

MOVING BEYOND *REACHING* WOMEN IN SEED SYSTEMS DEVELOPMENT

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Seed is critical to food security as the first link in the food value chain (Galiè 2013) and can be a powerful agent of change (Reddy et al. 2007). Similarly, women's empowerment and gender equality are key to food and nutrition security (Agarwal 2018). The interplay between the two is becoming increasingly important: socioeconomic and gender differences in seed and food security must be understood to target seed interventions effectively (FANRPAN 2011). However, the importance of seed systems to empower women has so far been neglected. This chapter contributes toward closing this gap. Gender analysis is important for a comprehensive understanding of seed systems and to shape effective and inclusive interventions that go beyond reaching women to benefit and empower them.

Gender relations shape seed access, use, and outcomes. In developing countries, seed is often managed by men and women on family farms and sourced mainly from farm-saved seed and the local market (GRAIN 2000, Sarapura 2012). Gender and other socioeconomic factors mediate how farmers access seed sourced through local and formal market channels (Thuo et al. 2014). These factors influence access to information about seed (e.g. origin, quality, price) and ability to purchase seed (e.g. access to cash, negotiating power), which in turn influence utilization (e.g. who plants which seed and where). Applying gender analysis to improve seed systems and reduce/overcome existing biases in access to and availability and use of quality seed of local and improved varieties is an essential first step toward empowering women (FANRPAN 2011).

This chapter reviews existing literature and evidence to answer the question: *How can seed system interventions advance women's empowerment and gender equality?* The study of seed systems does not have a very long history, compared with that of breeding, value chain development, or natural

resource management—which likely explains why gender analysis of seed systems is at an early stage. Relevant literature is emerging slowly but still limited. That made this chapter’s task not an easy one. It therefore starts with a more typical framing—of how gender dynamics affect seed system outcomes. It then explores how seed system interventions can benefit and empower women. The central premise of this chapter is that seed system interventions can contribute to women’s empowerment when designed intentionally to be gender-responsive.

This chapter is based on a systematic review of the seed system literature in English available in CGIAR repositories, using Mendeley and Google Search. The key words used included seed systems + gender roles; formal and informal systems and networks; seed banks and cooperatives; production, processing, storing, saving, exchange, marketing; entrepreneurship; access to seed and information; affordability; willingness to pay; and actors, policies and institutional landscapes. The initial categorization of documents was complemented by identification of parameters and gender frameworks used for analysis. From an initial set of 86 relevant references, 49 were selected for detailed review. Material about Africa was dominant, thus an attempt was made to include more references about Asia and the Middle East. While acknowledging the contextual specificities of gender dimensions and seed systems in these studies, the geographical coverage provided a sufficient base from which to identify and analyze gender asymmetries prevalent across seed systems in different locations.

Most of the literature reviewed lacks sex-disaggregated data; it focuses on how “farmers” as a unit access and use seed. The scarce sex-disaggregated literature that was available was based on household surveys, likely using responses from women heads of household and overlooking the majority of women who are living in households headed by men. These latter likely face different limitations and constraints compared with women household heads. The literature that considers roles of women and men and interactions in the seed system looks largely at informal systems.

We first introduce key gender and seed system concepts, to provide a basis for the discussion. We then take four key seed system outcomes related to seed users—availability, quality, access, and use and control—and review the available evidence through a gender lens. We next reflect on women seed producers and empowerment outcomes, and then summarize insights on the impact of gender dynamics on seed system outcomes and how seed system interventions can contribute to women’s empowerment. We conclude by

presenting key components of a forward-looking research agenda that support women's empowerment through seed systems.

Gender and seed systems concepts

Here, we present two sets of concepts that guide our analysis and discussion: seed system concepts; and gender equality and empowerment pathway concepts. For the first, we draw on seed security and associated outcomes (Remington et al. 2002, Sperling 2008, McGuire and Sperling 2011, Sperling and Boettiger 2013, FAO 2015, Subedi and Vernooy 2019) and on multi-stakeholder institutional frameworks for intervening in seed systems (RTB 2016, Bentley et al. 2018).

A brief introduction to seed system outcomes, delivery channels, and enabling environment

There are four main seed system outcomes: availability, quality, access, and use and control of seeds.

- **Availability** means having enough seed physically present at the right time and in the right place, especially seed of preferred crops and varieties.
- **Quality** is a standard of excellence in seed attributes that determine the potential performance of a seed lot. It includes both physical qualities (e.g. size, weight, color) and appropriateness (i.e. genetic quality) that result in good seed viability.
- **Access** concerns the capacity to obtain reliable information about how and where to obtain quality seed, its price, and how best to use it. Access is influenced by the mobility/networks of seed users, which is partly reflected in the delivery mechanisms they are able to tap into, such as available transport and logistics of getting seed from point A to B. Affordability is defined as the ability of farmers to buy seed at a reasonable price; it can be affected by the market.
- **Use and control** of seed and the benefits arising from its use are influenced by the resources to which women and men have access and the power relations in the household and community.

Seed delivery channels, a key aspect of seed access, fall broadly into three categories, often referred to as types of seed system: the national public seed system (formal), commercial seed distribution networks (formal), and

farmer-managed or community-based seed systems (informal). **National public seed systems** (formal) produce and market certified seed through national/state/parastatal (extension) agencies, cooperatives, and private sector dealer networks. In **commercial seed distribution networks** through wholesale and retail agrodealers (formal), private sector seed companies play a major role; seed of hybrid varieties (cereals and vegetables) that farmers demand every planting season are popular in this channel, and the seed is certified and branded. In **farmer-managed or community-based systems** (informal), seed is exchanged through social and local networks, often moral economy-based (Bates et al. 2011, Schöley et al. 2017, Suma and Großmann 2017) and/or obtained from local markets; seed is predominantly uncertified, truthfully labeled, or quality declared.

The institutional structures/factors that are key in determining the enabling environment for seed systems are seed policy, seed system governance, and seed system management. **Seed policy** refers to a statement of principles that guides government action and explains the roles of relevant stakeholders in a seed system. It can have a significant influence on all seed system outcomes. **Seed system governance** is the process whereby a group of individuals work as a collective to assure the health of a seed system. It usually includes moral, legal, political, and financial aspects. **Seed system management** includes the day-to-day coordination, execution, and monitoring of key tasks required to maintain a seed system in the short and long terms. It usually involves human resources, as well as technical, administrative, organizational, and financial elements.

