Chapter 14

Gender Topics on Potato Research and Development

Netsayi Noris Mudege, Silvia Sarapura Escobar, and Vivian Polar

Abstract Sustainable Development Goals 5 calls for addressing gender equality and women empowerment by, among other things, eliminating all forms of discrimination against women. At CIP we interpret this to mean strengthening the use of gender approaches in research and ensuring that research products are responsive to the needs of men and women. This chapter reviews lessons learnt over the years on integrating gender into potato research and development. The chapter discusses how gender has been approached in five key themes in potato research, namely (1) conserving and accessing genetic resources, (2) genetics and crop improvement, (3) managing priority pests and disease, (4) access to seed (seed flows and networks), and (5) marketing, postharvest processing and utilization. This chapter discusses how gender relations that favor men influence women's participation in and their ability to benefit from potato production, marketing, and research for development. The review shows that potato research has been increasingly focusing on social determinants of potato farming because of the realization that purely technical solutions will not solve inefficiencies in potato production. Using a gender relations approach, the chapter attempts to draw out lessons that can contribute to the design of future potato interventions including research aimed at reducing the gender gap in agriculture in general and potato farming in particular.

N. N. Mudege (✉)

International Potato Center, Nairobi, Kenya

e-mail: n.mudege@cgiar.org

S. Sarapura Escobar

Royal Tropical Institute, Amsterdam, The Netherlands

e-mail: sarapura@uoguelph.ca

V. Polar

CGIAR Research Program on Roots, Tubers and Bananas (RTB), Lima, Peru

e-mail: v.polar@cgiar.org

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14.1 Introduction

It has already been established that gender differences matter in agricultural production in various farming systems all over the world, where the ownership and management of farms and natural resources by men and women are often defined by culturally specific gender roles (Meinzen-Dick et al. 2010). Evidence indicates that agriculture and development projects should be gender responsive and take into consideration the needs, aspirations, knowledge, opportunities, constraints, and challenges faced by men and women farmers, young and old, if hunger and poverty are to be alleviated (Njenga and Gurung 2011). Additionally, it is also clear in research that gender intersects with other structures of social hierarchy such as class, race, caste, and age (German and Taye 2008). Certainly, farmers are not a uniform group. Men and women play different roles within agricultural systems occupying different socioeconomic positions linked to these roles, and may suffer from different vulnerabilities (Carr 2008). These differences and vulnerabilities should be considered when new technologies are being developed. Kingiri (2010) noted that generally in farming systems research and innovation, unequal relationships between men and women in households are taken for granted. As a result, development of new technologies may end up increasing the gender gap and benefiting men more than women because social relations of gender are not properly understood. In some cases, as noted by Quisumbing and Pandolfelli (2010), new technologies may even harm women if they are not properly thought through.

The interest of gender in research in potato-related research organizations such as CIP and partners started more than two decades ago. During this period, several studies have looked at the key technical potato production constraints. However, a limited number of studies have discussed the key technical constraints of potato production from gender perspective (see for example, Tapia and de la Torre 2000; Mera-Orcés 2001; Polar et al. 2017; Mudege et al. 2016). In a study promoting participatory technology development in potato farming and production in Ethiopia, Jibat et al. (2007) suggest that it is important to understand gender roles in agriculture production and decision-making to ensure that research address men and women's needs making the results of research more demand oriented. A key limitation of these studies is that they often look at gender roles, and pay little attention to gender relations (see for example, Tapia and de la Torre 2000; Mera-Orcés 2001).

Most of the research has focused on gender division of labor along the potato value chain. For example, a study by Muhinyuza et al. (2012) in Rwanda showed that both men and women are involved in main "potato production activities" as well as decision-making on production and marketing. "However, some activities such as weeding, cooking, and storage protection are exclusively done by women while predominantly men are totally concerned with pest management". Similar work has also been conducted in the Andes in Latin America on gender division of roles in potato production (Tapia and De La Torre 1998; Laub and Muir 2008). Such research often conducts sex disaggregated analysis of labor distribution but does not disaggregate when it comes to constraints because of the focus on technical constraints such as pests and disease (see Muhinyuza et al. 2012; Sah et al. 2007).

However, while early research focused on division of labor and social demographic variables, more recent research has started focusing more and more on gender relations, the normative environment including institutional factors along the potato value chain (Mudege and Demo 2016). Institutional factors such as access to credit and markets by men and women, and their influence on the adoption of improved potato varieties as well as productivity. As part of gender relations, gender norms and how they shape the opportunity structure for men and women in agriculture have been studied (Petesch et al. 2018). Some research also focuses on the gender gap in access to resources, (such as capital), assets (such as land and other productive assets), and knowledge (for example access to extension services and credible information sources) which if not addressed lead to a gender gap in productivity between men and women (Quisumbing et al. 2014).

In discussing gender topics in potato research, this chapter will go beyond the usual focus on gender roles and asset gaps to look at how the normative environment creates and shape the opportunity structure for men and women. This chapter will use the gender relations approach promoted by Kabeer and Subrahmanian (1996), who defines gender relations as social interactions that embody both the material and the ideological aspects that are revealed not only in the division of labor and allocation of resource between women and men but also in how “value is given, and power is mobilized.”

Thus, the gender relations approach focuses on unequal relations between men and women (Little and Panelli 2003). This is an important aspect of the approach because while understanding gender division of labor is good, it falls short in explaining the social reasons that limit women’s access to resources and information, which in turn influence adoption of new technologies and accessing the benefits that they can generate. Gender inequalities which in many cases favor men often limit the resources that women have access to and what they are able or not able to do. For example, gender relations influence access to resources such as land and water sources which are essential for agriculture production and productivity.

This chapter explores how gender matters in several key topics including: (a) conservation and access to genetic resources; (b) breeding and crop improvement; (c) access to seed; (d) managing priority pests and diseases; and (e) marketing, postharvest management, processing and utilization. The chapter will look at how gender relations can influence research processes to draw lessons that can contribute in the design of future interventions that can help reduce the gender gap in agriculture and to ensure agricultural research benefits both men and women. This chapter will examine how gender issues have been considered in key potato research topics.

14.2 Conserving and Accessing Genetic Resources

The assumption that guides all conservation efforts is that genetic resources are under threat and need to be safeguarded (Brush 2004) as essential source of foods to sustain healthy diets and a source of genes to supply resistance and functional

traits in breeding programs (Jones et al. 2018). Maintaining or conserving diversity in situ is an active and purposeful part of farm management (Brush et al. 1981) where men and women have differentiated roles and responsibilities. The role of women in conserving genetic biodiversity for potato has been well documented in different crops and agroecologies.

Regarding potatoes, studies in this area have been mostly conducted in the Andean region in Latin America. It has been noted that women play a key role in maintaining genetic diversity for potato particularly in selection of seed and varieties, storage of seed and utilization (GRAIN 2000; Sarapura 2013). Women in the Andes Mountains have been significantly involved in conserving genetic diversity particularly through their direct involvement in selecting and preserving different native potato varieties to meet different needs both in terms of culinary characteristics as well as to meet different social rituals and obligations. Sarapura (2013) notes that potato genetic conservation is done with care and tuber seed is stored in special places as the tubers are the nexus of relationships and commitments between the community, nature, cosmos, and deities (Sarapura 2013). Selection and conservation of native potato varieties are mostly done by women who know specific characteristics of potato varieties and have knowledge on how to select them according to different purposes the different potato varieties meet.

