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Understanding Men's and Women's Access to and Control of Assets and the Implications for Agricultural Development Projects

A Case Study in Rice-Farming Households in Eastern Uttar Pradesh, India

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ABSTRACT

This research was undertaken to understand gender issues on the distribution of, access to, and control over major assets of rice-farming households as well as the effects of technologies promoted by an Agricultural Research for Development (AR4D) project in selected villages in eastern Uttar Pradesh (EUP), India. The Cereal Systems Initiative for South Asia (CSISA), which started in 2009, is a collaborative AR4D project of the International Rice Research Institute, International Maize and Wheat Improvement Center, International Livestock Research Institute, and International Food Policy Research Institute. The project has the objectives of decreasing hunger and malnutrition and increasing the food and income security of resource-poor farm households. The project takes a multipronged approach through the accelerated development and inclusive deployment of new varieties and sustainable management technologies and policies. As part of research activities, in 2010, baseline socioeconomic surveys described farming practices and identified the performance and constraints to adoption of various technologies. However, information on ownership and control of assets was not disaggregated by gender, despite the fact that asset ownership may affect who participates in and who benefits from the project activities. Therefore, additional qualitative research and midline surveys of 318 households in 18 villages were conducted in EUP project areas in India.

Findings reveal that although no differences between genders are reported in the percentage of those who have access to major assets such as farmland and dairy animals across caste, differences in quantity and value are wide. Overall, the gender wealth gap for each of the major assets indicates that the gender gaps are more severe than suggested by the ownership incidence measures alone. Women do not own production and postharvest machinery or equipment. An analysis of the effects of the adoption of direct-seeded rice and mechanical paddy transplanter on men and women reveal that the impacts on women are quite different depending on whether they belong to a lower or upper caste. That gender impacts are mediated by caste is a very important issue that should be considered in an impact analysis of agricultural technologies. Findings also show that labor-saving technologies also have impacts on women's time and income generation. In anticipation of labor displacement and income (livelihood) owing to wide-scale use of large machinery through service providers, governments should increase women's ability to earn agricultural and nonagricultural income through agribusiness ventures or microenterprises. However, proper guidance and training should be given by governmental and nongovernmental organizations to females through established women's self-help groups. Group-based programs targeting women have greater potential to address gender relations within the household and society than programs targeting women as individuals.

Keywords: gender, assets, eastern India, rice, agricultural machinery

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The Cereal Systems Initiative for South Asia (CSISA) is implemented jointly by the International Maize and Wheat Improvement Center (CIMMYT), International Food Policy Research Institute (IFPRI), International Livestock Research Institute (ILRI) and International Rice Research Institute (IRRI), in addition to WorldFish in Bangladesh. The project is supported by Bill & Melinda Gates Foundation and the U.S. Agency for International Development (USAID). The views expressed in this publication are those of authors and do not necessarily reflect the views of the implementing partner organizations, the foundation or USAID.

ABBREVIATIONS AND ACRONYMS

AR4D	Agricultural Research for Development
CIMMYT	International Maize and Wheat Improvement Center
CSISA	Cereal Systems Initiative for South Asia
DSR	direct-seeded rice
EUP	eastern Uttar Pradesh
FGD	focus group discussion
GAAP	Gender, Agriculture, and Asset Project
IFPRI	International Food Policy Research Institute
ILRI	International Livestock Research Institute
IRRI	International Rice Research Institute
LLL	land laser leveler
MGNREGA	Mahatma Gandhi National Rural Employment Guarantee Act
MPT	mechanical paddy transplanter
NGO	nongovernmental organization
OBC	other backward caste
SC	scheduled caste
WSHG	women's self-help group

1. INTRODUCTION

A growing body of empirical literature from both developed and developing countries shows that the distribution of assets within the household is critical to household and individual well-being, as well as to achieving outcomes such as food security, nutrition, and education (Deere and Doss 2006; Quisumbing 2011). Persisting gender inequalities in access to agricultural assets, inputs, information, and services have hampered women's potential economic contributions in agriculture (World Bank, FAO, and IFAD 2009). Understanding the gender asset gap provides a stronger and much firmer basis for understanding gendered economic inequality and women's empowerment as compared to focusing solely on income or wages and may be a more powerful indicator of progress than others toward Millennium Development Goal 3 which is "to promote gender equality and empower women". The Millennium Development Goals (MDGs) are eight international development goals that were established following the Millennium Summit of the United Nations in 2000, following the adoption of the United Nations Millennium Declaration. Besides being a measure of opportunities (net wealth), ownership of assets is critically important to women's bargaining power and hence their economic empowerment (Doss, Grown, and Deere 2008).

Asia has many agricultural research for development (AR4D) programs. The Cereal Systems Initiative for South Asia (CSISA) project, which started in 2009, is one such AR4D effort with the broad objectives of decreasing hunger and malnutrition and increasing food and income security of resource-poor farm households. CSISA takes a multipronged approach through the accelerated development and inclusive deployment of new varieties and sustainable management technologies and policies. However, CSISA did not initially mainstream or design program activities to address gender-differentiated constraints to technology adoption. As part of its research activities, in 2010, baseline socioeconomic surveys were conducted to describe farming practices and to identify the performance of various resource-conserving technologies and farmers' constraints to adoption. These baseline socioeconomic studies collected sex-disaggregated labor use in rice and wheat production in several study sites in eastern Uttar Pradesh (EUP), Tamil Nadu, and Bihar. However, information on ownership and control of assets was not disaggregated by gender (Pede et al.2013). Therefore, critical gaps still existed on gender disparities in asset distribution and control of beneficiary households, on the consequences of agricultural technologies on the gender gap in assets, and on identification of strategies within the CSISA project, which can strengthen women's access to productive assets (Meinzen-Dick et al. 2011) in this project.

The paper aims to fill in the critical gaps in research on gender disparities in access to and control over key assets. Understanding the gendered nature of asset distribution and how this influences individual and household livelihoods is essential to designing effective AR4D interventions and policies. This understanding will help strengthen women's access to and control over key agricultural assets within the context of CSISA, focusing on EUP in rural India. More specifically, the objectives of this study are to (1) identify gendered distribution and control over major assets; (2) assess the impact on the gender asset gap of adopting CSISA-promoted technology; (3) recommend strategies CSISA can use to strengthen women's access to and control over key agricultural assets. Such access and control can foster improved livelihoods, food security, and well-being.

The next section presents the background of the research areas, followed by Section 3, which presents a guiding framework for the study, drawing on work from the Gender, Agriculture, and Assets Project (GAAP). Section 4 describes the methods of data collection. Section 5, the major part of the paper, presents results and discusses the importance of assets, gender gaps in access to and control of assets, acquisition of assets, and the value of assets. Section 6 discusses the CSISA-promoted technologies and gender and asset linkages. Section 7 presents the summary and conclusions of this study. Finally, Section 8 recommends strategies to strengthen women's access to and control of productive assets within the CSISA project.

2. BACKGROUND OF THE RESEARCH AREAS

Agroecological Characteristics

This study focuses on the EUP hub, representing one of the four major regions of the Indo-Gangetic Plain. EUP is well known for its potential for increasing cereal production, especially rice and wheat. EUP contributes about 30 percent of total food grain production of the state. From the baseline socioeconomic surveys, more than 92 percent of all farm households cultivate rice during *kharif,* or monsoon, season (June to September). Nearly 82 percent of the farmers possess holding sizes of 0.39 hectares (ha) on the average, and 12 percent have 1.41 ha on the average. Village censuses in the districts of Maharajganj, Deoria, and East Champaran showed that 4 percent, 2 percent, and 10 percent, respectively, of the total households are landless. The irrigation status of agricultural land in EUP indicates that about 40 percent of net sown area is entirely rain dependent and the remaining 60 percent is irrigated. The majority of the region is occupied by rice–wheat cropping systems with a cropping intensity of 150 percent. The major crop rotations in this study area are rice, with noncereal crops such as pulses, oilseeds, potatoes, and sugarcane; rice–wheat; and wheat–maize (Pede et al.2013).

Social and Cultural Norms

Who within a household has access to which resources and for what purposes is conditioned both by the broader sociocultural and economic context as well as by intrahousehold allocation rules. In EUP, the gender gap in access to assets is largely dictated by social norms, which extend to all dimensions of agriculture. Customary practices often restrict women's ability to own or operate land, the most important asset for households that depend on agriculture. Social and cultural norms, particularly the caste system, still predominate and dictate many practices to maintain the status quo. For example, dowry is still practiced, which increasingly puts stress on the financial status of families. There are cases wherein farmlands are sold or mortgaged to meet the expenses incurred during a daughter's marriage. Social inequalities in access to assets (biased toward the upper castes and large farmers) exacerbate gender inequalities in access to and control of resources and support services among the lower castes. Widely accepted social and cultural norms and practices define gender roles and responsibilities in every sphere of activity. They may define what category of persons cannot intermarry, the gender division of labor within the home (for example, household work and child care are usually seen as women's responsibilities); the gender division of labor in crop and livestock production; whether women should at all work outside the home (female seclusion norms restrict this among Hindu and many Muslim communities); who can participate most in household decisionmaking; and by what criterion society's resources should be shared (Agarwal 1997).

