AGRA
Sustainably Growing Africa's Food Systems

GHANA

Seed sector strategy & investment plan

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Acronyms

CORAF	West and Central African Council For Agricultural Research And Development
CRI	Crops Research Institute
CSIR	Council for Scientific and Industrial Research
DAES	Directorate of Agricultural Extension Services
DCS	Directorate of Crop Services
DUS	Distinctiveness, Uniformity and Stability
ECOWAS	Economic Community of West African States
GLDB	Grains and Legumes Development Board
GOG	Government of Ghana
GSID	Ghana Seed Inspection Division
IP	Intellectual Property
LCIC	Legacy Crop Improvement Centre
MOFA	Ministry of Food and Agriculture
NASTAG	National Seed Trade Association of Ghana
NSC	National Seed Council
NVRRC	National Variety Release and Registration Committee
OPV	Open Pollinated Varieties
PFJ	Planting for Food and Jobs
PPRSD	Plant Protection and Regulatory Services Directorate
PRA	Pest Risk Analysis
PVP	Plant Variety Protection
SARI	Savanna Agricultural Research Institute
SEEDPAG	Seed Producers Association of Ghana
SRID	Statistics, Research, and Information Directorate
TASAI	The African Seed Access Index
UCC	University of Cape Coast
VCU	Value for Cultivation and Use
WACCI	West Africa Centre for Crop Improvement

Executive Summary

The seed sector in Ghana has registered significant growth over the last six years, largely fuelled by the Planting for Food and Jobs (PFJ) program, the government's flagship initiative for agricultural transformation. The growth of the industry is evidenced by an increase in the participation of the private sector, a rise in the volume of certified seed being supplied to farmers, and an increase in the number of crop varieties being developed, released, and commercialized.

The Seed Sector Strategy and Investment Plan is one of the instruments to help implement the National Seed Policy of 2013 and is intended to replace the Ghana Seed Plan of 2015. The Strategy outlines the priority actions to advance the seed sector in Ghana.

The discussion of the issues in the seed sector is organized into eight components in Section 4 of this report – Breeding, Variety Release and Maintenance; Early Generation Seed supply; Quality Commercial Seed Production, Quality Assurance; Seed Marketing and Distribution; Farmer Awareness and Promotion; Policy, Legal and Regulatory Frameworks, and National Planning and Coordination.

The Strategy proposes to achieve seed production targets for the following key crops important for food security and household incomes: maize, rice, cassava, sorghum, cowpea and soya bean. The targets measure seed production as a percentage of annual seed requirement and range from 10% (cassava) to 80% (rice). The seed production target for maize is 40%, more than double the production in 2021/22.

The Strategy proposes ten high-level seed industry targets as measures to gauge the development of the seed sector. The Strategy proposes to achieve these targets by 2025.

The total estimated cost of implementing these ten priority interventions is USD 2,551,000 (Two Million, Five Hundred Fifty-One Thousand US Dollars). Of this amount, USD 1,666,000 (or 65% of the investment) is covered under the SAPIP project, which is funded by the African Development Bank (AfDB) and the Ministry of Food and Agriculture (MOFA). The amount covers the rehabilitation of four seed processing facilities at Kumasi, Winneba, Ho and Tamale, including the cost of seed processing equipment.

The implementation of the strategy takes into consideration on-going or planned projects or investments by various partners and the private sector. Some of these are outlined in Annex 1. It is important that, where successful, these interventions are scaled out to achieve maximum benefit.

The National Seed Council is the lead coordinator of the development of the Seed Sector Strategy and Investment Plan. The Chairman of the National Seed Council has appointed an eight-person team to coordinate the work needed to finalizing the document. This work entails stakeholder engagements across the country, targeting the key entities involved in in the seed sector.

Section 1:

Introduction

The Seed Sector Strategy and Investment Plan is one of the instruments to implement the National Seed Policy of 2013. The Policy acknowledges that seed is one of the critical inputs for agricultural development, as outlined in its overall objective, "to support the development and establishment of a well-coordinated, comprehensive and sustainable private sector-driven seed industry, through systematic and strategic approaches". (GOG, 2013)

The justification for the development of the Seed Strategy and Investment Plan is driven by three needs:

a. **Need to review the Seed Plan of 2015:** The Seed Plan of 2015 was developed to implement the National Seed Policy of 2013. There is a need to review this plan, as the policy is 10 years old. Table 5 summarizes the status of implementation under the four broad thematic areas of the Plan.

b. **Need to review funding strategy in existing Seed Plan:** The funding strategy for the Seed Plan of 2015 was through projects, but most were never funded. The new Strategy and Investment Plan outlines a more comprehensive yet flexible approach for fundraising to implement the priority interventions.

c. **Need to exploit/scale out on-going successful interventions:** There are a number of successful interventions that have either been conducted or are on-going, and could be scaled out or further exploited. The new Seed Strategy and Investment Plan intends to deliberately identify these interventions and build on them.

The objectives of the Seed Strategy are drawn from the objectives of the Seed Policy of 2013. The overall objective of the Policy is to support the development and establishment of a well-coordinated, comprehensive and sustainable private sector-driven seed industry through systematic and strategic approaches. The other objective cut across the different aspects of the seed industry:

1. **Research and Variety Development:**
    a. To enhance support in researching areas of human capacity development, infrastructure and financial resources to undertake both basic and adaptive research in collaboration with partners, both internal and external, in order to develop new varieties that are most suited to the Ghanaian agro-ecologies and end use.
    b. To ensure that processes of variety testing, release and registration, as well as issues of ownership and other rights, are adequately addressed as per international norms and standards.
    c. To ensure the establishment of a Research Fund supporting activities including the development and release of varieties.

2. **Biotechnology in crop improvement:**
    a. To progressively create the necessary platform for the safe and effective use of biotechnology applications and Genetically Modified (GM) crops in the national seed industry as a means of rapidly attaining the national food security goals.
    b. To support the training of all categories of staff (research and technical) in biotechnology applications as well as the observation of laid down bio-safety measures.
    c. To ensure the provision of infrastructural and logistical the support required to undertake both basic and applied research in biotechnology, and for seed multiplication and distribution of GM materials.
    d. To support the set-up of laboratories in the appropriately mandated agency, for the testing of seed and planting materials, for compliance with the regulations on the labelling of GM foods and other products.

3. **Variety release:**
    a. To ensure that materials emanating from research, and slated for introduction into the seed market as new varieties, are sufficiently screened as per laid down procedures.
    b. To ensure that adequate capacity and resources have been provided to mandated institutions to conduct the variety release process efficiently and effectively.
    c. To support the set-up of infrastructure for the conservation and maintenance of Plant Genetic Resources.

4. **Intellectual Property Rights (IPRs) (Plant Variety Protection):** To facilitate the implementation of the Plant Variety Protection Act (Act 1050) and its legislative instrument, encouraging breeders and farmers in their work to enhance the development and release of improved varieties, improve seed accessibility, and protect plant genetic products.

5. **Seed Quality Assurance:** To enhance the maintenance of high-quality seeds of crop varieties along the seed value chain.

6. **Seed production:** To ensure that both public and private sector actors providing services devoted to the production of all classes of seeds (breeder, foundation and certified) are optimized to form foundations for the seed industry. This will promote competition, partnership, and a vibrant seed sector with higher quality output for the systems.

7. **Private seed enterprises:** to rapidly promote the development of an active and efficient private seed sector through the creation of an enabling environment that includes effective collaboration between public and private, private and private, or public and public seed enterprises and agencies; facilitative investment incentive packages, and infrastructural development.

8. **Seed conditioning and storage:**
   a. To ensure that past investments in seed conditioning and storage are adequately protected, rehabilitated, maintained, improved, modernized and efficiently deployed to meet the current needs of existing public and private sector agencies involved in the production of all classes of seed.
   b. To encourage seed companies in establishing seed plants to service the needs of the emerging private sector, work towards privatizing any existing redundant seed plants, and encourage the private sector to invest in this area to meet their own specific needs.

9. **Seed marketing:** To ensure, in a manner consistent with prudent free-market economics and other national goals, the regular availability of quality seed for seed users in the form, time and place they need it, to guarantee crop production for food security and national development.

10. **Seed export and import:** To encourage the local seed industry to develop their output potential, and support them in exploiting export opportunities

11. **Agricultural extension:** To create an enabling environment and develop adequate capacities for a pluralistic extension system to play its critical roles in seed production, delivery and use.

12. **Informal Seed Sector:** To support the informal seed sector in integrating with the formal sector, and systematically upgrading some of its practices to eventually evolve into the formal seed sector, and enhance the growth of the formal sector.

High-level Priority Targets

The Ghana Seed Plan (2015) highlighted four broad areas of intervention. Building on the lessons of the Seed Plan, this Strategy proposes three broad sector goals. These goals in turn inform the high-level priority interventions the country should pursue. The broad goals are:

i. A vibrant and competitive private sector that consistently produces quality certified seed and has developed sustainable linkages along the seed value chain.
ii. Effective seed sector support services reliably provided by competent public and private entities.
iii. Effective seed sector governance that facilitates the planning and coordination of key activities across the seed sector.

The Strategy proposes to achieve seed production targets for six key crops important for food security and household incomes: maize, rice, cassava, sorghum, cowpea and soya bean. Table 1 below compares the seed production targets against the estimated annual seed requirement (calculated using seeding rate and area harvested to the different crops). The seed production targets for these crops range from 10% for cassava to 80% for rice. The seed production target for maize is 40%, more than double the production in 2021/22. This is for two reasons: (i) The maize seed production the previous year was close to this target, and (ii) up to 40% of the annual maize seed requirement was imported as hybrid maize in 2021. The goal is to increase production of hybrid maize in Ghana.

