

Scoping the implementation of recommendations from previous early generation seed studies in sub-Saharan Africa



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EXECUTIVE SUMMARY

The purpose of this report is to document and track progress on the implementation of recommendations from EGS studies that were carried out on selected countries in Eastern and Southern Africa (ESA) and West and Central Africa (WCA). The recommendations were designed to ensure a sustainable supply of EGS based on market-specific archetypes involving private, public and public-private partnerships. For the subsequent years following the conclusion and adoption of the study reports, there have been some significant achievements registered based on the country-specific recommendations from the studies. This report provides a review of the extent of implementation of the recommendations in each of the mentioned countries.

The study involved a review of literature which included the country-specific EGS studies and the available literature that comprised of projects reports, recent policy documents and any other relevant available literature. Despite the list of countries in which the studies were conducted, this study only focused on the implementation of recommendations in Uganda, Kenya, Tanzania, Rwanda, Malawi, Ghana and Nigeria.

Most countries have to a large extent implemented most of the recommendations from the EGS studies. A lot of emphasis was placed on addressing the creation of enabling environment aspects such as the enactment of seed acts, the plant variety protection bill and policies in Nigeria, Uganda, Ghana as well as harmonization between the national and regional seed laws. There was also emphasis towards capacity building for seed regulation and certification services through training of human resources and enabling private sector participation in seed inspection in addition to accreditation by the international bodies ISTA and OECD. PPPs were established for the root and tuber crops cassava and potatoes; and mainly hybrid and OPV maize for the cereal crops.

Fingerprinting of parental lines is the most notably unimplemented for all the countries that it was recommended, but also the national establishments such as Variety Testing Center, demand forecasting frameworks and National Seed Steering committee for the case of Malawi and Tanzania respectively. It is therefore recommended that further investigation of gaps in implementation be carried to understand reasons for non-implementation.

1.0 INTRODUCTION

The purpose of this report is to document and track progress on the implementation of recommendations from EGS studies that were carried out on selected countries in Eastern and Southern Africa (ESA) and West and Central Africa (WCA). The EGS delivery systems of Uganda, Kenya, Tanzania, Rwanda, Malawi, Zambia, Mozambique, Ghana and Nigeria resulted in a recommendation of interventions for improvement of EGS delivery systems given their status and the factors affecting its performance in the respective countries. The recommendations were designed to ensure a sustainable supply of EGS based on market-specific archetypes involving, private, public and public-private partnerships. For the subsequent years following the conclusion and adoption of the study reports, there have been some significant achievements registered based on the country-specific recommendations from the studies. This report, therefore, provides a review of the extent of implementation of the recommendations in each of the mentioned countries.

2.0 METHODOLOGY

The study involved a desk review of literatures from country-specific EGS studies and other literature that comprised of projects' reports, recent policy documents and any available relevant literature. Despite the list of countries in which the studies were conducted, this study only focuses on the implementation of recommendations in Uganda, Kenya, Rwanda, Malawi, Ghana and Nigeria

3.0 FINDINGS

3.1 Uganda

The Uganda EGS study analyzed mechanisms to promote the commercial and self-sustaining production and supply of breeder and foundation seeds of selected food crops in Uganda. It focused on five crops selected based on strategic reasons, they include hybrid maize, rice, finger millet, common beans, and sesame. They identified some institutional bottlenecks affecting the seed value chains of the selected crops. The significant challenges identified during the study included: lack of a coordinated EGS production programme at NARS institutes but only focus on only a few crops with external funding; Seed companies have limited capacity, human and financial resources to generate own varieties and to produce EGS; the nationally based seed companies have limited access to affordable credit services for their operations and investment in infrastructure for seed processing and generate sufficient cash flow for contracts with out-growers; low adoption and use of improved varieties by farmers and the farmers are also not in the habit of buying certified seed; unpredictable and inconsistent demand for seed due to lack

of forward and transparent planning and fragmented markets; limited capacity of the quality control agency , i.e., National Seed Certification Services (NSCS) in terms of personnel and logistics for inspection and monitoring of seed produced by many scattered out-growers and seed dealers; a weak enabling environment that is challenged by inadequacies in the implementation of the seed policy, and strategy and enforcement of available regulations that are essential to provide guidance and playing ground for seed sector stakeholders; and the high prevalence of counterfeit seed on the market.

Recommendations

The following crop and system wide recommendations were proposed for Uganda;

- Increase the price of EGS to represent the real cost of production and remove hidden subsidies.
- Train research scientists and seed companies on intellectual property rights systems to ensure equitable use of publicly developed varieties.
- Strengthen seed certification with the private sector to ensure seed quality
- Strengthen the technical and managerial capacities of seed companies to manage EGS and internal quality control.
- Fingerprint all maize parental lines.
- Develop a searchable database to share information on varieties, seed availability and levels of commercialization.
- Strengthen the linkages and complementarity between research with farmers through a well-coordinated extension and advisory service programme to enhance the adoption of quality seed by all farmers.
- Establish a foundation seed enterprise at NARO to secure and avail good quality foundation seed of crops that seed companies are not keen on producing due to low on no profit margins.
- Ensure an effective policy and regulatory environment that is critical to enhance the delivery of the seed sector.

The proposed actions for the government of Uganda were:

- Review Non Tax revenue policy
- Develop cost-effective EGS road maps per crop
- Explore licensing options for commercial varieties and publicize arrangements
- Fingerprinting of parental materials

- Set up a professionally managed foundation seed unit, recruit a seasoned business manager and develop a realistic business plan for EGS Unit
- Attaching an agribusiness staff at ZARDI's that produce EGS
- Develop an efficient methodology to determine annual seed requirements
- Support establishment of a national seed forum to articulate the seed subsector issues
- Strengthen extension and advisory services at the sub-county level to educate farmers in the use of agricultural inputs to increase crop yields

The proposed actions for development partners were:

- Support intermediate seed system transitioning to formal seed system to create a pluralistic, vibrant and market-driven seed sector in Uganda.
- Support the proposed EGS production models adapted for crops characteristics, profit margins and demand.
- Support capacity building of seed producers through a public-private partnership with clear roles and responsibilities for each entity.
- Support efforts that provide an evidence base indicating which of the proposed archetypes is working well and which don't and support the development of efficient methods for demand prediction.
- Support efforts that make new technologies available and affordable to curb poor quality seed. Examples are fingerprinting of all existing varieties, starting with Hybrid maize parental lines.
- Further support of quality assurance mechanisms, including accreditation of private inspectors and delegated authority towards local government, thus the arrangement and execution of quality assurance systems for all seed classes.
- Support development of a strong supportive environments such as quality physical infrastructures like roads, irrigation and markets; access to working capital and finance; build capacity and legal framework for farmers' organizations and participation in seed systems.

