Science Development
2024, Vol. 5, No. 4, pp. 92-106
https://doi.org/10.11648/j.scidev.20240504.12

Review Article

Collective Action for Seed Producer Cooperatives and Their Role in Improving the Sustainable Seed Supply and Impacts: The Case of Ethiopia

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Abstract

Seed is an essential component in crop production. Using superior seed from improved cultivars can increase yield by as much as fifty per cent per hectare. High-quality seed also encourages using extra agricultural inputs like fertilizers and insecticides. The Ethiopian seed system development strategy recognizes the formal, intermediary, and farmer seed systems. The farmers' system is the primary seed source, with relatively little contribution from the formal system. The public sector primarily controls the formal system's breeding and seed distribution. The formal, farmers', and intermediary systems are comparable to each other. The government encourages Seed Producers Cooperatives (SPCs) to cultivate and supply seeds to the market. Cooperatives (SPCs) supply of high-quality seeds for various crops in response to local and international demand and the needs of farmers. This helps to ensure national seed security. Policymakers and development experts have recognized the significant role of SPCs in Ethiopia's seed industry, and the country's agricultural development initiatives reflect this. It is essential to reform the seed industry to have a positive impact on Ethiopian agriculture's progress. However, the seed industry in Ethiopia faces limitations due to institutional, organizational, technical, and infrastructure challenges, preventing it from meeting the increasing demand from different agro-ecologies and farming systems. Despite this, little research has been conducted to study and document SPCs' involvement in the seed industry and their contributions. Unfortunately, not much work has gone into examining and recording their contributions to increasing seed access and availability as well as their involvement in the seed industry. Concerning improving seed supply and guaranteeing seed security in Ethiopia, this review aimed to evaluate Seed Producers Cooperatives' present standing in the seed industry.

Keywords

Seed, Seed Producer’s Cooperative, Government, Formal Seed Systems

1. Introduction

Background and Rationale

Ethiopia's economy is built on agriculture, which is also the most frequent means of subsistence. According to UNDP (2018), 83% of the population works in agriculture, while the sector accounts for 39% of the country's GDP. About 60% of the land is used for non-pastoral production systems, while the majority of agricultural people (90%) primarily depend on crop-livestock systems and natural resources for their livelihoods [22]. The

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Received: 27 August 2024; **Accepted:** 18 September 2024; **Published:** 28 November 2024

agriculture sector in Ethiopia has undergone significant changes due to structural reforms and market liberalization. Private investors' involvement in agricultural output has increased, while state-owned farms have decreased. Additionally, regulatory changes have redefined the role of agricultural cooperatives [23]. Government policy permits and encourages high levels of participation in agricultural production and marketing by private businesses and other organizations, such as cooperatives. Crops is important for food security, those traded commercially (such as sesame and haricot beans), and those used as raw materials for industries (like durum for pastries, bread wheat for flour factories, and malt barley for breweries) now occupy significant portions of agricultural production [21].

Inputs such as seeds are essential to crop production. Utilizing high-quality seeds from improved varieties can boost output per hectare by up to 50%. The use of additional supplementary agricultural inputs like pesticides and fertilizers is also prompted by high-quality seeds [3]. Ethiopia acknowledges formal, intermediate, and farmers' seed systems in its seed system development strategy. The formal system makes up a small portion of the seed supply; the farmers' system is the main source. Starting with breeding and ending with seed distribution, the formal system is mostly driven by the public sector. Certain characteristics of the formal and farmers' systems are shared by the intermediary system [39, 40].

Efforts have been made to help farmers form local cooperatives or community groups [47]. These initiatives aim to empower farmers to participate in markets [9, 46]. In the area of seed production, the organization of farmer groups is also encouraged, especially in Ethiopia where developing the seed sector is currently a top priority [7]. The primary reason for promoting group activities in the seed industry is the inability of the public sector to establish a viable seed industry that provides farmers with high-quality seeds of improved varieties. Decentralization and private sector involvement are currently advocated as practical means to enhance the accessibility and availability of high-quality seeds to smallholder farmers [7]. According to [24] farmer organizations, cooperatives, and other community seed production initiatives are viewed as being in the space between formal and informal seed systems, with the ability to connect traditional and commercial seed supplies.

In most developing nations, informal seed systems continue to be the main source of seed used by farmers, accounting for over 80% of all seed used, despite all previous public and corporate attempts to strengthen the seed industry. For many locally significant crops, farmers rely on the farmer-saved seed system, wherein seed production is incorporated into crop production because seed is just unavailable from other sources. For smallholder farmers, informal seed systems are essential to ensuring food security and building resilience in the face of growing unpredictability [24]. Most smallholder farmers rely on farmer-to-farmer seed exchange or saved seed to address the seed shortage. To bridge the gap between seed demand and supply, farmers are encouraged and supported to form seed producer cooperatives (SPCs) to produce and sell quality seed [11]. However, public and private seed producers mainly focus on a few cereal crops, particularly hybrid maize and bread wheat. Additionally, they only supply a small portion of the total quantity of seed demanded by farmers, thus failing to meet the diverse seed demand [6, 16, 46].

The government promotes SPCs' involvement in seed production and market supply. The SPCs provide high-quality seeds for a variety of crops and kinds in response to local and international demand, as well as the interests of farmers. As a result, they support national seed security. Policymakers and development professionals have given the SPCs' contribution to Ethiopia's seed industry a great deal of thought, and Ethiopian agricultural development policies reflect this recognition [10, 38]. It is crucial to transform the seed industry to positively impact Ethiopian agriculture's progress. Ethiopia's seed industry is nevertheless limited by institutional, organizational, technical, and infrastructure issues; as a result, it is unable to adequately meet the nation's growing demand from its many agro-ecologies and farming systems. However, not much research has been conducted to examine and document the involvement of Seed Producers Cooperatives (SPCs) in the seed industry and their contribution to improving seed access and availability. The objective of this review is to discuss the current role of SPCs in Ethiopia's seed industry, their contribution to increasing the country's seed supply, and their role in maintaining seed security. The review aims to analyze and discuss the current situation of Ethiopian Seed Producers Cooperatives, assess their potential for establishing local seed companies, and evaluate their impact on the seed supply sector.

2. Materials and Methods

Methodology Followed for a Review Assessment

The articles used for this review were gathered from Google Scholar sources. Several sources were used: a working paper, research papers, annual conference papers, journal articles, and a working strategy document. Journal of International Development, Springer, Journal of Crop Improvement, Agriculture and Food Security, Journal of Agriculture and Rural Development in the Tropics and Subtropics, sciencedirect.com/ELSIVIER /, Journal of African Economies, Food Science and Quality Management, Forum for Development Studies, Journal of Economic Structures, Ethiopian Journal of Agricultural Sciences, and International Journal of Research had been the sources of the journal articles.

