Norwegian University of Life Sciences

Master's Thesis 2021 60 ECTS
Faculty of Landscape and Society

Beyond seed security responses: Impacts of seed programmes on seed security, food security and income generation of small-scale farmers in Malawi and Uganda

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Declaration

I, Viviana Meixner Vásquez, declare that this thesis is a result of my research investigations and findings. Sources of information other than my own have been acknowledged and a reference list has been appended. This work has not been previously submitted to any other university for award of any type of academic degree.

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Abstract

Seeds are essential inputs for small-scale farmers' agricultural activities, but farmers' seed access is limited in developing countries. The theory of change proposes that through seeds, farmers could improve productivity and hence become food secure and earn sustainable income. Consequently, non-governmental organizations (NGOs) provide quality seeds to farmers through different seed security responses (SSRs). However, it remains understudied how through accessing seeds via SSRs in the humanitarian action and long-term development interventions, farmers could improve their living conditions in the long-term. Here, two case studies of SSRs implemented by two selected NGOs are analysed through the lens of the seed and food security frameworks, one in the context of humanitarian action in Uganda and the other in long-term development interventions in Malawi. The analysis is based on qualitative information from 45 semi-structured online interviews, 20 structured interviews, 2 focus group discussions and 10 key informant online interviews. The sample of interview participants included local farmers, SSR staff from the selected NGOs, seed traders and key informants who have worked and researched on seed security responses in African countries. The results of the study indicate that the NGO working within humanitarian action mainly provides certified improved seeds while the NGO working in long-term development provides local seeds. Irrespective of chosen seed type, farmers' long-term food security remains a challenge in both case studies and a decent and sustainable income has not been achieved. The data shows that seeds contribute to increased productivity, particularly local seeds, but other barriers such as land size, market constraints and limited access to other agricultural inputs prevent farmers from becoming self-sufficient. To achieve self-sufficiency, more local adaptation of the SSRs and inclusion of other agrarian change measures are suggested.

Acknowledgments

First, a sincere thanks to my supervisor, Ruth Haug, for her guidance and support during all stages of the research process. Professor Haug's remarkable dedication to food security has been an inspiring factor in my work.

I thank all my professors of the Master in Global Development Studies for their valuable reflections that were of great significance for the development of this thesis.

I would also like to thank all those who have made online fieldwork possible during difficult times due to the Covid-19 pandemic. In the Norwegian Refugee Council, a very special thanks to Thomas Ølholm, Sarah King and Knut Andersen for giving me the opportunity to explore the work done in Uganda and giving me access to the field office. In the Development Fund and the Biodiversity Conservation International, I would like to thank Mahara Nyirenda, Godwin Mkamanga, Isaiah Phiri and Fredrick Sanga for supporting me in remote field work and giving me the opportunity to explore the work done in Malawi.

Most importantly, I would like to thank each of the study participants, farmers, NGO field staff, seed traders, research assistants and experts on the topic for opening a virtual space and sharing their valuable knowledge, experiences and perspectives.

A special thanks to my mother Beatriz Vásquez, who has always trusted in my abilities and believed in me. She has inspired me every day of my life with her tireless and thoughtful personality. I want to thank my beloved husband Krzysztof Meixner, who has been a fellow partner who motivates me to follow my dreams, supports me in every step and has always believed in me. And finally, my thanks to my new-born son Sebastian Meixner, who gave me the best motivation I could have for developing and finishing my thesis.

I feel honoured to have had the opportunity to work with everyone who made this research possible. Thank you for believing that work is needed for farmers to achieve food security for themselves and their families.

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Abbreviation List

BCI	Biodiversity Conservation Initiative
CSB	Community Seed Bank
DF	Development Fund
DSD	Direct Seed Distribution
GoM	Government of Malawi
GoU	Government of Uganda
ISSD	Integrated Seed System Development
M&E	Monitoring and Evaluation
MAAIF	Ministry of Agriculture, Animal Industry and Fisheries
NGO	Non-Governmental Organization
NRC	Norwegian Refugee Council
OPV	Open Pollinated Variety
QDS	Quality Declared Seed
RQ	Research Question
SSA	Sub-Saharan Africa
SSR	Seed Security Response

Seed Glossary

The following glossary contains the main seed concepts used in this research. The definitions represent the meanings understood and shared during the investigation.

Hybrid Seeds	Seeds produced by the cross-pollination of unlike parents of the same crop. Parent plants are selected for certain traits and are self-pollinated for several generations to produce "inbred lines". These inbred lines are then cross pollinated to produce the F1 generation, which is known as a hybrid. Because the parents are genetically different, the F1 will have "hybrid vigour" (the opposite of consanguinity), resulting in strong, vigorous plants and greater yield under good agro-nomic conditions. F1 plants are uniform. However, when an F1 plant is cross-pollinated with another F1 plant to produce an F2, the latter will not have the same characteristics as its parent plants; it will not have hybrid vigour, and in fact, it may grow very poorly and have low levels of vigour and yield. (FAO, 2010).
Improved or Modern Seeds	Varieties created through formal plant breeding and varietal development programmes, multi-location trials, national variety release systems and formal seed production systems. Those seeds undergone testing and are released through a formal process. (FAO, 2016a).
Local Seeds	Varieties evolved over a period of time under the particular agro-ecological conditions of a defined area. A local variety is sometimes called a landrace or an ecotype. (FAO, 2006).
Open Pollinated Varieties (OPVs)	Seeds generated from populations where all plants have had an equal chance of pollinating each other and

	themselves. The main characteristic of these varieties is that they maintain a high degree of stability for several generations. Then, OPVs can be saved by farmers for use over the following seasons and the characteristics of the varieties will remain stable. Seed production of OPVs mainly requires that isolation distances can be respected, but it does not require the use of sophisticated pollination control methodologies. (FAO, 2010).
Quality Declared Seed (QDS)	Seed produced by a registered seed producer which conforms to the minimum standards for the crop species concerned and which has been subject to the quality control measures outlined in certain guidelines. QDS meets a minimum standard of quality but does not entail a formal inspection by the official seed certification system. The intent behind the QDS system is to provide farmers with the assurance of seed quality while reducing the inspection burden on government agencies responsible for seed certification. (FAO, 2006).
Quality seeds	Quality seeds include a number of seed attributes such as: Germination which is the ability of the seed to produce a normal seedling. Physical purity which means to be free from inert material and from dead or live insects. Moisture content which is the amount of water contained in the seed sample and is expressed as a percentage of the weight of the original sample. Seed health which is a seed free from diseases. And for some crops, varietal purity which means that the seed is of one variety and not a mixture of varieties or seed of various crops. (FAO, 2016a).
Seed certification	Seed certification is a comprehensive quality assurance system that links together the control of seed production

in the field and the laboratory testing of seed lots. Only varieties that are on the national list can be certified because the variety must have a recognized name and description. For a seed to be registered in the national list, varieties must satisfy the criteria for DUS and VCU. DUS testing determines the distinctness, uniformity and stability of the variety by means of a detailed examination of the plants on small plots. VCU trials establishes the value for cultivation and use by means of more extensive replicated trials, usually performed at several locations and over two or three seasons. Once seeds have passed the tests, the government approves the variety for release and commercialization. (FAO, 2018).

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1. Introduction

In response to climatic shocks, man-made disasters, increasing poverty, and inequalities in the agri-food system limiting farmers access to agricultural inputs, governments and non-governmental organizations (NGOs) have implemented seed security responses[1] (SSRs) to accelerate farmers' recovery (Remington et al., 2002 and Sperling & McGuire, 2010a). *In the short term, those responses are framed within humanitarian action*. These responses are developed to either stabilize or restart farming activities (Sperling & McGuire, 2010a and Sperling, 2020), while helping farmers shed their dependence on food aid (Sperling et al., 2008). *In the long term, those responses are part of long-term development programmes*. These responses aim to help farmers access seeds to achieve self-sufficiency in their farming activities during normal growing seasons and reduce their vulnerability to future stress (Sperling & McGuire, 2010a). "Supporting farmers through seeds is a rationale choice both in emergency and more normal situations" (Sperling et al, 2020b p.1).

NGOs have been involved in developing SSRs since the 1990s, particularly in Africa (Sperling et al., 2008), due to major disasters and conflicts (Sperling, 2020). For instance, the conflict in South Sudan, that has turned into a protracted refugee situation[2], has forced people to settle in Uganda, where the government grants refugees small plots of land (UNHCR, 2020). As many refugees have not been able to use the land productively, NGOs have provided refugees with seeds through SSRs (Action Against Hunger, 2020; NRC, 2020 and Caritas, 2020). In addition to man-made disasters, agricultural production in Uganda has faced challenges arising from climate change (among others, El Niño-induced drought in 2016, and irregular rainfall patterns in 2019), leaving refugees and local communities in food shortages (WB, 2020d). As a result, SSRs were conducted to provide farmers with seeds (FAO, 2016b). Furthermore, within African countries, Malawi has been recognized as especially vulnerable to climatic changes due to heavy reliance on rainfed agriculture (FAO, 2015b). In 2016, El Niño-induced drought led FAO to support subsistence farmers with agricultural inputs, particularly seeds and irrigation tools, to help them recover and build a stronger asset base (FAO, 2019).

[1] They are interventions focused on delivering seeds to farmers.
[2] A protracted refugee situation was defined by UNHCR (2004) as one in which 25,000 or more refugees from the same nationality have been in exile for at least five consecutive years in a given host country.

In the short term, NGOs employ various types of SSRs to provide quality seeds to farmers. The most popular responses have been direct seed distribution (DSD) and seed fairs (Sperling et al., 2008 and McGuire & Sperling, 2013). However, for years the prioritized response has been DSD (ibid). In DSD, seeds are purchased from outside the agroecological region and delivered directly to farmers free of charge, usually together with agricultural tools (Sperling et al., 2008). Despite DSDs' popularity among NGOs, the response in particular has been widely criticized for reasons such as:

1. The approach selection is based on institutional preferences rather than on the solution to real problems encountered (McGuire & Sperling, 2008).

2. Only commercial companies are invited to participate, and local vendors are not included, even though they are the backbone of smallholders' seed security (Sperling et al., 2020a).

3. Commercial companies often have limited product portfolios and do not provide farmers with what they normally sow (Coomes et al., 2015); and hybrid varieties, especially maize, dominate distributions with few other profitable vegetable seeds (McGuire & Sperling, 2013).

4. NGOs' limited budget does not allow supply of sufficient quantities (McGuire & Sperling, 2008).

5. The implementation of SSRs could undermine commercial and local markets (Sperling et al., 2008 and McGuire & Sperling, 2013).

6. DSD focuses on the purchase and delivery of seeds rather than guaranteeing distribution on time for the planting seasons (Sperling et al., 2007 and Sperling & McGuire, 2010a).

In the long-term, community seed banks (CSBs) have been one of the responses to improve seed and food security while building small-scale farmers resilience to climate change (Vernooy et al., 2014; Andersen et al., 2018 and Nyantakyi-Frimpong, 2019). CSBs are defined as community seed and grain storage sites where seeds are afterwards distributed to farmers under a loan and payback system *(*Maharjan & Maharjan, 2018). International NGOs have

increasingly supported the implementation of CSBs as a measure for disaster relief, seed security, conservation of local varieties, and adaptation to climate change (Vernooy et al., 2014 and Nyantakyi-Frimpong, 2019). Additionally, studies have shown the potential of CSBs to integrate formal and informal seed systems, as they offer a wide range of social and economic benefits to farmers (Vernooy et al., 2014 and Westengen et al., 2018). Despite the benefits CSBs can offer, studies have highlighted that NGOs' lack of funding to maintain CSB operations could cut back on activities or stop the operation all together (Nyantakyi-Frimpong, 2019 and Vernooy et al., 2017). Moreover, Nyantakyi-Frimpong (2019) showed that inefficiencies in CSBs' operation could potentially risk long-term sustainability leading to failure to build resilience. Inefficiencies are among others: lack of satisfaction of farmers' needs, poor credit recovery and marked gender inequalities that limit the participation of women in CSB operations (Nyantakyi-Frimpong, 2019) despite the fundamental role women play in agriculture (FAO, 2017). Indeed, in Malawi and Uganda, a higher proportion of women contribute to the agricultural labour force (NSO, 2017 and MAAIF, 2019). Malawi's ratio is 95% female vs. 83% male (NSO, 2017), while Uganda's ratio is 72% female vs. 62% men (MAAIF, 2019).

Scholars have analysed and described SSRs, especially and in great detail those conducted under humanitarian action. Previous research has focused on:

- How repetitive responses could create dependency as seeds are distributed for free (Sperling et al., 2008 and Jones et al., 2002).

- How responses involve the formal seed system and exclude the farmers' seed system, which has shown to be important under normal growing seasons and more resilient during stress periods (McGuire & Sperling, 2013).

- How strategies should be directed to include the adoption of a more systematic approach linking formal and informal seed systems to enhance farmers' access to seeds (Almekinders et al., 1994; Coomes et al., 2015; McGuire & Sperling, 2016 and Thornton et al., 2018).

- How CSBs are key in providing multiple functions and services including access and availability of seeds (Vernooy et al., 2014)

- How CSBs contribute to the realization of farmers' rights (Andersen & Winge, 2011) and to climate change adaptation (Vernooy et al., 2017).

Previous literature on the impacts of SSRs in the short term has largely focused on how much the responses have given to farmers rather than analysing whether the goals have been fulfilled (Sperling & McGuire, 2010a). Unfortunately, "implementers often regard seed aid as a one-off emergency intervention, and few have the wherewithal or schedule the time or resources to assess its effects" (ibid, p.96). The few evaluations that exist on the response impact tend to be carried out internally immediately after the event, and focus on practical operational aspects with simple outcome indicators, such as the quantity of seeds distributed (Sperling et al., 2008 and Sperling & McGuire, 2010a). And broader questions of the immediate and long-term effects, both negative and positive, (Sperling & McGuire, 2010a), as well as whether the initial aims under which the responses were set, are ignored. Additionally, in long-term SSRs, existing research shows an in-depth analysis of the CSBs' success stories (Reisman, 2017). However, those analyses tend to be carried out mainly by the NGOs and may potentially be conducted in a strongly biased way (ibid).