Tapia and de la Torre (1998), for example, note that in Peru and Bolivia women act as conservationists preserving native potatoes such as the bitter potato species (*Solanum juzepczukii* and *S. curtilobum*) which can survive temperatures as low as -3°C and can be freeze-dried into traditional products. Female producers in the highlands and especially in peasant communities do not only play a decisive role in food security (Tapia and de la Torre 2000), but also perform a significant role in seed management and food provision (Tapia and de la Torre 2000; Aguayo and Hinrichs 2015). Women select the seed of native varieties based on the crops' in situ morphological and yield interpretation, culinary quality and crop yield, processing quality, and resistance to diseases, drought, or floods (Tapia and de la Torre 2000). Management of genetic diversity through careful management of combination of varieties enables communities to manage risks, particularly where climate stress is more frequent and intense (De Haan 2009).

Tapia and de la Torre (1998) noted that although some women adopt new improved varieties, they also keep and conserve native potatoes, because genetic diversity increases food security in the Andean highlands. In addition, potato research has been increasingly focusing on how women can be recognized and benefit from their role of conserving biodiversity. For example, Sarapura et al. (2016) illustrate that women involved in the Management Consortium of Native Potato Producers of Junin and Huancavelica in Peru (COGEPAN) took part in a project called Papa Andina, coordinated by the International Potato Center (CIP), which helped linking farmers to markets and created formal market chains for native potatoes. This project empowered women who conserved native potatoes, since they were able to use proceeds from selling native potato to buy land under their own name or be able to rent or sharecrop land to increase agricultural production. Men

and women involved in the project were also able to access credit, and open bank accounts compared to counterparts who were not part of this project.

Research on potato genetic biodiversity in the Andes has illustrated that in many instances farmer knowledge on genetic biodiversity cannot be separated from the natural and cultural contexts from which it has emerged, including resources, relationships (kinship), and community relations. The traditional knowledge that women possess has been verbally transmitted from one generation to another, from person to person (mothers to daughters). It is based on the *saber campesino* (spiritual, ecological, geographical knowledge), sense and wisdom. It is entrenched in the Andean cosmovision in which the differences between elusive knowledge and physical things are frequently imprecise and vague. Research initiatives and interventions like the Papa Andina project have illustrated that the role that women potato farmers play in the Andes in safeguarding the traditional information, knowledge, traditions, and practices of producing and reproducing the Andean potatoes cannot be overestimated.

Based on our experience in potato research and review of existing literature, several opportunities and challenges related to conservation of genetic biodiversity and the role of gender relations are illustrated below.

As illustrated in Table 14.1, how men and women's work is valued and the resources they control may favor or limit the ability of women to not only participate in conserving potato genetic resources but also benefit from their efforts

Table 14.1 Gender relations in conservation and access to potato genetic resources

Gender relations aspects	Aspects that favor women's engagement	Aspects that limit women's engagement
Valuing of men and women's work	<ul style="list-style-type: none"> • Women conserve and control genetic resources • Women's work in conservation is recognized and highly valued 	<ul style="list-style-type: none"> • Women's role in conserving genetic resources is not highly valued by actors in the potato sector
Access to resources, assets and control of benefits	<ul style="list-style-type: none"> • Women have highly significant local knowledge on genetic conservation of landraces • Women are able to financially benefit from their genetic conservation efforts and be able to decide on how to use their benefits. 	<ul style="list-style-type: none"> • Men control information means and channels • Men control access to land
Gender norms and opportunity structure	<ul style="list-style-type: none"> • It is women's work to save seed of different varieties and store it • Women have access to local knowledge on genetic conservation 	<ul style="list-style-type: none"> • Men control marketing channels and land which makes it hard for women to benefit from their conservation efforts. • Men have more access to new technical information on potato production since they are targeted by extension.

Projects such as the Papa Andina Initiative integrated this traditional or “emic knowledge” with scientific and technical knowledge to give place to three different areas or spheres of innovation interconnected with the utmost essential and most original opening points for recognizing change in peasant women—(1) technology use, (2) social norm change or social innovation, and (3) economic resilience. For example, while it is acknowledged that women in peasant communities possess an intrinsic adaptive capacity to maintain, manage, and preserve the native potatoes and know how to adapt native potatoes to different climatic conditions, pathogens, and plagues (Sarapura 2013), through the Papa Andina initiative, women were able to strengthen their innovation capabilities as well as their ability to conserve genetic diversity in situ. For example, they were able to access new technical information and knowledge on potato production as well as receive market information using Information and Communication Technology (ICT) tools. Gender relations of power that restrict access to information for women may affect their ability to benefit from their genetic conservation efforts.

The analysis presented above highlights the importance of understanding gender relations in potato genetic resources conservation and use. Furthermore, it illustrates that the involvement of both men and women in the design and implementation of interventions and policies to support conservation should be prioritized.

14.3 Crop Improvement

It has been suggested that conventional breeding has not been able to benefit farmers in marginal areas such as in Rwanda because farmer traits are not considered in the breeding process, which leads to relatively low adoption (Muhinyuza et al. 2012). Hence, failing to consider the trait preferences of farmers, especially those in marginal areas, can lead to the promotion of varieties ill-suited to the needs of vulnerable groups such as women. For instance, one of the persistent gender gaps in agriculture is lower adoption of modern varieties among women producers (Ashby and Polar 2019). Overlooking traits important to women farmers and consumers may lead to women’s disempowerment and aggravated household food insecurity and poverty (Tufan et al. 2018).

More broadly, the need for the involvement and participation of farmers in the development of new crop varieties for smallholder farmers was explicitly explained by DeVries and Toenniessen (2001). As noted by these authors, farmers should be involved in all aspects of variety development that include priority setting, early generation breeding, variety testing, and selection so that breeders obtain regular input from farmers that enables them to structure their selection indices accurately. Thus, farmers should not be just technology recipients and beneficiaries but actors who influence and provide key inputs to the technology development process (Machida et al. 2014).

The literature on the gender dimension of agricultural production in Africa and elsewhere points to the connection between gender and crop preferences as well as gender-related dynamics and constraints in technology adoption. Indeed, given that women and men have different roles in providing for household food security, it is not surprising that research generally portray that they have different preferences as well (Meinzen-Dick et al. 2010; Tufan et al. 2018). However, until recently the gender dimensions of trait preferences have gone largely unrecognized and unappreciated as a distinct area of research on potato breeding. To address this weakness, potato research in increasingly integrating men and women farmers' views in crop improvement initiatives by collecting sex disaggregated data to identify differences and similarities between men and women's trait preferences. A recent study in Ethiopia, for example, suggested that there were only a few significant differences between men and women's desired traits (Kolech et al. 2015, 2017). They suggested that women in one of the study sites were more concerned with long stolons than men since this was an indicator that the potato could be harvested sequentially, according to needs, and not all at once addressing women's food security concerns, while on the other hand men were more concerned with low soil fertility which lowered yields, and limited market access. In their analysis the authors concluded that men were more concerned with market demand while women concerned more with food security. Gender relations that promote engagement of men in high value market chains while relegating women to the domestic economy with concerns mainly for family food may disadvantage women in the long run. In Kabale, Uganda, one of the potatoes growing districts, it was noted that both men and women traders prefer large sized potato suitable for making French fries (Bonabana-Wabbi et al. 2013). Therefore, understanding what men, women farmers and traders prefer is important for a breeding program.

14.3.1 Breeding Objectives

In line with the growing evidence of the need to integrate gender considerations into crop improvement, a key objective of the potato breeding program at CIP is to characterize gender differentiated preferences for traits, in different agri-food systems, and what the consequences would be of having those traits available to help breeding strategies accelerate varietal development. Research has been conducted in Latin America and Africa to understand gender differences in trait preferences. Research in Peru for example highlighted that men often preferred improved potatoes that are high in yield, resistant to hail and frost and to diseases (particularly late blight), while women often focused on culinary quality for fresh consumption, they prefer potato varieties with shallow "eyes," and as well as yellow/cream flesh color. A study in Ethiopia (Mudege et al. [forthcoming](#)) also noted some differences in men and women's trait preferences (see Box 14.1).