3. Results and Discussion

Literature Review

3.1. Theory of Collective Action

Olson (1971) identified group size, homogeneity, and goals as key factors influencing the success of collective action. A pivotal area of research in the theory and implementation of

collective action is the management of "common-pool resources" such as water, land, fisheries, and forests. Historically, the establishment of enforceable property rights over resources was seen as the solution to the "tragedy of the commons. "Recent research by Ostrom and others has shown that local institutional arrangements, such as social norms and customs created to encourage cooperative solutions, can help overcome the challenges associated with collective action and facilitate the efficient use of resources [41]. Different theories predict that problems involving collaborative action will rarely be solved. However, experimental and field-based empirical research has demonstrated that groups can cooperate and coordinate in a wide range of contexts. It's important to note that actors in any particular scenario are not guaranteed to overcome issues with coordination or social dilemmas. Many teams are unable to resolve these issues, while others experience an unraveling of collective action after initial success [44].

3.2. Conceptualizing Collective Action

Researchers from many disciplines have defined collective action, and they all share a common understanding of it. "Action taken by a group (either directly or on its behalf through an organization) in pursuit of members perceived shared interests" is how Marshall defines collective action. The majority of definitions agree that collective action entails some sort of shared activity that is taken to further a common interest, the participation of several people, and a shared interest within the group. Collective actions might involve making decisions as a group, creating management guidelines and group norms of conduct, carrying out decisions, and overseeing rule compliance [43]. The presence of a well-defined group participating makes collective action easy to recognize. Furthermore, the first of Ostrom's "design principles for long-lasting, self-organized irrigation systems" is "clearly defined boundaries." These concepts have also been applied to several other instances of natural resource management. This suggests that the group's boundaries, which make it possible for members to know who else is or should be contributing, encourage cooperative behavior. It's often unclear how a group is defined in collective action situations, and boundaries aren't always clear-cut or rigorous. While not all of the participants are aware of each other's identities, some individuals may engage in the activity more than once, and they all seem to identify with it as a group.

Coordination of collective action might benefit from the assistance of formal or informal organizations, but it's critical to make the distinction between organizations and collective action. While collective action may happen effortlessly, many organizations just exist on paper and do not result in action. Furthermore, collective action can take several forms and be interpreted as an institution (repeatedly applying the rules of the game), an event (one-time occurrence), or a process. One paper in this issue focuses on the collective action process, whereas the majority of the papers examine the collective action institution. The distinction between an institution (collective irrigation system maintenance) and an event (community flood response, for example) raises an intriguing question in and of itself: what are the consequences of institutionalizing an occurrence and when does it happen? The goal of collective action determines whether it becomes institutionalized or not. For example, routine maintenance is a need that is likely to be institutionalized in a community or group of users. Conversely, exchanges of seeds are a situation where institutionalization is unlikely to occur [43].

3.3. Categories of Producer Organizations and Their Functions

Producer groups might be legal cooperatives, unofficial associations, jointly owned agro-enterprises, or any combination of these. These organizations may be set up as societies, associations, or cooperatives, depending on their goals and the legal frameworks of the various nations. A farmer association is a non-profit organization that gives its members representation and a voice, facilitates information sharing, and employs group action to get certain services like agricultural extension. Conversely, farmer cooperatives are also capable of conducting business, including marketing produce and buying commercial inputs together. Members often receive their financial gains based on the collective activity's transaction volume after costs are covered [46] In contrast to alternative agro-enterprises, farmers frequently favor this type of organization since it grants tax exemption or makes the group eligible for further public or donor funding.

Farmer organizations may perform a variety of roles and engage in a wide range of activities. These could include: (a) commercial organizations focused on a particular commodity (cooperatives that grow coffee, tea, or cocoa); (b) advocacy groups that represent members' interests in policy discussions; (c) development groups that work to increase local capacity and access to technology and information; and (d) multipurpose groups that engage in a variety of economic, social, and empowerment activities, particularly in places where other providers are either unavailable or unable to provide such services at reasonable costs. Many farmer cooperatives, dealing with a diverse set of commodities and also engaging in social development and advocacy [48].

3.4. Concept of Seed Producer Cooperatives

In Ethiopia, a collective of individual farmers from a certain area creates seed producer cooperatives. Similar to other cooperatives, SPCs seek to achieve a shared objective that would be impossible for any one member to achieve on their own. According to [11], the SPCs are specialized cooperatives for the seed industry. SPCs' primary goals are to create and sell high-quality seed to regional and international markets, turn seed into a commercial commodity, and so increase revenue and members' standard of living. The policies and plans of the Ethiopian government for agricultural development acknowledge the SPCs. The government has made a

firm commitment to assist both newly formed and already-existing SPCs [38].

Several partners have helped to promote and strengthen the SPCs in support of the government's initiatives. Government agencies, NGOs, research institutes, Universities, Government offices, and development programs are some of these partners. The concept of local seed business (LSB), in which SPCs play a crucial role, was established by the Integrated Seed Sector Development (ISSD)/Ethiopia initiative in collaboration with Ethiopian partners [11]. The initiative helps LSBs (SPCs) grow, whereby cooperatives of farmers cultivate and distribute seed to nearby markets and other markets. In addition to building upon and enhancing the current tactics within the official and informal seed sectors, organizing farmers into SPCs could aid farmers in responding to changes in ecological, socioeconomic, and other situations. To address the need for seeds locally and beyond, the SPCs produce seeds of enhanced and regional types. SPCs and other community-based seed producers can serve the community by offering high-quality seeds of popular crops and variations [35].

In several regions of the country, the number of SPCs has increased. Universities, government agencies, non-governmental organizations, and other organizations have all supported and contributed to the creation of SPCs. As per [25], there are currently 327 SPCs in Ethiopia that are involved in the production and selling of seeds. According to [11], these SPCs are spread across the nation's low-to-highland and food-secure to food-insecure regions. Regarding agro-ecological conditions, the sociocultural context, farming (irrigation) facilities, local market demand, technical, managerial, and financial capabilities, infrastructure development (roads, electricity), credit availability, outside support, and experience, there are a lot of similarities and differences between them [11].

