Gender dynamics in rice-farming households in Vietnam: A literature review

Working Paper No. 183

CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS)

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RESEARCH PROGRAM ON
Climate Change, Agriculture and Food Security
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Correct citation:
Gallina A, Farnworth CR.2016. Gender dynamics in rice-farming households in Vietnam: A literature review. CCAFS Working Paper no. 183. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Copenhagen, Denmark. Available online at: www.ccafs.cgiar.org

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The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) is a strategic partnership of CGIAR and Future Earth, led by the International Center for Tropical Agriculture (CIAT). The Program is carried out with funding by CGIAR Fund Donors, Australia (ACIAR), Ireland (Irish Aid), Netherlands (Ministry of Foreign Affairs), New Zealand Ministry of Foreign Affairs & Trade; Switzerland (SDC); Thailand; The UK Government (UK Aid); USA (USAID); The European Union (EU); and with technical support from The International Fund for Agricultural Development (IFAD).

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Abstract

This literature review is part of the CCAFS program on low emission agriculture flagship of the CGIAR Research Program on Climate Change, Agriculture and Food Security. It serves as a background document to better understand gender roles and dynamics in the rice sector in Vietnam, and provides input into research activities on the gender dimensions of mitigation options such as alternate wetting and drying. An understanding of gender issues helps to both improve effective design and delivery of mitigation technologies and ensure that the benefits of mitigation technologies reach women and men equitably. This will enable mitigation technologies to contribute to livelihood resilience, gender equity, and other development objectives as well as to lowering greenhouse gas emissions.

Keywords

Gender; Vietnam; rice; alternate wetting and drying

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Acknowledgments

This literature review was carried out with support from the low emission agriculture flagship of CCAFS. The authors thank CCAFS and its partners in Vietnam for their cooperation.

Contents

Acronyms

AWD	Alternate wetting and drying
FFS	Farmer field schools
GHG	Greenhouse gas emissions
IPCC	Intergovernmental Panel on Climate Change
IPM	Integrated pest management
LED	Low emission development
SRI	Sustainable Rice Intensification
VLCRP	Vietnam Low Carbon Rice Project

1. Introduction

This literature review provides information to better understand gender roles and dynamics in the rice sector in Vietnam, and aims to inform research activities on the gender dimensions of mitigation options such as alternate wetting and drying (AWD). An understanding of gender issues helps to both improve effective design and delivery of mitigation technologies and ensure that the benefits of mitigation technologies reach women and men equitably. This will enable mitigation technologies to contribute to livelihood resilience, gender equity, and other development objectives, as well as contribute to lowering greenhouse gas emissions (GHG).

The need to limit global warming to 1.5°C above pre-industrial levels is a major challenge, given that trajectories for temperature and GHG indicate that the planet is heading for a rise of 4.8°C by the end of the century (IPCC 2013). Globally, agriculture emits an estimated 11–15% of anthropogenic GHG (ibid.). There is therefore increasing pressure on all sectors, including agriculture, to play a part in ensuring reductions and move toward low emission development (LED). Some 119 countries included mitigation in agriculture in their pledges to the United Nations Framework Convention on Climate Change agreement in Paris (Richards et al. 2016).

Many practices that mitigate GHG are also best management practices which improve agricultural productivity or reduce farm-level costs through more efficient use of inputs and productive resources. These so-called "mitigation co-benefits" are being actively promoted in many projects to make investing in LED technologies more attractive for farmers. In paddy rice production, for example, potential co-benefits of AWD include lower water consumption, higher lodging resistance, beneficial conditions to speed up decomposition of organic material, and higher resistance to some pests and diseases. These are expected to result in improved cost-benefit ratios for individual farmers while lowering the sector's overall GHG contribution.

Given that women are strongly active in the agricultural sector in many countries, the implementation of LED in agriculture at large scales will have significant impacts on the ways rural women and men frame and pursue their livelihoods and largely shape their effective participation. The implications of LED in agriculture for gender outcomes, however, remain under-analyzed, as are ways to involve women effectively. The scale at which climate

change negotiations take place, the large number of actors involved in mitigation initiatives, and the pressure for "scalable innovations" (Edmunds, Sasser, and Wollenberg 2013) place huge pressures on "tried and tested" approaches to working on gender in agriculture.