Gender Roles in Crop and Livestock Production

In EUP, caste and gender roles are important and intertwined in crop production and livestock management. In all rice environments, women from the upper caste do not work in the fields owing to *purdah* (social seclusion). However, they manage postharvest and processing activities, which are all done within their homesteads. Exceptions are those women-headed households who have to supervise laborers engaged in crop production. Upper-caste households are dependent on hired workers (mostly lower castes). On the other hand, women from the lower caste, particularly the other backward castes (OBCs) and scheduled castes (SCs), do most of the field activities on their own farms as well as work as hired workers on other farms. They can move about freely, and they work as daily wage laborers when work is available, putting them in the position of being important providers (Paris et al. 2000).

In rice production in EUP, men prepare the land for seedbed and also the fields (by tractor). They are also responsible for broadcasting fertilizer, spraying pesticides, and irrigating the fields. Women's tasks are applying farmyard manure on the fields, uprooting rice seedlings from the seedbed, transplanting, hand weeding, harvesting, and threshing. In wheat production, men prepare the land with the use of a tractor–cultivator and a rotavator and also broadcast wheat seeds. Women broadcast wheat seeds when men are not available. Sowing wheat using the zero-till machine connected to a tractor is mainly done by men. Use of a combine is common for harvesting and threshing wheat. When harvesting and threshing operations are not mechanized, more women than men perform these operations. Postharvest and processing activities such as parboiling rice, drying, winnowing, and selecting and storing seeds are women's tasks.

Livestock production is an integral component of the complex, diverse, and risk-prone nature of agriculture in EUP. Livestock play a very important role in household income and livelihood. Raising livestock is strongly associated with social and economic status, which dictates gender roles. The Yadav castes, which were famous for raising dairy cattle (especially buffaloes) as well as bullocks, belong to the OBC category. Although caste and associated occupation have changed through time, the Yadavs continue to raise livestock for milk production. With the exception of widows, divorcees, and those separated, women from the upper caste rarely take care of livestock. In contrast, women from the lower caste perform all activities such as collecting green fodder, preparing the fodder (manually or using a fodder cutting machine), feeding the animals, cleaning the animal sheds, collecting farmyard manure and applying it on the fields, and collecting and drying cow dung for household fuel. Milking dairy animals is done by both males and females. More women than men sell milk within the homesteads. But men are more engaged in selling milk in the market. Women from the lower castes and minority communities raise small animals, especially goats, for additional income (Paris et al. 2000).

Livelihood Strategies

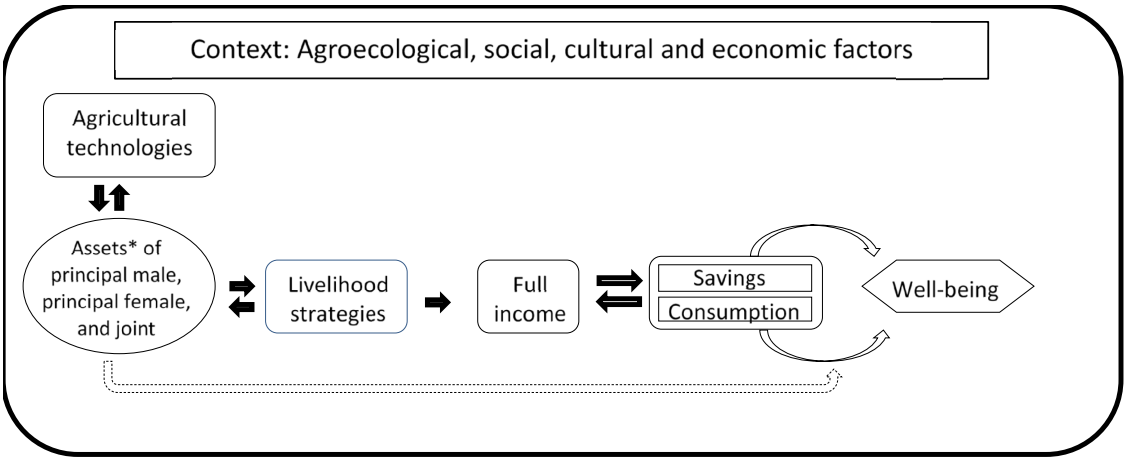
The economy of EUP is largely agrarian. Based on the CSISA baseline socioeconomic surveys, small and marginal farming households are engaged in several livelihood strategies. The most important income sources are from farm (crop and animal production) followed by nonfarm (pensions, business, services) and then off-farm (agricultural wages and payment in terms of harvest share) activities. Remittances contribute to total household income for small and marginal farming households but less as a percentage of total income for large farmers. Remittances, mostly from male migrants, help purchase farm inputs, pay for service providers of machinery, and cover food and household expenses. Men work as agricultural and nonagricultural labor within and outside the village. Poor women are more engaged in off-farm and nonfarm jobs. Income from businesses contributes more to the income of medium farmers than it does to small and large farmers. The contribution of income from livestock activities is more important to small and marginal farming households. Poor women earn income from taking care of small animals (Pede et al.2013; Paris, Singh, and Luis 2005).

3. GUIDING FRAMEWORK OF THE GENDER, AGRICULTURE, AND ASSETS PROJECT (GAAP)

This study was conducted in 2011 under the GAAP coordinated by the International Food Policy Research Institute (IFPRI) and the International Livestock Research Institute (ILRI). We have adapted the conceptual framework by Meinzen-Dick et al. (2011), highlighting the role of agricultural technologies rather than shocks. Here, we consider agricultural technologies as the drivers of change that will affect (positively or negatively) men's and women's access to and control of assets, leading to changes in livelihood strategies and income, which will affect individual consumption, savings and investment, and well-being. Due to the limited period, this study was able to assess the perceived outcomes of the project-introduced mechanical paddy transplanter (MPT) and direct-seeded rice (DSR), but not changes in livelihood strategies and income due to a reduction in gender inequalities in access to and control of assets.

The first element of this framework is the context, which includes agroecological, social, cultural, and economic characteristics (Figure 3.1). The agroecology determines the crops grown, varieties, cropping systems, farming practices, and livestock production. Even if individuals are living in the same household, men and women typically experience a given context differently based on their roles and responsibilities and other social, economic, and cultural factors. For example, cultural norms may define roles and responsibilities for men and women, and in some cases men and women are treated differently by laws and legal provisions. Agricultural technologies may affect ownership and control of assets (agricultural and nonagricultural), which in turn may affect the adoption of agricultural technologies. Access to and control over assets are the key determinants of individual agency. Within a household some assets are owned by women, some owned by men, and others owned or used jointly. The distribution of assets in a particular household will influence how the household and its members use their assets to further their livelihoods, consumption, savings, and well-being or use their assets to get out of deeper poverty traps owing to loss of other assets. Some assets like capital (from remittances from nonfarm jobs, savings, or pawning of jewelry) can be built into the process of carrying out livelihood strategies (farming) that contribute to full income, savings, consumption, and well-being. The broken lines in the figure, from assets to well-being, show how gender and assets directly influence the well-being of households and family members.

Figure 3.1 Understanding the linkages between gendered asset distribution, livelihoods, well-being, and women's empowerment



Source: Adapted from the GAAP framework (Meinzen-Dick et al. 2011).
Note: *Assets include both tangible and intangible assets. Principal males and principal females within the same household may have differentiated or joint access to and control of assets, agricultural technologies, livelihood strategies, income, and savings.

4. METHODOLOGY AND DATA COLLECTION

In 2010, as part of CSISA's research activities, baseline socioeconomic surveys reviewed farming practices and the performance of various technologies, as well as constraints to their adoption. However, information on ownership and control of assets was not disaggregated by gender, even though asset control may affect who participates in and who benefits from the project activities. Therefore additional qualitative research and midline surveys were conducted in three districts with large areas devoted to rice-wheat farming systems: Maharajganj, Deoria, and East Champaran in EUP. The CSISA baseline and midline socioeconomic surveys were conducted in the same districts. Village profiles from the selected villages were obtained from the CSISA baseline studies. The sampling scheme was designed as follows: From the complete list of districts where CSISA is currently active, we selected three districts per hub after discussing with the hub managers and national partners. The aim of this purposive district selection was first to capture the major cropping patterns prevailing in the respective hubs, and second to consider the pattern of resource conservation technology (RCT) diffusion. A complete list of CSISA intervention villages, along with their respective subdistricts (blocks in India), in each of the selected districts was obtained from the four hub managers. From this list, three CSISA-active subdistricts were randomly selected for each selected district. Subsequently, one CSISA intervention village and one non-CSISA village were randomly selected. The selection of the non-CSISA villages was drawn from a complete list of villages obtained by the National Census Bureau. The subdistrict head offices provided the village lists. Data were later analyzed according to farm size and social groups (caste). The qualitative and quantitative methods of data collection are discussed below.