3.5. Overview of the Seed Sector in Ethiopia

Smallholders, cooperatives, commercial enterprises, and government organizations have all contributed to the growth of Ethiopia's seed industry. There are various seed systems under which Ethiopia's seed industry can be categorized. Ethiopia's seed systems have historically been separated between official and informal groups [8]. The seed systems were divided into five categories by [34]: farm-saved seed, community-based, public companies, commercial firms, and closed value chains. Farm-saved and community-based systems make up the informal system. The term "farm-saved seed" describes the practice of preserving seeds for later use. A community-based system is an unofficial arrangement in which several farmers have joined forces to produce, exchange, or market premium seed—which may comprise both native and cultivated varieties. The formal seed system, whether public or private, must adhere to official standards and regulations when producing and selling seeds commercially. The closed value chain of the formal seed system oversees the seed value chain. In Ethiopia, commodities such as coffee, cotton, sugarcane, and cut flowers have closed seed value chain systems [34]. Some have categorized seed systems based on different crops. For example, [5] noted that Ethiopia has formal, informal, and alternative potato seed systems [21].

The Ethiopian Agricultural Transformation Agency (ATA) developed a seed system development strategy that recognized the three seed systems in the Ethiopian seed sector as formal, informal, and intermediary [10]. The three seed systems are categorized according to the following attributes, which are further discussed below:

3.5.1. Formal Seed System

In Ethiopia, certified seed of released varieties is obtained through a series of steps that constitute the formal seed system Scientific approaches to plant breeding serve as the foundation for the formal seed system. Basic seed is produced and distributed by approved multipliers or the research system. Public seed enterprises and a few licensed private seed companies are the suppliers of basic seed [6, 33, 34].

In Ethiopia, the state sector holds significant dominance in the formal seed system's seed production. Within the official seed system, the ESE and regional government seed enterprises hold prominent positions. To address the needs for seed on a regional and national level, they are in charge of seed production, processing, and marketing. A few cereal crops, primarily hybrid maize and wheat, dominate their seed production even though they are in charge of producing seeds for all crops, including cereals, pulses, fruits, vegetables, and forages. Large amounts of seed are supplied to growers by several small- to medium-sized private seed manufacturers and companies that are part of the official seed system. They mostly concentrate on hybrid maize seeds. The state that the percentage of the overall certified seed supply from the formal sector that is made up of wheat and maize is approximately 64% and 23%, respectively. Most of the country's farmers are smallholders and subsistence farmers, and the official seed system was unable to meet their needs, especially in rural and isolated areas [15, 16].

The formal system outlines the obligations of all parties involved in the seed chain, including Universities, smallholder farmers, public seed enterprises, private seed corporations, farmer organizations, and research organizations. Every stakeholder provides something to the dissemination or development of seeds. Table 1 enumerates the principal participants and their functions within Ethiopia's official seed system. The task of creating new kinds falls to universities, Regional Agricultural Research Institutes (RARIs), and the Ethiopian Institute of Agricultural Research (EIAR). They are also engaged in the manufacture of simple seeds. The government National Variety Release Committee (NVRC) is in charge of determining whether or not the varieties that researchers have recommended will be formally registered and made available for production. In addition to the Ethiopian Seed Enterprise (ESE), other organizations that produce seeds include unions, SPCs, private businesses, and Regional Seed Enterprises (RSEs). Regulations about the production, handling, and dis-

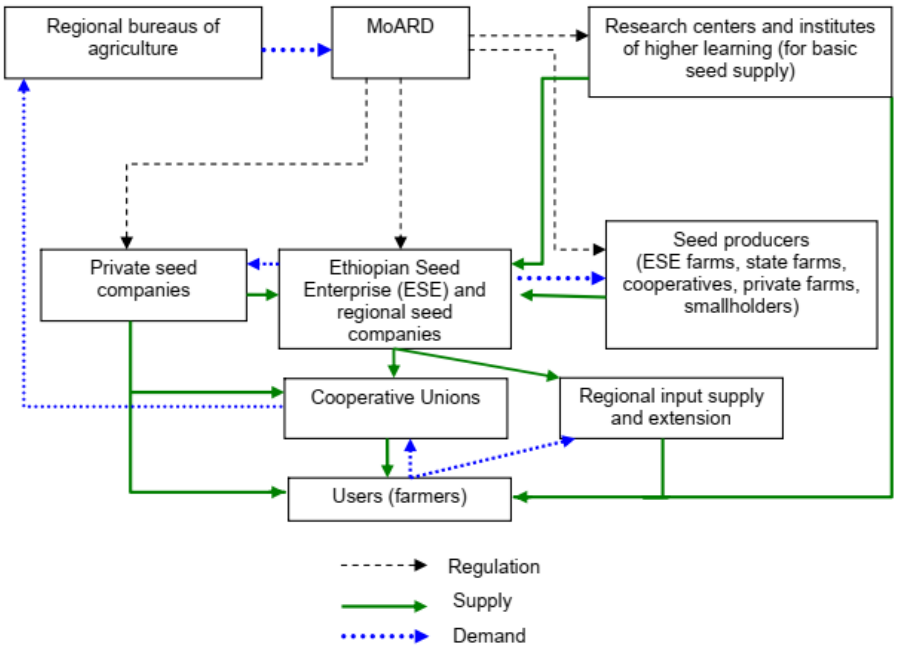
tribution of seeds are managed by the Ministry of Agriculture (MoA) and Regional Bureaus of Agriculture (BoA).

Table 1. Major stakeholders in the formal seed system and their roles.

Seed system components	Involved stakeholders†	Regulatory stakeholders††	Regulatory measures
Plant breeding	EIAR, RARIs, Universities		
Variety release	NVRC	MOA	Distinctiveness, uniformity, stability
Breeder seed production	EIAR, RARIs Universities		
Pre-basic seed production	EIAR, RARIs Universities, ESE, RSEs	MOA, regional BOA	Seed quality assurance
Basic seed production	ESE, RSEs, private companies, SPCs	MOA, regional BOA	Seed quality assurance
Certified seed production	ESE, RSEs, private companies, SPCs, unions, farmers-based seed production	MOA, regional BOA	Seed quality assurance

Source: [21]
†EIAR-Ethiopian Institute of Agricultural Research; RARIs-Regional Agricultural Research Institutes; NVRC-National Variety Release Committee; ESE-Ethiopian Seed Enterprise;
RSEs Regional Seed Enterprises; and SPCs-Seed Producer Cooperatives.
††MoA-Ministry of Agriculture; and BoA-Bureau of Agriculture.

The following figure shows a schematic diagram of the seed system and indicate the relation between different actors:



Source: [47]

Figure 1. A schematic of the Ethiopian seed system.

