



PSSD Impact Assessment Report

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Table of Contents

Table of Contents	ii
Abbreviations and Acronyms	iii
1. Objective of the assessment.....	4
1.1 Introducing the PSSD project.....	4
1.2 PSSD’s approach to reach men and women farmers	4
1.3 Objective of this impact assessment	5
2. Findings from desk review	5
2.1 Understanding PSSD’s approach and intervention areas.....	5
2.2 Reviewing PSSD’s monitoring and results measurement system	7
2.3 The approach for PSSD’s impact assessment and attribution methodology	11
3. Investigative field research to assess impact for PSSD’s work in the Burundian seed sector.....	12
3.1 Summary of findings	14
3.1.1. Seed Entrepreneurs.....	14
3.1.2. Farmers using certified seed	22
3.2 Limitations of the research	49
4) Next steps on improving the PSSD’s MRL system	50

Abbreviations and Acronyms

BSS	Business Support Services
COPROSEBU	The Collective of Burundian Seed Producers
DCED	Donor Committee for Enterprise Development
DPFAPFNL	Direction de la Promotion des Filières Agricoles et des Produits Forestiers Non Ligneux
FNS	Food and Nutrition Security
ISABU	Institut des Sciences Agronomiques du Burundi
MRL	Monitoring, Results Measurement and Learning
CNS	Commission National des Semences
ONCCS	Office National de Contrôle et de Certification des Semences
PSD	Private Sector Development
PSSD	Private Sector Seed Development
WEE	Women's Economic Empowerment

1. Objective of the assessment

1.1 Introducing the PSSD project

The Private Sector Seed Development project (PSSD) is funded by the Embassy of the Kingdom of the Netherlands in Burundi and implemented by the International Fertilizer Development Center (IFDC). It uses a Private Sector Development (PSD) approach to increase income opportunities for rural men and women farmers in Burundi, contributing to the reduction of poverty and inequalities, including gender inequality. In its last year of implementation, since 2018, the project aims to increase the availability and use of high-quality seed through the establishment of a commercially viable and self-governing seed sector, supported by client-oriented seed services.

In order to achieve this, PSSD works through a range of intervention strategies:

- Scaling up emerging commercial seed producers and the professionalization of national seed traders,
- the unlocking of Dutch and other international private sector expertise to the Burundi seed sector, and
- the large-scale promotion of quality seed used to grow the market to a stable, self-sustaining commercial sector

1.2 PSSD's approach to reach men and women farmers

Since 2018, the focus of the PSSD project has been to double the production and income of 178,000 households in Burundi engaged in Potato, Maize, and Beans farming. The project through its PSD approach incentivizes and supports Burundian and international seed companies to pilot innovations related to seed production and sales, as follows:

- 1) The development of sales strategies that are tailored to farmer household requirements. This includes:
 - The sale of seeds in micro-packs
 - Development of last-mile distribution capabilities through mobile agents or rural outlets
 - Micro-demonstration plots
 - Consumer education-focused communication strategies tailored to farmers
 - Development of specialized promotional materials tailored to farmers
- 2) Support seed companies to increase production efficiencies through the provision of technical and targeted financial support for:
 - Critical infrastructure upgrades
 - Intensification of production
- 3) Support initiatives to improve the business-enabling environment in relation to seed production and sales in Burundi, such as:
 - Liberalization of seed prices
 - Improvement of seed inspection and certification services
 - Policy coherency in relation to variety release and registration

1.3 Objective of this impact assessment

PSSD is in its last year of implementation, and IFDC Burundi wants to make sure their existing monitoring and evaluation system is streamlined to be able to assess impact of the project. This requires a review of the existing information captured by the project during implementation and identifying both the depth (benefit) and breadth (beneficiaries) of impact for the project across its different intervention areas.

The objective of this document is to explain the process taken by the consultant to assess the impact of PSSD's interventions among small holder Burundian farmers engaged in potato, maize, and beans farming. This document will also highlight how the impact assessment process followed is best suited for a dynamic PSSD project instead of following a more traditional monitoring protocol of project wide baselines and end lines. This assessment report aims to provide PSSD and IFDC context specific guidance on:

- How PSSD will reach men and women farmers through its work?
- How much certified seed for potato, maize, and beans is being produced per year that is attributable to PSSD's work?
- What possible tangible benefits may be incurred by men and women small holder farmers as a result of PSSD work?
- How can PSSD keep tracking the tangible benefits to farmers and the amount of certified seed produced by its partners over time?

2. Findings from desk review

2.1 Understanding PSSD's approach and intervention areas

PSSD is grounded in and fully in-line with Dutch development policy and thinking in relation to the SDG's, women's economic empowerment (WEE) and PSD. PSSD's work can be divided into two components:

- The first component focuses on working directly with seed entrepreneurs (individual farmers or cooperatives) for potatoes, maize (open pollinated and hybrid), and beans, building their capacity to increase the number of certified seed produced, creating awareness of this increased volume of certified seed among small holder farmers, and eventually assisting seed entrepreneurs in selling certified seed to small holder farmers. For doing this, PSSD signs contracts with seed entrepreneurs directly. A typical partnership results chain as used by the project is captured in figure 1 below. PSSD partners with seed entrepreneurs based on the following criteria:
 - o The seed entrepreneur should be recognized by the "Office National de Contrôle et de Certification des Semences" (ONCSS)
 - o The seed entrepreneur should be producing certified seed (by ONCCS) for at least 3 years
 - o The seed entrepreneur should have the capacity to scale up the amount of certified seed produced with increased investment in land and agri-inputs
 - o The seed entrepreneur has enough capital to contribute 50% of the co-finance contract signed with PSSD

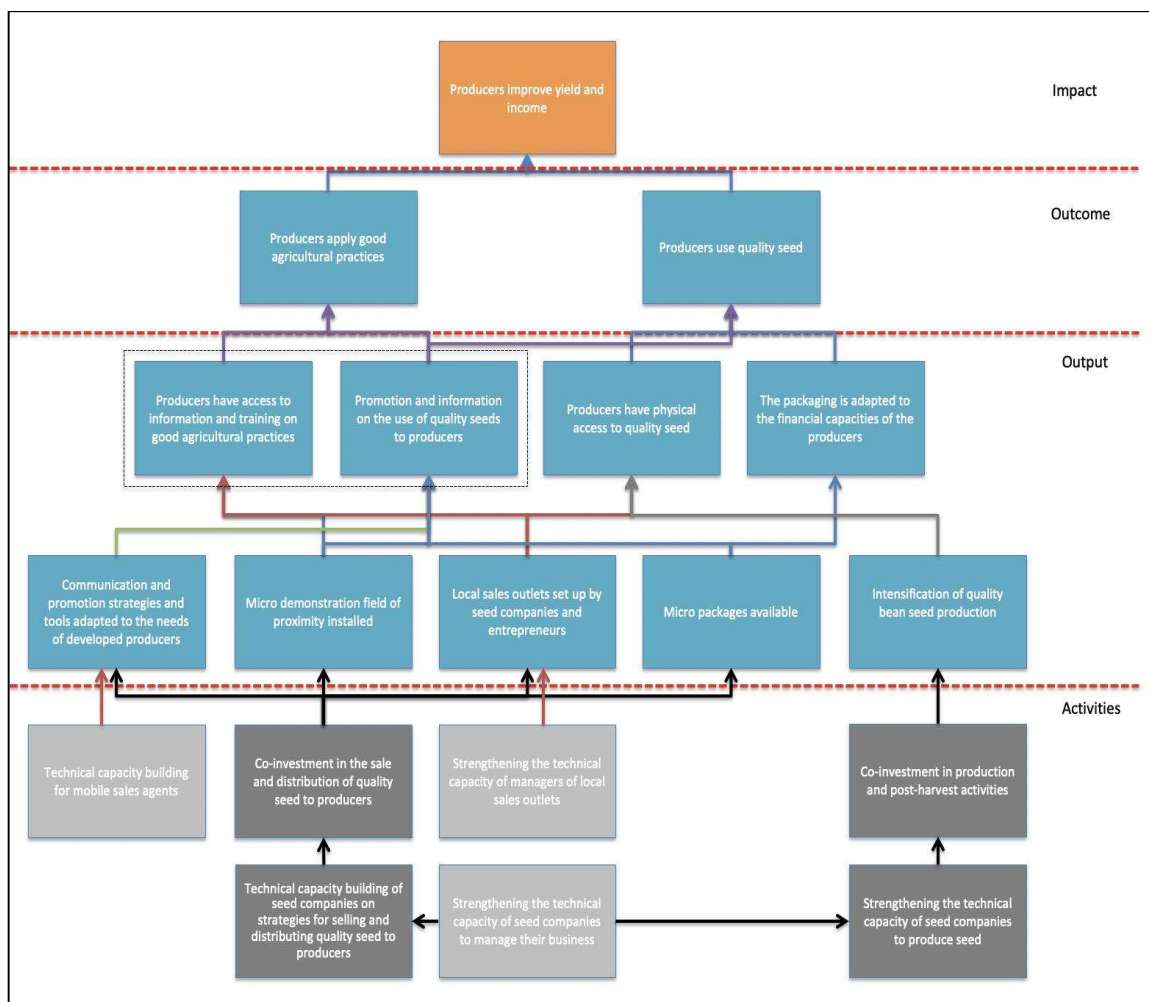


Figure 1: PSSD impact chain for their intervention with seed entrepreneurs

- The other area of operation for PSSD is to improve the business support services (BSS) and the enabling environment for seed companies. In order to do so, PSSD has established strategic partnerships with public institutions:
 - The partnership with ONCCS, is to facilitate releasing high yielding seed varieties in Burundi, develop the seed analysis and packages process by improving the organization’s technical capacity, and reduce the time it takes for accurately monitoring and inspecting seed entrepreneurs’ fields by increasing their resource capacity.
 - The partnership with the Institut des Sciences Agronomiques du Burundi (ISABU) is oriented to the research of new varieties, the production of first-generation seeds and the accompaniment of entrepreneurs who produce first generation seeds.
 - The activities of the partnership with the Direction de la Promotion des Filières Agricoles et des Produits Forestiers Non Ligneux (DPFAPNL) are related to the improvement of the seed regulation, the follow-up of seed companies, the coordination of the seed sector actors as well as the functioning of the central activities of the

institute. This relevant stake holders in this include The Collective of Burundian Seed Producers (COPROSEBU), and Commission National des Semences (CNS)

2.2 Reviewing PSSD's monitoring and results measurement system

The objectives of the PSSD MRL framework as defined in the project inception document are:

- 1) Measure progress made against the project results chain and logical framework
- 2) Test assumptions underlying the results chain.
- 3) Measure the level of systemic change in the seed system.
- 4) Capture lessons learned.
- 5) Share findings and lessons back into project management.

Since the PSSD project takes a partnership approach, the objectives as laid down for the MRL framework require careful planning and resourcing. The project interventions started in September 2019, with pilot provinces selected based on the potential productivity per crop type in the region. The targeted crops per province are:

- Beans for semi-voluble and biofortified varieties in Kirundo, Muyinga, Ruyigi and Cankuzo provinces.
- Composite maize for the provinces of Makamba, Rutana, Rumonge, Kirundo, Muyinga, Gitega and Karusi;
- Potatoes for Kayanza, Muramvya, Bujumbura, Bururi and Mwaro provinces.
- The sale of hybrid maize seeds throughout all the provinces of Burundi is carried out by two seed companies, SETRACO and NASECO.