Qualitative Methods

In two villages in each district (total of six villages), 12 focus group discussions (FGDs) on asset-related information were conducted separately with men and women from upper-caste and lower-caste groups. These FGDs provided information on what assets are commonly owned by farming households in the villages and helped to determine the gender-asset data collection methods.

Following the FGDs, we developed sets of pictures of assets and pretested a guide or form for in-depth interviews on the importance of assets in the same villages where the FGDs were conducted. A team of trained local researchers (males and females) led by a female Indian rural sociologist conducted the in-depth interviews of 10 households per sample village, for a total of 60 households. Within the same household, the principal male and principal female were interviewed separately. These households were also included in the midline surveys conducted in 2012. A set of 35 pictures of assets was given to each respondent. Each respondent was then asked to identify the assets he or she owns or has access to and then rank these assets by importance (1 as most important and 10 as least important) for income generation. We used pictures of assets because a majority of the female respondents, particularly from the lower castes, were illiterate, shy, and did not have any experience with being interviewed, especially on sensitive issues such as ownership and control of assets between husband and wife. These pictures also made the activity more lively and interactive. Stories and opinions of women were also used to explain why asset gaps exist between social groups and between men and women.

We used the Wilcoxon signed-rank test (Wilcoxon 1945)[1] to examine whether significant differences exist in the importance ranking between husbands and wives in the same households.

However, only 51 households out of the 60 samples were included in the analysis since the requirement of this test is that both husband and wife should have paired values, in this case, common asset.

[1] The Wilcoxon signed-rank test is a nonparametric statistical test used to compare two related samples, matched samples, or repeated measurements on a single sample to assess whether their population mean ranks differ.

Quantitative Methods

In 2012, midline surveys were conducted to collect gender disaggregated data on household composition and detailed assets. . A subset of 318 households were resurveyed in EUP out of the original sample of 324 households (we dropped 6 households because of lack of information and outliers). Of the sample households, 99 and 219 households belonged to the upper caste and lower caste, respectively. Because of the project's focus, the baseline sample included only households with land, so all landless laborer households are excluded from this analysis. The principal man and woman were shown pictures of assets and asked "Who owns this asset? Who controls it (decides to dispose of it)? How was the asset acquired? What is the value of the asset if you sell it?" We examined the share of the primary male (husband) only, the primary female (wife) only, and the couple together who has access to and controls the specific asset—for example, farmland, dairy animals, small livestock—by social class (upper caste and lower caste).

This measure tells us not only the differences in the incidence of ownership between social groups and between husband and wife but also whether the asset is widely owned or not. However, while husband and wife may own assets individually or jointly, it does not tell us the quantity and quality (value) of the asset. Thus, aside from calculating the gaps in access to and control of assets (by social groups and gender), we also calculated the wealth gaps by estimating the current value of each asset. This refers to the amount that they would receive if they were to sell the item on the day of the interview. Because of relatively low adoption of CSISA technologies and because the 2010 baseline surveys did not contain gender disaggregated information on assets, the findings are useful for diagnosis, but do not reflect changes in assets attributable to the project.

5. RESULTS AND DISCUSSION

Characteristics of Respondents

On the average, husbands among the upper castes are slightly older (51 years old) than those from the lower castes (48.74). Wives are younger than their husbands. A wide gap in access to education is seen by caste and gender. Among the upper castes, husbands have almost nine years in school and wives have six years. In contrast, among the lower castes, husbands have five years and wives have only two years in school. The disparity in access to education is also evident across caste and gender among the elderly and the middle-age group. However, the gap between caste groups and gender has narrowed among the younger family members (6–15 years old). Across castes, husbands have extensive farming experience (about 25 years). As expected, wives among the lower castes have longer farming experience (15 years) since they provide labor on most of the rice-farming operations. Although wives among the upper caste do not do field work, they have 9 years of farming experience because farming is their major source of livelihood. Households have two migrant members, on average. Migrants are predominantly males who work outside their villages on a seasonal or long-term basis and send remittances back home (Table 5.1). There is also disparity in land distribution by social groups. As shown in Table 5.2, the majority (89 percent) of the lower castes have marginal size of landholdings. Only 2 percent of them have medium and large landholdings. In contrast, a higher proportion (20 percent) of the upper caste have medium and large landholdings. The size of farmholdings is one of the factors to consider in the promotion of large agricultural machinery to increase the returns to land and labor.

Table 5.1 Socioeconomic characteristics (average) of the family members, midline surveys, 2012

	Upper caste		Lower caste	
Characteristics	**Mean**	**Standard error**	**Mean**	**Standard error**
Age of husband	51.35	1.40	48.74	0.90
Age of wife	43.55	1.29	43.57	0.90
Education of husband	8.59	0.58	5.01	0.39
Education of wife	5.55	0.52	1.96	0.28
Farming experience of husband	26.35	1.45	24.89	1.01
Farming experience of wife	9.07	1.11	14.55	0.87
Number of migrants[a]	1.54	0.14	1.59	0.10
Other members				
Education of males 6–15 years	5.56	0.42	5.49	0.34
Education of females 6–15 years	6.60	0.55	5.95	0.43
Education of males 16–54 years	11.66	0.31	8.72	0.26
Education of females 16–54 years	8.30	0.44	4.91	0.31
Education of males 55 years and over	6.36	0.66	3.60	0.67
Education of females 55 years and over	3.00	0.65	1.02	0.62

Source: Household surveys, GAAP–IRRI/IFPRI/ILRI project, EUP, India (2012).
Note: [a] Migrants are household members who left the village and had residence in another place for at least three continuous months and they send remittances to the household members left behind in the village.

Table 5.2 Land distribution by social class and farm size, midline household survey, 2012

Farm group	Upper caste				Lower caste			
	N	**%**	**Mean**	**Standard error**	**N**	**%**	**Mean**	**Standard error**
Marginal (<1.0 ha)	64	65	0.44	0.03	195	89	0.30	0.02
Small (1.0–2.0 ha)	15	15	1.47	0.06	18	8	1.32	0.07
Medium (2.0–3.0 ha)	7	7	2.36	0.14	3	1	2.29	0.13
Large (>3.0 ha)	13	13	6.47	1.08	3	1	5.89	2.12
Total	99	100	1.52	0.25	219	100	0.49	0.06

Source: Household surveys, GAAP–IRRI/IFPRI/ILRI project, EUP, India (2012).
Note: ha = hectares.

Importance of Assets

Ownership of assets, as defined by the respondents, includes any properties they inherited, purchased, or received as a gift as in the case of land, houses, machinery, animals (dairy animals, small livestock), jewelry, motorcycles, bicycles, and so forth that they can convert into cash during times of emergency or in the future. These assets can be developed, improved, and transferred across generations (as with land or a house). They generate flows, as well as additional stock, for example as with large and small livestock. These assets generate income and are important in sustaining individual livelihoods and providing a source of security. In some cases, an individual is willing to risk his or her life to protect an asset like farmland, dairy animals, and jewelry.

Table 5.3 shows the summary of important assets that are commonly identified by the husband and wife in the same household. These assets are farmland and dairy animals. The important nonagricultural assets are *pucca* house (made of durable materials), mobile phone, jewelry (gold), and transport means (bicycle). Results show no significant difference in the importance ranking of key assets between husband and wife except for gold jewelry and bicycles. Wives give a higher ranking than their husbands do on gold jewelry, while husbands give more importance than their wives do to bicycles. Gold jewelry is the only asset that a wife can own, which can easily be carried, sold, or pawned in in times of distress. The bicycle is the most inexpensive, available, and low-maintenance means of transport for the different needs of family members (for daily commuting of men to the nearby cities for nonfarm jobs, bringing children to school, marketing, and other needs).