14.3.2 *Gender Relations and Adoption of Improved Potato Varieties*

Due to the different roles that men and women play in families and communities, traits related to consumption exhibits some sharp gender differences. Based on our experience in potato research and review of existing literature, below we summarize examples of how gender relations may shape the opportunity space for adoption of potato varieties.

As Table 14.2 illustrates, when women's preferred traits are valued and integrated into the breeding program, this may improve women's willingness to adopt new improved varieties. Thus, breeding programs need to go beyond profits to ensure that key important traits that may not have an immediate economic value but are important to women are not neglected.

In line with their gender roles, women prefer traits that lessen their burden and time in food preparation. For example, women in Ethiopia preferred potato that did not have deep eyes because it is easy to peel and prepare local dishes (Mudege et al. [forthcoming](#)). In Peru it was noted that women preferred some varieties because they could make soup or different traditional dishes or because they could be used for traditional rituals such as testing the patience of a new bride by asking her to peel a particularly difficult-to-peel potato (Tapia and De la Torre 1998). Some potato varieties are regarded as more nutritious, particularly for pregnant women (Tapia and De la Torre 1998). Preferences of certain varieties for their perceived maternal

Table 14.2 How gender relations shape the likelihood for adoption and use of improved potato varieties

Gender relations aspects	Aspects that favor women's adoption and use of improved varieties	Aspects that limit women's adoption and use of improved varieties
Valuing of men and women's preferred traits	<ul style="list-style-type: none"> • Men and women are consulted on preferred traits and these traits are considered in a breeding program 	<ul style="list-style-type: none"> • Gender relations that limit women's access to markets and their ability to benefit from crop marketing may limit their need and ability to adopt improved potato varieties • Traits that women value may be neglected by a breeding program if they are deemed not to have any economic value
Access to resources, assets and control of benefits		<ul style="list-style-type: none"> • Men control access to land and finances, thus women may not be able to adopt or benefit from improved varieties that demand high inputs such as fertilizers.
Gender norms and opportunity structure	<ul style="list-style-type: none"> • Women are interested in food security so are likely to adopt improved potato varieties that are high yielding 	<ul style="list-style-type: none"> • Domestic use by women of traditional varieties for important social rituals.

health effects, i.e. more nutritious, is a fundamental revelation that can help breeding programs to better target women by developing varieties with traits that directly benefit them. Thus, to be able to breed potato that farmers can adopt more easily, research is increasingly realizing that we need to understand the socioeconomic and institutional contexts in which farmers operate.

Furthermore, farmers' trait preferences should also be understood in a holistic manner, that not only looks at gender roles but also at the sociocultural environment in which variety and trait decisions are made. When farmers consider agronomic traits such as yield, for instance, they do not do that in a discrete manner. The yield trait is important for commercial and food security purposes, as illustrated by the following example from Ethiopia (Box 14.1):

Box 14.1 : Men and Women's Differences in Potato Trait Preferences in Ethiopia

Gender mainstreamed Participatory Varietal Selection Activities (PVS) in Ethiopia showed that man and woman farmer perspectives need to be integrated to ensure that released varieties meet their needs. Men and women had different preferences in their selection of potato clones. For example, out of five important clones, men and women's preferences matched in the top two selected clones. However, in the top three clones that men and women selected, they preferred resistance to disease and pest attack, high yield as well as tuber sizes that are preferred by the market as criteria. However, while men only selected clones which they perceived as free from pests and diseases, for their second and third best clone, women selected some potato clones that had some insect and pest damage because these clones had a size which was preferred by markets, had a good shape and superficial eyes (shallow eyes) which made processing and peeling easier. For the clone which they selected as second, women stated that the clone had a disadvantage in that it had cracks which increased loss upon processing and did not make good potato stew as this type of cracked potato would disintegrate upon boiling. This study shows that although men and women are interested in marketable traits, women had additional requirements particularly related to processing that men did not have (Mudege et al. [forthcoming](#)).

In some instances, the introduction of new improved potato varieties does not require only the promotion of new potato varieties as alternatives to traditional/native or local potatoes, but also involves the construction of different social configurations, it requires new patterns of farming and the enrolment of many different social actors and different ways of interaction. For example, introduction of improved varieties in the Andes also entails training of farmers on new production technologies. New production technologies may have a gender implication. Breeding programs, on their own, cannot change social configurations to be more empowering to women. To achieve this, interventions should be linked to other

programs focusing on gender transformation; for example, in terms of access to and control of resources, finance, access to markets, all of which may determine farmer's ability to adopt new improved varieties. New social configurations could mean that breeding programs are linked more to other interventions focusing more on gender transformation in communities. Therefore, gaining support for improved varieties is not a simple process, especially if the new improved varieties are being promoted in contexts where there are already established potato regimes and landscapes. As others have already argued, although end users may not have all information, they are often the experts when it comes to knowledge of the local context (in which new varieties are being introduced), hence it is imperative that their needs and aspirations are taken into considerations in all initiatives that touch on them right from idea conception (Njenga and Gurung 2011). It therefore becomes important to consider farmers' preferences, values, practices, and behaviors because these matter in understanding the complexities surrounding adoption or rejection of new improved potato, and puts farmers' agency and knowledge at the center of analysis.

Additionally, gender differentiated access and control over assets and resources can influence the crop and/or variety selected for production (Njenga and Gurung 2011). In the Andean potato-based production systems, women have less access to labor, have difficult or limited access to farm equipment for land preparation, and face restrictions to access and use inputs such as fertilizers and pest control products. These constraints shape women's preferences for lower yielding native potatoes that have lower market value but also require less inputs and labor (Polar et al. 2017). Studies on gender-differentiated crop trait preferences show evidently that varietal choice is related to access to and control of resources, rights, and responsibilities differentially shared by men and women engaged in production, processing, and marketing (Christinck et al. 2017; Bentley et al. 2018; Ashby and Polar 2019).

14.3.3 How to Integrate Gender Concerns into Breeding and Crop Improvement

To integrate gender concerns into the potato breeding program, CIP is using a two-pronged approach:

The first prong is to ensure that the interest of men and women are taken into account in the setting of breeding objectives. This can be done if in depth research is conducted through analysis of secondary data and/or collection of new data to identify the needs and interests of men and women who are end users and target groups. The second prong is to ensure that men and women groups are engaged in the evaluation of new potato clones either through participatory varietal selection (PVS) or participatory plant breeding (PPB) (Box 14.2). It is felt that these approaches will increase likelihood of adoption of varieties and technologies while at the same time addressing issues of gender equity since the needs of men and women will be addressed by the breeding program. In line with this, CIP has developed and tested a manual for gender mainstreamed participatory varietal selection

to collect information on trait preferences as well as to allow men and women farmers to evaluate potato clones before release.

Box 14.2: PVS in the Peruvian Andes

In the mid-1980s, potato breeders in the Instituto Nacional de Innovación Agraria of Peru (INIA) and the International Potato Center (CIP) jointly evaluated advanced potato clones from a diverse late blight-resistant population. These evaluations were conducted in farmers' fields. Three hot spots for late blight were selected in the Department of Huanuco in central Peru. In return for their support, farmers received one-half of the output of the trials. Lastly, the retained seed provided farmers the opportunity to start multiplying and using any clone that fits their circumstances. In the final evaluation, six of the most promising clones from 6 years of on-station selection and 3 years of testing in farmers' fields were selected. By the time one of the selected clones, Canchan-INIAA, was released, dozens of farmers were growing the variety, and a considerable amount of seed had been distributed via the informal seed system. Both men and women were involved in the evaluation of clones. The early adoption of Canchan INIAA before its release was a result of positive evaluation by men in terms of yield, earliness, and resistance to late blight, and by women in terms of the skin color, storability, and consumption quality. Women played a significant role in conserving and managing Canchan INIAA potato variety seeds, while men had a strong role during weeding, hilling, and harvest. It was actually woman farmer- managed Canchan INIAA seed that was eventually used to release the variety (C. Fonseca, personal communication), and the inclusion of both men and women in the selection of Canchan-INIAA, not only because of resistance to late blight, but the quality attributes, may be the reason why it is still a popular variety more than 20 years after its release, and after having lost the resistance attribute.

