

# RESEARCH PRIORITIES

Strengthening Gender Intentionality  
and Accelerating Broad, Equitable Impacts  
of Genetic Innovations

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CGIAR  
GENDER EQUALITY  
AND INCLUSION

CGIAR  
GENEBANKS

# INTRODUCTION

Genetic innovations hold immense potential to address many global challenges and contribute to income generation opportunities, food and nutrition security, reduced environmental pressure, and climate resilience.

However, the current rates of genetic innovation take-up, scaling, and impacts are slow and uneven (Walker et al. 2015; Fuglie and Rada 2016; He and Li 2020; Wollburg et al. 2024). Many studies have highlighted the disproportionate lack of access by women and other vulnerable groups to these innovations, and their limited participation and agency in the institutions that govern the design and delivery of these innovations (FAO 2023; Njuki et al. 2025; Puskur et al. 2021).

This brief identifies key knowledge gaps and frontier research ideas to achieve broad, gender-equitable impacts from genetic innovation and seed systems development. It is primarily intended to provide recommendations to the new Science Program on Breeding for Tomorrow (B4T). The brief builds on the Genetic Innovation Gender Strategy (2024-2028), which establishes a roadmap for “best bet” investments in gender-intentional breeding, and priorities for gender research (Ashby et al. 2024). It elaborates on several of the Gender Strategy’s priorities and adds recommendations to advance a gender research agenda that could empower women and other marginalized farmers as partners in genetic innovations and seed systems development.

This brief highlights six research areas that can facilitate the delivery of broad equitable impacts from genetic innovations and seed systems. The research areas align with the product development

process and product life cycle of genetic innovations: (1) product concept, including market segmentation and customer profiling; (2) product design, including trait discovery, prioritization, crossing, screening, and deployment; (3) varietal testing and evaluation; (4) seed production, commercialization, and distribution; and (5) tracking of adoption and impact at scale.

Gender research can contribute to these stages to ensure inclusive and equitable impacts of genetic innovations. We propose six entry points for greater gender intentionality and more equitable impacts along the genetic innovation product life cycle (Figure 1):

1. Conduct gender mapping of market segments
2. Systematize data on gendered trait preferences
3. Assess advanced materials and existing varieties to identify opportunities from a gender perspective
4. Identify opportunities and test interventions for equitable access to and benefits from improved varieties and quality seed at scale
5. Test cost-effective strategies for expanding the entrepreneurship of youth and women in seed value chains
6. Analyze and use policy levers to achieve broad, gender-equitable impacts from genetic innovations

In each of the six gendered entry points, we summarize the state of knowledge, knowledge gaps, and key research questions for a future research agenda. We also describe research methods or tools that can help address research questions for each of the themes.



Cabbage harvesting in a FFS in Lilanda, Tshopo Province - DRC © Axel Fassio/CIFOR-ICRAF

## 1. CONDUCT GENDER MAPPING OF MARKET SEGMENTS

Understanding the customers and market demand is a critical first step in breeding programs.

Market intelligence through customer profiling, seed product market segments (SPMS), and target product profiles (TPP) of the SPMS have been promoted to guide breeding in CGIAR, and with national government and business partners (CGIAR 2023). Tools, guides, and data systems have been developed and are being promoted to guide breeding networks and partners. As of 2022, CGIAR worked with 420 SPMS and about 340 TPPs to identify market segments (CGIAR 2023). CGIAR developed gender tools, for example, the G+ tools, which are a systematic way to do customer and product profiling from a social impact, and specifically a gender perspective (Orr et al. 2021). CGIAR also created the Standard for Gender-intentional TPP, which is being promoted to certify whether evidence-based gender analysis has been conducted and if TPPs are considered gender-intentional.

As of 2022, only 22 percent of TPPs were certified as gender-intentional (Ashby et al. 2024). Therefore, it is a priority to accelerate the capacity development of these tools, and to promote their use. However, it is crucial to start by accurately defining the stakeholders and to focus on customer profiling and market segmentation, before moving into product profiling. It is this customer profiling for social impact that is still much underdeveloped, making people work backwards, as they start by investigating existing TPPs.

As part of gender-intentional customer profiling and market segmentation, we propose using gender mapping to identify “gender hotspots,” i.e., specific customers to focus on for social impact. These gender hotspots will be areas and populations within SPMS with high levels of gender inequality in:

- access to quality seed and varietal adoption
- gender roles along the food chain, and
- management of farming systems.