No studies of SSRs conducted in humanitarian action and long-term development interventions, to my knowledge, have analysed how those SSRs influence farmers' strategies to address long-term seed security, food security and income generation using each analytical framework dimension of food and seed security. Furthermore, studies have not analysed in detail how those SSRs affect the different target groups they serve individually, such as refugees, host community farmers (especially in humanitarian action), as well as females and males in both humanitarian and long-term development contexts. Uganda, in the humanitarian context, provides a highly relevant country to study SSR impacts, as it has experienced many shocks due to climate change and hosts the largest number of refugees in Africa. Refugees who together with the host community depend mainly on agriculture to meet their food needs. Malawi, in the context of long-term development, provides a highly relevant country to study SSR effects, as the country has been affected for years by weather shocks, and the majority of Malawians depend on agriculture as their main livelihood and food source. Furthermore, both countries have high levels of poverty and lack of access to improved seeds remains a major challenge for small-scale farmers, so questions about the impacts of SSRs are highly relevant.

Understanding the effects of SSRs on long-term seed security, food security and income generation represents an opportunity to either redesign the strategies that NGOs implement and change the approach for strategies that can solve the root problems that farmers face. New approaches that could more effectively influence farmers' strategies to recover from stressful situations and thus build more sustainable farming systems. Especially considering that climatic shocks and conflicts continue to emerge, and SSRs are likely to continue to be developed as they have been during past decades. The study addresses the following aims: to identify the reasons why SSRs take place in both humanitarian action and long-term development interventions, to explore in detail how the SSRs are selected by NGOs, and finally to assess the effects that SSRs have on farmers through the lens of the seed and food security frameworks. The research draws upon the seed security and food security frameworks, theories of food security, and the seed systems that are considered when implementing SSRs.

The study is organized as follows. The following section describes the research questions (RQs), followed by relevant background information on Malawi and Uganda. This is followed by the theoretical frameworks used to guide the research analysis. Chapter five presents the detailed methodology of how the study was conducted. And then the study findings are presented divided into two chapters, chapter six contains the findings in the humanitarian context in Uganda, while chapter seven contains the findings of the long-term development interventions in Malawi. Lastly, research findings are discussed, and conclusions are drawn.

2. Research Questions

2.1 Main Research Question

How does humanitarian and development assistance through SSRs influence small-scale farmers' access to quality seeds that improve their long-term seed security, food security and income generation?

2.2 Sub Research Questions

a. Why do NGOs in humanitarian action and long-term development interventions use certain seed security responses to supply small-scale farmers with seeds?

b. What are the main convictions that govern the SSRs implemented by the selected NGOs?

c. What are the contributions of seed security responses developed in humanitarian action and long-term development interventions on farmers' long-term seed security?

d. How, by accessing seeds during seed security responses, do farmers become food secure and generate sustainable income?

3. Background

The following section presents relevant background information to provide understanding of the general context of Malawi and Uganda and the relevance of this study. The socioeconomic profile of both countries is given with a description of the seed systems and seed legislative frameworks under which both countries currently operate. Additionally, information related to each country's strategy to address food insecurity is presented. And finally, in the Uganda case, the situation related to refugees is described.

3.1 Uganda

3.1.1 Socioeconomic profile

Uganda is a landlocked country in East Africa which remains ranked among world's least developed countries (UN, 2020a). Uganda's national poverty rate is 19.7% and more than a third of the population lives on less than USD$1.90 a day (WB, 2020c). 76% of the population lives in rural areas and 70% still depends primarily on rainfed agriculture for their livelihood (ibid). The vulnerability of people living in poverty is worsened by extreme weather-related shocks (PWC, 2019). Agriculture is a core economic sector and contributes with around 25% to GDP (WB, 2021). The agricultural sector is made up of small-scale subsistence farmers who are characterized by owning around 1 hectare of land with maize and beans as the most common staple crops (ibid).

3.1.2 Strategy to address food insecurity and refugee situation

Within its development plan, Uganda envisions moving the country from a predominantly low-income country to a competitive upper-middle-level country by 2040. To achieve that goal, Uganda recognizes agriculture as a key driver for enhancing national development by transforming subsistence farming to commercial agriculture (MAAIF, 2016). Improving agricultural research as well as diffusion and adoption of new technologies have been part of the strategic pillars to achieve improvements in productivity (ibid). Productivity improvement is seen as a result of the use of improved seeds, as seeds are considered fundamental inputs and basic means of technology transfer to farmers (ibid). However, according to the Government of Uganda (GoU), limited knowledge of where to obtain and what type of improved seeds to use hinders farmers from using quality seeds and thus producing higher yields (MAAIF, 2018). As a result, higher promotion of those technologies through policies has taken place.

Moreover, Uganda hosts the largest number of refugees in the world (NRC, 2020). In 2019, Uganda received over 1.3 million refugees (ibid), which was the largest number of refugees worldwide (UNHCR, 2020). The main drivers of forced displacement have been wars in the Horn of Africa, political instability in Burundi, and ethnic violence in the Democratic Republic of the Congo and South Sudan (Bernard et al., 2020). South Sudan is the third largest refugee producing country in the world and most refugees are women and children (UNHCR, 2020). The influx of refugees from South Sudan is expected to continue due to the ongoing conflict and social instability (ibid). According to UNHCR (2020) the West Nile region in Uganda hosts the highest number of settled refugees.

Uganda is recognised for having one of the most progressive refugee policies in the world (WB, 2019b). Refugees located in settlements, receive monthly food rations, household items and access to multi-sectoral services, as well as a land plot for housing and agriculture (UNHCR, 2020). The plots of land provided are meant to contribute to the basis of self-reliance (IRRI, 2018). The Self-Reliance Strategy was formalized in a policy with donor support in 1999 and updates regarding the right to work and to choose a place of residence were incorporated into the law in the 2006 Refugee Act (Betts et al., 2019). Despite having established the land access policies, secure land rights are not granted (ibid). Additionally, the increase in the number of refugees has threatened government policy, reducing fertile land available for refugees (Ahimbisibwe, 2019). For instance, “land size per refugee household has already been reduced from 50x50 metres to about 30x30 metres in order to accommodate new arrivals” as stated by Ahaibwe & Ntale (2018). The above-mentioned drawbacks could negatively affect the self-reliance strategy in which refugees are encouraged to grow their own food to quit dependency on food rations distributed by humanitarian agencies such as Word Food Programme (WFP) (Ahimbisibwe, 2019). WFP food rations sometimes only last from 13 to 23 days per month, or less when economic problems arise, and WFP is forced to ration reductions (FSIN, 2020 from FSNA, 2018).

3.1.3 Seed systems and regulations

In Uganda two seed systems coexist through which farmers can access seeds and planting materials, namely the formal and the farmers' seed systems (ISSD, 2020). Contrary to many other countries in Sub-Saharan Africa (SSA), Uganda's seed system is characterized by the GoU recognition of both seed systems in its policies and programmes (ISSD, 2012b). The formal seed system is regulated by the Government and contributes around 10-15% of food

crops, of which 70% is maize seed and 12% bean seed (MAAIF, 2018). The formal seed system focuses on producing and selling improved seeds certified by the National Seed Certification Service, which is a government entity under the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) (Mabaya et al., 2016). Meanwhile the farmers' seed system is where the majority of farmers in Uganda obtain their seeds, particularly for crops other than maize (Kansiime & Mastenbroek, 2016). It is worth noting that seeds under the farmers' seed system are not certified but are governed by indigenous knowledge and standards (ibid).

In line with its 2040 vision, in 2018 the GoU launched a new national seed policy. This policy aims to ensure availability and access of improved seeds among small-scale farmers to increase agricultural productivity and contribute to food security (MAAIF, 2018). Inspection and certification are considered essential to ensure quality seed production (ibid). Especially because seed quality assurance according to the Integrated Seed System Development (ISSD), 2012b "remains a major bottleneck in the system" (p.5). To promote various sources of quality seeds, the policy allows for certified improved seeds produced by the private sector, and QDS produced by farmer groups under a more flexible quality scheme (ibid). The ISSD (2012b) highlights that the aim of QDS is not to compete with the seeds produced by the private sector but instead to supplement the seed supply. Local seed businesses are farmer groups that produce QDS, and the quality inspection is done by MAAIF, but those seeds are intended to be sold within their community (Kansiime & Mastenbroek, 2016).

Several NGOs have supported farmer groups in the initiation of their own seed projects (ISSD, 2012b). This assistance consists of helping in the production of standard seeds and linking farmers with public organizations to access clean seeds and planting material (ibid). In addition to promote farmer groups, NGOs also support farmer saved-seed and community-based seed initiatives (ibid). Overall, to guarantee access to quality seeds, extension services remain to play a key role, which is highlighted in the seed policy. The purpose of extension services is to provide knowledge and skills that farmers need to source quality seeds and choose the right technology from the right source (MAAIF, 2018).

3.2 Malawi

3.2.1 Socioeconomic profile

Malawi is a landlocked economy in SSA and has been ranked as one of the poorest countries in the world (WB, 2020a). In 2020, the Human Development Index Report ranked Malawi 174th out of 189 listed countries. IMF (2017) reported that 50.7% of the population lived below the poverty line and 25% in extreme poverty. Poverty reduction in Malawi has stagnated in contrast to the rest of SSA (WB, 2020a). Malawi's poverty rate based on the US $ 1.90 threshold has decreased by 3% over the period 2004-2016, while it has decreased by almost 11% in SSA in the same period (ibid). With about 80% of the population living in rural areas, agriculture continues to be the primary source of livelihood for the majority of the households (WB, 2020a). In 2019, the agricultural sector accounted for 25.5% of GDP, 80% of export revenues and 80% of employment (ibid). Crop production is predominantly rainfed thus food security, employment and the economy tend to be highly sensitive to extreme weather events (WFP, 2019). Natural disasters such as droughts, and floods have increased in frequency, intensity and magnitude, threatening the sustainability of small-scale farmers' livelihoods (Haug & Westengen, 2020 and Katengeza, et al., 2019); and exacerbating rural poverty, where female-headed families suffer the most (WB, 2018).

3.2.2 Strategy to address food insecurity

During recent decades, Malawi has made efforts to eradicate extreme poverty by increasing food production as agriculture has been the backbone of the national and household economy (IMF, 2017). Maize has been the most important staple food (Westengen et al., 2019), and hence used to address food insecurity. Seed security has played an important role in food and nutritional security (Chirwa, 2005). As a result, different social protection programmes in the form of input subsidies have been implemented as part of post-drought starter packages as well as of long-term development efforts to increase productivity and improve food security (Sjaastad et al., 2007 from Haug & Wold, 2017). Agricultural subsidy programmes focused on supplying improved maize seeds (hybrid seeds and Open Pollinated Varieties (OPVs)) and non-organic inputs to subsistence farmers, have been the dominant response to persistent food insecurity (Haug & Westengen, 2020). One of the main subsidy initiatives has been the Farm Input Subsidy Programme (FISP), launched after the 2004-2005 food crisis (Dorward & Chirwa, 2013). A programme that initially was mainly funded by the Government of Malawi (GoM) (ibid), as it was rejected by international donors (Chinsinga, 2011).

Initially, the programme showed promising results and over time maize production increased to the point that the country was able to export its surplus, especially in years of good weather conditions (Nordhagen, 2013). Consequently, the distribution of certified improved seeds was seen as a success in increasing productivity and breaking the cycle of dependency on food aid until 2015 and 2016 when, due to extreme weather conditions, maize production fell again, and the country required humanitarian assistance (Haug & Westengen, 2020).

In terms of funding, the distribution of certified improved seeds has dominated Malawi's agricultural development strategy. Approximately, 75% of the agriculture budget is used for subsidies (WB, 2020b). However, several food security indicators in Malawi have remained low during FISP. For instance, the Global Food Security Index has ranked Malawi 110, 104 and 107 out of 113 countries in 2020, 2019, 2018 respectively, in terms of food affordability, availability and quality.

Despite the increased marketing of certified improved seeds through the FISP programme (Katengeza et al., 2019), there is still widespread cultivation of local maize varieties in Malawi (Wise, 2019). Local varieties have the attributes that small-scale farmers prefer in maize (Katengeza, et al., 2019) and yield is not the only characteristic. Studies have shown that additional preferences such as drought tolerance, storability and poundability are characteristics that Malawian farmers value (Wise, 2019). However, the distribution of certified improved seeds through subsidy programmes remains a major intervention (Dorward & Chirwa 2013). FISP was the long-term strategy until 2020 and recently it was replaced by the Affordable Inputs Programme which also focuses (although not exclusively) on subsidies for maize seeds and fertilisers (Matita et al., 2021).

3.2.3 Seed systems and regulations

The seed sector in Malawi consists of the formal and farmers' seed systems (MAIWD, 2018). The formal seed system is characterized by the presence of national and multinational seed companies, and by strong promotion of certified improved maize, especially hybrids, distributed through government subsidy programmes (ISSD, 2012a). The Malawian formal seed system benefits from quality assurance but has been less flexible in adapting to specific local demand (ibid). However, studies have shown that Malawian farmers continue to obtain seeds through the farmers' seed system (Bezner Kerr, 2013). This system comprises both

farmer-saved seeds and CSBs, and promotes dominant crops that can be adapted to local agricultural production systems rather than just promoting maize (ISSD, 2012a).

Due to the massive transformation of the seed industry, in 2018 the GoM launched a new seed policy to replace the 1993 version and promote modernization (MAIWD, 2018). Initially, civil society organizations opposed the policy stating that the formal seed system could be favoured over the farmers' seed system and thus farmers' rights could be neglected (Wise, 2019). The policy tended to benefit commercial seed producers in general and multinational seed producers in particular (ibid). The initial Malawi draft seed policy seemed to forbid the rights of farmers to save, exchange and sell the seeds they develop on their own (ibid). Hence, the seed policy threatened with restrictions on sales of farmers' saved seeds in the market (ibid). After contestations, elements related to the importance of recognition of the farmers' seed system were included (Haug & Westengen, 2020). As a result, a new modified version was released in May 2018 which promotes an enabling environment for the private seed sector but maintains a legal space for Quality Declared Seeds (QDSs) (ibid). The policy refers to QDS as: “a seed system in which 10 percent of the seed produced and distributed is checked by a certifying agency” (MAIWD, 2018 p. 7). Additionally, the policy highlights the importance of recognizing different classes of seeds to increase volume and availability (ibid).

4. Theoretical Framework

The following section outlines key concepts along with core elements of the food and seed security frameworks, which are used as central analytical frameworks in this study. Relevant literature and ongoing discussions on the importance of agriculture and seeds in addressing food insecurity are reviewed. A review of existing seed systems with their advantages and disadvantages to ensure sustainable seed security among small-scale farmers is also presented.