Table 1: *Seed production targets for 2025*

Crop	Estimated annual seed requirement (in MT)[1]	Production of certified seed in 2021/22[2]	Seed production as % of estimated annual requirement	
			Actual in 2021/22	Target in 2025
Maize	35,224	5,546.9	16%	40%
Rice	7,734	12,917.9	Tbd	80%
Sorghum	517	286	55%	60%
Soya bean	3,292	2,280	69%	80%
Cassava				10%
Cowpea	670	175	26%	50%

1 Calculated as product of area harvested and seeding rate. Data on area harvested sourced from FAOSTAT. Data on seeding rate obtained from Ghana Seed Plan (2015) for maize, cowpea and sorghum; SeedCo Growers' Guide, for soya bean; IRRI for rice.
2 Data for maize, rice and soya bean from PPRSD; Data for sorghum and cowpea is volume supplied through PFJ

Further, Table 2 shows ten high-level seed industry targets proposed by the Strategy to measure progress towards achieving the three goals. The Strategy proposes to achieve these cross-cutting targets by 2025.

Table 2: *High-level Seed Industry Targets*

Goal	Current status (in 2022)	Target by 2025
Vibrant and competitive private sector	Seed company/grower dependence on PFJ at 48% for maize seed, 67% for rice seed and 75% for cowpea seed.[3]	1. Reduce seed company/grower dependence on PFJ to below 20% for all crops
	Low volumes of locally produced maize hybrid seed	2. At least 15% of annual maize seed requirement is met through local production of maize hybrids
	Low number of seed companies owning seed processing plants	3. At least 10 seed companies own seed processing facilities and process their own seed
	Most seed companies and growers do not have internal quality control systems	4. At least 75% of active seed companies have and utilize comprehensive and complete protocols for internal seed quality assurance
	Only one registered seed company specialized in production of foundation seed	5. At least four registered seed companies actively producing quality foundation seed
Effective seed sector support services	Low number of public varieties (6 maize varieties, 2 soya bean varieties and 2 tomato varieties in 2022) licensed to seed companies for commercialization	6. At least 50 public varieties have been licensed to seed companies for commercialization through the CSIR Crop Variety Licensing System
	Private seed inspection arrangements yet to be developed and deployed	7. GSID authorizes and deploys private sector/ third party providers for various seed services including seed inspection, seed testing and seed analysis.
	Agro-dealers do not have sufficient training and knowledge in agricultural inputs, general business management and handling of carry-over stocks	8. At least 75% of all registered agro-dealers have received training in key topics related to the management of agricultural inputs
	Government seed processing facilities in Winneba, Ho, Kumasi, Tamale, Bolgatanga, and Wa are in various degrees of disrepair and in need of refurbishment	9. All 6 government processing facilities refurbished and fully functional
Effective system for seed sector governance	Inadequate support to the National Seed Council to carry out its mandate for overall seed sector planning and coordination	10. National Seed Council adequately funded and is effectively undertaking its mandate

3 Source: TASAI Ghana country study in 2022, which surveyed 80 seed companies and seed growers.

Section 2:

Status of agriculture and the seed sector in the country

Agriculture is key to Ghana's economy on several levels. According to the Ghana Statistical Service, in the 1st quarter of 2022, the contribution of the agriculture sector to GDP (at basic prices) was 21.3%, implying that agriculture contributes about one fifth to the Ghana economy. Figure 1 shows the trend in sectoral quarterly contribution to GDP, between 2012 and 2022. Agriculture's contribution has consistently hovered between 15% and 30% over this period. However, agricultural GDP has been close to 20% every quarter over the last 3 years.

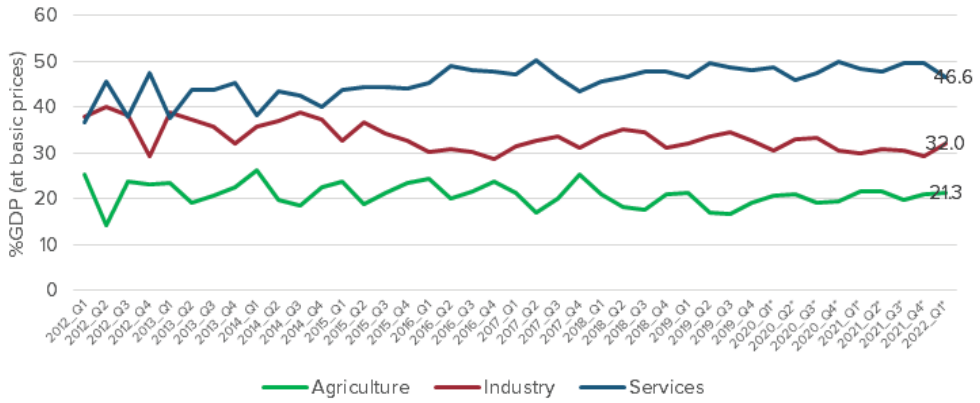

Figure 1: *Contribution of agriculture sector to GDP (%) (at basic prices)*

The agriculture sector is also a major employer in Ghana. According to the Ghana Statistical Services (GSS), in the 2nd quarter of 2022, the sector accounted for 38.4% of the employed population 15 years and older, a slight increase from 36.9% in the first quarter of 2022. The importance of the sector varies by region, but it accounted for more than half of the employed population in 10 of the 16 regions (GSS, 2022).

According to the Statistics, Research and Information Directorate (SRID) of the Ministry of Food and Agriculture (MoFA), the main crops cultivated by area are maize, cassava, yam, plantain, oil palm, and groundnut (Figure 2). Maize and cassava account for slightly less than half of the area cultivated in 2018. The chart shows that, in addition to maize, the other major seed-propagated crops are groundnut, rice, sorghum, and millet.

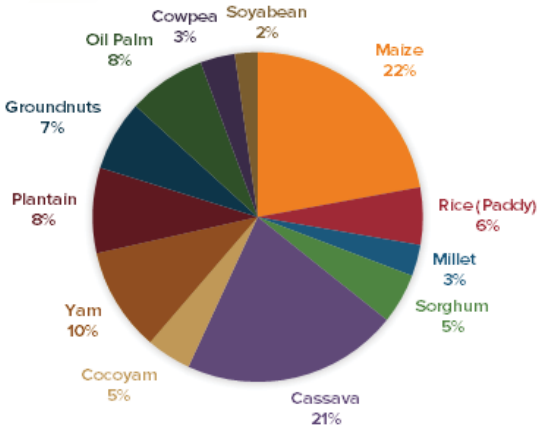

Figure2: *Area cultivated for major crops in 2018*

The seed sector in Ghana has improved notably over the last six years. This improvement is registered across the seed value chain and is evidence that the key public sector reforms have triggered industry growth. The volume of certified seed produced in the country has increased significantly over the last five years, has largely fuelled by the Planting for Food and Jobs initiative, the government's flagship agricultural program to promote food security. Figure 3 shows the volume of seed distributed through PFJ from 2017 to 2021, for three crops – rice, maize (hybrid and open pollinated varieties [OPV]), and soya bean. The volumes increased steadily over the five-year period for all crops, signalling an increase in seed available to farmers in Ghana. Further, except for hybrid maize, the seed for other crops is produced locally.

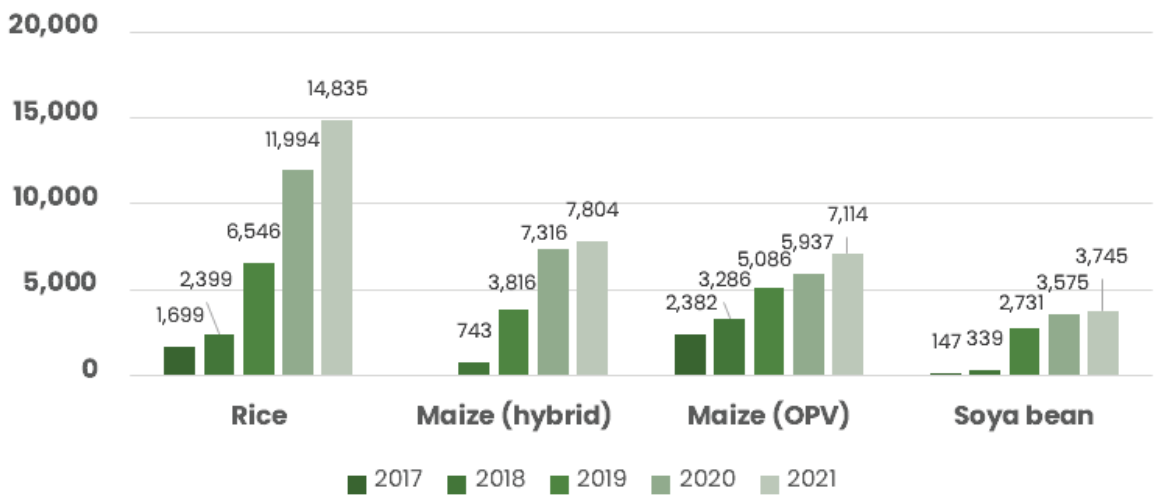

Figure 3: *Volume of seed distributed through PFJ between 2017 and 2021*

Seed companies are an important vehicle for industry growth, as they invest in the seed business by multiplying, processing and then commercializing crop varieties to farmers. The number of seed companies for the four key crops in Table 3 below increased between 2016 and 2021. Although most of the companies are still small and do not have their own processing facilities, this is an important indicator of private sector growth.