This is a very pertinent time to consider how to address gender in the context of LED in Vietnam because the country recognizes the importance of LED strategies in agriculture. Although policy has historically focused on boosting production and reducing input costs, emissions data are now encouraging the development of mechanisms to lower GHG. AWD+ technologies in the irrigated rice sector, particularly in the Mekong Delta, are being disseminated through different technology packages. Transitions from one technology package to another have not been smooth, and many farmers do not necessarily apply the reductions recommended. To date, women have only been marginally involved in AWD+ interventions in Vietnam. Despite the important role women play in rice farming, postharvest processing, and marketing, as well as in intra-household decision-making around household budgeting and technology adoption, their role is still largely overlooked by many institutional actors.

Gender relationships and dynamics can influence the way mitigation technologies are designed and delivered (Edmunds, Sasser, and Wollenberg 2013). Specific roles and interests among women and men across different production systems and geographical areas can lead them to respond differently to mitigation technologies. Given existing structural gender inequalities, the outcomes of mitigation initiatives do not necessarily benefit women and men equally. Valuing women's agricultural knowledge can also influence the development of new technologies, management practices, organizational forms, and political strategies that are effective in encouraging sustainable, low emission agricultural development (ibid.).

To improve understanding of how gender dynamics may influence adoption of AWD+ technologies, this review focuses on the following issues: gendered roles and responsibilities in rice production, including understanding significant differences in roles, responsibilities, and production systems between South and North Vietnam; intra-household dynamics; gender dimensions of selected extension programs, including examples of good practices; and the gender implications of technology change.

2. Methodology

The review is based on the analysis of existing literature on gender and rice production in Vietnam, including both academic and gray literature. The review process was structured in two phases. First, search keys were used in Google and Google scholar, and abstracts were reviewed to assess their relevance to the project. Selected papers were then examined in more depth. The most important keywords used were rice, gender, women, Vietnam, AWD.

From 40 articles reviewed, 22 were retained. The literature on gender dynamics in the rice sector in Vietnam is very scanty, with most of it more than 10 years old. Fewer still explore gender issues in relation to the dissemination of AWD+. Important technologies that are barely covered in the literature on gender and rice production include irrigation and water management. Finally, few studies systematize experience with gender-sensitive approaches in the delivery of sustainable intensification technologies. The gender research in rice production systems in Vietnam is dominated by a few experts, as will become evident upon reading this paper. They offer, however, deep and wide insights into gender and broader social dynamics in the rice sector over time.

Overall, there are a number of important knowledge gaps on gender and AWD, as well as on gender and rice more broadly. First, there is a need for further information and analysis of the role women play in decision-making concerning technology adoption, including an understanding of their preferences and objectives. Second, it would also be important to better analyze the situation of women heads of households to better identify their production and productivity constraints and understand their technology needs. Finally, the gender implications of the different programs for technology development and dissemination should be further explored to allow a better understanding of constraints to women's effective participation and to identify good practices and incentives.

3. Emissions data overview

GHG in Vietnam are 150.0 million tonnes of carbon dioxide equivalents ($TgCO_2e$). Agriculture contributes 43.1% of those emissions, or 65.09 $TgCO_2e$. Emissions from paddy rice cultivation contribute 57.5% of emissions from agriculture (Huynh et al. 2014). Over the

past 30 years, farmers have been adapting to changing environmental conditions by diversifying and modifying their production and water management systems. But recent and forecast agro-hydrological changes are threatening farmers' ability to continue such adaptation. The main constraints to their ability to adapt to a new hydrological regime are availability of suitable cultivars, soil nutrient management options, insufficient knowledge of potential harm from acid sulfate soil inundation, and planning tools.

