Chapter 5
Challenges and Lessons Learned in Mainstreaming Gender into Rice Research and Technology Development: A Case in Eastern Uttar Pradesh, India

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Abstract This chapter presents the challenges and lessons learned in mainstreaming gender into RR4TD in eastern India, in particular. The discussions in this chapter are based on the author's experiences as a social scientist/gender specialist at the Social Sciences Division. The following discussions are divided into the following sections: (1) importance of earlier policy statements in seriously mainstreaming gender in RR4TD; (2) critical challenges in mainstreaming gender in RR4TD; (3) strategies used to overcome these challenges; (4) lessons learned, and finally, (5) the conclusions. The strategies used to overcome these challenges were: (a) built the capacities of agricultural scientists and social scientists of the research teams on farmer participatory approach and gender analysis; (b) conducted socio-economic research including gender analysis; (c) developed a systematic and standardized method of collecting gender-disaggregated information/data; (d) developed a methodology for incorporating social and gender concerns in the stages of participatory varietal selection .The lessons learned were: (a) need to have a deep understanding of gender roles in a given context/situation; (b) political will of research institutions is critical in mainstreaming gender; (c) need to include female agricultural scientists and social scientists in research teams; (d) continue capacity-building programs/activities on how to mainstream gender into RTTD to sustain project activities; (e) social scientists/gender specialists and agricultural scientists should plan and work together; (f) conduct interviews separately for men's and women's groups; (g) involve women in training activities on all aspects of rice production, especially on seed management; (h) RR4TD institutions and local agricultural extension systems need to work with established and reputable Non-Government Organizations and Women's Self-Help Groups

Keywords Mainstreaming gender · Gender analysis · Technology development

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5.1 Introduction

Within Southeast and South-Asia, rice dominates not only in production and consumption, but it is also inextricably woven into the social and economic fabric of life. Empirical studies reveal that across countries and types of production systems (irrigated, rainfed) and by socioeconomic status, in general, women's labor contribution compared with men in rice farming is higher in South Asia (more than half in Nepal and eastern India) than in Southeast Asia (more than one fourth) on—a per hectare basis (Pandey et al. 2010; Paris et al. 2008a). Women's and men's roles are often conditioned by several interrelated socio-cultural (including class, ethnicity, age, marital status, and religion), economic, and environmental factors. However, gender roles and responsibilities are dynamic and can change over time depending on emerging changes, e.g., climate variability and abiotic stresses, shifts from subsistence to commercialized rice production, increasing mechanization, urbanization, male labor outmigration, technological interventions, and other driving forces (Pandey et al. 2010). For example, the increasing outmigration of men and decreasing male: female ratio in agricultural labor, tend to change the traditional division of labor in rice production, with women not only increasingly providing field labor for rice production but also taking on managerial and decision-making roles on the farm, including choosing rice varieties to be grown (Paris et al. 2009). Yet, women face several constraints in performing these roles because of their lack of access to technical knowledge and technologies which can reduce their drudgery and provide additional income. Agricultural research for development programs has seldom deliberately included women as users and potential beneficiaries.

Poor rice farming households are often faced with several production constraints such as low productivity due to limited land size, stresses such as drought, floods, salinity, and socioeconomic constraints. Rice farming households need rice and rice-related technologies which can help them solve these constraints (Hossain 2006). The International Rice Research Institute (IRRI) is a non-profit agricultural research and training center under the umbrella of the Consultative Group of International Agricultural Research Centers (CGIAR) located in different parts of the world. IRRI's primary goal is to "*improve the health and welfare of rice farmers and consumers, promote environmental sustainability in a world challenged by climate change, and* support *the empowerment of women and youth in the rice industry"* (https://www.irri.org) (CGIAR 1998). Its objectives are to generate and disseminate rice-related knowledge and technology of short and long-term environmental, social and economic benefits to help enhance national rice research systems.

Thus, to improve food production, food security, nutrition, and reduce poverty, the concerns of women farmers and not only those of men should be addressed in rice research for technology development (RR4TD). Gender mainstreaming is a term commonly used in the development community to discuss the process of bringing the concerns and experiences of women and men into development policies and programs for action aimed at achieving gender equality. As such, the needs of women and men can be valued and favored equally (UN Women 2014). Similarly,

gender mainstreaming in agricultural research for development (AR4D) is to achieve gender equality. To achieve this goal, gender mainstreaming must be considered in the research and technology development phases, including situational diagnosis, identification of problems, design, testing of proposed interventions, monitoring and evaluation, and impact assessment (Meinzen-Dick et al. 2011). This requires a multi-disciplinary team of scientists, including social scientists (not only economists, to work together to achieve food security, reduce poverty, and gender equality.

This chapter presents the challenges and lessons learned in mainstreaming gender into RR4TD in eastern India, in particular. The discussions in this chapter are based on the author's experiences as a social scientist/gender specialist at the Social Sciences Division. The following discussions are divided into the following sections: (1) importance of earlier policy statements in seriously mainstreaming gender in RR4TD; (2) critical challenges in mainstreaming gender in RR4TD; (3) strategies used to overcome these challenges; (4) lessons learned, and finally, (5) the conclusions.

5.2 Policy Statements

Formal gender policy statements make an explicit commitment to gender research. These are incorporated into the CGIAR's and IRRI's research strategies**.** Below a**re** the policy statements in the early phases of gender research and sustained through the years.

5.2.1 Gender Research Within the CGIAR

The CGIAR has had a long but varied history of integrating gender analysis into its research portfolio (Meinzen-Dick 2009). Efforts in mainstreaming gender within the CGIAR and IRRI can be traced back to the mid-1980s in the inter-seminar on gender held in Bellagio, Italy. One of the policy recommendations from this inter-center seminar was that:

> For greater awareness of women's roles in agriculture and their special needs as technology users and beneficiaries, international and national agriculture research centers should develop long-term strategies to involve women, where possible, in all phases of research and technology development work (Rockefeller/ISNAR 1985).