Table 3: *Number of active seed companies for key crops*

Crop	Number of active seed companies in 2016	Number of active seed companies in 2019	Number of active seed companies in 2021
Maize	17	29	47
Rice	7	19	41
Soya bean	5	15	32
Cowpea	9	13	19

The public research institutions, namely CRI and SARI, have played a key role in the development and release of varieties for the key food security crops in the country. These, and other research institutions, have released 54 maize varieties, 17 rice varieties, 24 cowpea varieties, and 21 soya bean varieties between 2000 and 2021. These varieties are developed with various traits, including climate-smart features, such as early maturity and drought tolerance, nutrition enhancement, such as quality protein maize and pro-vitamin maize, disease and pest resistance, and resistance to pod shattering (for soya bean). However, only 40 varieties of the four crops were sold in 2021 (Table 4), implying that farmers are only accessing about one third of the varieties that have been developed and released.

Table 4. *Number of varieties released and commercialized*

Crop	No of varieties released between 2000-2021	No of varieties sold in 2021
Maize	54	25
Rice	17	5
Soya bean	24	5
Cowpea	21	5
Total	**116**	**40**

Despite the importance of the agriculture sector and significant developments in the seed subsector in the country, food insecurity persists. About 41.2% of the population, equivalent to about 13 million people, experienced food insecurity in the 2nd quarter of 2022 (GSS, 2022). This was a decline from 49.1% in the 1st quarter. Food insecurity is more prevalent in the rural areas, where the percentage is higher — 55.3% in the 2nd quarter of 2022. These high percentages indicate that the country is falling short of the United Nations Sustainable Development Goal of Ending hunger and achieving food security by 2030.

Section 3:

Performance review of the National Seed Plan of 2015

The National Seed Plan of 2015 was formulated as an instrument to guide the implementation of the Ghana Seed Policy of 2013. The Plan outlined areas of reforms centred around four broad themes: (i) Direct Private Sector Interventions, (ii) Supportive Services for the Seed Industry Growth, (iii) Addressing gaps in the Strategic Components of the Seed Sector, and (iv) Seed Sector Governance and Coordination.

Overall, the status of implementation of the plan has been mixed. On one hand, the government has facilitated the establishment of an enabling environment for seed sector development through the enactment of laws, and the passing of regulations. In addition, one of the government's flagship projects, Planting for Food and Jobs has triggered an increase in the level of activities in the sector at the stages of research, seed production, seed marketing, and seed distribution. Further, partner organizations such as AGRA and USAID have implemented projects aimed at addressing the challenges at various points in the seed system. On the other hand, several of the projects that were proposed as tools for implementing the plan did not materialize. Table 5 provides brief summary of the performance review of the Seed Plan of 2015.

Table 5: *Summary of performance review of National Seed Plan 2015*

Thematic area 1: Direct private sector interventions	**Status of Implementation**
Strengthening the Role of the Private Sector in the Ghana Seed Industry	The National Seed Trade Association of Ghana (NASTAG) was formed in 2017 and is very vibrant. According to the TASAI Ghana report of 2021, members' overall satisfaction with NASTAG was 75% in 2021, a significant increase from 46% in 2017.
Developing the private sector seed marketing	The marketing of seed across the country has improved over the years. However, the private sector is reliant on the PFJ program as the main buyer of seed. According to TASAI, from a sample of 80 seed companies and growers, 48% of maize seed, 67% of rice seed and 75% of cowpea seed was sold to PFJ. Further, only a few companies have invested in packaging their seed using their brands.
Assisting the private seed sector with improved infrastructure	The private sector is still reliant on government processing facilities. Very few seed companies have their own processing facilities.
Thematic area 2: Supportive Services for the Seed Industry Growth	**Status of Implementation**
A strong seed value chain for a vibrant seed industry	**Research and development**: Vibrant research institutions engaged in variety development. Institutions include: CSIR-SARI and CSIR-CRI as well as agricultural universities such as the University of Ghana, and the University of Cape Coast, which have developed and released a number of varieties. **Seed Conditioning and Storage.** Most seed growers rely on the government's processing facilities. Very few seed companies process their own seed. **Agricultural Extension:** Both public and private seed extension services are being promoted to enhance the transfer of knowledge to seed dealers. **Seed Marketing:** Seed distribution and marketing has been enhanced through the Food Crops Module of the PFJ. This has increased seed quantities and sales at agro-input shops. **Other interventions:** NASTAG is implementing a seed value chain project involving key seed sector stakeholders to strengthen the value chain.

Ensuring adequate human resources for the seed industry	Capacities of all seed sector stakeholders are being built to enhance productivity. The number of breeders for key commodities have increased and the number of seed Inspectors have increased over the last five years.
Strengthening the plant genetic resources base of the seed industry	Samples of all released varieties are being deposited at the centre as a key requirement for post-variety release.
Thematic area 3: Addressing gaps in the strategic components of the seed sector	**Status of Implementation**
Catering for the seed needs of traditional crops	The National Agricultural Stations have been involved in the production of planting materials of major traditional crops such as cassava, sweet potato, yam, cashew and coconut, among others.
National seed security project	The Ghana Grains and Legumes Development Board is handling the national seed security stock of the country. Each year, some quantities of foundation seed is stored under controlled environment as security stock.
Facilitating the positive and contributory role of the informal seed sector in Ghana	The positive role of the informal seed sector has enhanced the use of improved seed. The PFJ Campaign has led to an increase in the adoption of improved seed — from 10% in 2016 to 43% in 2020 (mainly maize)
Thematic area 4: Seed sector governance and coordination	**Status of Implementation**
Strengthening the national seed council secretariat	The National Seed Council has been inaugurated and is working actively to support the holistic development of the seed sector

Section 4:

Analysis of Seed Sector Challenges and Priorities

High-level priority interventions

To achieve the goals and the ten high-level targets in Table 2, the Strategy proposes the following ten (10) high-level priority interventions. These interventions are to be implemented across the seed system and by various seed industry stakeholders, including government agencies, private sector and national agricultural research centres. The total estimated cost of implementing these priority interventions is USD 2,551,000 (Two Million, Five Hundred Fifty-One Thousand US Dollars). Of this amount, USD 1,666,000 (or 65% of the investment) is covered under the SAPIP project, which is funded by AFDB and MOFA. This amount is for the rehabilitation of four seed processing facilities at Kumasi, Winneba, Ho and Tamale and will include the cost of seed processing equipment.

1. Refurbish of the government seed processing and storage facilities at Winneba, Ho, Kumasi, Tamale, Bolgatanga, and Wa. These facilities are in varying states of disrepair. Currently, the SAPIP project, funded by MOFA and the African Development Bank (AfDB) is funding the renovation of four of the six facilities. Since most of the seed growers rely on these facilities for seed processing, there is need to refurbish all six centres. The specific actions include: (i) conducting feasibility studies to establish the current state of the facilities, and (ii) rehabilitation of the facilities and replacing out-dated equipment.

2. Develop a reliable and efficient marketing strategy to reduce seed growers' dependence on government seed support programs. This should lead to the steady development towards a market-driven seed distribution system. The specific activities include: (i) developing marketing strategies for seed companies, (ii) conducting promotional activities, including demonstrations, media engagement, farmer awareness campaigns, etc, (iii) building networks of supply outlets through seed sellers and distributors, (iv) purchase of small seed packaging materials to serve as samples for farmer demonstrations.

3. Promote the uptake of newly released and well-performing varieties among farmers: According to the Ghana Catalogue of Plant Varieties, between 2002 and 2019, a total of 49 maize, 20 rice, 24 cowpea, and 12 soya bean varieties were released. Most of these varieties were developed with important features such as climate smartness, nutrition-enhancement, and pest and disease-tolerance. However, despite the availability of these newly-released varieties, seed growers still produced old non-performing varieties to farmers. There is a need to invest in the promotion of these new varieties so that farmers can benefit from their new special traits.

4. Strengthen the seed quality control capacities within seed companies and growers. Activities include: (i) hiring a seed expert to work with NASTAG and GSID to develop protocol for seed company quality control; (ii) Training seed companies, seed growers, and GSID staff on quality control.

5. Sustain efforts to build seed companies' capacity to multiply basic seed for maize hybrid varieties. CSIR institutes and universities have conducted several training programmes on hybrid maize production and maintenance. Additionally, the National Seed Trade Association of Ghana (NASTAG) has conducted several training sessions on hybrid seed production and the maintenance of parental lines of maize hybrid varieties, in collaboration with the Kwame Nkrumah University of Science and Technology (KNUST), the Legacy Crop Improvement Centre (LCIC), and the West Africa Centre for Crop Improvement (WACCI). These efforts have increased companies' capacity as they shift their focus from OPV to hybrid varieties. The NASTAG should continue to build the capacity of seed companies in this area so that they can multiply and commercialize the maize hybrid varieties being developed by the research institutions.

6. Raise awareness for seed companies on the variety licensing system. The Crop Research Institute has developed a system for licensing varieties to seed companies for commercialization. By the end of 2022, the CRI had either issued licenses or was in the process of issuing licenses for 6 maize varieties, 2 soya bean varieties, and 2 tomato varieties. The Intellectual Property office at CRI needs to sensitize seed companies and the NASTAG about this system with the aim of enhancing the uptake of varieties under this arrangement.

7. Develop guidelines for accreditation by third-party certification. The guidelines should cover the scope of accreditation, criteria for interested applicants, payment arrangements, and plans for sustainability. Once the guidelines are in place, the next step is the training of third-party actors, including public extension agents (AEAs), and private parties, seed inspection and certification.