To achieve these objectives, PSSD has a dedicated resource for managing the MRL system in house. This resource is responsible for making sure information related to seed production and sales from PSSD's partners is being collected per season and is being stored on an internal dashboard. PSSD has two local NGOs (UCODE and Twitezimbere) who support the project in field specific implementation tasks as well as data collection on seed sales and demo plot attendance. The information related to production and sales is reported from the seed entrepreneurs directly to the NGOs and is relayed to PSSD through quarterly reports. The total amount of certified seed sold per PSSD partnering seed entrepreneur is specifically traced as the volume supported by PSSD partnerships, in relation to the early generation seed and the additional land (area) used for multiplying basic seed for certified seed. I.e., The certified seed production produced by the seed entrepreneurs on their own (any expansion or continuation of production on their existing land) is not included in the figures consolidated by the project. The project collects information related to their partnerships with ONCCS, and ISABU directly. The overall progress on PSSD's work overtime is consolidated through PSSD's annual reports and reported using the Food and Nutrition Security reporting framework and indicators. The FNS results framework and indicators is shown in the figure 2 and 3 below.

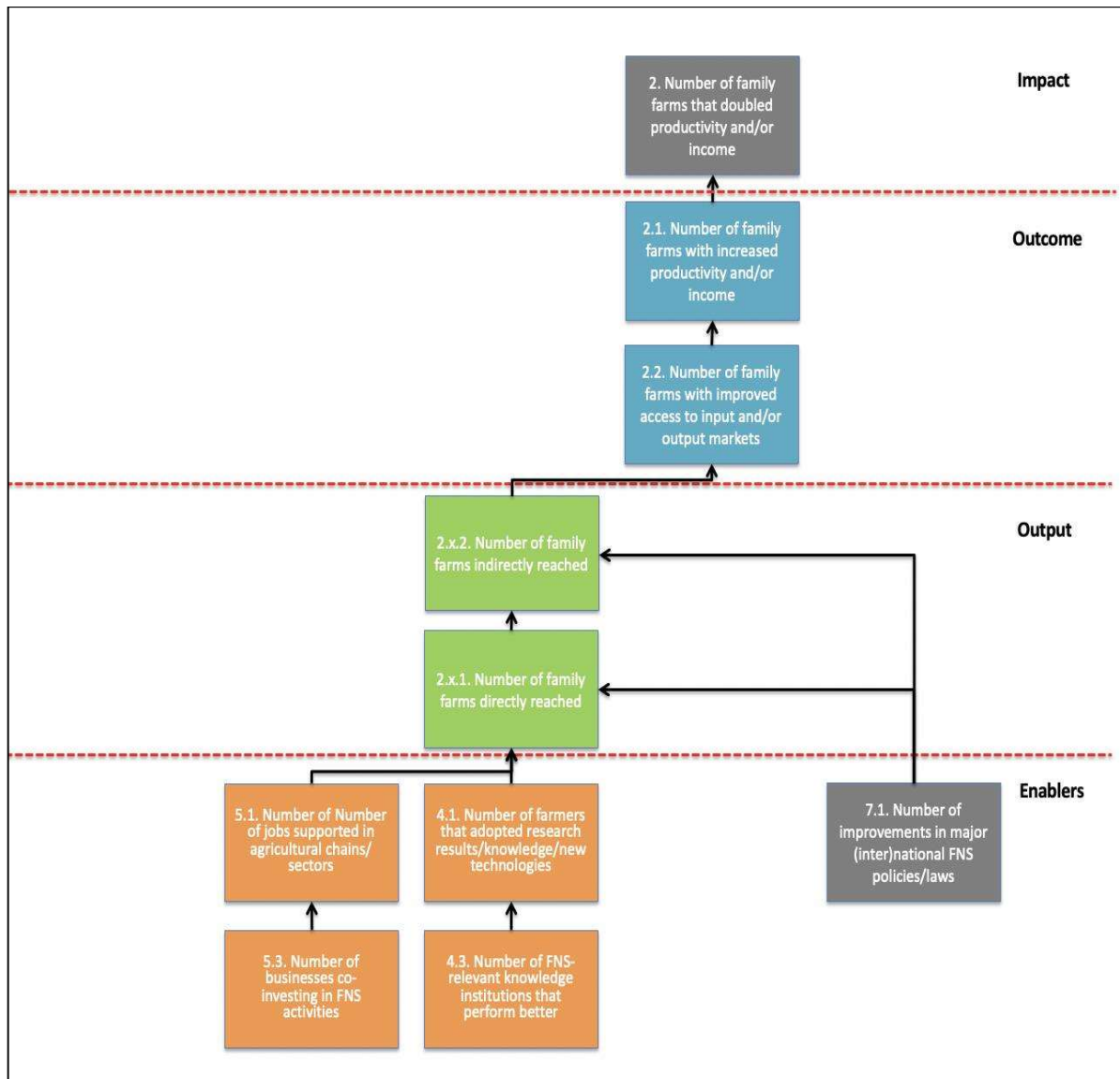


Figure 2: PSSD FNS Indicator ToC

Level	FNS #	Indicators	Definition
Impact	2	Number of family farms that doubled productivity and/or income i. Male-headed family farms ii. Female-headed family farms iii. % of family farms headed by an individual under 35 years of age	A. Yield B. Revenue C. Profit
Outcome	2.1	Number of family farms with increased productivity i. Male-headed family farms ii. Female-headed family farms iii. % of family farms headed by an individual under 35 years of age	A. Yield B. Revenue C. Profit
	2.2	Number of family farms with improved access to input and/or output markets i. Male-headed family farms ii. Female-headed family farms iii. % of family farms headed by an individual under 35 years of age	A. Total family farms directly (2.x.1) and indirectly (2.x.2) reached
Output	2.x.1	Number of family farms directly reached i. Male-headed family farms ii. Female-headed family farms iii. % of family farms headed by an individual under 35 years of age	A. Family farms of which one member visited a demonstration plot installed by project partners B. Family farms that purchased quality seeds from project partners
	2.x.2	Number of family farms indirectly reached i. Male-headed family farms ii. Female-headed family farms iii. % of family farms headed by an individual under 35 years of age	A. Number of family farms: i. For which distance to agro-dealers has measurably decreased ii. For which access to micro packs has increased iii. That have access to more seed iv. That have access to more seed varieties v. That have timely access to seeds vi. For which distance to micro demonstration plots has measurably decreased vii. That have more interactions with agro-dealers / mobile sales agents B. Family farms of which one member visited a demonstration plot installed by non-project partners C. Family farms that purchased quality seeds from non-project partners D. Number of family farms that have benefitted from improvements in major (inter)national FNS policies/laws

Figure 3: FNS Results Framework and Indicators

Enablers	4.1	Number of farmers that adopted research results/knowledge/new technologies i) Male farmers ii) Female farmers iii) Farmers under 35 years of age	A. Number of farmers that use newly introduced seed varieties (from 2018 and later) B. Number of family farms that use newly introduced Dutch seed varieties (from 2018 and later)
	4.3	Number of FNS-relevant knowledge institutions that	A. Seed certification more efficient and accurate B. More seed varieties marketed C. Private sector organization and advocacy strengthened D. Market constraints removed and market distortions mitigated and/or minimized
	5.1	Number of jobs supported in agricultural chains/sectors i) Men ii) Women iii) Individuals under 35 years of age	A. Number of permanent jobs created i. Mobile sales agents ii. Agro-dealers iii. Seed farm laborers B. Number of temporary jobs created i. Seed farm laborers
	5.3	Number of businesses co-investing in FNS activities i) Burundian ii) International a) Dutch b) Non-Dutch	A. Number of businesses co-investing in FNS activities B. Volume of investments by businesses
Enabler	7.1	Number of improvements in major (inter)national FNS policies/laws	A. Number of improvements in major (inter)national FNS policies/laws that benefit at least hundreds of thousands of farmer households.

Based on the initial understanding of the impact areas, PSSD conducted a baseline survey in 2019. This survey consisted of data from 500 households growing maize, 511 households growing beans, and 510 households growing potato crops. Later, as part of the midterm review in 2021, households from the same baseline survey were tracked in the same season (Season A for maize and potato, Season B for beans) to assess the impact of PSSD's work in the seed sector. The results from the midterm review suggested that only a small percentage of HHs were purchasing and using certified seed from PSSD's supported seed entrepreneurs. This is the basis of the impact assessment conducted in August 2022, to verify whether seed sale figures reported by the project are accurate and if so, why was that not being captured by an external evaluator in the mid-term review?

2.3 The approach for PSSD's impact assessment and attribution methodology

After the desk review the consultant held several discussions with the PSSD project team, not just the MRL team but also the project implementation team (business advisers and specialists), to understand in detail the expected benefit or vision of impact for the different type of interventions implemented by the project. As mentioned before, the annual impact data collection exercise was to be designed based on the data needs for filling information gaps for each intervention and determining the appropriate attribution strategy for measuring impact through different stakeholders for the project. Therefore, the consultant spent a week with the PSSD staff to determine program structure and procedures, and to understand each intervention or partnership in more detail, the work that is going on per crop type (Potatoes, Maize, Beans) hearing the narrative behind previous assessments and assessing the credibility of monitoring data.

Specific activities to encourage gender and youth inclusion were found to be embedded in all the interventions planned by the project. Since, the focus of the assessment was to determine where the program was in terms of measuring impact from its respective partnerships and what more was required to fill these gaps. It was agreed that this assignment for capturing impact would be used to supplement existing monitoring and data collection efforts rather than repeating research.

Based on these discussions, it was determined that the project was clear on its work in the number of different high yielding varieties they had introduced and reported on in their annual reports. It is relatively less likely to have inaccurate information for this, as PSSD had active partnerships and a good working relationship with ONCCS and ISABU. However, when it came to information for the certified seed use and benefit for farmers the project wanted more clarity.

Hence, it was decided that for this assessment, the research effort in the field would focus on the certified seed entrepreneurs, the total volume of certified seed produced per year by these entrepreneurs that was attributable to the project, and the benefit for men and women farmers that were using certified seed sold by PSSD supported seed entrepreneurs. While the focus of the intervention was on certified seed production, the research also focused on the role of ONCCS and ISABU in facilitating PSSD's seed entrepreneurs.

A program like PSSD with a diverse portfolio of partnerships at different levels of maturity accordingly had different information needs. Institutional interventions had more data as compared to the partnerships with seed entrepreneurs, in which case we focused on triangulating evidence through different sources of information. While for the seed entrepreneur partnerships, we designed and conducted fresh research. The consultant from his experience with the implementation of DCED Results Measurement Standard and having led programs through successful audits in the past, understand the level of rigor required for data collection and analysis for credible impact reporting. There are multiple methods to assess attribution and therefore the assessment methodology could not be predefined for a program. The most appropriate attribution strategy depends on intervention logic and program context.

For PSSD's partnerships, we have seed entrepreneurs producing certified seed. The entrepreneurs supported through the partnership also develops small packets of seed, carry out demo plots to promote the certified seed and create awareness on good agriculture

practices, and distribute it through newly established sales points and agronomists. In terms of the target beneficiaries, some farmers purchase certified seed directly after learning about good practices at the demos, while others learn about good agri-practices through agronomists and purchase certified seed. Therefore, to assess the attributable impact of farmers using certified seed from PSSD partners, we spoke with farmers buying certified seed (after attending demos and without attending demos) to compare their yields and incomes from when they were not using certified seed. Also, to control for external factors such as the weather that may account for seasonal discrepancies in production, we spoke with farmers that had not attended demos or purchased certified seed from PSSD partners. This category will form the comparison group against which the yields of certified seed users will be assessed.