In addition, it is important that potato gender research contributes to current work on crop ontologies. In this way, end user priorities can be integrated into breeding programs by standardizing farmer priorities while ensuring that the breeding programs are not overwhelmed. The CGIAR Research Program on Roots Tubers and Bananas (RTB) for instance has developed next-generation breeding systems based on the collection and application of genetic, metabolite, and phenotypic data together with participatory, gender-responsive research on farmers' trait preferences, aiming at establishing a connection between preferred traits and the genetics that explain them. Thus, efforts in potato research should continue to contribute to the selection of traits that can be used in genomic prediction, and use of weighted selection indices that aim to ensure that new varieties have wide and gender-equitable impact (RTB 2016). By building up and contributing to sex disaggregated crop ontology database, gender mainstreamed potato research will ensure that

potato breeding objectives continue to evolve in ways that are responsive to men and women farmers in different agrifood systems. This effort is being integrated in the definition of more specific breeding product profiles that can take user and gender-differentiated preferences into account.

14.4 Managing Priority Pests and Diseases

The adoption of pest and disease management practices is an important topic to reduce production losses in potato. In some regions of the Andes, potato production is associated with heavy use of chemical inputs to manage pests and optimize profits (Mera-Orcés 2001). Similarly, in highland regions of Africa diseases and insect pests have the greatest potential for potato yield reduction, thus farmers rely heavily on pesticide use (Okonya and Kroschel 2015). However, most studies on the topic adopt a limited approach of only looking at gender roles (see Malena 1994) and how differentiated access to land, labor, finance, and education, shape women's technological needs differently (Malena 1994). In addition, writing on gender in the Andes, Paulson (2003) suggests that women are not homogenous as we have widows, married women, young, and single who have different experiences and different needs. Thus instead of focusing on a dichotomy of static gender roles, we should instead focus on the "possibilities for a more dynamic conceptualization of social roles in relation to changing social, economic, and environmental condition" (Paulson 2003). Since women differ by age, socioeconomic status, and other variables, we instead look at gender relations, which help to explain the roles of men and women and the decisions they make in relation to pests and disease management.

14.4.1 Gender Relations and Pest and Disease Management in Potato

Gender relations play a critical role in the management of pests and diseases in potato. Recent research in Malawi (Mudege, unpublished results) illustrates that social relations that privileged men's potato crop over women's crop for spraying meant that women's potato fields were more likely to be affected by late blight compared to men's crops. This in turn affected the availability of quality planting material for women if their crop was diseased, since farmers selected planting material from their ware potato crop for the next cropping season. Additionally, since men in men-headed households were expected to grow potato for the market, while women's potato plots were mostly for family consumption, men controlled the family budget. This had gender implications in pest and disease management. While lack of money to buy chemicals for spraying was mentioned as a key obstacle for both men and women, women were disproportionately more affected as they were only able to buy small quantities of chemicals and also because as mentioned, men's

potato crop was privileged when it came to application of chemicals (see Box 14.3). While some women could afford the chemicals, many often mentioned they may not have access to knapsack sprayers that were even more expensive to purchase and difficult to rent from other farmers. Where men and women from the same household cultivated and managed different plots, the men's plot were prioritized when it came to spraying for diseases. Women often mentioned that they could not afford to buy the knapsack sprayer because in families where men and women had separate plots often there was no cooperation, leaving women with a higher burden of taking care of family consumption needs and little to invest in agriculture. Additionally, women often mentioned that because they had no money to buy quality seed, they sometimes purchase diseased seed because it is cheaper.

Box 14.3: Using Pest and Disease Control Methods in Malawi

Women focus group participants in a study conducted by CIP in Malawi debated whether it was easy for women to purchase and use chemicals if their potato crop was affected by disease:

Participant: ...some [women] don't have the money we have seen the whole field being infected by disease but people failing to get money to buy the chemical. *(People arguing, many people speaking at the same time)*

Participant: The chemical is 100 kwacha it is not expensive anyone who want can buy the chemical.

Participant: Let me speak for myself, there was a year when my potato was destroyed because I had no money for chemicals. My husband was working but he was not being paid so I thought that if I go and borrow money from somewhere how will I repay the money so the whole field for potatoes was destroyed.

Participant: You could have sold 2kgs of maize and got 100 kwacha.

Facilitator: Your friends are surprised.

Participant: They are surprised because they can afford but I am talking about what happened at my home I am not talking about someone else (Dedza, women farmer group members)

Even if you have money to buy the chemical the problem is we have one [knapsack sprayer] in the house and since it was bought on the husband's budget he takes it with him to the field everyday and you will have nothing to use to spray with until all your potato is destroyed (Ntcheu, women nongroup members).

Source data (Unpublished data Malawi- Integrating gender into RTB research to improve development outcomes project)

Table 14.3 How gender relations shape engagement of women in pest and disease management

Gender relations aspects	Aspects that favor women's adoption and use of improved pest and disease management options	Aspects that limit women's adoption and use of improved pest and disease management options
Valuing of men and women's crops	<ul style="list-style-type: none"> • Cheap farmer-based pest and disease management practices • Pest control methods which may be labor-intensive but require very little use of outside inputs 	<ul style="list-style-type: none"> • Men's potato crop is valued more than potato cultivated on women-controlled plots because men's crop is for commercial purposes and women's crop is for domestic use. Men's crops get preferential treatment when it comes to pest and disease management (this is context specific in some African countries but not the same in the Andes)
Access to knowledge and other resources	<ul style="list-style-type: none"> • Women have access to information about pest and disease control which often is a preserve of men 	<ul style="list-style-type: none"> • Information on pest and disease management is packaged in ways that favor/promote men's access
Gender norms and opportunity structure	<ul style="list-style-type: none"> • Women are consulted and engaged in decision about crop protection • Cooperative household decision-making on agricultural investments • High outmigration of male labor which leads to feminization of most practices related to pest and disease management 	<ul style="list-style-type: none"> • Men dominate decision-making about adopting and using pest and disease management technologies

Box 14.3 shows that power relations in the household may determine distribution of resources and women's ability to use household resources in controlling pests and diseases in women managed plots. In a different context in the Andes, there is gender differentiated specialization in terms of pest management, which is usually perceived as men's job. Therefore, men have access to information and knowledge on pesticide use and pest control in general, including IPM in the field, while women are more interested in controlling pests in the store, which is more under their control.

Sharma et al. (2017) identified the use of disease-free tubers as seed as one of the key ways of controlling bacterial wilt. Since farmers normally use saved seed from their crop, small holder-friendly seed technologies will benefit women immensely in terms of increased productivity even if the land under production does not expand because they will have lower pests and disease burden.

Based on our experience with potato research and gleaning from some of the literature we reviewed, Table 14.3 shows how gender relations shape the opportunity space for women potato farmers.

If women are able to gain access to pest control information and methods are responsive to the resources available to them, women will benefit.

In many communities, such as in the Andean region, men-biased sources of information and knowledge on pest and disease management are used. For instance, information and knowledge on pest and disease management accessed through training events or the fact that men have higher literacy and can read labels of commercially available products more easily. Women on the other hand had lower literacy levels and lower command of Spanish, which limited their access to information provided in written form or through capacity building events (Polar et al. 2017). In Uganda, women and men's sources of information also differed. For example, in Eastern Uganda men obtained their information from vendors at local markets or from labels in pesticide packages, while women indicated that extension agents were their most important source of pesticide information (Erbaugh et al. 2003). However, in Uganda like in many other Africa countries extension is often underfunded. The gap in terms of access to information may need to be reduced, for example, by packaging information and presenting it in ways which makes it equally available to men and women, including use of local languages and bringing information and training closer to villages since women may not be as highly mobile as men.