Gender hotspots will indicate where high-impact gender-intentional breeding and seed strategies are most needed. The proposed gender mapping will build on the Global Market Intelligence Platform’s current characterization of sex-disaggregated demographics and other innovative strategies for mining existing datasets such as the Living Standards Measurement Study (LSMS), other large-scale surveys, and WEAI-related surveys. The gender mapping will use citizen science and assemble crowdsourced data system. The mapping will mobilize expert opinion on relevant gender relations, such as clear gendered tasks. Depending on the available data, gender hotspots can span various districts, or countries per SPMS. Gender mapping can start with SPMS or commodities with the greatest social impact opportunity or the most available data. Gender maps would be updated regularly as more gender-disaggregated data and studies become available. The maps can monitor progress and determine if gender-intentional breeding products and delivery systems achieve positive impacts.

### Key research questions:

- Which factors contribute to gender inequalities and how can genetic, agronomic, and social innovations be effectively brought together in innovation bundles to increase the impact of breeding and reduce these inequalities?
- What qualitative and quantitative indicators can be included in customer profiling and market segmentation to identify opportunities for gender and social impacts, and to track progress over time?
- Which geographies and demographics have the highest gender inequalities in access to quality seed and varieties? Which market segments need to be prioritized to address these inequalities?

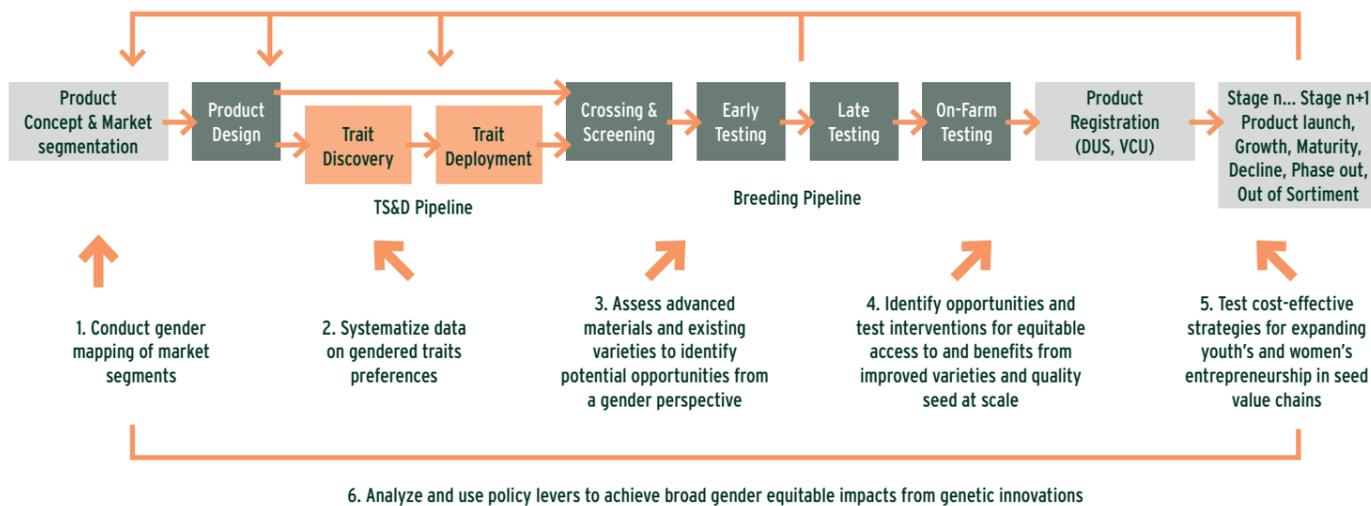


Figure 1 Entry points for gender intentionality along the genetic innovation product life cycle

Source: Authors’ illustrations.

## 2. SYSTEMATIZE DATA ON GENDERED TRAIT PREFERENCES

Customer profiling and market intelligence for genetic innovation requires understanding trait preferences for diverse women and men producers and other value chain actors.

This is essential for developing new breeding products that address gendered preferences and in expanding varietal options for diverse customers. Across commodities, much research exists on gender differences in varietal trait preferences (Box 1). However, some practitioners are more likely to recommend these types of research for under-researched commodities and market segments. While socioeconomic surveys and gendered trait preference studies have established important social and market intelligence (Polar et al. 2022), there is still limited integration of the data into breeding programs (Tufan et al. 2018; Occelli et al. 2024).

Comparative studies are essential for informing breeding prioritization and interventions. Broad characterization of user preferences is essential for determining market segments and

aligning gender-intentional TPPs, both from a “do no harm” perspective and to target desired traits. It is also important to systematize gendered and intersectional preferences for traits, and to screen for relevant diversity among customers. Systematization aims not merely to distinguish varietal traits valued differently by women and men, but also to identify diverse crop user segments, to improve the alignment between traits prioritized by breeders and those demanded by diverse farmer segments, especially by groups targeted for social impact, a common mandate of public breeding.