Implementation of recommendations in Uganda

Uganda has made tremendous progress in implementing the recommendations from the EGS study that was conducted in 2016. Table 1 provides a summary of status of achievements made. A lot has been done to create an enabling environment for seed systems development with emphasis on EGS delivery.

- There have been four seed sector policy and regulatory frameworks put in place thanks to the concerted efforts between government agencies MAAIF, NARO, with financial and

technical support from USAID Feed the Future “Uganda Enabling Environment for Agricultural development Activity” (EEA) Program, and the development partner ISSD Uganda

- The policy and regulatory frameworks put in place include;
- The National Seed Policy and strategy (Figure 1). This was enacted and approved in October 2018. An abridged version of the policy was further developed to enable and broaden stakeholder understanding of the policy
- Draft of Plant Variety Protection Regulation in place
- NARO has streamlined the EGS institutional framework to enhance quality seed production and marketing (Figure 2).

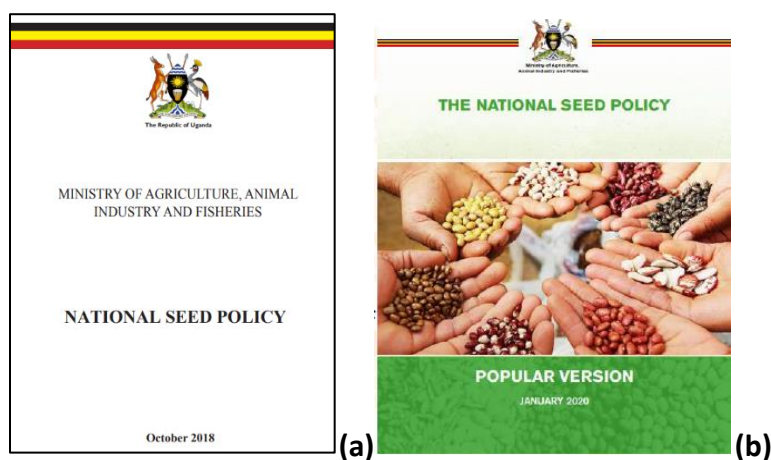


Figure 1. (a) National Seed Policy, 2018 (b) an abridged version of National Seed Policy, 2020
Source: ISSD Uganda

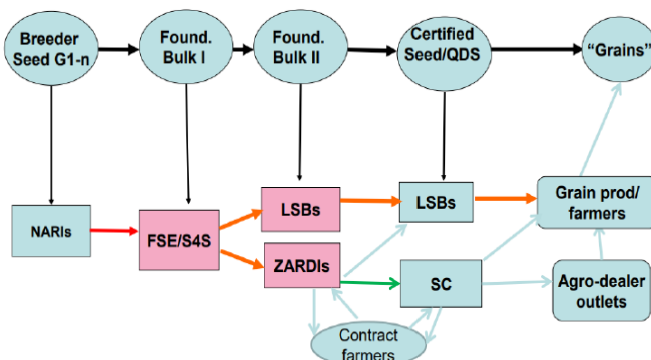


Figure 2. Institutional framework to enhance quality seed production and marketing in Uganda
Source: ISSD Uganda

- A national Foundation Seed Enterprise was established as a subsidiary of NARO Holdings Ltd, the business wing of NARO. The enterprise is implemented as “Seed for Seeds Uganda Limited.” The enterprise is operating on a cost-recovery business approach.

- In line with the other recommendations, NARO and its partners (mainly ISSD Uganda) have made effort to install the required infrastructure such as; 200 acres of land provided by NARO, NHL with co-funding from ISSD Uganda installed the irrigation system on 30 acres land, established 60MT cold storage facility as well as seed processing and conditioning equipment (Figure 3).



Figure 3. Seed processing Facility at the NARO Holdings Limited

Source: ISSD Uganda

- Established Public-Private Partnerships (PPP) for the production and supply of legume crops common bean and groundnuts EGS. The foundation seed enterprise is established through a PPP arrangement involving NARO, NARO holdings Ltd with support and coordination from development partners ISSD Uganda and AATF. This has been operationalized with the production and supply of common bean and groundnut foundation seeds.
- NARO also entered a PPP arrangement with the processor Uganda Breweries Limited (UBL), a partnership that seeks to commercialize agricultural technologies as a means foster development of value chains for industrial growth (NARO, 2021). The partnership involves promotion and dissemination of information and research technologies that increase agricultural production and productivity. This is to be attained through joint development of effective sorghum, barley, and cassava seed production and distribution systems to enhance sustainable access to quality planting materials of the target commodities by of smallholder farmers (<https://observer.ug>). This arrangement is an example of the Niche Market archetype pathway for the supply of EGS in which seed production is organized around a processor that assures grain off-take at downstream of the crop value chain. This partnership was attained with the support through the USAID Feed the Future Agricultural Research Activity.

- Establishment of a digitalized seed quality assurance system by putting in place a Seed Tracker Tracing System (STTS) to support coordination along the seed value chains (figure 4). The system enables digital coordination of EGS pre-ordering (pre-booking), registration of seed growers, field inspection services, tracking and tracing seed batches (ISSD Uganda, 2021). This system also supports seed demand planning.