8. Enhance agrodealer business training. Facilitate the capacity building of seed distributors in a range of topics including:

a. Business management, product knowledge and agronomy and scaling for seed distributors;
b. Handling of carryover stocks;
c. Use of ICT tools to enhance business management, through improvements in inventory management, accounting and record keeping, among other areas.

9. Support the National Seed Council in carrying out its mandate for overall seed sector planning and coordination. The NSC should be supported with the necessary human and financial resources and logistical capacity to fulfil its mandate, which includes convening inclusive stakeholder gatherings, data collection and analysis on the seed sector, and long-term seed sector planning.

10. Sustain the NASTAG as an effective platform for private sector representation and industry advocacy. The NASTAG has registered significant improvements in organizational performance since its formation in 2017. Members' overall satisfaction with has increased from 46% in 2017 to 75% in 2019 and 69% in 2021. The improvements are due to NASTAG's effective engagement with government and service delivery to members. There is need to sustain NASTAG as an effective platform for the private sector. This would entail financial support to run the secretariat and key activities and technical support to design the organization's sustainability strategy.

Table 6: *Investment Costs for High-Priority Interventions*

High-Priority recommendation	On-going interventions	Total investment (USD)	Description of cost
1. Refurbish the government seed processing and storage facilities.	On-going investments by the SAPIP project, under AFDB and MOFA	1,666,000	Rehabilitation of 4 seed processing facilities and 2 seed warehouses. On-going activity. (This is an actual cost obtained from the AfDB project document)
2. Strengthen the seed quality control capacities within seed companies and growers	No on-going investment	110,000	Hire seed expert to develop quality control manual for seed companies; and training costs for seed company staff
3. Develop a reliable and efficient marketing strategy to reduce seed growers' dependence on programs and facilitate the steady development towards a market-driven seed distribution system. Demonstrations	On-going activities by some seed companies. All costs to be borne by seed companies.	55,000	Promotional activities; developing andimplementing seed company marketing strategies.
4. Sustain efforts to build seed companies' capacity to multiply basic seed for maize hybrid varieties	No on-going investment	100,000	Meeting/farmer training costs
5. Develop guidelines for accreditation of third-party certification in seed inspection and certification	On-going work under the SAPIP project.	60,000	Hiring consultant to develop guidelines; training costs
6. Enhance agrodealer business training in digital solutions for business management; and training on handling of carry-over stocks	Tools and modules exist	150,000	Training costs.
7. Raise awareness amongseed companies about the variety licensing framework by CRI	CRI presented the framework during the 3rd Seed Forum	10,000	Meeting costs between the IP office of CRI and seed companies
8. Support the National Seed Council to carry out its mandate for overall seed sector planning and coordination	NSC secretariat under GSID	250,000	Stakeholder engagements (Mandatory 4 seed council activities) @USD 50,000 per year

9. Support the NASTAG to serve as effective platform for private sector		150,000	Salary support; meeting and training costs
TOTAL		**2,551,000**	

The interventions outlined above are the top 10 priorities to focus on to achieve the goals and high-level targets. In addition to these, there are other important interventions, The sections below outline the major challenges in eight components along the seed value chain and the interventions needed in response to these challenges.

Component 1: Breeding Variety Release and Maintenance

The key metric for the success of a breeding program is the rate of genetic gain it delivers in farmers' fields. Investments in public breeding programs can only be justified if there is genetic gain over time. Thus, there is a need to embark on system changes that will improve the ability of the research system to generate and deliver products efficiently. The main institutions involved in agricultural research and breeding of the main staple crops are CSIR institutes, the Savannah Agricultural Research Institute (SARI), and the Crop Research Institute (CRI). Other important research institutions include the West Arica Centre for Crop Improvement (WACCI), the University of Ghana, and the University of Cape Coast, among others.

The major challenges include:

i. Lack of dedicated funding for research and development and variety release. Variety release is financed through projects that fund various breeding programs;
ii. Inadequate support (infrastructure and financial) for the maintenance of the genetic resources of released varieties as well as landraces and wild relatives;
iii. High cost of variety release processes due to the large membership of the National Variety Release and Registration Committee;
iv. Inadequate human resource capacity for breeding/research of crops like vegetables, and
v. Lack of established guidelines for the maintenance of released varieties by research institutions.

Priorities for intervention

1. Provide adequate budget to meet goals for variety development, release and maintenance of germplasm - Agricultural research programs are heavily dependent on donor funding for variety research and development. The research programs need to engage with experts to design a system for revenue generation through variety licensing and a robust monitoring system for royalty payments, which could be ploughed back to support research programs.
2. Prioritize investments to ensure research programs are supported with suitable infrastructure (lab, greenhouse, seed store etc.) to carry out their research activities - Well-designed, purpose-built facilities contribute to the quality and efficiency of work. However, there is weak infrastructure to support research activities. Program effectiveness is severely constrained by make-shift seed storage units, non-functional lab and field equipment, and irrigation facilities, as well as poor state of greenhouses where available, etc. With proactive equipment maintenance schedules; and continuous back-up power supply, most equipment could last a long time. There is an urgent need to support infrastructure development such as seed storage units, functional labs, field equipment, irrigation facilities etc. In addition, an effective crop improvement program requires adequate seed stores, labs, irrigation facilities, etc.
3. Design breeding programs based on clear definitions of product profiles and target crop growing environments with a focus on delivering the realized genetic gain to farmers - Breeding programs include activities from trait integration through testing of advanced products in wide area trials, to the release of products into the marketplace. Product profile development should be enhanced with further engagements with other stakeholders to help guide the breeding program by defining market segments and priority constraints based on a sufficient understanding of target markets and production systems.
4. Implement an effective variety release process considering adequacy, timeliness and cost effectiveness - Organize formal channels (workshops, publication and online presence), where information can easily be accessed to provide variety release and registration information/data to both public and private breeders, and seed producers. Define variety dissemination and advancement systems through verified datasets using the most competitive cultivars to provide meaningful comparisons in target environments. The high cost of variety release and registration could be minimized by downsizing the membership of the National Variety Release and Registration Committee. Breeders and breeding institutions are encouraged to carry out scheduled block crop releases.
5. Establish procedures for variety maintenance - Breeding teams support the seed sector by delivering better performing varieties with high quality seed. Recognition of proper variety maintenance is manifested through established guidelines and appropriately trained personnel for monitoring and maintenance of parental line stocks to enable the production of high-quality seed in sufficient quantities. There should be in place an established reporting channel or periodic reporting on variety maintenance by all research institutions whose varieties are published in the national catalogue. The NSC/NVRRC is expected to carryout monitoring visits to the research institutes to ascertain the state of maintenance activities.
6. Awareness for seed companies on the variety licensing system – The Crop Research Institute has developed a

system for licensing varieties to seed companies for commercialization. By the end of 2022, the CRI had either issued licenses or was in the process of issuing licenses for 6 maize varieties, 2 soya bean varieties, and 2 tomato varieties. The Intellectual Property office at CRI needs to sensitize seed companies and NASTAG about this system with the aim of enhancing the uptake of varieties under this arrangement.

Component 2: Gaps in Early Generation Seed

Seed companies use basic seed to produce certified seed for sale to farmers. Most seed growers obtained basic seed from public institutions: The Grain and Legumes Development Board (GLDB), the CSIR-CRI, and the CSIR-SARI. The government supports these public institutions under the PFJ program to produce and provide all early-generation seed. The Ghana Seed Inspection Division (GSID) recently licensed nine seed companies to start producing basic seed. These companies would complement the Legacy Crop Improvement Centre (LCIC), another private entity that has specialized in the production and marketing of basic seed.

The major challenges include:

i. Inadequate funding to support the production and storage of all classes of Early Generation Seed (EGS) - Effective EGS management requires adequate production facilities supported by irrigation and adequate facilities for long term storage (especially cold storage). These facilities would support operations throughout the year.

ii. Inadequate seed planning and forecasting - the government institutions that produce EGS do not have a system for forecasting the demand for EGS by seed growers.

iii. Inadequate technical capacity within research institutions in the area of production, maintenance and storage of EGS, of all classes

Priorities for intervention

1. Fund CSIR institutes, universities, and GLDB to produce, maintain and store early generation seed - Seed growers mainly source basic seed from the Council for Scientific and Industrial Research (CSIR) institutes (CRI and SARI), and the Grains and Legumes Development Board (GLDB). The institutions acknowledge that there is a need to improve their seed production and storage capacities to meet the increasing demand for basic seed by seed growers. In addition, the institutions will need to: (i) install irrigation systems and other production-enhancing methods, and (ii) refurbish the existing cold storage facilities to prolong the shelf life of produced EGS.
2. Fund PPRSD to monitor and certify early generation seed – The GSID is responsible for seed certification and quality control of seed and planting materials, especially EGS. Insufficient funds to conduct seed farm inspections at the required time impacts negatively on the quality of EGS used for multiplication. The Directorate needs funds for the procurement of vehicles and motorbikes to enhance mobility in inspection, and the procurement of inspection kits.
3. Sustain efforts to build seed companies' capacity to multiply basic seed for maize hybrid varieties –CSIR institutes and universities have conducted several training programmes on hybrid maize production and maintenance. Additionally, the National Seed Trade Association of Ghana (NASTAG) has conducted several training sessions on hybrid seed production and the maintenance of parental lines of maize hybrid varieties, in collaboration with the Kwame Nkrumah University of Science and Technology (KNUST), the Legacy Crop Improvement Centre (LCIC), and the West Africa Centre for Crop Improvement (WACCI). These efforts have increased companies' capacity as they shift their focus from OPV to hybrid varieties. The NASTAG should continue to build the capacity of seed companies in this area so that they can multiply and commercialize the maize hybrid varieties being developed by the research institutions.
4. Develop a framework to forecast the national demand for early generation seed - Seed growers source basic seed from several sources, including public institutions such as CSIR-SARI, CSIR-CRI, GLDB, and several private entities. However, seed growers occasionally face a shortage of quality basic seed. To address this challenge, the seed companies and the different EGS producers should develop a framework to determine the annual national requirement for the different classes of EGS. In addition, the framework should outline the methods through which seed growers can access EGS from the various sources.