While some studies in Latin America (see Polar et al. 2017; Mera-Orcés 2001) have focused on access to information by men to promote the use of pest and disease management technologies, approaches to gender and pest and disease management in potato need to go beyond just access to knowledge, information, and pest management technologies. Access to training and information in many cases intersect with control over assets and resources and power relations within households which affect use of improved pest and disease management technologies by men and women within households and communities. For example, although both men and women in Malawi had the same knowledge related to spraying of chemicals, women often mentioned that they did not have money to buy chemicals nor access to other resources that were essentially controlled by men, as illustrated in Box 14.3. This case clearly describes how access to assets and resources interplays with gender relations of power to determine the use of pest and disease management technologies. Even if economic resources are available to women, priorities are established based on whose crop is valued, who has access to and control of resources such as spraying equipment, and who makes decisions about use of available resources.

As relations of power, gender relations shape men and women's access to assets and resources. Access to and control of resources in turn may determine the type of potato pest and disease management technologies that men and women can adopt. A cross country study in Bolivia, Ecuador, and Perú on potato-based agricultural systems found that men and women have different perceptions and usage of chemical or organic inputs for pest and disease management. Women often preferred organic inputs and/or management practices because of their low cost, even if they were time-consuming; men on the other hand preferred chemical control because, they regarded chemicals as more effective against potato late blight (Polar et al. 2017). However, in adverse environments, both men and women were inclined to use chemical inputs to reduce the risk of economic losses in potatoes that were produced for markets (Polar et al. 2017; Mera-Orcés 2001). In this case the use of

chemical inputs is conditioned by the women's lower access to economic resources, as well as by the purpose why the crop is cultivated: domestic versus market.

The role of women as caregivers influences the distribution of activities linked to potato production. Although pest and disease management in general is perceived as both men and women's responsibility, the actual application of pesticides is more associated with men, while food preparation for field workers is a woman's responsibility (Mera-Orcés 2001 [Ecuador]; Erbaugh et al. 2003 [Uganda]). The examples above show that it is important to analyze both division of labor and decision-making processes related to use and adoption of pest and disease management options.

Hierarchical gender relations that denote men as decision makers at community level may result in women's needs not addressed or considered in programs. Sarapura (2013) reported that in peasant communities in the Andes, decisions on applying a new technique or a new method of cultivating native potatoes had to be approved by the community council. These councils are dominated by men as leaders and number of members. Even though, women are in charge of most of the production processes related to potato, in the case of a disease outbreak, community councils decide on the way forward. For example, in the community of Racracalla in Peru, peasant producers who were concerned about a new disease, late blight, caused by *Phytophthora infestans* and did not have access to formal extension systems, tried to resolve this issue by using their community organizations. For example, they tried to deal with the disease using different methods such as high tilling, construction of canals inside the plots, use of ashes in order to repel the disease. All the solutions were agreed upon by the community councils and tried. Sarapura (2013) identified gender implications in that if extension systems are just directed to the community councils which are men dominated, women may be left behind. In this specific case, decision-making is also controlled at the collective level, where women's perceptions, needs, and limitations may not be adequately considered, since all decision makers are men.

Pest and disease management in the potato crop is a more complex issue and depends on the type of pests or disease, the alternative control methods available, the inputs to be used, the information and knowledge available and the access to external sources of information. There is the need to also differentiate the perceptions of men and women regarding alternatives, and also understand the factors that influence access to and control of resources, so that suitable control methods can be identified during participatory research and used by farmers. This aspect becomes even more critical since climate change is likely to influence the increase in pests and diseases in the potato crop in different parts of the world.

14.5 Access to Potato Seed (Seed Flows and Networks)

The lack of disease-free, quality planting material has been mentioned in several studies as one of the key reasons for low potato productivity (Hoque and Sultana 2012; Litaladio et al. 2009; Gildemacher et al. 2009). For example, in Malawi,

Demo et al. (2008) suggests that lack of quality planting material is a key barrier to improved productivity. In many developed countries, formal systems are the source of quality planting seed for many crops including vegetatively propagated crops such as potato. Although the formal sector dominates the seed systems in developed countries, in developing countries, in spite of huge investments in the sector, “90–95% of the world’s small holder farmers still obtain seed from informal sources, largely from other farmers” (Reddy et al. 2007). The situation is particularly dire for vegetatively propagated crops in many Sub-Saharan Africa countries. There has been less focus on tuber crops, legumes, and horticultural crops among the formal seed systems of SSA (Biemond et al. 2012). It had been noted that in many Southern African countries many commercial seed companies are not interested in producing seed for vegetatively propagated crops because of added complicating problems such as low multiplication rate, bulkiness, short shelf life, and difficult maintenance during the dry season.

There has been debate regarding whether formal seed systems or the integration of formal and informal elements are good for potato seed systems as and to understand which are better for women and men farmers in marginal areas. Potato projects are increasingly encouraged to collect sex disaggregated data as well as to conduct studies to understand how gender relations affect the dissemination of new seed technologies. Based on our experience in potato research and the literature we reviewed, below is a table outlining some of the ways gender relations may impact on the efficacy of seed systems for women.

Table 14.4 gives examples of how gender relations permeate this sector. Approaches to seed certification clearly show how gender relations have an impact on the seed system. For example, some approaches regard formal seed certification

Table 14.4 How gender relations shape engagement of women in potato seed systems

Gender relations aspects	Aspects that favor women’s access and use of quality seed	Aspects that limit women’s access to and use of quality seed
Which channels are valued for seed dissemination?	<ul style="list-style-type: none"> • Improved technologies that promote availability of affordable quality seed • Availability of quality seed in local seed networks and local markets friendly to women 	<ul style="list-style-type: none"> • Unaffordable quality seed • Methods of availing seed that value masculine channels • Formalization of potato seed systems (certification) that dispossess women of their role as seed producers and conservers
Access to knowledge on quality seed and other resources	<ul style="list-style-type: none"> • Women access not only knowledge but also other resources, mainly credit, so they can run own seed businesses or gain access to quality seed for purchase 	<ul style="list-style-type: none"> • Men dominate decision-making on seed at both household and community level • Men control the resources needed to purchase quality seed
Gender norms and opportunity structure	<ul style="list-style-type: none"> • Farmer-based quality seed management technics • Gender-responsive farmer-based seed producer groups at community level 	

as essential to make available good quality seed to farmers. However, although certification could guarantee good quality seed, evidence from other crops have shown that in some cases women are less able to benefit from certification schemes than men. For example, women may lack the resources needed to have them certified as seed producers, thus are dispossessed from their role as seed producers and keepers. In addition, currently in many countries where CIP is intervening, new improved varieties of potato are available, but taking longer to disseminate, which means technologies that include public–private partnerships for rapid multiplication would benefit both men and women potato farmers especially if they lead to the availability of cheaper, good quality seed. Development of an innovative seed systems model called the “3G approach,” which combines rapid multiplication of tuber seed (through aeroponics) with technologies for good farmer seed management in about three generations rather than in the conventional seven have the potential to increase the availability of good quality seed and may also lower the cost of seed thereby improving seed security (Demo et al. 2015).