3.5.2. Informal Seed System

In the Ethiopian context, the term "informal seed system" refers to seed distribution and production methods without official legal seed certification. Millions of independent small-scale farmers make up the system; they exchange or save seed locally. It also includes non-regulatory projects and development organizations that assist community seed production. It provides both local and improved crop types and is regarded as the most adaptable system available. Local

standards, social structures, and conventions, rather than government laws and regulations, oversee and regulate the seed production and distribution processes [21].

Approximately 60–90% of seed produced and distributed globally is produced through informal systems; however, specific percentages may differ based on the crop and locality. In sub-Saharan Africa (SSA), it is the predominant system. Similar to Ethiopia, where the informal seed system provides up to 90% of the country's seed requirement, it serves as the main source of seed supply. This was primarily due to that the formal supply system in our country struggles to meet the needs of smallholder farmers, who request relatively small quantities of seed. Additionally, the formal system is not accessible in remote areas, and smallholder farmers have limited financial resources to purchase expensive, officially certified seeds. Furthermore, the demand for seed is unpredictable and diversified. Because of the limited demand for seeds, the formal seed system typically does not provide a large variety of crop varieties or seeds for minor crops. Due to the formal seed system's lack of timely and sufficient supply, farmers are forced to rely on the unofficial seed system [21].

3.5.3. Intermediary Seed System

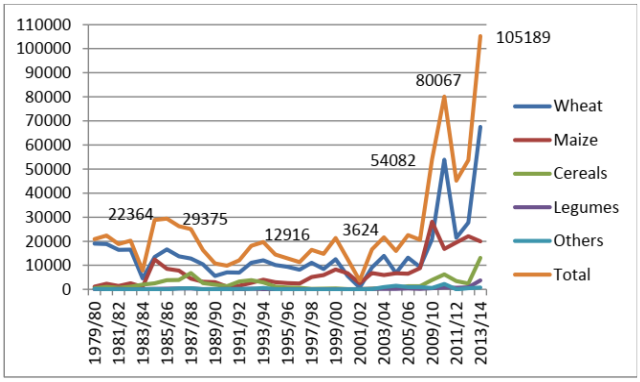
Ethiopia has parallel, and occasionally even overlapping, institutional and informal seed systems [8]. The inability of the formal seed system to supply smallholder farmers with seed has prompted debate over whether the advantages of both the formal and informal seed systems may be combined. There hasn't been much scientific research done on how to merge the two seed systems, thus more investigation is needed. Both the formal and informal seed systems share characteristics with the recently acknowledged intermediary seed system. Groups of farmers involved in community-based seed production and sale are the main players in this system [10]. Cooperatives may be granted licenses under this arrangement to grow and market seeds. Nonetheless, they do not always follow official procedures to obtain planting supplies or go through the formal certification procedure. As [5] have described, the alternative seed system comprises local farmers producing and marketing seeds with financial and technical assistance from NGOs and breeding centers.

3.6. Seed Production in Ethiopia

Several individuals and stakeholders are involved in the production of seeds in Ethiopia. They have aided in the nation's enhanced seed production, marketing, distribution, and promotion. Research indicates that enhanced seed covers a very small portion of the land. [8] report that of the 12 million hectares of land under key food crops between 2005/6 and 2009/10, only 3,5 per cent were planted with improved seed.

The performance of the formal sector underwent significant changes in recent years, compared to the early 1980s. In the first ten years of its existence, from 1980 to 1989, the ESE distributed 21,162 tons of seed annually on average, mostly for haricot bean and a few other legume crops. The majority of its clients were public state farms, then the MoA and NGOs. The average annual seed supply fell to 14,012 tons in the second decade (1990–1999) as a result of a decline in demand from public state farms; the Federal Ministry of Agriculture and the regional Bureaus of Agriculture replaced them as the main consumers. Between 2000 and 2009, the official seed supply averaged 18,632 tons; however, in 2010, that amount more than doubled to 54,000 tons. The fourth half decade (2010-2014) had a significant increase in the supply of formal seeds, with an average of 67,630 tons reaching over 105,100 tons in 2014. This comes in close to one-third of the GTPI objective, which was 360,400 tons by the end of 2015 [19].

Despite the nation's more than 40 years of organized seed distribution, there has been little change in the range of crops and varieties of certified seed offered, with the majority of these being cereals, of which wheat and maize make up the majority. While both crops make up roughly 13 and 17% of the farmed land in the same order, wheat and maize account for 64 and 19% of the formal seed supply in 2014. The amount and range of seed that the private sector can supply is restricted when it comes to certified seed delivery. Before the establishment of several small- to medium-sized domestic private seed companies in the 2000s, Pioneer Hi-bred Ltd. was the only source of private seeds in the nation. The company began operations in 1990. Between 1998 and 2008, the private sector contributed an average of 1,388 tons of seed, mostly for maize. This amounts to roughly 21% of the entire supply of maize seed or 9% of the total official seed supply for all crops. One of the main providers to the private sector is Pioneer Hibred. From slightly more than 500 tons in 1996 to about 3,000 tons in 2011, its percentage of hybrid sales grew. In 2012, the amount reached 4,214 tons; in 2014, it reached 7078 tons; and in 2016, it is anticipated to surpass 10,000 tons. As [6] discovered a comparable circumstance in which the private sector contributes very little to other crops and mostly to maize seed.



Source: Certified seed supply in Ethiopia [19]

Figure 2. *Certified seed supply in Ethiopia (1979-2014).*

The private sector dominates the vegetable seed industry. From roughly 2,000 tons in 2012 to 2.5 thousand tons in 2013,

and roughly 3.6 thousand tons in 2014, total seed imports have increased, with corresponding CIF values of USD 3.7 million, 4.6 million, and 6.3 million, respectively. Certain legumes (excluding haricot beans), oilseeds, root and tuber crops, fodder and pasture crops have negligible or no certified seed availability. Undoubtedly, the comparatively higher seed-to-grain price ratio and the now low productivity of these crops in comparison to wheat and maize may have restricted or discouraged the demand for certified seed and technology of these crops [19].

3.6.1. Private Seed Producers (Companies)

Pioneer Hi-bred the first private seed firm was Ethiopia, a multinational private enterprise that was founded in the 1990s after the economic reforms. Other private seed companies began to enter the Ethiopian seed market gradually. Large private seed businesses mostly target vegetable, potato, and hybrid maize seeds. The primary emphasis of other small and medium-sized seed manufacturers is also hybrid maize. Some grow seeds on private farms, while others do so under contracts with individual or collective farmers [47].