Table 5.3 Ranking of importance of key assets by husband and wife in the same household

Assets	n	Mean rank		Wilcoxon Signed Rank test (Z)
		Husband	Wife	
Farmland	51	2.33	2.41	–0.942
Dairy animals	33	4.36	4.12	–0.069
Pucca house (bricks)	46	3.22	3.33	–0.374
Mobile phones	43	6.30	6.42	–0.681
Gold jewelry	34	6.65	4.56	–3.386***
Silver jewelry	30	7.03	6.20	–1.542
Bicycle	35	5.51	7.26	–3.261***

Source: In-depth interviews of husband and wife in 51 farming households, GAAP-IRRI/IFPRI/ILRI Project (2012).
Note: *** indicates significance at 1 percent. The lower the ranking, the more important it is. The Wilcoxon signed-rank statistic follows the Z distribution when the sample size is greater than 30 (Wilcoxon 1945). Distribution of Assets among Sample Households

Except for farmland, a gap exists in ownership of assets between the upper and lower castes. As shown in Table 5.4 a higher proportion of the upper caste has agricultural assets (dairy animals, tractor, cultivator, water pump) and nonagricultural assets (*pucca* house, television, radio, mobile phone, radio, jewelry, bicycle, and motorcycle). Thus, they are more likely to adopt technologies that can increase farm productivity and income. In contrast, the lower castes do not own agricultural assets (tractor, cultivator, rotavator, and mechanical thresher) because they do not have the capital or credit to purchase them. Moreover, they are not set up to optimize the use of expensive machinery for their marginal and small landholdings. Very few households own small livestock. However, a higher proportion (19 percent) of the lower-caste households own goats compared with the upper caste (6 percent). A higher proportion of the upper-caste households than the lower-caste households owns a *pucca* house than *kutcha* house, mobile phone, jewelry, and a bicycle.

Table 5.4 Inventory of agricultural and nonagricultural assets of sample households by social class

	Upper caste		Lower caste	
Asset	**N**	**%**	**N**	**%**
Agricultural				
Farmland	97	98	209	95
Dairy animals	52	53	96	44
Small livestock	6	6	42	19
Tractor	15	15	3	1
Cultivator	14	14	3	1
Rotavator	2	2	0	0
Combine	4	4	0	0
Thresher	9	9	0	0
Water pump	32	32	49	22
Nonagricultural				
Kutcha house	39	39	78	36
Pucca house	84	84	168	77
Television	44	44	68	31
Radio	15	15	19	9
Mobile phone	89	89	168	77
Gold jewelry	87	87	166	76
Silver jewelry	89	89	173	79
Bicycle	87	87	171	78
Motorcycle	44	44	39	18

Source: Household surveys, GAAP–IRRI/IFPRI/ILRI project, EUP, India (2012).
Note: Of the 99 and 219 upper- and lower-caste households, respectively; the rest of the households rent their lands.

Access to (Owned or Rented) Agricultural Machinery and Equipment

Having access to an agricultural asset may mean having ownership or renting. After asking the question, "Do you have land or machinery?" we asked, "If yes, do you own or rent it?" Those who use the land or machine through rental arrangements do not have control of its use and disposal. The service providers decide on the date and time the machine can be rented out to the farmer and also determine advance payments. Thus, during peak crop operations when labor is scarce, crop management and consequently profits and income can be negatively affected.

As shown in Table 5.5, both upper castes and lower castes rent agricultural machinery (four-wheel tractor, tine cultivator, disc harrow, rotavator, mechanical thresher, combine, and *bhusa* reaper) rather than purchasing their own, owing to the high costs of these machines. However, a few of the upper castes own a disc harrow, rotavator, and seed drill. The lower castes do not own or rent a seed drill, MPT, and dehusker (maize). At the time of the survey, only one farmer from the upper caste had access to an MPT on a rental basis. Farmers in general lack the capital needed to purchase and control large machinery; thus adoption will depend on the availability of service providers, famers' access to large capital, and government support. No women own any machinery or equipment for production and processing crops such as paddy, wheat, and corn. Thus, it is important for the CSISA project to develop strategies and encourage policies that promote agricultural machinery and equipment for production and postharvest operations particularly for small and marginal farming households and women who can use and have some control of the management of these assets.

Table 5.5 Distribution of farming households who own and rent agricultural machinery and equipment

Machinery and equipment	Upper caste N	Upper caste Own (%)	Upper caste Rent (%)	Lower caste N	Lower caste Own (%)	Lower caste Rent (%)
4-wheel tractor	74	15	85	174	3	97
Tine cultivator	91	14	86	209	2	98
Disc harrow	13	8	92	31	0	100
Rotavator	18	11	89	57	0	100
Diesel pump	93	32	68	206	22	78
Electric submersible pump	2	100	0	2	0	100
Monoblock pump	1	100	0	2	100	0
Diesel generator	2	50	50	4	50	50
Seed drill	5	60	40	0		
Mechanical transplanter	1	0	100	0		
Pesticide sprayer	0			2	0	100
Knapsack sprayer	48	35	65	105	27	73
Thresher (power)	71	13	87	123	0	100
Thresher (pedal)	16	6	94	20	0	100
Combine harvester	22	18	82	68	0	100
Dehusker (maize)	7	86	14	0		
Bhusa reaper	*4*	0	100	*24*	0	100
Fodder chopper	41	88	12	48	96	4

Source: Household surveys, GAAP–IRRI/IFPRI/ILRI project, EUP, India (2012).
Note: N = number of households who possess the asset.

Gendered Distribution and Control over Major Assets

The benefits to asset ownership may differ depending on whether the asset is owned individually or jointly. Individual ownership may confer more rights over the asset; joint ownership implies that one of the owners may not be able to make the decisions alone. Owning multiple assets jointly may provide greater protection from vulnerability than owning a single asset individually (Deere and Doss, 2006). Having assets in the hands of women empowers them; improves well-being at the individual, household, and community levels; significantly enhances their decisionmaking capabilities; and has a positive impact on the health and welfare of children.

Agricultural Assets

Farmland

Land is considered to be the most important asset of farming households. Land is valued by a household not only as a current productive asset but also as security for the future and as a safety net. Farmland serves as the major source of livelihoods, provides food security, is a status symbol (if the farmholding is large), and can be converted into cash, if necessary.

Our findings show that the husbands or principal males are the major owners of the farmland. Among the upper castes, the wives or principal females do not have land titles under their names. A low proportion (2 percent) of the wives or principal females in the lower castes are sole owners of farmland. These findings confirm the continuity of the deeply embedded social norms, which favor males in terms of landownership. However, 34 percent of the households reported that their lands are jointly owned by the husband and wife (Table 5.6a). Although the land title is under the husband's name, the wife jointly with the husband also uses the land by providing labor in most farming operations and participates in decisions to sell or rent out the land to sustain their livelihood. Wives, except for widows, neither have

sole control of land nor can make decisions alone in the disposal of land because the land title is registered under the husband's name (Table 5.6b). The husband, as the officially registered owner of the land, is identified as the farmer and automatically becomes the recipient or beneficiary of government programs. This restricts the opportunity of women farmers, especially those that have migrant husbands, to receive farm inputs and participate in training activities. Lack of rights to landownership limits women's potential ability as farm managers in increasing crop productivity and the returns to land. For example, under the Stress Tolerant Rice for South Asia and Africa (STRASA) project, the National Food Security Mission[2] in India, distributed seeds to more than 180,000 farmers for demonstration trials of new, high-yielding stress-tolerant rice varieties. Of these participants only 13 percent were women farmers, because they are not the officially registered landowners (Dar 2013).

Table 5.6a Gender gaps in ownership of agricultural assets

	Upper caste				Lower caste			
Asset	N	Husband (%)	Wife (%)	Joint (%)	N	Husband (%)	Wife (%)	Joint (%)
Farmland	97	66	0	34	209	64	2	34
Dairy animals	52	54	10	37	96	52	3	45
Small livestock	6	33	33	33	42	29	21	50
Tractor	15	80	0	20	3	100	0	0
Cultivator	14	79	0	21	3	100	0	0
Rotavator	2	50	0	50	0			
Combine	4	75	0	25	0			
Thresher	9	78	0	22	0			
Water pump	32	91	0	9	49	84	0	16

Source: Household surveys, GAAP–IRRI/IFPRI/ILRI project, EUP, India (2012).

Table 5.6b Gender gaps in who controls the agricultural assets

	Upper caste				Lower caste			
Asset	N	Husband (%)	Wife (%)	Joint (%)	N	Husband (%)	Wife (%)	Joint (%)
Farmland	97	23	0	77	209	17	2	81
Dairy animals	52	25	0	75	96	18	2	80
Small livestock	6	0	17	83	42	5	19	76
Tractor	15	47	0	53	3	67	0	33
Cultivator	14	57	0	43	3	100	0	0
Rotavator	2	50	0	50	0			
Combine	4	50	0	50	0			
Thresher	9	44	0	56	0			
Water pump	32	63	0	38	49	59	2	39

Source: Household surveys, GAAP–IRRI/IFPRI/ILRI project, EUP, India (2012).