3. Investigative field research to assess impact for PSSD's work in the Burundian seed sector

For a project like PSSD, a traditional approach of a pre-defined baseline and endline of farmers does not work. To accurately trace attributable impact, the project needs to track changes as defined by the results chains through an investigative approach, starting from the partners (seed entrepreneurs) and then eventually tracing where are the seed entrepreneurs selling certified seed.

From the seed entrepreneur's we want to understand the following:

- How much certified seed is producing as a result of the partnership with PSSD?
- How are the seed entrepreneurs selling the certified seed and at what price?
- Are small holder male and female farmers aware of the benefits of using certified seed sold by PSSD partner seed entrepreneurs?
- How many small holder male and female farmers are buying and using certified seed from PSSD supported seed entrepreneurs?

The next step is to go from the seed entrepreneurs to their customers (small holder male and female farmers) buying and using certified seed and understand the following:

- How much certified seed did you use and what was the additional cost for using this?
- Did you change any other cultivation practices while using certified seed? What are these?
- What was the yield difference if any of using certified seed from PSSD seed entrepreneurs as compared to the seed you were using before?
- What was the benefit (increased income or consumption) from using certified seed from PSSD supported seed entrepreneurs?
- Will you use certified seed in the future? Why or why not?

Emphasis was given to make this a collaborative effort between the consultant and the PSSD project team. This ensures that the project team takes ownership of the assessment exercise and can communicate results captured to different stakeholders in the future. Guidance from the DCED Standard also suggests that project MRL and Implementation staff should collaborate on research efforts. This also underlines the limitation of engaging external

evaluators to conduct assessments through surveys for dynamic development projects with different interventions. The project's implementation staff is best fit to assess impact of its interventions through a series of in-depth interviews, designed under the specific context under which the project operates. The sampling plan for the in-depth interviews conducted under the project is given in Table 1 below:

Table 1 Sampling plan for impact assessment 2022

Respondent Type	No. of interviews	Location of Respondents	Gender
Seed Entrepreneurs			
Potato seed entrepreneurs	7	1 Bujumbura, 4 Bururi, 2 Mwaro	4 male, 3 female
Maize seed entrepreneurs	7	1 Gitega, 1 Karusi, 1 Kirundo, 2 Muyinga, 1 Rutana, 1 Bujumura (SETRACO)	4 male, 3 female
Beans seed entrepreneurs	5	1 Karusi, 1 Kirundo, 2 Muyinga, 1 Rutana	3 male, 2 female
	19		11 male, 8 female
Farmers			
Potato certified seed users	19	7 Bujumbura, 6 Bururi, 6 Mwaro	9 male, 10 female
Potato local seed users	3	2 Bururi, 1 Mwaro	1 male, 2 female
Maize certified seed users	19	3 Gitega, 3 Karusi, 5 Kirundo, 5 Muyinga, 3 Rutana	14 male, 5 female
Maize local seed users	7	2 Karusi, 2 Kirundo, 2 Muyinga, 1 Rutana	2 male, 5 female
Maize hybrid seed users	3	2 Gitega, 1 Karusi	3 male
Beans certified seed users	15	3 Karusi, 6 Kirundo, 6 Muyinga	10 male, 5 female
Beans local seed users	6	2 Karusi, 2 Kirundo, 2 Muyinga	1 male, 5 female
	72		40 male, 32 female
Public Institutions			
ONCCS	1	1 Bujumbura	
ISABU	1	1 Bujumbura	

Total Interviews	93
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A total of 93 in-depth interviews were conducted with a break down per type of respondent given in table 1 above. The respondents were purposively chosen to represent the different crops that PSSD is working in. A mixture of male and female respondents were randomly selected to get representation of the different types of target beneficiaries. The seed entrepreneurs selected for the research had been partners with PSSD for at least 1 full year to allow for sufficient time to trace impact and should be able to recall information related to their certified seed production before partnering with PSSD (was still triangulated with ONCCS). The farmers were invited at the seed entrepreneur's premises by the PSSD field staff and the seed entrepreneur agronomists, as conducting research at the farmer HH level at their farms would require special permissions from the government and would have taken at least 2 months for approvals.

3.1 Summary of findings

3.1.1. Seed Entrepreneurs

How much certified seed is being produced by seed entrepreneurs attributable to PSSD?

All PSSD partner seed entrepreneurs interviewed had been successful in producing and selling certified seed.

1) For PSSD partnering potato seed entrepreneurs (Table 2 below):

- a. The co-finance for producing certified seed was used to add additional land for multiplying basic seed and producing certified seed in addition to the existing land they had used for producing certified seed on their own before the partnership. **Hence, all the certified seed produced on the additional land is attributable to the project as it does not replace existing land used by the potato seed entrepreneurs for producing certified seed.**
- b. On average an additional 5.4 hectares of land per year was used for producing certified potato seed by multiplying basic seed per potato seed entrepreneur directly as a result of the partnership. On average 4.2 hectares of land was used for multiplying basic seed and producing certified seed by potato seed entrepreneurs on their own which is almost the same as the total land seed entrepreneurs were using before the partnership. **However, due to better agricultural practices (including proper use of fertilizer, pesticide, organic manure) and with continued guidance from the agronomist that was included in the business as a result of the partnership, the volume of certified seed produced per kg of basic seed used also improved from 5.9 kg to 8.6 kg per 1 kg of basic seed multiplied.** This leads to additional volume of certified seed produced that is attributable to PSSD not just from the additional land added to the partnership but also the existing land that was used by potato seed entrepreneurs for producing certified seed.

- c. **The volume of seed certified from the total volume of seed harvested for potato seed entrepreneurs increased from 65% before partnering with PSSD to 84% after partnering with PSSD.** This is because of better agricultural practices that were introduced to seed multiplication after the partnership and the guidance from agronomists. This is also because of the store house that was added after the partnership with PSSD that led to reduced post harvest losses.
- d. **The volume of potato seed certified per entrepreneur as a result of the partnership with PSSD is 133% more than the volume of certified potato seed produced by entrepreneurs before the partnership.**
- e. Given the increased productivity for certified seed, **the total volume of certified seed attributable to PSSD is 24% more than the certified seed supported by the partnership contracts.**

Table 2: Potato Seed Entrepreneur's production summary

Potato Seed Entrepreneur	Baseline (PSSD)	PSSD partnership	Production outside PSSD partnership	Certified Seed attributable to PSSD	Plan (next 2 years)
Average Volume of basic seed used	8,333	10,800	8,333	10,800	20,000
Average Price (FBU/kg) of basic seed	1,600	1,600	1,600	1,600	1,600
Total cost for basic seed (FBU)	13,333,333	17,280,000	13,333,333	17,280,000	32,000,000
Land used for planting basic seed (Hectare)	4.3	5.4	4.2	5.2	11.3
Total seed harvested (kg)	76,200	110,800	82,167	116,767	174,470
Total seed certified (kg)	49,333	92,600	71,500	114,767	171,481
Total seed not certified (kgs)	26,867	18,200	10,667	2,000	2,988
Selling price of certified seed (FBU/kg)	1,400	1,400	1,400	1,400	1,400
Revenue from certified seed sales	69,066,667	129,640,000	100,100,000	160,673,333	240,074,074
Certified seed produced per kg of basic seed	5.9	8.6	8.6	10.6	8.6

Additional income from selling certified seed (FBU)	55,733,333	112,360,000	86,766,667	143,393,333	-
% Certified seed sold of total production	65%	84%	87%	98%	98%
% Increase in certified seed from baseline	-	-	-	133%	-
% Increase from expected certified seed from PSSD partnership	-	-	-	24%	49%

2) For PSSD partnering maize seed entrepreneurs (Table 3 below):

- a. **The co-finance for producing certified maize seed was used to add additional land for multiplying basic seed which increased the total land used for producing certified maize seed per entrepreneur.** However, 2/3 maize seed entrepreneurs interviewed (67%) were able to increase or add land for multiplying seed for beans from the increased income of producing certified maize. **While all 3 bean seed entrepreneurs (100%) that were supported by PSSD through co-finance partnerships, were able to increase or add land for multiplying seed for maize from the increased income from producing certified beans seed.**
- b. **Hence, the additional maize seed produced by seed entrepreneurs supported for beans seed production through PSSD co-finance partnerships is also attributable to the project.**
- c. **The average land used for multiplying certified maize seed attributable to PSSD per entrepreneur is 13 hectares.** On average an 8 hectares of land per year was used for producing certified maize seed by multiplying basic seed per maize seed entrepreneur directly as a result of the partnership. On average 9 hectares of land was used for multiplying basic seed and producing certified seed by maize seed entrepreneurs on their own from the increased income from seed sales. The same seed entrepreneurs interviewed were previously multiplying seed from 4 hectares of land before partnering with PSSD. The entrepreneur using basic seed for producing hybrid maize was using 2 hectares of land.
- d. **Due to better agricultural practices (including proper use of fertilizer, pesticide, organic manure) and with continued guidance from the agronomist that was included in the business as a result of the partnership, the volume of certified maize seed produced per kg of basic seed used also improved from 68.8 kg to 208.8 kg per 1 kg of basic seed multiplied.** This means that maize seed entrepreneurs needed a smaller area of cultivation for planting the same volume of basic seed. This leads to additional volume of certified maize seed produced that is attributable to PSSD not just from the additional land added to the partnership but also the existing land that was used by maize seed entrepreneurs for producing certified

seed. For hybrid maize seed, the seed entrepreneur got 426 kg or certified hybrid maize seed per kg of basic seed.

- e. **The volume of seed certified from the total volume of seed harvested for maize seed entrepreneurs increased from 76% before partnering with PSSD to 89% after partnering with PSSD.** This is because of better agricultural practices that were introduced to seed multiplication after the partnership and the guidance from agronomists.
- f. **The volume of maize seed certified per entrepreneur as a result of the partnership with PSSD is 606% more than the volume of certified maize seed produced by entrepreneurs before the partnership.** The increase is both due to the increase in productivity from better practices and the additional land used for certified seed multiplication from increased incomes autonomously by the PSSD supported seed entrepreneurs.
- g. Given the increased productivity for certified seed, **the total volume of certified seed attributable to PSSD is 132% more than the certified seed supported by the partnership contracts.** The increase is both due to the increase in productivity from better practices and the additional land used for certified seed multiplication from increased incomes autonomously by the PSSD supported seed entrepreneurs.