A brief introduction to gender analysis and women's empowerment pathways

In this chapter, we look at gender dynamics in seed systems for women seed users and producers. Our analytical lens is informed by the Social Relations Framework, which argues that underlying causes of gender inequality are not confined to the household and family but are reproduced across a range of institutions, including the community, state, and market (Kabeer 1994). The use of this Framework enables the examination of power issues, gender dynamics, and social change in relationships, communities, and institutions, and assessment of the potential for gender transformation through seed systems. The Framework conceptualizes gender in terms of social relations that define the ways in which a culture or society defines rights, responsibilities, and the identities of men and women in relation to one another (Bravo-Baumann 2000). These gender relations have strong institutional dimensions,

and encompass recognition, gender division of labor, access to and control over resources, decision-making, and social and gender norms (Galiè 2013, Bezner Kerr 2013, Sen et al. 2007). Each is elaborated below.

- **Recognition** is the acknowledgment of the identities and associated roles individuals freely choose or aspire to take in society.
- **Gender division of labor** refers to the allocation of different jobs, responsibilities, or types of work to women and men. This is often influenced by social norms and what is considered suitable and appropriate for each sex. These roles could vary over time and space and are constantly under negotiation. They are also affected by societal, economic, and historical changes. This division of labor influences the economic and other opportunities men and women have.
- **Access to resources** refers to the opportunities and rights to use a resource as per one's need and **control over resources** refers to the rights and power to decide on the use of resources.
- Women express agency in **decision-making** when they influence and make decisions and establish and act on goals. Key decisions that affect women's lives and futures occur in both private and public spheres and often entail a process that includes negotiation and compromise.
- **Gender and social norms** refer to rules and shared social expectations that define acceptable and appropriate actions for women and men in a given group or society.

To deepen the analysis and look at empowerment pathways, we draw on the Reach-Benefit-Empowerment Framework (Johnson et al. 2018) introduced in Chapter 1 of this volume. In short, in the context of seed systems, seed interventions need first to *reach* women and address barriers to reaching them; once reached, women can potentially *benefit* from the use of seed and this could contribute to their *empowerment*. We can consider women's involvement, benefits, and empowerment in seed systems from two angles: women as seed users and seed producers.

A seed system that recognizes the differentiated needs and preferences of women and men farmers as seed users ensures the availability of good quality seed of preferred crops and varieties through appropriate and effective delivery channels. It provides the first step on the pathway toward empowerment by **reaching** women farmers. Women farmers' access to quality seed can be enhanced through creating awareness and providing access to information

about the seed and its availability. For seed systems to reach women, quality seed also needs to be affordable and measures need to be in place to support women to overcome the barriers to mobility and networking (Bezner Kerr 2013). These actions have the potential to expand women's access to resources and opportunities and result in positive **benefits** in the form of increased productivity, higher incomes, and food security. Only when women have access to and control over inputs, resources, knowledge, skills, and decision-making can seed systems contribute to women's **empowerment**.

Empowerment through seed systems first requires social and institutional structures that create enabling conditions where women's contributions are valued and rewarded. Gender transformative approaches are those that aim to influence the social context, creating an enabling environment for gender equality and women's empowerment (Razavi 2009, Chant and Sweetman 2012, Kabeer 2012, Okali 2012, Galiè and Kantor 2016; see also Chapter 10, this volume). When seed systems are empowering, the equal rights of men and women to seed are acknowledged and opportunities are equally available to men and women as seed users and as producers. Second, empowerment requires that both men and women farmers are represented when decisions affecting operations of seed systems are discussed and implemented. Third, it requires that women farmers are able to make strategic decisions related to their ability to access, utilize, and benefit from seed.

While this chapter focuses mainly on women seed users, we also examine evidence related to women's empowerment through their engagement as seed producers. Women seed producers challenge stereotypes that narrow women's roles to that of farm laborer without any decision-making power. Seed production is inherently associated with better access to inputs, including knowledge, land, fertilizer, machinery, and credit. This means that women seed producers usually have access to good quality seed to multiply and to associated inputs and resources through networks and institutions. By controlling seed production, it is expected that women producers will generate benefits. When they also have agency over the use of the seed they produce and these benefits (e.g. higher incomes that they control), women seed producers are empowered. An interesting question to explore, for which not much evidence is available now, is whether seed production by women leads to enhanced access to quality seed for women seed users in informal and formal seed systems.

Women seed users and gender dynamics in seed systems

This section focuses on women as seed users and reviews the existing knowledge on gender dynamics in seed systems. We look at seed availability, quality, and access, and use of and control over seed.

Availability

Availability of seed is influenced by the type of delivery channel or seed system (as described above). The formal seed sector generally sells certified seed through a limited number of officially recognized seed outlets. It often focuses on seed from formal breeding programs and a few crops of high commercial value. This sector has generally been less successful in marginal, more variable, low-potential areas; seed often does not reach certain social groups (Shiferaw et al. 2008). As a result, crops and crop varieties with low market value, that are important for smallholder farmers' household food security, are left out. These crops and crop varieties often are under women's control, sometimes referred to as "women's crops." Sometimes, the varieties available may not be relevant (Ceccarelli and Grando 2007, Galiè 2012) or well suited to the complex and gendered needs and preferences of smallholder farmers. Another constraint is the high(er) price of formal sector seed, which makes it unaffordable for many smallholder farmers (Galiè 2013). In sum, the formal seed sector—both private and governmental—faces challenges in reaching women smallholder seed users and meeting their preferences and needs.

Participatory plant breeding (PPB) addresses some of the shortcomings of the formal system to make crop diversity better available to smallholder farmers (Vernooy 2003). PPB brings farmers and scientists together on equal terms to assess and improve varieties (from the national breeding system and local sources) under local farm conditions, based on the selection of locally preferred traits. Varieties created through PPB can then be multiplied locally, and, where government rules and regulations allow, be submitted for formal registration and release. PPB contributes to a seed system that is better able to address supply- and demand-side issues (Almekinders et al. 2007). It is also influenced by gender dynamics. For example, in Syria, women farmers faced difficulties getting involved in a PPB program because male government extension workers were accustomed to working only with men farmers (Galiè 2013). Communities did not appreciate women's involvement in agriculture and did not support them. Gender norms discouraged women's interaction with unrelated men, including breeders and extension workers. In addition,

men farmers involved in the sale of seed produced by the program obstructed women's involvement, fearing potential competition.