Comparative analysis of gender-disaggregated preferences across SPMS, crops, and cultures will lead to a product profile that addresses as many crop users of the targeted customer profile as possible. Such analysis will identify the minimal number of product profiles that breeding programs need to achieve social impact, including unmet demand that warrants attention. Systematic, comparative analysis is impossible without consistent standards for data collection, research design, and disaggregation by gender and other social markers. Analysis is also limited by the scarcity of in-depth studies of the social drivers behind trait preferences (Occelli et al. 2024).

### Box 1. Tools for identifying varietal trait preferences by gender

Several research methods have been established to understand gendered trait preferences. These methods are usually conducted using structured surveys, semi-structured interviews, or focus group discussions. They may include questionnaires conducted during participatory varietal selection (PVS) trials, demonstrations, or field days. They usually involve some scoring or scaling (e.g., best-to-worst scaling, magnitude scales, hedonic scales, and pairwise or triad comparisons resulting in ranking data) of a range of varietal traits from crop production, processing, and cooking, to eating and market acceptability. In some cases, the scoring is accompanied by further inquiries about which varieties are preferred (and why).

Advanced techniques such as willingness to pay, discrete choice experiments, experimental auctions, and digital investment game apps are also used to elicit varietal preferences of farmers and consumers (Mulwa et al. 2024; Ynion et al. 2024). However, these are seldom disaggregated by gender. More recently, as part of citizen science approaches, the tricot approach has been used for varietal evaluation and assessment of trait preferences (Teeken et al. 2023a). Tricot engages many farmer-participants

who each receive three varieties as part of an incomplete block design. The farmers evaluate the varieties in their fields from planting to post harvest and food preparation. Data are systematically stored and analyzed in ClimMob - [www.climmob.net](http://www.climmob.net) - including social and environmental covariates. It integrates a guide for social- and gender-inclusive participant selection, with strong attention for locally-relevant social categories to assess intersectionality, apart from standard demographics that are recorded (de Sousa et al. 2024).

The data are also linked to the Global Market Intelligence Platform (GloMIP) - [glomip.cgiar.org](http://glomip.cgiar.org) - which focuses on breeding investment cases. Tricot’s human-centered, iterative design works with dyads (two farmers per household) to capture intra-household dynamics and the reasons behind trait preferences. Organoleptic (taste) testing and processing diagnosis (Tarjem et al. 2021) are also used, as well as cooking and tasting demonstrations and distribution of mini-packs of food, grain or flour of the improved varieties for home testing (Olaosebikan et al. 2024; Trachtman et al. 2022).

Current survey practices of gendered trait preferences rarely integrate crop users’ tacit knowledge (Teeken et al. 2021b). Recent discussions on intersectionality also underscore the need to show how gender interacts with other social categories (i.e., age, occupation, ethnicity, marital status, and socioeconomic background) (Galiè et al. 2022; Tavenner et al. 2022). The intersectionality lens has not been adequately applied in research on trait identification (Tavenner et al. 2022): women have been treated as a homogeneous category—when in reality women in different contexts cannot all be measured and targeted in the same way. Nor has there been enough engagement with youth, or with different ethnicities and classes. Studies are emerging of intersectionality in trait preferences (Bacud et al. 2024), but more are needed. Identifying the social context that drives gendered trait preferences is crucial for assessing whether the low adoption of improved varieties should be addressed just through breeding, or along with other innovations. By incorporating the experiences of different groups, researchers can help create strategies that improve productivity and recognize diverse local knowledge. Greater social and gender segmentation and intersectionality in trait preference studies will be important topics for future research in this field.

## 3. ASSESS ADVANCED MATERIALS AND EXISTING VARIETIES TO IDENTIFY OPPORTUNITIES FROM A GENDER PERSPECTIVE

Advanced materials need to be tested with male and female farmers and other value chain actors in all social categories to identify materials with unrecognized or undervalued potential to improve gender equality.

The evaluation of advanced materials in breeding pipelines has been slower than trait discovery and breeding. There is limited information on how advanced materials address the demands of women and men producers, entrepreneurs, and consumers in diverse locations. While the Standard for Gender-intentional TPPs are intended for use in the early-variety-design stage, they can also be used to rapidly assess advanced materials and to identify desirable materials (from a gender perspective) in the later stages of breeding, for example, in regional or national trials.

This assessment should be prioritized in hotspots where women have been slow to adopt improved varieties and new seed. Gender researchers, together with breeders, variety release officials, and seed producers and distributors, will have to identify the steps needed to advance these promising materials to achieve rapid release and distribution. National and local partners (especially variety release committees) must consider gender-specific indicators during selection and release. For example, after much dialogue and negotiations, tricot has been officially accepted as an improved method for on-farm testing for variety release in Nigeria (Bello et al. 2024).