To implement this CGIAR policy recommendation, the following suggestions to International Agricultural Research Centers (IARCs) were made (Poats 1990):

> Gender issues must be linked to the entire technology generalization process. Possible areas for consideration of gender-specific concerns in the technology development process should include variety/commodity choice, technology design, crop and livestock management and adoption, and policy research to break current constraints to technology use. Specific considerations of these concerns could take place in farming systems research. IARCS

> should collaborate with national organizations in generating information and methodologies dealing with gender issues. Interdisciplinary teams of scientists should identify specific areas in which gender makes a difference in making IARC work more effective and efficient. Inter-center exchange among natural and social scientists to discuss particular issues in n particular gender in research plans and procedures. National programs should offer more training opportunities for women, find ways to increase the number of female extension workers to reach farm women, and pay specific attention to gender concerns in on-farm research.

CGIAR has a long but varied history of integrating gender analysis into its research priorities. At the systems level, from mid-1991 to 1997, CGIAR had two components: Gender Analysis and Gender Staffing. In 1997, the CGIAR initiated a System-Wide Program (SWI) on Participatory Research and Gender Analysis (PRGA) to further mainstream gender concerns to plant breeding and natural resource management projects. In 2013, several IARCs including IRRI developed Gender Strategies under the CGIAR Gender Platform to strengthen mainstreaming of gender into their respective programs (CGIAR: Gender Platform 2012).

5.2.2 Within IRRI

The Technical Advisory Committee of the CGIAR endorsed IRRI's policy statement in IRRI's strategy (IRRI 1989: 23), stating that:

> IRRI will continue to promote integrating women's concerns into its research projects and joint research with national agricultural research systems (NARS). Specifically, the inclusion of gender analysis explicitly recognizes the contributions of men and women to rice and rice-related activities. Technologies that reduce the burden of rural women without displacing their income-generating capacity will be accorded priority. IRRI will also intensify efforts to recruit qualified women scientists for its research programs and encourage NARS to expand the number of female scientists working in national rice research and extension programs.

What has been stated by IRRI in its strategy statement concerning women was revolutionary concerning unity. In this policy statement, women engaged in rice farming who used to be taken for granted were now acknowledged as users and potential beneficiaries of rice research and technology development. In 2012, gender was further mainstreamed in IRRI under the Global Rice in Science Partnership (GRiSP). A gender strategy was developed to mainstream gender in its overall programs. To support its overall mission and objectives, the goal of GRiSP's gender strategy is to reduce the gender gap in the rice sector. Its specific objectives were: to ensure that the development of GRiSP's products and services along the rice value chain (production, post-harvest, processing) takes gender differences into account, and addresses the specific needs and preferences of women (GRiSP 2013).

5.3 Background of IRRI's Gender Mainstreaming in Eastern Uttar Pradesh, India

5.3.1 IRRI Collaboration with National Agriculture and Extension Systems (NARES) Partners

In November 1988, IRRI and the Extension Department of the Indian Council of Agricultural Research (ICAR) in New Delhi, India, jointly organized an international conference on "Appropriate Agricultural Technologies for Farm Women in India: Future Research Strategy and Linkage with Development Systems." IRRI former Director M.S. Swaminathan initiated this conference to strengthen links between ICAR and IRRI. One of the primary considerations of this conference was to enhance collaboration between the IRRI Women in Rice Farming Systems (WIRFS) program and the Department of Extension at ICAR-Extension Department on gender issues in rice farming. Thus, in 1991, the WIRFS program at IRRI and the Department of Extension at ICAR initiated the first training activities on "Gender Analysis and Its Application in Farming Systems Research Projects," held in West Bengal and Orissa.

In 1992, the Ford Foundation in New Delhi, India, supported IRRI to coordinate collaborative research on "Rainfed Lowland Rice Production Research (RLRP) in Eastern Uttar Pradesh, India." This consortium provided a farming systems research (FSR) perspective on improving rice productivity in stress-prone environments. For several reasons, EUP was chosen as the primary research area for this project. EUP represents the rainfed shallow lowland ecology wherein the yield gap varied from 34.8% in EUP to 59.5% in Assam. Rice farming in EUP is most vulnerable and risk-prone due to complex ecological situations marked by frequent floods or drought, or both. An analysis of the area, production, and yield of rice during the last 10 years shows that the yield is stagnating at around ≤2.0 t /ha from 2001–2002 except in the year 2002–2003, 2004–2005, and 2009–2010 due to uneven rainfall distribution which causes excess water stagnation/ drought or both in different years (Diwedi 2012). Aside from these environmental stresses, rice farming households face several economic, social, and cultural constraints. Social and cultural conditions include a rigid caste system, high illiteracy rates, high population, and discrimination against women. Poverty is pervasive compared with the other Indian states due to limited farmlands and low and unstable yields. These constraints and challenges for increasing rice productivity under adverse conditions made eastern India a priority region for rice by IRRI and ICAR.

This RLRP project allowed testing and validating the methodology for incorporating/mainstreaming gender concerns in collaboration with NDUAT. In 1994, IRRI organized an international conference on "Stress Physiology of Rice" held in Lucknow, U.P. India. This highly technical rice conference was traditionally attended mainly by male agricultural scientists, including agricultural economists and socio economists (Singh 1996). The inclusion of social scientists in the technical discussions provided a greater understanding of the social and economic constraints

of resource-poor rice farming households in EI. For the first time, gender issues were presented in a technical forum (Paris et al. 1996; Hossain and Laborte 1996).

With IRRI playing a significant role in this initiative, a project on "Participatory Research in Plant Breeding and Gender Analysis" under the CGIAR SWI on PRGA was initiated in selected rainfed lowland villages in eastern India. Two of the research sites in Faizabad, Uttar Pradesh, were the same villages for gender research in collaboration with the Narendra Deva University of Agricultural Technology (NDUAT) in Kumarganj, EUP) (Paris 2000).