Figure 4. Seed Tracker and Tracing System

Source: ISSD Uganda

Table 1: Summary of implementation of the Uganda EGS study recommendations

Recommendations	Progress
- Increase the price of EGS to represent the real cost of production and remove hidden subsidies.	Done
- Train research scientists and seed companies on intellectual property rights systems to ensure equitable use of publicly developed varieties.	Done
- Strengthen seed certification with the private sector to ensure seed quality	Done
- Strengthen capacity of seed companies to manage EGS and internal quality control	Not done
- Fingerprint all maize parental lines.	Not done
- Develop a searchable database to share information on varieties, seed availability and levels of commercialization	Done, but yet to be operationalized
- Strengthen linkages between research with farmers through a well-coordinated extension and advisory service programme to enhance the adoption of quality seed by all farmers.	Done
- Establish a foundation seed enterprise at NARO to ensure the availability of good quality foundation seed of crops that seed companies are not keen on producing	Done
- Ensure an effective policy and regulatory environment	Done
- Explore licensing options for commercial varieties and publicize arrangements	Done
- Fingerprinting of parental materials	Note done
- Attaching an agribusiness staff at ZARDI's that produce EGS	Partly done
- Develop an efficient methodology to determine annual seed requirements	Done
- Support establishment of a national seed forum	Not done
- Strengthen extension and advisory services at the sub-county level to educate farmers in the use of agricultural inputs to increase crop yields	Done
- Support quality assurance mechanisms, including accreditation of private inspectors and delegated authority towards local government	Done
- Support development of a strong supportive environments such as quality physical infrastructure like roads, irrigation and markets; access to capital and financing; build capacity and legal framework for participation of farmers' organizations in seed systems.	Done

3.2 Kenya

The study identified crop-specific constraints affecting EGS delivery in the country. It came up with constraints affecting the delivery of maize, potatoes and common bean. In general, EGS supply bottlenecks for all the three crop commodities are mainly attributed to the certification system, production-related issues as well as seed demand-related constraints. An overall recommendation for the establishment of public-private partnerships (PPP) for each of the crops studied was made. There were also crop-specific recommendations for the success of these PPPs.

For hybrid maize, the priority objectives include increasing private sector access to public sector varieties and supporting the development of a sustainable supply of high quality EGS to support demand for hybrid seed. Achieving these objectives would result in the creation of more choices for farmers and a broadening of the potential royalty base for the public sector. The study, therefore, recommended Public-private collaboration for basic seed across KALRO, private seed companies and public universities was for the achievement of these objectives. It also recommended the improvement of inspection and certification services and overall reduction of the cost of producing basic seed. This was to be achieved by ensuring broad private-sector representation within the PPP, revision of inspection and certification system and allocating required resources to the national extension service.

Recommendations from the Kenya EGS study

The overarching recommendation of expanding and enhancing potato EGS production was a PPP that is anchored at the breeder seed production level between KALRO and private seed companies. The specific recommendations were to involve international companies in the creation and operations of the PPP, align EGS production locations with demand centers and realize the potential marginal economic value of potato.

The establishment of an EGS system for common beans that is built around a PPP to increase the supply of improved seed in order to meet the current market demand was recommended. Additionally, the study recommended the need to build on-farm demand for improved varieties and quality seed as well as create sustainable demand by increasing the marginal economic value of common bean for farmers.

Implementation of recommendations in Kenya

Kenya has been able to implement most of the recommendations made through a number projects embedded in partnerships (Table 2). The following has been accomplished;

- Establishment of PPP arrangements for each crop
- ✓ Establishment of a PPP for hybrid maize EGS: This was accomplished through the establishment of the company Qualibasic Seeds Limited (QBS). This is a private foundation

seed company located in South Africa, Zambia and Kenya but with its headquarters in Nairobi, Kenya. The establishment of QBS was spearheaded by AATF with funding from the Bill and Melinda Gates Foundation (BMGF) in partnership with CIMMYT. The company mainly deals in hybrid maize seeds but has also added soybean in its product portfolio.

- ✓ Establishment of a PPP for potato EGS: KALRO entered a partnership with the private potato seed multiplier *Kisima Farms* through a licensing deal brokered by Syngenta Foundation for Sustainable Agriculture in 2016. In this arrangement, Kisima Farm pays KALRO royalties for seed potato sales from three KALRO-bred varieties (<https://www.syngentafoundation.org/news-highlights> ; Lemaga, 2018).
- ✓ Establishment of a PPP for common bean EGS: The one Acre Fund with KALRO built a partnership with the support of the Syngenta Foundation for Sustainable Agriculture, to avail improved common bean varieties to farmers. The initiative involved KALRO in partnership with CIAT which led the initiative through the Pan-Africa Bean Research Alliance (PABRA); this initiative closely worked with seed companies, individual seed entrepreneurs, bean traders and processors in Kenya (<https://www.pabra-africa.org/scaling-success-leading-change-syngenta-foundation/>).
- Ensuring broad private-sector representation within the PPPs. As discussed in the section above, a number of private sector actors are involved in the various partnerships with clearly defined roles in the production of maize, potato and common bean EGS.
- Revise the seed inspection and certification system. The seed inspection and regulatory services in Kenya were revised during the year 2017. The revised regulations allows the private sector to actively support and participate in seed inspection services in the country (AgriExperience, 2017).
- Reduction of the overall cost of hybrid maize seed production. This was achieved through the SPTA project. The project promoted the “Ms44” technology to improve yields and reduce the cost of producing hybrid maize seed. The “Ms44” technology specifically eliminates the manual labour-intensive de-tasselling of maize using a naturally occurring genetic mutation (Ms44) in maize; a gene aborts the development of microspores into pollen to create female parent plants which become male-sterile. The initial phase of this initiative was from 2016-2020 with the second phase underway from the start of 2021.

Table 2: Summary of implementation of key recommendations in Kenya

Recommendations	Progress
1. Establish a public-private partnership for each crop	Done: Qualibasic seed ltd for hybrid maize, the Potato PPP, common bean PPP with licensing of seed companies
2. Ensure broad private-sector representation within the PPPs.	Done: Private Seed companies provided licensing to some varieties, Kisima Farms potato PPP, Qualibasic seed company for maize

3. Revise current inspection and certification system	Done: Private sector now involved in seed inspection service
4. Reducing the overall cost of maize seed production	Done: through SPTA project “Ms44” technology

3.3 Malawi

The Malawi study identified some supply and demand-related constraints. The constraints included a weak capacity for breeder seed production, inadequate private sector involvement in basic and commercial seed production, absence of an EGS market information system, limited capacity of the Seed Services Unit to enforce seed certification services, lack of smallholders’ awareness of benefits of improved varieties, limited awareness of the business case to invest in improved varieties of the non-traditional seed business crops, inadequate financing services for seed production and access, and inadequate capacity to identify counterfeit seed by farmers.