Smallholder farmers continue to rely to a large extent (70–90 percent) on informal seed sector seed. Medium-scale and better-off farmers also rely to some extent on seed from these sources. The literature on farmer-managed (informal) seed systems is rich and varied and offers good insights into gender roles, community dynamics, and kinship structures. Women play a central role in these systems in seed exchanges, selection, production, and storage, contributing to enhancing nutrition and maintaining crop diversity. Seed is obtained through family, kinship, and friendship relationships, including from saved seed and local markets. An advantage of these systems is that they provide seed of varieties preferred by local communities and that respond to women's needs and preferences. Farmer-managed systems reach women more easily as they circumvent the barriers of mobility and cash to buy seed (Galiè et al. 2017).

Farmer-managed systems are critical in maintaining agrobiodiversity and contribute to resilience and diversity (Subedi and Vernooy 2019), but they are not always able to meet all of the seed needs of the farming community. An emergent new group of seed producers (sometimes referred to as the intermediary seed sector), made up of seedbanks and seed cooperatives, has started to bridge gaps (Box 3.1). In the Gumbu community seedbank, women are key actors, and are provided with varieties that meet their demands. They benefit (from earning extra cash) and are empowered through their active involvement in seed governance and management. While there are examples of women playing a critical role in community seedbanks (World Bank 2009, Vernooy et al. 2015, Mudege et al. 2020), systemic gender inequities, including biased community attitudes, tend to prevent women from realizing the full benefits of such initiatives. For example, a seedbank initiative set up by a nongovernmental organization in 15 villages in northern Ghana saw lower participation of women in seedbank governance as well as constraints to women's membership and leadership, as a result of unrealistic criteria set by male village leaders, hindering availability of seed, information, and skills to women (Nyantakyi-Frimpong et al. 2019).

While there are differences in the way formal and informal systems reach women seed users to make preferred seed available, they share important points of integration. Farmers use both systems to access seed for different crops from both channels. An increasing number of (formal) breeding programs involve farmers in variety selection; farmers sit on variety release committees; and some improved varieties are diffused through local channels.

BOX 3.1 Women farmers ensure availability of preferred crops and varieties through their seedbank in South Africa

The Gumbu community seedbank in Limpopo province, South Africa, operated by women, is located in a remote dryland area with limited market access and low crop diversity. Farming and seed exchange are mostly conducted by poor smallholder women farmers. The seedbank prioritizes the maintenance of nutritious crops and varieties needed for the preparation of traditional dishes. The women farmers of Gumbu contend that the community seedbank allows them to maintain the range of crop species and varieties inherited from their parents. This supports their household food supply, gives them a sense of satisfaction, and allows them to earn some extra cash. They say that the community seedbank is a great new space to meet, talk, decide, and work together.

Source: Vernooy et al. (2015).

It is critical that both systems coexist and together help meet the needs of women seed users.

Quality

Seed quality is defined by genetics, physical appearance, physiological response, and health (Tripp et al. 1997, Weltzien and von Brocke 2001). Use of quality seed alone could increase productivity by 15–20 percent (Yapa 2015). In the formal seed system, quality is defined by trueness to variety, germination percentage, vigor, appearance, and freedom from disease. In a farmer-managed seed system, seed quality is defined more loosely to reflect the performance of seed in a given context. It is “measured” based on the expectations of the seed user.

Men and women farmers often have their own subjective parameters for determining quality. A case study on rice in India, for example, revealed that women and men farmers often related seed quality to yield and thereby conflated varietal traits and seed quality parameters. This kind of “measurement” influences their trust in seed sources (R. Puskur, pers. comm.). A study conducted with bean and cowpea farmers in Tanzania and Ghana to gauge the relative demand for three types of seed products that differ in price and quality (certified, quality-declared, recycled) indicated that farmers were willing to pay significantly more for the higher-rated relative to the lower-rated seeds.

However, for a majority of farmers, the magnitude of the premium they are willing to pay for higher-quality seed is less than the current price differential between certified seed and grain (Maredia et al. 2019). Unfortunately, the literature on seed quality generally fails to capture whether or not there are differences in criteria women and men use to judge or measure seed quality, and what women might value most.

It is often assumed that the seed produced in farmer-managed systems (uncertified) is of low quality. However, a study in Ethiopia and Syria of wheat seed found that a large number of seed samples produced by farmers met the minimum physical purity and germination standards for certified seed, comparable with those of seed from the formal sector (Bishaw et al. 2012). A study in Tanzania found that more than 90 percent of farmer rice seed samples met national seed quality standards. Only about a fifth of the samples from formal and informal systems met the minimum standard for genetic purity (Gebeyehu et al. 2019).

While formal seed system actors often remain skeptical about the quality of seed from farmer-managed systems, most farmers tend to trust the seed produced and provided by fellow farmers more than they trust seed bought from commercial actors (Box 3.2). However, trust is also gendered. For example, in Malawi, men were comfortable obtaining potato seed from outside the village while women concentrated their efforts on accessing seed from farmers they knew in their communities. This was in part because the women

BOX 3.2 What is good quality seed and whom can we trust to provide this?

Women rice farmers in two eastern states of India and Nepal have very high levels of trust in the quality of seed from women's seed producer groups. When probed about quality, they mentioned physical purity (cleanliness of seed) and mixture of varieties as important. They rated the quality of seed produced by seed producer groups more highly than they did seed from private companies or seed dealers, and preferred it. They also felt they would not be cheated, as peer pressure is at play and the seed producer groups are locally accountable. The women seed producers have become true seed experts. They do the quality testing themselves, which enhances users' trust in their seed.

Source: Puskur et al. (forthcoming).

were afraid of being blamed by their husbands if the crop failed as a result of poor-quality seed (Mudege et al. 2016b).

Access to seed

Seed access is determined by access to information and mobility and networks of women and men, and by affordability. We look at the gender dynamics in these two aspects.

ACCESS TO INFORMATION, NETWORKS, AND MOBILITY

Access to information creates awareness of and demand for seed and is mediated by gender norms and relations. Key information sources include extension services, other farmers, family members and relatives, and religious and peer groups (Akca et al. 2008, Poudel et al. 2015). Seed flows tend also to follow these channels. A small proportion of farmers obtain information through information and communication technologies and mass media sources, and from seed companies and agrodealers. Women may not always be targeted (effectively) to receive information and may not have equal access to information and knowledge about seed (Galiè 2013, Mudege et al. 2016, Njuguna-Mungai et al. 2016).