5.4 Key Challenges Faced and How They Were Addressed

IRRI's research on unfavorable rainfed lowland and upland rice-based farming systems led to a new approach from the conventional method, "transfer of the technology." In this mode, scientists determine priorities, who generate technology on research stations and laboratories, to be transferred through extension services to farmers. Although this so-called "top-down"and technology-centric approach successfully led to the adoption of rice technologies in favorable irrigated rice areas, the same process did not apply to the adoption of rice technologies in unfavorable lowland and upland environments. Thus a new approach was needed. There was a need for involving social scientists at the initial stage of planning rather than at the end of the project to do an impact assessment. Instead of starting with the knowledge, problems analysis, and priorities of scientists, the new approach begins with the understanding, problem analysis, and importance of farmers and farm families. Instead of the research station as the primary locus of action, experiments are conducted on farmer's fields and with the involvement of the farmer-cultivator. Instead of the scientist as the central experimenter, it is now the farmer, whether a woman or man, and other family members. A pilot project using this approach was agreed to be conducted first in the Narendra Deva Agriculture Technology (NDUAT) in Kumarganj, Uttar Pradesh, in EUP and later was conducted in other states of EI.

However, several challenges were encountered during the planning phase in mainstreaming a gender perspective using the FSR approach. These were: (1) deeply rooted social and cultural beliefs, perceptions, and practices that discriminate against women; (2) lack of female social scientists with skills and interests to do social science research, i.e., gender analysis (3) lack of socioeconomic data, gender-disaggregated data, in particular; and (4) lack of a systematic strategy to include gender analysis in the RR4TD process. The critical challenges in mainstreaming gender in RR4TD and how they were addressed are shown below (Table 5.1):

Table 5.1 Critical challenges in mainstreaming gender in RRTD and how they were addressed

Challenges to gender integration in agricultural research for development	Strategies used to meet these challenges
(a) Social and cultural constraints	(a) Conducted socioeconomic research including gender analysis
(b) Lack of female local social scientists with skills and interests to do social science research, i.e., research on the gender issues	(b) Built the capacities of social scientists to conduct social science research
(c) Lack of comparable gender-disaggregated data/information	(c) Developed a systematic and standardized method of collecting gender-disaggregated data/information
(d) Lack of an accepted process to integrate gender analysis into an ongoing technology development project	(d) Developed a methodology for incorporating social and gender concerns in the stages of PVS

5.4.1 Social and Cultural Constraints

Patriarchal ideology, dowry during the marriage, caste structure, class, and joint/combined families are the social and cultural practices that influence gender roles and gender relations, affecting intrahousehold resource allocation. Women's identity and space intersect and multiply their marginalities where intersectionality is not just about identity—caste, class, and gender but also in terms of space-household, work, community, and society. The predominant force in the social organization of Indian society is patriarchy. Land ownership in India, the acquisition, license, and transfer of property are through the male members of the family. Although the right to inherit property in post-independence India had been assured to female members by law, there are several issues when it comes to the practical implementations on ground. Furthermore, the socialization of girls within the patrilineal form of social organization ensures that women will not be in a position to claim their legal rights (Ghosh 1987). Moreover, the perception that girls will become housewives anyway deprived them of getting formal education and their potential to pursue their professional pursuits. The majority of the women interviewed were illiterate and had never had the experience of being interviewed.

Classification of families by caste is still practiced in EUP.

These deeply rooted socio-cultural beliefs, perceptions, and practices that discriminate against women led to undervaluation of women's unpaid work (family and exchange labor), in the crop, livestock, and homestead activities, lower wages of women compared with men, no or low representation of women in meetings, training activities, and demonstration trials. The women were hesitant to be interviewed, particularly in open spaces and in the presence of men (Paris 2000).

5.4.2 Lack of Female Local Social Scientists with Skills to Do Social Science Research

With the strong support of the Director of Research at NDUAT, Faizabad, plans were laid down to research gender issues. To better understand gender issues within the biophysical and socio-cultural environment, it was essential to have a female local social scientist on the team. The first barrier faced by the team was the unavailability of female social scientists in NDUAT to conduct gender research. During that period, girls enrolled in the Home Sciences Department rather than in the Agriculture Department. However, these changed as more opportunities and incentives were given to female agriculture graduates.

One female professor from the Home Sciences Department agreed to conduct interviews. Unfortunately, after a few visits, she could not continue because she had to bring to and fetch her son from his school. Moreover, it was difficult to synchronize field visits among the research team members. Furthermore, it was not culturally acceptable for a lone female scientist to go with a group of male colleagues on trips to remote villages, even on official field visits.

Another option was to hire an educated local girl from the village who could speak English and collect information. However, due to social restrictions, young girls were not allowed to roam around in the villages. Given the social and cultural limits, wives were more comfortable with female interviewers or with both male and female interviewers and in their private domains, e.g., the kitchen or the homesteads.

5.4.3 Lack of Gender-Disaggregated Data and Information

One constraint of fully integrating gender in rice-based FSR was the lack of gender-disaggregated data. Although agricultural economists collected labor data for costs and returns analysis of rice production, the labor days per hectare contributed by family, exchange, and hired labor were not disaggregated into male and female. Thus, women's unpaid and paid labor contributions were not counted. This led to women's invisibility in statistics and a lack of recognition of their roles as farmers and farm workers. Aggregated data did not provide a clear picture of gender issues and gender relations.

During the earlier phase of the project, social scientists encountered several problems eliciting responses from women. These were: high illiteracy rates among women; no confidence among women to respond to the questions especially when the male spouse is present; difficulty in relying only on the recall method on the labor hours and days spent by the worker for each operation per plot area; unavailability of women for interviews during peak season. The use of structured questionnaires and too detailed and extended formal discussions were not practical to hold the attention of either men or women farmers, particularly during peak cropping periods. Lower

caste women were not confident and comfortable being interviewed in the presence of women from the upper caste.

5.4.4 Lack of an Accepted Process to Integrate Gender Analysis into an Ongoing Technology Development Project

It was agreed that an FSR using a participatory approach be adopted. Thus, a major challenge facing managers of institutional breeding programs is to figure out ways to foster increased participation by end-users. Unfortunately, however, "participatory research for development" does not automatically result in the involvement or inclusion of marginalized social groups, including poor women who contribute significantly to rice production, post-harvest, and meal preparation. Moreover, examples of how social, including gender analysis, add an essential dimension to assessing the potential benefits of participatory varietal selection (PVS) are uncommon.

A formal or accepted process was lacking to integrate gender analysis in an ongoing on-FSR project. This meant identifying gender issues and opportunities to consider both men's and women's perspectives in each stage of the research process. This also meant giving women more access to resources and opportunities to reduce the existing gender gaps.