Several gender-inclusive tools are currently used to evaluate advanced materials with users, including participatory plant

### Key research questions:

- What do we know about gender norms and roles and their relation to trait preferences across crops and geographies? How is this information systematized and used to inform market segmentation and breeding priorities?
- How do gender and market demand affect trait preferences in different crops, geographies and social groups from an intersectional lens? How should that information be systematized to inform market segmentation and breeding priorities?
- How can trait preferences of crop users and food chain actors be organized to create optimal feedback loops that inform breeding priorities and product profiles? What tools, and approaches are needed to strengthen these feedback loops?

breeding, participatory varietal selection (PVS), and citizen science scaled PVS, such as tricot. Taking part in varietal selection can improve representation, and decision-making power for end-users through early engagement in product development, as long as participants are treated as partners, and not as mere respondents. Gendered preferences and markets are dynamic and may evolve during the period between TPP design and testing. Fortunately, participatory selection can clarify emergent demand and trigger the discovery of varieties with qualities that neither farmers nor researchers could have predicted when TPPs were first designed.

However, after several decades of promoting participation in varietal selection, efforts and data remain fragmented (Teeken et al.



Studying behavior through games, Cambodia © Milo Mitchell / International Food Policy Research Institute / 2013

2021b). Participatory methods have achieved limited representation and robustness to inform breeding and achieve impact. For example, participatory plant breeding has addressed too many niches as case studies, achieving limited genetic gain per unit of investment (Biermayr-Jenzano et al. 2011). Participatory varietal testing and selection must use a systematic approach to data systems and standardized protocols for incorporating gender into socioeconomic data collection. This improves the quality and utility of data for gender mapping.

Tricot is a promising approach that combines human-centered design, standard protocols for data collection and aggregation, and a systematic approach (de Sousa et al. 2024). This potentially addresses the limitations of earlier participatory approaches. Tricot needs to be scaled and continuously reviewed and updated based on past learnings. Other current tools and methods should be reviewed, evaluated, and updated to provide new and innovative models for on-farm testing of candidate materials and varieties.

Recently, breeders have started to implement integrated approaches for evaluating varieties along the food chain. For example, within CGIAR's Root, Tuber, and Banana breeding project, the integrated gender approach combines tricot with a participatory evaluation with experienced food processors to assess labor intensiveness (Teeken et al. 2021a). Market studies use choice experiments and willingness-to-pay estimates (Mulwa et al. 2023). Other methods include food product testing with consumers (Olaosebikan et al. 2024), qualitative gender research within tricot trials (Teeken et al. 2023b), and transdisciplinary and participatory Gendered Food Product Profiles (Forsythe et al. 2024). This integrated approach links breeding, food science, gender, PVS, and economic auction data on the same varieties, creating a continuum, and triangulating feedback from various food chain actors. These integrated approaches have just begun and should be expanded and institutionalized.

Other studies have highlighted the need for greater integration of participatory research and co-design, acknowledging that neither

crop users nor the variety design team know exactly what is needed (Müller et al. 2024; Teeken et al. 2021b; 2023b). Participatory video with tricot participants can effectively engage researchers and marginalized groups in two-way communication, changing the power dynamics inherent in research (Koningstein and Azadegan 2021). This approach is leading to "co-design of data" instead of "one-way data extraction" common in surveys and trait preference studies. Tricot is engaged in the 1000farms project (www.1000farms.net) to improve the tricot method and empower crop users in the breeding process and beyond. Other promising results from similar integrations are emerging (Woldeyohannes et al. 2022; Gesesse et al. 2023), although these do not yet focus enough on evaluations by crop users and the social and gender segmentation and intersectionality among them. Future research agendas will require robust, data-driven tools, to iteratively co-design solutions with users, including consumers (van Etten et al. 2023).

#### Key research questions:

- What traits need to be prioritized to maximize benefits of new breeding products for women and men?
- What existing varieties/candidate materials have traits that can respond to gender-related challenges, opportunities, and preferences?
- What are the most cost-effective and efficient participatory approaches for varietal evaluation with diverse food chain actors?
- What are the cost-effective processes and data systems to integrate gender, social, and market information and varietal evaluation to create concrete market intelligence to inform breeding investment cases?



WomenConnect Challenge (Heifer) © Narendra Shrestha for DAI

## 4. IDENTIFY OPPORTUNITIES AND TEST INTERVENTIONS FOR EQUITABLE ACCESS TO AND BENEFITS FROM IMPROVED VARIETIES AND QUALITY SEEDS AT SCALE

Equitable access to seed also requires addressing gender norms and structural barriers that prevent women from engaging with seed markets, financial systems, or even from conversing with male extension providers (Kramer and Trachtman 2024).