Seed information channels in communities are anchored in local social networks and community processes that are often gendered. In Laos and Indonesia, men have larger seed information networks, and this influences the flow of seed-related information to women negatively (Tatlonghari et al. 2012). In Bangladesh, women depend on family members and neighbors to obtain information on seed, while men obtain this information from both local and external sources, such as extension agents. Older women, who generally have higher mobility, are more able to access information from the public arena (Aktar et al. 2010). While women's low literacy levels do not affect access to informal services, women are less confident about interaction with agrodealers (Lamontagne-Godwin et al. 2018).

For open-pollinated varieties and vegetatively propagated planting materials, awareness-raising and information-sharing can be conducted very effectively through participatory processes, such as field demonstrations, farmer field schools, and participatory varietal selection. While such efforts are often small in scale, the information and experience gained is high as farmers interact intensively with other seed system actors. For women, these processes are often very beneficial: they interact freely, unconstrained by social norms of interaction with men, who are non-family members. Because of time and financial constraints, participatory methods are often implemented with a

BOX 3.3 *Alea*—a social labor-sharing arrangement as an entry point for sharing seed information in Uganda

In northern and eastern Uganda, farmers replace groundnut and sorghum seed every two/three seasons, with women farmers replacing their seeds more often sourcing it from other farmers. The only external actors with whom women interact are local grain stockists. Women farmers have a traditional labor-sharing mechanism called *Alea*: a common interest group. They take turns working on members' farms at critical times in the crop production cycle, during which they share information about groundnut varieties. At harvest time, they share seed for the next season. *Alea* is a key entry point for sharing new information and seed by the groundnut breeding program in Uganda.

Source: Njuguna-Mungai et al. (forthcoming).

small number of farmers (sometimes referred to as lead farmers or trainers), who tend to be mostly, or only, men. Participatory approaches may thus not reach women.

Innovations are emerging to improve women's access to seed information. Box 3.3 presents a case in which a groundnut breeding program leveraged a unique social arrangement in Uganda through which women farmers access information and seed. Another example is Victoria Seeds' use of local transportation (*tuk-tuks* in Uganda) to function as mobile seed shops in remote villages. Private seed companies have started using videos featuring local farmers to enhance the efficiency and speed of information reach to women (Aktar et al. 2010). This technique borrows from gendered advertising, used to target niche areas for users of a specific gender and age for certain products based on preferences (Njuguna 2009). This approach is used mainly for selected crops and varieties for which profits are assured.

AFFORDABILITY

Seed affordability is not gender-neutral. Lack of money to purchase seed is a major constraint for women, affecting both the quality and volume of seed use (Mudege and Torres 2017). It has impacts on women's ability to buy seed sold by formal systems and increases their dependence on farmer-managed systems. Women use other means to access quality seed in communities, such as seed exchange, casual labor supply, labor exchange, gifts, seed loans or money loans,

and deferred payments (Lukonge et al. 2015, Mudege et al. 2015, McGuire and Sperling 2016). However, purchasing seed has a higher prestige than saving one's own in some contexts (Bates et al. 2011).

Farmers are less likely to buy seeds for open or self-pollinated crops such as rice and wheat. The yield potential of open or self-pollinated crops diminishes less between generations, so farmers tend to carry over farm-produced seed. In some cases, both men and women may be willing to pay for new seed, but not once it becomes ubiquitous in the community and they can obtain it from their neighbors and friends. As women and men have overlapping as well as different needs from the same crop, willingness to pay is guided by different drivers (Khan et al. 2016, McGuire and Sperling 2016). The social determinants and gendered differences of farmers' willingness to pay for particular traits and actual ability to pay often remain unaddressed in studies (Kassie et al. 2017).

Women commonly can only afford seed that is relatively cheap (Mudege et al. 2015). In Malawi, women purchased low-quality potato seed that they could afford, while being aware of the risk of pests and disease that could spread to other plots (Mudege et al. 2016b). Large- and medium-scale farmers often opt for more expensive, superior quality, seed of high-yielding varieties obtained from commercial producers (Bogale et al. 2018).

Small packages, "mom and pop" stores, and presentations and promotions in local markets all positively influence the purchase of seeds by women and young farmers (McGuire and Sperling 2016, Kandiwa et al. 2018). For maize in Malawi or sweet potato in Tanzania, subsidies and vouchers are provided (Mudege et al. 2018), although this approach is criticized for creating artificial markets and increasing aid dependency (Mudege and Walsh 2016, Bentley et al. 2018). Little gendered research has been done to understand the influence of incentives and subsidies on affordability.

Use of and control over seed

We now discuss how gender dynamics affect women's use of and control over seed mediated by women's access to resources, including knowledge and skills, and by social norms that influence decision-making.

KNOWLEDGE AND SKILLS

Women's limited access to new knowledge and skills affects their ability to use new seed technologies. Extension services often fail to adequately reach women and provide the services they need (Manfre et al. 2013). Extension officers in Malawi who trained men heads of household on seed marketing

BOX 3.4 Training is necessary but not sufficient

An Irish Aid-funded project, Rooting Out Hunger in Malawi through Orange Fleshed Sweet Potato, targeted women farmer groups for training on conserving vines. A woman participant mentioned that she was conserving her vines using a traditional method by digging a hole and planting the vines in it. This technique conserves moisture and is easier than what is taught in the training (line-planting of vines and irrigating them). She said that she did not have money to purchase irrigation equipment or clean planting material. Women in her community did not control money from the sale of most crops and thus could not save enough to invest in new technologies and practices.

Source: Mudege et al. (2016b).

and profit maximization excluded women farmers (Mudege et al. 2015). This also perpetuates the perception that women are not farmers and therefore need not be consulted by men for decision-making related to seed and farming in general (Mudege et al. 2017).

Some research and development programs do target women to provide information, training, and good quality seed of the varieties they prefer (Mudege and Torres 2017). In Eastern Africa, regional seed companies outperform their global peers in many areas, including in addressing women farmers' needs. Programs for women are conducted by Seed Co. in Kenya and Victoria Seeds in Kenya and Uganda (Access to Seeds Index 2019). While intentional targeting may be necessary to reach women, it is not sufficient. Women farmers' participation in training sessions is usually contingent on negotiating gender norms enforced by kin and community. Moreover, when women's socioeconomic environment is not conducive to implement what has been learned, women may not apply the knowledge and skills they gain. Women's use of seed technologies may be further constrained when they negatively affect their labor burden or when women lack resources to buy additional inputs (Box 3.4).

