ISSD Uganda

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Early generation seed business models for sustainable access to quality basic seed
The case of non-hybrid crops in Uganda

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Background

The sustainable supply of quality early generation seed (EGS) is the foundation of any viable quality seed system. In Uganda, the National Agricultural Research Organisation (NARO), through its crop-specific National Agricultural Research Institutes (NARIs), has a mandate for variety development and bulking of sufficient volumes of quality early generation seed to feed into the commercial seed value chain. Over the past eight years, Uganda's seed system has been transformed into an inclusive seed system with certified seed complemented by the new Quality Declared Seed class (QDS) for self-pollinated and open-pollinated crops.

Unlike for hybrid maize, sunflower and exotic vegetables, the commercialisation of EGS for self-pollinated crops has been challenging due to the unattractive business cases resulting from low profitability and unpredictable seasonal demand, among other issues. Given the limited funding, it became difficult to sustain production at the institutional level. The QDS system, however, created a profitable business case for these self-pollinated crops when produced under the Local Seed Business (LSB) arrangement. This has increased the demand for EGS for self-pollinated crops required to sustain the supply of the QDS in the market.

Interventions to increase EGS production for self-pollinated crops

To sustainably produce and market the EGS of self-pollinated crops (including beans, groundnut, soybean, rice, potato and sesame), ISSD Plus and NARO established alternative business models to support the production and marketing of quality basic seeds for these crops on a cost recovery basis. The three EGS models are the National Foundation Seed Enterprise model, the Zonal Agricultural Research and Development Institute (ZARDI) led basic seed model, and the Local Seed Business led model. These three models function best within their specific contexts and for particular crop enterprises.

This brief explains the establishment and operationalisation of these EGS business models and how they have influenced the demand for quality basic seed required for producing commercial seed classes, both certified and QDS. It also describes the newly instituted quality assurance steps to ensure that the basic seed supplied by these models is of the recommended quality standards. The three EGS business models have been integrated into the EGS institutional framework (Fig.1) for the delivery of quality basic seed for self-pollinated and vegetatively propagated crops. This framework was developed by NARO with support from the ISSD Plus project.

The interventions represented EGS institutional streamlining and transformation to address the existing status quo of ambiguity in roles and responsibility regarding EGS production and marketing by NARIs, ZARDIs and NARO Holdings.

The principal purpose of the creation of the FSE is to institute a distinct EGS coordination entity to streamline the pre-existing NARO status quo. The FSE will act as an EGS producer, play a coordinating role for the ZARDI and LSB led models and serve as a pre-booking and marketing channel of EGS for these important food crops.

The strategic purpose of the ZARDI model is the cost-effective bulking of EGS generations and decentralisation and geographic diversification for easy regional access by seed producers.

The purpose of the LSB Model is geographic diversification coupled with production risk management for the FSE by spreading risk to more cost-effective LSB production settings.

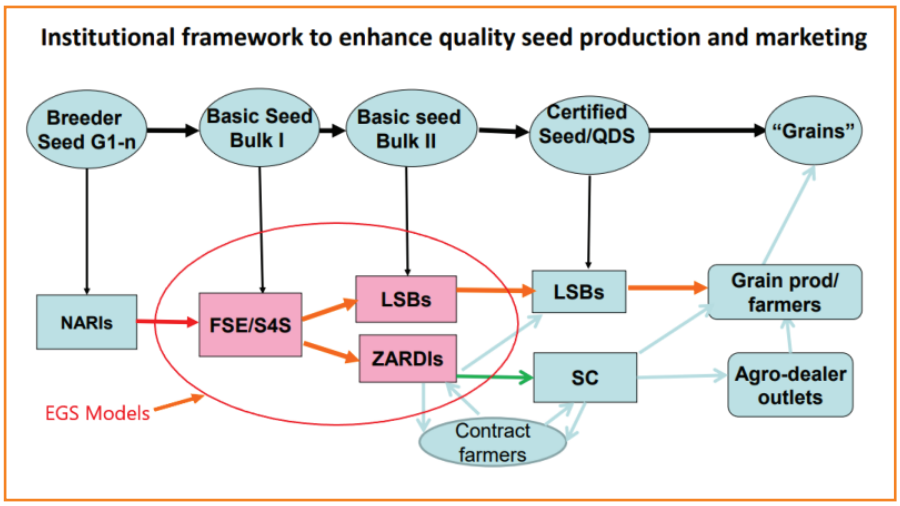


Figure 1: Institutional framework within which the EGS business models are embedded

