.

2.4 Phase IV: Stakeholder engagement II

We compiled a draft longlist of innovations for each CGIAR center, and documented gaps in the list. Then, the second round of stakeholder engagement was initiated to validate, refine, and address gaps in the longlist. For this exercise, we drew on a prepared list of stakeholders associated with the particular innovations, compiled for ICAR-NARES institutions and SAUs.

We conducted a series of meetings, including internal workshops, advisory committee consultations, follow-up interactions with CGIAR centers, interviews with senior scientists from ICAR-NARES institutions and SAUs, and discussions with state agricultural departments.

These activities have been grouped into three: 'internal consultation', which includes in-house meetings with experts and workshops with the advisory committee; 'multiple stakeholder consultation', which encompasses engagements with CGIAR centers, ICAR-NARES institutes, SAUs and state and central government stakeholders; and a 'one-day consultation' workshop with all the aforementioned stakeholders.

2.4.1 Internal Consultation

Several rounds of meetings and workshops were conducted throughout the stocktake exercise to present and discuss the draft longlist, identify the gaps, and solicit expert feedback. Each CGIAR center's draft longlist was presented and discussed during the meetings over the past year.

2.4.1.1 Advisory Committee Meeting

Certain gaps in attribution, inclusion and exclusion criteria for the innovations and innovation-specific data gaps were identified while drafting the manuscripts in the previous step. In order to address these gaps and solicit recommendations from experts, a meeting with the advisory committee members was scheduled.

Advisory committee members (Appendix Table 2) participated in a workshop on 25 September, 2025 to discuss the stocktake process and draft longlist of innovations. The Advisory Committee provided valuable feedback and methodological suggestions, particularly with respect to refining the process of

listing innovations as well as defining the major categories of innovations. The key points emerging from the workshop were as follows:

- Similar innovations across CGIAR centers could be consolidated into a single innovation.
- The inclusion criteria, specifically novelty of an innovation to the end user (farmer and policymakers/governments), required critical re-examination, and certain listed innovations were recommended for removal from the longlist.
- 'Non-CG Partners' column was recommended to be subdivided into three distinct categories: 'Scientific Development', 'Funders', and 'Dissemination', to delineate the specific role of each partner. This column was further disaggregated to distinguish between ICAR institutes and State Agricultural Universities (SAUs).
- It was proposed that a new column, 'Impact of Adoption', be introduced to capture the impact in terms of changes in productivity, income, sustainability, and livelihoods.

Based on suggestions on documenting the impact of adoption, a systematic review and analysis of the available literature was undertaken. Both CG materials, such as evaluation reports from IAES, impact assessment studies and similar studies conducted by the ICAR, were reviewed thoroughly to obtain information on the overall impact of the adoption of the innovation.

2.4.2 Multiple Stakeholder Consultation

2.4.2.1 Revisiting CG Centers

Following the comments and feedback received from the Advisory Committee meeting, we systematically reviewed all innovations and documented the identified gaps in a standardised format. The queries broadly covered crop-specific details on pedigree, particulars of the project through which each innovation was developed and/or disseminated, and the specific role of the respective CGIAR centers. In general, data on evidence of adoption for many of the innovations were still missing, with scant materials on adoption and its impact available.

Subsequently, the research team re-engaged with the respective CGIAR centers to solicit their comments and suggestions, to refine the draft longlist and address the identified gaps for specific innovations. A document listing queries was prepared and, along with the draft longlist of innovations, sent to the respective CGIAR centers for their review and response.

The CGIAR centers shared available literature on the evidence of adoption. The Centers' responses not only helped the research team access resources and literature on adoption, but also validated the innovations listed in the draft longlist.

2.4.2.2 Visit to ICAR-NARES Institutes and SAUs:

Given the central role of ICAR-NARES institutions in the development, adoption, and scaling up of all agricultural innovations in India, including those related to CGIAR institutions, the stocktake exercise also included in-depth interviews with eminent agricultural scientists who have held and continue to hold senior leadership positions within ICAR and NARES institutes. The key objectives of this step were to validate the listed innovations in the selected states, solicit experts' comments on the scale of adoption at the regional and state levels, collect relevant administrative data on these innovations, and understand the specific Centers.

The research team conducted visits to ICAR institutes and State Agricultural Universities, mainly in the states selected for this study. The visits comprised extensive interviews with senior scientists and other identified experts from these institutions who had been involved in the collaborative projects between CGIAR centers and respective institutions.