Even when gender-responsive breeding is done and new TPPs are gender-intentional, a new breeding product may not effectively address some gender inequalities in access to quality seeds. Poor women disproportionately face limited access to quality seeds, information, and complementary inputs (Puskur et al. 2021; Tihanyi et al. 2024). There are many supply- and demand-side constraints to quality seed access by poor producers, especially women. Strategies for faster and more equitable access to quality seeds of these new varieties are urgently needed. To respond to this call, we need systematic data and testing of interventions that work (or not) on a large scale, recognizing a spectrum of seed quality assurance system (formal certification, quality declared seed) and seed production and distribution systems (centralized, decentralized) that farmers use.

Strengthening seed quality assurance and certification systems is essential for the seed market to function. Formal certification is important, but countries can also benefit from using flexible, and more inclusive quality assurance systems, such as quality declared seed (QDS), to promote seed market diversity and access to quality seeds of improved varieties (Kuhlmann and Dey 2021). Streamlining seed regulations by balancing quality control with flexibility can facilitate the entry of diverse seed sources into the market, including informal seed (Kuhlmann and Dey 2021; Takeshima et al. 2025).

The standards and protocols for these seed types need to be designed, validated, and enforced. Several countries have legal and regulatory frameworks for these seed types, particularly for crops of limited interest to private seed companies, but there is still limited production of these alternative seed types, even after a decade of implementation (Longley et al. 2021). Further research is needed to understand the bottlenecks hindering QDS expansion, test interventions to address those bottlenecks, evaluate the seed quality and productivity under different quality assurance systems, and assess the impact of QDS on equitable access and development outcomes.

A related approach is a decentralized seed production system to get quality seed of improved varieties to poor farmers in remote areas faster. Instead of relying solely on centralized seed production or on large seed companies, local communities and small-scale seed producers can be organized to produce quality seeds, especially for self-pollinating crops, such as legumes and vegetatively produced seed, e.g., root crops. This is often done through the distribution of registered seed of improved varieties to trained local seed producers. These community-based seed production systems provide a good platform for testing different varietal options - new improved varieties, older modern varieties, and local varieties. They are particularly effective for locally adapted varieties and can



Products based on local grains are prepared with devices such as this processing unit Niger © Stephan Gladieu / World Bank

empower farmers, especially women, and poor households, lower castes, or families with little land (Gautam et al. 2020).

Community seed banks can also ensure a steady supply of quality seeds to women (Rengalakshmi et al. 2024) and facilitate seed and knowledge exchanges and access to crop diversity. This can strengthen the social-ecological resilience of local communities (Porcuna-Ferrer et al. 2020). There is also a growing literature on how to expand quality seed access in emergency, and post-conflict areas, and where decentralized seed production systems and QDS systems can help to get quality seeds at the needed quantities faster (Longley et al. 2004; Sperling et al. 2020; Walsh and Sperling 2019). However, effectively integrating improved varieties into these decentralized systems is not understood well enough. While organizations function well with project funding, the momentum often dies after funding ends.

For example, in Nigeria, funding by the Growth Enhancement Program was provided to seed producers to promote local decentralized seed production and improve access to quality seeds (Ragasa et al. 2024). Local seed businesses mushroomed as a result, but most of these seed businesses failed due to the withdrawal of funding, lack of coordination in the seed system, and the sale of poor quality seeds which diminished farmers' trust in the seed market, among other reasons (Ragasa et al. 2024). It is still unclear how to develop cost-effective and sustainable strategies to scale local seed businesses and access to quality seeds in remote areas and to groups with limited access to seed.

From the demand side, there are some proven good practices that must be promoted and expanded. For example, small packs have been successful in many countries and for many crops, especially among poor women farmers. In many countries, smallholders may plant just half a hectare, or less. Small seed packs (1, 2 and 5 kg) rather than the conventional ones (25, 50 and 100 kg) can help to make quality seeds available (McGuire and Sperling 2016; Rubyogo et al. 2019). A second example is training and information campaigns

through farm demonstrations, field days, radio and TV, and seed fairs (Tenneti et al. 2023; Rubyogo et al. 2019). Digital tools are also being used for quick and broad information dissemination.

A third example is a value chain approach to training and capacity building and facilitating market linkages (Walsh et al. 2013; Rubyogo et al. 2019). In all of these cases, implementers need to ensure that they are inclusive to poor women and men farmers and in remote areas. The Tropical Legume project in several countries in sub-Saharan Africa and South Asia, for example, used the above strategies to reach more than 16.6 million smallholder farmers (61% women) with seeds of improved legume varieties between 2007 and 2017 (Rubyogo et al. 2019). A remaining knowledge gap is again tracking and evaluating whether the impacts of pilot cases are sustained when project funding ends.