EGS business models

1. The National Foundation Seed Enterprise (FSE) Model

Based on a cost recovery business model and implemented in a private-public partnership, the National Foundation Seed Enterprise (FSE) Model is implemented by the Seed for Seed (S4S) (U) Ltd company, a subsidiary of NARO Holdings which is the business wing of NARO. The company operates independently of NARO Holdings and has its own board of directors with representatives from NARO, MAAIF, USTA and experienced seed system experts. The model is designed to produce and market the first generation of basic seed for self-pollinated crops for the decentralised producers of basic seed, but also directly to certified and QDS producers. This model is tactfully designed to address the difficulties in sustaining low-profit EGS production of the self-pollinated crops, which are characterised by low multiplication and seed replacement rates that greatly deter their commercialisation.

The FSE has a five-year business plan (2019-2023) with a complete financial modelling indicating a positive net present value (NPV) and promising to break even in three to four years of being operational. The FSE Model is geared towards social obligations, such as providing farming communities with quality seed for self-pollinated crops, rather than towards business profitability. The main objective is to deliver the much-desired quality basic seed on a cost recovery basis, with the potential for commercial sustainability in the future. The model is in its second year of implementation and the production and marketing trend indicates promising targets to break even as planned (2021-2022).

The FSE model required significant start-up funds to stimulate production, which will later be able to sustain its operations based on the modest profit that is generated from the business.

In this regard, the ISSD Plus project in partnership with NARO jointly invested in the start-up of the FSE to give it the initial momentum for the business. The investment focused on operational (Fig. 2) and capital (Fig.3) expenditures which were critical for the implementation of the FSE business plan. On breaking even, the FSE is expected to run its operations without any significant additional external funding. The start-up funding is mainly intended to support the business and establish its asset base in order to streamline operations. After this CAPEX financing, the funding requirements will reduce (Fig.4) as the business will then focus on the operational expenses.

NARO will maintain oversight in the FSE EGS business model and will create an easy link to its NARIs for required pre-basic seed. Being a public institution, NARO (through NHL) will ensure sustainable oversight without its public sector policies directly affecting the operations of the FSE by virtue of its largely autonomous status.