DECISION-MAKING

Women's decision-making power to acquire and use seeds is important given their roles as household managers and custodians of seed, in particular in farmer-managed systems (Mudege et al. 2015, Khan et al. 2016). In Africa and Asia, planting, selecting, cleaning, and drying seeds are often in the female

domain, giving women exclusive access to seed at the sowing and postharvest stages. Similar patterns regarding seed selection are reported for potato in the Andes (GRAIN 2000, Sarapura 2012) and Uganda (Mudege et al. 2016a).

There is, however, little systematic evidence on gendered decision-making and control with regard to seed access and use within households. Gender differences in control of seed in the household appear to vary with the crop and variety and are related to market orientation. In Tanzania and Ethiopia, women manage seed selection, processing, and storage for food crops but not for cash crops (Amri 2010). In some contexts, women do not control the income of crop sales; this in turn affects their ability to purchase seed (Mudege et al. 2018).

The question on women's decision-making power extends beyond a narrow focus on the household, in particular in farmer-based systems. Farmer-managed systems and well-designed participatory breeding programs, in which women play key roles in seed management and production, offer women significant access to and control and use of the desired crops and varieties (Bezner Kerr 2013, Galiè 2013, Mudege et al. 2016a, 2018). In South India, for example, farmers tend to rely on saved seed, which gives them self-reliance in seed, crop diversity, and nutrition. These are three realms that are largely under women's control (Pionetti 2006).

Being able to save their own seed means women can ensure diversity in crops and food, both now and in the future. They can also ensure crop characteristics meet their own specific needs, including sowing at the optimal time. Women's engagement in seed management, including their decision-making, is a factor that positively affects seed system outcomes for women. In addition, women are able to accumulate seed capital and bargaining power within the household. This is discussed in more detail below on empowerment pathways. First, we take a closer look at women as seed producers and the related gender dynamics.

Gender dynamics and women seed producers and entrepreneurship

Seed production can be beneficial for women as an enterprise, and can at the same time strengthen their key roles in seed systems. In Burkina Faso, women first trained in groundnut seed production in 2015 now make up a community of 540 seed producers, earning up to US\$200 in one season. In Malawi, where 27–64 percent of the seed is purchased from local markets and 48 percent of farmers use their own saved seed, 47 percent of members in seed

BOX 3.5 Empowering women through a participatory plant breeding program

A gender-responsive PPB program that engaged 12 women farmers from three Syrian villages increased women's self-confidence and visibility as knowledgeable farmers, which in turn increased their decision-making power within the household. Women's participation resulted in their access to and control over improved barley and wheat varieties that responded to the preferences of both women and men and that performed better than locally grown varieties. These improved varieties were sold locally at a premium price. Although traditionally only men farmers engaged in seed marketing, women's access to and control over the new PPB varieties through the program created a novel opportunity for two women to start selling the improved seed and earn a significant income.

Source: Galiè (2013).

producer clubs are women. Women seed producers have indicated profit levels, which are 1.5 times the national average income; they feel more food-secure and have gained a sense of entrepreneurship (ICRISAT 2018). Seed systems can create and expand spaces for women's economic participation (Kandiwa et al. 2018). One way to do this is by supporting women to become community-based seed entrepreneurs with seed operations that start at the local level with one or a few crops and then expand to other areas and more crops. In a similar vein, a PPB program has led to significant empowerment outcomes for women seed producers (Box 3.5).

Most evidence and experience of engaging women as seed producers can be found in the farmer-managed and community-based systems. Social norms related to mobility and access to information appear to influence women's participation in markets as seed sellers. Women are quite invisible in seed production and entrepreneurship and are often referred to as the "daily laborers" in smallholder seed production, particularly in the formal or commercial sector (de Roo and Gildemacher 2016). However, there are a few ongoing efforts to engage women in commercial seed production as producers and entrepreneurs (Ogero et al. 2016). Women are increasingly participating in the formation and management of small seed enterprises (World Bank 2005) that deliver better-quality seed compared with the farmer-managed systems.

Box 3.6 Women seed producers—opportunities and challenges

In southern Ethiopia, women engaged in seed production benefited more than those engaged in grain production because of their access to the inputs and continuous follow-up by development workers. However, only 30 percent of the seed producers were women and all of them were single (widowed, divorced, or separated). Lack of time affected women's participation in seed and grain production, limiting opportunities for networking or participating in community meetings. Married women's access to information was predominantly through their husbands. Women marketed small quantities, owing to limited networks and mobility, resulting in control over smaller income. However, their engagement in seed and grain production enhanced their capacities, income, and assets, and reduced their vulnerability.

Source: Geleta et al. (2017).

While there are some successful examples, the efforts and related outcomes are constrained by the challenges women entrepreneurs face (Box 3.6).

The weak economic position of women, limited access to production factors, and intra-household dynamics hamper women in their efforts to become entrepreneurs. Farm plot size, land used, soil fertility, ox ownership, access to markets, credit, and extension services had significant effects on outcomes realized by women-headed households¹ from participation in local seed businesses (seed producer cooperatives) in Ethiopia (Mulate et al. 2018). Women seed entrepreneurs face challenges as a result of limited access to finance and seed processing machinery, inability to attract and retain skilled workers, and delayed payments. These are further complicated by societal bias toward women in business (Adam et al. 2018).

Women in households headed by men face several challenges in starting professional seed production. Husbands may not see the advantage of their wives becoming seed producers. Sometimes, men do not support their wives starting a business or an activity for which they have to travel outside the village. The heavy work burden of women owing to domestic and other care

¹ An exclusive focus on women-headed households may result in misleading conclusions and recommendation, as this group represents a small proportion of women with constraints and needs that differ from those of the majority of women in households headed by men (Doss and Kieran 2014).

responsibilities compounds this problem. Meanwhile, commercial seed production is capital-intensive and requires more land; however, women's access to capital and assets is often limited (Vice Versa 2017).