4.1 Food security framework

Food security as a term, has had many definitions since its introduction and has evolved considerably (Westengen & Banik, 2016). This study leans on the definition that was affirmed at the 1996 World Food Summit. “Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life”. The four dimensions of food security are: 1. *Food availability* that addresses the supply side and is determined by the level of food production, stock levels and net trade (FAO, 2008) and includes food aid (FAO, 2006). Although food availability is relevant to be food secure, it is worth noting that the analytical literature explaining the availability-based approach of food security has shifted towards a new accessibility-based approach (Ericksen, 2008). 2. *Food access* is determined by how well people can convert their assets into food, whether purchased or produced (Ericksen, 2008). Sen (1981) stated that in addition to the amount of food, it is necessary to establish purchasing power to acquire food as world hunger is not only based on increased food production. 3. *Food utilization* is commonly understood as the way the body makes the most of various nutrients in the food (FAO, 2008). However, utilization could be affected by additional factors such as age, hygiene and health, among others (Ericksen, 2008). 4. *Food stability* refers to the condition in which the three above-mentioned dimensions are met, thus guaranteeing food security at all times. If one of the above dimensions fails, a person is considered food insecure (FAO, 2008).

Despite the reduction of hunger in the world in recent decades, food insecurity and malnutrition remain a challenge in many countries (FAO, 2020b and GNR, 2020). Most of the world's undernourished people live in Asia (381 million) and Africa (more than 250 million) (FAO, 2020b). In Africa, the number of undernourished people is increasing (FAO, 2020b and WB, 2019a). The prevalence of food insecurity is higher among women than men (FAO, 2020b).

Much of the food in Africa is produced by small-scale farmers, yet they are the most affected by food insecurity (WB, 2008 and WB, 2019a). Hence agricultural development is one of the most powerful tools to provide food availability, income for purchasing food, and food with high nutritional values (WB, 2008). Studies have shown that growth in the agriculture sector is more effective in raising incomes among the poorest compared to other sectors (Ivanic & Martin, 2018, Ligon & Sadoulet, 2018 and Jayne et al., 2018). While agricultural intervention has a proven track record of increasing economic growth and reducing poverty, conflicts in various parts of the world have slowed that growth (WB, 2019a). However, a more pervasive contributor to slowing growth in agriculture is climate change (ibid).

To address the negative effects of climate change on agriculture and satisfy the food demand, developing countries must increase the use of agricultural technologies (WB, 2019a). Agricultural technologies could increase production and thus improve access to food, as experience with the green revolution has shown in Asia and Latin America (Evenson & Gollin, 2003). Whereas the need to improve productivity to foster sustainable development in the small farm sector is a key issue among its supporters, the question of what kinds of technologies are best to achieve that goal is debated. Low external input strategies are considered by some to be the most appropriate response, considering that small-scale farmers do not have the assets to repeatedly purchase agricultural inputs (Shiva, 2016, Via Campesina, 2018; GreenPeace, 2015 and De Schutter & Vanloqueren, 2011). On the contrary, others emphasize the use of genetically engineered seeds (certified improved varieties, mainly hybrids), chemical fertilizers, irrigation and other external inputs as key to improve productivity (Pingali, 2012 and Borlaug, 2007). On the one hand, advocates of low external input strategies argue that the use of agrochemicals and high-yielding crop varieties would destroy the environment and biodiversity (Holt-Giménez et al., 2013 and Shiva, 2016). This strategy would also move farming towards more commercial agriculture with no benefits for smallholder farmers (Shiva, 2016). On the other hand, arguments in favour of the use of genetically engineered seeds, focus on the fact that those varieties will produce higher rates of yields with the appropriate use of fertilizers (Juma, 2011). A strategy that could guarantee food security, especially in Africa, where the first green revolution did not take off to the same extent as elsewhere (Pingali, 2012).

Although improving agricultural productivity is necessary to maintain sustainable food production, others argue that addressing gender-based inequalities could more efficiently contribute to a significant improvement in food and nutrition security (WB, 2009). Indeed,

female farmers play and important role in agriculture in many countries, a trend known today as feminization of agriculture (FAO, 2017). However, to contribute effectively to agriculture, women depend on their access and property rights to land, which is an important resource for farmers in general (Agarwal, 2018). Hence, the laws governing women's rights to land need to be addressed for enhancing their livelihood and food security (ibid). In 2011, FAO estimated that with equal access to land by women, agricultural yields could increase between 20% and 30% and, as a result, agricultural production in developing countries could also increase between 2.5% and 4.0%. Furthermore, women are fundamental to translate the product they cultivate into food and nutritional security for their families (WB, 2009); as women are generally responsible for food selection and preparation as well as for the care and feeding of children (ibid). Therefore, it becomes of great relevance to increase the autonomy of women in making decisions about the distribution of food, as well as to increase women's ability to generate income to maximize food security and nutrition at the household level (Agarwal, 2018).

While increasing women's income could positively contribute to food insecurity, some scholars emphasize the need to improve farmers' access to markets as key to achieve food security. Addressing market constraints for balanced and nutritious diets could be more important over increasing farm production diversity (Sibhatu et al., 2015; Koppmair et al., 2017 and Sibhatu & Qaim, 2018). In particular, considering that farmers not only consume what they produce but also buy part of their food in the market (Sibhatu & Qaim, 2018). For instance, a study conducted by Sibhatu et al., (2015) indicated that “smallholder access to agricultural markets and off-farm employment have positive effects on household dietary diversity” (p. 10660). Also in Malawi, where subsistence farming is relevant, markets still play an important role for dietary diversity (Koppmair et al., 2017). To improve farmers' access to markets, constraints such as long distances from markets (Sibhatu et al., 2015), high market prices (FAO, 2020a) and low farmers' income need to be addressed. FAO's report (2020a) revealed that “healthy diets by any definition are far more expensive than the entire international poverty line of USD $1.90” (p.19).

4.2 Seed security framework

Seed security appeared as a concept in the 1990s and originated when evaluating seed aid in humanitarian relief efforts (Dalle & Westengen, 2020). Initially three dimensions were part of the seed security framework: availability, access and quality (quality included seed quality and

variety quality) (ibid). FAO (2016b) published a revised version of the seed security framework and added two additional dimensions. The new version is the one used in this study under the following definition: “Seed security exists when men and women within the household have sufficient access to quantities of available good quality seed and planting materials of preferred crop varieties at all times in both good and bad cropping seasons” (p. 6).

Under the above definition, *availability* refers to having seeds available in an adequate space and in the determined periods in which they are needed (ibid). *Access* implies the ability to acquire seeds through cash, exchange, loans, or social networks (ibid). *Quality* is framed only in terms of the physical seed quality and considers the germination rate, physical purity and absence of pests and diseases (FAO, 2016a and FAO, 2015a); while *varietal suitability* (a new dimension) focuses on how well the varieties satisfy farmers' needs and preferences as well as the seed adaptability to local conditions (ibid). Lastly, the second added dimension, *resilience* refers to the seed system stability considering shocks (ibid).

4.3 Food security and seed security

Due to the similarities that the concepts of food and seed security have, it has been assumed that if a person is food insecure, the person is also seed insecure and seeds must be delivered (McGuire & Sperling, 2011). For instance, during the food price crisis 2007-2008, widespread donor actions focused on agriculture in general and seed security programmes in particular (ibid). However, a study conducted by McGuire & Sperling (2011) showed a weak correlation between food and seed security and instead stated that casual links are mainly one-directional from seed to food security, particularly around the access dimension. Many humanitarian interventions were developed without evaluations to analyse whether seeds were needed or not (Sperling & McGuire, 2010a and Longley, 2003).

Instead of assessments, NGOs have assumed that food insecurity is synonymous with seed insecurity and when farmers do not have seeds, seeds must be delivered from outside (Remington et al., 2002). DSD has been the most common response used to address the seed availability problem (ibid). Indeed, DSD can be useful and may be the only way to provide crops and varieties that are unavailable in the area and that cope with stressed conditions (McGuire & Sperling, 2008). However, NGOs tend to overlook how seed systems actually work before implementing SSRs (Sperling et al., 2008). Problems of access rather than availability could for instance be what farmers face during crises, hence other types of SSRs

might be more appropriate (Remington et al., 2002). When the problem is access, seed fairs could be a more suitable response, as seed fairs are SSRs that provide an ad hoc marketplace where seed traders and local vendors are invited, and farmers receive free vouchers from the NGOs to acquire seeds (Sperling et al., 2008). Seed fairs foster farmers' decision-making power, as they select the seeds of their choice while also strategize and purchase seeds for both current and future seasons (McGuire & Sperling, 2008 and Sperling et al., 2020b). Another SSR for instance that aims to address both access and availability is a CSB (Vernooy et al., 2014).

Seed availability could be affected by natural and man-made disasters (Almekinders et al., 1994), but as Sperling et al., (2008) indicated "different seed channels may be affected by the crisis to different extents and in different ways" (p.594). Therefore, some seeds/crops could be available in local markets, while others may have been affected and are not found locally or in nearby areas. In this study two types of concepts for markets are used. First, commercial markets are understood as established marketplaces where certified improved seeds are commercialized (McGuire & Sperling, 2016). The sellers of those seeds are commonly known as seed traders or agro-dealers. Second, local markets are understood in this study as established marketplaces where products with a local demand are commercialized including fresh vegetables and grains, and are located within smallholder farmers' local communities (Sperling et al, 2020a). The seeds sold in those marketplaces are local and indigenous without certification. Those who commercialize these seeds are identified as local vendors.

Governments and NGOs tend to assume that local seeds are not of good quality and thus certified improved seeds are considered the right seeds to supply (Remington et al., 2002). Contrary to those beliefs, studies have shown that quality is an important criterion among small-scale farmers. The quality of seeds farmers select, and use is high despite not having certification (Remington et., 2002 and Sperling & McGuire, 2010b). The seeds that farmers save have been found in local markets even during stress periods (McGuire, 2007).

The use of local and commercial markets has been shown to be negatively affected by poorly designed aid programmes (Sperling & McGuire, 2010a). First, the seeds provided may not germinate or adapt to local conditions, so farmers' land could be wasted (ibid). Second, delays in seed supply, regardless of the SSR, could lead farmers not to plant when the season begins,

thus losing their harvest for the upcoming season (ibid). And lastly, repetitive seed aid could undermine markets as farmers become dependent on aid to source their seeds (Sperling, 2020).

Even though seed aid could contribute to farmers recovery, it has been found that the contribution could not generate major impacts (Sperling et al., 2008 and Mulesa et al., 2021). Farmers do appreciate the support but value the seeds they produce on their own and from known channels higher (ibid). Additionally, McGuire & Sperling (2008) explained that when too much seed interventions take place, farmers tend to be aware of how needy they need to be to qualify for assistance. So by assessing only farmer's needs, practitioners often assume that seed aid is the major, if not the only, source of seeds for crisis affected farmers (ibid). Lack of additional assessments could contribute to the poorly designed responses. As Sperling et al., (2008) stated "This lack of assessment means that seed aid is carried out in an environment of relative ignorance and that a narrow set of responses monopolise the field by default" (p.604).

Based on the above-mentioned insights, many SSRs have been overly simplified and developed based on assumptions rather than actual analyses that could identify the real problem and thus the correct response. In the last decade, many researchers have created awareness that supplying seeds without prior analysis presents a problem, and so problem identification should be highly relevant for NGOs before delivering seeds (Sperling, 2020). As a result, seed security assessments and guidelines to conduct them have been created. "The onus of resilience response will have to lie with the seed systems that farmers use for most of their seeds, that are able to supply crop and variety diversity" (McGuire & Sperling, 2013 p.651). In short, assessments are highly relevant, otherwise poorly designed seed aid could undermine farmers' resilience, do harm and create seed dependency (Sperling et al., 2008).

If designed correctly, SSRs could contribute to avoid farmers dependency on food aid (Sperling et al., 2008), as dependency narratives conceptualize food aid as detrimental to self-sufficiency (Gautam, 2019). Indeed, SSRs are considered a cost-effective strategy to avoid food aid dependency and also contribute to recovery after crisis (Sperling et al., 2008). Studies have though shown that farmers engage in both farm and non-farm activities to access food instead of relying on aid (Little, 2008 and Gautam, 2019). Farmers may occasionally benefit from food aid, but food aid is too unstable and poorly timed to depend on (Little, 2008).

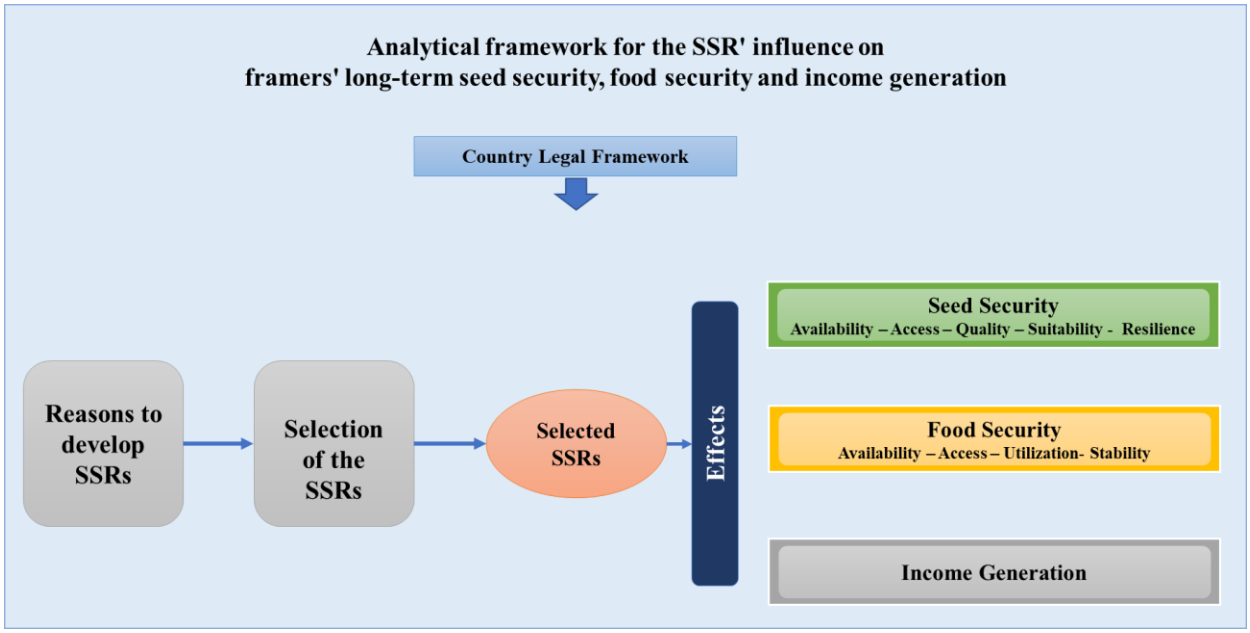

Figure 1: Analytical framework of the study

Source: Author, based on seed and food security frameworks

4.4 Seed systems

Farmers worldwide are normally involved in two types of systems to obtain seeds. The first is *the formal seed system* characterized by the vertically organized production and distribution of tested and approved varieties (Almekinders et al., 1994). The system structure is guided by scientific methodologies of plant breeding and controlled multiplication operated by specialists from both public and private sectors (Louwaars & De Boef, 2012). The use of strict quality controls characterizes the formal seed system (Almekinders et al., 1994) to ensure that the seeds are of acceptable quality in terms of varietal integrity as well as in terms of difference from grain (Remington et al., 2002). The seeds produced under this system are known as improved varieties and have a quality certification. Those seeds can be hybrids or OPVs. However, hybrids are the main seed varieties promoted by the formal seed system (Louwaars & De Boef, 2012). Hybrid seeds are also called *miracle seeds* and have since their creation been promoted as high-yield varieties (Thompson & Scoones, 2009) because they in combination with chemical fertilizers could increase productivity (Harwood, 2019). For this study, the seeds produced under the formal seed system are of two types and are understood as *hybrid certified improved seeds* and *OPV certified improved seeds.*