Table 3: Maize Seed Entrepreneur’s production summary

Maize Seed Entrepreneurs	Baseline (Pre-PSSD)	PSSD partnership	Production outside PSSD partnership	Certified Seed attributable to PSSD	Plan (next 2 years)	Hybrid Seed PSSD partner
Volume of basic seed purchased	80	80	253	253	575	15
Price (FBU/kg) of basic seed	1,775	1,533	2,025	1,779	2,167	5,000
Total cost for basic seed (FBU)	166,875	123,333	530,000	486,458	1,275,000	75,000
Land used for planting basic seed (Hectare)	4.0	8.0	9.0	13.0	20.0	2.0
Total seed harvested (kg)	7,200	18,867	30,575	42,242	62,100	7,000
Total seed certified (kg)	5,500	16,700	27,625	38,825	56,575	6,400
Total seed not certified (kgs)	1,700	2,167	2,950	3,417	5,525	600

Selling price of certified seed (FBU/kg)	1,867	1,867	1,867	1,867	1,867	3,000
Revenue from certified seed sales	10,266,667	31,173,333	51,566,667	72,473,333	92,866,667	19,200,000
Certified seed produced per kg of basic seed	68.8	208.8	109.4	153.8	98.4	426.7
Additional income from selling certified seed (FBU)	10,099,792	31,050,000	51,036,667	71,986,875	-	19,125,000
% Certified seed sold of total production	76%	89%	90%	92%	91%	91%
% Increase in certified seed from baseline	-	-	-	606%	-	
% Increase from expected certified seed from PSSD partnership	-	-	-	132%	46%	

3) For PSSD partnering bean seed entrepreneurs (Table 4 below):

- a. **The co-finance for producing certified bean seed was used to add additional land for multiplying basic seed which increased the total land used for producing certified bean seed per entrepreneur. However, 2/3 maize seed entrepreneurs interviewed (67%) were able to increase or add land for multiplying seed for beans from the increased income of producing certified maize.** While all 3 bean seed entrepreneurs (100%) that were supported by PSSD through co-finance partnerships, were able to increase or add land for multiplying seed for maize from the increased income from producing certified beans seed.
- b. **Hence, the additional bean seed produced by seed entrepreneurs supported for maize seed production through PSSD co-finance partnerships is also attributable to the project.**
- c. **The average land used for multiplying certified bean seed attributable to PSSD per entrepreneur is 16.5 hectares.** On average 13 hectares of land per year was used for producing certified bean seed by multiplying basic seed per bean seed entrepreneur directly as a result of the partnership. On average 8.3 hectares of land was used for multiplying basic seed and producing certified seed by bean seed entrepreneurs on their own from the increased income from seed sales. The same seed entrepreneurs interviewed were previously multiplying seed from 4.8 hectares of land before partnering with PSSD.

- d. **Due to better agricultural practices (including proper use of fertilizer, pesticide, organic manure) and with continued guidance from the agronomist that was included in the business as a result of the partnership, the volume of certified bean seed produced per kg of basic seed used also improved from 16.1 kg to 21.4 kg per 1 kg of basic seed multiplied.** This leads to additional volume of certified bean seed produced that is attributable to PSSD not just from the additional land added to the partnership but also the existing land that was used by bean seed entrepreneurs for producing certified bean seed.
- e. **The volume of seed certified from the total volume of seed harvested for bean seed entrepreneurs increased from 89% before partnering with PSSD to 95% after partnering with PSSD.** This is because of better agricultural practices that were introduced to seed multiplication after the partnership and the guidance from agronomists, while also introducing new varieties which were easier to manage and get certified (bio fortified varieties)
- f. **The volume of bean seed certified per entrepreneur as a result of the partnership with PSSD is 606% more than the volume of certified bean seed produced by entrepreneurs before the partnership.** The increase is both due to the increase in productivity from better practices and the additional land used for certified seed multiplication from increased incomes autonomously by the PSSD supported seed entrepreneurs.
- g. Given the increased productivity for certified seed, **the total volume of certified seed attributable to PSSD is 327% more than the certified seed supported by the partnership contracts.** The increase is both due to the increase in productivity from better practices, high yielding varieties, and the additional land used for certified seed multiplication from increased incomes autonomously by the PSSD supported seed entrepreneurs.

Table 4: Bean Seed Entrepreneur's production summary

Bean Seed Entrepreneurs	Baseline (Pre-PSSD)	PSSD partnership	Production outside PSSD partnership	Certified Seed attributable to PSSD	Plan (next 2 years)
Volume of basic seed purchased	374	980	717	1,323	3,067
Price (FBU/kg) of basic seed	1,800	1,950	1,950	1,950	1,950
Total cost for basic seed (FBU)	673,200	1,911,000	1,397,500	2,635,300	5,980,000
Land used for planting basic seed (Hectare)	4.8	13.0	8.3	16.5	35.0
Total seed harvested (kg)	6,772	22,210	12,223	27,661	55,525

Total seed certified (kg)	6,020	21,000	10,750	25,730	46,000
Total seed not certified (kgs)	752	1,210	1,473	1,931	9,525
Selling price of certified seed (FBU/kg)	1,760	1,760	1,760	1,760	1,760
Revenue from certified seed sales	10,595,200	36,960,000	18,920,000	45,284,800	80,960,000
Certified seed produced per kg of basic seed	16.1	21.4	15.0	19.5	15.0
Additional income from selling certified seed (FBU)	9,922,000	35,049,000	17,522,500	42,649,500	-
% Certified seed sold of total production	89%	95%	88%	93%	83%
% Increase in certified seed from baseline	-	-	-	327%	-
%Increase from expected certified seed from PSSD partnership	-	-	-	23%	79%

Certified seed sales and prices

From seed entrepreneurs producing certified seed: 2/7 (29%) of the potato certified seed producers, 2/5 (40%) of the bean certified seed producers, and 1/6 (17%) of the maize certified seed producers suggested that they were unable to sell all the certified seed that they had produced before signing a partnership with PSSD. **Whereas after a partnership with PSSD while they were producing much larger quantities of certified seed, they were still able to successfully sell all the certified seed that they produced.**

This was primarily because of the access to certified seed for farmers through the newly established sales points. Previously all seed entrepreneurs were selling their seed from their production sites which was sometimes not as convenient to access for some farmers. Small holder farmers were now easily able to purchase certified seed that was available through the sales point established by the seed entrepreneurs in close proximity to their farms.

From seed entrepreneurs producing certified seed: 1/7 (14%) of the potato certified seed producers, 2/5 (40%) of the bean certified seed producers, and 2/6 (33%) of the maize certified seed producers increased the number of sale points in addition to the sale point(s) that were supported through the PSSD partnership. The sales points did not

replace any of the previous sales points established through the PSSD partnership. These new sales points were established just like the ones supported through the partnership with a manager/sales supervisor and with regular visits from the seed entrepreneur's agronomist.

For potato seed entrepreneurs, the cost of basic seed per certified seed was consistent at FBU 1,600/kg and the selling price of certified seed was also consistent at FBU 1,400/kg. The potato seed entrepreneurs suggested that this was a set price from the government, and they were not allowed to change this price even if though there was a high demand of certified seed. **For maize seed entrepreneurs, the cost of basic seed and the selling price of certified seed varied per year.** Maize is primarily grown in season A. The cost of basic seed was on average FBU 1,600/kg in season A as compared to FBU 2,000/kg in season B. Similarly, the selling price of certified maize seed was FBU 2,000/kg in season A as compared to around FBU 2,500/kg in season B. **The cost of basic seed for hybrid maize was FBU 5,000/kg in season A and the selling price of certified hybrid maize seed was FBU 3,000/kg.** For bean seed entrepreneurs, **the cost of basic seed and the selling price of certified seed varied per year primarily depending on the variety of beans** (bio-fortified high yielding varieties popular among farmers). The cost of basic seed varied from 1,600/kg to 2,200/kg. Similarly, the selling price of certified bean seed varied from 1,600/kg to 1,800/kg.

Awareness of using certified seed sale among small holder male and female farmers

PSSD's work with seed entrepreneurs has been able to increase the availability of certified seed for small holder male and female farmers, while also increased the access to information on the benefits of using certified seed sales. Seed entrepreneurs engaged in producing certified seed for potatoes, maize (OPV or Hybrid), and beans were successful in selling all the seed that was certified by ONCCS. Most of the seed entrepreneurs (across crops) claimed that the demand for their certified seed from their customers was much higher than what they were currently producing, and that is why they were planning to increase certified seed production in the future by sourcing increased volume of basic seed and increasing land for cultivation. Seed entrepreneurs did not find it difficult to increase land for seed multiplication. Most entrepreneurs already owned land that was previously underutilized while practicing crop rotation. Other entrepreneurs that did not have additional land on their own claimed that they could easily rent additional land if needed.

The seed entrepreneurs claimed that the increased awareness among farmers about the benefits of using certified seed was due to the different activities under the PSSD partnership. Such as establishing demos, field visits and follow ups from agronomists, promotional activities (disbursing flyers, brochures, megaphone messaging etc.), and the increased sales points that were established after the partnership with PSSD.

1/7 (14%) potato seed entrepreneurs increased the number of demo plots in addition to the number of demo plots that were supported through the PSSD partnership. This potato seed entrepreneur established 80 additional demo plots in addition to the 40 demo plots that were supported through the PSSD partnership. The additional demo plots were established in nearby provinces, with the plan for establishing additional sales points around the demo sites to cater to farmers from nearby regions. The maize and bean seed entrepreneurs did not plan to increase the number of demo plots yet, as they have had no challenge in selling all the certified seed that they are producing. As their production of certified

maize and bean seed increases in the future, they may establish additional demo plots to push sales if required.

Customers buying certified seed from PSSD supported seed entrepreneurs

The average number of clients per year per type of average seed entrepreneur and their current production is given in table 5 below. Note: This does take into account discounting repeat customers in a year

Table 5: Average number of customers per average type of certified seed entrepreneur

Type of Entrepreneur	Total	Male	Female	Male %	Female %
Potato Seed Entrepreneur	1,201	427	775	36%	64%
Bean Seed Entrepreneur	3,333	1,012	2,321	30%	70%
Maize Seed Entrepreneur	4,538	2,105	2,433	46%	54%
Hybrid Maize Entrepreneur	3,206	1,112	2,094	35%	65%

The total number of female customers as compared to the total number of male customers was higher for all types of seed entrepreneurs. The research probed this further as this was different to the information that PSSD has been collecting from the entrepreneurs and reporting in their dashboard. **The reason for the inconsistency was because female customers often sign off with the name of a male member of their household when they have been registering with the seed entrepreneurs.** All seed entrepreneurs emphasized that it is easily visible that they have more female clients as compared to men on the ground.

Most of the certified seed produced was going to individual small holder farmers. For potato seed entrepreneurs only 2/7 (28%) respondents were selling certified seed to cooperatives or large farmer groups, selling on average 9% of seed to cooperatives with an average of 87 farm members. For maize seed entrepreneurs only 2/6 (33%) respondents were selling certified maize seed to cooperatives or large farmer groups, selling on average 27% of seed to cooperatives with an average of 313 farm members. For bean seed entrepreneurs only 2/5 (40%) respondents were selling certified bean seed to cooperatives or large farmer groups, selling on average 18% of certified seed to cooperatives with an average of 175 farm members.

3.1.2. Farmers using certified seed

The sampling breakdown for farmers using certified seed or local seed (for control farmers) is given in table 6,7,8, and 9 below:

Table 6: Sampling breakdown for potato farmers (total interviewed 22)

Age	Gender	Location	Category
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Potato farmers	Youth	Non-youth	Male	Female	Bujumbura	Bururi	Mwaro	Treatment	Comparison
%	23%	77%	45%	55%	32%	36%	32%	86%	59%
Total	5	17	10	12	7	8	7	19	13

Table 7: Sampling breakdown for maize farmers

Maize farmers	Age		Gender		Location				Category		
	Youth	Non-youth	Male	Female	Gitega	Karusi	Kirundo	Muyinga	Rutana	Treatment	Comparison
%	31%	69%	62%	38%	12%	19%	27%	27%	15%	73%	27%
Total	8	18	16	10	3	5	7	7	4	19	7

Table 8: Sampling breakdown for beans farmers

Beans farmers	Age		Gender		Location			Category	
	Youth	Non-youth	Male	Female	Karusi	Kirundo	Muyinga	Treatment	Comparison
%	29%	71%	52%	48%	24%	38%	38%	71%	29%
Total	6	15	11	10	5	8	8	15	6

Table 9: Sampling breakdown for hybrid maize farmers

Hybrid Maize farmers	Age		Gender		Location		Category	
	Youth	Non-youth	Male	Female	Gitega	Karusi	Treatment	Comparison
%	33%	67%	100%	0%	67%	33%	100%	0%
Total	1	2	3	0	2	1	3	0

Farmers using certified seed as compared to local seed

1) For Potato Farmers

A baseline was retrospectively constructed to assess the use and benefit of using certified seed instead of local seed. This was based on information collected from potato farmers that had never used PSSD supported certified seed and through a recall from farmers who had recently started using PSSD supported certified seed (Table 10).