5.5 Strategies Used to Meet these Challenges

Overcoming the challenges mentioned above to mainstream gender into rice-based FSR required transformative change among the research leaders and managers. Below are the strategies and transformations which took place over the years. These strategies were: a) built the capacities of agricultural scientists and social scientists of the research teams on farmer participatory approach and gender analysis; b) conducted socioeconomic research including gender analysis; c) developed a standardized method of collecting gender-disaggregated information/data; and d) developed a methodology for incorporating social and gender concerns in participatory varietal selection (PVS).

5.5.1 *Conducted Socioeconomic Research Including Gender Analysis*

Gender roles differ and vary depending upon the given environment (biophysical, socioeconomic, and cultural). Thus, it is important to include gender analysis in any characterization of research sites. Both qualitative and quantitative methods were used to gain a better understanding of gender roles, gender relations and constraints that men and women face in securing their livelihoods in given rainfed farming systems. Due to social restrictions, group interviews were conducted separately for men and women from different social classes. Information on male and female participation in farm, off-farm and non-farm activities were collected using Participatory Rural Appraisal (PRA) tools. Gender analysis as part of the socioeconomic analysis was used to characterize and understand farm household systems in typical rainfed lowland rice villages in the Faizabad district in eastern Uttar Pradesh. Since then, several socioeconomic studies including gender analysis were conducted as integral in the characterization of several stress-prone environments in EI (Paris et al. 1996, 2000, 2007, 2008a). Researchers were also trained on how to gather, analyze, and report the information from male and female farmers.

The extent of female participation in production in India is determined by a nexus of class/caste hierarchy and norms of patriarchal ideology. The lower castes are officially classified as the backward and scheduled castes. They are considered the most deprived and underprivileged regarding access to resources and social status. Women from the upper castes stay in seclusion or "indoors" and do not engage in manual work to maintain their social status. Women from the lower castes have more freedom to work on their farms and outside their homesteads to earn a living. But aside from working to earn a livelihood for the family, they are not allowed to move outside of the home. This short time and space that the girls go out for wage work expose them to the dynamics of workspaces, e.g., low wage, caste stigma, and hierarchical relationships (Paris et al. 2008b).

Male outmigration on a long-term or short-term period is one of the constraints in increasing rice productivity. In nuclear households, the wife of the male migrant becomes the de facto household head with increased responsibilities on the farm, household, and childcare responsibilities. Female family and exchange labor participation were higher than male family labor among households with migrant members (Paris et al. 2005). Because of the cultural perception that wives do not know anything about rice farming, they are often ignored in training and extension activities. They lack access to technical knowledge, new or improved seeds, and other productive resources. Compared with men, women have lesser access to assets such as land, farm inputs, e.g., improved seeds, water pumps, and machinery (Paris et al. 2013).

5.5.2 Built the Capacities of Female Social Scientists

To address the lack of female social scientists to do gender analysis and fieldwork, the Ford Foundation, which funded FSR research in EI, sponsored three tribal women from Hazaribagh, India, to pursue their M.S. degrees in Social Sciences at the University of Los Banos, Laguna, Philippines. The Ford Foundation also supported several training courses for social scientists and agricultural scientists to enhance their capacities on FSR. It was agreed that gender-focused research should be piloted in two or three rice-growing villages near the experiment station of NDUAT University, Faizabad, eastern Uttar Pradesh.

With the recommendation and the strong support of Dr. RK. Singh, Director of Research of NDUAT, Abha Singh, a sociologist with a Ph.D., was trained and hired to conduct gender research. She received further training at IRRI on gender analysis in RR4TD. She conducted interviews with men and women in the pilot villages in EUP and had shared her findings in publications and conferences. To reduce the gender gap in training programs, particularly dealing with leadership, in 2002, the first Leadership Course for Asian and African Women for Research and Extension (LCAAWRE) was organized in collaboration with IRRI's Training Center. Aside from developing the leadership skills and confidence of Asian and African women in agriculture, the training course aimed to make them effective agents of change in the agriculture sector and trainers of local women on improved crop production, processing, and seed management (Rubzen et al. 2016). This course provided opportunities for female scientists in EUP, India.

5.5.3 Developed a Systematic and Standardized Method of Collecting Gender-Disaggregated Data/Information

A systematic and comparable gender-disaggregated socioeconomic demographic information, labor participation in crop (rice and non-rice), livestock, off-farm and non-farm activities, wages, and participation of the male and female heads of the heads household in critical agriculture-related decisions were gathered in selected research areas in EUP. Labor participation by gender revealed that across stress-prone rice production systems, female labor inputs comprise 74%, 61%, and 50% in sodic, submergence and drought-prone rice environments, respectively of the total labor inputs. These labor inputs came from women from the lower caste households (Paris et al. 2008a). In coastline saline environments in Orissa, India, labor inputs of female family members were higher among the marginal farming households than on small and medium/farms. These results indicate that female family labor increases with poverty (Paris et al. 2007).

Gender-disaggregated data and women's participation in decision-making were incorporated in the baseline socioeconomic surveys under the Stress Tolerant for Rice in Asia and Africa (STRASA) project. These surveys were conducted by the

IRRI Social Sciences Division in eastern India, Nepal, and Bangladesh. Deka and Gauchan (2012) revealed that women's contribution is slightly more than half in selected stress-prone villages in Golaghat, Sibsagar, and Assam, India. Compared with men, women have low sole decision-making power in rice production, marketing, and income-related decision-making activities. In a similar study by Behura et al. 2012, labor participation of women compared with men was higher (in Chattisgarh) at 58% than in Orissa (18%). Results show that the husbands mainly make farming decisions in most cases, particularly in Orissa. However, women are more empowered in making household-related decisions. Thus, labor participation by male and female workers (family and hired) can be compared by the size of land (small, medium, large) by caste, wealth status, production systems (irrigated, rainfed), degree of commercialization, the incidence of male outmigration, and by technology adoption. The impacts of technological change on gender can be assessed.