Altogether, 36 scientists were interviewed from the following institutes: ICAR, New Delhi; ICAR-National Bureau of Plant Genetic Resources (NBPGR), New Delhi; ICAR-Indian Agricultural Research Institute (IARI), New Delhi; ICAR-Central Rice Research Institute (CRRI), Odisha; ICAR-Central Institute for Women in Agriculture (CIWA), Odisha; ICAR-Indian Institute of Maize Research (IIMR), New Delhi; Punjab Agricultural University (PAU), Punjab; and Odisha University of Agriculture and Technology (OUAT), Odisha.

These interactions provided critical insights into the long-standing partnerships between CGIAR centers and national institutions that have historically contributed to agricultural research and development in India. Any available data on the evidence of adoption were also collected and documented.

2.4.2.3 Central Agencies and State Agricultural Departments

Central Agencies and State Agricultural Departments of the state governments play a crucial role in the dissemination of agricultural technologies, tools and schemes in India. It was therefore imperative to engage with government officials to collect documents and to develop a more comprehensive understanding of the innovations within the respective states. The relevant officials were first identified and contacted, following which meetings were scheduled with the respective departments.

We subsequently conducted follow-up interactions to collect relevant administrative data, which were indicative of the evidence of adoption, including crop breeder seed indents[7], seed rolling plans[8], seed distribution, state agricultural contingency plans, activity reports, and details on agricultural machinery. Special efforts were made to address the gaps in data on the reach of the innovations by analysing these administrative data. The findings derived from this process were incorporated in the longlist of innovations.

2.4.3 One-day consultation

A one-day consultation was convened in January 2026 at the National Agricultural Science Complex (NASC), New Delhi. The consultation was structured with two broad objectives:

- To present the draft longlist of innovations, solicit feedback on the comprehensiveness of the longlist, address the gaps, and verify the accuracy of records.
- To gather inputs for establishing the scale of adoption (in terms of area, farmers, number of machinery or any other relevant indicators), and to identify innovation-specific criteria for shortlisting of innovations for the subsequent stage of the project.

Prior to the consultation, we compiled a list of stakeholders from ICAR, SAUs, government departments, CGIAR-SPIA, the advisory committee and all CGIAR centers operating in India, and invited the identified participants. Two documents were prepared and circulated among all participants:

a) Stocktake document: This document served as a reference for participants, which included the stocktake process and details of each innovation in the draft longlist, presented in a summarised and standardised format. Specifically, it included a brief description of the innovation, the contribu-

[7] The 'Breeder Seed Indent data' published by the Ministry of Agriculture and Farmers' Welfare (MoA&FW), is the demand placed on the Department of Agriculture Cooperation and Farmers Welfare, Government of India, by state agricultural departments and institutions such as the National Seed Association of India (NSAI), Indian Farmers Fertilizer Cooperative Limited (IFFCO), and Krishak Bharati Cooperative Limited (KRIBHCO), among others, within the formal public seed system for a particular variety.

[8] The Seed Rolling Plan is a three-year planning document submitted to the Department of Agriculture and Farmers Welfare, under the MoA&FW, Government of India, by the state governments. It assesses the state-wise seed requirement of different crops/varieties for kharif and rabi seasons as per the prescribed seed rate, the area under crop/variety, and the seed replacement rate.

tion of CGIAR centers in development and/or dissemination, a list of ICAR-NARES partners associated with each innovation, the timeline of the innovation and details of regions/states in which the innovation has been introduced and adopted.

b) Expert Comments: We prepared this document to systematically collect experts' comments on the scale of adoption of each innovation in a standard format. It aimed to collect and document available data, evidence, and literature from the experts. Moreover, experts' assessment pertaining to the extent of adoption in terms of area, number of farmers reached, and the geographical spread of each innovation was also collected in this document.

More than 50 stakeholders participated in the consultation. The draft longlist was presented in two breakout sessions: one focused on crop improvement innovations, and the other on all remaining innovations. Both sessions were attended by domain experts from the respective fields. The participants provided detailed comments on each innovation.

Some of the major comments received during the consultation were as follows:

- Incorporating data: Experts recommended incorporating data from ICAR survey reports and SAUs to strengthen the evidence of adoption.
- Adding missing innovations: Experts suggested including innovations which had been missed in the draft longlist, for instance, the crop cassava.
- Modifying innovations: Experts recommended consolidating a few similar innovations to avoid duplication and improve clarity.

In addition to these suggestions, it was proposed that a standardised template or pro forma be shared with the participants following the consultation, to gather details on the reach and scale of adoption of the innovations. The experts also recommended engaging with relevant officials from various departments of the Central and State governments and scientists from SAUs to obtain further information at the regional scale. Following the workshop, we conducted regular follow-up interactions with concerned scientists and officials to gather further details.

The comments and suggestions received were subsequently analysed to address the gaps in the longlist.