It was found that the volume of local seed used per farmer and the area of cultivation was roughly the same for farmers that had never used certified seed before with farmers that had recently (within 3 seasons) switched to using certified seed and were previously using local seed. Information was collected for 2 seasons in a year to account for any variances due to external factors such as the weather.

On average farmers used 47 kg of local potato seed for 0.05 hectares of land at an average cost of FBU 1,169/kg. The average yield for potato farmers using local seed was 130 kgs out of which around 70% was sold in the market while the remaining 30% was either retained for seed use next year or for HH consumption. Farmers using local seed often had poor agricultural practices such as broad spreading of seed, not preparing the land properly (spacing of seed), not using the right amount of fertilizer, or timely use of pesticides. The use of urea and some fertilizer was common among such farmers.

Both women and men grew potato on similar land sizes with similar yields, while women used slightly higher volumes of local seed. Women also retained a larger quantity of potato for using as seed in the next season as compared to men. The selling price of potato varied per region with the highest price in Bururi and the lowest price in Mwaro. On average the selling price per kg of potato sold was FBU 766.

Table 10: Baseline Production figures for potato farmers using local seed

	Volume of seed used (kg)	Cost per kg of seed (FBU)	Land planted (Hectares)	Average cost for seed (FBU)	Potato Yield (kgs)	Volume sold (kgs)	Selling price /kg	Total revenue from potato sales (FBU)	Volume for HH consumption or recycled seed	% Sold	Potential Revenue from total yield
Overall	47	1,169	0.05	55,335	130	91	766	69,335	40	70%	99,762
Bujumbura	60	1,300	0.05	78,000	177	135	700	94,500	42	76%	123,667
Bururi	25	1,131	0.02	28,564	51	11	956	10,246	41	21%	49,008
Mwaro	62	1,100	0.09	67,886	181	132	604	79,938	49	73%	109,289
Men	40	1,115	0.06	44,935	130	106	688	72,584	25	81%	89,440
Women	54	1,218	0.05	65,450	131	76	836	63,229	55	58%	109,183

In comparison (Table 11), on average farmers used 147 kg (increase of 210% from baseline) of certified potato seed for 0.08 hectares of land (increase of 55% from baseline) at an average cost of FBU 1,400/kg (increase of 20% from baseline). This is consistent with what was found from the interviews with seed entrepreneurs, i.e., potato farmers have increased the volume of seed that they use while also increasing the land for potato cultivation. **The average yield for potato farmers using certified seed was 1,197 kgs out of which around 83% was sold in the market while the remaining 17% was used for HH consumption.** Farmers using certified seed had improved agricultural practices which they had either learnt from participating in demos or from the guidance of PSSD supported seed entrepreneur's agronomist. **On average, male users purchased a larger volume of seed (181 kg) as compared to female users (117 kg) and cultivated potato on a relatively larger plot of land (0.10 hectares compared to 0.07 hectares).** By using certified seed, both men and women sell a high percentage of their total produce in the market either directly or by selling through agro dealers who purchased potato directly from the farmlands.

The additional cost of production for farmers using certified seed was the price difference in seed, the cost of additional labor required for harvest, and the cost of pesticide. However, the cost of pesticide and labor was spread across different crops that farmers were cultivating.

The average yield for farmers using certified seed was 1,197 kgs as compared to only 130 kgs at baseline (818% increase). This is not just because of certified seed but also because of better practices. The average additional cost of practices and certified seed was found to be 38% of the total revenue from potential potato sales. Hence, the average potential income for a farmer using certified seed and improved agricultural practices is FBU 669,613 (Potential revenue x 62%) as compared to a farmer using local seed at baseline per hectare FBU 44,819.

For PSSD to assess the impact of farmers using certified seed, they will first need to increase the total volume of certified seed attributable to the project by adjusting the potato certified seed calculated directly from the contracts by 24% (as explained above). Using the volume of certified seed and the average volume of certified seed per farmer (147 kgs), an estimate for the total number of farmers can be calculated that can later be triangulated with the total number of customers provided by the seed entrepreneurs. Similarly, the same averages can then be applied to get a break down of farmers per region.

Table 11: PSSD Assessment production figures for potato farmers using certified potato seed

	Volume of seed used (kg)	Cost per kg of seed (FBU)	Land planted (Hectares)	Average cost for seed (FBU)	Potato Yield (kgs)	Volume sold (kgs)	Selling price /kg	Total revenue from potato sales (FBU)	Volume for HH consumption or recycled seed	% Sold	Potential Revenue from total yield
Overall	147	1,400	0.08	205,726	1,197	994	903	897,263	202	83%	1,080,022
	210%	20%	55%		818%	998%	18%		410%		
Bujumbura	219	1,400	0.11	306,000	1,790	1,606	871	1,399,265	184	90%	1,559,857
	264%	8%	131%		913%	1089%	24%		342%		
Bururi	61	1,400	0.05	85,167	765	590	1150	677,925	175	77%	879,175
	141%	24%	133%		1392%	5402%	20%		332%		
Mwaro	150	1,400	0.08	209,300	936	685	692	473,792	251	73%	647,515
	142%	27%	-15%		418%	418%	14%		417%		
Men	181	1,400	0.10	253,089	1513	1316	939	1,235,891	197	87%	1,420,435
Women	117	1,400	0.07	163,100	912	704	870	612,480	208	77%	793,266

Comparing the impact of certified seed and practices from the same unit of land (1 hectare) to the use of local seed and following baseline practices, on average farmers used 1,801 kg of certified seed as compared to 900 kg of local seed (increase of 100% from baseline) for 1 hectares of land at an average cost of FBU 1,400/kg of certified seed (increase of 20% from baseline) as compared to FBU 1,169/kg for local seed.

The average yield for farmers using certified seed was 14,667 kgs as compared to 2,476 kgs at baseline (492% increase). This is not just because of certified seed but also because of better practices. The average additional cost of practices and certified seed was found to be 38% of the total revenue from potential potato sales. Hence, the average potential income per hectare for a farmer using certified seed and improved agricultural practices is **FBU 8,472,950 (Potential revenue x 62%)** as compared to a farmer using local seed at baseline per hectare **FBU 844,308**.

The per hectare is only for comparison purposes to indicate the difference good seed and practices can have from the same amount of land. The increase in the volume of certified seed used for the same amount of land demonstrates that farmers were using low quality local seed in a relatively smaller quantity as well. The increase in yields is because of both using a higher quantity of seed and a higher quality of seed (certified).

Table 12: Baseline potato farmer's average production per hectare

	Volume of seed used (kg)	Cost per kg of seed (FBU)	Land planted (Hectares)	Average cost for seed (FBU)	Potato Yield (kgs)	Volume sold (kgs)	Selling price /kg	Total revenue from potato sales (FBU)	Volume for HH consumption or recycled seed	% Sold	Potential Revenue from total yield
Overall	900	1,169	1	1,051,614	2,476	1,721	766	1,317,687	755	70%	1,895,922
Bujumbura	1,220	1,300	1	1,586,441	3,593	2,746	700	1,922,034	847	76%	2,515,254
Bururi	1,263	1,131	1	1,428,203	2,563	536	956	512,277	2027	21%	2,450,391
Mwaro	665	1,100	1	731,077	1,948	1,425	604	860,875	523	73%	1,176,963
Men	713	1,115	1	795,301	2,301	1,867.26	688	1,284,673	434	81%	1,583,009
Women	1,094	1,218	1	1,333,232	2,659	1,540.00	836.363636	1,288,000	1119	58%	2,224,108

Table 13: Certified seed using potato farmer's average production per hectare

	Volume of seed used (kg)	Cost per kg of seed (FBU)	Land planted (Hectares)	Average cost for seed (FBU)	Potato Yield (kgs)	Volume sold (kgs)	Selling price /kg	Total revenue from potato sales (FBU)	Volume for HH consumption or recycled seed	% Sold	Potential Revenue from total yield
Overall	1,801	1,400	1	2,521,806	14,667	12,185	903	10,998,711	2482	83%	13,238,985
Bujumbura	1,925	1,400	1	2,694,340	15,761	14,138	871	12,320,575	1623	90%	13,734,591
Bururi	1,304	1,400	1	1,825,000	16,382	12,632	1150	14,526,964	3750	77%	18,839,464
Mwaro	1,888	1,400	1	2,643,789	11,825	8,653	692	5,984,737	3173	73%	8,179,140
Men	1,892	1,400	1	2,648,605	15,833	13,776	939	12,933,740	2,057	87%	14,865,013
Women	1,688	1,400	1	2,363,768	13,214	10,203	870	8,876,522	3,012	77%	11,496,609

Of the total potato farmers interviewed (22): 8 potato farmers (36%) had learnt of certified seed and good agricultural practices by setting up demo plots on their own land for the PSSD supported seed entrepreneurs, 11 potato farmers (50%) learnt about certified seed and good agricultural practices through seed entrepreneurs' agronomist and by visiting demo plots, while 3 potato farmers (14%) had never attended a demo plot or used certified seed.

As summarized in table 14 and 15, **Demo Farmers using certified seed and following good agricultural practices had an average yield of 187 kgs as compared to 72 kgs for Demo farmers using local seed and following good agricultural practices. (An increase of 160% attributed to certified seed only).**

Demo Farmers using local seed and following good agricultural practices had better yields/hectare (7,186 kg/hectare) than baseline yields/hectare (2,476 kg/hectare) for farmers. (An increase of 190% attributed to practices only if local seed quality is the same)

The average yield/hectare for demo farmers using certified seed and practices was found to be the highest at 18,700 kg/hectare, followed by farmers using certified seed and following good practices on their own at 14,667 kg/hectare, followed by demo farmers using local seed and demo practices at 7,186 kg/hectare , and finally the lowest yields were found to be at baseline when farmers used local seed and did not know of best practices at 2,476 kg/hectare.

Yield per hectare scale per type of farmer:

Demo farmer using certified seed > Farmer using certified seed after learning about good agri practices > Demo farmer using local seed > Baseline farmer using local seed

This does not necessarily mean that farmers were unable to follow the practices as they were taught during the demos, but because they had much smaller lands dedicated for demos which are easy to manage and supervise.