Given the gender asymmetries in ownership of assets and access to resources/land and financial capital, women are often unable to invest in the agriculture sector. This trend is reflected in the seed sector, which sees a dominance of male-owned companies and operations. For example, the maize seed sector in East and Southern Africa is male-dominated, with men owning and running most seed companies. In this region, the International Maize and Wheat Improvement Center (CIMMYT) has been building capacity and nurturing commercial women seed producers, with a particular focus on making stress-tolerant maize seed reach smallholder farmers. In this process, CIMMYT supports women in breaking social barriers, contributing to improving household nutrition and livelihoods by providing both jobs and improved seed varieties (Adam et al. 2018).

Promising methods to support women's entrepreneurship include (a) gender-specific laws and strategies; (b) integrated loan and training programs; and (c) alternative credit assessment strategies. Targeting groups and individual seed producers is required (de Roo and Gildemacher 2016). Few groups perform production activities collectively, as individual production is seen to encourage better performance. Farmer group efforts focus on the acquisition of inputs and basic infrastructure, training, and joint marketing. Building organizational and financial management capacity is critical to sustain collective action. Developing an intervention that promotes women seed producers and entrepreneurs should take into account social norms that affect women, be flexible enough to include unpaid care responsibilities, and encourage collaboration among family and community members.

Seed systems as pathways to women's empowerment?

Women and men farmers' roles have been segregated in many seed systems, with little change over the past decades in most countries and for most crops. Social and gender relations and norms in households and communities mediate these roles. In all types of seed systems, women's effective access to quality seed is determined by gender inequities in access to and control over resources (including money, credit, extension services, information, and land). These are also related to limited recognition of women's involvement and knowledge in

seed systems, sometimes combined with negative attitudes toward women's leadership and management.

While there is extensive literature on seed systems and how they need to be organized to ensure seed security and resilience for smallholder farmers, the body of research unpacking gender dynamics within these seed systems has only recently started to emerge. Formal seed systems, either governmental or private sector-based, tend to reach out to men—as farmers and household heads—without formally recognizing women as seed users and making no specific efforts to reach them. In farmer-managed systems, across cultural and spatial contexts, women often play central roles as custodians, savers, and managers of seed in the household and within communities (Abdelali-Martini et al. 2008, FANRPAN 2011, Pschorn-Strauss 2016, Paris and Rola-Rubzen 2018). Such farmer-managed systems and community-based seed systems seem more responsive to women's needs and interests—but here also gender inequalities constrain women's access to and benefits of using seeds. Challenges persist such as lack of participation in seed-related decision-making, ensuring good seed quality, and access to novel varieties and related information.

Our review has shown that women's awareness and use of seed of new varieties can be limited as a result of lack of knowledge and access to training (AGRA 2016). Women farmers fail to access good quality seed when they do not control income from crops or lack income from other sources (Mudege et al. 2015). Women may also opt for more affordable but lower-quality seed. To access seed, women tend to rely on social networks and kinship structures based on reciprocity and the “moral economy.” Gender-responsive packaging and thoughtful, well-designed subsidies may make seed more accessible to women.

Agricultural extension and advisory services enable farmers and other rural actors to gain knowledge and, importantly, provide information on seeds, inputs, technology, credit, markets, and other value chain/business development services. Such services offer the opportunity to women farmers to strengthen their capacity to improve livelihoods, and health and nutrition outcomes for their families. Knowledge was the most important characteristic conferring status to farmers in Syria (Galiè et al. 2012).

However, extension services often do not reach women farmers. Besides, the mere participation of women in extension services and programs is not sufficient for them to benefit significantly if this occurs in a context where gender inequities and asymmetries persist. Factors such as literacy levels, work burden (balancing of household chores with farm work), and managing

limited household budgets all play a part in women's negotiation capacity and ability to attend training sessions.

Taking note of the emerging knowledge and understanding how gender inequalities affect seed system outcomes for women as seed users, the key question is how seed system interventions can advance women's empowerment and gender equality. Some studies demonstrate how this can happen (Galiè et al. 2012, Mudege and Torres 2017). Access to good quality and relevant plant seed can increase productivity, resilience, nutrition, and food security (Mudege and Walsh 2016) and, potentially, enhance benefits and lead to empowerment of women, contributing to gender equality. Access to quality seed alone can increase yield in farmer fields, for example 10–15 percent for maize (Abebe and Alemu 2017) and rice (Haque et al. 2012) and 30–50 percent for potato (Wang 2008). Access to good seed of multiple varieties can be a useful strategy to respond to changing climatic conditions, increasing farmers' resilience (McGuire and Sperling 2016) and enable women to realize their full potential as farmers and seed producers in their own right. In particular, access to and control over seed can change gender relations in a community. Seed sales can enhance women's economic empowerment when they strengthen their decision-making in the household.

Women who were provided access to stress-tolerant rice variety seed and trained in seed production in eastern India and Bangladesh claimed that their social status had improved, and they perceived themselves as farmers and not just housewives (Cueno 2014). They also gained confidence in decision-making, enhanced their knowledge, had marketable surplus, and experienced better status within the household and community. The increased income and control over the use of crops helped them produce quality seed based on their own resources, to be used in the subsequent planting season (*ibid.*). These are all notable empowerment outcomes of seed availability and access to and use and control of seeds.

The evidence on women's benefit and empowerment outcomes as a result of engagement in seed systems is slightly more tangible when looking at women seed producers. The engagement of women as producers appears to hold high potential to expand economic opportunities. Nonetheless, efforts to promote sustainable and viable women-led small-, medium- and large-scale seed enterprises have to contend with gender inequities in access to resources, particularly capital and market linkages. Gender norms that affect mobility, access to networks for information, and market linkages can influence these initiatives negatively. However, even in societies where social norms are highly

Box 3.7 Bangladesh—the specialized women’s seed network

The Nayakrishi Seed Network in Bangladesh is the active farmers’ network of Nayakrishi Andolon, a large agroecological movement in the country. Women farmers are key actors and leaders in the network, covering three major agroecological zones and bringing together 300,000 farmers. The network is made up of seed huts at the village level and community seed wealth centers at district level. This network creates space for women to have their own sphere of knowledge and practice. Among the results has been an increase in the use of local crop varieties, most of which are better adapted to the local agroecological conditions and the reintroduction of (rice) varieties that had disappeared

Source: Ubinig and Nayakrishi Andolon (2015), Ubinig (2018).

constraining, engagement of women as seed producers can provide pathways for empowerment.