Recommendations from the Malawi EGS study

The following recommendations were made to address these constraints;

- Establish a public-private collaboration at the basic seed stage across the major players in the maize seed system;
- Encourage more private sector participation in the production of basic seed;
- Revitalize and improve the SSU human resource and infrastructure capacity;
- Enact the new Seed Act to enable the implementation of the breeder’s rights and farmers rights;
- Build the capacity of seed producers and all relevant stakeholders;
- Careful domestication of the SADC Seed Harmonization Programme;
- Establish a national Variety Testing Centre;
- Enhance the capacity of the national extension system, and
- Put in place a national framework to project the potential demand for seed for each year.

Implementation of recommendations in Malawi

The extent of implementation of recommendation in Malawi is more or less that 40% with just a few (Table 3) of the recommendations fully implemented. The following actions were undertaken

Table 3.: Summary of implementation of key recommendations in Malawi

Recommendations	Progress
- Establish public-private collaboration at the basic seed stage across the major players in the maize seed system	Not done
- Encourage more private sector participation in the production of basic seed	Not done
- Revitalize and improve the SSU human resource and infrastructure capacity	Done

- Enact the new Seed Act to enable the implementation of the breeder's rights and farmers' rights	Not done
- Build the capacity of seed producers and all relevant stakeholders	Partly done
- Careful domestication of the SADC Seed Harmonization Programme	Done
- Establish a national Variety Testing Centre	Not done
- Enhance the capacity of the national extension system	Done
Put in place a national framework to project annual potential demand for seed	Not done

- Revitalize and improve the SSU human resource and infrastructure capacity. The capacity of the Seed Service Unit (SSU) was improved through the USAID Feed the Future “Malawi Improved Seed Systems and Technologies” (MISST) project. The project trained over 100 seed inspectors and deployed them to farmer organizations, seed companies, and the Department of Agricultural Research Services (DARS) Seed Services Unit (SSU).
- Domestication of SADC seed harmonization programme. This was equally undertaken in the year 2017 as indicated under the MISST project initiatives.

3.4 Rwanda

The Rwanda study came up with key recommendations that mainly targeted the maize, potato, common bean, soybean and wheat EGS systems.

Recommendations from the Rwanda EGS study

The following recommendations were made.

- Establish a PPP for potato and common bean with the specifications related to partners and position within the seed system developed according to the needs of the given crop.
- Increase the availability of new improved potato varieties
- Enhance the economic value of potato
- Include soybean and wheat in the common bean PPP model to make it attractive to the private sector
- Develop and communicate a strategy to eliminate maize subsidies
- Allow private maize seed companies to make seed production decisions, including what to produce and where to produce it, without government approval
- Develop purpose-built agricultural lending products tailored for smallholder farmers
- Harmonize Rwanda's registration and seed import process with EAC and COMESA procedures
- Operationalize plant variety protection policies that have been embodied in the recently passed seed law
- Focus RAB's hybrid maize program on conducting trials to provide farmers with unbiased data.

Implementation of recommendations in Rwanda

Rwanda registered enormous progress in attaining most of the above recommendations (Table 4). Most of the achievements are attributed to AGRA interventions in seed systems development in the country. The following has been implemented to date.

- Harmonization of Rwanda's registration and seed import process with EAC and COMESA procedures. The national seed laws were aligned with the COMESA and EAC procedures (COMESA, 2018).
- Develop and communicate a strategy to eliminate maize subsidies. The Rwandan government partly removed subsidies on imported seeds which includes maize seed as a strategy to reduce seed imports and promote uptake and use of locally produced improved seeds. The locally-produced seeds are currently subsidized by 79% while the imported seeds are subsidized by 40% (Nkurunziza, 2021).
- Increase the availability of new improved potato varieties. New potato varieties (eleven) have been released by RAB during the years 2020 and 2021 under AGRA - PIATA grants (MINAGRI, 2019; RAB, 2020)
- Allow private maize seed companies to make seed production decisions, including what to produce and where to produce it, without government approval.

AGRA also works with partners and the Government of Rwanda to increase incentives for private sector participation and investment into the seed sector and at the same time working to enhance access to finance and markets, the adoption of climate-smart technologies and the use of agro-inputs. For instance, the organization has supported the Bank of Kigali to develop an online application system tailored to increase access to improved seeds by smallholder farmers through MOPA and IKOFI (E-wallet) platforms. The MOPA platform facilitates the purchase of seeds from accredited suppliers by agro-dealers while IKOFI (E-wallet) permits the smallholder farmers to purchase seeds with fertilizers from agro-dealers (AGRA, 2021).

AGRA supported 15 seed companies by providing grants to RAB who capacitated weak start-up seed enterprises with seed production technologies through on-site practical skills transfer and in-class training as a means for boosting seed business capacities by the private sector (AGRA, 2021).

AGRA, by supporting the implementation of the country's Strategic Plan for Agriculture Transformation (PSTA 4, 2018–2024) gave grant to MINAGRI for reforming and operationalizing policies and regulations related to agricultural inputs and markets for conducive business environments of agriculture (MINAGRI, 2020). A summary of the implemented actions is presented in Table 4.

Table 4: Summary of implementation of recommendations in Rwanda

Recommendations	Progress
- Establish a PPP for potato and common bean with the specifications related to partners and position within the seed system developed according to the needs of the given crop.	not fully attained
- Increase the availability of new improved potato varieties	Done
- Enhance the economic value of potato	Done
- Include soybean and wheat in the common bean PPP model to make it attractive to the private sector	
- Develop and communicate a strategy to eliminate maize subsidies	Done
- Allow private maize seed companies to make seed production decisions, including what to produce and where to produce it, without government approval	Done
- Develop purpose-built agricultural lending products tailored for smallholder farmers	Done
- Harmonize Rwanda's registration and seed import process with EAC and COMESA procedures	Done
- Operationalize plant variety protection policies that have been embodied in the recently passed seed law	On going
- Focus RAB's hybrid maize program on conducting trials to provide farmers with unbiased data.	Done

3.5 Ghana

For Ghana, nearly all of the seven crops EGS systems that were evaluated were classified under PPP market archetype with the exception of imported maize hybrids and sorghum which fall under the private sector and public sector dominant archetypes respectively (AGRA-SSTP, 2016). The OPV maize, local hybrid maize, rice, cowpea, soybean and groundnut were recommended for development through PPP arrangement. Unlike other country cases, PPP arrangements already exist in the Ghana seed sector which is attributed to the positive changes in the industry that has had increased private sector participation in the seed system. The existing arrangements are however weak, unbalanced and fragmented. Therefore unlike other studies where the establishment of new PPPs' was recommended, modifications to strengthen and formalize the existing PPP frameworks were recommended for improvement of EGS delivery in Ghana.