Private seed companies' proportion of the seed market has increased, but they are restricted to a few crops. As reported by [5], 32% of the nation's formal seed supply is supplied by private producers combined. The total volume of seed produced in Ethiopia by private producers for the three years 2012–13–2014–15 is shown in Figure 4 [8]. Private producers produced a total of 9819.2 tons of seed in 2014–15, up from 4994.1 tons in 2012–13. More precisely, private manufacturers have a significant role in the sale and production of hybrid maize seeds. For example, private producers accounted for 38% (1832.2 tons) of the total hybrid maize seed produced and distributed in the Amhara region alone in 2014 (4803.7 tons) [21, 30].

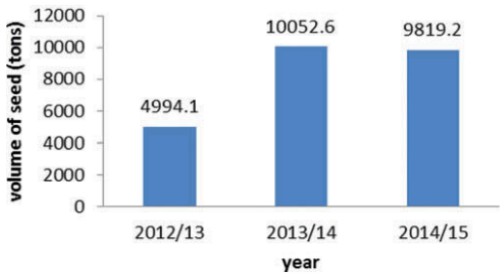


Figure 3. *Number of seed produced (tons) by private producers (2012/13–2014/15).*

Source: Integrated Seed Sector Development (ISSD)/Ethiopia 2015 [30]

3.6.2. Seed Producer Cooperatives

Researchers, decision-makers, and development partners have recently become interested in the role that SPCs play in the growth of Ethiopia's seed industry. The SPCs generate a wide range of crops and a variety of seeds. Through a variety of market channels, including direct sales to farmers, agreements with private and public seed businesses, research institutes, and institutional buyers (GOs, NGOs), they market the seed.

Types of cooperatives

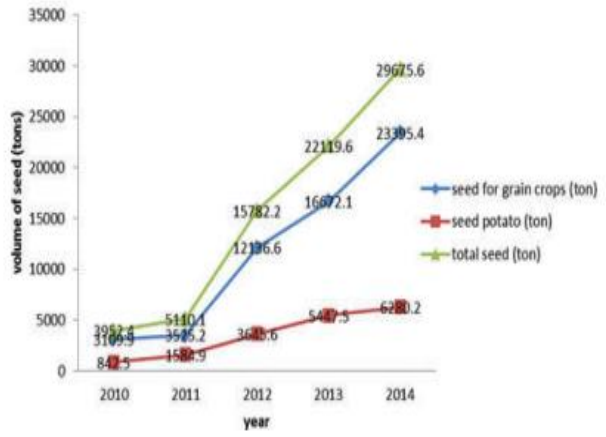
Ethiopian cooperatives are categorized according to the types of activities they carry out. Certain cooperatives have diverse goals and carry out several tasks. Other cooperatives specialize in one particular industry, including those that produce seeds, sell fruits and vegetables, raise livestock, provide veterinary care, grow trees, produce sugarcane, grow coffee, raise dairy, fisheries, irrigation, apiaries, and provide housing and savings and credit. Each group has a different number of cooperatives, members, and capital invested. According to [25], the agricultural sector has the highest number of registered cooperatives, followed by housing, savings, and credit cooperatives [23].

3.7. The Role of Seed Producer Cooperatives to Seed Supply Improvement

In Ethiopia's seed industry, cooperatives of seed producers are essential. They directly sell to consumers both locally and internationally, producing high-quality seeds of a variety of crops and kinds. For instance, SPCs produced 131 kinds and over 23 distinct crops in 2014 alone [30]. They are supplied by agro-ecological circumstances and consumer wants. They may perform the role of out-growers for unions, public and private seed companies, and under contractual agreements. They cater to the niche market for crops that are only partially served by public seed corporations and for which private seed manufacturers have little interest in investing (i.e., find them financially attractive). For local food production and cultural practices, the SPCs can provide high-quality seeds of crops and types that are in great demand locally and are frequently crucial [50].

It has been reported that SPCs provide significant amounts of seed to the market annually. For instance, 37% of the seed given in the country in 2015 came from SPC production and distribution through the official distribution process [25]. Nearly 32.2% and 20.9% of the estimated national certified seed used for potatoes and wheat, respectively, came from SPCs in 2014. More than 10% of certified seeds of teff, legumes, oilseeds, and potatoes are purportedly contributed by Ethiopian SPCs. Over the past few years, Ethiopian SPCs have produced an increasing volume of seed overall. Trends in the total volume of seed produced by SPCs for potatoes and grain crops are displayed in Figure 4. Seed Producers Cooperatives (SPCs) generated a total volume of seed, increasing from 3,952.4 tons in 2010 to 29,675.6 tons in 2014. During this period, SPCs' overall seed supply to the market has expanded. Table 1 [30] presents the forecasts for the share of the market that SPCs will service from 2010 to 2014. These estimates are based on information from Ethiopian agriculture statistics, seed replacement rates for each crop, and SPC production data. The data shows that for most of the crops evaluated, the share of the market serviced by SPCs' seeds has generally increased over the years.

Seed producer cooperatives (SPCs) help reduce transaction costs and provide affordable, easily accessible, and community-supported seed. Some successful SPCs can offer seeds to farmers at a lower cost compared to larger seed operations, while still maintaining the same quality as public and private seed enterprises. The prices charged by SPCs do not include labor, marketing, administrative, or transportation costs. SPCs also help in the rapid adoption and dissemination of newly released crop varieties among farmers. Some SPCs can access new varieties through collaborations with nearby research organizations, and these new cultivars are integrated into the production system as part of their product portfolio [30].



Source: [30]

Figure 4. The volume of seed produced by Seed Producer Cooperatives (SPCs) across years (2010-2014).

Table 2. Estimated percentage of seed of selected crops.

Crop	2010	2011	2012	2013	2014
Barley	0.4	1.5	5.5	8.9	7.2
Chickpea	NA	0.2	2.6	7.8	12.7
Common bean	0.9	3.2	2.4	3.2	10.2
Finger millet	NA	NA	2.6	0.9	1.8
Groundnut	1.0	0.7	2.9	5.9	12.1
Lentil	NA	0.5	4.6	16.0	22.8
Maize	2.1	0.5	1.9	1.7	2.6
Potato	3.1	5.3	11.4	22.3	20.7
Rice	7.5	72.4	44.1	31.7	37.8
Sesame	NA	NA	0.2	1.1	10.5
Sorghum	NA	NA	6.8	14.1	14.9
Soybean	NA	NA	10.4	3.7	9.6
Teff	0.07	1.0	5.6	12.8	20.1
Wheat	1.8	2.4	121	18.2	31.1

Source: Adopted from Integrated Seed Sector Development (ISSD)/Ethiopia 2015 annual report [30]

3.8. Collective Action Participation and Role of Seed Producers' Cooperatives for Members

The role of seed producer's cooperative in seed system very crucial. The role for members was described as follows.