In eastern India, for example, women who had no say in decision-making about sourcing seeds were trained in quality seed production and engaged as seed producers. They were very confident of the breadth and depth of knowledge they had acquired, and some started training other women in their communities and beyond. They are now able to discuss at length seed quality parameters in technical terms and do the basic quality testing after production. This has enhanced their self-esteem. They now take part in household decision-making regarding varietal and seed choice (Puskur et al. forthcoming).

Community seedbanks which often engage women actively in seed production and decision-making are important for smallholder farmers, women in particular, to access quality seeds (World Bank 2009, Ubinig and Nayakrishi Andolon 2015, Vernooy et al. 2015, Ubinig 2018). There are some good examples of seed networks managed by women that have created a space for own decision-making and leadership (Box 3.7), going beyond reaching women.

We draw four lessons at this point. First, most seed system interventions by research and development organizations may reach women, and some may benefit them. Second, while gender inequities constrain seed systems from reaching women, gender equality and the recognition and leadership of women’s involvement in seed management and production not only contribute

to women gaining access to quality seeds but also offer important opportunities for them to obtain benefits and also experience empowerment outcomes.

A third lesson is that it is necessary to consider institutional dimensions of both gender relations and seed systems. Institutional dimensions of gender relations include the extent to which women's involvement in seed management, production, and use is recognized and valued. This also includes gender norms regarding expected and appropriate roles, behavior, voice, and mobility of women. With respect to seed systems, institutional dimensions pertain to seed policies, management, and governance. The evidence about whether and how women's involvement in seed management translates to women's empowerment is limited. Evidence suggests that empowerment of women depends on several social factors beyond the realm of seed systems, and no automatic causal relationship can be established.

Fourth, acknowledging the institutional dimension is critical for approaches that explicitly aim to integrate or mainstream gender in seed systems. This requires a critical analysis of the influence of community norms and practices, customary laws, and formal policies and laws. In some cases, gender mainstreaming approaches are overly technical, ignoring the systemic causes of inequality. Seed systems interventions therefore need to consider gendered power asymmetries and dynamics at play.

Toward gender equality through a seed systems research agenda

Seed systems per se do not directly lead to women's empowerment and gender equality. To achieve this, seed system interventions require specific and targeted objectives, such as the promotion of women's access to resources; women's voice in household and community decision-making; and addressing structural barriers to women's participation. Gender-responsive seed policy is required to ensure gender equality goals are achieved. Here, we propose some elements of a forward-looking research for development agenda that will begin to build the systemic evidence base needed to inform the design and implementation of such gender-responsive seed systems, bolstered by gender-responsive seed policy.

Build evidence on gender dynamics in seed systems. As described, there is little evidence available on gendered aspects of seed systems. There is little sex-disaggregated and much lesser qualitative data to support a deeper gender analysis. Available quantitative data mostly concern women heads of household, who constitute a very small proportion of rural women; most

women live in households headed by men. We need better and intentional integration of gender in seed systems studies and also specific efforts to bridge knowledge gaps. Understanding the local social and gender context is critical in designing seed systems that allow equitable access to seeds and that empower women either as users or producers of seed. This should be based on a systematic analysis and understanding of gender roles and the social norms and power relations at play that determine access and use.

Adapt and track gendered seed access indicators. Development of the Access to Seed Index (<https://www.accesstoseeds.org/>) is a commendable effort, and this a useful tool to gather evidence on access to seed by the private sector. However, the current index does not make a gender-informed analysis of access and does not include gender indicators. It covers crops and varieties that private companies produce (mostly hybrids and cash crops) but not other crops that may be important for women, including vegetatively propagated crops and varieties important for nutrition. What is not measured is not managed. National governments and other research and development agencies could take a cue from this and develop indicators of seed access for a broader range of crops and varieties important for women, and track them.

Analyze gendered impacts of seed systems policies. A very relevant and urgent area of research involves understanding how policies affect seed systems reaching, benefiting, and empowering women. Seed policies developed without a gender lens could have negative impacts on women's ability to access seed. Even though farmer-managed seed systems are the principal source of seed for food crops in both Africa and Asia, national and regional seed policies often do not support them—and may even undermine them. No concerted efforts to date have studied gender dimensions in formal seed policy processes and seed governance, and this is a key knowledge gap to fill.

Flip the question—ask what seed systems can do for women and not just what women can do for seed systems. While unpacking gender dynamics of seed systems, it is important to move beyond the instrumental use of gender analysis to improve seed system outcomes to examine how seed systems can facilitate, support, and spur women's empowerment. Some key questions to address include:

- How should the formal seed sector reinvent itself to be more relevant to women seed users—including understanding and responding to their preferences and needs; designing effective quality seed and information delivery channels; and enhancing capacity of women seed users to be able to use the seed?