The second seed system is *the informal seed system* that is also known as the local seed system, traditional seed system and farmers' seed system (CGRFA, 2011). This study will use *the*

farmers' seed system concept to distinguish it from the formal seed system. It is mainly characterized by the local reproduction and multiplication of seeds by farmers themselves and particularly women are the ones doing the seed selection process (Almekinders et al., 1994). The seeds produced under this system do not have a standardized process nor do they obtain a quality certification (Remington et al., 2002). However, farmers go through a careful seed selection process immediately after harvest to prevent mixtures of seeds and grains, as well as to guarantee preservation of the best seeds (ibid). Local knowledge guides farmers' seed system performance (McGuire, 2001). In addition to their own harvest, seeds under farmers' seed systems are obtained through gifts and exchanges between friends, neighbours and family, as well as through local markets (Sperling et al., 2008). CSBs are generally part of the farmers' seed system, and their main function is to maintain seeds for local use (Vernooy et al., 2014). CSBs, like all other sources in the farmers' seed system, perform selection, conservation sharing and breeding without the involvement of or control by research or other formal institutions (ibid). The seeds within the farmers' seed system are known as *local and indigenous seeds* and both concepts are used in this study to refer to seeds produced under the farmers' seed system. Seeds that after a detailed farmers' selection process can also be recognized as improved seeds without any quality certification and that are also OPVs.

Farmers normally access seeds of different crops through both seed systems (McGuire & Sperling, 2016), however studies across developing countries have shown that the farmers' seed system remains their major seed source (Almekinders et al., 1994; Remington et al., 2002; Almekinders & Louwaars, 2002 and McGuire & Sperling, 2016). A study conducted by McGuire & Sperling (2016) based on 9660 observations in six countries, of which five were African countries, and covering 40 crops, showed that farmers access 90.2% of their seed through farmers' seed systems. Likewise, Almekinders & Louwaars (2002) stated that depending on the crop and the country, from 60% to 100% of the seeds planted by farmers comes from their own production or through exchange. In terms of Africa, the World Bank Agriculture for Development report (2008) estimated that 80% of all seed used by farmers is produced under their own seed system. Farmers continue to rely primarily on their own seed system, despite efforts made in many developing countries to promote the formal seed system (McGuire & Sperling, 2016).

Particularly in Africa, the formal seed system has been highly promoted through policies and subsides (Sheahan & Barrett, 2017). “Low use of modern inputs is nearly synonymous with

African agriculture and acts as a motivation for the policy priorities" (ibid p. 12). Formal seed system supporters claim that the low growth of agriculture in SSA is due, among others, to the lack of a strong formal seed system that guarantees a constant seed source (Gaffney et al., 2016). A claim that has been supported by the Alliance for a Green Revolution in Africa (AGRA) that alleged that farmers access seeds through their own networks due to the weaknesses in the supply channels of the formal seed system, despite the improvements AGRA in itself has made through years (AGRA 2019).

Despite the promotion of the formal seed system, various reasons have led farmers to remain loyal to their seed system. Among others, the production of the formal seed system has mainly focused on hybrid certified improved seeds of few crops that guarantee profitability while neglecting seeds and crops farmers use and prefer (Jones et al., 2002, Louwaars & De Boef, 2012 and van Niekerk & Wynberg, 2017). The farmers' seed system offers demanded seed diversity and is easily accessible in terms of distance and cost (Coomes et al., 2015). A study by Haug et al., (2016) further found that farmers in Tanzania use the farmers' seed system as they cannot invest in improved seed varieties from the formal seed system due to the high cost along with the risky nature of agriculture.

Own stocks and local markets have been found as the main sources of the farmers' seed system which farmers rely upon (McGuire & Sperling, 2016 and Sperling et al., 2020a). However, it is worth noting that seed sources vary significantly depending on the type of crop (ibid). A study by McGuire & Sperling (2016) found that local markets are the main source of seeds for crops such as legumes, while own stocks are especially essential for vegetatively propagated crops (VPC), as well as grain cereals from the drylands. Among the advantages that farmers find in their own seeds is that stored seeds are cheap, of known quality, adaptable to local conditions as well as ready to use when needed (Almekinders et al., 1994 and Louwaars & De Boef, 2012). Furthermore, for dryland cereals, small seeds and dry storage present fewer challenges for self-storage than for legumes (Sperling & McGuire, 2010b). In general, farmers tend to possess good knowledge of their major crops which facilitates proper selection and storage for further use (Louwaars & De Boef, 2012). However, Almekinders et al., (1994) highlighted that it is important to keep in mind that local methods need improvements, especially with regard to storage in unfavourable climates or in areas where crops have been recently introduced. Seed availability can be at high risk after poor seasons, not only because

farmers cannot depend on their own seeds, but also because their networks could not have enough seed to exchange (Louwaars & De Boef, 2012).

In case of quality deterioration of their own seeds, farmers themselves look for other seed sources (Almekinders et al., 1994 and Sperling & McGuire, 2010b); and thus local markets play a key role in seed supply (Sperling et al., 2020a). A study conducted by McGuire & Sperling (2016) showed that by using local markets, farmers demonstrated that they are willing to use their money and pay for quality seeds when needed. Despite not providing any type of certification, local markets also have seed quality criteria that are usually determined by the buyer (Remington et al., 2002 and Sperling et al., 2020a). Quality is based on trust rooted in good neighbourliness (Sperling et al., 2020a). However, it was stated that just as agro-dealers tend to ignore important segments in the countryside and not have stores or outlets around key locations, local vendors may also tend to ignore this segment (ibid).

Additionally, social networks are seed sourcing channels of the farmers' seed system. McGuire & Sperling (2016) found that the main seeds obtained through social networks are the VPCs because of limited market options. Almekinders et al., (1994) explained that farmers with good seed practices tend to have a good reputation as suppliers within the community, making farmers rely on the seed quality that they can obtain from their social networks. Farmer networks can be very effective in spreading new varieties (Almekinders et al., 1994). Although farmers obtain seeds through exchange, studies have shown that this seed channel does not appear to be an important source in terms of quantities or frequency of use (McGuire & Sperling, 2016). Therefore, although the exchange of seeds can be very effective, the small quantities, the speed, the frequency and the scope can create delays in access. Additionally, not all farmers of a community have access to seed networks. Coomes et al., (2015) found that the exchange is not egalitarian. For instance, social exclusion of widows or orphans of tenant farmers could occur within communities (Bezner Kerr, 2013). Therefore, farmers can be selective about with whom to share seeds and germplasm; as seeds are a source of wealth, pride and identity (Coomes et al., 2015). As a result, communities with weak social networks have been shown to be more vulnerable to adverse conditions due to restricted access to locally adapted seeds, compared to those with strong social networks (Poudel et al., 2005).

CSBs have become a successful and trusted institution that improves farmers' accessibility to locally adaptable and improved seeds (Vernooy et al., 2014). CSBs are located in areas close

to the communities and maintain a payment loan system ensuring both accessibility and availability (Vernooy et al., 2014 and Maharjan & Maharjan, 2018). Despite the CSB success demonstrated through studies, some weaknesses could threaten their sustainability. Implementers could promote seeds that do not meet farmers' preferences and needs (Nyantakyi-Frimpong, 2019). Thus, farmers who resist those varieties could sabotage the payment system to stop the circulation of those varieties (ibid). Valuing the local knowledge (Bezner Kerr et al., 2019) then becomes relevant for CSBs' sustainability. Sustainability that could also be threatened as CSBs are collective institutions and some farmers may feel little pressure to repay their loans, trusting that other farmers will pay (Reisman, 2017). The study by Nyantakyi-Frimpong (2019) identified more difficulties to recover seed loans from men than from women. However, fewer women were part of the CSB management, and consequently of the benefits.

Due to the strengths and weaknesses of both seed systems, experts and academics have stated the need to link the two systems to improve seed supply for small-scale farmers (Coomes et al., 2015, Louwaars & De Boef, 2012). For instance, Almekinders et al., (1994) led to the conclusions that both seed systems are complementary and that the use of integrated approaches in breeding and seed production could have a promising potential for improving seed supply. Likewise, McGuire & Sperling (2016), Jones et al., (2002) as well as Almekinders & Louwaars (2002) concluded that linking the formal seed system with the farmers' seed system and improving the latter may be in many cases a more effective strategy to improve national and local seed supply. As a result, a system called *Integrated Seed Sector Development* (ISSD) emerged to offer affordable good quality seeds from a variety of crops (Louwaars & De Boef, 2012). The result of this integration is to produce good quality seeds under more flexible quality standards (ibid). More flexible standards are made to support small-scale farmers who want to multiply their own seeds and work with different crops, but do not meet all the requirements to obtain a quality certification like the one obtained by large seed companies under the formal seed system. Seeds that are certified under this quality scheme are known *as Quality Declared Seeds* (QDS) and their purpose is to improve availability of quality control seeds to poor farmers, help reduce fake seeds on the market, expand the quality seed portfolio and focus on local seed trade (Louwaars & De Boef, 2012).

5. Methodology

5.1 Research design

The exploratory nature of the study, along with its aims, led to the use of a case study approach. "The case study approach is an empirical method that investigates a contemporary phenomenon in depth and within its real-world context" (Yin, 2018 p. 15) from the participant views by using multiple sources of evidence. Simultaneously, case studies are characterized by being studied in their natural environment, being oriented towards understanding and generating theories (Rowley, 2002). Bryman (2016) based on Yin (2009) makes the distinction between different types of case studies. For this research, the type of representative or exemplified case was selected to capture cases that could provide the appropriate contexts to answer the RQs (Bryman, 2016). Simultaneously, this type of case design allows to examine key social processes (ibid). From the beginning, I sought access to Norwegian NGOs that have implemented SSRs in the appropriate contexts (humanitarian action and long-term development) to assess in detail the SSR processes.

Having decided to analyse both contexts in which SSRs take place, the multiple case study strategy (two cases) was selected. Results from contrasting situations could represent a strong start toward theoretical replication and strengthen study findings (Yin, 2018). Additionally, more than one case shows different perspectives on the topic of interest (Creswell, 2013), and thus more analytical outcomes and conclusions can emerge (Yin, 2018 and Rowley, 2002). Two NGOs were selected, the Norwegian Refugee Council (NRC) developing SSRs after emergencies and the Development Fund (DF) developing SSRs in a development context.

Furthermore, the case study approach suited the research needs and allowed me to immerse in the humanitarian and development contexts to empirically illustrate the theoretical connections of those contexts and their SSRs, as well as discover the whys and hows. Why and how are explanatory and deal with the monitoring of operational processes over time, not with mere frequencies or incidents (Yin, 2018). First, the leading question is about how the SSRs developed by NGOs in humanitarian action and long-term development interventions influence small-scale farmers' long-term seed security, food security and income generation. Second, this is a study about why NGOs decide to develop SSRs within their programmes and why they use certain SSRs to supply small-scale farmers with seeds. Consequently, the research benefits

substantially from direct conversations with those involved in the SSRs both as implementers (staff from the selected NGOs) and as beneficiaries (small-scale farmers and seed traders) as well as from examinations of case studies.

Although case study design has great advantages in social sciences, there are also criticisms considering its use. A common concern is that the results of a case study cannot be generalized to a broader level (Yin, 2018 and Bryman, 2016). However, since the beginning of the study the aim was not to generalize, but rather to make a more exploratory analysis of the SSRs in both humanitarian action and long-term development contexts that the selected NGOs work within. Another concern is that the researcher bias could influence the study findings (Yin, 2018). To address bias, first I selected two NGOs that I had not worked with before, and I also selected settings (African countries) that I have not visited and where the selected NGOs develop SSRs. Second, I employed different interview methods with different participants who are part of the SSRs and with key informants who are external to the selected NGOs but who have knowledge and experience of the topic in each selected country. So I relied on multiple sources of evidence (ibid) that in addition to help me to avoid bias, also helped me triangulate the results and increase the data validity. Finally, another critical remark of using a case study design comes from the use of qualitative data which can be seen as less robust and unreadable (ibid). To mitigate this, the collected data was classified by case study and then analysed and reduced by categorizing and identifying patterns. The reduction of data made the information more workable to identify the main findings.

5.2 Research method

"No everything that can be counted counts, and not everything that counts can be counted"

Albert Einstein

A qualitative method was used to create a broad and comprehensive understanding of how SSRs developed by the selected NGOs in humanitarian action and long-term development interventions influence small-scale farmers' long-term seed security, food security and income generation. More specifically, the study method allowed the study design to focus on exploring both the perceptions and experiences that small-scale farmers had before, during and after participating in SSRs; as well as the original reasons and aims that lead NGOs to implement those SSRs. Indeed "qualitative research properly seeks answers by examining various social settings and the groups or individuals who inhabit these settings" (Berg & Lune, 2012 p. 8).

Qualitative research focuses primarily on the words of those who inhabit certain settings to generate insights into a phenomenon rather than quantification in data collection and analysis (Bryman, 2016). Therefore, when the aim of an investigation is to understand the experiences of a phenomenon of a small group of individuals who have been part of a certain setting, qualitative research is recommended (Brockington & Sullivan 2003). Through qualitative research I gained understanding of how SSRs are developed (from the experiences of those who conducted them in the field) and their effects on who the direct beneficiaries of those SSRs are.