Component 3: Quality Commercial Seed Production

In 2021, the Ghana Seed Inspection Division (GSID) under the PPRSD registered more than 300 seed growers. Of these, 180 were maize seed growers, 93 were rice seed growers, 88 were soya bean seed growers, and 17 were cowpea seed growers. Further, a small percentage were also registered with the Registrar General as seed companies (36 for maize, 27 for rice, 14 for soya bean, and 7 for cowpea). Most of the seed companies are NASTAG members.

In 2021, the PPRSD certified a total volume of 5,547 MT of maize seed, 12,918 MT of rice seed, 2,280 MT of soya bean seed, and 376 MT of cowpea seed, in addition to seed for other key crops. In the same year. the PPRSD also issued import permits to businesses that imported a total of 10,247 MT of maize seed from Belarus, Brazil, France, India, Malawi, Nigeria and South Africa. Most of the maize seed imports are for hybrid maize varieties that are sold to farmers through the PFJ program.

The major challenges include:

To be completed

Priorities for intervention

1. Strengthen the seed quality control capacities within seed companies and growers: The Seed Regulations outline the requirements for registration of seed growers in Ghana, in terms of human resource and infrastructure. These requirements are also outlined in the ECOWAS Seed Regulations of 2008. These requirements are intended to ensure that all registered seed growers produce quality commercial seed in line with national standards. The Plant Protection and Regulatory Services Directorate (PPRSD) should strictly implement these requirements among all seed growers, starting with their registration. For example, ECOWAS Regulations require that all seed producers have sufficient land, qualified technical personnel and appropriate equipment and facilities. The PPRSD, in collaboration with the National Seed Trade Association of Ghana (NASTAG) and the Seed Producers' Association of Ghana (SEEDPAG) should conduct an annual audit of all seed companies and growers to assess whether they adhere to these requirements and standards. A plan should also be in place to address any gaps within specific timelines, because the failure to address the identified gaps may lead to the withdrawal of growers' or companies' operating licenses.
2. Refurbish the government seed processing and storage facilities, encourage and support the private sector to set up similar facilities, especially in the production communities: Most seed growers process their seed at the various government-owned seed processing facilities at Winneba, Ho, Kumasi, Tamale, Bolgatanga, and Wa. Most of the processing equipment in these facilities need repair, impeding their capacity. The Savannah Zone Agricultural Productivity Improvement Program (SAPIP) is in the process of restoring them with support from the African Development Bank (AfDB)and MOFA. The Ministry of Food and Agriculture (MoFA) needs to conduct a comprehensive assessment of the status of the rest of these facilities and invest in their refurbishment. In addition, the private sector must be encouraged and supported financially to set up similar facilities, especially in the major production zones to serve the desired needs with accreditation from the PPRSD.
3. Develop a reliable and efficient marketing strategy to reduce seed growers' dependence on the PFJ and facilitate the steady development towards a market-driven seed distribution system: Some seed companies are over-reliant on the PFJ program, which is the main buyer of certified seed from growers, accounting for between 48% of maize seed, and 75% of cowpea seed purchases among 80 surveyed seed growers in 2021. The NASTAG and the MoFA should work together to develop a post-PFJ marketing strategy that will reduce the seed growers' dependence on the program. Importantly, the program should be phased out gradually instead of ending abruptly to allow growers transition into other sales avenues.
4. Enhance and sustain efforts to address the challenge of counterfeit/ fake seed, and monitor their effectiveness: There have been notable improvements in the collaborative actions by the government and other stakeholders in response to the challenge of fake seed. According to the TASAI Ghana report of 2020, seed growers have acknowledged these improvements – their satisfaction with the efforts increased from 49% in 2016 to 75% in 2019. To sustain the improvements, the National Seed Council (NSC) and NASTAG should intensify the monitoring of the following specific interventions: (i) inspection of seed fields, processing facilities, and agro-dealer outlets by the Ghana Seed Inspection Division (GSID); (ii) the implementation of the requirement that all seed be sold in packages with labels and certification tags; (iii) the requirement that evidence of procurement of basic seed is provided when selling to farmers, (iv) a farmers' awareness campaign as part of the farmers' adoption seed drive, and (v) adoption of e-verification system (scratch cards).
5. Promote the uptake of newly released and well-performing varieties among farmers: According to the Ghana Catalogue of Plant Varieties, between 2002 and 2019, a total of 49 maize, 20 rice, 24 cowpea, and 12 soya bean varieties were released. Most of these varieties were developed with important features such as climate smartness, nutrition-enhancement, and pest and disease-tolerance. However, despite the availability of these newly-released varieties, seed growers still sold old non-performing varieties to farmers. There is a need to invest in the promotion of these new varieties as farmers are not benefiting from their special traits.

Component 4: Quality Assurance

National governments want to ensure that farmers are receiving high quality seed from the formal sector. Yet, they often do not have proper quality assurance regulations in place, nor the capacity to implement existing quality assurance regulations well. This results in low quality seed for farmers. A healthy seed system is one in which farmers have confidence that the certified seed meets labelled quality standards. In this system, farmers actively patronize the brands with the highest quality seed of the varieties they want to plant, and seed companies work to exceed quality standards, viewing the regulator as their partner in this quest. This thematic area covers seed certification process (on-field verification & post-harvest testing, seed testing and certification), seed importation and exportation, emergency seed interventions, and emerging trends (private inspection, internal quality assurance units, auto certification, e-tags and seed traceability systems, and plant variety protection legislations).

The major challenges include:

i. Inadequate funding to GSID to conduct surveillance at the different stages of the seed supply chain including production, processing and distribution.
ii. Lack of adequate suitable land for seed production, where seed growers can apply the required isolation distances.

iii. Lack of a national seed traceability system as a tool for seed quality assurance.
iv. Inadequate packaging materials produced by GSID leading to incidences of counterfeit seed in the market.
v. Insufficient and under-resourced seed laboratories for seed testing and analysis.

Priorities for intervention

1. Increase funding to GSID to conduct surveillance and monitoring; conduct seed inspection, and implement appropriate levels of pre- and post-control activities.
2. Develop guidelines for accreditation by third-party certification – The guidelines should cover the scope of accreditation, criteria for interested applicants, payment arrangements, and sustainability arrangements.
3. Train third-party actors, including public extension agents (AEAs) and private parties, in seed inspection and certification.
4. Expand crop scope/portfolio for seed quality assurance (QA). Support the national seed regulatory authority (Ghana Seed Inspection and Certification Division) to develop the protocols for all priority scheduled/focus crops with the view of formalizing seed certification for a wider range of crops, including for vegetatively propagated materials
5. Conduct scoping studies for effective field-based QA activities - For field-based sampling and other QA activities such as inspection, conduct scoping studies to establish the current and optimal number of field inspectors, levels of competency, logistical/transport support, equipment, facilities, office infrastructure, and budgetary support.
6. Fund the construction and equipping of functional QA laboratories at various seed centers - Conduct scoping studies to assess current and anticipated QA laboratory volumes, and assess their feasibility and develop guidelines for private sector involvement or investment in QA laboratories. This should lead to the construction of functional QA laboratories in the various seed centers. Also, trainings should be facilitated for lab staff in areas of capacity building to ensure the prudent and efficient use of laboratories.
7. Develop and roll out scratch card labels for seed packages to be used by all seed growers and companies. Conduct farmer awareness to increase the understanding of the scratch labels.
8. Adopt digital tools for increased volume and efficiency of QA processes - Identify recommended practical opportunities and recommended approaches to support QA processes with digital tools such as e-certification, GPS-linked field tracking and inspection reporting, and online registration of seed growers.

Component 5: Seed Marketing and Distribution

The country has a well laid out legal and policy framework that supports seed marketing and distribution systems. Further, the harmonization of its regulations with the ECOWAS regulations makes seed trade within the region easier and less costly. The agencies in charge of seed distribution licensing are the Plant Protection and Regulatory Services Directorate (PPRSD) under the Ministry of Food and Agriculture (MoFA); the Environmental Protection Agency (EPA); and the Controller and the Registrar General for company registration. The PFJ has contributed to increased farmer awareness in the use of certified seed and other farm inputs. Distribution of farm inputs under this program is though agrodealers.

The country also has a fairly well-developed private sector-led seed distribution system. Agrodealers, estimated to be about 3,500, are the main channel for the supply of seed and other farm inputs.

The main challenges include:

i. Insufficient information on local and export seed markets: Seed companies need information on seed demand and the varieties demanded to exploit seed marketing opportunities across the country.
ii. Inadequate commercialization of newly released varieties: New varieties are being released by public institutions. However, seed companies and growers are not investing in marketing these varieties.
iii. Inadequacy of seed dealer networks: The number and capacity of seed dealers across the country is inadequate.
iv. Inadequate facilities for seed storage limiting seed growers' capacity to safely store seed for long periods.
v. Inadequate information on external seed markets to inform business decisions for seed export.
vi. High volumes of seed (mainly hybrid maize) imports affecting the competitiveness of locally produced hybrid varieties.