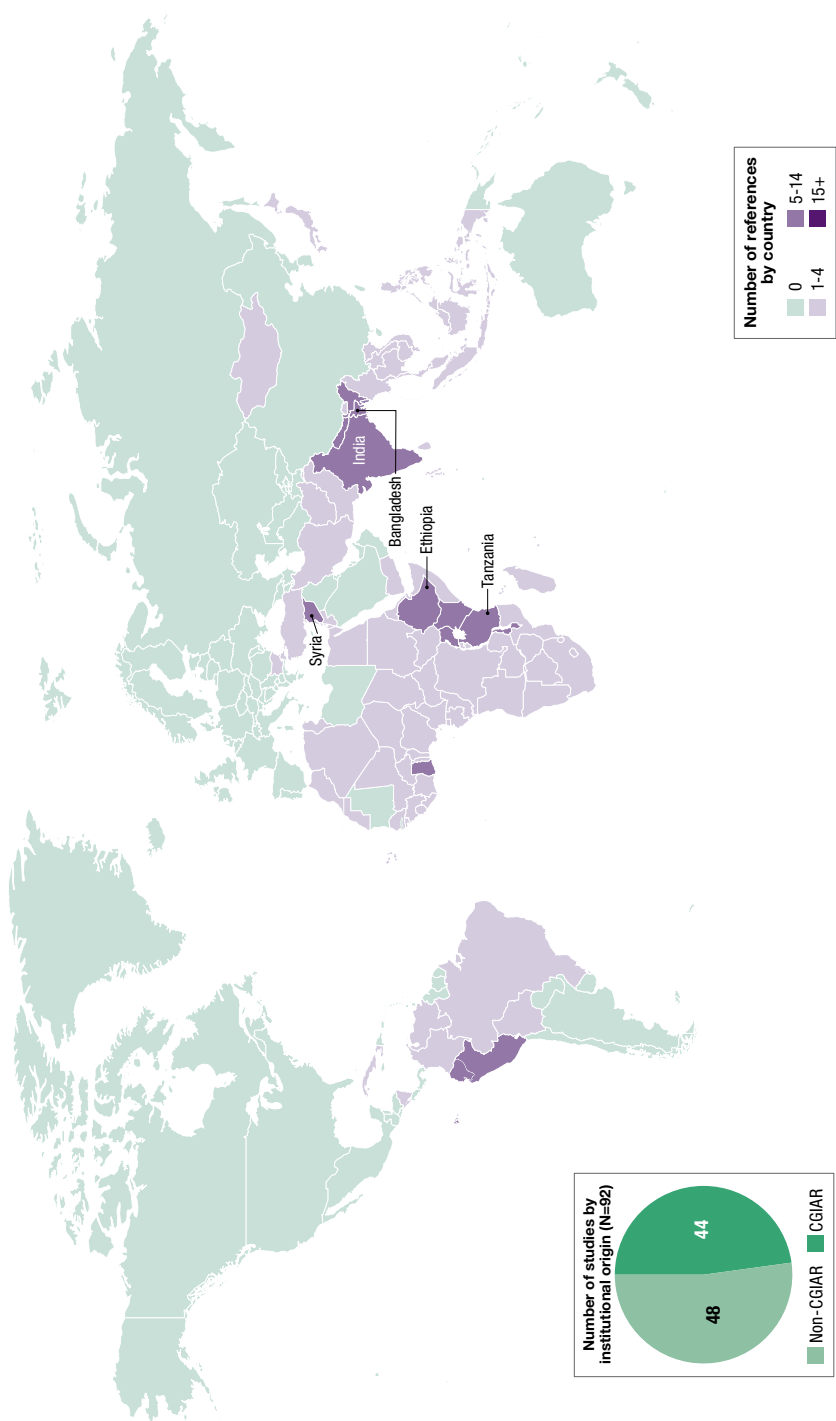
- What institutional and marketing innovations and incentives make quality seed affordable to smallholder women seed users?
- What mechanisms and approaches support nurturing women seed entrepreneurs/producers, including gender-responsive financial products, business development services, skills development, and policy incentives and support?
- Do social and behavioral change communication approaches, if integrated into seed system interventions, influence gender norms, attitudes, and behavior that constrain women seed users and producers from obtaining positive benefits from engagement?

Use integrated seed sector development approaches. The integrated seed sector development approach (Louwaars et al. 2013), adopted by the Integrated Seed Sector Development (ISSD) Africa program, provides a practical framework for countries to move toward a more balanced seed sector. The approach proposes to build stronger linkages between formal and farmer-managed systems and create more space for community-based seed initiatives, for example seedbanks, seed cooperatives, and women-led seed enterprises. A better understanding of gender dynamics in integrated seed sector development could strengthen the approach. The theme on Gender and Seed Systems of the ISSD Africa program, in which several CGIAR centers participate, has put this at the core of its agenda (<https://issdafrica.org/gender-and-seed-systems/>).

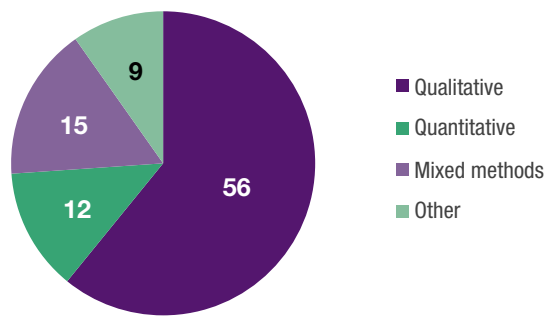
There are other opportunities to integrate gender into global seed system development frameworks and initiatives. For example, in 2017, the CGIAR Collaborative Platform for Gender Research (since January 2020 the GENDER² Platform) funded five projects on gender dynamics in seed systems. The ISSD Africa program, already mentioned, is another example. However, the gender transformational potential of seed systems remains under-researched and under-profiled. Interventions designed to systematically test the impact of gender-responsive approaches on women's empowerment are very much needed: they represent a contemporary call to arms for seed sector actors and programs. Gender equality and women's empowerment should be the next frontier for seed system development.

2 <https://gender.cgiar.org/>

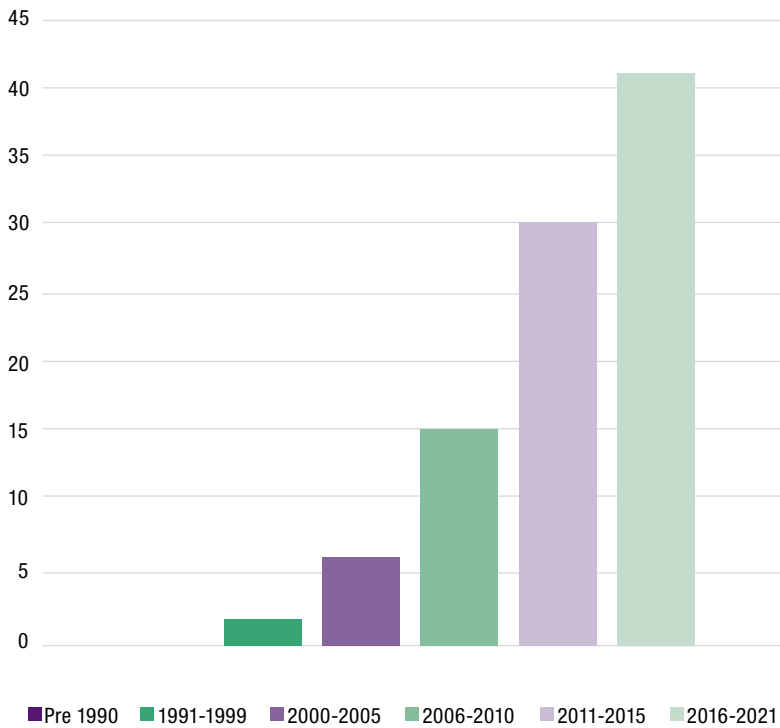
Geography of study sites for publications cited in Chapter 3



Number of cited studies by research methodology (N=92)



Timeline for references cited



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