Policy has historically focused on boosting production and reducing input costs. However, GHG data are now encouraging the development of mechanisms to lower emissions. AWD+ technologies in the irrigated rice sector, particularly in the Mekong Delta, are being disseminated through three integrated technology packages: (1) 3 Reductions, 3 Gains (3R3G); (2) 1 Must, 5 Reductions (1M5R); and (3) Sustainable Rice Intensification (SRI). Particular provinces have opted to broadly promote particular packages. Following piloting from 2010, 1M5R was certified in 2013 by the Ministry of Agriculture and Rural Development as a nationally approved approach for best practices in rice production and a contribution to lowering GHG emissions. The "must do" is the use of certified seed; the five "reductions" are in the amount of seed, fertilizer, chemical pesticides, water used, and postharvest losses. The Vietnam Low Carbon Rice Project (VLCRP) decided to build on 1M5R and call its model 1M6R (the fifth reduction refers explicitly to a reduction in emissions). VLCRP and other actors, however, recognize that a reduction in emissions cannot just be bolted on. Achieving this objective means that each reduction has to be calibrated still further to maximize synergies. The "+" in AWD+ is a reminder that clear co-benefits must be delivered and made explicit to farmers. The core co-benefit is reduced input costs without negatively impacting yield, and thus results in increased profitability at farm level.

AWD+ requires close supervision and management of water. Findings reported in this study indicate that although AWD is simple to understand, it requires level fields and effective irrigation committee management to be successful. Regarding the latter, flexibility in allowing farmers to draw down water is critical; however, success in this depends on the flexibility of irrigation cooperative management. Depending on the soil type, and amount of rain, "safe" AWD allows water between 10 cm and 15 cm below soil level.

Unsurprising, transitions from one technology package to another have not been smooth. Many farmers apply a blend of 3R3G, 1M5R, SRI, and AWD, using their own observations

together with their personal and institutional circumstances to create their preferred mix. They do not necessarily apply the recommended reductions (Nyugen et al. 2013).

4. Gendered roles and responsibilities in rice production: an overview

In Vietnam, female and male family members are involved in rice cultivation, but women constitute the bulk of the labor force in rice in terms of time spent according to (Paris 1998a; Paris and Chi 2005). The degree of women's participation in rice farming varies across regional areas, livelihood systems, typology, and the socioeconomic profile of the household. Typically, especially in the South, the labor process is gender sequential, with women and men undertaking separate activities along the production cycle, and only some activities jointly. In the North, women are heavily involved in almost all activities; in some cases, they conduct all of them alone (Paris and Rola-Rubzen 2009). However, the gender division of labor in agriculture in the country is not rigid: in some areas, the wife and the husband share the same tasks to a greater or lesser degree (Chi et al. 2010).

A general trend is that men are involved mostly in what are culturally defined as heavy tasks, such as rice threshing, land preparation (particularly tillage), broadcasting chemical fertilizer, spraying pesticides, and hauling farm products. They also bear the primary responsibility for using machinery such as tractors, plows, and combine harvesters, though these are often hired in together with drivers. Women conduct the majority of the farm operations related to sanitizing farm fields; some work in leveling, pulling, transplanting seedlings, weeding, and postharvest processing. With regard to the latter, key activities such as seed cleaning, selection, storing seeds for the next cropping season, dehusking the grains, cooking rice, or preparing rice into products for home consumption or for sale typically lie within women's domain (Paris 1998a). Women's responsibility in farm management also includes cooking for workers, visiting the farm, and overseeing the work of hired laborers, especially when men are away. Harvesting is usually jointly conducted when this is not mechanized, although more women than men engage in this activity, along with other family members, including both sons and daughters (Paris and Rola-Rubzen 2009). Irrigation is predominantly a male activity (Tuan et al. 2001). Both women and men sell rice, usually at the farm gate.

Despite the important contribution women make to rice production, it is widely held, especially in the South, that rice farming is primarily a male domain. This is because some tasks require physical strength, and because men are perceived, culturally, as decision-makers in rice production. A study on women's role in irrigation management in the Red River Delta suggests that women are hardly involved in the management, coordination, or decision-making processes of irrigation. This is despite women being the main source of labor in the field and participating in almost all work that contributes to agricultural products, from crop preparation to harvesting.

It was noted above that socially constructed gender norms shape the perception of appropriate "male" and "female" tasks in rice, and that male tasks are seen as heavier than female tasks. Gendered patterns of wage employment in rice farming mirror the same perception, with men being paid higher wages than their female counterparts due to their heavier work (Paris and Chi 2005). Even when women and men are hired to carry out the same activities, wage gaps still exist, as male laborers are expected to be more productive (ibid.; Chi et al. 2010).