Table 14: Potato demo with local seed and good agricultural practices

	Volume of seed used (kg)	Cost per kg of seed (FBU)	Land planted (Hectares)	Average cost for seed (FBU)	Potato Yield (kgs)	Volume sold (kgs)	Selling price /kg	Total revenue from potato sales (FBU)	Volume for HH consumption or recycled seed	%Sold	Potential Revenue from total yield
Overall	16	979	0.01	15,378	72	72	879	63,132	0	100%	63,132
Bujumbura	18	1,167	0.01	21,389	106	106	850	89,817	0	100%	89,817
Bunuri	13	1,000	0.02	12,500	48	48	1000	47,500	0	100%	47,500
Mwaro	15	675	0.01	10,125	46	46	800	36,400	0	100%	36,400
Men	15	867	0.01	13,000	61	61	867	52,578	0	100%	52,578
Women	16	1,063	0.01	17,266	80	80	888	71,222	0	100%	71,222

Table 15: Potato demo with certified seed and good agricultural practices

	Volume of seed used (kg)	Cost per kg of seed (FBU)	Land planted (Hectares)	Average cost for seed (FBU)	Potato Yield (kgs)	Volume sold (kgs)	Selling price /kg	Total revenue from potato sales (FBU)	Volume for HH consumption or recycled seed	%Sold	Potential Revenue from total yield
Overall	16	1,400	0.01	23,000	187	163	971	158,759	24	87%	181,657
Bujumbura	18	1,400	0.01	25,667	193	183	933	171,111	10	95%	180,444
Bunuri	15	1,400	0.02	21,000	252	200	1200	240,000	52	79%	302,400
Mwaro	15	1,400	0.01	21,000	113	97	800	77,600	16	86%	90,000
Men	17	1,400	0.01	23,333	160	142	1000	141,667	18	89%	159,667
Women	16	1,400	0.01	22,750	208	180	950	170,763	28	87%	197,125

2) For Maize farmers

A baseline was retrospectively constructed to assess the use and benefit of using certified seed instead of local seed. This was based on information collected from maize farmers that had never used PSSD supported certified seed and through a recall from farmers who had recently started using PSSD supported certified seed (Table 16).

It was found that the volume of local seed used per farmer and the area of cultivation was roughly the same for farmers that had never used certified seed before with farmers that had recently (within 2 seasons) switched to using certified seed and were previously using local seed. Information was collected for 2 seasons in a year to account for any variances due to external factors such as the weather. Any anomalies drastically different due to a different season or where farmers were unable to remember previous information were removed from the sample. Maize was primarily grown for one season in a year (Season A).

On average farmers used 4 kg of local maize seed for 0.2 hectares of land at an average cost of FBU 1,004/kg. The average yield for maize farmers using local seed was 73 kgs out of which only 17% was sold in the market while the remaining 83% was used for HH consumption. Farmers using local seed often had poor agricultural practices such as improper spacing of seed while planting, not preparing the land properly (spacing of seed), not using the right amount of fertilizer, or timely use of pesticides. The use of urea and some fertilizer was common among such farmers but not in appropriate quantities.

Women grew maize on 0.16 hectares of land on average using 2 kgs of maize seed, while men grew maize on 0.22 hectare of land on average using 5 kg of maize seed. Women had an average yield of 28 kgs while men had an average yield of 100 kgs. Women also sold a smaller quantity of their total produce as compared to men, which is expected as the yields were found to be really low.

The selling price of maize varied per region with the highest price found in Kirundo and the lowest price in Gitega. On average the selling price per kg of maize sold was FBU 1,035

Table 16: Baseline Production figures for maize farmers using local seed

	Volume of seed used (kg)	Cost per kg of seed (FBU)	Land planted (Hectares)	Average cost for seed (FBU)	Maize Yield (kgs)	Volume sold (kgs)	Selling price /kg	Total revenue from maize sales (FBU)	Volume for HH consumption or recycled seed	% Sold	Potential Revenue from total yield
Overall	4	1,004	0.20	4,189	73	12	1035	12,415	61	17%	75,010
Gitega	4	733	0.10	2,933	127	-	867	-	127	0%	109,778
Karusi	6	1,300	0.19	7,540	72	20	1060	21,200	52	28%	75,896
Kirundo	3	1,029	0.13	3,086	66	17	1214	21,163	48	26%	79,969
Muyinga	3	886	0.28	2,720	59	3	943	2,694	57	5%	56,033
Rutana	6	1,000	0.24	6,250	68	18	975	17,063	50	26%	65,813
Men	5	500	0.22	2,672	100.5	18	1,019	18,465	82	18%	102,384
Women	2	910	0.16	2,093	28	2	1060	2332	26	8%	29,362

In comparison (Table 17), on average farmers used 5.4 kg (increase of 31% from baseline) of certified maize seed for 0.23 hectares of land (increase of 16% from baseline) at an average cost of FBU 1,863/kg (increase of 86% from baseline). This is consistent with what was found from the interviews with seed entrepreneurs, i.e., maize farmers have increased the volume of seed that they use while also increasing the land for maize cultivation. **The average yield for maize farmers using certified seed was 463 kgs out of which around 78% was sold in the market while the remaining 22% was used for HH consumption.** Farmers using certified seed had improved agricultural practices which they had either learnt from participating in demos or from the guidance of PSSD supported seed entrepreneur's agronomist. **On average, male users purchased a larger volume of seed (6 kg) as compared to female users (3 kg) and cultivated maize on a relatively larger plot of land (0.24 hectares compared to 0.18 hectares).** By using certified seed, both men and women sell a high percentage of their total produce in the market either directly or by selling through agro dealers who purchased maize directly from the farmlands. At baseline, the yield was so low that most farmers cultivated maize for their own consumption.

The additional cost of production for farmers using certified seed was the price difference in seed, the cost of additional labor required for harvest, and the cost of pesticide. However, the cost of pesticide and labor was spread across different crops that farmers were cultivating.

The average yield for farmers using certified seed was 463 kgs as compared to only 73 kgs at baseline (539% increase). This is not just because of certified seed but also because of better practices. The average additional cost of practices and certified seed was found to be 27% of the total revenue from potential maize sales. Hence, the average potential income for a farmer using certified maize seed and improved agricultural practices is FBU 419,358 (Potential revenue x 73%) as compared to a farmer using local seed at baseline per hectare FBU 70,820

For PSSD to assess the impact of farmers using certified seed, they will first need to increase the total volume of certified seed attributable to the project by adjusting the maize certified seed calculated directly from the contracts by 132% (as explained above). Using the volume of certified seed and the average volume of certified seed per farmer (5.4 kgs), an estimate for the total number of farmers can be calculated that can later be triangulated with the total number of customers provided by the seed entrepreneurs. Similarly, the same averages can then be applied to get a break down of farmers per region.

Table 17: PSSD Assessment production figures for maize farmers using certified seed

	Volume of seed used (kg)	Cost per kg of seed (FBU)	Land planted (Hectares)	Average cost for seed (FBU)	Maize Yield (kgs)	Volume sold (kgs)	Selling price /kg	Total revenue from maize sales (FBU)	Volume for HH consumption or recycled seed	% Sold	Potential Revenue from total yield
Overall	5.4	1,863	0.23	10,149	463	362	1239	448,168	102	78%	574,463
	31%	86%	16%		539%	2913%	20%		68%		
Gitega	3.3	1,867	0.12	6,222	349	183	1067	195,556	165	53%	371,911
	-17%	155%	20%		175%		23%		31%		
Karusi	10.0	1,667	0.29	16,667	950	900	1800	1,620,000	50	95%	1,710,000
	72%	28%	51%		1227%	4400%	70%		-3%		
Kirundo	3	2,000	0.17	6,200	376	326	1520	495,520	50	87%	571,520
	3%	94%	29%		471%	1770%	25%		3%		
Muyinga	7	1,960	0.35	14,112	540	380	890	338,200	160	70%	480,600
	134%	121%	26%		809%	13200%	-6%		183%		
Rutana	4.0	1,667	0.16	6,667	110	30	967	29,000	80	27%	106,333
	-36%	67%	-34%		63%	71%	-1%		60%		
Men	6	1,829	0.24	11,624	525	410	1,168	478,821	115	78%	613,125
Women	3	1,960	0.18	5,684	291	226	1440	325440	65	78%	419,328

Comparing the impact of certified seed and practices from the same unit of land (1 hectare) to the use of local seed and following baseline practices, on average farmers used 24 kg of certified seed as compared to 21 kg of local seed (increase of 13% from baseline) for 1 hectares of land at an average cost of FBU 1,863/kg of certified seed (increase of 86% from baseline) as compared to FBU 1,004/kg for local seed.

The average yield for farmers using certified seed was 2,039 kgs as compared to 369 kgs at baseline (452% increase). This is not just because of certified seed but also because of better practices. The average additional cost of practices and certified seed was found to be 27% of the total revenue from potential potato sales. Hence, the average potential income per hectare for a farmer using certified seed and improved agricultural practices is **FBU 1,844,542 (Potential revenue x 73%)** as compared to a farmer using local seed at baseline per hectare **FBU 278,934**.

The per hectare is only for comparison purposes to indicate the difference good seed and practices can have from the same amount of land. The increase in the volume of certified seed used for the same amount of land demonstrates that farmers were using low quality local seed in a relatively smaller quantity as well. The increase in yields is because of both using a higher quantity of seed and a higher quality of seed (certified).

Table 18: Baseline maize farmer's average production per hectare

	Volume of seed used (kg)	Cost per kg of seed (FBU)	Land planted (Hectares)	Average cost for seed (FBU)	Maize Yield (kgs)	Volume sold (kgs)	Selling price /kg	Total revenue from maize sales (FBU)	Volume for HH consumption or recycled seed	% Sold	Potential Revenue from total yield
Overall	21	1,004	1	21,340	369	61	1035	63,245	308	17%	382,102
Gitega	40	733	1	29,333	1,267	-	867	-	1267	0%	1,097,778
Karusi	30	1,300	1	39,271	373	104	1060	110,417	269	28%	395,292
Kirundo	23	1,029	1	23,632	504	133	1214	162,082	371	26%	612,457
Muyinga	11	886	1	9,666	211	10	943	9,572	201	5%	199,101
Rutana	26	1,000	1	26,042	281	73	975	71,094	208	26%	274,219
Men	24	500	1	12,232	460	82.98	1018.75	84,531	377	18%	468,712
Women	14	910	1	13,008	172	13.67	1060	14,493	158	8%	182,486

Table 19: Certified seed using maize farmer's average production per hectare

	Volume of seed used (kg)	Cost per kg of seed (FBU)	Land planted (Hectares)	Average cost for seed (FBU)	Maize Yield (kgs)	Volume sold (kgs)	Selling price /kg	Total revenue from maize sales (FBU)	Volume for HH consumption or recycled seed	% Sold	Potential Revenue from total yield
Overall	24	1,863	1	44,642	2,039	1,590	1239	1,971,260	448	78%	2,526,770
	13%	86%			452%	2502%	20%		45%		
Gitega	28	1,867	1	51,852	2,906	1,528	1067	1,629,630	1378	53%	3,099,259
	-31%	155%			129%	1	23%		9%		
Karusi	35	1,667	1	57,604	3,283	3,111	1800	5,599,078	173	95%	5,910,138
	14%	28%			780%	2886%	70%		-36%		
Kirundo	18	2,000	1	36,686	2,225	1,929	1520	2,932,071	296	87%	3,381,775
	-20%	94%			341%	1345%	25%		-20%		
Muyinga	20	1,960	1	39,864	1,525	1,073	890	955,367	452	70%	1,357,627
	86%	121%			622%	10473%	-6%		125%		
Rutana	25	1,667	1	41,958	692	189	967	182,517	503	27%	669,231
	-3%	67%			146%	159%	-1%		142%		
Men	26	1,829	1	47,590	2,149	1,679	1168	1,960,279	471	78%	2,510,113
Women	16	1,960	1	31,578	1,618	1,256	1440	1,808,000	362	78%	2,329,600

Of the total maize farmers interviewed (26): 7 maize farmers (27%) had learnt of certified seed and good agricultural practices by setting up demo plots on their own land for the PSSD supported seed entrepreneurs, 12 maize farmers (50%) learnt about certified seed and good agricultural practices through seed entrepreneurs' agronomist and by visiting demo plots, while 7 maize farmers (27%) had never attended a demo plot or used certified seed.