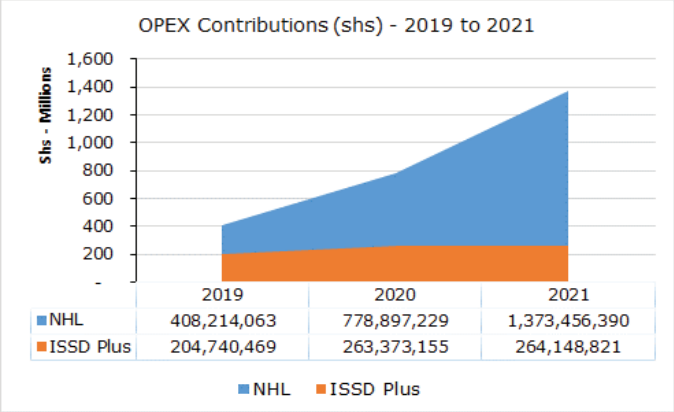


Figure 2: Operational expenses for FSE EGS business model

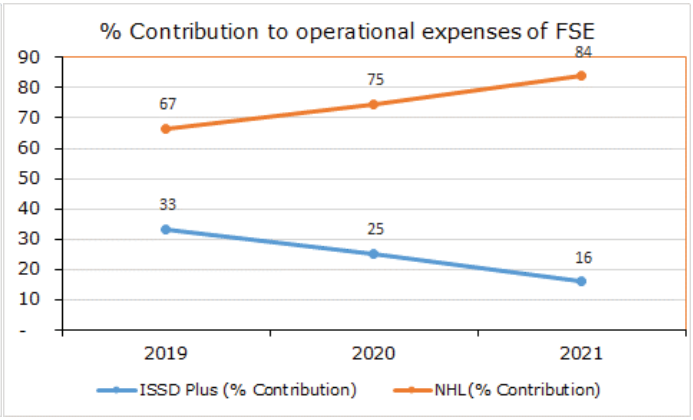
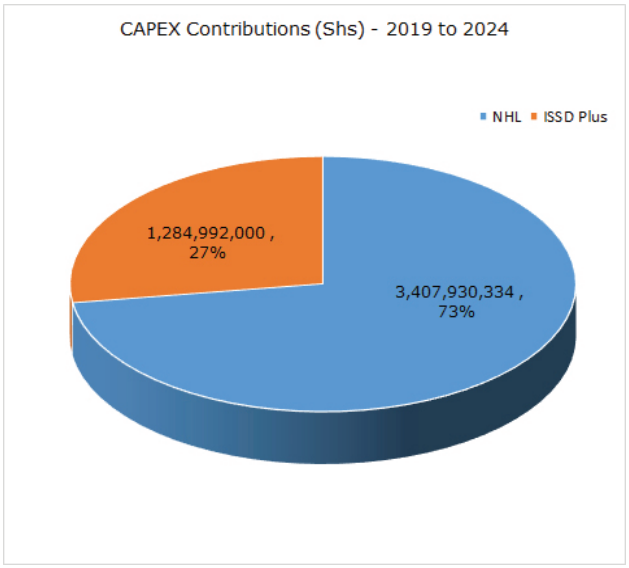


Figure 3: Financing trends for the implementation of the FSE EGS business model



Capital items procured as per FSE business plan

- **200 acres** of production land
- **30 acres** under permanent drip irrigation
- **60 MT** cold room storage
- **01 4x4** pickup truck
- **02** field motorcycles

Figure 4. ISSD and NARO contribution towards capital expenses for implementing the FSE EGS business model

Figure 5. Seed processing plant at Seed for Seed (U) Ltd in Kigumba

FSE built its marketing base for quality basic seed for district local governments, quality seed producers (especially QDS) and certified seed producers. Seed companies are increasing their interest in EGS produced and marketed under the FSE business model (Fig.7). The expanding market demand – especially through local seed businesses producing QDS and seed companies – has a positive impact on its sustainability. FSE is currently focusing on basic seed for beans and groundnut, with intentions to diversify to rice and soybean over time.

The demand for quality basic seed continued to increase annually in the last four years (Fig. 8 and 9), as many quality seed producers now find it more economical to invest their resources in producing commercial seed for their business rather than producing their own basic seed for self-pollinated crops. This is because the FSE delivery model offers an affordable and high-quality alternative for sourcing basic seed. As a result, the FSE continues to enjoy significant demand for its quality basic seed from the commercial seed producers (seed companies and local seed businesses). The increasing demand creates room for expanding the FSE business model.

Figure 6. Beans basic seed production field for Seed for Seed (U) Ltd. season B, 2021