In addition to their involvement in rice, women also participate —and often play a central role—in livelihood activities such as animal husbandry, up-land crop production, homestead gardening, small trading, and handicrafts. In livestock production women are often culturally considered key decision-makers. Trading is popular among women as it secures access to a small amount of cash on a daily basis (Chi et al. 2010). Livelihood diversification into off-farm activities is an important source of income for many rural women (Kabeer and Thi 2000).

5. Comparison between North and South Vietnam

There are marked gender differences in rice production between North and South Vietnam (Kabeer and Thi 2000).

5.1 North Vietnam

In the North, where rice cultivation is a principal crop for the overwhelming majority of households, along with animal husbandry, rice is predominantly managed by women. Subsidiary crop production of tubers and maize, often used to supplement the diet when there is a shortfall of rice, is also done mostly by women (ibid.). In the North, land is leased from the state for 50 years, and leases can be renewed. Farm sizes are typically well under 1 ha,

meaning that farms are economically hardly viable. Men in smallholder farms typically migrate in search of waged work, usually in construction, carpentry, or digging fields. This enables them to complement household income from agriculture and also to send remittances for investment.

Although migration also affects the South of the country, out-migration is more common in the North mainly due to the smaller size of land parcels, higher population pressure, and low rice productivity in upland systems. Food shortages are frequently experienced (Pandeya and Minhb 1998; Kabeer and Thi 2000; Paris and Chi 2009; Paris and Rola-Rubzenet al. 2009). In the late 1980s, under the impact of a program of economic renovation called *doimoi*, mobility across the country increased, especially from rural to urban areas and from the northern mountainous areas to the south.

Women left behind to manage the farm have to compensate for the lack of male labor, typically by increasing their own workloads. They also have to take on farm managerial responsibilities. A study (Paris and Rola-Rubzen 2009) found that many women have taken over traditional male responsibilities in rice operations, including irrigation, land preparation, dredging field canals, pest management, pest identification, pesticide spraying, fertilizer application, and hauling of paddy sacks. They also hire and supervise farm laborers during peak cropping seasons. In case of labor shortage, women exchange labor with other women of the same social status. Women respondents considered that irrigation was very difficult to manage without male support, and that fertilizer and pesticide application can be very time consuming.

The effects of male out-migration on agricultural productivity and overall household welfare are therefore mixed. On the one hand, the reduction of family labor supply can have a negative impact on farm production and productivity. These can increase, however, if remittances are reinvested in farming, by acquiring inputs and hiring additional laborers to relieve drudgery. It appears that male out-migration has not reduced rice yields because the members left behind used remittances to pay for farm inputs and the hiring of labor. Overall women's drudgery has increased, however (Paris and Chi 2009; Paris and Rola-Rubzen 2009).

5.2 South Vietnam

In the South, landholding disparities are larger than in the North (Kabeer and Thi 2000). There are more landless farmers than in the North, and there are larger and more productive farms. Greater landlessness is not necessarily associated with greater poverty in the South because of the greater availability of off-farm wage labor and higher real wages. The Mekong Delta in the South is the most important rice-producing area in the country. It has a greater amount of agricultural land per capita and produces about half the country's rice crop and all its exported surplus (ibid.). Yet despite the production gains experienced by the region since the 1980s as a result of de-collectivization, intensification, and diversification, the South still lags behind in terms of many social indicators, including education and housing. Women—and the Khmer ethnic minority—figure as the most disadvantaged categories in terms of access to education and training. There is evidence that smallholder farmers are increasingly facing livelihood insecurity, loss of opportunities in agricultural wage labor, and pressure from climate change (Garschagen and Diez 2012).

Gender studies focusing on the Mekong Delta indicate a complex and heterogeneous picture. Paris and Chi et al. (2009) show that in some districts of the southern provinces, women's contribution to rice production is almost the same as that of men. Slight variations occur depending on the farming system. Women provide 46% of the total labor in rice-cropping systems, 44% in rice-rice-rice cropping systems, and 48.2% in rice-upland crop-rice cropping systems. Another study conducted in the Omon and Co Do districts in Can Tho Province suggests that in the majority of male-headed households, labor inputs in rice production are dominated by men, with women providing only a minor role (Chi et al. 2010). Overall, men's strong role in rice production can be attributed to larger farm size (often 2–3 ha). This makes rice farming a viable farm household livelihood strategy in many parts of the Mekong Delta.