Recommendations from the Ghana EGS study

Overall, several recommendations were made and included the following;

- Creating an enabling environment by completing the guidelines allowing the private sector to legitimately undertake foundation seeds production and marketing; the guidelines for liberalization of varietal release process to make it independent, transparent and fair; ratification of the ECOWAS seed regulation to allow free movement of varieties and seeds within the region to create markets of sufficient size; the passage of the Plant Breeders' Bill into law to reward and incentivize breeders towards developing reliable and high quality breeder seeds; liberalization of seed imports and import licensing procedures to make them transparent, independent and open for competition.

- Promote information flow for awareness creation through digitization and electronic sharing of a database of released varieties, along with descriptors and pictorial representations will greatly promote awareness.
- Formulate and operationalize sound and legally binding PPP frameworks that fairly represent the interests of key stakeholders through broad consultations processes.
- Liberalizing seed importation and strengthening the public regulatory agencies to effectively monitor imports and manage risks.
- Institutional Transformation by ensuring seed regulatory and supervisory agencies are resourced and empowered to adequately supervise the operations of actors and provide the needed technical guidance and oversight for instance; PPRSD be given autonomy to effectively supervise actors; The GSID should be resourced to provide needed technical support services; GLDB should morph into a competency training and technical service provider on a demand-driven and fee-based basis and its assets divested under a PPP arrangement.
- NARIs to play a central role within the enhanced PPP through breeding and facilitating access to high quality breeder seeds by building their technical and operational competencies.
- The enhanced PPP model should resolve the severe constraints experienced in accessing good quality foundation seed for all locally produced EGS.
- Institute a competency-based training and mentorship programme to help the private sector upgrade its technical and business management capacities in the production, quality control and assurance and Business Development Skills.
- Design a suitable funding mechanism to enable the private sector make the requisite investment in infrastructure, equipment, production and processing to achieve large economies of scale.
- Strengthen NASTAG, to become the lead advocate and to position itself to effectively link into and benefit from regional platforms like ASIWA to advance the cause of the private sector.
- Nurturing and strengthening linkages with output markets
- NASTAG to spearhead development and promotion of market information systems
- Develop effective promotion and awareness creation strategies with seed companies
- Co-funding awareness creation programs that include field demonstrations, radio educational campaigns and the use of ICT such as those piloted by ATTP.
- GSID should fully allow individual branding and packaging by seed companies to promote brand recognition, greater accountability and quality assurance and also facilitate premium pricing.

- Seed companies must develop and be guided by effective marketing plans that will set goals and strategies to realize these outcomes including investment in personnel and marketing systems.
- NASTAG to adopt and spearhead stakeholder platforms like those facilitated by ATT in Northern Ghana to serve as a starting point for establishing a credible demand forecasting system to support proper production planning and seed marketing.

Implementation of recommendations in Ghana

With support from development actors as well as the private sector, Ghana has been able to implement most of the recommended points of action (Table 5).

Table 5: Summary of implementation of key recommendations in Ghana

Recommendations	Progress
- Creating an enabling environment by; <ul style="list-style-type: none"> ✓ Completing the guidelines allowing the private sector to legitimately undertake foundation seeds production and marketing; ✓ Completing the guidelines for liberalization of varietal release process to make it independent, transparent and fair; ✓ Completing ratification of the ECOWAS seed regulation to allow free movement of varieties and seeds within the region to create markets of sufficient size; ✓ Completing the passage of the Plant Breeders' Bill into law to reward and incentivize breeders towards developing reliable and high quality breeder seeds; ✓ Complete liberalization of seed imports and import licensing procedures to make them transparent, independent and open for competition. 	Done
- Promote information flow for awareness creation through digitization and electronic sharing of a database of released varieties, along with descriptors and pictorial representations will greatly promote awareness	Done
- Formulate and operationalize sound and legally binding PPP frameworks that fairly represent the interests of key stakeholders through broad consultations processes	Done
- Liberalizing seed importation and strengthening the public regulatory agencies to effectively monitor imports and manage risks	Done
- Institutional Transformation by ensuring seed regulatory and supervisory agencies are resourced and empowered to adequately supervise the operations of actors and provide the needed technical guidance and oversight	Done
- Institute a competency-based training and mentorship programme to help the private sector upgrade its technical and business management capacities in the production, quality control and assurance, and Business Development Skills	Partly done
- Design a suitable funding mechanism to enable the private sector to make the requisite investment in infrastructure, equipment, production and processing to achieve large economies of scale	Done
- Strengthen NASTAG, to become the lead advocate and position itself to effectively link into and benefit from regional platforms like ASIWA to advance the cause of the private sector	Done
- Nurturing and strengthening linkages with output markets	Done
- NASTAG to spearhead the development and promotion of market information systems	Done
- Develop effective promotion and awareness creation strategies with seed companies	Done
- Co-funding awareness creation programs that include field demonstrations, radio educational campaigns and the use of ICT such as those piloted by ATP.	Done
- GSID should fully allow individual branding and packaging by seed companies to promote brand recognition, greater accountability, and quality assurance and also facilitate premium pricing	Partly done

- Seed companies must develop and be guided by effective marketing plans that will set goals and strategies to realize these outcomes including investment in personnel and marketing systems	Done
- NASTAG to adopt and spearhead stakeholder platforms like those facilitated by ATT in Northern Ghana to serve as a starting point for establishing a credible demand forecasting system to support proper production planning and seed marketing	Done

According to Mabaya et al., 2020, the following achievements have been recorded towards the creation of an enabling environment as alo;

- The variety catalogue was updated as of 2019 with the variety release procedures harmonized with ECOWAS requirements.
- Seeds Regulations Certification and Standards was harmonized with the ECOWAS regulations, gazetted in November 2018 and came into force in December 2018.
- The Plant Breeders Bill, Plant Variety Protection Act, 2020 was passed into law in November 2020 but is not yet operational. The law provides a legal framework to protect plant breeders' rights.
- Seed imports and import licensing procedures have been liberalized. Ghana today has the lowest requirements in ECOWAS because the documentation process for importing seed was simplified.
- The GISD received technical support services in form of seed inspectors whose number rose from 32 extension workers to 45 workers. These extension staffs are however hindered by a lack of adequate resources to perform their role.