Qualitative research also has the potential to give a voice to minority groups, which may not be heard otherwise (McGrath et al., 2019). Through qualitative research, I could unravel stories of small-scale farmers in hard-to-reach rural areas to understand to what extent their condition changed after being part of activities intending to improve the difficulties they live due to poverty, war, displacement or other factors. So, "Qualitative methods can provide powerful insights into the world" (Brockington & Sullivan 2003 p. 59).

Furthermore, qualitative methods go beyond numbers and consider the meaning of the findings rather than critically accepting produced data (Brockington & Sullivan 2003). Numbers cannot tell the full story of the SSRs effects on small-scale farmers. Although it is true that numbers can describe quantities of seeds farmers received, types of crops farmers obtained, planted hectares, expected and lost harvest; numbers cannot tell us why an SSR is planned, why an SSR is prioritized while others are rejected, neither what farmers learn or how they can improve self-sufficiency.

5.3 Sample selection approach

The sampling strategy used to collect the qualitative data of this study was single-stage, generic purposive sampling, using a priori criteria. The sample was purposively selected to interview participants who could provide relevant information to answer the RQs. As stated by Bryman (2016) purposive sampling is a form of non-probability sampling that aims to sample and select participants or units of analysis to answer the RQs. Purposive sampling was key to the study because it helped to ensure representativeness and capture the population heterogeneity (Maxwell, 2013). Additionally, the particularity of the study in terms of a specific topic related to SSRs developed by the selected NGOs, as a researcher, I was aware of what needed to be

known and set out to find organizations and participants able and willing to provide information by virtue of knowledge and experience (Bryman, 2016).

Regarding the sampling context, the first step was to select Norwegian NGOs that implement SSRs in developing countries as part of their agricultural activities to improve farmers' livelihoods and seed security, in the context of humanitarian action and long-term development interventions. Second, through the Oslo headquarters of the selected NGOs, NRC and DF, I selected a country in each organization where SSRs were recently developed. In NRC's case, access to field staff in Uganda was facilitated by the global level Seed and Food Security Advisor. In the DF case, access to the field staff in Malawi was facilitated by the Director of Malawi. Selection of the field staff participating in the semi-structured interviews was based on the following criteria:

- Field staff who have been part of the planning, design, implementation, and/or monitoring of SSRs.
- Field staff from implementing partners who have been strategic allies in the development and/or advocacy of SSRs.

Subsequently, access to farmers in Uganda was facilitated by the Livelihoods and Food Security - Agronomy Officer from NRC while in DF similar access in Malawi was assisted through a member of the implementing partner Biodiversity Conservation Initiative (BCI). The selection of farmers participating in semi-structured interviews, structured interviews and focus groups was based on the following criteria.

- Female and male working age (18-60 years old) farmers included in SSRs developed by the NGOs, especially in the last two years.
- Female and male farmers with access to land and with different kinds of cultivated crops.
- In the case of Uganda, female and male farmers with refugee and host community status.
- For the focus groups, in addition to above characteristics, farmers who had participated in the most recent SSRs organized by NRC and DF.

Key informants for this study were also purposively selected, so their experience, participation in the design of SSRs, and knowledge helped to enhance the research understanding. Selected informants ranged from people who created and implemented seed security modalities and

introduced the concept of seed fairs in African countries, to people who now work in Uganda, Malawi and globally developing SSRs, but who are not part of the targeted NGOs. Furthermore, I conducted snowball sampling, as some key informants introduced me to other experts on the topic who had relevant characteristics for the study (Bryman, 2016). The advantage of snowball sampling was to use and access the social network of previous key informants (ibid).

Below is the number of study participants:

Group of study participants Uganda	Female	Male	Total
NRC staff	2	9	11
Refugees	10	10	20
Host community farmers	7	7	14
Seed traders	0	4	4
Total			**49**

Table 1: Uganda study participants

Source: Author

Group of study participants Malawi	Female	Male	Total
DF staff	0	2	2
DF partners	1	3	4
Farmers	9	8	17
Total			**23**

Table 2: Malawi study participants

Source: Author

Key informants	Female	Male	Total
Informants from Uganda	2	1	3
Informants from Malawi	1	2	3
Other key informants	1	3	4
Total			**10**

Table 3: Key informants

Source: Author

5.4 Data collection

A large proportion of social science research is based on data collected through interviews (Brinkmann & Kvale 2015). Interviews have the purpose of obtaining the views in which those interviewed interpret the meaning of a described phenomenon (ibid.). To understand the impacts that SSRs developed by NGOs have on farmers' long-term seed security, food security and income generation, primary data was collected through a series of semi-structured online interviews, structured interviews conducted by research assistants in the field, online focus groups as well as online key informant interviews. The collection of information using multiple types of interview methods was developed to triangulate the information. The use of different methods serves to validate the research findings (Berg & Lune 2012); increase the reliability (Bryman, 2016) and reduce the risk that the study conclusions reflect only the biases of a specific method (Maxwell, 2013).

Although observation is another method that can allow making inferences about perspectives that cannot be obtained by relying exclusively on data from different interview methods (Maxwell, 2013); observation was not used for this research because I was unable to visit the field due to Covid-19 travel restrictions. Hence, I could not explore local seed markets, visit crops, or participate in SSRs. Consequently, as stated by Maxwell (2013) I relied on different interview methods because "interviewing can also be a valuable way of gaining a description of actions and events, often the *only way*, for situations to which you cannot gain observational access" (p. 103).

One of the interview methods used was online semi-structured interviews. Those interviews were conducted with NRC field staff in Uganda, DF field staff in Malawi, small-scale farmers in both countries, seed traders in Uganda and key informants. An online semi-structured interview method was considered appropriate because it is flexible and has open-ended questions that help respondents to give answers that contribute to the RQs (Bryman, 2016). Furthermore, this method allows respondents to provide their own experiences, knowledge, and thoughts on the topic, while allowing the interviewer to guide the focus and obtain relevant data (ibid). Each interview lasted approximately one hour and, in some cases, especially with NGOs field staff who are directly in charge of the SSR development, up to two interviews were conducted to gain in-depth understanding.

The online key informant interviews contributed to broaden my understanding of the topic, obtain accurate information, reduce potential bias and triangulate findings. Participating key informants were seed experts working with both development of SSRs and social research on seed security. Those interviews lasted on average one hour.

In addition to the online semi-structured interviews with small-scale farmers, two online focus groups were set up, one in each country. The focus group of Uganda consisted of four women, two of whom were refugees and two host community members. The focus group in Malawi consisted of three participants, two female and one male. The focus group interview in Uganda was conducted in English, whereby interviewees with the highest command of the language were selected. In contrast, in Malawi the focus group interview was arranged with the support of a research assistant as translator, because the selected participants had limited English proficiency. Each focus group interview lasted for on average 90 minutes. The focus groups were planned to give me the opportunity to explore the topic further. It also facilitated transport efficiency to a single point using the translator only once in the case of Malawi instead of several times in individual interviews.

Focus groups is a form of group interview (Bryman, 2016); however, the focus group approach offers the opportunity to assess personal and group motivations, behaviours, attitudes, and reasons for developing certain views (Berg & Lune, 2012). Furthermore, an important characteristic of focus groups cited by Merton et al. (1956: 3 cited by Bryman 2016), is that "interviewees are selected because they are known to have been involved in a particular situation". The main focus group characteristic in Malawi was that they all sourced seeds from the same CSB and participated in the seed fair in November 2020. In the case of Uganda, the focus group members participated in the most recent DSD in June 2020, and all belong to the same refugee camp community. A central feature of focus groups is that they provide researchers with direct access to the language and concepts that participants normally use to structure and discuss their experiences (Berg & Lune, 2012). Finally, this approach offers the opportunity to study the collective ways in which participants make sense of a phenomenon (Bryman, 2016). Instead of simply answering the questions asked by the researcher, the participants had the opportunity for discussion and thus complement the answers, express their common points of view as well as their different perspectives.

Despite having had the opportunity to interview farmers through online platforms, I wanted to explore further and involve more non-English speaking farmers in the study. Nevertheless, it was not feasible to mobilize more farmers to a place with good internet connection for reasons such as: Covid-19 mobility restrictions; travel costs and farmers' time availability. Consequently, I involved research assistants to conduct structured interviews with farmers in the field. Both NGOs provided support in this matter. To diminish bias when collecting information, Monitoring and Evaluation (M&E) employees of the NGOs were engaged, instead of field staff who could have been involved in SSRs.

Because qualitative researchers are interested in how people say things in addition to what they say (Bryman, 2016), all online interviews were recorded with prior participant consent. Notes were taken during the interviews, particularly to assist transcriptions as well as to highlight themes that were emphasized by the participants. When participants did not want to turn on the video, the interviews were still recorded with their approval. The use of no video happened especially due to connection problems rather than by fear of being filmed.

5.5 Data analysis

Before analysing the data, all recorded interviews were transcribed. “A transcript is a translation from a narrative mode, oral discourse, into another narrative mode, written discourse” (Brinkmann & Kvale 2015 p. 204). Although during the transcriptions the tones of voice or intonations and other relevant interview aspects may be lost (ibid); all the video recordings were watched as many times as necessary to capture and write down all the information mentioned by the participants during the interviews, including the exact wording, pauses and confirmation of answers when the online connection presented problems. The transcripts were initially separated according to case study and then to target groups. Each participant, depending on the case study and group, was named with a pseudonym to be anonymized, as shown in Table 4 and Table 5.

Group of farmers	Pseudonyms Female	Pseudonyms Male
Refugee farmers	FFRU	MFRU
Host community farmers	FFHCU	MFHCU
Farmers from Malawi	FFM	MFM

Table 4: Farmer pseudonyms

Source: Author

Group of study participants	Pseudonyms
NRC staff	NGOUI
DF staff and DF partners	NGOMI
Seed traders from Uganda	STU
Key informants	KI

Table 5: Other study participant pseudonyms

Source: Author

The first case study was named *Seed security responses and humanitarian action* and the following groups were designed: NRC field staff from Uganda, female and male Ugandan refugee and host community farmers, Ugandan seed traders, Ugandan key informants and other key informants. The second case study was named *Seed security responses and long-term development* and the following groups were designed: DF field staff from Malawi, female and male Malawian farmers, Malawian key informants and other key informants.

The transcripts were made as the interviews were carried out from September to December 2020. The aim of transcribing simultaneously while developing the interviews was to organize the data for analysis to avoid overwhelming volumes of raw data at later stages (Berg & Lung, 2012 and Bryman, 2016). Furthermore, transcribing directly after the interviews made it possible to begin preliminary analysis (Maxwell, 2013). Transcripts were subsequently read as recommended by Maxwell (2013) based on Emerson et al., 1995, and analysed to highlight significant remarks (Bryman, 2016). Simultaneously, notes taken during the interviews were added to the transcripts and memos with possible codes, categories and relationships were created.

Field interviews conducted with support of research assistants were translated and transcribed by them. In the case of NRC, the interview transcripts were uploaded in real time to an online platform. No printed documents were generated for NRC, and I was the only one with access to read and download the data. In the case of DF, I received scanned pdf-transcripts and rewrote them to review the answers and categorize the information. Participant's names were not recorded in the transcripts done by the NGOs. The research assistants in both countries were contacted to clarify the answers given by the small-scale farmers when necessary while creating initial notes, memos, and preliminary codes.

After transcribing and adding of notes, conventional content analysis was used to analyse the data. Content analysis is defined as a "careful, detailed, systematic examination and interpretation of a particular body of material in an effort to identify patterns, themes, biases, and meanings" (Berg & Lune, 2012 p. 349). Content analysis involves the coding of categories derived from raw data, to reduce and code it to make the information more accessible and understandable to extract themes and patterns (ibid). Coding categories were developed deductively and inductively. The deductive approach, also known as directed content analysis, was used because it involves implementation of analytic codes derived from exiting theories and explanations relevant to the RQs (Berg & Lune, 2012). Coding categories and themes were created based on the seed and food security frameworks. The inductive approach, also known as conventional content analysis, was used for the creation of other coding categories derived directly from the raw data itself (Berg & Lune, 2012). When reading the transcripts, codes that did not yet belong to any theory emerged and were placed in groups relevant to answer the RQs. This approach originated from the grounded theoretical approach (ibid) and prioritizes the importance of allowing theoretical ideas to emerge from raw data (Bryman, 2016). Moreover, the creation of codes was a way to answer the RQs (Berg & Lune, 2012).

The analysis was conducted manually using hand-coding. Initially, several codes were identified and represented with an individual colour. Each code had subcodes to guarantee that all relevant information to a certain code was included when the transcriptions were reviewed. Afterwards, the related codes were grouped and classified into categories to create the themes. Then, each transcript was revised to identify statements for code classification. As stated by Berg & Lune, (2012) main transcript elements can be counted when textual content analysis is developed. Each colour code was examined for repeating words and phrases, recurring patterns describing perceptions or ideas, trends, relationships, commonalities, deviations, or concepts. Although some participants used different words to express their experiences, the meanings were similar. During the transcript review, I counted the number of participants who mentioned certain statements, concepts or ideas, as well as the frequency with which each participant mentioned certain statements and under what context. The use of numbers in itself does not turn a research study into mixed methods, but numbers give precision to descriptions of particular phenomenon (Maxwell, 2010).

After colour-coding, similarly coloured statements were transferred to a matrix where the codes were arranged and combined with the data obtained from the transcripts to provide in-depth

detailing for triangulation of each code. Subsequently, patterns and common trends were identified to answer the RQs. Lastly, a summary of each main finding was made by theme and by case, including also main characteristics of the findings. The final matrices contained the RQs, codes, subcodes, themes, detailed descriptions of the main findings for each theme and quotations that emphasized and captured the emerging themes.

5.6 Ethical considerations

The ethics of research in social sciences comprises the notion of *do no harm*[3]. To avoid harm, the researcher must anticipate and prevent consequences that may be detrimental to the participants; and it is worth considering that the research experience could always be perceived as disturbing (Bryman, 2016). So, all participants must be protected from being harmed, including avoiding any deception in the study (Yin, 2018). Since the design phase of this research, I attempted to maintain the key ethical consideration *do no harm* as a guiding principle. Following are the fundamental ethical considerations adopted in this study.

Informed consent was an important ethical consideration for this research. “Informed consent entails the implication that even when people know they are being asked to participate in research, they should be fully informed about the research process" (Bryman, 2016 p. 129). After receiving authorization by the Norwegian headquarters of NRC and DF to contact their field staff, written explanation of the study purpose and the importance of their participation was sent by e-mail with the informed consent attached. The written informed consent was developed to inform participants of the general research aim and the possible risks and benefits of participation (Brinkmann & Kvale 2015); giving them the right to accept or deny their cooperation based on the information provided (Locke et at., 2013). Those who voluntarily agreed to participate replied with a signed informed consent and with their availability to schedule the online meeting.