Conversely, in very poor and isolated saline-prone areas, women do most of the work in rice production and perceive themselves as being the principal "caretakers" of rice cultivation. A study carried out by Chi et al. (2013) estimates that up to 70% of labor inputs into rice production in such areas are provided by women. This is because in saline-prone areas, households only have one rice crop a year, leading farmers to seek greater diversification, including seasonal out-migration, which is mostly a male activity. Women also play an important role in shrimp cultivation, which is usually conducted jointly with men.

6. Intra-household dynamics

Women typically enjoy a considerable degree of participation in intra-household decision-making. Vietnamese women's predominant role in household budgeting and in marketing are characteristic of the Southeast Asian cultural belt (Kabeer and Thi 2000).

In saline-prone areas of the Mekong Delta, women from rice-producing families make decisions jointly with their husbands on important areas such as how much product to store and sell, at what price to sell, and which rice cultivar to grow (ibid.; Chi et al. 2013). Female household members across the Mekong Delta also largely manage sales activities of rice products because they traditionally play a primary role as purse keepers. Similar trends can be found in fruit and fishery production, which is male-dominated with respect to production activities. It is reported that men cannot make critical marketing decisions without consulting their wives (Kabeer and Thi 2000).

That women are mainly responsible for keeping money and controlling overall household expenditures, however, can also be a burden. Should household monies be limited, they bear significant responsibility to (1) find ways to borrow and repay money lenders or friends, (2) look for other income-generating activities, and (3) engage in cost-savings activities (Paris et al. 2005; Chi 2008). In addition to their farm production activities and housework, women may be required to engage in off-farm activities such as trading or wage labor. A study by Chi (2008) showed that livelihood diversification activities made women feel that they had a heavy workload, that they slept less, and had no time for leisure; they felt tired and worn out with aching backs, legs, and arms. And although women's economic diversification results in higher income, better nutritional status, and education for children, it can have a negative impact on women's overall welfare.

As in many other countries, the gender division of labor in reproductive activities is not very flexible. Gendered patterns of migration demonstrate this. When men migrate, women are able to take over traditional male activities. When women migrate, principal males find it difficult to change gender roles in household and maintain childcare responsibilities (Paris and Rola-Rubzen 2009).

7. Gender dimensions of extension and technology change in extension programs

Women's role in rice production continues to be largely overlooked in public extension programs, which tend to be targeted mainly to men. This situation is counterproductive, considering the important role women have in rice production as both family laborers and, in some cases, farm managers. The adoption of several yield-increasing technologies, such as hybrid rice and integrated pest management (IPM), requires new skills and knowledge. Productivity gains from new rice technologies will, however, be hard to achieve unless women are considered to be recipients of new technologies alongside men (Paris 1998b).

Research studies suggest that women farmers in different regions of the country have limited access to formal extension dissemination channels. Rural organizations (e.g., IPM clubs, animal husbandry clubs, fishery clubs, cooperatives, farmers' associations, extension groups, and village leadership structures) are dominated by men, who are the primary recipients of information. Women generally obtain technical information primarily from more informal channels such as television, village loudspeakers, radio, their husbands, experienced old men, male neighbors, relatives, and other women in the village (Chi 2010).

Women are typically clustered in female-only associations, which rarely receive technical assistance—particularly in the agricultural sector—although the Women's Union develops income-generating activities in rural areas, for instance in livestock.

A study by Paris (et al. n.d.) shows that in areas affected by high rates of male out-migration, women did not use remittances effectively to invest in agriculture because of the high cost of inputs such as seed, chemical fertilizer, and pesticides. Information on existing technologies to reduce the costs of production and make efficient use of inputs, such as IPM, site-specific nutrient management, and water-saving technologies, had never reached these women.

Extension workers are often male, and the majority (though not all) of the senior positions are occupied by men (Tuyen 1997). Training approaches and materials are often designed with a male farmer in mind. Some training manuals have no pictures of women rice farmers (Virmani 1993). One of the greatest problems experienced by women is time constraints; yet these are rarely acknowledged in the scheduling of extension activities.

Chi (2010) found that women felt excluded because they had never been invited by agricultural support staff to attend training sessions. The majority of women interviewed did not know where to find extension workers and other agricultural staff. A further problem was that the knowledge shared by technical staff seldom reaches non-trained farmers, including women and those living in poorer and remote areas where rice cultivation is less intensive. Men do not necessarily inform their wives of the technical content of their training courses.