Priorities for interventions

1. Conduct national seed distribution mapping exercise. Establish the number, type, geographical density and capacity of seed distributors to determine investments for upgrading and scaling. Support for the regulator (Ghana Seed Inspection Division – GSID) to carry out continuous online and or manual registration, monitoring and surveillance to enhance quality seed distribution.
2. Link private sector to credit sources for business improvement and expansion. Link private distributors to in-

formation and/or affordable credit facilities to enable them invest in seed scaling initiatives such as proper storage (potentially including facilities such as cold rooms), farm input promotional activities, and general expansion (potentially including vegetatively propagated planting materials)

3. Enhance agrodealer business training. Facilitate the capacity building of seed distributors in a range of topics including:
   a. Business management, product knowledge and agronomy and scaling for seed distributors;
   b. Handling of carryover stocks;
   c. Establishment of more outlets, and
   d. Use of ICT tools to enhance business management, through improvements in inventory management, accounting and record keeping, among other areas.
4. Develop models for distribution of vegetatively propagated planting material. Explore the best practices for distribution models of sustainable private sector supply of quality assured planting materials for vegetatively propagated crops to farmers.

Component 6: Farmer Awareness and Promotion

Agricultural extension services are under the Directorate of Agricultural Extension Services (DAES) in the MoFA. At the regional level, the Regional Agricultural Development Units (RADUs) oversee the extension activities of districts. The DAES facilitates and coordinates regional/district level planning through the Research extension farmer linkage and liaison committee (RELC), which deals with various agricultural issues.

Major gaps and challenges

i. Inadequate number and capacity of extension officers: The number of extension officers at the regional and district level are low and need to be increased. In addition, extension staff need to be trained on modern technologies (including agricultural input technologies, agronomy and machinery), the use of ICT in information collection and delivery, and the use of animations.

ii. Inadequate resources for extension services: Extension officers need to be adequately funded to travel to the various locations in their areas of operation.

iii. Weak coordination between providers of extension services: There is lack of coordination and collaboration between public, private and NGO providers of extension services leading to the duplication of services and incoherent extension messaging. Further, the private sector may explore opportunities of utilizing the existing government network of extension agents.

iv. Inadequate degree of specialization among extension agents as they usually have a broad mandate across crops.

v. Inadequate investment by the private sector in farmer awareness through field demonstrations and promotional events to raise the awareness of their new varieties and other technologies.

vi. Late or untimely release of resources by the government to the MoFA, leading to government provision of extension services after planting.

vii. Low utilization of local and indigenous knowledge in extension delivery.

Priorities for intervention

1. Support/conduct studies on extension models – Support studies of functional private and public extension models in the world, and share findings with stakeholders and government through convenings to establish strategies for more effective and efficient extension delivery in line with Ghana's socio-cultural peculiarities. These studies should also include: (i) effective and sustainable funding models for extension, and (ii) pathways for gender and youth inclusivity in extension services.
2. Increase the scope and frequency of training and capacity building - Provide regular training to public and private extension officers and Subject Matter Specialists (SMS) through programs such as in-service training, as well as by providing widely and freely available training and support materials both as hard and soft copies for online distribution. This can be done by creating a platform for cross-learning and sharing among extension service providers.
3. Establish knowledge management systems for extension services - Establish a user-friendly online resource database of all relevant extension and agricultural training material that can be easily accessed by both farmers and extension workers, including lessons on agronomic practices and cultivation (soil health, seed choice, soil and seed matching, fertilizer application and spraying) as well as harvesting, post-harvest handling and processing, and marketing.
4. Strengthen private sector involvement in extension services - Private seed companies can hire private extension agents such as Community Based Advisors (CBAs) and lead farmers as promoters of company varieties through demonstrations and field days.
5. Intensify effective farmer outreach communication efforts. Identify, support and scale functional farmer outreach communication channels such as Farm Radio International, and popular agricultural mass media programs (radio, television, posters, etc.) so that they can reach a lot more farmers.

Component 7: Policy, Legal and Regulatory Framework

Well-functioning formal seed systems have effective coordinating institutions that work well together. Ghana's seed policy framework comprises the National Seed Policy of 2013, National Seed Plan of 2015, Plant and Fertilizer Act of 2010 (Act 803), Seeds (Certification and Standards) Regulations, 2018 (L.I. 2363), and the Plant Variety Protection Act of 2020 ((Act 1050).

The major gaps and challenges

1. Incomplete PVP Regulatory Framework. A conducive legal and regulatory framework on plant variety protection (PVP) or plant breeders' rights (PBR) encourages innovation through protection for (public and private) varieties, and acts as an incentive for breeders. Although Ghana has in place a legal framework for plant variety protection (PVP) under the PVP law, which was a notable development, PVP regulations are not yet in effect and remain in draft form.
2. Regulatory and Capacity Gaps in the Variety Registration and Release Process. Section 43 of the Plants and Fertilizers Act stipulates that a new variety may be introduced into the country only after the MoFA's approval. A new variety is entered into the national variety list after appropriate DUS and VCU tests have been conducted. In 2012, the MoFA released a manual on the Procedure for Release and Registration of Crop Genetic Material (Variety Release Manual). This Manual, however, only sets out DUS and VCU protocols for eight crops, namely, maize, rice, cowpea, cassava, yam, sorghum, groundnuts, and sweet potato. Secondary research also shows that, while supervised multi-location field trials are conducted by Research Institutions in collaboration with the MoFA, in practice, resource constraints occasionally prevent these trials.
3. Lack of harmonization between environmental release and variety release processes. The environment release process pertains to GMOs, and is under the Environmental Release- Biosafety Act, while the national variety release process is under the Plant and Fertilizer Act. The lack of harmonization may result in duplication of some tests and higher costs.

Priorities for interventions

1. Update DUS and VCU Evaluation Protocols - Update the MoFA manual on the Procedure for Release and Registration of Crop Genetic Material (Variety Release Manual) to cover more than the 8 crops that are currently in the manual.
2. Implement and Support Private Seed Inspection - As a good regulatory practice, authorization of private seed inspection can help alleviate the financial and capacity stresses on regulators and leverage the private sector's specialized skills. Good practices from other countries, such as Zambia and Kenya, could be adopted and adapted.
3. Advocate for approval of Plant Variety Protection Regulations -While a PVP law exists, regulations are still under development, and the PBR regulatory framework is incomplete without them. An institutional framework will also have to be put in place.
4. Explore legal and regulatory reforms to enhance an inclusive seed system - Explore the legal and regulatory options that would support the development of the informal seed sector. This would cover aspects such as quality assurance systems.

Component 8: National Planning and Coordination

National Planning and Coordination (NPC) refers to whether or not the MoFA has a coordinated team or unit in place, with senior Ministry representation that is focused on sustainable seed sector development and growth.

The main challenges include:

i. Inadequate resources to effectively support the NSC in conducting its mandate as the national body in charge of the overall coordination of the seed sector
ii. Lack of funds to operationalize the Seed Fund. The account for the fund has been opened but the fund is not yet operational. The NSC has developed guidelines for the use of the fund, and submitted them to the MoFA.

Priorities for interventions

1. Support the National Seed Council in carrying out its mandate for overall seed sector planning and coordination. The NSC should be supported with the necessary human and financial resources, and logistical capacity to fulfil its mandate, which includes convening inclusive stakeholder gatherings, data collection and analysis on the seed sector, and long-term seed sector planning.
2. Operationalize the National Seed Support Fund by implementing the strategy to add resources to the Fund, and popularize it with relevant institutions.
3. Develop an online seed sector platform that brings together information on seed (e.g., seed varieties, agro-dealers, agro-chemicals, seed industry contacts, key downloads), and invest to keep the platform up to date and relevant.
4. Implement the seed demand-forecasting tool developed by CORAF, and train seed sector stakeholders on its

functionalities.

5. Convene Annual National Seed Stakeholder Forum meetings as opportunities for networking among players in the seed sector, updating stakeholders on industry developments, and strengthening business linkages within the sector.
6. Sustain NASTAG as an effective platform for private sector representation and industry advocacy. NASTAG has registered significant improvements in organizational performance since its formation in 2017. Members' overall satisfaction with has increased from 46% in 2017 to 75% in 2019 and 69% in 2021. The improvements are due to NASTAG's effective engagement with government and service delivery to members. There is need to sustain NASTAG as an effective platform for the private sector. This would entail financial support to run the secretariat and key activities and technical support to design the organization's sustainability strategy.

Section 5:

Results framework

Section 4 of the Seed Strategy has outlined the priority interventions that will help to achieve seed sector development in the country. This section proposes targets that the Strategy should aim to achieve as it pursues these interventions. These targets should be tracked over the course of the implementation of the Strategy. Table 6 presents 24 seed industry targets. These targets include the 8 high-level targets proposed in Table 1.