Research, food security and M&E assistants in the two NGOs, supported me in the field to contact small-scale farmers previously participating in SSRs the organizations developed and invite them to participate in the research. The assistants received training in the research aim, and in all the informed consent details to correctly approach potential participants and explain the consent (in some cases translate it). During the training sessions, particular emphasis was

[3] Types of harm include psychological harm, physical harm, legal harm, social harm, and economic harm.

placed on the need to inform small-scale farmers that this research was being carried out by an independent researcher to the NGOs and that their participation would neither have any economic benefit, nor any sanction if they decided not to participate. Due to the online context in which the research was conducted, the small-scale farmers' written consent was obtained with the assistants' support. However, in some cases fingerprints were used instead of signatures because some participating farmers were illiterate.

Before each online interview, I again notified all participants of the terms and conditions of the consent to maintain transparency and asked for their verbal consent. During the interviews with NGO staff, it was emphasized that participation was voluntary and their link with the organization would not be affected if they denied participation or avoided answering some questions. Small-scale farmers interviewed online and by field assistants were also informed that participation was voluntary and that the services provided by the NGOs will not change or be affected by their decisions or responses. All participants were also provided with the possibility to ask questions throughout the process and were further informed about their right to withdraw from the study at any time.

Before starting the video recordings during online interviews, the participants were again asked for permission and explained that the purpose of recordings was to conduct detailed analysis of the conversations. Moreover, detailed information was provided on how data would be stored and processed only by me, and on how their identities will be kept anonymous. Keeping anonymity helps to guarantee confidentiality which in research refers to the fact that private data that identifies participants remains undisclosed (Brinkmann & Kvale 2015), to prevent participants from unknowingly putting themselves in undesirable situations (Yin, 2018).

Online interviews offer great potential for maintaining anonymity as the lack of a physical meeting makes it difficult for the researcher to recognize participants in other contexts (Bampton, et al., 2013). Hence, online interviews supported me in keeping personal information about research participants confidential. However, in the specific case of the NGO staff, I further highlighted that although all information will be kept anonymous; their quotations would be reviewed when emphasizing findings.

Although I could not do physical fieldwork, through the alternative online methods I developed online fieldwork and met with different target groups. However, doing field work,

interviewing, and interacting with vulnerable people can lead to another ethical concern related to power relations between the researcher and the researched (Scheyvens, 2014 & Brydon, 2006). Thus, from the beginning of my interaction with the participants, I worked on creating an environment of empathy to allow them to open up and express their knowledge and experiences. Many farmers expressed gratitude for being selected to speak about the SSRs and the importance of seeds for their livelihoods.

I was careful not to create false expectations among small-scale farmers in terms of continuity or improvement of the programmes they belong to. However, I always made sure to treat them with respect, introduced myself and thanked participants for their contribution and their time. Small symbols of appreciation and respect are part of the means of reciprocity (Locke et al., 2013). Additionally, in the case of NGOs and key informants, a written summary of the findings and recommendations was agreed upon to give access to the research in a friendlier way as recommended by Scheyvens (2014). Already at the end of 2020, an oral presentation and report with preliminary findings were provided to NRC for their 2021 work plan on seed and food security.

5.7 Study limitations

5.7.1 Study concepts

Concepts related to “seed security”, “food security”, “types of seeds and seed systems” as well as “seed markets” can be called and interpreted differently by different people, limiting the study. Berg & Lune (2012, p.39) therefore highlight the importance of operational definitions to “concretize the intended meaning of a concept in relation to a particular study”. Operational definitions allow readers familiarize themselves with the concepts and evaluate how effectively they work in certain research (ibid). Consequently, after a profound literature review, the meanings of the most relevant concepts used in the study were defined in the theoretical framework. The use of different literature to build the study concepts later helped to see how the results fit into existing theories and previous studies, as well as to answer the RQs (Berg & Lune, 2012). Additionally, due to the complexity of various types of seeds that the target groups use and promote; an exclusive seed glossary was added in the annexes. This glossary was produced with the intention of avoiding personal values or theoretical biases to influence the research and the findings derived from it (Bryman, 2016).

Another limitation faced considering concepts was the difference between the technical meaning of seeds and how those seed types were defined by the study participants. The use of poorly understood concepts when conducting research could lead to questionable reliability and validity of the findings (Bryman, 2016). Consequently, to address this limitation, during the interviews several questions were asked about the seed types referred to by the interviewees to better understand what they meant while mentioning certain types.

5.7.2 Sample selection approach

A limitation to highlight in this study is the impossibility to interview farmers who have not been part of the SSRs implemented by the selected NGOs. I recognize that the sampling would have provided a higher degree of reliability if non-participating farmers had been included. This could have allowed a comparison and thus better understanding of the impacts between those who are part of and those who are not part of the implemented responses. Thus, a sampling bias is introduced, as those members were purposely excluded from the sample (Bryman, 2016). So, “it was impossible to determine whether differences exist between the population and the sample after non-response in terms of deeper factors” (ibid, p. 175).

Similarly, in the Malawi case study, it was not feasible to include government employees in the sample, as I was unable to connect with them via email or establish a contact person on site. This limits the study as their views on how current policies support SSRs developed by NGOs were not included. Additionally, the sampling selection approach could have been affected by the influence of the NGOs and those who supported me with farmer selection. Farmers who have better relationships with the selected NGOs could have intentionally been targeted.

To overcome the above-mentioned drawbacks and strengthen the study credibility, I included interviews with relevant key informants who do not work with the selected NGOs. The inclusion of key informants helped to triangulate the information provided by other participants. Triangulation is a key technique to ensure credibility in qualitative research. "Qualitative researchers generally use this technique to ensure that an account is rich, robust, comprehensive, and well-developed" (Pandey & Patnaik, 2014 p. 5747).

5.7.3 Data collection

The semi-structured interviews made it possible to ask follow-up questions to either clarify concepts when information was not clear in the first instance or to delve into issues relevant to the study. Indeed, this type of interview is open to change of sequence and question forms, to follow up on the specific answers given (Brinkmann & Kale, 2015). However, semi-structured interviews opened space for participants, particularly farmers, to raise topics that were sometimes unrelated to the study, as wanted to request additional support for other challenging situations. Although I listened to their requests, I had to cordially emphasize my role as a researcher rather than an NGO worker, and kindly return to the study questions.

Another obstacle encountered during focus group sessions was that some participants assumed a more active role, limiting the active intervention of other participants. The response to this situation to maintain the finding credibility was, firstly, to remain neutral and ensure that all participants could feel comfortable expressing their opinions and secondly, to engage shy participants with comments such as "could you tell me your experience also?" or "what do others of you think?".

Moreover, to ensure the study transferability all data was documented, including notes taken during interviews and data reviews, as recommended by Bryman (2016). Nonetheless, problems affecting transferability and reliability of the study could be: First, that the Malawian assistants transcribed by hand, so the writing was sometimes unclear. Limitations in transcript accuracy and understanding could affect data reliability. To avoid misinterpretations, confirmation calls were made to clarify the writing. Second, that the Malawi focus group was conducted with a translator. Consequently, limitations in translation precision may have affected the reliability of the collected data. To counteract this limitation: First, I was always aware of the response length versus the length of the translations and asked for more details when the translation was short. Second, as the participants had some English proficiency, when translations were short, I asked if they agreed with the translation and gave them space to add more on the topic in English.

5.7.4 Participant behaviour

The unnatural character of the interviews and the behaviour of the participants when being observed are known as reactivity, and they represent a serious threat to research validity (Bryman, 2016 and Hutchinson & Wilson, 1992). During interviews, participants could change

their natural behaviour patterns due to the presence of the researcher (Bryman, 2016). Reactivity may represent a risk for this study as interviewees could have seen me as an NGO member, and therefore could have tried to provide answers that they considered beneficial for their relationship with the NGOs. Furthermore, interviewed NGO staff could have seen me as an external evaluator of their field activities and thus could have tried to adjust their answers to emphasize positive outcomes of their work.

Thus, to reduce reactivity and increase the credibility of the findings, the following strategies were used: First, I used different interview methods and informants to triangulate the study and hence diminish reactivity. Triangulation reduces the risk of systematic bias that the use of a single method can generate (Maxwell, 2013); while strengthening the quality of the case studies (Yin, 2018). Second, I conducted several online interviews with some field staff to learn more about the process, validate their first responses and assess preliminary findings obtained during previous interviews. Third, I used respondent validation to increase reliability of analysed data. Respondent validation prevents the possibility of misinterpreting the meanings of what participants say (Bryman, 2016). Lastly, I organized individual online interviews with all the target groups without assistants and conducted as many interviews as was required to obtain similar responses from various individuals and no new insights were suggested. When the data reaches the point where no new information is provided, data saturation is reached, and it concludes the study from a reliability point of view (ibid).

5.7.5 Researcher bias

Researcher bias is another threat that may affect the validity of the study (Maxwell, 2013). Researchers must reflect on the implication of methods, theories, and assumptions and analyse how these may or may not affect the research (Bryman, 2016). Due to my previous work experience in the agriculture sector in other contexts (especially in Latin America), I may have been biased at the beginning of this study. However, to conduct a fruitful investigation, I was open to the realities that my interviewees experience. I looked at SSRs of NGOs that I had not worked with before and did not use leading questions when conducting the interviews. I did not involve prior findings from other settings while conducting the study, nor did I involve prior assumptions that I may have created from previous research and theories. Being open to contrary evidence helps to avoid potential bias (Yin, 2018).

5.7.6 Data protection measures

Previously, it has been explained how pseudonyms were used to anonymize the interviewees. However, as online platforms were used to conduct the interviews, additional protection measures were taken. First, when organizing Zoom-meetings (which was the main platform used), I always acted as administrator and used my university account. Thus, I was the only person authorized to make recordings and admit meeting participants. Each meeting was created with a unique password sent to each participant separately one day before the meeting. When using Skype and WhatsApp, I also was in charge of the recordings. Second, after the interviews were finished, the video recordings were stored on my computer and later transfer to a hard drive to maintain a copy. Although storage in the cloud could guarantee more flexible access and safer backup, clouds are more susceptible to hackers which could lead to loss of confidentiality. Third, the folders containing the video recordings were named with pseudonyms to strengthen confidentiality levels. Fourth, transcripts and videos were stored in separate folders. Hard copies of transcripts were also made for backup. Lastly, all informed consents were stored digitally and separated from the folders mentioned above. Throughout the research process, I was always aware of how to protect participants identity while collecting and storing the data safely.

5.7.7 Interpretations

The issue of language barrier is particularly critical during the development of social research and was especially challenging when doing research online because there was less access to interpreters. On the one hand, the interpreters who work for the NGOs were supporting the responses to the Covid-19 humanitarian crisis. On the other hand, accessing external interpreters online was restricted due to the lack of contacts in the field areas. The language barrier was mediated through three strategies. First, speaking English was one of the criteria to select farmers for online interviews, when getting interpreters was not feasible. Second, interviews with the support of interpreters were arranged in advance to adapt to interpreter availability. And third, the assistants who could speak the local languages conducted interviews especially on weekends not to interfere with their daily work activities.

The interpreters and assistants functioned as valuable informants who helped me interpret interviews, access participants, and arrange logistics. Having an interpreter who could speak the same language as the community was an effective strategy to encourage conversations, promote cross-cultural linkage between me as researcher and participants as well as giving me

space to take notes during the interviews. Simultaneously, having had assistants who supported me in the field, I obtained collaboration with the translations, the transcriptions, as well as the clarification of some answers prior to the analysis. However, one disadvantage of having interpreters or assistants was that when translations were required, I could not express myself freely to gain a broad understanding of farmers' experiences and opinions. The received data could have been filtered, lost, misinterpreted, or altered.

5.7.8 Online research

Due to the global health crisis, this study had to rely heavily on online methods to collect primary data. Using online platforms I could communicate with all the target groups of the research, eliminating the need of being physically present. Meetings were organized at flexible hours based on participants availability. Furthermore, as mentioned by Kite (2017), online tools support recordings through the system, which reduces the risk of losing parts of the discussion. In each platform I recorded the interviews from the start to the end while capturing all the details. No problems with the recording tools were faced.

Despite the mentioned benefits, some constraints were encountered during the online research. As mentioned by Deakin & Wakefield (2014) lack of high-speed internet access, unfamiliarity with online communication, and digital illiteracy can affect the course of online interviews. Indeed, connectivity problems were one of the great challenges faced during the data collection making some interviews more exhausting. When communication was repeatedly disrupted, the interviews were rearranged for the following days to mitigate the internet problem. Additional issues were encountered in relation to sound quality and the correct use of the microphone and occasionally with software installations. Consequently, a brief training was established at the beginning of each interview to solve quality problems and thereby save valuable time during the interviews.

5.8 Other challenges

One of the main challenges of this study was to perform field work without visiting the field, as this research was conducted during times of travel bans caused by the Covid-19 pandemic. However, to overcome this challenge, connecting with Norwegian NGOs working in humanitarian action and long-term development contexts, and on seed security interventions helped me to do my fieldwork through their networks. So instead of physically going to the field, I used digital communication platforms to conduct extensive conversations with SSR

participants. Albeit having established this type of online research, it was important to recognize that chosen technological tools had limitations. Connectivity problems prolonged the interviews as participants (the researcher or interviewee(s)) occasionally needed to reconnect or repeat the information to ensure that there was a clear understanding of the statements.

Another obstacle in collecting primary data was to communicate with small-scale farmers who were part of the target groups involved in the SSRs, as those refugees and host community farmers live in hard-to-reach rural areas. Areas where small-scale farmers do not have free internet access, or their access is too limited to conduct video meetings. This challenge was overcome by mobilizing small-scale farmers to the field offices of the two NGOs where internet connection was available, through the help of local assistants.

The field assistants were key partners in the collection of primary data from small-scale farmers who could not be mobilized to the field offices for direct online interviews. But during the online process there was not enough time to train them, and therefore some answers did not respond to the questions. Though, since the interviews conducted with the first NGO were documented on an electronic platform that allowed me to monitor the interviews in real time, I was able to stop the process after the second interview to conduct another training session with the assistants. Although some of the responses did not contribute to the research, having the option of stopping the interviews and reinforcing the training allowed to improve the quality of the responses as well as the training process for assistants of the second NGO.