As summarized in table 20 and 21, **Demo Farmers using certified seed and following good agricultural practices had an average yield of 45 kgs as compared to 18 kgs for Demo farmers using local seed and following good agricultural practices. (An increase of 149% attributed to certified seed only).**

Demo Farmers using local seed and following good agricultural practices had better yields/hectare (1,453 kg/hectare) than baseline yields/hectare (369 kg/hectare) for farmers. (An increase of 294% attributed to practices only if local seed quality is the same)

The average yield/hectare for demo farmers using certified seed and practices was found to be the highest at 3,613 kg/hectare, followed by farmers using certified seed and following good practices on their own at 2,039kg/hectare, followed by demo farmers using local seed and demo practices at 1,453 kg/hectare , and finally the lowest yields were found to be at baseline when farmers used local seed and did not know of best practices at 369 kg/hectare.

Yield per hectare scale per type of farmer:

Demo farmer using certified seed > Farmer using certified seed after learning about good agri practices > Demo farmer using local seed > Baseline farmer using local seed

This does not necessarily mean that farmers were unable to follow the practices as they were taught during the demos, but because they had much smaller lands dedicated for demos which are easy to manage and supervise.

Hybrid maize seed:

The average yield per hectare for maize farmers using hybrid seed on their own an following good agriculture practices was found to be 3,364 kg/hectare using 19 kg of basic hybrid seed at an average cost of FBU 3,133. The sample for hybrid maize seed users was low (3 respondents) and the yields in Karusi were found to be low (3,240 kg/hectare) due to unfavorable weather conditions, while in Gitega the average yield for hybrid maize users was 11,800kg/hectare. Farmers who have tried hybrid maize seed want to use it in the future as they believe the yields were much higher than what they would have received from using OPV maize seed.

Table 20: Maize demo with local seed and good agricultural practices

	Volume of seed used (kg)	Cost per kg of seed (FBU)	Land planted (Hectares)	Average cost for seed (FBU)	Maize Yield (kgs)	Volume sold (kgs)	Selling price /kg	Total revenue from maize sales (FBU)	Volume for HH consumption or recycled seed	%Sold	Potential Revenue from total yield
Overall	0.8	800	0.01	633	18	-	2000	-	18	0%	36,333
Gitega	0.4	800	0.01	300	27	-	2000	-	27	0%	53,000
Karusi	1.0	800	0.02	800	14	-	2000	-	14	0%	27,333
Rutana	1.0	800	0.01	800	15	-	2000	-	15	0%	30,000
Men	0.8	800	0.01	633	18.	-	2,000	-	18	0%	36,333

Table 21: Maize demo with certified seed and good agricultural practices

	Volume of seed used (kg)	Cost per kg of seed (FBU)	Land planted (Hectares)	Average cost for seed (FBU)	Maize Yield (kgs)	Volume sold (kgs)	Selling price /kg	Total revenue from maize sales (FBU)	Volume for HH consumption or recycled seed	%Sold	Potential Revenue from total yield
Overall	0.8	1,500	0.01	1,188	45	13	2000	25,000	33	28%	90,333
Bujumbura	0.4	1,500	0.01	563	39	-	2000	-	39	0%	78,000
Bunuri	1.0	1,500	0.02	1,500	48	25	2000	50,000	23	52%	95,333
Mwaro	1.0	1,500	0.01	1,500	50	-	2000	-	50	0%	100,000
Men	0.8	1,500	0.01	1,188	45	13	2,000	25,000	33	28%	90,333

3) Beans Farmers

A baseline was retrospectively constructed to assess the use and benefit of using certified seed instead of local seed. This was based on information collected from bean farmers that had never used PSSD supported certified seed and through a recall from farmers who had recently started using PSSD supported certified seed (Table 22).

It was found that the volume of local seed used per farmer and the area of cultivation was roughly the same for farmers that had never used certified seed before with farmers that had recently (within 2 seasons) switched to using certified seed and were previously using local seed. Information was collected for 2 seasons in a year to account for any variances due to external factors such as the weather. Any anomalies drastically different due to a different season or where farmers were unable to remember previous information were removed from the sample. Beans were primarily grown in season B but most farmers grew it for 2 seasons in a year.

On average farmers used 21 kg of local bean seed for 0.16 hectares of land at an average cost of FBU 1,076/kg. The average yield for bean farmers using local seed was 78 kgs out of which only 40% was sold in the market while the remaining 60% was used for HH consumption. Farmers using local seed often had poor agricultural practices such as improper spacing of seed while planting, not preparing the land properly (spacing of seed), not using the right amount of fertilizer, or timely use of pesticides. The use of urea and some fertilizer was common among such farmers but not in appropriate quantities. The bean varieties grown during baseline were also less nutritious as compared to the bio fortified varieties introduced by PSSD later. However, farmers only cared about the yield when it came to choosing the variety to grow.

Women grew beans on 0.12 hectares of land on average using 14 kgs of bean seed, while men grew beans on 0.19 hectare of land on average using 26 kg of bean seed. Women had an average yield of 46 kgs while men had an average yield of 107 kgs. Women also sold a smaller quantity of their total produce as compared to men, which is expected as the yields were found to be low.

The selling price of bean varied per region with the highest price found in Kirundo and the lowest price in Muyinga. On average the selling price per kg of bean sold was FBU 1,050 per kg.

Table 22: Baseline Production figures for bean farmers using local seed

	Volume of seed used (kg)	Cost per kg of seed (FBU)	Land planted (Hectares)	Average cost for seed (FBU)	Bean Yield (kgs)	Volume sold (Kgs)	Selling price /kg	Total revenue from bean sales (FBU)	Volume for HH consumption or recycled seed	% Sold	Potential Revenue from total yield
Overall	21	1,076	0.16	22,223	78	31	1050	33,000	47	40%	82,100
Karusi	11	1,080	0.08	11,880	102	84	1,040	87,360	18	82%	106,080
Kirundo	11	1,188	0.15	13,508	54	12.50	1,306	16,328	42	23%	71,027
Muyinga	35	963	0.21	33,327	87	17.50	800	14,000	70	20%	69,700
Male	26	1109	0.19	28,736	107	51	1055	53,686	57	47%	113,316
Female	14	1040	0.12	14,352	46	10	1045	10,450	36	22%	48,070

In comparison (Table 23), on average farmers used 8 kg (decrease of 61% from baseline) of certified bean seed for 0.20 hectares of land (increase of 29% from baseline) at an average cost of FBU 1,840/kg (increase of 71% from baseline).

This is consistent with what was found from the interviews with seed entrepreneurs, i.e. bean farmers have decreased the volume of seed that they use while also increasing the land for bean cultivation because of high yielding varieties and better practices. **The average yield for bean farmers using certified seed was 299 kgs out of which around 77% was sold in the market while the remaining 23% was used for HH consumption.** Farmers using certified seed had improved agricultural practices which they had either learnt from participating in demos or from the guidance of PSSD supported seed entrepreneur's agronomist. **On average, male users purchased a much larger volume of seed (16.3 kg) as compared to female users (4 kg) and cultivated beans on a relatively larger plot of land (0.25 hectares compared to 0.10 hectares).** By using certified seed, both men and women sell a high percentage of their total produce in the market either directly or by selling through agro dealers who purchased beans directly from the farmlands. At baseline, the yield was so low that most farmers cultivated beans for their own consumption.

The additional cost of production for farmers using certified seed was the price difference in seed, the cost of additional labor required for harvest, and the cost of pesticide. However, the cost of pesticide and labor was spread across different crops that farmers were cultivating.

The average yield for farmers using certified seed was 299 kgs as compared to only 78 kgs at baseline (283% increase). This is not just because of certified seed but also because of better practices. The average additional cost of practices and certified seed was found to be 54% of the total revenue from potential bean sales. Hence, the average potential income for a farmer using certified bean seed and improved agricultural practices is FBU 201,581 (Potential revenue x 46%) as compared to a farmer using local seed at baseline per hectare FBU 59,877

For PSSD to assess the impact of farmers using certified seed, they will first need to increase the total volume of certified seed attributable to the project by adjusting the beans certified seed calculated directly from the contracts by 327% (as explained above). Using the volume of certified seed and the average volume of certified seed per farmer (8 kgs), an estimate for the total number of farmers can be calculated that can later be triangulated with the total number of customers provided by the seed entrepreneurs. Similarly, the same averages can then be applied to get a break down of farmers per region.

Table 23: PSSD Assessment production figures for bean farmers using certified seed

	Volume of seed used (kg)	Cost per kg of seed (FBU)	Land planted (Hectares)	Average cost for seed (FBU)	Bean Yield (kgs)	Volume sold (kgs)	Selling price /kg	Total revenue from bean sales (FBU)	Volume for HH consumption or recycled seed	% Sold	Potential Revenue from total yield
Overall	8	1,840	0.20	14,851	299	229	1463	335,591	70	77%	438,220
	-61%	71%	29%		283%	630%	39%		50%		
Karusi	9	1,667	0.17	15,278	355.00	320.00	1,733	554,667	35	90%	615,333
	-17%	54%	105%		248%	281%	67%		94%		
Kirundo	3	2,167	0.13	6,319	191.50	158.33	1,475	233,542	33	83%	282,463
	-74%	82%	-13%		252%	1167%	13%		-21%		
Muyinga	23	1,600	0.29	36,800	379	255	1,316	335,750	125	67%	499,894
	-34%	66%	38%		336%	1357%	65%		79%		
Male	16.30	1700	0.25	27,710	333	251	1510	379,010	82	75%	503,132
Female	4.00	2120	0.10	8,480	232	186	1370	254,820	46	80%	317,840

Comparing the impact of certified seed and practices from the same unit of land (1 hectare) to the use of local seed and following baseline practices, on average farmers used 40 kg of certified seed as compared to 131 kg of local seed (decrease of 70% from baseline) for 1 hectares of land at an average cost of FBU 1,840/kg of certified seed (increase of 71% from baseline) as compared to FBU 1,076/kg for local seed.

The average yield for farmers using certified seed was 1,475 kgs as compared to 498 kgs at baseline (196% increase). This is not just because of certified seed but also because of better practices. The average additional cost of practices and certified seed was found to be 54% of the total revenue from potential potato sales. Hence, the average potential income per hectare for a farmer using certified seed and improved agricultural practices is **FBU 992,683 (Potential revenue x 46%)** as compared to a farmer using local seed at baseline per hectare **FBU 148,295**

The per hectare is only for comparison purposes to indicate the difference good seed and practices can have from the same amount of land. The increase in the volume of certified seed used for the same amount of land demonstrates that farmers were using low quality local seed in a relatively larger quantity as well. The increase in yields is because of both using a higher quantity of seed more efficiently and with good practices.