Dairy Animals

Owing to the high adoption of tractors for land preparation, the number of draft animals is low. However, dairy animals (cattle and she-buffaloes) are important assets for both upper-caste and lower-caste groups. Dairy animals can easily be sold in times of distress. Family members use the milk and milk products (curd, butter, and cheese) for home consumption and sale and produce farmyard manure, which the

[2] National Food Security Mission is a *Central Scheme* of GOI launched in 2007 for 5 years to increase production and productivity of *wheat, rice and pulses* on a sustainable basis so as to ensure food security of the country. The aim is to bridge the yield gap in respect of these crops through *dissemination of improved technologies and farm management practices* (www.gktoday.in/national-food-security-mission).

women apply on the fields. Cow dung materials are dried and used as household fuel, which women need to cook daily meals. Raising dairy animals is also an investment for future needs, for example, as gifts for a daughter's marriage and as payment for children's education.

We gave a she-buffalo to my daughter during her wedding. However after three years of married life, their economic situation deteriorated because her husband became sick. She had to sell her buffalo for Rs [Indian rupees] 26,000 for her husband's hospitalization and medicines. Her husband was able to recover due to proper medication but she lost an important asset. (A 63-year-old married woman from OBC in Maharajganj). Although the majority of ownership is solely by the husband, wives are also consulted by their husbands because purchasing and selling dairy animals is a major decision (Tables 5.6a and 5.6b).

We have 4 acres [1.6] of land, two sons, and two daughters. My husband is involved in farming, while I raise a buffalo and goats. I use my income from selling goats and milk from my buffalo to help pay for my children's education. I also keep some savings from my income for my daughter's dowry during her marriage and also for building our pucca house. Both my husband and I decide on how to use our income from our animals. -A 45-year-old married woman of OBC category

Small livestock

Of the few households that raise small livestock (mainly goats), both husband and wife claim ownership, use, and control, particularly among the lower castes. Both husband and wife make decisions on the disposal of small livestock. However, in some cases only the wife owns, uses, and has control of goat raising and use of the income (Tables 5.6a and 5.6b). Goats are an important asset to poor women because they require low maintenance, are easy to sell, and are a low-risk investment but have good returns. Women sometimes use the income from goat rearing to pay for children's education and more often for other personal needs.

I have the right to sell the goats that I raise and also use my earnings as I wish. I got my goats as gifts from my parents. Now I can sell them and use my money to buy cloth and ornaments for my daughter's wedding. -A 40-year-old married Muslim woman

For marginal farming households (like ours) migration is the only option of my husband. Transplanting is the only available employment in the village. So I decided to increase the number of goats to raise so that I can have additional income and help my family. -A 35-year-old married woman with a migrant husband

Agricultural machinery and water pumps

The gender gap is wide in the ownership and control of agricultural machinery and water pumps. While men are the major owners and users of machinery and water pumps, no women solely own or control any this agricultural machinery or equipment (Tables 5.6a and 5.6b). Moreover, women do not have access to (via owning or renting) other equipment such as a mechanical weeder, pedal thresher, and corn hand-sheller, which can reduce their drudgery and time spent on farm and home-based food-processing activities.

Nonagricultural Assets

House

Residential houses are owned primarily by husbands, followed by joint ownership (Table 5.7a). Houses (either *kutcha* or *pucca*) are inherited, mainly by the son from his parents, or purchased. Decisions regarding disposal, construction, and renovation of the house are generally made by the male head and with other male adults (who earn money or pay for the construction cost), followed by the female head (Table 5.7b). In combined families, the oldest member of the household makes the decision on its sale and renovation.

Table 5.7a Gender gaps in ownership of nonagricultural assets

	Upper caste				Lower caste			
Asset	N	Husband (%)	Wife (%)	Joint (%)	N	Husband (%)	Wife (%)	Joint (%)
Kutcha house	39	49	0	51	78	41	4	55
Pucca house	84	54	0	46	168	54	2	44
Television	44	50	11	39	68	53	6	41
Radio	15	73	7	20	19	58	0	42
Mobile phone	89	62	2	36	168	72	4	24
Gold jewelry	87	5	84	11	166	4	89	7
Silver jewelry	89	1	97	2	173	4	89	7
Bicycle	87	91	6	3	171	96	2	2
Motorcycle	44	100	0	0	39	95	0	5

Source: Household surveys, GAAP–IRRI/IFPRI/ILRI project, EUP, India (2012).

Table 5.7b Gender gaps in who controls nonagricultural assets

	Upper caste				Lower caste			
Asset	N	Husband (%)	Wife (%)	Joint (%)	N	Husband (%)	Wife (%)	Joint (%)
Kutcha house	39	13	0	87	78	10	1	88
Pucca house	84	20	0	80	168	14	1	85
Television	44	18	9	73	68	15	1	84
Radio	15	47	0	53	19	21	0	79
Mobile phones	89	35	1	64	168	39	1	61
Gold jewelry	87	5	84	11	166	4	89	7
Silver jewelry	89	1	97	2	173	4	89	7
Bicycle	87	91	6	3	171	96	2	2
Motorcycle	44	100	0	0	39	95	0	5

Source: Household surveys, GAAP–IRRI/IFPRI/ILRI project, EUP, India (2012).

The major reason for nonownership of the house by the wife can be explained by the twin norms of patrilocal postmarital residence and village exogamy, amplified by the notion that a married woman literally "belongs" to her in-laws. After marriage she moves in with her husband's family in another village.

I am involved in everything [from taking care of the household members to rice production activities], but I don't have anything by my name and don't have legal right to sell any asset like land and house. My husband has the only authority and control over our assets like our land and house. -A 45-year-old married woman from the upper caste

After marriage, I migrated to my husband's place and worked as wage laborer to earn money to buy food. I don't have any idea of the assets I own. Whatever house or land we have, my husband inherited from his parents and they are all registered under my husband's name. My main responsibilities are taking care of family members, work in our farm, and work as laborer in other farms. My husband and I make joint decisions on matters related to our house and land. What I know and believe is that whatever assets my husband owns, I also own it. -A 40-year-old married woman from marginal landholding household

Television and radio

Across castes with a television, about half are owned solely by men and the rest are jointly owned by the couple. Since a television and radio provides entertainment and information for all family members, their disposal is also a joint decision of husband and wife (Tables 5.7a and 5.7b).

Mobile phones

Ownership of mobile phones has increased in the past four years. Husbands are the major owners of mobile phones because they are responsible for purchasing them. However, both husband and wife use the mobile phone for varied purposes (Tables 5.7a and 5.7b). A few of the husbands mentioned that they use mobile phones for communicating with the service providers on the rental and use of agricultural machinery. Moreover, mobile phones are also used by CSISA research staff in making appointments with the farmer–cooperators in relation to scheduling demonstration trials, traveling seminars, and so forth. On the other hand, wives use the mobile phone for checking on their children who are studying outside the village. Both husband and wife jointly decide on its disposal.

Jewelry

The major attraction to jewelry aside from its aesthetic value is its high market value. Although jewelry is not a productive asset, it is a store of wealth that can be easily transported, sold, or pawned. It is a form of savings or investment and economic security. In addition, it is an important indication of the social and economic status of a family. It can easily be converted into cash, particularly during crisis.

Jewelry is one asset for which there is a significant gender gap in favor of women in EUP. A higher proportion of women than men own and use gold and silver jewelry (Table 5.7a). Men also own jewelry but less than women in terms of quantity. These findings are similar to the study by Swaminathan, Rahul, and Suchita (2012) in India who found that for all major asset categories except jewelry, women were less likely to own assets. Disposal of jewelry is done by the wife alone or jointly. Women make the decisions on the use and disposal of jewelry (Table 5.7b). However, if the value of the jewelry is too high, then its disposal or sale becomes a joint decision of the husband and wife. In times of distress, women sell their jewelry which is their most important asset.

We don't have any savings and enough money to cover the expenses necessary for my husband's migration expenses such as train fare, food, and accommodations while he is looking for a job. I decided to mortgage my silver jewelry to a local money lender at Rs 25,000. I really did not want to mortgage my jewelry because this was a gift by my parents during my wedding as a part of dowry. Just last year, I was able to repay the money with interest by saving money from the remittances that my husband sent me. I also saved some money from selling two goats. Nowadays, silver and gold jewelry are very expensive, so instead of purchasing new ornaments, we decided to give this jewelry during my daughter's marriage. -42-year-old married women from lower caste

Parents save, purchase, and keep jewelry as dowry or gifts to their daughters during marriage. *For our daughter's marriage we managed our expenses through savings, loans borrowed from our relatives and friends, and by mortgaging our land. We also gave my daughter my silver ornaments and few gold items as gifts/dowry. Thus, our ornaments are our important assets.* -A 50-year-old woman from SC in east Champaran

Bicycle

This is an important asset of men in the household, especially with the increasing costs of public transportation (Table 5.7a). Men use their own bicycle in commuting to other villages or nearby towns for nonfarm work, purchasing farm inputs and daily needs, marketing farm products, and other purposes such as medical needs. Women are dependent on men for marketing outside the village or providing transport to them and their children (women ride on the back of bicycles) when they leave the village. Having a bicycle enables men to be more mobile and have more access to income opportunities than women.