Efforts such as social behavior change and communication interventions have been piloted in Uganda to address these gender norms and enhance equitable access to seed (Yila et al. 2024). However, it is not known how effectively these interventions shape the roles, norms and power relations that determine access and use, which are critical to design equitable seed systems at scale.

Similarly, there is a scarcity of rigorous impact evaluations and cost-effectiveness studies of different delivery strategies and socio-technical innovation bundles (STIBs) to improve equitable access to varietal information and turnover (Kramer and Trachtman 2024). A few gendered impact evaluations of innovation bundles, including seed-related interventions, are available (Ragsdale et al. 2022) and more of these need to be done in rigorous, iterative, and participatory ways. We need to identify optimal combinations of critical interventions within the STIBs in order to minimize costs while maximizing impact.

Issues with definitions and measurement also hinder inclusive access to quality seeds. There are tools to monitor seed system performance. For example, 11 evidence-based tools are available to diagnose, evaluate, and improve seed systems for root, tuber, and banana crops (Andrade-Piedra et al. 2022). While most of the tools strive to incorporate gender, there is a need for greater gender integration in existing tools and for stand-alone gender tools (Andrade-Piedra et al. 2022, 344). Fortunately, a new measurement framework and list of indicators have been developed and piloted in Uganda to track inclusive access to quality seeds (Tihanyi et al. 2024; Bomuhangi et al. 2024). This tool will need to be further tested, refined, and expanded to track progress in inclusive seed access over time and across contexts.

It is also important to define and develop indicators for gender-inclusive seed access for different household types and different farm management types, including the family or jointly managed farms. Better quality data are needed for the adoption and scaling of innovations. Innovative and cost-effective ways of collecting these quality data are urgently needed. Alemu et al. (2024) deliver strikingly contrasting variety adoption findings when using farmers' self-reported data vs. DNA-based varietal data. Self-reported data suggests that adoption is positively correlated with larger landholdings and households with lower female participation in agriculture, and negatively correlated with poorer households. On the other hand, DNA fingerprinting data show that farm size, gender and poverty status are no longer predictive of adoption. This highlights the importance of data quality for credible, evidence-based policies. As better data are collected, the gender mapping, market segmentation, and social impact assessment opportunities

(see theme 1 above) can be updated regularly for effective programming.

### Key research questions:

- What are the gender-differentiated demand- and supply-side drivers to expand equitable access to quality seed?
- What are the optimal and cost-effective combinations or elements of sociotechnical bundles that can expand access to quality seeds and amplify development impacts under different contexts (emergency, post-conflict, remote, central areas)?
- How can sex-disaggregated data be collected and analyzed through a gender lens to inform emergency seed assistance? How can decentralized seed system and flexible quality assurance regulatory systems and the women and men actors working on those systems be better integrated into emergency seed assistance and resilience programming?
- How effective are capacity development models in scaling inclusive access to and use of quality seed of improved varieties?
- What capacity and skills are needed by different actors to advance gender-intentional and socially inclusive seed sector development?
- What gender indicators can be included among the set of objectively verifiable indicators to monitor and assess the performance and impact of seed sector development? What type of data and analysis are needed in applying a gender lens? How can national and regional actors be supported to employ these methods?



Training in bamboo transformation in Yangambi, DRC © Fiston Wasanga/CIFOR



Greenhouse Youth Group with Grand plans © C. Schubert (CCAFS)

## 5. TEST COST-EFFECTIVE STRATEGIES FOR EXPANDING THE ENTREPRENEURSHIP OF YOUTHS AND WOMEN IN SEED VALUE CHAINS

Numerous interventions are being piloted, but there is limited understanding of how these interventions are scaled and how their impacts are sustained.

Gender inequalities persist in the seed sector, with women often being unrecognized as seed users or producers (Puskur et al. 2021; Farnworth et al. 2024).

This exclusion constrains women's access to producing and using seed, perpetuating disparities (Puskur et al. 2021; Farnworth et al. 2024). In Uganda, women sellers are rated lower than male dealers, even though their products are of similar quality (De et al. 2024). This gender bias creates unfair competition and entry barriers for women, especially young ones, with inequalities rippling through the entire seed system. At the same time, the seed sector can provide job and employment opportunities for youth.

Many seed entrepreneurship initiatives have been piloted to support youth's and women's engagement. These include youth and women quality centers (Ojiewo et al. 2024; Yila et al. 2024) and more flexible seed quality assurance systems, for example, QDS (Mastenbroek et al. 2021; Longley et al. 2021). In India (Andhra Pradesh, Telangana, and Odisha), all-women farmer producer companies (FPC) that are given dedicated support by an incubating organization to establish seed production as a business improved their chances of profitability.