Table 24: Baseline bean farmer's average production per hectare

	Volume of seed used (kg)	Cost per kg of seed (FBU)	Land planted (Hectares)	Average cost for seed (FBU)	Bean Yield (kgs)	Volume sold (kgs)	Selling price /kg	Total revenue from bean sales (FBU)	Volume for HH consumption or recycled seed	% Sold	Potential Revenue from total yield
Overall	131	1,076	1	141,464	498	200	1050	210,064	298	40%	522,613
Karusi	134	1,080	1	144,878	1,244	1,024	1040	1,065,366	220	82%	1,293,659
Kirundo	76	1,188	1	90,127	363	83	1306	108,945	279	23%	473,911
Muyinga	164	963	1	157,759	412	83	800	66,272	330	20%	329,941
Men	133	1,109	1	148,052	554	262.30	1054.54545	276,602	291	47%	583,828
Women	119	1,040	1	123,299	395	85.91	1045	89,777	309	22%	412,973

Table 25: Certified seed using bean farmer's average production per hectare

	Volume of seed used (kg)	Cost per kg of seed (FBU)	Land planted (Hectares)	Average cost for seed (FBU)	Bean Yield (kgs)	Volume sold (kgs)	Selling price /kg	Total revenue from bean sales (FBU)	Volume for HH consumption or recycled seed	% Sold	Potential Revenue from total yield
Overall	40	1,840	1	73,136	1,475	1,129	1463	1,652,615	345	77%	2,158,008
	-70%	71%			196%	465%	39%		16%		
Karusi	54	1,667	1	90,759	2,109	1,901	1733	3,295,050	208	90%	3,655,446
	-59%	54%			70%	86%	67%		-5%		
Kirundo	22	2,167	1	48,240	1,462	1,209	1475	1,782,761	253	83%	2,156,202
	-71%	82%			303%	1349%	13%		-9%		
Muyinga	79	1,600	1	125,812	1,298	872	1317	1,147,863	426	67%	1,709,041
	-52%	66%			215%	952%	65%		29%		
Men	64	1,700	1	108,880	1,309	986	1510	1,489,234	323	75%	1,976,943
Women	40	2,120	1	84,631	2,315	1,856	1370	2,543,114	459	80%	3,172,056

Of the total bean farmers interviewed (21): 3 bean farmers (14%) had learnt of certified seed and good agricultural practices by setting up demo plots on their own land for the PSSD supported seed entrepreneurs, 12 bean farmers (57%) learnt about certified seed and good agricultural practices through seed entrepreneurs' agronomist and by visiting demo plots, while 6 bean farmers (29%) had never attended a demo plot or used certified seed.

As summarized in table 26 and 27, **Demo Farmers using certified seed and following good agricultural practices had an average yield of 33.2 kgs as compared to 19.3 kgs for Demo farmers using local seed and following good agricultural practices. (An increase of 72% attributed to certified seed only).**

Demo Farmers using local seed and following good agricultural practices had better yields/hectare (3,867 kg/hectare) than baseline yields/hectare (498 kg/hectare) for farmers. (An increase of 677% attributed to practices only if local seed quality is the same). * This may be inflated in the research due to some farmers not being able to recall their pre-PSSD baseline yields too well. In an ideal situation we would have liked to talk with more comparison farmers who were using local seed.

The average yield/hectare for demo farmers using certified seed and practices was found to be the highest at 6,647 kg/hectare, followed by demo farmers using local seed and demo practices at 3,867 kg/hectare, followed by farmers using certified seed and following good practices on their own at 1,475/hectare, and finally the lowest yields were found to be at baseline when farmers used local seed and did not know of best practices at 498 kg/hectare.

Yield per hectare scale per type of farmer:

Demo farmer using certified seed > Demo farmer using local seed > Farmer using certified seed after learning about good agri practices > Baseline farmer using local seed

This does not necessarily mean that farmers were unable to follow the practices as they were taught during the demos, but because they had much smaller lands dedicated for demos which are easy to manage and supervise. Farmers during the demo season had been able to get a bumper crop due to favourable weather conditions. A more appropriate comparison is between impact farmer and baseline farmer, instead of comparing the yields from demos.

Table 26: Bean demo with local seed and good agricultural practices

	Volume of seed used (kg)	Cost per kg of seed (FBU)	Land planted (Hectares)	Average cost for seed (FBU)	Bean Yield (kgs)	Volume sold (kgs)	Selling price /kg	Total revenue from bean sales (FBU)	Volume for HH consumption or recycled seed	%Sold	Potential Revenue from total yield
Overall/Muyinga	0.47	975	0.01	455	19	-	1000	-	19	0%	19,333
Men	0.45	975	0.01	439	23	0	1000	-	23	0%	23,250
Women	0.50	975	0.01	488	12	0	1000	-	12	0%	11,500

Table 27: Bean demo with certified seed and good agricultural practices

	Volume of seed used (kg)	Cost per kg of seed (FBU)	Land planted (Hectares)	Average cost for seed (FBU)	Bean Yield (kgs)	Volume sold (kgs)	Selling price /kg	Total revenue from bean sales (FBU)	Volume for HH consumption or recycled seed	%Sold	Potential Revenue from total yield
Overall/Muyinga	0.47	1,600	0.01	747	33	-	1300	-	33	0%	43,203
Men	0.45	1600	0.01	720	38	0	1300	-	38	0%	48,750
Women	0.50	1600	0.01	800	25	0	1300	-	25	0%	32,110

3.2 Limitations of the research

While the investigative research was helpful to understand the impact of using certified seed by potato, maize, and beans farmers, it was still limited in its scope. Given the limited number of days of the consultant in the field, it was not possible to verify production information from all active PSSD partner seed entrepreneurs. Hence, priority was given to areas with most seed producers for each crop. i.e. partner seed entrepreneurs producing the largest volume of seed were preferred. As such the sample of respondents from the respective provinces may not give a full picture of all the other provinces where PSSD seed entrepreneurs are producing and selling certified seed but is still likely to suggest the general trend for the impact from producing larger volumes of certified seed. The research study tried to spread out its respondents as much as possible. The farmers purchasing seed from the PSSD partner seed entrepreneurs came from different communes. Moreover, a mix of new and relatively old PSSD partner seed entrepreneurs were selected for the study to account for any differences in impact based on the time of engagement with PSSD. The new entrepreneurs had partnered with PSSD for around 1 year while relatively old partners had contracts close to 2 years.

Farmers were invited by the seed entrepreneurs and could not be randomly selected. This was because reaching out to farmers directly required special permissions from the government which was not possible within the timeframe in which the study was planned. To mitigate the bias of only having the “best” farmers/customers being invited by the seed entrepreneurs the research team randomly selected some farmers from the group of farmers that attended the seed entrepreneur’s production site. The agronomists with the seed entrepreneur were also briefed on how to invite these farmers and were asked to select randomly from their list of customers. The research team also tried to mitigate the selection bias by only giving a day’s notice of inviting farmers. This would reduce the time that may be required for planning and inviting well performing farmers. “Walk-in” repeats clients that approached seed entrepreneur’s for purchasing seed on the day were preferred to be included in the assessment. Finally, farmers in the study were interviewed separate from the seed entrepreneurs to make sure there was no pressure from responding farmers

The baseline for the study had to be retrospectively constructed. The research team used a combination of recall, opinion, and comparison for establishing a baseline. Farmers included in the study were preferred if they had recently used and harvested certified seed so that they were able to recall their cultivation practices from before and compare it with their practices after interacting with PSSD supported actors. Some farmers brought records of their previous yields and practices and were able to verify information. To reduce the seasonal differences, information was collected for two consecutive seasons (where relevant) to avoid exceptionally good or bad seasons. For comparison, certified seed using farmers were asked about their yields before they started using certified seed (before PSSD partnerships) and their previous yields were compared with yields from non-certified seed users (local seed users).

This study was able to direct PSSD in the direction of identifying attributable impact which is currently being under reported from the seed entrepreneurs and farmers. The study also highlights how a significant portion of the project’s beneficiaries are likely to be women which was not realized before. However, the policy level impact of PSSD’s work with ISABU and ONCCS could not be captured in this study and would require further research. With the

expected expansion of certified seed production from seed entrepreneurs, the role of ISABU and ONCCS would become even more important in this space. PSSD's work with ISABU in developing their in-vitro labs is likely to increase its capacity for providing plantlets and basic seed to seed entrepreneurs. The demand for basic seed and early generation seeds is likely to increase as the number of entrepreneurs and the area of production per entrepreneur grows in the future. The impact of PSSD's support to ISABU is likely to also go to seed entrepreneurs which are not directly supported by PSSD through a partnership (and even to seed entrepreneurs producing other crops besides the 3 supported by PSSD). Similarly, ONCCS has been supported by PSSD through private inspectors for speeding up the process of certification. The benefit of reduced time for certification is attributable to PSSD not only for the 3 crops, but also for other crops for which the private inspectors are being engaged. While the time taken for certification is significantly reduced, it remains to be seen if this is going to be sustainable in the long run. As more seed entrepreneurs (and larger volumes of seed) submit seed for certification, ONCCS would need to keep up. According to ONCCS, they will be unable to maintain the salaries of private inspectors that have been supported by PSSD in the future but they are planning to try a different model of inspection by getting reports directly from agronomists working with seed entrepreneurs. The feasibility and accuracy of this model remains to be seen and would require careful invigilation.

The research could not get sufficient data for hybrid maize seed users. Hybrid maize seed is relatively new and is competing directly with imported seed varieties. From the limited sample of farmers using hybrid maize seed, the yields and benefit looked promising. However, this still needs to be pushed towards small holder farmers who are not fully aware of its potential. A comparison with farmers using imported hybrid maize seeds will help in understanding the potential for this market.

4) Next steps on improving the PSSD's MRL system

The following key considerations can help the project to further strengthen the MRL measurement framework:

- ✓ **Conduct more field research to understand relevance of PSSD interventions on small holder men and women farmers.** As mentioned in the previous section, the field research conducted to develop this study had some caveats due to time and mobility restrictions. More in-house research carried across different categories of farmers specifically in different locations, gender, youth and employees at seed entrepreneurs, will help the project to understand and validate how its work can affect these different beneficiary categories. This research conducted with the PSSD team also serves as a brief training on practical research techniques of probing, triangulation and validation. Accurate insights do not necessarily need large sample sizes. Whereas, a combination of repetitive research efforts carefully conducted over time and with information triangulated from different stakeholders is more practical and better suited for a program like PSSD to understand what works? what does not work? and what part of their strategy requires some tweaks for scalable impact? The PSSD team

through this research effort realized how respondents need to be probed through a series of questions to get accurate responses which is likely to be missed by large surveys conducted by external research firms.

- ✓ **Update intervention-specific results chains to map out the anticipated impact and develop corresponding measurement plans.** Measurement plans need to be updated along with results chains to articulate specific impact for farmers. The intervention managers/business facilitators are most familiar with the context of the partnership and for successfully implementing interventions they need to have accurate timely insights to adapt and adjust activities if required. PSSD's intervention managers are not as familiar with PSSD's monitoring framework or results chains as PSSD's MRL team. Good monitoring practices (as also mentioned in the DCED Standard) require close collaboration between intervention managers and the MRL team. A collaborative review of intervention results chain involving both the intervention team and MRL team will lead to a more clear and defined focus on how individual interventions can lead to attributable impact – some of which (as seen from this research) is systemic and goes beyond the partnership contract.
- ✓ **Conduct detailed assessments for policy level interventions with institutional partners.** As mentioned in the previous section, this study could not focus on the policy level impact of PSSD interventions. A dedicated monitoring effort for such partnerships like ONCCS and ISABU would need to be planned. Investigative research conducted in-house will help the project understand their progress towards this. Similarly, this study could only scratch the surface on the benefit of introducing new variety of seed(s). The project should dedicate some time to understand the awareness among farmers on the different varieties of seed that have been registered and introduced with the support of PSSD. From the little evidence, further support would be required to promote specific newly introduced seed varieties among small holder farmers.
- ✓ **Update projections and results achieved by the project.** Based on this study, all the indirect impact in terms of the total volume of certified seed produced and sold (for all crops) due to PSSD's interventions needs to be updated. This would also lead to a better estimate on the total number of beneficiaries for the project. This study also offers evidence for calculating the estimated additional income for target beneficiaries (smallholder farmers) and partners (seed entrepreneurs).