3.8.1. Quality Seed Production

Farmers who are part of Seed Producer Cooperatives (SPCs) produce higher quality seeds compared to non-members. This is because SPC members benefit from the quality control processes of the cooperatives, which ensure that the seeds meet established quality standards. Members are aware that their cooperative will not accept their products if they do not meet quality requirements, which motivates them to focus on their farming methods and activities. Additionally, members of the seed quality control committee receive guidance on preserving seed quality during and after harvest. They are driven to produce high-quality seeds due to their common goal for the seed industry. Government and development partners assist members in receiving technical training and guidance on producing high-quality products [21].

3.8.2. Reduced Transaction Costs

Transaction costs encompass expenses related to contracts (involving negotiation and agreement-making), contacts (involving information-gathering and partner/product searches), and control (involving agreement monitoring, enforcement, and safeguarding costs). Seed Producers cooperatives (SPCs) follow specific procedures and engage in activities that require task coordination to obtain supplier inputs on time. By working together, SPCs reduce transaction costs, allowing members to access high-value markets that would otherwise be inaccessible to individual farmers. Cooperatives can help their members take advantage of economies of scale by leveraging their negotiating power to lower transaction costs [14].

3.8.3. Input (Seed) Access

In the Ethiopian seed industry, the availability of agricultural inputs, especially basic seeds, is a major concern [12, 49]. Seed availability encompasses seed variety, quality, and quantity. Public institutions such as universities and research centers, along with a small number of private businesses, have limited capacity to supply farmers and seed growers with an adequate amount of basic seeds. Furthermore, seed providers only focus on a limited number of crops, which makes it difficult to meet the diverse seed needs of the farming com-

munity [16]. To address this issue, farmer cooperatives collaborate with public firms to ensure their members have access to basic seeds. As long as the SPCs meet all the requirements established by outside quality assurance organizations, they are also qualified to produce basic seeds. The SPCs' strong ties and relationships with suppliers allow them to obtain seeds for their members.

3.8.4. Working with and Support from Externals

The primary partners of SPCs in Ethiopia include research institutes, NGOs, agricultural offices, cooperative promotion offices, state and private seed firms, and seed-related projects. For variety development, adaptation, multiplication, and pre-extension demonstration, research institutes collaborate with SPCs [6]. Collaborating with outside partners makes SPCs competitive in their industry and helps them get the knowledge and abilities needed to manufacture and market a variety of high-quality seeds. In addition to audits, legal services, seed quality control, and certification, the government offers extension services to support novel cultivars and agricultural technologies. Additionally, NGOs serve as intermediaries to deliver government services to cooperatives and their members' advantage [26, 50].

3.8.5. Business Opportunities for Seed Producer Cooperatives

Seed Production Cooperatives (SPCs) in Ethiopia have significant potential to grow into strong, medium-sized seed businesses. These SPCs are enthusiastic about meeting the specific needs of farmers within and outside their communities by producing seeds for pulses, vegetables, and grains. By taking advantage of lower distribution costs, SPCs could effectively compete with other seed suppliers to provide farmers with the products they need. Additionally, SPCs can offer high-quality seeds and cultivars that are in high demand in specialized local markets, which play a crucial role in regional food production and social norms. Large commercial and public seed businesses frequently overlook locally desired crops and kinds because the profit margins and demand are too low for private seed companies to invest. Large seed firms' lack of interest leaves the SPCs with a niche market to serve local clients. Certain SPCs manufacture crop seeds, such as potatoes and red beans, in which neither the public nor private seed companies are interested [50].

3.9. Factors Affecting Performance of Seed Producers Cooperative (SPCs)

The research shows that the cereal seed sector in the developing world is either in the preindustrial or emerging stages. During these stages, the main focus of agriculture is subsistence, and very few farmers are using modern varieties. To understand the benefits that seed producers hope to achieve during these stages, it's important to examine their success in the production and marketing phases separately. Farmers can increase the quantity of crops they produce during the production phase; even if they are unable to sell the seed on the market, they will still benefit because the output they generate will help feed their families. There are two categories of potential influences on seed producer performance: external and internal factors [24].

3.9.1. External Factor

Seed growers are unable to control certain factors, such as government policies, initiatives, and the actions of non-governmental organizations (NGOs). These entities are key service providers to seed growers and their associations. The behavior of seed producers is influenced by seed consumers and policy environments. Therefore, this discussion will explore how customers and policy environments impact the performance of seed producers.

Policy environment NGOs and government organizations are the primary service providers for CBSP during its initial stages of growth. These organizations establish rules, laws, and plans that act as policy guides during the seed production and marketing stages. Government agencies face challenges related to the availability of source seeds, facilities for testing seeds, and providing technical and managerial training for seed manufacturing and marketing.

Seed demand characteristics

Farmers in rural areas vary widely in terms of their socio-economic attributes, including the amount of their land. Larger farms typically use hybrid or contemporary cultivars together with additional agricultural inputs like chemical herbicides and fertilizers. Conversely, crop types that require less external inputs and are more risk-averse may be the top goals for small farmers. Similar to this, factors including cropping patterns, land features, variety characteristics, price of seed, and so on influence how farmers purchase seed at the market (Paudel and Matsuoka 2008 referenced in [24].

3.9.2. Internal Factors

Socio-economic characteristics of seed growers

Many studies have demonstrated that factors related to their efficiency in using resources and farmers' participation in the market include demographic (family size, age and education of the household), economic (operational land, irrigation facility, fertilizer, soil or land characteristics, etc.), and institutional (membership in the organization, access to training, etc.) variables [21]