Through the USAID Feed the Future project, Agriculture Policy Support Project (November 2016-May 2018), NASTAG made the following achievements;

- Recognition of the role of the private sector in seed systems
- Multinational private companies like Dupont Pioneer and Seedco have received approval to release high yielding varieties of maize in Ghana.
- The private sector companies have obtained the approval to produce foundation seeds once they meet the specified requirements
- Organized the National Seed Value Chain Business Networking Forum comprising an estimated 200 seed value chain actors and stakeholders.
- Spearheaded the Northern Ghana Seed Platform

The EGS consortium for Sustainable Production of Quality Seeds was launched in 2020 under the leadership of the WACCI in partnership with CSIR-Crop Research Institute, CSIR-Savannah Agricultural Research Institute LCIC, and the Integrated Water Management and Agricultural Development Ghana Limited and working closely with NASTAG, and supported by AGRA and USAID (NASTAG, 2021). The consortium aims to produce both breeder and foundation seeds for major crop value chains including maize, groundnut, soybean, and cowpea; undertake promotion activities for improved crop varieties, and build capacity of the seed producers.

Capacity building and Mentorship of NASTAG through the USAID-GIAT project. This involved building capacity to establish monitoring and evaluation systems with an emphasis on data collection and management. The purpose was to enable and support efficient and accurate analysis of data received from seed producers but also provide detailed information for informed decision-making (NASTAG, 2021).

the electronic seed demand forecasting tool was launched in the year 2020 to facilitate seed demand planning and production. This initiative was led by CORAF through the USAID-PAIRED project (USAID, 2021). The project also undertook the development of up-to-date regional catalogues of plant species along with released crop varieties.

3.6 Nigeria

Recommendations from the Nigeria EGS study

The Nigeria EGS study came up with a number of recommendations some of which were cross cutting. They included;

- Establishment of maize-soybean EGS public-private partnership (PPP) for both maize and soybean
- Establishing a National Seed Fund
- Implementing and enforcing clear Intellectual Property (IP) policies
- Improving the quality assurance system
- The FMARD pushing for the early enactment of the New Seed Law to suppress the counterfeit seed trade.

The crop-specific recommendations from the EGS study included;

- Establish a private processor oriented rice seed system and promoting policies to increase local paddy production through support integrated rice processors that process locally produced paddy at a competitive quality and price
- Establishing a strong National Yam Value Chain Association
- Demonstrating the benefits of adopting improved yam varieties at farm level
- Supporting the distribution of improved seed yam
- Establishing an EGS PPP for both maize and soybean
- Accelerating the production and distribution of maize hybrids in the Humid Rain Forest agro-ecological zone
- Increasing the capacity of the National Cereals Research Institute (NCRI) substations to increase soybean breeder seed production and improving the knowledge of the benefits of improved soybean varieties among agro-dealers.

Implementation of recommendations in Nigeria

Nigeria has made good strides to improve the performance of its seed sector based on the recommendations from the EGS study (Table 6).

Table 6: Summary of implementation of recommendations in Nigeria

Recommendations	Progress
- Establishment of maize-soybean EGS public-private partnership (PPP)	Not yet done
- Establishing a National Seed Fund	
- Implementing and enforcing clear Intellectual Property (IP) policies	Done
- Improving the quality assurance system	Done
- The FMARD pushing for the early enactment of the New Seed Law to suppress the counterfeit seed trade.	Done

- The enactment of the Plant Variety Protection (PVP) bill and signing of the seed law (USDA, 2021). This was a result of the collaboration between the National Assembly Business Environment Roundtable (NASSBER), AGRA, Partnership for Inclusive Agricultural Transformation in Africa (PIATA), Bill and Melinda Gates Foundation, Rockefeller Foundation and USAID. NESG has been collaborating with the Nigeria Agricultural Seed Council (NASC).
- AGRA through two large consortia supported two seed companies in Kaduna State to increase production and commercialization of maize, rice and soybean breeder seed (KIT, 2020).
- Improving Quality Assurance System.

The states were also supported to increase certified seed production. There is increased seed quality control and seed sector governance today in Nigeria through the National Agricultural Seed Council (NASC) and regulatory progress through legislative advocacy. AGRA in collaboration with the NASC facilitated seed quality control through a turnkey electronic seed certification system with scratch card authentication (KIT, 2020).

4.0 Analysis

The recommended actions and their respective level of implementations are summarized in Table 7.

Table 7: Analysis of implementation

Country	Recommended Actions	Achievements	Rate
Uganda	- Increase the price of EGS to represent the real cost of production and remove hidden subsidies.	✓	70%
	- Train research scientists and seed companies on intellectual property rights systems to ensure equitable use of publicly developed varieties.	✓	
	- Strengthen seed certification with the private sector to ensure seed quality	✓	
	- Strengthen capacity of seed companies to manage EGS and internal quality control	X	
	- Develop a searchable database to share information on varieties, seed availability and levels of commercialization	✓/X	
	- Strengthen linkages between research with farmers through a well-coordinated extension and advisory service programme to enhance the adoption of quality seed by all farmers.	✓	
	- Establish a foundation seed enterprise at NARO to ensure the availability of good quality foundation seed of crops that seed companies are not keen on producing	✓	
	- Ensure an effective policy and regulatory environment	✓	
	- Explore licensing options for commercial varieties and publicize arrangements	✓	
	- Fingerprinting of parental materials	X	
	- Attaching an agribusiness staff at ZARDI's that produce EGS	✓/X	
	- Develop an efficient methodology to determine annual seed requirements	✓	
	- Support establishment of a national seed forum	X	
	- Strengthen extension and advisory services at the sub-county level to educate farmers in the use of agricultural inputs to increase crop yields	✓	
	- Support quality assurance mechanisms, including accreditation of private inspectors and delegated authority towards local government	✓	
	- Support development of strong supportive environments for participation of farmers' organizations in seed systems	✓	
Kenya	- Establish a public-private partnership for each crop	✓	100%
	- Ensure broad private-sector representation within the PPPs.	✓	
	- Revise current inspection and certification system	✓	
	- Reducing the overall cost of maize seed production	✓	
Malawi	- Establish public-private collaboration at basic seed stage across major players in the maize seed system	X	50%
	- Encourage more private sector participation in the production of basic seed	✓	
	- Revitalize and improve the SSU human resource and infrastructure capacity	✓	
	- Enact the new Seed Act to enable the implementation of the breeder's rights and farmers' rights	X	
	- Build the capacity of seed producers and all relevant stakeholders	✓/X	
	- Careful domestication of the SADC Seed Harmonization Programme	✓	
	- Establish a national Variety Testing Centre	X	
	- Enhance the capacity of the national extension system	✓	
	- Put in place a national framework to project annual potential demand for seed	X	
Rwanda	- Establish a PPP for potato and common bean with the specifications related to partners and position within the seed system developed according to the needs of the given crop	✓/X	80%
	- Increase the availability of new improved potato varieties	✓	
	- Enhance the economic value of potato	✓	
	- Include soybean and wheat in the common bean PPP model to make it attractive to the private sector	X	
	- Develop and communicate a strategy to eliminate maize subsidies	✓	
	- Allow private maize seed companies to make seed production decisions, including what to produce and where to produce it, without government approval	✓	
	- Develop purpose-built agricultural lending products tailored for smallholder farmers	✓	
	- Harmonize Rwanda's registration and seed import process with EAC and COMESA procedures	✓	
	- Operationalize plant variety protection policies that have been embodied in the recently passed seed law	✓/X	
	- Focus RAB's hybrid maize program on conducting trials to provide farmers with unbiased data.	✓	