Table 7: Seed industry targets

Component	Current situation	Proposed target
Component 1: Breeding Variety Release and Maintenance	Public research institutions underfunded by government and heavily reliant on donor support for variety development, production, maintenance, and storage of EGS	Research institutions generating funds through several sources including the National Seed Fund (retaining at least about 20%)
	Limited funding to the variety release process leading to inconsistency in meetings	Variety release process fully funded, and NVRRC meetings conducted at least once a year
	Low number of public varieties (6 maize varieties, 2 soya bean varieties and 2 tomato varieties in 2022) licensed to seed companies for commercialization	At least 50 public varieties have been licensed to seed companies for commercialization
Component 2: Early Generation Seed	Low number of seed companies multiplying basic seed for hybrid varieties of crops, especially maize	At least 50% of active seed companies multiplying and commercializing hybrid maize
Component 3: Quality Commercial Seed Production	Government seed processing facilities in Winneba, Ho, Kumasi, Tamale, Bolgatanga, and Wa are in various degrees of disrepair and in need of refurbishment. There is on-going work to rehabilitate four of these facilities (Winneba, Ho, Kumasi and Tamale), jointly funded by MOFA and AfDB.	All 6 government processing facilities refurbished and fully functional At least 10 new seed cleaners and 10 new mobile seed cleaners procured and installed At least 90% of all locally-produced certified seed cleaned and processed before being sold to farmers
	Low number of seed companies owning seed processing plants	
	Low number of seed companies packaging seed with their own branded packages	At least 50% of active seed companies sell seed in branded packaging materials
Component 4: Quality Assurance	National seed laboratories not adequately equipped for seed testing and seed analysis	National seed laboratory accredited to the International Seed testing Association (ISRA) for key seed tests
	Private seed inspection arrangements yet to be developed and deployed	GSID authorizes and deploys private sector/ third party providers for various seed services including seed inspection, seed testing and seed analysis.
	Crop scope for quality assurance only covers eight crops	At least 15 crops included in scope for quality assurance
	No system for seed traceability	Seed sticker labels designed and deployed as systems for seed traceability
	Most seed companies and growers do not have internal systems for quality control	At least 75% of active seed companies have comprehensive and complete protocols for internal seed quality assurance

Component 5: Seed Marketing and Distribution	Agro-dealers do not have sufficient training and knowledge in agricultural inputs, general business management and handling of carry-over stocks	At least 75% of all registered agro-dealers have received training in key topics related to management of agricultural inputs
	There is no system for the distribution of vegetatively propagated planting material	GSID has developed and is utilizing a system of quality assurance in the distribution of vegetatively propagated planting material
Component 6: Farmer Awareness and Promotion	Low level of investment in farmer awareness on varieties developed and released for commercialization	At least 50% of active seed companies consistently conduct farmer awareness on varieties being commercialized
	Low level of coverage of agricultural extension, estimated at about 20% of farming households	At least 50% of farming households have consistent access to agricultural extension services
Component 7: Policy, Legal and Regulatory framework	Regulations to implement the Plant Variety Protection Act of 2020 yet to be passed and implemented	Plant Variety Protection (PVP) Regulations passed by the Cabinet are being implemented
	Lack of policy and regulatory framework to support the informal seed sector	An appropriate and viable policy and regulatory framework for the informal seed sector thoroughly interrogated by the seed sector, and is ready for implementation
Component 8: National Planning and Coordination	Inadequate support to the National Seed Council to carry out its mandate for overall seed sector planning and coordination	National Seed Council adequately funded and is effectively undertaking its mandate
	National Seed Sector Support Fund though set-up, is not yet operational	National Seed Support Fund adequately funded, and resources utilized for various seed sector activities, as determined by the National Seed Council
	National Seed Forum is convened as an annual event for industry stakeholders	National Seed Forum convened annually as a platform for networking and information sharing
	There is no national framework for planning and forecasting the demand of seed for all classes	CORAF seed demand forecasting tool (or other tool) consistently utilized in national planning for all classes of seed
	NASTAG is highly regarded by members, government, and other seed industry stakeholders. However, the entity's main challenge is resource mobilization	NASTAG is a consistent and effective platform for private sector representation and is financially sustainable.

Section 6:

Investment Plan

The total estimated investment cost to implement this Seed Strategy is USD 8,156,000 (Eight million, One hundred and Fifty-Six Thousand US Dollars only). Of this, the funding gap is USD 5,885,000. This is because of the AfDB and MOFA-funded SAPIP project that is covering a significant percentage of the QCSP costs related to the establishment or rehabilitation of seed warehouses and processing facilities. The cost is broken down by component in Table 3 below.

Early Generation Seed is the costliest component as it includes funding for the CSIR institutes, Universities and GLDB to produce and maintain early generation seed. The least costly components are Policy, Legal and Regulatory frameworks, Seed Marketing and Distribution and National Planning and Coordination, as the costs for these interventions mainly pertain to meetings. The table disaggregates the costs that may be covered under on-going interventions and projects. In addition, the table shows the costs that can be covered though technical assistance from entities like AGRA, CORAF and FAO. Tables 4 to 10 below provide a detailed breakdown of the investment costs by component.

Table 8: *Summary of estimated investment cost*

Strategy component	On-going investment (USD)	Technical Assistance (USD)	Funding gap (USD)	Total investment cost (USD)	Component Percentage
Component 1: Breeding, Variety Release and Maintenance	0	70,000	1,210,000	1,280,000	16%
Component 2: Early Generation Seed	0	10,000	3,000,000	3,010,000	35%
Component 3: Quality Commercial Seed Production	1,721,000	40,000	70,000	1,831,000	22%
Component 4: Quality Assurance	300,000	30,000	160,000	490,000	6%
Component 5: Seed Marketing and Distribution	0	0	370,000	370,000	5%
Component 6: Farmer Awareness and Promotion	0	50,000	410,000	460,000	6%
Component 7: Policy, Legal and Regulatory Framework	0	20,000	155,000	175,000	2%
Component 8: National Planning and Coordination	0	30,000	510,000	540,000	7%
TOTAL	**2,021,000**	**250,000**	**5,885,000**	**8,156,000**	**100%**

Table 9: *Investment for Breeding, Variety Release and Maintenance component*

Priority recommendation	On-going interventions	On-going activity	Technical assistance	Funding gap	Total investment (USD)	Description of cost
Provide adequate budget to meet goals for variety development, release and maintenance of germplasm	MoFA projects and programs provide partial support for variety development and release to specific crops	0	0	0	0	Costs incorporated in (2) below.

Prioritize investments to ensure research programs are supported with suitable infrastructure		0	20,000	0	20,000	Hire of consultant to develop plan for infrastructure development [Technical Assistance]
		0	0	1,000,000	1,000,000	Procurement of equipment and construction costs (lab, greenhouses, irrigation facilities); hiring necessary staff
Design breeding programs based on clear definitions of product profiles and target crop growing environments with a focus on delivering realized genetic gain to farmers	Research, Farmer and Extension Linkages Committee (RELC) systems, and innovation Platform (IP) put in place to address such issues	0	50,000	0	50,000	Planning meetings for CSIR institutes and other research institutions (USD 10,000 per institute). [Technical assistance]
Implement an effective variety release process considering adequacy, timeliness and cost-effectiveness	Breeders cover the associated costs	0	0	100,000	100,000	Operational cost of NVRRC meeting costs
Implement guidelines for variety maintenance.	MoFA has developed guidelines for variety maintenance	0	0	100,000	100,000	Costs of in-situ and ex-situ conservation activities
Conduct awareness to seed companies about the variety licensing framework by CRI	CRI presented the framework during the 3rd Seed Forum	0	0	10,000	10,000	Meeting costs between the IP office of CRI and seed companies
Total		**0**	**70,000**	**1,210,000**	**1,280,000**	

Table 10: *Investments for EGS component*

Priority recommendation	On-going interventions	On-going activity	Technical assistance	Funding gap	Total investment (USD)	Description of cost
Fund CSIR institutes, Universities & GLDB to produce, maintain and store early generation seed (EGS)	GoG budget support for salaries	0	0	2,000,000	2,000,000	Operational cost, procurement of tools and equipment to produce, maintain and store early generation seed
Fund PPRSD to monitor and certify early generation seeds.						

MAG support (ending in 2023)	0	0	500,000	500,000	Operational cost, procurement of vehicles, motorbikes, tools and equipment to monitor and certify early generation seed	
Sustain efforts aimed at building seed companies' capacity to multiply basic seed for maize hybrid varieties	On-going support from NASTAG projects	tbc	0	500,000	500,000	Training costs, facilitators' fee
Develop a framework to forecast the national demand for early generation seed	Forecasting tool developed by CORAF has been shared with stakeholders in Ghana	0	10,000	0	10,000	Training to use the CORAF tool [Technical assistance]
Total		**0**	**10,000**	**3,000,000**	**3,010,000**	

Table 11: *Investments under Quality Commercial Seed Production*

Priority recommendation	On-going interventions	On-going activity	Technical assistance	Funding gap	Total investment (USD)	Description of cost
Refurbish the government seed processing and storage facilities, encourage and support the private sector to set up similar facilities, especially in the production communities. Costs include: (i) rehabilitation of the facilities; (ii) procurement of seed processing equipment	On-going investments by the Savannah Zone Agricultural Productivity Improvement Program (SAPIP), with funding from AfDB and MOFA	1,666,000	0	0	1,666,000	Rehabilitation of seed warehouses & procurement of seed processing equipment.
Strengthen the seed quality control capacities within seed companies and growers. Activities including: (i) hiring seed expert to work with NASTAG and GSID to develop protocol for seed company quality control; (ii) Training seed companies, seed growers and GSID staff on quality control	Existing Seed Company Toolkit, developed by Agri-Experience	0	40,000	0	40,000	Hire seed expert to develop quality control manual for seed companies [Technical Assistance]
		0	0	70,000	70,000	Training costs for seed growers/ companies' staff, GSD staff and seed dealers