Women farmers who are members of mixed gender FPCs can also profitably engage in seed production if a supporting organization intentionally supports the women (Kapur et al. 2024). This intentionality includes taking deliberate steps to ensure that women attend training events; giving women technical support; setting up seed processing units at the federation level; and branding, marketing and packaging support (Kapur et al. 2024). These brands from the FPC are now being locally recognized as standards of quality

seeds and are contributing to the uptake of seeds of improved crop varieties in regions where women seed entrepreneurs are active (Kapur et al. 2024). Nonetheless, the pilot project shows that better monitoring and evaluation systems are required to track the effectiveness of training and capacity-development.

Despite more than a decade of QDS implementation in several countries, seed production from QDS remained very small (Longley et al. 2021). In spite of many pilot cases on capacity building and support for youths' and women's seed entrepreneurship, there is limited evidence that they go to scale. This implies a need to experiment, and monitor the scalability and sustainability of pilot cases.

### Research questions:

- Which empowerment domains, conditions, and gender norms need to be targeted to improve youths' and women's participation in seed entrepreneurship?
- What are the impacts of promoting women's participation in seed production, marketing or distribution on local gender norms in seed systems, on women's empowerment, and on livelihood resilience?
- What are the impacts and cost-effectiveness of the different strategies used to promote youths' and women's participation in seed entrepreneurship?
- What are the key areas of focus to improve the effectiveness of youths' and women's seed entrepreneurship and how can we sustain them?
- Are women in seed production more responsive to women and other marginalized groups' seed needs? Do women seed users trust women seed producers more?

## 6. ANALYZE AND USE POLICY LEVERS TO ACHIEVE BROAD GENDER-EQUITABLE IMPACTS FROM GENETIC INNOVATIONS

The complex power dynamics within genetic innovation contribute to the marginalization of women in different ways.

. Gender concerns are often missing in agrifood and innovation policies, and there are few women leaders, breeders, and scientists within innovation organizations (Meinzen-Dick et al. 2011; FAO 2023). Transdisciplinary teams have limited participation in breeding, and few women are engaged in breeding programs.

### 6.1 Gender-responsive institutional framework and transdisciplinary teams

Gendered trait preferences, and formulating gender-responsive breeding objectives are crucial for developing breeding products that address gendered preferences, expanded choice options, and access by poor women and men farmers and value chain actors.

There are many tools and studies on gendered varietal trait preferences, but their ability to inform breeding priorities remains

Tools are available to analyze these power dynamics, but testing is limited to lessons on what works (or not) to transform breeding objectives, institutional frameworks, and incentives in research institutions and the role of policies for achieving equitable development impacts at scale. Below, we discuss first a future research agenda to identify entry points for gender-responsive institutional framework at research institutions and breeding networks. This is followed by a discussion of enabling policies to achieve equitable impacts at scale. And lastly, options to protect local varieties and biodiversity, local communities' rights to seed, and varietal heritage.

underexplored. There is a scarcity of studies that track whether and how gender differences and preferences are being considered and are influencing breeding priorities—and if they are not, how these objectives can be achieved. One needs to look at the institutional framework, incentive systems, and power dynamics within research institutions and breeding networks to understand how breeding objectives are formulated, and entry points for reform.

Transdisciplinary teams have been proposed as a key solution, where team members with different backgrounds work together to learn crucial content from other disciplines. For example, staff with expertise in food science, breeding, and social science together carry out activities from each other's fields, thus mitigating power dynamics between disciplines (Forsythe et al. 2024). However, further analysis is needed on how this really works in practice, what elements account for success (or failure), and what entry points can support and enhance the effectiveness of the transdisciplinary teams.

#### Key research questions:

- What principles of transdisciplinary research can be incorporated into crop breeding research? How do we evaluate if the breeding is transdisciplinary?
- What strategies are needed to operationalize a transdisciplinary product design process?
- What institutional framework and incentive mechanisms in the breeding networks foster or constrain the use of gender-related information and motivate gender-responsive priorities by the breeding program?
- What are the entry points within breeding institutions for greater gender-intentionality in trait prioritization and breeding programs?



Laos cattle farmer © ILRI Stevie Mann

## 6.2 Enabling policies for equity and inclusion

Enabling environment, including policies and regulations, is important to enable women's engagement in innovation and seed systems and to achieve broad equitable impacts.

Some reviews exist of national seed policies and how they are integrating gender (Sulle and Mudege 2021). These need to be expanded. More importantly, a better understanding is needed of various policies, and programs, including subsidies, in different countries. How gender-responsive they? Do they make any difference to poor women and men? If these interventions are beneficial, how can we amplify or scale them? Otherwise, how can we reform them? A few gendered policy impact analyses explore the effect of input or seed subsidy policy, from a gender perspective (Smale and Thériault 2022; Matita et al. 2022; Fisher and Kandiwa 2014). They need to be expanded. This represents a huge research agenda and little available knowledge.