6. Seed security responses and humanitarian action

6.1 Participant characteristics

6.1.1 Farmers

The primary data for the qualitative analysis in the Uganda case study was collected from various groups, including female and male refugees. All the refugees interviewed were from South Sudan and had lived in Uganda since 2016. Despite reporting struggles to build their lives and their networks in Uganda, refugees mentioned that they did not plan to return to South Sudan unless peace could be established. Among female refugees, 60% were married while 40% were single mothers. However the majority of the married women reported being sole caretakers of their children as their husbands either lived permanently in South Sudan or travelled frequently. 100% of the male refugees reported being married and living with one or more partner. All refugees reported having children and the average household size was 6.2 for women and 7 for men.

Female and male refugees interviewed, reported that their main activity in Uganda was agriculture, as they obtained 30*30 meters of land from the GoU to become food secure (Table 6). However, some reported that their main activity in South Sudan was not agriculture and that they had learned farming while living in Uganda, especially men. Male refugees mentioned that to expand their crops, they had been able to rent more land both by paying or by working in the host community's gardens. All the refugees indicated that they received food from WFP. The food ration, as they stated, mainly consisted of beans and maize, offering them two meals a day of the same food.

Female and male host community farmers also contributed to the qualitative data of the study. 71% of the women reported being married, while 29% were single mothers. Among men, 100% reported being married. All members of the host community reported having children and the average household size for both was 7. Interviewed women reported being in charge of the agricultural activities while their husbands were involved in casual labour and small-scale businesses. Among the men interviewed, only 40% reported being farmers, while 60% mentioned that they help with agricultural activities at home, but that was not their main activity. Their reported land size was between 1.2 and 5.0 hectares (Table 6) and all participants

stated to have two meals a day. All host community members indicated that decisions considering household spending were made together with their partners.

Land size	Refugee		HCF		Total
	Female	Male	Female	Male	
30*30 meters	6	4	0	0	10
50*50 meters	1	2	0	0	3
1.0 ha	0	2	0	0	2
1.2 ha	1	1	5	2	9
1.5 ha	2	0	2	0	4
2.0 ha	0	1	0	1	2
5.0 ha	0	0	0	4	4
Total	**10**	**10**	**7**	**7**	**34**

Table 6: Land size

Source: Ugandan farmers

Lastly, all farmers mentioned that mainly women handle sales in the local daily night market in the refugee camp, while men only occasionally carry out this activity. Vegetables (especially tomatoes and onions), simsim, ginnuts and sweet potatoes were the main crops sold by refugees. Host community farmers on the other hand, referred to cassava, beans and vegetables as the best options to sell.

6.1.2 NGO staff

The primary data for the qualitative analysis in the Uganda case study was also collected from field-level employees at NRC. All interviewed employees had been involved in developing SSRs for NRC in different stages of the process. The average time they had worked at NRC Uganda was 4 years. However, at least half of the interviewed employees had worked for NRC in other African countries or for other NGOs in Uganda. The interviewees mainly belonged to the Food Security area that leads the development of SSRs. But also employees from the logistics, finance and M&E areas took part in the study. Those employees played important supporting roles in the development of seed related activities. The interviewed staff had positions at NRC such as head of programmes, managers, coordinators, specialists, controllers as well as office and field assistants. They had participated in several DSDs for NRC and other NGOs, and all had participated in the planning but not necessarily in the implementation of seed fairs organized by NRC.

6.1.3 Seed traders

Seed traders, who had experience with SSRs, were also a source of primary data for the Uganda case study. Two of the traders had been NRC's seed suppliers in the last two years, while the other two had not worked with NRC recently but had been suppliers of other DSDs or seed fairs in the area where the refugee camp is located. All seed traders reported having been part of SSRs (both DSDs and seed fairs) in 2020. Seed traders interviewed, reported selling only certified seeds of both hybrids and OPVs. None of them were farmers and their outlets were located in the main area called Yumbe, which is beyond walking distance from the refugee camp. All seed traders reported having been working with seeds and other agricultural inputs such as fertilizers and pesticides for an average of 8 years. The seed traders described that within their portfolio they had a wide variety of seeds such as cereals, legumes and vegetables. All participants stated that they do not give credits to farmers unless they know them beforehand. The interviewed seed traders mentioned that their sales volumes per customer are small, except when NGOs buy in bulk.

6.2 Reasons to implement SSRs

Regarding the reasons NRC has to implement SSRs, three significant patterns emerged from the qualitative data. (1) Seed security guarantees food security, (2) Seed security contributes to access nutritious food and (3) Seed security helps to produce marketable crops for income generation. Exploring each pattern in detail will assist in understanding why NRC supports refugees and host community farmers with seeds to begin with and how those reasons attempt to influence farmers' long-term seed security, food security and income generation. The programmes developed under humanitarian action included either one of those reasons or a combination of all of them.

6.2.1 Food security through seed security

> "If farmers use quality seeds, they will be able to increase their productivity and hence become food secure" NGOUI-4

One important factor that has contributed to the implementation of SSRs within agricultural programmes is the need of achieving food security in the area. When farmers do not have access to quality seeds and continue to recycle their local varieties, or in worst cases do not acquire seeds at all, it becomes difficult to avoid food insecurity. Those were part of the claims made by the NRC staff to highlight the importance of implementing SSRs to guarantee food security withing agricultural programmes (Figure 2).

Statements: Food Security through seed security

NGOUI-1*:* "We do have multi-year projects that support farmers to be food secure and that is why we provide seeds". **NGOUI-2:** "Quality seeds guarantee high productivity to be food secure" . **NGOUI-3:** "One of the key aspects of our programmes is livelihood and food security, and in the food security aspect we have a strong component around access to quality seeds because refugees for example use bad seeds and then they become food insecure". **NGOUI-5:** "For my understanding, those quality seeds need fertilizer to boost up the yield. But even if you do not use fertilizer you get a good yield. Good yield helps food security". **NGOUI-8:** "We aim to support farmers and their food security, at least in the first two years of the project, through supporting them in with the provision of agricultural inputs, especially seeds and tools of sufficient quality". **NGOUI-9:** "If they use quality seeds, they will have high yield and of course they will have enough food". **NGOUI-10: "**Farmers need seeds to have better yield, and in our food security programmes we need to give them quality seeds, not the same seeds they use"

Figure 2: Food security through seeds

Source: NRC participants

A frequently repeated conviction was that beneficiaries will have more food available for consumption at the household level by being supplied with quality seeds of a wide range of crops that produce high yield. Seeds that would not be easy to obtain otherwise, especially by refugees whose income is zero and whose networks in the new country are weak or not yet established. In the case of host community farmers, the seeds obtained through SSRs may not have been available to them before, because they are usually too expensive, and farmers do not spend their low income on those seeds.

Lastly, some interviewees attributed the use of SSRs to the fact that the majority of refugees in Uganda (the main target group of NRC's programmes) have access to small land plots. Seeds and other basic tools are therefore also needed to ensure that farmers will start up crops to obtain their own food. Through their harvest, refugees are expected to become food secure. NGOUI-3: "Refugees need to have good quality seeds to ensure their meals". NGOUI-1: "With the right seeds, farmers can get better return on their lands and hence increase their productivity to have more food at the household level".

6.2.2 Seed security and nutrition

A striking common theme that emerged among all NRC participants was that SSRs are a way to improve nutrition. Especially when parts of the provided seeds are nutrient-rich vegetables. In the case of refugees, the food obtained through the seeds provided is a complement to the food ration obtained from WFP. And in the case of the host community, the food obtained

through the provided seeds becomes additional food that they do not normally consume until they join SSRs. Participants made statements such as: NGOUI-2: “In small areas which you can do some backyard garden, it is important to make sure farmers access vegetable seeds, which are good for complimenting the food, for nutrition. So, we had been extensively involved in providing assortment of vegetable seeds to the farmers”. NGOUI-11: “Vegetables are good for complimenting the food. Vegetables seeds are a source of nutrition”

Concerns about lack of nutritional values by only eating one group of foods were raised. A proper diet becomes increasingly challenging for refugees, especially considering that the majority of the refugees were women and children. NGOUI-3, NGOUI-5 and NGOUI-11 explained how nutritious foods are on the agenda for the development of SSRs. NGOUI-3: “If women eat only one group of food, then their children will experience food insecurity, so we need to provide more vegetables seeds to complement”. NGOUI-5: “Filling the stomach with a lot of only one group of food is not enough, what is relevant is the kind of food that the person eats, so vegetables and other cereals seeds provide nutrients”. NGOUI-11: “We analyse what kind of seeds can provide farmers with nutritious food; it is not only about the issue of getting some food such as maize or beans but to address the issue of food insecurity from the perspective of nutritious food”.

6.2.3 Income generation

Being seed secure with the right seed technologies was considered essential to produce the right marketable crops to generate surplus and hence income. Consequently, SSRs as a way to promote sustainable income generation emerged as a noticeable theme in most discussions. The programmes focus on influencing both refugees and host community farmers not only to produce their own food but also to generate income for their future sustainability and to contribute to the local economy. Developing SSRs is a way of providing farmers with the right quality seeds to produce crops that are in high demand in local markets to meet their family needs. Providing the right cash crop seeds creates opportunities for a new start for refugees and for income increase for host community farmers.

Cassava for example, was mentioned as a highly important crop to support income generation. NGOUI-1: “Cassava have roots, so they grow on the ground. And if you cut them well, it takes a little bit more time. But once they start growing, you harvest a lot. And year after year you

can continue. Then when the stems come, you can regrow them and you can have them for your food but most important it has supplies for cash. Cassava is an important cash crop".

To create self-sufficiency, SSRs should focus on marketable crops. Market evaluation was mentioned during the discussions as an indispensable tool to identify the most profitable crops, varieties and price trends. However, despite the importance of market assessments, there was a noticeable avoidance of talking about how and when those market assessments are developed. The methods for estimating the expected profitability of crops from seeds planned for supply through SSRs were also unclear. On the contrary, knowledge of the local area was in many cases the strategy mentioned to establish what type of crops and seed varieties should be supplied to encourage income generation. NGOUI-1: "It is based on the commonly what people use in an area. Some of our staff come from the area. We deal with farmers. We know what they commonly buy. So just buy like one common seed and do a distribution for that". NGOUI-3: "We know the area. Unfortunately, we make most of our decisions subjectively and sometimes with no regard to what the market is".

Although income generation is one of the main aims for developing SSRs, it was found that transforming individual success stories into broader agricultural development programmes in humanitarian action among all beneficiaries remains a challenge. All the respondents from NRC mentioned quality seeds from the formal seed system, hybrids and OPVs, as the right technology to provide. However, the package of technologies in agricultural production seems not to be enough because in the specific case of refugees the land provided by the government tends to be too small. But in addition to the small size, the land has tended not to be sufficiently fertile to establish plantations. NGOUI-10: "When we do monitor our beneficiaries, we have found that they have been provided with the land, but some of this land is not productive. It is a rocky land". FFRU-8: "We need to get other things like other tools because our land is too small and too rocky, so it is very hard to dig".

6.3 Justifications for selection of DSDs or seed fairs

Based on collected data, the main reasons for selecting an SSR at NRC Uganda can be divided into the subsequent categories: (1) The need of farmers to obtain seeds, identified by using a community-based approach method; (2) The need to provide farmers with quality seeds to improve productivity, and (3) The stimulation of the certified seed market. The first two identified explanations are used to decide to develop DSDs and seed fairs, while the last is an

exclusive justification for the selection of seed fairs. Both SSRs are conducted in response to displacement, as refugees have the possibility to obtain land. Host community farmers are also part of the SSRs to strengthen the relationship with refugees, but also because they are trapped in cycles of poverty and food insecurity.

6.3.1 The expressed need of refugees to access seeds

A key tenet for NRC to implement SSRs is the expressed need of refugees to access seeds to develop farming activities after being displaced. To identify farmers' needs, NRC uses the community based-approach method. An approach that utilizes in-depth conversations with the beneficiaries to understand their short and mid-term needs and the best strategies to address those needs. Overall, all NRC participants emphasized the importance of involving beneficiaries in the design of programmes and highlighted how farmers mentioned the lack of seeds as one of their primary needs. Therefore, farmers are the ones who request inclusion in SSRs and raise their voices to ask for either seed fairs or DSDs (Figure 3).

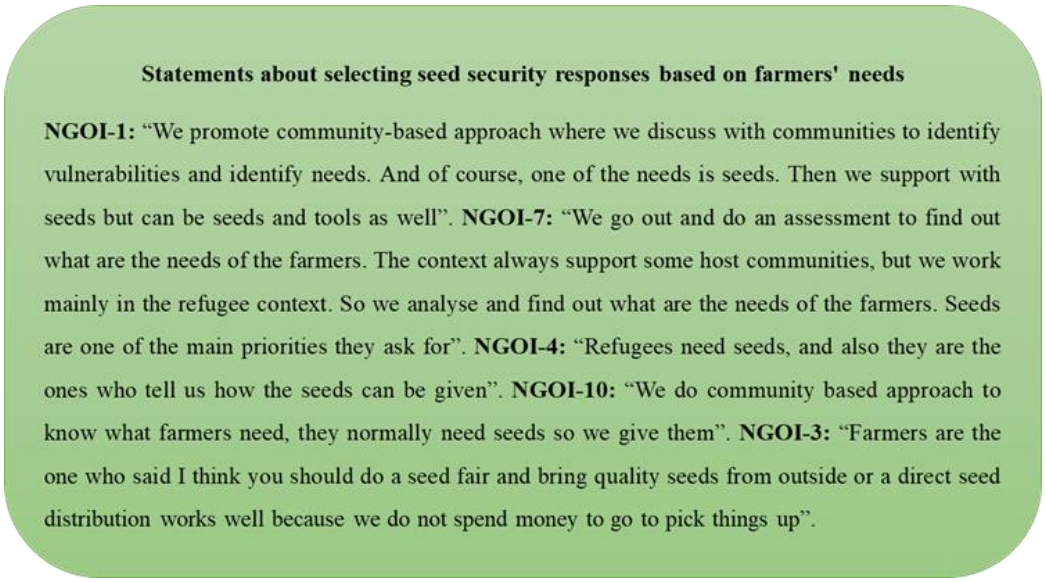

Figure 3: Type of SSR based on farmers' needs**.**

Source: NRC participants

6.3.2 Provision of certified seeds

Another important reason that has led NRC to implement SSRs within agricultural programmes in humanitarian action is that farmers need access to quality seeds to start farming activities or to improve current productivity. NGO staff reported various detrimental effects experienced by farmers due to the use of poor-quality seeds. Before going into detail about these effects, it is important to highlight the sources and characteristics of quality seeds mentioned by NRC

staff. Seeds considered to be of good quality are certified seeds produced by the formal seed system in Uganda which pass the germination test conducted by MAAIF. Figure 4 contains NRC staff statements about quality seed characteristics:

Statements: Sources and characteristics of good quality

NGOI-1: "For seed fairs, all the different big companies will present with their seeds because they are of good quality". **NGOI-2:** "Seeds that can germinate is important. So those are the certified seeds. Germination test is the only most important". **NGOI-4:** "Why would we include local farmers who do not have any certification". **NGOI-6:** "So if the farmer or the suppliers do not have the certification is very hard for us to contract them". **NGOI-7:** "The big companies, as I said, they have outlet places where they sell everything with good quality". **NGOI-9:** "One of the requirements before these seeds are provided is to do the germination tests". **NGOI-10:** "We do not select you as seed dealer unless you have passed the germination test and these batches are being produced by this factory, otherwise we will not accept the seeds". **NGOUI-11:** " Local seeds are of good quality, hybrids are the ones that produce high yield"

Figure 4: Definition of good quality seeds
Source: NRC participants

In addition to the above characteristics, another reason to consider only certified seeds as quality seeds may be donors' influence or requirements. As key informant KI-1 phrased it when reflecting on quality seeds:

"In terms of quality of the seeds, sometimes the donors require to have a certificate of seed quality. They want a non-hybrid seeds or a hybrid seed, for example. They want some type of seeds that sometimes local vendors cannot provide. So we are obliged to do in kind distribution and to go through a selection of, uh, of let us say, bigger providers, not the local vendors, but the bigger companies that will sell us seeds with a certificate of the quality"

In terms of the reported effects that farmers experience in the humanitarian context for the lack of use of quality seeds, the following were mentioned by NRC participants: First, the use of low-quality seeds and local varieties have resulted in poor crop yields and, in some cases, harvest failure that affect sustainable food production. As a result, farmers have been trapped in cycles of food insecurity and dependency on food aid. Second, when farmers buy non-certified seeds, there is a high risk of buying fake seeds. Third, local varieties are not necessarily resistant to climate change, and since we face droughts, pests and diseases, farmers

could waste their land for an entire season. Lastly, farmers sometimes sow grains instead of seeds and consequently end up having poor germination, or in some cases no yield, making it difficult to guarantee the basic food needs at the household level.