5.5.4 Developed a Methodology for Incorporating Social and Gender Concerns in the Stages of Participatory Varietal Selection

It is usually fair to say that the earlier use of participation occurs in a breeding process, the more opportunities users are given to influence the objectives, breeding strategy, and final outputs. However, the extent to which users can realize this opportunity depends on the degree of participation.

In 1997, a farmer–participatory plant breeding program for rainfed rice was developed at IRRI in collaboration with the ICAR. The project includes six research sites representing different rice ecosystems in EI. The project is under the umbrella of the CGIAR's System-Wide Initiative on Participatory Research and Gender Analysis (PRGA). The project was carried out in response to the low adoption rates of improved released cultivars in rainfed rice environments. The low adoption rates relate mainly to the inability of the high centralized breeding system to address the enormous diversity of environmental conditions and end-user needs in EI. This project aimed to increase food security by providing varieties capable of producing high and stable yields. The goal of this initiative is to develop, test, and refine methodologies of participatory research and gender analysis as they apply to the development of new technologies in germplasm and natural resource management This project aims to test the hypothesis that farmer participation in rainfed rice breeding can help develop suitable varieties more efficiently. It is also designed to identify the stages in a breeding program where farmer interfacing is optimal. (Farnworth and Jiggins 2003; Courtois et al. 2001).

The project had two components: a) plant breeding component to develop and evaluate a methodology for participatory improvement of rice for heterogeneous environments and to produce breeding materials suiting to farmers' needs; b) social

science component (including gender analysis) that aimed to: (1) characterize cropping systems, diversity of varieties grown, and the crop management practices of rice farmers; (2) to analyze male and female farmers' selection criteria and their reactions in a wide to a range of cultivars and breeding lines, and (3) to enhance the capacities of national agricultural research systems (NARS) in participatory research and gender analysis in plant breeding and rice varietal selection (Courtois et al. 2001). The plant breeding components of the project were PPB and PVS, which IRRI plant breeders led.

1. *Participatory Plant Breeding (PPB*). Using the pedigree selection method, farmers and breeders selected individual plants from segregating populations (F4–5) _ of different varietal crosses. Trials were held on-farm and on-station. Plants chosen by breeders and farmers evaluated these genotypes at maturity stages based on grain character and susceptibility to stem borer. The next phase of the research involved field testing and comparing the breeder-selected and farmer-selected materials. The promising lines thus selected were multiplied and supplied to farmers for evaluation and release.
2. *Participatory Varietal Selection.* In PVS, a fixed set of lines (13–25) advance lines and a local check) suited for the specific hydrological conditions in the area were tested on-station and on farmers' fields. The advanced lines were obtained from the IRRI Shuttle Breeding Program and other breeding programs of NARES in eastern India. Two to three farmers per village conducted the on-farm trials under their management level. During pre-harvest and harvest periods, farmers and breeders visually ranked the rice lines grown on-station and on-farm. The Kendall coefficient of concordance and the Spearman's rank correlation coefficient was used to analyze the agreement of ranking of the genotype among farmers, among breeders, and between farmers and breeder (Courtois et al. 2001). PVS includes researcher-managed trials and farmer-managed trials.

   The methodology for mainstreaming socio-cultural and gender analysis in PVS is discussed in this section.

5.5.4.1 Methodology for Mainstreaming Socio-Cultural and Gender Analysis in PVS

There are many ways to ensure that social and gender analyses are considered in PVS. A guidebook was published to build the capacities of rice breeders to incorporate a gender perspective into their projects (Paris et al. 2011). PVS provided an opportunity for social scientists to work closely with plant breeders by helping build more excellent rapport with farmers and including women in each stage of the PVS stages. Below are the steps of PVS, such as setting breeding goals, the evaluation of new rice lines, comprehensive evaluation of new rice lines, the wide diffusion of seeds, and assessment of benefits of PVS (Fig. 5.1).

The methods and tools for integrating social, cultural, and gender analysis in PVS if the varietal selection process are discussed below.

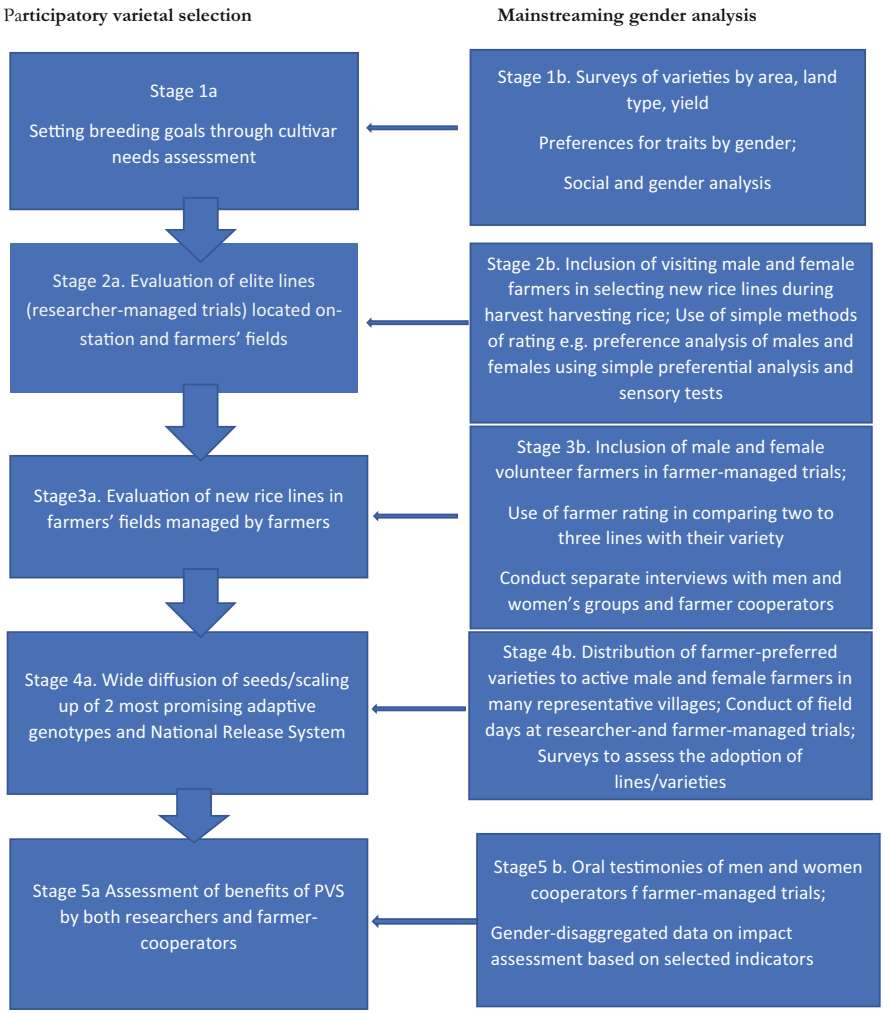

Fig. 5.1 Tools and methods for incorporating socio-cultural and gender analysis in PVS. Source: Paris et al. (2011)