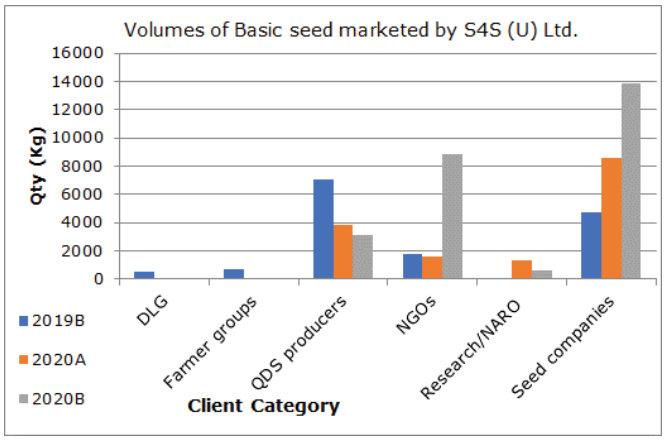


Figure 7. Marketing trends and customer categories of S4S(U) Ltd. basic seed

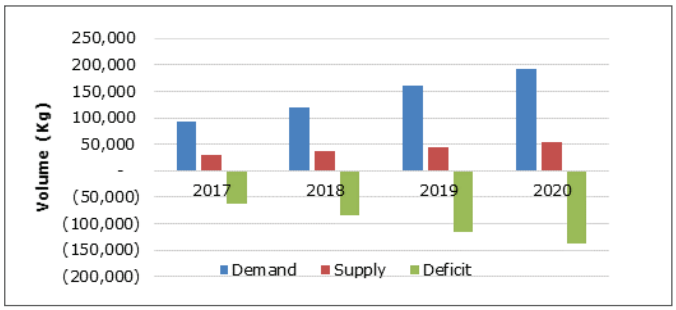


Figure 8. Demand trends for beans quality basic seed from FSE model 2017-2020

Figure 9. Demand trends for groundnut quality basic seed from FSE model 2017-2020

Detail	2017A	2017B	2018A	2018B	2019A	2019B	2020A	2020B	2021A	2021B
Estimate total production area/ha			269 600 acre	269 600 acre	269 600 acre	269 600 acre	269 600 acre	269 600 acre	269 600 acre	674 000 acre
Proportion planted with QDS/Certified seed			0.0 %	1.0 %	2.0 %	4.5 %	7.0 %	9.0 %	11.0 %	13.0 %
Area planted with QDS/Certified seed			0 ha	2 696 acre	5 392 acre	12 132 acre	18 872 acre	24 264 acre	29 656 acre	87 620 acre
Calculated QDS/certified seed production required				162 t 324 acre	364 t 728 acre	566 t 1 132 acre	728 t 1 456 acre	890 t 1 779 acre	2 629 t 5 257 acre	
Calculated foundation seed production required (third cycle)				27 t 55 acre	42 t 85 acre	55 t 109 acre	67 t 133 acre	197 t 394 acre		
Calculated second cycle foundation seed production required				3 t 6 acre	4 t 8 acre	5 t 10 acre	15 t 30 acre			
Calculated first cycle foundation seed production required			0.2 t 1 acre	0.3 t 1 acre	0.4 t 1 acre	1.1 t 2 acre				
Calculated breeders' seed required		11 kg	14 kg	18 kg	52 kg	52 kg				
Calculated pre-breeders' seed reqd	1 kg	1 kg	1 kg	4 kg	4 kg					

Table 1: FSE production plan for quality basic seed 2018-2021

2. The Zonal Agricultural Research and Development Institute (ZARDI) led basic seed business model

The ZARDI basic seed business model is a public sector-based model which leverages on opportunities of the ZARDI to produce and market quality basic seed as a business. Such opportunities include but are not limited to the availability of large production land, technical skills from ZARDI scientists and farm managers, their mandate for zonal agricultural technology dissemination which is very pertinent to crop varieties and proximity to quality seed producers especially the LSBs producing QDS. The ZARDI model obtains its starter materials from the FSE's basic seed cycle one, bulks it for at least one season and markets it to seed producers at affordable prices. This model also decentralises basic seed production, thereby addressing the key challenges of distance and timeliness in accessing quality basic seed for seed producers.

The ISSD Plus project supported the start-up of these ZARDI-led basic seed business models by financing their start-up production costs and providing some seed conditioning equipment to support business operations.

ZARDIs involved in basic seed production

a- AbiZARDI (West Nile) – Beans, soybeans, sesame, potatoes

b- Kachwekano ZARDI (Kigezi) – Potatoes, climbing beans

c- Ngetta ZARDI (North) – Upland rice, soybeans, groundnut

d- Buginyanya ZARDI (East) – Potatoes, beans

e- Mbarara ZARDI (Ankole) – Beans, soybeans

f- Rwebitaba ZARDI (Rwenzori) - Beans

ZARDI directors and farm managers from the six involved ZARDIs were also taken through a training in basic seed production and marketing. Each of the ZARDIs was also supported in developing a business plan with a detailed cost-benefit analysis (Table 2.) for their basic seed business, based on the demand information from the LSBs producing QDS in the respective regions.