2.5. Phase V: Final longlist (a link to the Final Longlist (the excel file) will be added here)

Engagement with diverse stakeholders and the recommendations gathered through these interactions were instrumental in shaping the final longlist. The longlist underwent multiple rounds of iterative refinements, with the process focused on modifying, removing, and adding innovations to prepare a comprehensive list of CGIAR-related innovations in North India since 2000. Refinements included:

Modification of Innovation: Innovations that were similar in nature or served comparable purposes across CGIAR centers were carefully reviewed, and wherever appropriate, consolidated into a single innovation entry. For instance, both ICARDA and ICRISAT have been involved in the development of chickpea varieties. Disease-resistant and drought-tolerant innovations from both Centers were combined rather than kept as separate innovations.

In addition, certain innovations were renamed to improve clarity and consistency across the longlist. Certain crop-related innovations consisting of multiple traits, including disease resistance, insect tolerance, drought tolerance, short duration, and high yield, among others, were renamed to represent the multi-trait nature. For example, 'multi-trait groundnut' comprises varieties that are drought-tolerant, disease-resistant and high-yielding with confectionery traits.

Addition of Innovations: Based on the suggestions received from various stakeholders, three additional innovations, namely, widely adaptable wheat, disease-resistant rice and improved and biofortified cassava, were incorporated into the longlist.

Removal of Innovations: The removal of innovations from the list was guided by the following criteria:

- Innovations introduced after 2023 were excluded, as they fall outside the temporal scope of the study.
- Innovations for which clear and verifiable CGIAR involvement could not be established were removed from the longlist. For instance, 'Integrated Pest Management (IPM) for Pulses' from ICRISAT was removed because CGIAR's involvement and specific role were not clear.
- Activities that were primarily promotional in character, rather than constituting substantive innovations, were excluded from the longlist. CIP's 'Promotion of Collective Farming (Small Farmers, Large Field)' was excluded because it was promotional in nature
- Innovations utilised primarily within CGIAR centers for internal research purposes, without direct application or adoption by farmers, were removed from the longlist.

As per the refinement criteria mentioned above, the 157 innovations identified in Phase III, for which detailed manuscripts were prepared, were subsequently modified, removed, or added. The output from this refinement process is provided in Appendix Table 3.

Following these iterative refinements, the final longlist of innovations was compiled in an updated stocktake template. The definitions of the stocktake template are provided in Appendix Table 4. The final longlist comprised a total of 102 innovations (Table 4). Appendix Table 5 provides the Center-wise count of the 102 innovations.

Table 4. Total number of innovations in the final longlist, by category

S. No.	Category	Number of Innovations
1	Crop Improvement	59
2	Aquaculture	2
3	Seed Production Technique	1
4	Digital Advisory Tools	12
5	Scientific Management of NRM Practices	1
6	Machinery and Agronomic Practices	4
7	Policy/Institution Building	23
Total		**102**

This final longlist of 102 innovations, across 7 categories, will form the basis for the next component of the project, which is preparing a shortlist of innovations, based on scale of adoption and context-specific relevance.

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Glossary

Abbreviation	Full form
AICRP	All India Coordinated Research Projects
ARC	Apical Root Cutting
Alliance Bioversity & CIAT	Alliance of Bioversity International and International Center for Tropical Agriculture
CIMMYT	International Maize and Wheat Improvement Center
CIP	International Potato Center
CIFOR-ICRAF	Center for International Forestry Research and World Agroforestry
CIWA	Central Institute for Women in Agriculture
CRRI	Central Rice Research Institute
CSF	Classical Swine Fever
DSR	Direct-Seeded Rice
FAS	Foundation for Agrarian Studies
IAES	Independent Advisory and Evaluation Service
IARI	Indian Agricultural Research Institute
ICAR	Indian Council of Agricultural Research
ICARDA	International Center for Agricultural Research in the Dry Areas
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IITA	International Institute of Tropical Agriculture
IFPRI	International Food Policy Research Institute
IIMR	Indian Institute of Maize Research
ILRI	International Livestock Research Institute
IRRI	International Rice Research Institute
IWMI	International Water Management Institute

Abbreviation	Full form
MEL	Monitoring, Evaluation, and Learning
MoA&FW	Ministry of Agriculture and Farmers' Welfare
NARES	National Agricultural Research and Education System
NASC	National Agricultural Science Complex
NBPGR	National Bureau of Plant Genetic Resources
NGO	Non-Governmental Organisation
NRM	Natural Resource Management
OUAT	Odisha University of Agriculture and Technology
PAU	Punjab Agricultural University
SAU	State Agricultural University
SPIA	Standing Panel on Impact Assessment
TPS	True Potato Seed
TSU	Technical Support Unit