A study analyzing the factors affecting the uptake of an IPM package (Three Reductions, Three Gains)[1] in 13 provinces in the Mekong Delta indicated that the poor involvement of women in training sessions hurt adoption rates (Chi 2008). Training sessions were not scheduled at appropriate times for the farmers, the trainers lacked effective training skills, and, critically, the lack of participatory discussion sessions made it difficult to transfer and disseminate a complex technological package to farmers with low education levels. Further, the program did not reach remote rural areas. Consequently, the program served well only a small group of primarily male farmers. Furthermore, the exclusion of women from training sessions contributed to intra-household tensions, as women did not fully understand the potential benefits of the new technologies. Nor was the technical information delivered in training sessions shared effectively within the household. Since women actually conduct a significant proportion of the work in the rice fields, they did not reduce their use of external inputs nor apply them more effectively. Finally, the study showed that belonging to an ethnic minority negatively affected participation, since members of these groups are marginalized and act primarily as wage labor, though they may hold small land parcels. They also lack sufficient time and resources to attend training sessions and invest in new technologies. Older male farmers were found to be reluctant to switch to new agricultural practices (Chi 2008).

8. Examples of gender-sensitive extension programs

In countries where high-input Green Revolution agriculture has been promoted for decades as a dominant agricultural practice, the use of pesticides, including highly toxic products, is

[1] The Three Reductions, Three Gains campaign was launched by the government in early 2000, through traditional extension work and mass media, to motivate rice farmers to modify three resource management practices regarding the use of seeds, fertilizers, and herbicides. The campaign focuses on reducing the use of these inputs by addressing farmer's misconception that that high external-inputs would increase productivity.

widespread (Tuyen 1997; Brainerd and Menon 2014). Their impact on women's health, especially on lactating women, can be particularly severe if they do not use any protective clothing when they spray (Tuyen 1997). IPM is a knowledge-based technology that aims to help farmers reduce pesticide applications—in this case, on rice after transplanting. Gender experts in Vietnam (Chi et al. 1995) argue that since women are increasingly applying pesticides themselves due to a shortage of male labor, a reorientation toward IPM extension strategies to better address women's specific roles and needs is needed (Paris 1998a). Furthermore, since women farmers are the principal decision-makers regarding the allocation of household financial resources, they often have a particular interest in learning how to reduce the amount and costs of inputs without reducing yields (Paris et al. n.d).

There is some evidence that when extension programs make targeted efforts to reach women farmers, the likelihood that women participate and adopt the proposed technology is higher. For instance, a gender-sensitive communication campaign implemented as part of the Three Reductions, Three Gains program achieved positive gains. Women were invited directly by the extension staff to attend the training course. A simple invitation made a great difference because the women had never been contacted before. As a result of the training, some of the women who used to grow long-duration rice varieties at the rain-fed sites shifted to short-duration varieties (3 months). They also reduced the number of insecticide sprays, amount of fertilizer used, and number of seeds. They were able to save 350,000–400,000 dong/ha (US $22–25) per growing season from the reduction in the cost of inputs. In villages that grow irrigated rice, women were already growing short-duration varieties. After the training, however, they reduced the amount of urea, increased the dosage of potassium, and reduced the number of insecticide sprays and seed rates. Yields increased during the wet season.

Similarly, in order to reduce gender disparities in access to seeds and technical knowledge, the Cuu Long Delta Rice Research Institute and the International Rice Research Institute proactively involved both women and men in participatory varietal selection and discussion on their preferred criteria. The program was implemented in coastal areas of the Mekong Delta. This approach gave women opportunities to provide input on their own needs and criteria in varietal choice (Chi et al. 2011; Chi et al. 2013).

Another example of successful inclusion of women is related to the implementation of gender-sensitive farmer field schools (FFS). Since the 1990s, FFS have been introduced and

scaled up in Vietnam as a means to disseminate new knowledge-based technologies more effectively (Pingali and Hossain 1998). Because FFS are based on experiential learning and peer-to-peer dissemination, farmers are able to research, adapt, and share knowledge with their peers based on their own adaptive capacity and needs. This is proven to contribute to higher adoption rates and greater sustainability in technology change. The FFS approach has been used to share IPM technologies in many parts of Vietnam, with gender considerations also being taken into account to a certain extent (Tuyen 1997).