EXPENDITURE ITEM	Amount (UGX)		
	Beans	Sesame	Potato
LAND PREPARATION	**575,000**	**575,000**	**575,000**
1st ploughing	250,000	250,000	250,000
2nd ploughing	250,000	250,000	250,000
Harrowing	75,000	75,000	75,000
PLANTING MATERIALS/SEEDS	**804,000**	**489,000**	**2,444,000**
Cost of seeds (breeder seed)	300,000	45,000	2,000,000
Sisal string-planting lines	24,000	24,000	24,000
Labour for planting (in rows)	300,000	300,000	300,000
Weeding x2	180,000	120,000	120,000
FERTILIZER APPLICATION & SPRAYING	**470,000**	**285,000**	**1,670,000**
Fertilizer NPK (bags) applied (Bean specific NPK)	140,000	130,000	500,000
Labour for fertilizer application	50,000	20,000	80,000
Spray pump	80,000	80,000	80,000
Chemicals/pesticides	100,000	35,000	280,000
Labour for spraying	100,000	20,000	250,000
Field monitoring (mainly potato)	0	0	480,000
Sub total			
HARVESTING & POST-HARVEST HANDLING	**544,000**	**607,300**	**1,222,400**
Dehaulming	0	0	55,000
Labour harvesting (stacking for Simsim)	100,000	150,000	200,000
Gunny bags	24,000	50,000	15,000
Labour (seed &harvest transport)	100,000	100,000	400,000
Drying	40,000	150,000	0
Threshing & winnowing	100,000	50,000	0
Labour for sorting, packaging and storage	40,000	57,300	80,000
Treatment/storage chemicals	40,000	50,000	50,000
Packaging material and marketing	100,000	50,000	422,400
TOTAL COSTS	**2,393,000**	**1,956,300**	**5,911,400**
cost of prod/kg/bag	5,983	5,648	84,500
Yield (kg/acre)	400	400	65
*Potential margin (25%)	598,250	489,100	1,477,850
Total cost + Margin/acre	2,991,250	2,445,400	7,389,250
Total cost + Margin/bag	**7,500**	**6,120**	**113,389**

**Percentage margin may change according to the marketing strategy of the Basic seed*

Table 2: Cost-benefit analysis for beans, sesame and potatoes for Abi ZARDI led EGS model

The margins vary per crop, with potato presenting much higher potential for profitability. In other crops, higher margins may be achieved by minimising the production costs and leveraging on the available tools and assets of the institute, including the use of tractors to plough the land at subsidised costs and the available technical labour already paid for by the institute. Higher profit margins can also be achieved by substantially increasing the yields using readily available agronomic technologies at the ZARDIs.

Figure 10: Buginyanya ZARDI team and ISSD representative monitoring a basic seed production field for potatoes in Eastern Uganda, August 2020

The EGS business there may only provide them with incentives from seed sales. Reduced production costs also make it possible to set the marketing price within an affordable range for seed growers, especially those producing and marketing QDS within the zone.

3. Local seed business-led basic seed business model

The third basic seed business model is based on the local seed business (LSB) approach. In the LSB basic seed model, capable and competent local seed businesses were identified and trained by the respective crop breeders on the technical requirements needed to produce quality basic seed. The groups were also trained in business management by ISSD agribusiness experts. This model targeted bulky planting materials, such as potato and groundnut seed, which are difficult to safely move across regions. However, tremendous progress was also made for beans, especially in regions with high bean production such as southwestern Uganda. In this model, the LSBs obtain the last cycle of basic seed from the ZARDI, bulk it under MAAIF inspection for purposes of quality assurance and market it to QDS producers in their locality.

Figure 11: Postharvest handling of bean basic seed by Omutima Gwa Ruhiira LSB in South Western Uganda

The LSB model leverages on proximity of the basic seed producers to QDS producers and their available production assets, such as land and labour. Proximity is important for minimising transportation challenges, especially for bulky crops such as potatoes and groundnut. The respective crop breeders from NARO regularly monitor the basic seed production fields during the growing period and provide guidance on maintaining genetic purity. Six LSBs were involved with the implementation of the LSB-led basic seed model.