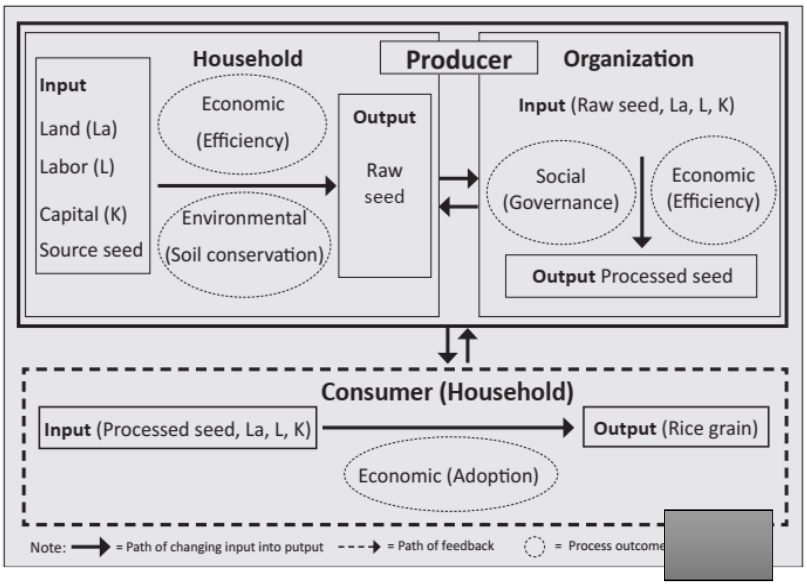
Organizational management

Community-based seed production (CBSP) involves the production of seeds at the household level, which are then marketed by community-based seed producer organizations. These organizations gather raw seeds from independent growers, process, store, and distribute them to consumers as part of their marketing initiatives. They also provide technical assistance to their members through training and monitoring visits. In many developing nations, CBSP organizations take

the form of groups or cooperatives, continuing the tradition of traditional social organizations with the main goal of promoting the socio-economic growth of their members (Witcombe, Devkota, and Joshi 2010 quoted in [24]).

The framework of Producers:

Producer's seed producing households having membership in CBSPOs. Seed production takes place at the household level, and it is the responsibility of each household to determine how to use technology and scientific knowledge to convert inputs such as land, labor, capital, and source seed into raw seed while achieving the desired economic and environmental results (as shown in Figure 5). Environmental performance, which involves implementing soil conservation practices, serves as the basis for long-term efficiency, while economic performance refers to the household's productivity. The household produces raw seed and then delivers it to their organization (CBSPOs) for marketing, which involves market research, collection, processing, distribution, and storage. Subsequently, CBSPOs process the raw seed into marketable seed for customers. The marketing performance of a CBSPO can be assessed using metrics such as efficiency and governance. The creation of policies and procedures by CBSPOs to achieve marketing efficiency is primarily the subject of their governance.



Source: [24]

Figure 5. *Framework for understanding sustainability of seed producer's system.*

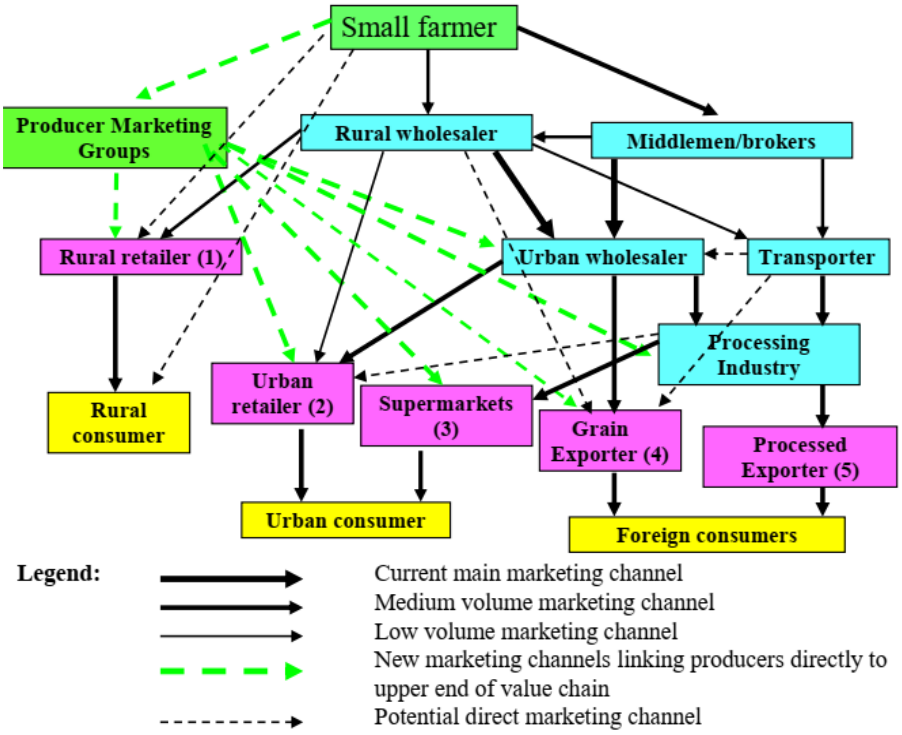
3.10. Farmer Organization's Role in Improving Markets

Through the provision of contractual links to input and output markets, farmer organizations can contribute to the mitigation of the effects of imperfect markets. Additionally, by leveraging market functions for smallholder farmers, they promote economic cooperation in liberalized markets. Small-scale farmers in the output markets can share the fixed costs of marketing through collective marketing, which also helps them to get a stronger negotiation position and more market power. When information is incomplete, producer groups can select participating farmers based on their local knowledge and utilize peer pressure to ensure contract compliance. The benefits of organized small producers include better communication of market conditions, standardized production processes to comply with food safety or fair-trade rules, and product quality control. In general, grouped small farmers are better able to share information about market conditions, standardize production techniques to comply with food safety or fair-trade regulations, monitor the quality of their produce and provide consistent products to meet consumer preferences, and use temporal and spatial arbitrage in agricultural markets to absorb shocks [46].

Cooperatives and Producer Marketing Groups (PMGs) have the potential to enhance market accessibility, lower marketing expenses, and align purchasing and selling strategies with seasonal price fluctuations. As seen in Figure 6, PMGs can reduce the length of marketing chains by establishing a closer connection between manufacturers and the top of the chain. Well-organized farmers will be able to communicate directly with urban wholesalers, high-end merchants, processors, and exporters, eschewing the middlemen and assemblers in rural marketplaces [45].

Accessing agricultural inputs such as seeds and fertilizer is difficult for smallholder farmers in rural areas due to high costs and transaction expenses. The expenses of shipping and transactions for small quantities of supplies make investing

in commercial inputs unfeasible for many smallholder farmers. However, farmer marketing organizations have the potential to improve commercial operations and technological advancements in agriculture by providing market access and service delivery, despite conflicting findings [45, 48].



Source: [46]

Figure 6. Role of producer marketing groups in grain markets: example of grain legumes.

3.11. The Impact of Producer Organizations on Market Access and Technology Adoption

An increasing amount of research is examining the effects of cooperatives (as a particular kind of POs) and the circumstances in which beneficial effects can be achieved. The majority of research has examined how belonging to a cooperative affects certain performance metrics. Research by [54] has demonstrated that cooperative membership makes it easier to get into more profitable specialized markets in Costa Rica's coffee industry. Finding by [27] discovered that Kenyan banana growers who are members of cooperatives enjoy higher pricing and greater farm revenue. According to [52], dairy farmers in India who are part of a cooperative operate more profitably and with greater efficiency. Ethiopian smallholder farmers saw a similar outcome [1]. Membership in a cooperative has a significant favorable impact on the revenue of Chinese watermelon producers, as demonstrated by [13, 31].