5.5.4.2 PVS and the Integration of Gender Analysis Are Discussed in this Section

Stage 1a: Set Breeding Goals with Farming Communities

In setting breeding goals, the essential steps are: selecting the target site/village which represents the problem of the environment, e.g., drought-prone, submergence-prone, description of the village, understanding when stress occurs, varieties and

yields, crop management practices, coping mechanisms, and technology needs and opportunities to increase productivity.

Stage 1b. Gather Information on Socioeconomic Information, and Conduct Gender Analysis, Including Gendered Perceptions of Varietal Preferences

Social research, including culture and gender issues, requires information on the interaction between social class, gender, and labor participation practices. A more gender-responsive agricultural extension, development, and extension system call for a comprehensive look at the same system: who are the actors, the users of the technology, and whose needs are addressed at each stage, from priority setting through the implementation to evaluation and impact assessment.

- Identify gender roles in the household, in on-farm and non-farm activities, and farming practices; quantify the labor contributions of men and women in significant farm activities; assess gender differences in access to and control of resources.
- Identify constraints, potential, and needs; identify options for improvement; Pertinent questions are: Are there gendered differences in rice varietal preferences based on gender roles from rice production, post-harvest, and food preparation? Are there mechanisms to consider the needs of women and men as both producers and consumers? The perceptions that" women do not know anything about rice production and post-harvest traits, etc., automatically excluded them from participating in farmers' meetings, on-farm technology demonstrations, and on-farm trials. As shown in Fig. 5.2, for the first time, the wife was asked what desirable traits they like in a variety.

Fig. 5.2 Identifying gendered perceptions of rice varietal traits

Fig. 5.3 Identifying women's ability to identify rice varieties and performance of rice varieties in stress-prone environments

- Summarize and share the findings with members of the farming communities and research team members. Are there available lines or varieties better than farmers' current varieties? Are farmers willing to test the new lines or varieties in their fields using their management knowledge? As shown in Fig. 5.3, male social scientists can also interview women in the fields where women feel more comfortable expressing their opinions, knowledge, and experience.
- Social scientists play essential roles in eliciting men's and women's knowledge, attitudes, and perceptions on different rice varieties they have grown and would like to grow in the future. Desirable traits should include not only agronomic traits but also cooking, eating, marketable traits, and other post-harvest traits such as being suitable for feeds for the animals, etc.

5.5.4.3 Farmers' Perceptions of Useful Traits in Varietal Adoption

To determine whether there are gender differences in perceptions of useful traits in varietal adoption, the gender research team used graphic illustrations of traits. The team first showed cards that illustrate useful traits in selecting rice varieties They then asked each farmer what traits he or she consider in selecting rice varieties for specific land types—upland and lowland fields. To assess how farmers valued each trait, then this question was asked: "If you have 100 *paise,* how much would you pay for each trait?" The value in *paise* allocated to a particular trait corresponded to the importance given by the farmer**.** Because many traits are interrelated, the traits were further reclassified in consultation with a plant breeder. Results showed that women farmers are particularly skilled in assessing post-harvest traits such as milling

recovery, and the cooking and eating quality of rice. Listening to farmers' perceptions and involving both men and women farmers in selecting rice varieties at the early stage of breeding can lead to faster adoption of varieties suited to their specific rice ecosystems and vice versa (Paris et al. 2001).

Stage 2a. Evaluation of New Rice Lines on Researcher-Managed Located on-Station and Farmers' Fields

A researcher-managed trial is similar to a research station trial, but it can also be conducted in farmers' fields. This includes a) selection of treatments; b) experimental design; c) plot size and plant spacing; d) field layout; e) field operations and data collection. This information is mainly taken by the researchers (plant breeders, agronomists, and field assistants) in collaboration with farmers. Usually, the researchers take charge of crop management and shoulder the costs of the inputs while the farmer lends the plot without remuneration. The researcher and the farmer agree on how the outputs are shared. Researchers include varieties farmers are already using and also new lines. These lines are evaluated during the pre-harvest, harvest, and post-harvest periods.

Stage 2b. Evaluation of New Rice Lines and Farmers' Varieties by Men and Women Farmers during Harvest Season

Plant breeders seldom consult about their rice lines or varieties preferences despite women's active participation in rice production and post-harvest operations. Using simple voting methods, men and women, especially those with no access to formal education, can identify the two most preferred and two most minor select lines in the preferential analysis (Fig. 5.4). At the initial phase of the project, a rule was imposed that at least 30% of the participants should be female to collect reliable information subjected to both qualitative and quantitative analysis of data and information. The preferential analysis and sensory test of cooked rice should be disaggregated by male and female cooperators/participants. These ratings and the information about trial conditions should be recorded in a form that summarize farmers' opinions and preferences. The Kendall coefficient of concordance and the Spearman's rank correlation coefficient can be used to analyze the agreement of ranking of the genotype among farmers (male and female), and between farmers and breeder (Courtois et al. 2001). Separate interviews for male and female farmer-cooperators will encourage women to voice their opinions with confidence.

Fig. 5.4 Women farmers use ballots to vote for preferred rice lines during harvest time

Stage 3: Evaluation of Farmer–Preferred Lines on Farmers' Fields (Farmer-Managed Trials)

Stage 3a: Farmer-managed trials or baby trials are closely associated with farmers' cropping systems Experiments are laid on one side of a farmers' field, and replication is across five areas. Unlike the researcher-managed trials, this usually includes fewer treatments (<3). The steps include: selecting the target site for where farmer-managed trials will be conducted; meeting with farmer-cooperators for farmer-managed PVS; experimental design collection of agronomic data analysis.