Ghana	- Focus RAB's hybrid maize program on conducting trials to provide farmers with unbiased data.	✓	93%
	- Promote information flow for awareness creation through digitization and electronic sharing of a database of released varieties, along with descriptors and pictorial representations will greatly promote awareness	✓	
	- Formulate and operationalize sound and legally binding and inclusive PPP frameworks	✓	
	- Liberalize seed importation and strengthening the public regulatory agencies to effectively monitor imports and manage risks	✓	
	- Institutional Transformation by ensuring seed regulatory and supervisory agencies are resourced and empowered to adequately supervise and provide technical guidance and oversight	✓	
	- Institute a competency-based training and mentorship programme to help the private sector upgrade its technical and business management capacities in the production, quality control and assurance, and business development skills	✓/X	
	- Design a suitable funding mechanism to enable the private sector investment in infrastructure, equipment, production and processing to achieve large economies of scale	✓	
	- Strengthen NASTAG, to become the lead advocate and position itself to effectively link into and benefit from regional platforms like ASIWA to advance the cause of the private sector	✓	
	- Nurturing and strengthening linkages with output markets	✓	
	- NASTAG to spearhead the development and promotion of market information systems	✓	
	- Develop effective promotion and awareness creation strategies with seed companies	✓	
	- Co-funding awareness creation programs that include field demonstrations, radio educational campaigns and the use of ICT such as those piloted by ATP.	✓	
	- GSID should fully allow individual branding and packaging by seed companies to promote brand recognition, greater accountability, and quality assurance and also facilitate premium pricing	✓/X	
	- Seed companies must develop and be guided by effective marketing plans that will set goals and strategies to realize these outcomes including investment in personnel and marketing systems	✓	
	- NASTAG to adopt and spearhead stakeholder platforms to serve as a starting point for establishing a credible demand forecasting system to support proper production planning and seed marketing	✓	
Nigeria	- Establishing a National Seed Fund	X	75%
	- Implementing and enforcing clear Intellectual Property (IP) policies	✓	
	- Improving the quality assurance system	✓	
	- The FMARD pushing for the early enactment of the New Seed Law to suppress the counterfeit seed trade	✓	

Extent of implementation

From a general perspective, most countries endeavored to address the recommendations given during the EGS studies. The achievements registered demonstrate that most countries have to a large extent (more than 75%) implemented most of the recommendations from the studies (Table 7) .

A lot has been achieved in the creation of the enabling environment for all the countries with most countries enacting the respective seed acts and signing them into law as well as the aspects of the plant breeders bills or the plant variety protection bill and policies in Nigeria, Uganda, Ghana. Most of the studied countries made effort to harmonize and domesticate the national seed laws with regional markets laws and requirements A few countries for which accreditation by international seed bodies ISTA and OECD was recommended also made effort to implement.

The need to build capacity in seed quality and regulatory services was also seriously considered in most countries where it was recommended. Uganda, Malawi, Kenya, and Ghana had their

human resources trained in order to build efficiency in seed inspection and regulation. This is strengthened further with the building of capacities of seed companies to participate in seed inspection and regulatory service provision.

The establishment of PPPs as a means to address the EGS needs was successfully implemented in most countries courtesy of specific ongoing project initiatives. PPPs for delivery of EGS for cereal crops such as hybrid maize, sorghum, common beans, soybeans, and the root and tuber crops cassava and potatoes were established especially in Kenya, Uganda, and Ghana.

Implementation gaps

Despite the efforts to implement most of the recommendations a few cases exist where some have not been done yet (Table 8). The recommendations that have notably not been implemented are mainly those that were directed to respective governments such as the establishment of National Variety Testing Center, putting in place a national framework for future demand forecasting as well as fingerprinting of breeding products. It is therefore, recommended that respective governments and lead development agencies followup on areas that have not been implemented so as to ensure efficiently functional seed sectors.