A study carried out in 1994 by the Hanoi-based Centre for Family and Women Studies (ibid.) documented successful gender-sensitive practices. First, the Women's Union was involved in the program, especially at the local level, to encourage local leaders to act as facilitators of women's participation. Information campaigns were organized to draw public attention to the problem of women and pesticide use. As part of this campaign, a national contest was organized and broadcast on television. Most important, both women and men were selected as trainers. The degree to which women participated in FFS depended mostly on the perception and initiative of individual staff and trainers. That a significant number of female trainers were hired has influenced the way local leaders perceive women's capabilities. The women trainers act as role models for other women in the village, who find it easier to communicate and talk openly with female trainers.

An Oxfam program also implemented FFS to disseminate a pro-poor production technology package, SRI, as part of an extension partnership between Oxfam America and the Plant Protection Department, which started in 2006. SRI is a sustainable, low external-input production system, widely considered to be appropriate for poor, small-scale rice farmers, including women. The system comprises a number of distinctive practices concerning the transplanting of seedlings, water management, weed control, and soil aeration, together with the use of organic nutrients. These methods have proven to increase yields while consuming less water and reducing the need for chemical fertilizer and pesticide, leading to an overall increase in productivity (Glover 2010). As a result of the program, SRI farmers, across 22 provinces, have increased yields by 9–15% while reducing use of inputs compared with conventional practice. They reported using 70–75% less seed, 20–25% less nitrogen fertilizer, and 33% less water. This has resulted in additional income of US $95–$260/ha per crop season. Farmers also reported positive changes to the environment and their health as a result

of lower use of pesticides, herbicides, and chemical fertilizers (Castillo, Nguyet, and Pfeifer 2012).

Oxfam prioritized working directly with women farmers, who made up 70% of participants in SRI FFS (ibid.), thereby creating a women-dominated peer-learning structure. Social and gender empowerment was a critical outcome of the program: Learning about SRI has given women greater confidence both at home and in public. Also, women farmers have proven to be better at peer training than men. After participating in an FFS, each woman helped, on average, five to eight other farmers adopt SRI principles, whereas every male participant in an FFS helped one to three other farmers. According to a study evaluating SRI activities implemented under the German-funded "Poverty Alleviation in Rural Areas" project and the International Fund for Agricultural Development-funded "Improving Market Participation of the Poor" project, the establishment of female "SRI transplanting teams" as service providers was more effective, since transplanting is an important component of the program usually done by women (Dill et al. 2013).

9. Gender and social equity implications of technology change

Since the 1960s, many Asian countries have introduced new Green Revolution rice-producing technologies such as high-yielding varieties, irrigation, machinery for land preparation, harvesting, and threshing to boost rice production and productivity. Historically, these technologies have been shared mainly with male farmers; the gender implications of technology change have been largely overlooked. Yet technology change can bring deep social and gender transformations. It is recognized that technologies that alter the demand for labor in particular will impact women and men differently (Paris 1998a).

A typical trend in the Asian region is that although some technologies have increased the workload of rural women, other technologies have relieved women's labor by performing activities that were traditionally female dominated (ibid.). The effect of technological change on the demand for male- and female-hired labor is particularly relevant for landless—and near landless—households who rely mostly on wage employment for income.

Analyses conducted in the context of Vietnam have demonstrated that women and men often have different technology needs, although these are rarely considered in technology research and innovations. For example, a study on farmers' participation in rice varietal selection reveals that the criteria used for selecting rice varieties often differ by gender (Chi 2007). Male farmers value rice traits associated with the adaptation to abiotic and biotic environmental conditions, whereas women are more concerned about the characteristics related to the postharvest phase, such as quality and the market value. This example shows the necessity of assessing gender-specific trait preferences in breeding programs before introducing new seeds.

Since the 1980s, Vietnam has introduced several machines for land preparation and threshing. For instance, plastic row/drum seeders have been promoted as reducing seed rates and consequently production costs. Paris and Chi (2005) showed that the new technology has had a differential impact on different groups of rural women, depending on their socioeconomic status and whether they engaged in farming as family or wage labor.