Stage 3b: Inclusion of male and female volunteer farmers in farmer-managed trials and use of male and female farmer ratings A farmer-managed trial can be managed by a female (widow *or* de facto head of household) or male farmer. The social scientist conducts baseline surveys of farmer-cooperators of farmer-managed PVS. Farmers grow farmer-selected or preferred lines/varieties on their farms under their management and farm conditions. Men and women are invited to rate the lines using a voting system and coded ballots during harvest season. Farmers compare two to three new lines with their local/traditional variety. After counting the votes, the women and not only the men are invited to express their own opinions on why they selected a specific line or variety. Focus interviews with separate groups (males or females) and individual male and female farmers are also conducted. The farmer-managed trials should contain a group discussion on the performance of the varieties, and farmers should be asked to talk about the good and bad (positive and negative) characteristics of the varieties. These ratings and the information about trial conditions should be recorded in a form that summarizes farmers' opinions and

preferences. PVS is mainly organized and led by social scientists to objectively assess which lines/varieties are preferred by farmers rather than just pleasing the plant breeder.

Stage 4a Wide Diffusion of Seeds/Scaling up

The wide diffusion of improved stress-tolerant seeds took more time than expected due to the need for further testing on farmers' fields and approval from the national release system. Moreover, there was a general lack of quality seeds produced at the research station. Farmers with large farm sizes who were able to produce seeds became the local suppliers in the village.

Stage 4b. Distribution of farmer-preferred varieties to active male and female farmers in many representative villages. Seeds of varieties preferred by farmers were disseminated through farmer exchange. The participation of farmers during the field days also encouraged other farmers to test the new lines/varieties. Social scientists began to assess the adoption of specific lines/varieties.

Stage 5a Assessment of Benefits of PVS by both Researchers and Farmer-Cooperators

Based on focus group discussions, the benefits of PVS by both researchers and farmer-cooperators are the following:

- Clearer understanding among plant breeders of farmers' selection criteria. These would be considered in formulating breeding objectives.
- More representation of poor women as visiting farmers in evaluating the performance of new lines in researcher–managed trials.
- Farmers are exposed to many varieties or new lines and have many to choose from.
- Active poor women farmers are included as project cooperators in farmer-managed trials. Both men and women farmer-cooperators can make a more objective evaluation of the new genotypes using their resources.
- Farmers' rights are promoted.
- There is a faster uptake of new varieties in rainfed areas.
- Men and women have better access to improved seeds and new knowledge.
- Varieties are approved from PVS by formal release systems, which consider yields and other traits for poor subsistence-oriented farmers.

During the adoption phase of stress-tolerant seed. An earlier assessment of PVS on women farmers by Paris et al. (2008b) revealed that involvement in PVS and access to new seeds are positively and significantly related to women's empowerment. Women gained confidence in making decisions related to varietal choice, acquisition, and disposal of seeds, and crop management. Participation of both men and women in the early evaluation of the performance of the rice lines/genotypes on

their farms led to the development of varieties that are suited to their stress-prone environments. Women's participation in PVS gave them the ability to make choices and increased their access to available seeds, improved gender relations, and appreciation for their knowledge by family members and members of the community.

The Stress Tolerant for Rice in South Asia and Africa (STRASA) project helped women by providing them with flood-tolerant varieties (S*warna* Sub-1, *Sahbhagi dhan*) and including them in PVS. Including women farmers in PVS also contributes to a better understanding of other traits such as ease of threshing, keeping quality after cooking, and straw quality for animal fodder. For women in flood-prone rice areas, Swarna Sub1-also called "scuba rice" can survive underwater for up to 2 weeks, no longer have to suffer from drudgery, and face health risks since they do not have to replant after severe floods destroy young seedlings. Swarna Sub1, of medium height, is easier to thresh, thus making manual threshing easier for women workers. Moreover, the quality of its rice straw makes for good fodder for their livestock. Thus, they do not have to walk long distances to look for fodder and use their time to take care of their children (GRiSP 2013a).

Early efforts in the dissemination of stress-tolerant seeds gave women access to stress-tolerant seeds, and the opportunity to make decisions as well. as in raising their status in the community. For example, in the Mayurbani district in EI, through the Balasore Social Service Society (BSSS), IRRI introduced and supplied a drought-tolerant variety *Sahbhagi dhan*, after which the Holy Family Catholic Parish started mobilizing the tribal community toward adopting the variety The Odisha Agricultural Development helped provide training and access to facilities. Women led the development of a seed bank, which gave them an important role in seed conservation and the decision-making processes within the family and the community (GRiSP 2013b).

Through focus group discussions (FGDs) conducted with men and women farmers, it became obvious that farmers took pride in being part of the varietal development through PVS trials that allowed them to express their preferences. Furthermore, other traits such as taste and cooking quality need to be assessed carefully. For example, farmers may prefer a bold grain shape or a good volume expansion ratio of cooked rice to give a feeling of satisfaction after eating (Singh et al. 2000).

Mehar et al. (2017) conducted a study on the role of gender, risk, and time preferences in farmers' rice variety selection in eastern India. The results revealed that female farmers who are more risk-averse, usually choose rice varieties based on cooking quality (e.g., good taste, high cooking quality, and good straw quality) and stress tolerance. They are less likely to select hybrid rice and also less likely to have their decision for market-oriented reasons, compared with male farmers.

5.6 Lessons Learned

(a) *Need to have a deep understanding of gender roles in a given context/situation*. Gender roles and responses are variable across and within cultures. Gender roles and gender relations within households are strongly influenced by social (caste, class, ethnicity, religion, etc.), cultural (belief system and practices), economic circumstances (sources of income), family structure (nuclear or extended), stage of women in the life cycle, marital status (single, married), level of education, degree of mechanization, male outmigration, etc. Gender roles are not static and change through time. Therefore, many factors constrain technology adoption, and social scientists play a vital role in problem diagnosis. They should be involved in the initial phases of the technology development process rather than at the impact assessment stage only.