Table 8: Implementation gaps by country

Country	Recommended Actions	Achievement
Uganda	- Strengthen capacity of seed companies to manage EGS and internal quality control	X
	- Fingerprinting of parental materials	X
	- Support establishment of a national seed forum	X
Malawi	- Establish public-private collaboration at the basic seed stage across the major players in the maize seed system	X
	- Enact the new Seed Act to enable the implementation of the breeder's rights and farmers' rights	X
	- Establish a national Variety Testing Centre	X
	- Put in place a national framework to project annual potential demand for seed	X
Rwanda	- Establish a PPP for potato and common bean with the specifications related to partners and position within the seed system developed according to the needs of the given crop.	√/X
	- Include soybean and wheat in the common bean PPP model to make it attractive to the private sector	X
	- Operationalize plant variety protection policies that have been embodied in the recently passed seed law	√/X
Ghana	- Institute a competency-based training and mentorship programme to help the private sector upgrade its technical and business management capacities in the production, quality control and assurance, and Business Development Skills	√/X
	- GSID should fully allow individual branding and packaging by seed companies to promote brand recognition, greater accountability, and quality assurance and also facilitate premium pricing	√/X
Nigeria	- Establishing a National Seed Fund	X

5.0 Conclusion and recommendations

Generally, most implementation of the recommendations has been attained where there are specifically funded programmes or projects that focused on seed system development by addressing some specific challenges in a given country. This is for instance the case in Kenya where more PPPs were realized as a result of programmes such as SPTA, One Acre Fund Initiative, PABRA among others. It is also the case for the big achievements observed in Uganda as a result of the presence of the ISSD programme with deliberate core interests in addressing EGS challenges. The same applies in RWANDA with the AGRA Rwanda programme facilitating the attainment of most recommendations especially with creating the enabling environment. To understand the reasons behind the non-implementation of some of the recommendations, we recommend further investigation to unravel the underlining causes.

REFERENCES

- Access to seed index, 2019. Available at <https://www.accesstoseeds.org/index/eastern-southern-africa/country-profile/tanzania/> (Accessed 10/7/2021).
- Douthwaite, Boru (2020). Development of a cassava seed certification system in Tanzania: Evaluation of CGIAR contributions to a policy outcome trajectory. International Potato Center: Lima, Peru.
- AGRA, 2015. Malawi Early-Generation Seed Study. Lilongwe. Available at: <http://www.seedquest.com/News/pdf/2017/malawi.pdf> (Accessed: 8 August 2021).
- AGRA impact Series, 2021: Growing Africa's Agriculture. AGRA supports the seed system in Rwanda
- AGRA, 2016. Mozambique Early Generation Seed Study. Available at: https://agrilinks.org/sites/default/files/resource/files/mozambique_early_generation_seed_report.pdf (Accessed: 26 September 2021).
- AGRA-SSTP, 2016: Tanzania early generation seed study report
- AGRA-SSTP, 2016. Ghana early generation seed study report
- AgriExperience, 2017. Case study: Revising seed regulations in Kenya. <https://agriexperience.com/wp-content/uploads/2017/05/Case-Study-Revising-Kenya%E2%80%99s-Seed-Regulations.pdf> (Accessed on 8/8/2021)
- Berga Lemaga, 2018. Kisima Farms: a large farm supporting local communities. <https://potatocongress.org/wp-content/uploads/2018/05/potato-value-chain-EXAMPLE-1.pdf> Accessed 8/8/2021
- Context Network and Sahel Capital, 2016. Nigeria Early Generation Seed Study, Country Report
- Context Network, 2016. Rwanda Early Generation Seed Study, Country Report
- COMESA, 2018: <https://www.comesa.int/seven-comesa-states-have-harmonized-seed-regulations/> (Accessed 10/7/2021)
- Douthwaite, Boru (2020). Development of a cassava seed certification system in Tanzania: Evaluation of CGIAR contributions to a policy outcome trajectory. International Potato Center: Lima, Peru.
- <https://www.pabra-africa.org/scaling-success-leading-change-syngenta-foundation/> (Accessed 2/ 7/2021)
- <https://observer.ug/businessnews/69730-naro-industrialists-to-improve-crop-varieties> (Accessed 2/ 7/2021)

<https://www.tanzaniainvest.com/agriculture/seed-sector-international> (Accessed 8/8/2021)

<https://www.syngentafoundation.org/news-highlights> (Accessed 8/8/2021)

KIT, 2020. Nigeria Outcome Monitoring Report 2019, AGRA-PIATA Programme. Alliance for a Green Revolution in Africa, Nairobi; KIT Royal Tropical Institute, Amsterdam

Lauren Good, 2020: New Models for Cassava Seed Systems: Tanzania and Nigeria. Agrilinks website <https://agrilinks.org/post/new-models-cassava-seed-systems-tanzania-and-nigeria> (Accessed 8/8/2021)

Lewis, Linzi & Masinjila, Sabrina. (2018). Status report on the SADC, COMESA and EAC harmonised seed trade regulations: where does this leave the regions' smallholder farmers?. 10.13140/RG.2.2.23914.98244.

MIT, 2020: Project brief. Seed Production technology for Africa, <https://www.cimmyt.org/content/uploads/2019/03/CIMMYT-SPTA-seed-production-SMEs-2020-07-web.pdf> accessed 3/7/2020.

Mabaya, E., Waithaka, M., Tihanyi, K., Yao, S., Wobil, J., Mugoya, M., Magambo, G. 2021. Ghana 2020 Country Study - The African Seed Access Index (version June 2021).

Micheal Nkurunzina, 2021: Rwanda: Why Rwanda Reduced Subsidies on Imported Maize Seeds. The New Times. <https://allafrica.com/stories/202009210069.html> accessed 07/08/2021

Miklyaev, M.; Jenkins, G.; Shobowale, D. Sustainability of Agricultural Crop Policies in Rwanda: An Integrated Cost–Benefit Analysis. Sustainability 2021, 13, 48. <https://dx.doi.org/10.3390/su13010048>

National Seed Trade Association of Ghana, [https://ghanalinks.org/documents/20181/86239/National+Seed+Trade+Association+of+Ghana+\(NASTAG\)+--+Next+Steps+to+Unlocking+the+Seed+Sector/fe31a34e-481c-44c3-bd01-4f8be98cae0d?version=1.0](https://ghanalinks.org/documents/20181/86239/National+Seed+Trade+Association+of+Ghana+(NASTAG)+--+Next+Steps+to+Unlocking+the+Seed+Sector/fe31a34e-481c-44c3-bd01-4f8be98cae0d?version=1.0) (Accessed 10/7/2021)

National Seed Trade Association of Ghana, 2021; Annual Report.

USDA, 2021: Government of Nigeria Signed Plant Variety Protection Bill into Law, <https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Government%20of%20Nigeria%20Signed%20Plant%20Variety%20Protection%20Bill%20into%20Law%20Lagos%20Nigeria%2006-21-2021.pdf> (Accessed 6/7/2021)

USAID West Africa region, 2020; https://www.usaid.gov/sites/default/files/documents/PAIRED_Cleared_FACT_SHEET_Revised_June_2021_BB_edits_.pdf (Accessed 12/10/2021)



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