LSBs involved in basic seed production

a- Kyazanga LSB (Ankole) – Beans

b- Omutiima Gwa Ruhiira LSB (Ankole) – Beans

c- Tic Ryemo can LSB (North) – Groundnut

d- Aye Medo Ngeca LSB (North) – Groundnut

e- Mengya Integrated Farmer association (Sebei area, East) – Potato

f- Agieramach Odyebo Women's Group for Development (West Nile) - Potato

Progress made by the three basic seed business models

By 2020, all three EGS models were performing effectively under their unique operational environments. The ZARDI-led model showed good performance for potato and rice crops, while the LSBs model is effective for groundnut and beans. The S4S (U) Ltd model is well placed to coordinate operations of the other two basic seed models while complementing their efforts by producing large volumes of high quality bean, groundnut and soybean basic seed for seed growers. The LSB model generated significant revenue for the basic seed growers involved while the other two models were operating on cost recovery basis. This indicated that these models could sustainably produce and market basic seed which will ultimately scale up production of quality seed (certified seed and QDS).

Under the three business models, a total of 269 MT of quality basic seed of beans, groundnut, sesame, soybean, rice and 358 MT of potato was produced and marketed since 2018 (see Table 3). For beans, this met over 80% of the basic seed demand.

Table 3: Basic production under the three models

EGS Model	Crop	FS Production (MT)*					
		2018A	**2018B**	**2019A**	**2019B**	**2020A**	**Total**
ZARDI & LSB led model	Beans	7	5.4	21.3	30.4	29.9	94
	Potato			37.2	83.6	237.5	358.3
	Sesame			0.1	0.2		0.3
	Groundnut	10.6	5.4	17.5	1.5	2.1	37.1
	Soybean				0.2	1.3	1.5
	Rice				1.8	2	3.8
FSE (S4S (U) LTD) model	Beans	27.5	12.5	16.8	20.3	37.1	114.2
	Groundnut			8.4	3	2.1	13.5
	Soybean					4.3	4.3
Total by season		45.1	23.3	101.3	141	316.3	
Total for legumes, cereals and oil crops basic seed across all seasons							**268.7**
Total for potato planting material across seasons							**358.3**

Institutionalising quality assurance of early generation seed

It is important that an independent quality assurance system is in place to provide proof of recommended quality standards for basic seed. Unlike when MAAIF delegated the quality assurance roles for early generation seed to the respective crop breeders, ISSD Plus piloted the inspection of basic seed fields by inspectors from the National Seed Certification Services (NSCS) under the current arrangement. Through this pilot, it was demonstrated that providing external quality assurance for EGS (as is done with commercial seed) is very important in ensuring that the EGS class produced are of the required genetic purity and quality.

MAAIF now inspects basic seed fields from all three basic seed business models and the process is coordinated by S4S (U) Ltd. The company compiles the planting returns of all basic seed producers every two weeks after planting and submits them to the NSCS to prepare for field inspection. The basic seed producers also pay for field inspection through S4S (U) Ltd. After the harvest, the available seed is sampled for laboratory testing. Only seed lots that pass the laboratory tests are issued with white labels to distinguish them from the quality seed classes. MAAIF is still using the manila-based labels for basic seed, but these should be upgraded to white tamper-proof labels soon.

Future outlook for sustaining EGS business models for self-pollinated crops

The EGS system needs further strengthening

For efficient and effective delivery, the EGS models will require additional support to establish standard coordination systems for pre-booking and access to quality basic seed and quality assurance services including field inspections, laboratory seed testing and label acquisition for standard packaging. It is also important that they are linked to the newly established digital Seed Tracking and Tracing System (STTS) for easy tracking of EGS sources as a quality assurance strategy for the seed sector. Additionally, due to institutional bottlenecks, initial implementation of the S4S (U) Ltd business plan was delayed, which in turn caused a setback in consolidating its performance. The business model predicts that the S4S (U) Ltd can only start breaking even from the third year of its implementation for self-sustainability.

Conclusion

In conclusion, the three basic seed business models have significantly decentralised and eased access to quality basic seed for quality seed production. The engagement of MAAIF to provide independent quality assurance services has since improved the quality of basic seed procured by quality seed growers, especially the local seed businesses. However, a lot more work is still required to consolidate the business cases of the different business models and undertake a technical economic analysis to determine their efficiency.

Colophon

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