Men also make decisions on the use and disposal of bicycles (Table 5.7b). Traditionally, it is not common for women to ride bicycles owing to sociocultural norms. However, the number of women who ride bicycles is increasing. Young mothers are now using bicycles to bring their children to nearby schools. Furthermore, under the Scholarships and Financial Assistance Schemes for School Education in India in March 2010, young girls are provided a free bicycle or scooty,[3] along with free schooling and incentives such as insurance coverage. Owning a bicycle gives a woman more mobility and more freedom to move rather than relying only on the male members of her family.

Motorcycle

This is another important asset in the household, particularly in remote villages that do not have reliable transportation. A motorcycle is also used to transport farm inputs. The husband is the dominant owner, user, and controller of the motorcycle (Tables 5.7a and 5.7b).

Acquisition of Assets

Assets are acquired through inheritance, purchase, or gift (Table 5.8). Land is acquired mainly through inheritance of the husband from his parents. Since farmland is acquired mainly through inheritance, the son automatically becomes the owner of the land. Having joint ownership on the land registration is important for the protection of the future of the wife in case she is widowed. Moreover, claims to landownership become a controversy when a widow's in-laws claim the right to the land. Thus, it is important that the wife has legal entitlements to the land in the registration documents to avoid contestations in the future, which may end up in court and lead to disharmony among relatives. Agricultural machineries owned by the upper castes are purchased on a cash or credit basis. Dairy animals are mainly purchased from the town market or from other farmers. However, more upper caste households acquire dairy animals as gifts during marriage. Goats are acquired mainly through purchase. A few households among the lower castes acquire them as gifts. If the wife acquires the goat as a gift, then she can make the decision to sell it. During distress periods, goats are the first to be sold, aside from jewelry.

Most households own their house through inheritance from the husband's parents. Other nonagricultural assets purchased are mainly items such as televisions, radios, mobile phones, bicycles, and motorcycles. Individuals acquire jewelry through inheritance, purchase, or gifts during marriage. In EUP, passing down jewelry from one generation to another is a tradition among the upper and middle classes. During Teras (two days before Diwali, the festival of lights), Akshaya Tritiya, and other occasions such as the marriage of a son or daughter, family members buy gold or silver jewelry as gifts to the bride, relatives, or friends. Women from the upper caste obtain their jewelry through purchase more than as gifts. On the other hand, women from the lower caste acquire jewelry through gifts during their marriage. Men acquire gold or silver jewelry (ring, necklace) from their parents-in-law during marriage and also through purchase. When cash is given as dowry to the groom's parents during marriage, then in turn, it is customary for the groom's parents to give gold and silver ornaments, the value of which will depend on their economic status. This jewelry becomes the bride's after marriage for her use and economic security.

[3] Scooty is an Indian brand of scooters specifically designed for women and has come to represent a generic name for any women's two-wheeler.

Table 5.8 Types of acquisition of assets

	Upper caste					Lower caste				
Asset	N	Inherited (%)	Purchased (%)	Gift (%)	Others (%)	N	Inherited (%)	Purchased (%)	Gift (%)	Others (%)
Agricultural										
Farmland	97	93	7	0	0	209	94	6	0	0
Dairy animals	52	0	71	29	0	96	5	88	7	0
Small livestock	6	0	100	0	0	42	5	83	12	0
Tractor	15	7	66	27	0	3	0	100	0	0
Cultivator	14	7	64	29	0	3	0	100	0	0
Rotavator	2	0	50	50	0	0				
Combine	4	0	100	0	0	0				
Thresher	9	0	56	44	0	0				
Water pump	32	9	75	16	0	49	8	92	0	0
Nonagricultural										
Kutcha house	39	75	15	10	0	78	64	31	4	1
Pucca house	84	46	37	12	5	168	50	36	8	6
Television	44	9	82	9	0	68	1	84	15	0
Radio	15	0	73	27	0	19	5	84	11	0
Mobile phone	89	0	76	24	0	168	4	92	4	0
Gold jewelry	87	1	53	45	1	166	2	45	52	1
Silver jewelry	89	6	47	45	2	173	3	49	48	0
Bicycle	87	0	72	28	0	171	9	86	5	0
Motorcycle	44	2	78	20	0	39	8	89	3	0

Source: Household surveys, GAAP–IRRI/IFPRI/ILRI project, EUP, India (2012).

Wealth Gaps Based on Gendered Asset Distribution

While there are no differences in access to major assets such as farmland and dairy animals across caste (among the sample households, which excluded landless households), differences on the quantity and value are large. Tables 5.9a and 5.9b present the social and gender wealth gap for the major assets. Comparison across social groups reveals that the values of all assets held by the upper castes are higher than those held by the lower castes. Analysis by gender shows that the values of assets owned by men are higher than those held by women. Across castes, the quantity and value of dairy animals, *pucca* house, expensive clothing, jewelry, television, and cell phones is higher among the upper castes than among the lower castes. Overall, the gender wealth gap for each of the major assets indicates that the gender gaps are more severe than suggested by the ownership incidence measures alone. This is because not only are women less likely to own many of the specific types of assets, but they are also likely to own fewer assets and those that are less valuable, except for expensive clothing and jewelry. Thus, the challenge is to bring equitable access to assets and resources between social groups and between men and women.

Table 5.9a Ownership rate (%) and mean value of real assets (in Indian rupees, Rs) of upper-caste households, eastern Uttar Pradesh, India, 2012 (n = 99)

Type of asset	Husband			Wife			Both		
	Percent (number)	Mean value (Rs)	Standard error	Percent (number)	Mean value (Rs)	Standard error	Percent (number)	Mean value (Rs)	Standard error
Farmland	65 (64)	3,585,007	722,097				33 (33)	2,954,677	1,641,632
Dairy animals	28 (28)	39,071	4,869	5 (5)	19,600	4,545	19 (19)	24,278	5,106
Small livestock	2 (2)	20,000	10,000	2 (2)	7,000	3,000	1 (1)	2,000	
Kutcha house	19 (19)	122,778	27,642				20 (20)	72,368	9,944
Pucca house	45 (45)	532,614	84,671				39 (39)	257,895	30,244
Television	22 (22)	9,295	1,946	5 (5)	9,600	2,482	17 (17)	4,269	1,074
Radio	11 (11)	825	271	1 (1)	500		3 (3)	1,033	549
Cellular phones	56 (55)	15,998	9,373	2 (2)	1,250	750	32 (32)	4,626	985
Expensive clothing	6 (6)	18,667	8,078	23 (23)	12,113	3,440	23 (23)	17,250	3,456
Gold jewelry	4 (4)	107,500	52,658	74 (73)	88,671	13,076	10 (10)	77,000	18,138
Silver jewelry	1 (1)	3,600		87 (86)	28,840	4,447	2 (2)	25,000	15,000
Bicycle	80 (79)	1,906	359	5 (5)	875	217	3 (3)	1,333	333
Motorcycle	44 (44)	32,233	3,152						

Source: Household surveys, GAAP–IRRI/IFPRI/ILRI project, EUP, India (2012).
Note: US$1 = 55 Rs.

Table 5.9b Ownership rate (%) and mean value of real assets (Indian rupees, Rs) of lower-caste households, eastern Uttar Pradesh, India, 2012 (n = 241)

Type of asset	Husband			Wife			Both		
	Percent (number)	Mean value (Rs)	Standard error	Percent (number)	Mean value (Rs)	Standard error	Percent (number)	Mean value (Rs)	Standard error
Farmland	61 (133)	1,445,038	275,896	2 (5)	395,000	68,496	32 (71)	1,182,754	315,678
Dairy animals	*23 (50)*	*28,780*	2,404	*1 (3)*	*25,000*	5,000	*20 (43)*	*27,419*	2,384
Small livestock	5 (12)	3,558	648	4 (9)	4,300	945	10 (21)	7,095	1,300
Kutcha house	15 (32)	286,938	96,969	1 (3)	66,667	8,819	20 (43)	60,921	6,046
Pucca house	42 (91)	355,444	37,099	1 (3)	190,000	10,000	34 (74)	195,479	20,441
Television	16 (36)	6,319	810	2 (4)	1,625	239	13 (28)	4,414	1,028
Radio	5 (11)	536	99				4 (8)	1,388	517
Cellular phone	55 (121)	3,465	391	3 (6)	1,300	360	19 (41)	9,434	7,270
Expensive clothing	3 (7)	9,243	3,702	16 (36)	5,358	851	14 (31)	8,048	1,279
Gold jewelry	3 (6)	48,650	25,525	68 (148)	29,602	2,751	5 (12)	44,917	12,647
Silver jewelry	3 (7)	10,986	3,941	70 (154)	10,153	851	5 (12)	13,917	3,135
Bicycle	75 (164)	2,422	634	1 (3)	1,000	200	2 (4)	775	131
Motorcycle	17 (37)	35,703	6,466				1 (2)	25,000	5,000

Source: Household surveys, GAAP–IRRI/IFPRI/ILRI project, EUP, India (2012).
Note: US$1 = 55 Rs.