However, a CIP study in Malawi (Mudege and Demo 2016) shows that commercialization of seed could ensure the availability of seed but may not ensure accessibility of seed. Although both men and women prefer quality seed, women often lack the income to afford clean potato seed. Both men and women expressed a willingness to pay more for good quality, but men could afford to pay much more than women. On one hand, women preferred noncash transactions—such as paying for seed with labor or asking their friends for loans of seed to be returned after harvest. On the other hand, most men said they had opportunities for odd jobs in the community and surrounding areas which they could use to raise money to purchase seed. Women said that they could rely on their friends to get seed to repay after harvest, but it was usually difficult for men to give another man seed to plant (Mudege and Demo 2016). Likewise, in the Andes it has been suggested that because women have lower access to economic resources, they prefer low cost technologies and use local seed which they can access through barter, in kind payments, rituals in festivals and farmer to farmer exchange (Thiele 1999; Tapia and de la Torre 1998; Zimmerer 2003; Sperling and McGuire 2012). As a result of limited access to cash, private sector markets may not increase women’s access to quality seed, but local markets because of mechanisms where women can provide labor in exchange for seed. Thus, it is not only important to target multiplication of seed to increase availability of quality seed, but to focus on the mechanisms and pathways that can ensure women’s access to seed despite the limitations they face in terms of access and control over other resources.

Furthermore, FAO (2008) acknowledges that commercialization of agriculture, including seed trade, tends to exclude women. Women are usually excluded because they lack the resources which are needed to participate in commercialized systems. Zimmerer (2003) regards women as important in seed flows but men are often engaged in seed dissemination beyond the community in the Andes. Women are key players at procuring seed within the community. Both men and women are engaged in seed flows “at the extra community level”; however, when it comes to procurement of seed from the market and development institutions women’s role reduces.

Therefore, suggestions for commercial seed systems need to be evaluated from a gender perspective—in order not to do harm to women (Gibson et al. 2009). In addition, formal markets may not be able to sell fertilizers and other inputs in the smaller quantities that women can afford. Thus, vibrant local markets which are not only cash reliant but based on other forms of reciprocity and relationships within the community would be able to meet women's needs. However, when commercially produced seed is available, the effects have the potential to trickle down when those farmers who can afford to buy clean seed may have relatively clean planting material to sell to other farmers at harvest time.

To accommodate women and other poor marginalized farmers, research is also moving increasingly towards developing farmer friendly seed management techniques such as negative and positive selection, which have been promoted to improve the quality of seed in the informal sector. Positive and negative selection are two methods introduced in Malawi to help farmers to access healthier planting material. Positive selection requires marking potato plants as parent stock. Plants chosen must display good growth and most importantly should show no signs of bacterial wilt and/or viruses. Negative selection is selecting plants that will not be used as parent stock. Plants marked are those infected with bacterial wilt and/or viruses (Tantowijoyo and van de Fliert 2006 see also Salazar 1996; Njukeng et al. 2007). Farmers who belong to farmers groups are taught how to identify health plants and select them as parent stock for seed. Farmers are taught how to identify the health plants which are supposed to be “big”; have many and thick stems; have dark green leaves without malformations; have many, large and well-shaped tubers; do not show obvious disease symptoms (Gildemacher et al. 2007, 2011). A study by Gildemacher et al. (2011) in Kenya shows that positive selection provided small holder farmers with better quality seed and led to high yields. However, potato research in Malawi has for example illustrated that women are often left out on training on agronomic practices and thereby lack the knowledge they need to improve their productivity and accessing clean seed (Mudege et al., 2015a, b).

Since positive and negative selection relies on visual inspection, it is not entirely reliable as it needs a farmer to be experienced in spotting the diseased plants (Chiipanthenga et al. 2012). In addition, even when farmers have knowledge, cultural practices and norms can militate against dealing with pests and diseases. For example, in the Andes it was noted that farmers were afraid to rogue diseased plants for fear that if they tampered with food crops they could be punished by the ancestors (Thiele 1999). Very few studies have also discussed what men and women know regarding seed quality and how to maintain it. Given the critical importance of quality seed it is important to know what farmers know about seed quality and how this can affect the fight against potato diseases and pests in the informal seed system. Thus, work has been conducted in different countries, including Malawi and Uganda, to understand what men and women's knowledge and perceptions are regarding seed quality.

Potato research has also looked for innovative ways to link the formal and informal seed systems to ensure accessibility of seed. For example, the Consortium of Potato Producers from Ecuador CONPAPAA initiative in Ecuador sought to pro-

duce good quality seed by providing producers (farmers) seed grown through aeroponics and training them to multiply it as quality declared seed (Kromann et al. 2016). This approach managed to make available seed which was less expensive than certified seed. Using this approach allowed women and indigenous farmers to access quality planting material through the merging of formal and informal seed systems than would not have been possible with conventional approaches. In Peru, the informal system satisfies the seed needs of 99% of the potato growers. Seed in the informal sector in Peru is locally available and cheaper than certified seed. This shows that an integrated seed system under certain conditions can outperform stand-alone formal and informal seed systems. Orrego and Andrade-Piedra (2016) present a case in Peru where quality seed from the formal sector was distributed through both formal and informal channels for further multiplication and dissemination. Having locally available clean and cheap seed is particularly important for women, since they have low access to monetary income. Research on potato in the Andes has already shown that women are often more engaged in sourcing seed within the Andes using family and community networks (Tapia and De la Torre 1998; Zimmerer 2003). Some women's movements in Latin America are building on traditional roles of indigenous women in seed management to positioning themselves as privileged custodians of seeds and biodiversity (Aguayo and Hinrichs 2015).

Given the current challenges to design seed systems that contribute to resilience of farming systems to threats, such as climate change, it is important to understand and take into account both women and men perceptions for seed-related alternatives, particularly, if seed businesses could become an important source for income for women and youth.

14.6 Marketing, Postharvest Processing and Utilization

This section will look at how female farmers face gender-specific challenges in relation to potato markets, and the discussion of key findings describes how gender matters in marketing. Urbanization has provided potential markets for potato and potato products due to demand from urban consumers (Bonabana-Wabbi et al. 2013). However, farmers have very limited market information and cannot take advantage of emerging opportunities to meet demand. Bonabana-Wabbi et al. (2013) suggest that because of lack of market information farmers are prone to exploitation by middleman. To address this, farmer collective marketing has often been used to improve the bargaining position of farmers in marketing (Bonabana-Wabbi et al. 2013). However, CIP research on gender and collective marketing in Malawi, illustrated that gender inequalities were often reinforced in marketing groups (Mudege et al. 2015b). For example, in groups, payment was often given to male household heads even when women had submitted the potato for sale in cases where their husbands were also group members. This was a different experience from the COGEPAN in Peru (Sarapura et al. 2016) where women directly received their money and invested it for their own benefit. While in COGEPAN, the approach

Table 14.5 How gender relations shape engagement of women in potato markets

Gender relations aspects	Aspects that favor women's participation in markets and their ability to benefit	Aspects that limit women's participation in markets and their ability to benefit
Power relationship between male household heads and women	<ul style="list-style-type: none"> • Approaches that allow women to have direct access to markets and benefits 	<ul style="list-style-type: none"> • Ideologies that regard male household heads as the official representatives of the family and therefore in charge of markets and marketing proceeds • Men control all decisions related to marketing.
Access to markets	<ul style="list-style-type: none"> • Women participate in case of low potato quantities 	<ul style="list-style-type: none"> • In men-headed households, high volumes of potato sold are usually decided by men
Gender norms and opportunity structure	<ul style="list-style-type: none"> • Training on business management and market access targeting women 	<ul style="list-style-type: none"> • Men make decision on how much to sell, where to sell and whom to sell to • Lack of mobility for women restricts access to high value markets

challenged gender relations of power, in the Malawi case, collective marketing reinforced existing gender inequalities.

In Kabale, Uganda, it was noted that men and women were equally engaged in potato trading (Bonabana-Wabbi et al. 2013). However, studies often rank types of trade in order of how many people are engaged without looking at the division of participation by sex to ensure that targeted gender responsive interventions are made. For example, Bonabana-Wabbi et al. (2013) reported that in some districts in Uganda the majority of those engaged in potato trade were in retail compared to wholesale followed by collectors, agents, and transporters. However, her study and other studies do not segment these value chain actors from a gender perspective. For example, it is not clear how many men and women are engaged at these levels and what profit margins accrue to men and women at these different nodes (Box 14.4). Research on potato marketing for example could collect this information since it is critical to know who benefits from potato technologies including improved varieties (Table 14.5).