(b) *Political will of research institutions is critical in mainstreaming gender*. Research institutions' written policy statements are essential for implementing programs and plans addressing gender issues. In NDUAT, Kumargani, U.P., the Director of Research, strongly supported the project. Among other things, he provided transportation for the research teams to go to the villages and assigned scientists to the team. IRRI developed strong linkages with ICAR—Center for Women in Agriculture (CWA) through the provision of training, gender audit, and research activities. Gender research was conducted under ongoing RR4TD projects in IRRI and the CGIAR. It is more relevant to integrate gender concerns under the umbrella of ongoing research and development programs that have sufficient budgets for participatory research.

(c) *Need to include female agricultural scientists and social scientists in research teams.* Agricultural scientists (plant breeders, agronomists) and social scientists should listen to women farmers' opinions, assess their attitudes towards certain farms practices, and consider their criteria in the development and dissemination of rice and rice-related technologies. Without a female member in a team, it would be difficult to elicit information from women farmers, particularly in situations where there are social restrictions on women.

(d) *Continue capacity-building programs/activities on how to mainstream gender into RTTD to sustain project activities.* Capacity building for research leaders and managers, agricultural scientists, researchers, mid-level women professionals engaged in research, extension, and development, both men and women farmers should be integral in an institution's plans and programs. For example, in 2002, IRRI Training Center conducted a training program "The IRRI Leadership Course for Asian and African Women for Research and Extension (LCAAWRE) for women professionals in agriculture (Rubzen et al. 2016). A module on integrating a gender is now incorporated in IRRI's Research for Development Training Course for researchers and leaders under the Department of Agriculture in the Philippines.

(e) *Social scientists/gender specialists and agricultural scientists should plan and work together.*

Castillo (1988) remarked: "If one wants to make things happen. One should be in the place where the action is." Ideally, the social scientists and the other research team members (agronomists, plant breeders, social scientists) should visit the field and talk with women farmers." During PVS (harvest time), plant breeders also had the opportunity to interview women and not only men. They were able to elicit first-hand information on the positive and negative traits of the new rice lines. The local social scientists in this project played a pivotal role in bridging the gap between the scientists and the farmers. They provided leadership in organizing meetings/discussions with the people in the village, arranging PVS visits, data analysis, interpretation, and writing jointly authored papers in technical journals and presentations in international and local fora.

Aside from working together in conducting PVS with men and women, farmers, plant breeders, and social scientists co-authored technical publications and presented results in international and national fora (Mackill et al. 2012; Courtois et al. 2001; Paris et al. 2002; Singh et al. 2002)).

(f) *Conduct interviews separately for men's and women's groups*. Village meetings should start with mixed groups followed by single-sex groups to keep men from dominating the discussions. Women can express themselves better if they are with a group of women only. Moreover, the place, time, and duration of meetings for women should be adjusted to accommodate women's time for household and childcare responsibilities. More women will participate in training activities after they have finished their household chores in the morning and when the meeting is conducted within walking distance in the village.

(g) *Involve women in training activities on all aspects of rice production, especially on seed management.* Women's knowledge and skills are vital in making sound decisions on growing rice and post-harvest, particularly when wives become de facto heads of households after husbands migrate for jobs in the cities or abroad. In cases where illiteracy is high among women, visual aids or "hands-on" training or Farmer Field School (FFS) are more relevant than lectures for farmers with lower levels of education Training activities should be conducted separately for men and women.

(h) *RR4TD institutions and local agricultural extension systems need to work with established or reputable Non-Government Organizations (NGOs) and Women's Self-Help Groups.*

During the early phases, there were no Self-Help Groups in the study villages. Thus, it was difficult to mobilize women to participate in project activities. Working with established Self-Help Groups in the village with active women leaders would greatly facilitate the adoption of rice and rice-related technologies. Although there were NGOs in a few villages, these NGOs were more focused on developmental rather than agricultural research for development projects. They have limited skills in conducting research, particularly on gender analysis which requires collecting and analyzing gender-disaggregated data as well as writing reports.

5.7 Conclusions

This chapter has demonstrated how gender issues were integrated into RR4TD conducted by IRRI in collaboration with NARES partners in NDUAT, in Faizabad district, EUP. It discussed the challenges, strategies, and lessons learned.

Despite the many challenges during the early phases of the project, women's inclusion in the rice breeding processes led to several positive outcomes. PVS provided an opportunity to include both men and women in the early evaluation of lines or varieties suitable to farmers' needs in stress-prone rice environments in Faizabad, EUP. Women could express their knowledge and opinions about the new lines/varieties without being intimidated. Plant breeders and agronomists realized that there are gender differences in varietal preferences and women's opinions do matter in the adoption of varieties. The women felt empowered because, for the first time, they were allowed to voice their opinions about their varietal preferences. Participation of both men and women in the early evaluation of the performance of the rice line/genotypes on their farms led to the development of varieties that are suited to their fragile environments. However, involving women in PVS is only the first step toward reducing gender discrimination in project activities and reaching more women. The requirement in PVS to include at least 30% of participants be women among the evaluators, provided opportunities for plant breeders to listen to women's perceptions about their trait preferences. As emphasized by Johnson et al. 2018, simply reaching women does not ensure that they will benefit from a project, and even if women benefit (e.g., increased income or better nutrition), that does not ensure that they will be empowered (e.g., in control over that income or greater participation in decision-making). Although these early efforts failed to measure women's empowerment, the project was able to shift gender morns and attitudes. Reaching women through PVS proved to be a powerful way to increase women's access to information, new seeds, and confidence. However, more women should be provided with training on new knowledge and skills in conserving and managing the seeds, as well as in managing crops and other farm resources.

While there are ongoing efforts to develop and test technologies for women farmers, it is essential to recognize that gender inequalities in access to technologies, labor, and economic returns through gender mainstreaming in RR4TD do not happen automatically. The success of sustaining the inclusion of women depends on the commitment and concerted action of agricultural research systems and policymakers, and women themselves. The greatest challenge for RR4TD institutions is motivating scientists and technologists to undertake to listen and learn: through collaboration with poor women while developing their research priorities and strategies.

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