Gender Gaps in Access to Other Resources

Aside from the tangible assets, very few respondents from the lower castes included in the midline surveys mentioned other resources that are important to them. These resources are membership in any organization, participation in agricultural training activities and employment under the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA)[4] and access to income (remittances from migrant family member) and other income from nonfarm employment in the village. Despite the high labor participation of women from the lower caste in crop production and postharvest, no women had access to agriculture-related training programs and microcredit.

Women more than men do not have access to these resources. Thus, there is a need to increase women's access to agricultural assets (farmland, dairy animals and small livestock, tools and equipment) and human capital (education and skills including entrepreneurial skills) extension services and technical knowledge for better crop management in agriculture. However, in recent years, more women are now joining women's self-help groups (WSHGs) that are organized by nongovernmental organizations (NGOs). These WSHGs are given microcredit and training on nonagriculture and can serve as the entry point for introducing agricultural technologies, for example, improved seeds of stress-tolerant rice varieties and training on seed management and storage. In another project, STRASA led by IRRI, a subproject "Stress-Tolerant Rice Varieties for Women Farmers" was conducted with WSHGs in Odisha, Assam, EUP, and West Bengal in collaboration with NGOs and state agricultural universities in EUP (Paris 2012).

Unexpectedly, a low proportion of the wives have access to MGNREGA jobs, although poor women are encouraged by the government to avail of this employment guarantee program.

I am now a member of MGNREGA, and I am no longer interested in working as hired laborer in rice and wheat production. I worked in MGNREGA for 30 days last year and was paid Rs 3,600. I used my earnings for my daughter's gown for her wedding, for my personal needs, for social obligations, and to buy household needs and farm inputs. I even rented-in 0.5 hectares of farmland. Before, I worked as hired laborer and was paid as low as Rs 40–50 per day. Most of the time, the landlord's payment to me was late. Many things have changed since then. We have more options to have alternative sources of income such as employment from MGNREGA, remittances, and food from rented in land for food security. -A 45-year-old woman who does unpaid family work and other nonfarm work

Thus there is a need to provide both men and women access not only to agricultural technologies but also to social networks, membership in organizations that include access to microcredit and training such as WSHGs, participation in agricultural extension, and training programs and employment under the MGNREGA. Providing women equal access to opportunities that men have can improve family welfare and women's social and economic status in the family and in the community.

[4] The National Rural Employment Guarantee Act 2005 (or, NREGA No 42) was later renamed as the "Mahatma Gandhi National Rural Employment Guarantee Act" (or, MGNREGA), is an Indian labor law and social security measure that aims to guarantee the 'right to work'. It aims to ensure livelihood security in rural areas by providing at least 100 days of wage employment in a financial year to every household whose adult members volunteer to do unskilled manual work (India, MRD 2005).

6. AGRICULTURAL TECHNOLOGIES, GENDER, AND ASSETS

The framework (see Section 3) describes the importance of assets, social and gender gaps in access, use and control of major assets, and well-being. These findings will be useful in the design and implementation of a range of strategies or project interventions to reduce the gender gaps and implementation of gender-responsive policies. The adapted Gender, Agriculture, and Asset Project (GAAP) framework also helped us to better understand how gendered asset distribution can affect livelihood strategies, risks and outcomes, and women's major assets. The CSISA project has the best intention of increasing returns to assets such as land or labor to increase productivity and income through the promotion of technologies in EUP. These are the laser land leveler, zero-tillage for rice and wheat, direct-seeded rice (DSR)[5] using machine, and mechanical paddy transplanter (MPT). The technologies that have direct effects on women's access to assets (mainly land, labor, and cash) are DSR and MPT. Labor-saving technologies will affect women's labor participation as unpaid and hired workers in seedbed preparation and transplanting of seedlings. The outcomes will be reduced drudgery and health risks for women who work on their own farms and loss of income and food source (wages in terms of grains) to these women who also work as agricultural wage laborers on other farms. Although agricultural development programs are affected by and affect the distribution of assets within the household, very few efforts have been made to examine these impacts. This is partly because of the type of technologies being promoted, dissemination strategies that exclude women from participating, and lack of gender analysis in relation to technology adoption.

Despite the low adoption and frequent disadoption of DSR and MPT, preliminary studies have been conducted to assess the outcomes of these technologies. Based on the preliminary report of Yamano et al. (2013) of DSR in EUP, trained farmers in CSISA phase 1 have adopted and disadopted DSR as an alternative method to manual transplanting that could reduce the labor and irrigation water requirements for crop establishment. Of the sample of 342 farmers in Bihar and EUP who have used DSR at least once in the four-year period of 2009–2012, 57 percent applied DSR in 2012. The reasons for disadoption of DSR in 2012 include water scarcity, weed problems, and unavailability of service providers, especially to small farmers. There was a 50 percent reduction in labor use when farmers used DSR. The reduction of labor mainly comes from transplanting rice, which is conducted mostly by hired female workers (mostly from marginal and smallholder and lower-caste households). The reduction in female labor use owing to change in crop establishment is similar to the findings of Paris and Chi (2005). The demand for female family labor declined when rice-farming households shifted from manual transplanting to a row seeder in South Vietnam. The reduction in labor benefited women from farming households but led to a loss of income by poor women who work as hired agricultural workers in transplanting.

We also conducted a separate study on the outcomes of the MPT to men and women in selected villages in EUP. The CSISA project introduced the MPT to large farmers in 2010. Adoption was high in the initial phase but declined owing to many constraints. Household surveys on adopters of MPT and manual transplanting reveal that the labor inputs of female family members and hired labor declined by 67 percent and 70 percent, respectively, owing to the shift from manual to machine transplanting. (Paris et al.2013b). With the use of MPT, women are involved only in replanting the gaps, while in manual transplanting women are responsible for pulling seedlings from the nurseries, hauling or carrying the seedlings, and transplanting in the fields. Women suffer from drudgery and health risks such as water-borne skin diseases, excessive itching, discolored nails, floods, extreme heat, and other ailments after long exposure working in wet and muddy fields contaminated with chemicals for preparing nurseries,

[5] DSR in place of the traditional transplanted rice is a way to reduce labor charges for nursery raising, puddling, and transplanting. DSR is sown directly into the moist soil, just like wheat, corn, or cotton, and does not need continuous submergence, so it reduces overall water requirement also. Precision leveling is desirable; it increases water efficiency, improves crop stand, and optimizes input use. The advantages of DSR are labor savings up to 75 percent, water savings up to 30 percent, early maturity of crop, timely sowing of wheat crop, and saving of machinery operations (needed for puddling) (http://www.knowledgebank.irri,org/CSISA).

uprooting the seedlings, and transplanting. Thus the adoption of MPT is expected to have a positive effect on women workers in relation to these problems.

Varied perceptions based on focus group discussions emerged from women from different social groups (farming and landless households). Lower-caste women from small and medium farming households, who provide unpaid labor on their farms, said they are happy to be relieved of the drudgery of pulling seedlings and transplanting, to have reduced health risks, and to be liberated from strenuous forms of unpaid work that compete with other daily activities.

On the other hand, the lower-caste women from marginal farm holdings and from landless households are worried that DSR and MPT will take away their traditional source of income. This is despite the fact that women laborers are exploited, owing to the large differences in wages between men and women for the same work. For poor women, their labor as well as farming experience is their most important asset for their livelihoods and food security. Thus, there is a need to explore possibilities of introducing technologies that can provide women with alternative income along with knowledge and skills, for example, involving and training women on raising rice seedlings on mats for MPT or for purchase, or managing an MPT to provide services to other farmers, as a group enterprise.

7. SUMMARY AND CONCLUSIONS

This study provides a greater understanding of the links between the gendered distribution in access to and control of assets, agricultural technologies being promoted by an AR4D project, and well-being within the agroecological, social, cultural, and economic environment in EUP. It identifies which assets are important to individual men and women and to farming households as well as patterns of access, use, and control of assets by social groups and gender, and the manner of acquisition of these assets. This study also provides a deeper understanding of the potential impacts of CSISA-promoted technologies on the existing gender disparities in asset distribution and control, as well as identifies strategies and mechanisms that the CSISA project can use to best strengthen women's access to productive assets.