Potato research has also looked at the gender-related constraints to marketing. For example, it was noted that in Uganda men sold more potato than women because they had contact with buyers and brokers whom they meet at local markets (Sebatta et al. 2014). In order to gain insight on the lack of participation by women in potato commercialization, the structures influencing men and women's participation need to be understood as well. For example, Jibat et al. (2007) notes that in Ethiopia women are engaged in potato markets when selling at low quantities and in local markets while men dominated bulk sales as well as sales at markets far from the village. However, the potato story is not all doom and gloom since it is possible to

conduct research and implement interventions that are gender responsive as the example below shows (Box 14.4):

Box 14.4: Markets and Inclusive Value Chains

Research in potato marketing in Uganda revealed that both men and women mentioned that they had limited access to markets and to timely information on potato market prices. Women also suggested that because of unequal relationships within households, men often decided on who to sell to, how much potato to sell and where to sell as well as deciding on use of potato income without necessarily consulting women. In addition, it was clear that the market itself was structured in ways that did not favor women's participation. For example, gender norms that designated potato as a men's crop meant that women who tried to sell potato on their own without their husbands were viewed with suspicion while husbands could sell crops on their own without their wives. Lack of mobility for women, poor transportation system and infrastructure, selling potato in large bags that women could not handle, and distance to markets were all mentioned by women as barriers to participating in potato marketing. To address some of these issues within the remit of the project, both men and women farmers and traders were targeted with training of trainers on business skills including marketing and net profit and loss calculation. Sixty nine men and 34 women were trained in marketing to ensure that they understood what marketing was, demand and supply forces, customer analysis and customer feedback mechanism, strategies, segmentation, product differentiation, and marketing information in the context of potato business. Effort was made to ensure involvement of women in this training even if they were not involved in management committees of associations. Since both men and women mentioned lack of market information as limiting their ability to negotiate with buyers, the project through its partner Self Help Africa (SHA) developed mechanisms for disseminating market-related information such as potato prices in Kampala through text messaging to group leaders who would then disseminate this information to other group members to ensure that farmers negotiate from an informed position. (Summary of our experiences with the ENDURE project in Uganda).

In Uganda (Mudege et al. 2016) notes that men mentioned lack of knowledge on what the market wants and also on price intelligence. Although men participated more in markets than women, both men and women did not have enough market skills or adequate market information. For example, women in Wanale mentioned not even knowing where exactly their husbands sell the potato, whilst men mentioned that they were often told that their potato was poor quality and also that they were not sure about the prices their potato would reach. Lack of engagement by women in markets was also noted elsewhere by Mudege et al. (2015b), who showed that in Malawi wherever husband and wife made joint decisions over use of income

from potato, money was used to buy seed and fertilizer and other equipment; whereas when male household heads made decisions on their own, women mentioned that they often did not benefit from potato income. Thus, potato research and interventions should not just focus on technical aspect of potato production but also include social aspects such as promoting joint decision-making to ensure that both men and women benefit. In addition, methods to improve access to markets and bargaining power, for example, the use of Information and Communication Technologies (ICT) to inform women and men about market prices or weather forecasts could increase the ability of women and men to benefit from potato markets. In reference to de facto female-headed cotton farming households, Horrell and Krishnan (2007) state that “even without additional resources, greater profitability could be achieved from their existing agricultural output through access to better selling networks and buying consortia for inputs.” The same can also be true for women potato farmers, if social norms that prevent them from marketing potato or deciding on household expenditure are challenged, women may be able to invest more into potato production resulting in better quality crop and better storage. Based on our experience and literature reviewed, Table 14.5 shows examples on how gender relations may influence the ability of women to engage and benefit from potato marketing.

Power relations between men and women heads of households and the position of women in the community relative to the position of men may shape the opportunity space for women to not only engage in marketing but also benefit from it.

In other geographical and social setups, such as in the Andes, research has shown that women dominate potato markets including price negotiation and control of income (Amaya and Alwang 2012), because men regard women as better negotiators. Additionally, Amaya notes that traders in the market are mostly women, and men regard it as undignified to argue with women when bargaining for a better price, thus let their wives sell potato. However, it is noted that women increasingly need information to participate in regional markets although marketing decisions are made jointly by husbands and wives. It was also noted that men monopolize the use of cellular phones to get information on markets (Amaya and Alwang 2012). Therefore, the cellular phone has not fundamentally changed gender roles: market decisions continue to be jointly made, and men continue to control access to market information.

14.6.1 Postharvest Utilization

Gender relations also influence women’s access to postharvest technologies. In many parts of the world women are responsible for postharvest activities at household level. Knowledge and skills are passed on dynamically from generation to generation and these actions have long subsisted outside public and private sectors, R&D and agricultural extension systems (Tapia and de la Torre 2000), and often-times when technologies are being designed, the innate skills that men and women farmers have and the roles they play are not taken into account. However, since

postharvest technologies have been developed and disseminated, there are concerns that men take over the latest technology and women can be left behind. A study in Bolivia (Polar et al. 2017) illustrates that women are the ones who are mostly engaged in grading potato by size. However, when technologies to mechanise potato selection were tested, only men were engaged in validation meetings. These technologies were later introduced but were not adopted by the women who were supposed to benefit. Women were not involved in evaluating this technology and found it difficult to use because the machine was tall and needed substantial physical strength to manually load heavy bags of potato. The machines were later adapted to meet women's needs, and their use helped reduce the amount of time women devoted to selection of tubers for the market. Ogunlana (2004) also suggests that women farmers can easily adopt innovations that can enhance their economic status if constraints pertaining to access to the technology (e.g. information and ease of utilization) are taken into consideration. Box 14.5 highlights a case where gender-related concerns were integrated during the introduction of ambient stores for storing ware potato in Uganda:

Box 14.5: Introducing Ambient Stores for Storing Ware Potato

A potato postharvest project implemented by the International Potato Center (CIP) in collaboration with the CGIAR Research Program on Roots, Tubers and Bananas (RTB) in Eastern Uganda to introduce ambient stores for storing ware potato under ambient conditions was rolled out through farmer and trader associations. Evidence from the associations demonstrated that women were underrepresented in leadership positions and almost nonexistent in storage management committees of the four associations.

Women expressed concern that if only men hold leadership positions in the management of the store, women may not be able to benefit from and to fully utilize the stores. For example, they noted that training targeted group leaders who were often men. Women insisted that for them to benefit from the stores, there should be gender balance in the people selected to manage the store. And although women had expressed the will to be active in store management, personnel from an NGO who facilitated the process of selecting store management committees revealed that most women refused to occupy these positions when elected. Some of the reasons women used to explain why they refused to occupy leadership positions included lack of time to commit for such duties, fear that their husbands would not allow them, meetings times may not be conducive for women, and some women regarded their illiteracy as a limiting factor.

While recognizing the need to have women represented in the group management committees, women also mentioned the risk of women being given token positions where they would not be involved in decision-making, stating for instance that women could be designated to deputy or committee member positions which did not have much influence in terms of decision-making. Some associations noted that since men had been the original members of the

associations they dominated positions and it was difficult for women to break into top leadership.