In the Mekong Delta, women participate in most rice operations along with men but bear exclusive responsibility for gap-filling, hand weeding, and harvesting. Poor women from landless households earn an important part of their income by working as hired labor on other farms. As a direct result of the introduction of drum seeder technology, it is estimated that 97% of landless women lost their jobs in gap-filling and hand weeding due to the reduced demand for hired labor in these operations. Almost half of them (43%) found it difficult to find alternative income-generating activities. Women's substantive income loss had significant negative consequences on family food security and health.

Conversely, women from better-off households reaped the benefits of reduced drudgery from adopting drum seeders. They were able to spend more time with children and engage in more remunerative income-generating activities, such as animal raising, vegetable planting, and small trade. They also had more time for leisure, personal care, and social activities, thus enjoying a higher quality of life.

According to Paris (1998b), the negative impact of technology change on poor landless women could be mitigated by enabling them to have direct access and control over row seeder technologies. In this way, they could provide service to other farmers. Yet dissemination efforts barely reach rural women. As already pointed out, women are generally excluded from

extension activities. Furthermore, local gender norms in agriculture tend to associate men with the use of machinery.

A study assessing the factors affecting mechanization in rice harvesting and drying finds that participation in training sessions, education level, farm size, and availability of financial capital are the most critical factors in adoption of the technologies (Chi 2010). Intriguingly, the study found that female-managed farms were more likely than male-managed farms to adopt mechanization. Harvesters and dryers are labor-saving technologies that reduce rice loss and increase rice quality, thereby improving income. They can enable women (family farm and wage) workers to perform their operations more effectively and alleviate drudgery.

By way of contrast, Chi (2008) points out that the low popularity of harvesting machinery in the Mekong Delta is mainly because it is too costly and too heavy to be moved from field to field. In many cases, the design of harvesters is unsuited to the characteristics of rice farms in Vietnam (i.e., small fields, narrow pathways, soft and muddy soil). The potential negative impact of the dissemination of harvesters on women's wage labor should also be assessed.

10. Conclusion

Despite the significant contribution that women in both South and North Vietnam make to rice production, the design and transfer of agricultural technology and extension services are performed with a male farmer in mind, thus leaving women's specific roles and needs along the rice value-chain unaddressed. Frequently, women are not explicitly targeted by extension programs because they assume that men, considered to be the principal rice producers, will transfer skills and technologies necessary to women.

Technology research and innovations rarely consider the roles of women during the design phase and fail to assess likely outcomes of implementation. This review showed that a technology such as row seeders can relieve the drudgery of better-off women, while displacing the labor of poorer and more vulnerable women. Assumptions that such women will be able to adapt effectively by changing how they generate incomes are unwarranted; the actual effects of technology change up gender and social equity are under-researched. Suggestions for future research are shown in box 1.

Box 1. Recommended actions for agricultural research and extensions institutions

- Design, validate, and disseminate suitable varieties (stress tolerant, high-yielding, short duration) and associated improved crop and resource management practices to increase cropping intensity, productivity and income, and to diversify livelihoods.
- Identify, test, and evaluate technologies that can increase returns to labor, reduce drudgery, and meet labor requirements in anticipation of future trends (e.g., ageing labor force, increasing work burden on women left behind to manage family farms, and lack of interest of the younger generation in rice farming).
- Acknowledge the roles of principal women as farmers and de facto farm managers by enhancing their technical knowledge of all aspects of rice production and processing.
- Promote the involvement of women farmers by increasing their representation (at least 30% of all participants) in farmers' meetings, on-farm demonstration trials, and participatory varietal selection in rice breeding.
- Target all women farmers, particularly women heads of households and de facto farm managers, as direct beneficiaries of training programs in technologies that can lead to efficient management and use of inputs, reduce input costs, and raise profits. These technologies include improved rice varieties, efficient nutrient and pest management (weeds, insects, disease), water management, and production of quality seed of varieties suitable to specific agro-ecological conditions.

Source: Paris, Rola-Rubzen, et al. n.d.

Policymakers, program planners, and researchers need to consider gender and social equity when developing and promoting new technologies. This is particularly urgent, considering that increasing rates of male out-migration often leave women as principal farm managers. It is clear from this brief review that an important knowledge gap exists on current gender issues in the rice value chain, particularly in relation to the need to address climate change through mitigation and adaptation.

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