Farmland is the most important asset of rice-farming households. Farmlands were mainly owned by the principal male through inheritance. Since the husband was the officially registered owner of the land, he was identified as the farmer and the recipient or beneficiary of government programs. This restricted female farmers' opportunity to receive farm inputs and participate in training activities. Without registration of joint ownership, widows were also vulnerable to loss of land to in-laws or sons. These findings reaffirmed that gender inequalities in assets, particularly farmland, persist owing to deeply embedded social norms on inheritance patterns, which are highly biased toward men. However, some positive signs show that land is jointly owned and shared husbands and wives, who make joint decisions to use, sell, or mortgage the land. Although women are not the major owners of these assets, women can use these assets based on their high participation in crop production, postharvest, and processing activities. Both men and women work on the same land with assigned roles and responsibilities. Thus, both husband and wife have opportunities to benefit from the returns to land through suitable interventions such as crop diversification and land intensification.

Dairy animals were reported as owned by husbands or jointly; use of dairy products and decisions to sell or buy animals was mostly joint. The few households that raised small livestock where both husband and wife claimed ownership, use and control, tended to come from the lower castes. Small livestock are important assets for poor women, who can use crop-livestock technologies to increase productivity from improved food, breeds and management practices.

Women do not own agricultural machinery or production and postharvest equipment. To benefit fully from agricultural innovations, women need increased access to agriculture-relevant physical assets (land and machinery) and human capital (education and extension services). An analysis of the effects of the adoption of the MPT on men and women reveals that the impacts on women are quite different depending on whether they are lower or upper caste. That gender impacts are mediated by caste is a very important issue that should be considered in impact analysis of agricultural technologies. To anticipate the displacement of labor and disruption of livelihoods due to widespread of use of large machinery made available through service providers, development programs should increase women's ability to earn agricultural and nonagricultural income. Among the nonagricultural assets, jewelry (gold and silver) is the only major asset that primarily women own. Among the upper castes, jewelry is mainly purchased and secondarily received as gifts. In contrast, among the lower castes, jewelry is more frequently acquired as gifts through marriage and less often purchased. Decisions to dispose of jewelry, especially in disaster or stress periods, are made by the principal women alone and then jointly as a couple, especially if the value of the jewelry is quite high. Thus, women should have other sources of income, so that they will not dispose of their only asset during times of distress. A high proportion of the bicycles are owned by men. However, the number of women who own bicycles is increasing, thus giving them more mobility. For young girls, a bicycle is an important asset to pursue secondary or tertiary education, which is often located in another village.

Women from the lower caste who provide most of the labor in crop production and postharvest operations have very low membership in organizations, training, credit and MGNREGA. Thus, proper guidance and training should be given by CSISA in collaboration with NGOs and governmental organizations to the female members through established SHGs and WSHGs. Group-based programs targeting women have greater potential to address gender relations within the household and society than programs targeting women as individuals.

8. SPECIFIC RECOMMENDATIONS AND ACTIONS TAKEN IN MAINSTREAMING WOMEN IN CSISA PROJECT

To correct a lack of attention to gender concerns in the first phase of the project, a Gender Strategy Plan for phase 2 (Paris 2013a) will go beyond promoting large machinery and focus more attention on crop intensification and diversification, which will increase the farm income of small farming households—women's income in particular—and improve nutrition among household members. This intensification and diversification process includes increasing women's access to training (including training in how to raise community mat nurseries for mechanical paddy transplanters) and seeds of improved varieties. It also involves introducing post-harvest and processing technologies as agribusiness ventures and conducting rigorous research on the adoption of CSISA-promoted technologies and their differential effects on the assets of men and women, within and across different social categories.

Consistent with CSISA's objective, this project has adopted an integrated approach and model of participatory research, planning, and delivery for women farmers. Although many of the CSISA technologies involve machinery, these do not need to be owned by the households if effective rental markets are available. During the last two years, CSISA has facilitated more than 1,300 farmers in EUP and Bihar districts to become service providers and has been building their capacities through trainings on relevant knowledge and skills, such as conservation agriculture and small-scale machinery.[6]

Women-focused programs will face many challenges, which may take time and require more resources and dedicated researchers. Moreover, partnership with government agricultural extension agencies and NGOs who work with WSHGs engaged in farming is crucial for reaching thousands of grassroots women.

Table 8.1 presents the key recommendations and actions taken by CSISA to involve women in various participatory research, field demonstrations, forums, dialogues, and training activities. With these initiatives, hopefully lack of access to assets (land, machinery and equipment, technical skills and knowledge, information, farm inputs—seeds in particular) by disadvantaged groups, especially women, will be reduced and women will be empowered to make informed decisions that can help alleviate poverty and ensure food security and family nutrition.

On December 17 and 18, 2014, a workshop "Empowering Women in Agriculture through Systematic Inclusion in Farming Value Chains" was held in Odisha. The workshop identified CSISA-promoted technologies and associated training activities that can directly benefit women: community mat-type nursery preparation for MPT, improved crop varieties, improved weed management practices and tools, improved water management practices, and improved postharvest practices (threshing, drying, and storage) of grains. Training programs on entrepreneurship on mechanization (service providers), on seed production system, and establishment of community seed banks were also designed and incorporated in the season calendar. In implementing these activities, CSISA has established collaboration with reputable NGOs who are working with SHGs and WSHGs in large areas. A list of CSISA-promoted technologies that can directly benefit women is provided in Appendix Table A.1.

[6]http://csisa.org/todays-service-providers-tomorrows-rural-entrepreneurs.

Table 8.1 Recommendations and actions taken to involve women in CSISA project implementation

Recommendations	Actions taken
Hire qualified female researchers as members of the CSISA team	In 2013, three junior female social scientists were hired by IRRI and CIMMYT to conduct gender research and facilitate the mainstreaming of women in CSISA project plans and activities in EUP, Bihar, and Odisha (new hub), India. In June 2014, IRRI hired a project scientist (gender specialist) based in New Delhi, India. They work with the CSISA hub teams and NGOs.
Identify, introduce, and validate improved cropping systems using short-duration crop varieties	The CSISA project has identified, introduced, and validated improved cropping systems using short-duration crop varieties, improved crop management practices and machinery that can increase returns to land and labor, increase profits, and directly benefit women and their family members.
Provide women access to CSISA-promoted technologies through participation in training activities and demonstration trials	Several CSISA-organized training activities, for example, raising nursery rice seedlings for MPT and operation of the MPT (including women operators), were conducted. Various technology dissemination models (at least any one suitable technology) are used to mainstream thousands of women farmers.
Introduce postharvest and processing technologies as microenterprise or agribusiness ventures	Corn hand-sheller and open drum diesel threshers are being piloted by CSISA in partnership with NGOs that manage WSHGs. Threshing services to women and men farmers were initiated in *kharif* 2013.
Identify active women-led NGOs that are already working with women's groups in agriculture	CSISA is now working with many SHGs and WSHGs in Bihar, Odisha, and EUP and the government-sponsored Mahila Samakhya program. Women are given the opportunities to choose the available technologies and participate in field experiments and demonstration trials.

Source: Paris (2013b); Swati (2014); Munshi (2014); Aanand Kumar (personal communication, 2014).
Note: EUP = eastern Uttar Pradesh; IRRI = International Rice Research Institute; CSISA = Cereal Systems Initiative for South Asia; MPT = mechanical paddy transporter; NGO = nongovernmental organization; WSHG = women's self-help group.

APPENDIX: SUPPLEMENTARY TABLE

Table A.1 List of technologies that can directly benefit women in farming

Specific activities and technologies	Description
Community mat nursery for MPT	Mat nursery can support MPT to address issues of labor shortage and can reduce women's drudgery in transplanting. Poor women trained to produce mat-type nurseries can sell seedlings as a group to other farmers (service providers), earn additional income, and will be empowered (in terms of technical knowledge and economic status).
Improved crop varieties (stress tolerant, short duration)	Seed production of improved crop varieties will increase cropping intensity, increase women's income (for crops grown by women), reduce or eliminate women's drudgery (in retransplanting or gap filling of seedlings), ensure food and nutrition security, provide additional or independent income, and empower women. Short-duration crop varieties can fit in noncereal crops into the cropping systems. Women can earn additional income, produce more nutritious crops, and ensure food security.
Improved weed management practices and tools (upland weeder)	Improved weed management practices and tools can reduce input costs in weeding (labor and herbicides), increase productivity, reduce drudgery (in the use of weeder), provide women more time for leisure, children, and other income-generating activities.
Improved water management practices, such as alternate wet and drying method	Improved water management practices can ensure crop growth, increase productivity, and reduce women's drudgery in weeding (less drought).
Improved postharvest practices (threshing, drying, storage) of grains	Improved postharvest practices including threshing equipment can reduce postharvest losses, reduce women's drudgery in manual threshing, ensure food security, provide additional or independent income, and empower women.

Source: Paris (2013b).

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