The potato team worked with partners such as Self Help Africa (SHA) as well as farmer and traders' associations to review association management rules for gender inclusiveness. Where it was not possible, the team made a concerted effort to ensure that even if they were not in leadership positions, women representatives were also trained on store management to ensure that they are knowledgeable and actively involved. Under this project, 119 farmers and traders were trained on structure and governance (41 women and 78 men), 102 farmers (32 women and 70 men) were trained on enterprise analysis focusing on cost benefit analysis. Additionally a total of 106 farmers (69 male and 37 female) were trained on business planning in order to equip participants with skills to develop and use business plans to maximize profitability. A total of 111 (82 male and 29 female) were also trained on record keeping and store management. The aim of the module was to equip participants, in particular the store management committees, with skills to manage the ambient stores effectively and ultimately develop store management guidelines and records (Mudege and Mayanja 2016).

The case described in Box 14.5 illustrates that in some cases it is important to be gender intentional when designing potato interventions and research, otherwise researchers run the risk of not including women. It is important to identify the constraints that women face, so that these can be taken into consideration and addressed during the design of research and interventions.

14.7 Access to Extension and Training

Research has shown that women in most potato-growing areas have very limited access to training (Dersseh et al. 2016; Mudege et al. 2015a; Polar et al. 2017). For example, when women and other poor households are not targeted with training on new improved potato varieties, they did not regard lack of training as a key constraint to production (Dersseh et al. 2016). While the cause and effect relationship is unclear, it may be because oftentimes, women lack information about the importance of access to training and of improved varieties, and therefore they do not engage in training to the extent they should. Based on our experience and literature review, Table 14.6 gives some examples on how gender relations shape women's engagement and access to training and information.

If training is organized where it is physically accessible to women, women are directly invited to participate, and training methodologies are taking cognizance of women and men's capabilities, women will be able to access the information they

Table 14.6 How gender relations shape engagement of women in access to and benefit from potato-related extension services

Gender relations aspects	Aspects that favor women's access to and benefit from extension services	Aspects that limit women's access to and benefit from extension services
Valuing of men and women's access to extension	<ul style="list-style-type: none"> • Training venue and time selected according to women's physical mobility and time availability • Use of female extension workers • Using appropriate language and training methods 	<ul style="list-style-type: none"> • Women and poor households not targeted on invited for training • Training targets men as heads of households and decision makers • Training targets group leaders. Men usually lead farmer groups
Gender norms and opportunity structure	<ul style="list-style-type: none"> • Access to information, technology, and resources to implement knowledge and skills acquired from training 	<ul style="list-style-type: none"> • Men may make household decisions on who will attend training

need. However, whether women can use the knowledge and information they gain may depend on gender and decision-making power within households.

Research has shown that in East Wollega and West Shewa Zones in Ethiopia, even though the gender division of labor regards potato as a woman's crop, it was mostly men who participated in training on potato production, regardless the roles they played in its cultivation (Jibat et al. 2007). There are similar findings in the Andes where women play a key role in potato farming and management, yet they have low participation in training events compared to men (Polar et al. 2017). On the other hand, where potato cultivation is regarded as a men's activity women's contributions are overlooked (Mera-Orcés 2001) and women are denied access to the resources and training they need. In Malawi, potato research has also illustrated that women are often left out of training which further reinforces gender stereotypes that women know nothing (Mudege et al. 2015a).

The potato seed system intervention in Malawi relies on farmer participation both as group members and as lead farmers in the knowledge cascade approach. Men and women were targeted with training as part of groups. However, Mudege et al. (2015a) found that unless properly managed and monitored, delivery mechanisms that depend on participatory activities can be gender-blind. Interventions based on participation can become gender-blind if they do not recognize the differences between men and women. Gender-blind approaches "make assumptions, which lead to a bias in favor of existing gender relations ... gender blind policies tend to exclude women" (March et al. 1999). For example, Mudege et al. (2015a) notes that farmer group training mostly targeted group leaders who were frequently men. If women do not have access to same extension services as men, their productivity and incomes may be limited. A study of factors influencing potential adoption of technology in potato-based systems in the Andes found that women had limited exposure to innovations through capacity building because they lacked skills in the official languages, had lower literacy levels, and the spaces where technical infor-

mation was provided were dominated by men (Polar et al. 2017). Thus, to enhance women's access to and benefit from extension services, services need to be accessible to women in terms of language used, methodological tools, schedule times, and delivery spaces.

14.8 Conclusions

The analysis presented in this chapter discusses how gender relations shape the opportunity space for men and women potato farmers along the potato value chain. Power to make decisions and act on them is important and influences the ability of men and women to participate along the potato value chain and benefit from it. The analysis shows that lack of access to and control over assets and resources and decision-making can restrict women's engagement in potato production, marketing, and utilization. Institutional innovations and more gender responsive programming that consider the opportunities and constraints of men and women can contribute to equitable development of the sector. How men and women efforts are valued and the resources they control do not only affect women's ability to participate in the potato sector but also shapes their participation and ability to reap benefits from the sector at the same level as men.

Gender research related to potato production, use, and commercialization has in many cases attempted to show the role and importance of women in different potato-related activities from production to market, for example, as laborers or as custodians of genetic diversity and local knowledge. While most of this research has been concerned for example in bringing to the forefront hitherto hidden women's contributions to potato farming, it has also succeeded in developing initiatives to address both men and women's needs depending on the roles they play and the needs they have. However, research has also shown the folly of limiting gender analysis just to gender roles and access to resources and assets. This is so because even where women are the ones engaged in certain roles, they may fail to benefit from their labor because they defer to male households' heads to make decisions. Women may also not access training even for tasks they are engaged in because recruitment may favor male household heads to attend training even if they are not engaged in potato activities. As a result, it is important for potato research to also investigate gender relations and how the valuing of men and women's labor and contributions determine their ability to engage in potato production, management, and marketing. This chapter has illustrated the importance of going beyond just understanding gender roles and access to resources and to also understand gender power relations within households and communities since these determine whether women and men are able to equitably benefit from the products of research.

Non-pecuniary benefits of cultivating certain varieties of potato may influence adoption. Non-pecuniary benefits are those nonmonetary benefits related to social and ritual needs in communities where potato is part of the culture such as in the Andes. These types of benefits need to be understood as part of the value proposi-

tion to ensure that released improved varieties meet man and woman farmer's needs. Breeding programs should ensure that key important traits that may not have an immediate economic value but are important to women are not neglected. Farmers may continue to cultivate varieties that have lost some of their key attributes because these varieties may meet some needs which are not readily quantifiable. This means gender work in potato breeding should continue to contribute to knowledge on men and women user preferred traits that can be standardized and integrated into breeding programs to ensure that they continue to be responsive to farmers' needs. Failure to do so may jeopardize farmers' ability to benefit from genetic gains resulting from new improved varieties.

A supportive social and institutional environment is needed to promote adoption of improved varieties and other potato-related technologies by men and women farmers. For example, access to resources such as land, cash, and decision-making power influences whether men and women can use and adopt new technologies and methods. Having knowledge only may not result in adoption of technologies in the absence of a supportive institutional and social environment. For instance, if extension services are gender biased women will not be able to benefit from them. However, having access to information is itself not enough condition of benefitting from potato research. Unequal gender relations and other relations of inequality may prevent men and women from adopting technologies that can help them.

Commercialization and commoditization of seed runs the risk of dispossessing women of their control of seed and may also jeopardize their ability to access seed. Seed is often part of the social fabric where women may gain status or capital by distributing seed freely in their communities. Although noncash transactions such as women working for seed are often not valued by policy makers who promote commercialization and certification, they often ensure redistributive potential within communities where women and other poor and vulnerable groups are able to access seed. More research and investment may be needed to improve farmer-based seed to ensure circulation of better-quality planting material in communities. This also will be able to address the needs of women and other vulnerable groups from poor communities who prefer culturally recognized noncash transactions for accessing seed.

Certainly, more research on gender and potato still needs to be conducted because most of the research that has been conducted so far is at a relatively small scale. More large-scale research including surveys need to be conducted on a variety of topics to ensure that results are more generalizable and lead to the development of gender integration approaches suited to various regions and countries.

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