Appendix

Appendix Table 1. Types of CGIAR involvement across innovations

S. No.	Type of Innovation	CGIAR-related efforts for development and/or dissemination
1	Crop improvement	Supply of germplasm
		Collaborative efforts for breeding - This includes collaborative efforts undertaken as projects to advance trait development, such as the use of donor lines, molecular breeding, and field evaluation. This does not include germplasm development and dissemination.
		Dissemination and scaling up
2	Aquaculture	Supply of germplasm
		Development of the technique
		Collaborative efforts for breeding
		Dissemination and scaling up
		Knowledge Partner
3	Seed production technique	Development of the technique
		Dissemination and scaling up
4	Digital advisory tools	End-to-end development of the tool
		Customisation of the tool
		Dissemination and scaling up
5	Scientific management for NRM practices	Identifying and/or implementing the best scientific practices
		Promoting the use
6	Agronomic practices and machinery	Customisation
		Promoting the use
7	Policy/Institution building	Knowledge partner
		Institution building
		Evidence-based policy recommendation

Appendix Table 2. Advisory Committee

S. No	Name and Designation of Personnel
1	Professor. K. C. Bansal, Former Director, ICAR-National Bureau of Plant Genetic Resources, New Delhi.
2	Mr. P. C. Mohanan, Former Acting Chairman, National Statistical Commission, Govt of India.
3	Professor V. K. Ramachandran, Former Professor, Indian Statistical Institute, Bengaluru Centre.
4	Professor R. Ramakumar, School of Development Studies, Tata Institute of Social Sciences, Mumbai.
5	Dr. V. Surjit, Associate Professor and Head, Centre for Agrarian Studies, National Institute of Rural Development and Panchayati Raj, Hyderabad
6	Dr. Sreeja Jaiswal, Postdoctoral Researcher, Climate Economics and Policy-MCC Berlin, Potsdam Institute for Climate Impact Research (PIK), Germany.

Appendix Table 3. Innovation refinement accounting table

S. No.	Criteria	Number of innovations
	Manuscripts prepared (after initial screening)	**157**
	Removed and consolidated	
A	Consolidated: similar innovations merged across CGIAR centers	7
B	Removed	
i	Outside temporal scope (introduced after 2023)	6
ii	Primarily promotional in nature	16
iii	CGIAR involvement not clearly established	16
iv	Used for internal research only; not adopted by farmers	13
	Total removed and consolidated	**58**
C	Added: based on stakeholder suggestions	3
	Final longlist	**102**

Appendix Table 4. Definitions of the stocktake template

S. No.	Attributes	Definitions
1	Innovation	The name of the innovation

S. No.	Attributes	Definitions
2	Description	A description outlining the brief history, relevance, key features, objectives, and functionality of the innovation. It also includes the specific details of the innovation.
3	CG Institute	The coordinating CGIAR center.
4	Other CG Institutes	The list of other CGIAR institutes involved in the development, testing, and/or dissemination of the innovation.
5	Non-CG Partners	The list of all Non-CGIAR institutes, such as ICAR institutes (and other NARES), departments of state and central Governments, private companies, NGOs and funders, who have been involved in the development or dissemination of the particular innovation. This section has been further divided into three distinct categories: 'Scientific Development', 'Funders', and 'Dissemination', to delineate the specific role of each center.
6	ICAR/NARES Partners	A bifurcated list of ICAR and SAUs that collaborated on the innovation.
7	Contributing CGIAR Research Programme:	The CGIAR Research Programme(s) under which the innovation was developed and/or supported.
8	CGIAR-related efforts for development and/or dissemination	The description of the pathway of the specific efforts and role played by the CGIAR institutes, and details on the projects through which this innovation was developed or implemented
9	Timeline	The key milestones in the development and/or dissemination of the innovation, such as the year of release or major phases of development
10	Observable Features	A clear and identifiable feature(s) that distinguishes the CGIAR-related innovation from others. This would also allow the innovation to be measured in a survey setting.

S. No.	Attributes	Definitions
11	Location	The geographic areas where the innovation was implemented include block, district, state, and region within India.
12	Evidence of adoption	Available details on the adoption of the innovation, including the extent of its reach and scale, are mentioned under this section. For clarity, the findings have been organised into administrative data (for crop improvement), published government/administrative reports, peer-reviewed articles, grey literature and expert opinions.
13	Impact of adoption	This section includes any studies conducted that examined the impact of the adoption of the innovation, for instance, in terms of yield and income.

Appendix Table 5. CG Center-wise innovation count

S. No.	CG Center	Number of innovations
1	Alliance of Bioversity International and CIAT	2
2	CIFOR-ICRAF	1
3	CIMMYT	17
4	CIP	9
5	ICARDA	11
6	ICRISAT	32
7	IFPRI	3
8	ILRI	6
9	IRRI	10
10	IWMI	6
11	WorldFish	5
Total		**102**