#### Key research questions:

- What are the costs, benefits, and tradeoffs for diverse types of women and men of alternative policy, regulatory, and investment options that shape the performance of seed sector development?
- What policies, rules, and practices are required to ensure that breeding outputs are shared with and used by end-users in an effective, and equitable manner?

### 6.3 Protecting farmers' rights to seed and promoting varietal heritage

Seed diversity is crucial to the sustainability of food and agricultural systems. Informal seed systems barely surface in policy debates.

In some countries, they are criminalized (Ragasa et al. 2024; Takeshima et al. 2025). More recently, there are emerging social movements for the revival of indigenous and traditional varieties and landraces which are deemed important for adaptation to climate change, socio-ecological resilience, cultural heritage, nutrition, and income (Porcuna-Ferrer et al. 2023). These have big implications for gender and food system transformation. Safeguarding the vital indigenous contribution to seed security and diversity requires a biocultural rights-based approach to seed governance, and further support from policy reform (Porcuna-Ferrer et al. 2023; Nishikawa and Pimbert 2022). However, more knowledge is needed on which policies effectively support a biocultural rights-based approach to seed governance, and how to integrate formal and informal seed systems.

Other issues include the legal rights to sell seed of crop varieties, and the legal rights of local communities related to pre-breeding strategies for desirable trait identification, as enshrined in the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity (Secretariat of the Convention on Biological Diversity 2011). Currently, information on local varieties and their uses is poorly documented. As a result, local varieties are disconnected from their farm community trajectories of innovation and use. Demand-led breeding does not imply that breeders have to improve on more traits, but they will have to monitor many more

traits, as some traits are not conducive to the livelihood conditions of farmers.

Thus, it becomes more important for breeders to seek reference varieties that have all the traits needed within a certain product profile. As most communities already work with varieties that have many preferred traits, we must ask: what is the role of these communities when their varieties are used as parents in breeding a new variety can be labeled "improved" and used on a large scale? How do we ensure that (1) farmers and other crop users can legally keep multiplying and selling their varieties in the informal and formal seed sector, and (2) communities and their heritage are recognized as contributors to the creation of new varieties that can also help advance the search for desired traits? Addressing these questions is crucial in acknowledging communities for their breeding work and to decolonize breeding by acknowledging crop users as stakeholders in public plant breeding.

#### Key research questions:

- How can varietal heritage be connected to local communities to formally acknowledge them as breeding stakeholders? To what extent is it useful for breeding to document the qualities and uses of these varieties in these communities in order to identify useful traits for product development?

# CONCLUSIONS

To confront multiple global challenges, we need faster and more equitable access to quality seeds of superior varieties that can benefit poor producers and consumers and protect the environment. To deliver broad, gender-equitable impacts, breeding needs to refine its customer targeting; clarify when and where gendered trait preferences may constrain or encourage widespread adoption; alleviate gendered constraints to seed access that hold up adoption; expand entrepreneurial opportunities in seed value chains; and identify pivotal innovations in seed policy and in research institutions needed to realize these changes. All of these will require research based on transdisciplinary approaches, partnerships, and a diversity of perspectives. Future research agendas will need to assess and design new strategies for bringing innovative solutions to farmers' fields and achieve sustainable and equitable impacts at scale. We need a coordinated, systematic, data-driven, and solution-oriented approach to our research agenda.



Bean power in Tanzania © 2016 CIAT/GeorginaSmith

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### ABOUT THIS SERIES

This brief produced jointly by the CGIAR Gender Equality and Inclusion Accelerator and the CGIAR Science Programs, is one in a series of agenda-setting briefs that aim to further develop an agenda for strategic areas of gender and social inclusion research within the new portfolio of CGIAR Science Programs and Accelerators, and inform the development of gender and inclusion strategies for these moving forward. The briefs are the culmination of a collaborative work that started during the CGIAR GENDER Science Exchange 2024 that convened 72 gender researchers from across the CGIAR to bring together experiences, ideas and insights from across centres, that can help in developing a gender strategy for the SP in the future.

### About CGIAR Gender Equality and Inclusion (GENDER Accelerator)

CGIAR Gender Equality and Inclusion is CGIAR's Accelerator working to put equality and inclusion at the heart of food systems research and development. The Accelerator leads strategic and innovative research that advances gender equality, opportunities for youth, and social inclusion across CGIAR's Food, Land and Water Systems portfolio.

Cover: *Gerald Action (left) OFSP farmer, with Felistus Chipungu, breeder and scientist from CIP*  
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