Develop a reliable and efficient marketing strategy to reduce seed growers' dependence on programs, and facilitate the steady development towards a market-driven seed distribution system. Activities include: (i) developing marketing strategies for seed companies, (ii) conducting promotional activities including demonstrations, media engagement, farmer awareness campaigns, etc, (iii) building networks of supply outlets through seed sellers and distributors, (iv) purchase of small seed packaging materials to serve as samples for farmer demonstrations	On-going activities by some seed companies. All costs to be borne by seed companies	20,000	0	0	20,000	Promotional activities i.e., media engagement demos etc. Cost to be borne by seed companies.
		10,000	0	0	10,000	Developing seed company marketing strategies. Cost to be borne by seed companies.
		20,000	0	0	20,000	Seed company costs related to building network of seed sellers.
		5,000	0	0	5,000	Purchase of small-sized seed packaging materials. Both costs to be borne by seed companies.
Promote the uptake of newly released and good performing varieties among farmers. Activities include: (i) Seed companies establishing demos and conducting field days, (ii) procuring small seed packages for demonstration purposes, (iii) conducting farmer education campaigns using print and radio media options	On-going activities by some seed companies. Some activities in collaboration with research institutions. All costs to be borne by seed companies.	150,000	0	0	150,000	Costs include establishment of farmer demonstration fields, purchase of small seed packages, and farmer awareness activities. Seed company costs. Costs to be borne by seed companies.
Total		**1,721,000**	**40,000**	**70,000**	**1,831,000**	

Table 12: *Investments under Quality Assurance*

Priority recommendation	Current situation	On-going activity (USD)	Technical assistance (USD)	Funding gap (USD)	Total investment (USD)	Description of cost
Increasing funding to GSID	GSID funded under MOFA					tbc
Scoping studies for effective field-based QA activities.		0	20,000	0	20,000	Hiring expert to conduct scoping studies [Technical assistance]

Develop guidelines for accreditation for third party certification		0	10,000	0	10,000	Hiring consultant to develop guidelines [Technical assistance]
Train third party actors, including public extension agents (AEAs) and private parties, in seed inspection and certification		0	0	50,000	50,000	Training costs
Expansion of crop scope/portfolio for seed QA including vegetatively propagated materials.		0	0	10,000	10,000	Cost of meetings between GSID and breeders
Fund the construction and equipping of functional QA laboratories at various seed centers	On-going work under SAPIP project funded by AFDB	300,000	0	0	300,000	Construction and equipment purchase
Develop and roll out scratch card labels for seed packages		0	0	100,000	100,000	Hiring technology provider and costs associated with awareness of farmers and seed sellers/ distributors
Adopt digital tools for increased volume and efficiency of QA processes.	GSID staff use several digital tools for QA activities	0	0	0	0	No additional cost, as activity is on-going
Total		**300,000**	**30,000**	**160,000**	**490,000**	

Table 13: *Investments under Seed Marketing and Distribution*

Priority recommendation	Current situation	On-going activity (USD)	Technical assistance (USD)	Funding gap (USD)	Total investment (USD)	Description of cost
National seed distribution mapping exercise		0	0	200,000	200,000	Nationwide survey/mapping exercise. Field costs and training.
Credit support for business improvement and expansion	Funding opportunities through commercial banks	0	0	0	0	Advocate for the inclusion of the seed sector in the priority areas for roll out by the Development bank.

Enhance agrodealer business training. Also includes training on digital solutions for business management; and training on handling of carry-over stocks	Tools and modules exist	0	0	150,000	150,000	Training costs. May be done concurrently with (1) above.
Develop and implement models for distribution of vegetatively propagated planting material		0	0	20,000	20,000	Meeting costs to discuss distribution models
Total		**0**	**0**	**370,000**	**370,000**	

Table 14: *Investments under Farmer Awareness and Promotion*

Priority recommendation	On-going interventions	On-going activity (USD)	Technical assistance (USD)	Funding gap (USD)	Total investment (USD)	Description of cost
Support/conduct studies on extension models		0	30,000	0	30,000	Research studies on diverse extension models [Technical assistance]
Increase scope and frequency of training and capacity building for extension officers	DAES on-going work	0	0	100,000	100,000	Scale out on-going DAES training programs
Establish knowledge management platform for agricultural extension	Information exists but neither curated nor centralized	0	20,000	0	20,000	Hire developer to set up online platform & populate platform with relevant information [Technical Assistance]
Strengthen private sector involvement in extension provision	On-going ad hoc efforts by private sector	0	0	10,000	10,000	Meeting costs between DAES and private extension providers
Intensify farmer outreach communication	On-going ad hoc activities	0	0	300,000	300,000	Costs of media engagement: radio, tv, social media campaigns, posters, etc
		0	**50,000**	**410,000**	**460,000**	

Table 15: *Investments under Policy, Legal and Regulatory Framework*

Priority recommendation	On-going interventions	On-going activity (USD)	Technical assistance (USD)	Funding gap (USD)	Total investment (USD)	Description of cost
Expand the number of crops on the release manual	GSID has held preliminary discussions	0	0	35,000	35,000	Three rounds of technical meetings
Develop standard descriptors for all crops and incorporate them into manual for variety release	0	0	20,000	20,000	GSID meetings; and printing costs	
Develop guidelines to conduct independent trials for DUS before release	No guidelines available for independent DUS evaluation	0	0	25,000	25,000	Stakeholder engagements (Breeders and Variety Release committee
Harmonize the Environmental Release and Variety Release Process to reduce cost of variety release	On-going meetings	0	0	25,000	25,000	NSC/GSID technical meetings
Explore appropriate Policy and Regulatory framework to support the informal seed sector		0	20,000	0	20,000	Hire seed/legal expert to develop regulatory framework [Technical assistance]
		0	0	50,000	50,000	Stakeholder meetings to discuss framework
Total		**0**	**20,000**	**155,000**	**175,000**	

Table 16: *Investment costs for National Planning and Coordination*

Priority recommendation	On-going interventions	On-going activity (USD)	Technical assistance (USD)	Funding gap (USD)	Total investment (USD)	Description of cost
Support the National Seed Council to carry out its mandate for overall seed sector planning and coordination	NSC secretariat under GSID	Tbc	0	250,000	250,000	Stakeholder engagements (Mandatory 4 seed council activities) @ USD 50,000 per year
Operationalization of the National Seed Support Fund to support the operation of the seed industry (Explore options through various stakeholder engagement including potential contributors to the fund, parliamentarians, government ministries)	Account for the Fund has been opened. Guidelines for Fund have been submitted to the MoFA	tbc	0	0	0	Stakeholder meetings convened by NSC to discuss the Fund. Activity is part of (1) above

Develop an online seed sector platform that brings together information on seed and invest to keep the platform up to date and relevant.		0	20,000	30,000	50,000	Hiring IT consultant; Stakeholder engagement meetings [Technical Assistance for USD 20,000]
Implement the seed demand-forecasting tool developed by CORAF and train seed sector stakeholders on its functionalities	Seed demand and forecasting tool has been developed by CORAF. Stakeholders in Ghana have been trained on its use	0	10,000	20,000	30,000	Additional training by CORAF; NSC meeting to discuss the roll-out [Technical Assistance for expert support. Other costs are for training]
Convene Annual National Seed Forum meetings for stakeholders in the seed industry	NASTAG has convened the last 3 Seed Forums	0	0	60,000	60,000	Meeting costs, at USD 15,000 per meeting per year
Support NASTAG to serve as effective platform for private sector	Support to staff salary cost, partly funded as on-going interventions	Tbc	0	100,000	100,000	Salary support
	Support to key NASTAG activities like seed industry meetings	Tbc	0	50,000	50,000	Meeting/training costs
Total		**0**	**30,000**	**510,000**	**540,000**	

Annex:

Summary of on-going initiatives and investments

Table 17: *Existing initiatives and investments in the seed sector in Ghana*

Name of intervention	Name of responsible organization	Description of intervention	Duration of intervention	Duration of intervention
1.	USAID-AGRA Cooperative Agreement under PIATA	AGRA	Multiple activities are being planned under Phase II, in two broad areas: **Building systems to catalyze adoption of quality inputs:** (i) Scale-up EGS and CS Supply, (ii) Seed Quality Assurance (scale-up scratch code, private seed certification), (iii) Seed Extension, Farmer Awareness, Last-mile input supply, and (iv) Variety Development and Release for Resilience (specific crop profiles). **Improve the enabling environment for private sector participation**: (i) Strengthening National Seed Planning and Coordination, Data Management, Digitization, (ii) Strengthened dialogue among industry players, (iii) Operationalizing the PVP Law, (iv) Establishing Ag. Insurance fund	
2.	USAID Policy Link	USAID	Objective is to strengthen the capacity and ability of Ghanaian stakeholders at the national and subnational levels, enabling them to participate in a more transparent, inclusive, and evidence-based agriculture and food systems policy process. The main on-going activity is an examination of the practice and performance of agricultural lending and the long-term interventions to improve agricultural lending terms.	5 years
3.	Savannah Zone Agricultural Productivity Improvement Program (SAPIP)	Ministry of Food and Agriculture and the African Development Bank	Multiple activities including: (i) Refurbishment of four seed processing plants with state-of-the-art equipment, (ii) building capacity of agricultural extension officers in seed inspection and certification; refurbishing 2 seed warehouses	
4.	Seed demand forecasting tool	CORAF	Seed demand forecasting tool has been developed by CORAF. Stakeholders in Ghana have been trained on how to use the tool, though additional training is needed. The tool can be used for different classes of seed	
5.	Planting for Food and Jobs	Ministry of Food and Agriculture	50 warehouses completed by the Ministry of Special Development Initiatives and handed over to the MoFA out of the 80 proposed (capacity – 114,000 MT)	
6.	Crop Research Institute	Licensing varieties to seed companies	The Intellectual Property (IP) office at the Crop Research Institute has developed a framework for licensing public varieties to seed companies. by the end of 2022, CRI had either issued licenses or were in the process of issuing licenses for 6 maize, 2 soya bean and 2 tomato varieties.	

This section describes on-going or recently completed initiatives and/or investments in the Ghana seed sector. These include interventions from the government, private sector, research institutions, development partners, and NGOs.

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