To access markets for inputs, technical support, and loans, farmers must also pay substantial transaction costs. Cooperatives can also address the issue of transaction costs in this situation by making group purchases or by offering services that would not otherwise be possible. For example, [45] demonstrate that better varieties are adopted more frequently in Kenya when members of grain cooperatives are involved. According to research by [4, 28], belonging to a cooperative encourages the use of mineral fertilizers, which raises farm productivity. Nonetheless, given that there is no free market for fertilizers and that cooperatives are the only way to participate in the government-run fertilizer distribution scheme, this result is not shocking [1]. In the end, POs can serve as significant catalysts for the adoption of innovation and the modernization of production systems by fostering effective information flows, as [27] have suggested. As a result, the advantages of PO membership include improved chances for innovation and higher-quality product development in addition to the obvious benefit of market access.

However, variations across POs—for example, along the lines of the typology previously presented—have not received much attention in the scant research on the effects of agricultural cooperatives in developing nations. But lately, there have been a few outliers. Finding by [53] for example, examined cooperatives in Rwanda operating in disparate industries (vegetables against corn) and with disparate pay structures (more individualization versus higher collectiveness). The authors discovered that, even in cooperatives where marketing is done jointly, the influence of membership on farm performance is greatest in those where production and

compensation are determined individually. A study by [27] discovered that more established and homogeneous groups in Kenya's banana POs were better able to provide benefits for their members. Additionally, the PO's performance is influenced by how it was established: either top-down by state agencies or bottom-up by the farmers.

According to Barham and Chitemi's (2009) analysis of Tanzanian farmer groups, more established groups with robust internal institutions, well-run group activities, and a solid natural capital asset base—such as access to irrigation water—are more likely to strengthen their position in the market. Furthermore, the kind of commodity matters: organizations selling fruits and vegetables had a higher chance of improving the market conditions than organizations pushing staple crops like cereals and legumes. The group's capacity to pool funds to purchase the specialized machinery required for sorting, storing, and transporting perishable goods like fruit, vegetables, and milk explains. Furthermore, the danger of exploiting time-related dependencies—also referred to as "hold-up" in transaction cost theory—is higher for perishable goods, which strengthens the motivation for farmers to work together to find a solution. In a 2009 study on collective action in Meso-America [36]. validated the proportional importance of cooperatives for high-value crops. These results are consistent with those for Europe, where cooperatives hold the largest market share in the dairy and fruit and vegetable industries [13].

One factor that influences the organizational success of a group is the type of product [42]. It is important to understand how group size and performance are related. Large organizations have a greater opportunity to achieve economies of scale, while small groups are more likely to exhibit high levels of informal information exchange and internal cohesion. In addition to group characteristics, the size of member deliveries also matters. Side-selling by members jeopardizes the organization's financial stability because member deliveries are essential for achieving processing and marketing efficiency [42].

4. Conclusion And Recommendations

4.1. Conclusion

The government has designated cooperatives that grow seeds as one area of focus in the national agenda for improving the country's food security. Having access to superior seeds is one of the most crucial resources for improving the food security of smallholder farmers. Smallholder farmers who work with cooperatives to produce seeds have the chance to sell their seeds to non-governmental organizations (NGOs), other farmers, and organization’s that manage seed-related operations. As a result, the smallholder farmers can benefit from shared advantages as well as self-seed security.

The development of the seed industry poses a complex challenge in developing and emerging economies like Ethiopia. When a nation's seed industry adopts dynamic, pluralistic, and market-oriented practices, it can contribute to economic growth. In Ethiopia, each seed system plays a distinct role. Therefore, development strategies for the seed sector should be based on a variety of seed systems.

Supporting farmers' self-organization into neighborhood associations or regional cooperatives is becoming more popular. In the field of seed production, farmer group organization is also fostered, particularly in nations such as Ethiopia where the growth of the seed sector is presently a top priority. The main motivation for encouraging group activities in the seed industry is the public sector's inability to develop a viable seed industry that offers farmers high-quality seeds of improved kinds. In between the official and informal seed systems, farmer groups, cooperatives, and other community seed production initiatives are thought to be able to connect the traditional and commercial seed supply. Because of its limited capacity and the existence of only one contemporary seed potato company, the Ethiopian Seed Enterprise (ESE) is not involved in the production and supply of seed potatoes.

The SPCs assist members and farming communities in producing high-quality seeds and disseminating agricultural innovations while also dramatically lowering input access prices. Ethiopian SPCs help to boost the nation's seed supply while being diverse and facing several difficulties. SPCs may enjoy improvements in their access to markets, commercial performance, and competitiveness in the market if they are organized into large seed unions.

4.2. Policy Implication

The possible policy option suggested to improve seed producer’s cooperative discussed as follows:

1. Modify institutional structure of seed system one important mechanism because its great challenges of constraint potato seed system limited capacity of formal public seed enterprise one of option.
2. The distribution of basic seeds at the national and regional levels should recognize the role of cooperatives. Cooperatives should enhance market access for seed farmers by utilizing media to disseminate market information.
3. Clear guidelines and standards for collective action are essential for successful institutions that facilitate effective collective activity. These institutions establish rules and standards for participation and enforcement mechanisms to reassure other market participants. These guidelines also create incentive structures to influence and regulate the behavior and expectations of individual members. The rules should outline the tasks, responsibilities, rights, and entitlements of each member as well as the organization as a whole.
4. Therefore, the government and development partners should promote and strengthen SPCs to maximize their performance in the seed business and their ability to improve the seed supply, thereby securing seed security in Ethiopia.

Abbreviations

ATA	Agricultural Transformation Agency
EIAR	Ethiopian Institute of Agricultural Research
ESE	Ethiopian Seed Enterprise
FAO	Food and Agricultural Organization
FCA	Federal Cooperative Agency
ISSD	Integrated Seed Sector Development
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
MOA	Ministry of Agriculture
NVRC	National Variety Release Committee
POs	Producers' Organizations
RARIs	Regional Agricultural Research Institutes
RSEs	Regional Seed Enterprises
SPCs	Seed Producers Cooperatives

Author Contributions

Getu Mitiku Bekuma is the sole author. The author read and approved the final manuscript.

Conflicts of Interest

The authors declare no conflicts of interest.

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