6.3.3 Certified seed market stimulation

The establishment of seed fairs provides seed traders with new insights about the needs and preferences of refugees and host community farmers. NRC staff recognizes how seed fairs, that are organized markets, could give farmers the opportunity to communicate directly with seed traders and express their opinions in terms of germination, types of preferable seed varieties and crops, among others. As a result, seed traders may have new ideas on how to expand their seed and crop portfolio, relocate their business to the vicinity of refugee camps, expand their network and even make more frequent visits to the refugee camp to offer their products and follow up on farmers. NGOUI-1 explained for example how "Seed fairs give a good market understanding for the companies because then they try to understand why people are not buying from them and they are buying from other companies. The companies could maybe improve on their quality. So it is very good in stimulating the market". A statement that was expanded by NGOUI-4 who said that "the problem is not about insufficient demand but insufficient supply in the area and companies need to know what farmers want".

Furthermore, the seed fair offers space for certified seed traders to increase awareness among farmers of the benefits of certified seeds in order to increase their number of clients and consequently increase production of certified seeds from a wider range of products. Additionally, NRC staff repeatedly mentioned how seed fairs resulted in the creation of a bond for knowledge exchange between farmers and certified seed traders. The following words were used to describe that bond: "linkage", "relationship" and "stable connection". NGOUI-2 highlighted that: "The aim of a seed fair is to create a market stimulation, hopefully once the project is out, farmers can sustain that relationship with the certified seed traders". NGOUI-8 broadened the explanation: "The aim is not that farmers develop the seed fairs on their own, but to facilitate the development of a linkage between the farmers and the seed traders".

Although the development of seed fairs aim to link and strengthen the relation between farmers and seed traders, it was found that many seed fairs have not resulted in a strong long-term relationship yet. NRC has not developed seed fairs in Uganda, but seed traders who interact with NRC in DSDs have been part of several seed fairs developed by other NGOs around the

refugee settlement. A common theme that emerged among the seed traders was that they have not moved to sell seeds near the refugee settlement because those farmers lack money (Figure 5). Additionally, seed traders mentioned that few refugees and host community farmers approach their outlets to buy certified seeds. Though, when those customers finally approach the outlets, instead of prioritizing quality certification they look for seeds at affordable prices. They typically prefer OPVs over hybrids.

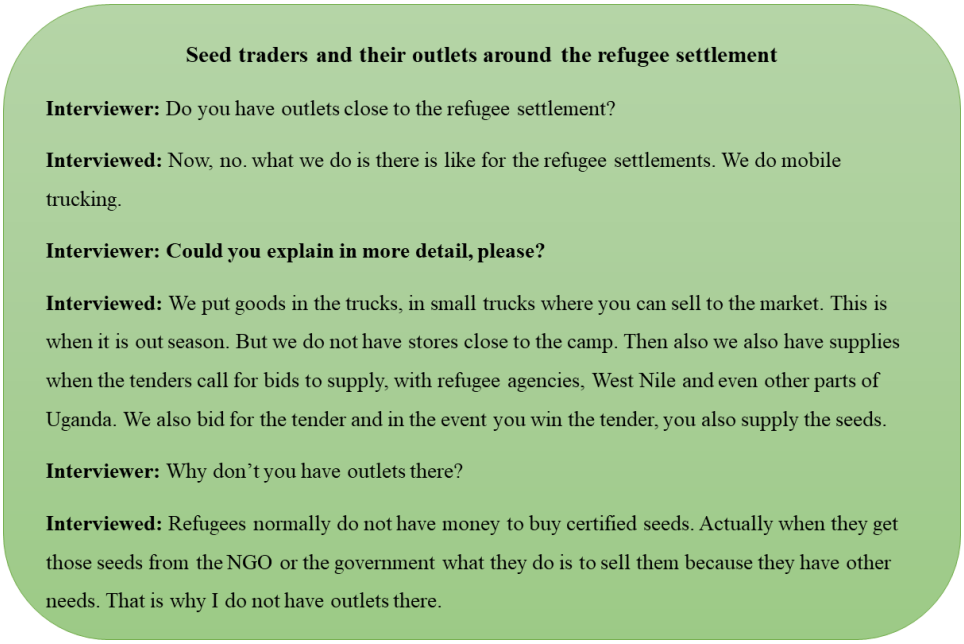

Figure 5: Seed trade around the refugee settlement

Source: Ugandan seed traders

Key informants emphasized that including only the formal seed system will not guarantee a lasting relationship that improves farmers' access to seeds. Farmers should be linked to all seed systems in the area. An idea under which seed fairs were initially conceived when local vendors were also part of the invited seed suppliers (Figure 6).

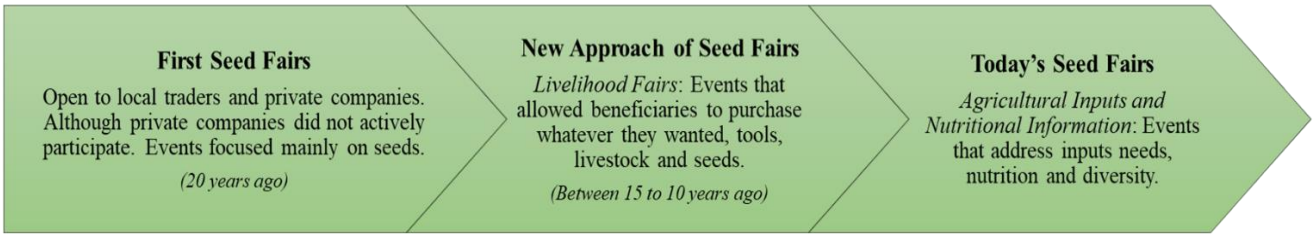

Figure 6: Seed fairs evolution

Source: Key informants

6.4 Main convictions governing SSRs in NRC

6.4.1 Farmers' needs motivate seed distribution

As mentioned in 6.3.1, a community-based approach has been used to identify beneficiaries' needs. However, additional in-depth assessments were found to be lacking in terms of what key reasons for seed needs are and how to best address the problem. Instead, it was repeatedly mentioned that DSD has become the leading SSR developed by NRC Uganda. Additionally, it was reported that a seed fair was planned in 2020, but no real prior analysis was done to decide why to switch from DSD to a seed fair or why that year a seed fair might have been the most appropriate response.

Despite committing to implement a seed fair, the activity was cancelled due to Covid-19. Consequently, a DSD was again conducted as NRC personnel is more familiar with its implementation and the community needed seeds. However, the distribution was conducted with delays and seeds were handed out after the rainy season when seeds should not be planted because farmers lack irrigation systems. The following statements reveal the lack of evaluation of the problem and of the selected solution to it. NGOUI-11: "Any assessment before the decision of a seed fair, I do not think so. This is something that the consortium as a consortium decided to pursue and included in this project. I do not think, or I have not seen an assessment that said it is a seed fair the best". NGOUI-7: "We do very few assessments in terms of market functionality, but the other partners do that". NGOUI-3: “We do not do assessments to identify the problem of farmers not having seeds, if they say they do not have we know that they need seeds”.

The above quotes underlined a gap in triangulation of the information that farmers provide. Key informants mentioned that farmers must be involved because they are the direct beneficiaries, but more information is needed to create a response that could help them to overcome the situation and link them to sustainable seed systems. Lack of prior analysis could lead to repeated delivery of seed aid that could generate other problems as identified by some participants (Figure 7).

Statements: Lack of market assessments

NGOUI-2: " We do market surveys like maybe twice a year, for example, at the start of the year and maybe midway that year, so that we are informed of the prevailing market prices. But we do not know if there are enough seeds in the market, or what kind of seeds you find and what you do not find". **NGOUI-3:** " We do not say we are going to supply seeds, what about the seed storage that are in the market. Are we affecting other seed suppliers?". **NGOUI-4: "**We do not develop assessments to understand why farmers do not have seeds, we just(pause) ….know that farmers need of course quality seeds". **NGOUI-6:** "I will be honest, though, we have not yet conducted the market survey, since we held a tender early last year. So, the basis of pricing is based on the basis of pricing in the system, I mean on the previous year prices. If we affect prices in the area we do not know". **NGOUI-7: "**We do not explore if there are seeds in the market close to the refugees because we use certified seed suppliers, and those are not located in the area"**.**

Figure 7: Lack of assessments

Source: NRC participants

6.4.2 Seeds can be purchased as any other good

A purchase order is launched, and this is how the process begins. First, all NRC staff involved in acquiring seeds mentioned that there is no special seed procurement procedure. What was mentioned as highly relevant is that all seed suppliers must be registered and certified and have previous experience in distribution of large volumes of seeds. NGOUI-1: "Seed distribution is considered a procurement process and therefore goes through the same process as any other". NGOUI-6: "We have a standard process to buy everything through it and a certification guarantees the quality".

Furthermore, it was found that not all team members who are involved in the development of SSRs know the difference between crops and varieties, including those who publish purchase orders and are part of the evaluation committee. Therefore most team members rely on few employees with previous experience as well as on the seed traders. Many of the participants demonstrated lack of knowledge about alternative quality certification schemes. So as long as MAAIF provides positive germination tests, seeds are considered of good quality and therefore no future problems should arise with their use.

Finally, NRC has its own warehouses where seeds are normally stored before being distributed to farmers. DSD can take up to a month depending on the number of beneficiaries. However, according to collected data, items that should not be stored with seeds are also kept in those warehouses. Consequently, the quality of the seeds could deteriorate as seeds are stored with

inappropriate elements, as well as in inadequate facilities. Then, when seeds are distributed to beneficiaries free of charge, they may have already been spoiled. Even though farmers receive seeds, those seeds could not perform as expected and farmers could risk their food and income due to the use of non-yielding seeds. Participant NGOUI-4 made the following reflection:

> "NRC has a storage place and seeds are taken to the place. However, the conditions of the seeds can be affected if the weather or the temperatures are not favourable for storage. It would affect the growth of the germination stage of the seed. We need to check our warehouse because you can do germination test today, but because if you put it in a storage that is not favourable for the seeds, then by the time you distribute them, it has lost something because it has been affected by the poor storage conditions"

6.4.3 Formal seed systems guarantee quality seeds

A trend in the data indicated that NRC staff considered the formal seed system essential for SSRs because it complies with established procedures and country regulations. However, simultaneously it was found through interviews with key informants belonging to the National Agriculture Research Organization (NARO), other NGOs and the ISSD in Uganda, that the GoU has opened for inclusions of other seed systems. Additionally it was mentioned that today the country has two different seed certification schemes. Consequently, a noticeably common theme that emerged was a lack of knowledge about nationwide seed regulations among NRC participants, limiting their SSRs to include only the formal system.

Only one interviewee mentioned the quality schemes the country has while for instance, participant NGOUI-2 stated that in terms of quality schemes: "Everything is the same, there is one certification scheme in this country". An explanation supported by participant NGOUI-7 who said that: "Now, I think in this country we have one certification system. It is done by the ministry of agriculture. We have private companies who are certified to supply the seeds and that is in the law". While key informants such as KI-2 stated that: "The policy that was passed in 2018 now formally recognizes community seed growers and the QDS class". Also KI-3 said: "We have two certification schemes in Uganda. We have supported small growers. The certified class has a blue label and the QDS class has a green label". So, the NRC staff has not developed a general overview of how the seed systems, laws, policies and quality schemes work in the country and area.

6.5 Seed Security

This section presents the impacts that DSD, the main SSR developed by NRC Uganda, has on farmers' long-term seed security. A large proportion of respondents reported medium-term (positive and negative) changes in their seed security at the household level following the development of DSDs and connected programmes. While many also reported a weak short-term improvement that lacks influence to improve their seed security at the household level in the medium and long-term.

6.5.1 Effects of SSRs on seed availability

Although seed saving is frequent and important for both refugees and host community farmers to have seeds available for following planting seasons, the data collected revealed that seed storage is more affected among refugees than among host communities. Therefore, refugees experience a high risk of poor seed availability in the seasons following DSDs.

One of the most common problems refugees experienced is the household storage conditions. First, the hygienic conditions in the refugee settlement are low, thus attracting a large number of rodents and the houses are not built to prevent their entry. For instance, MFRU-10: expressed: “Rats and other insects are very problematic at home. They destroy the seeds”; a concern that was highlighted also by MFRU-1 who said: “We keep them in rooms at home. Sometimes we use metal to make the seeds safe from the rats, but still rats end damaging some” FFRU-7: “The rats will eat it. The houses we are having they are not good. It is very hard to store seeds”. Second, the storage space is small as the houses themselves are small, so the seeds of a wide range of crops cannot be maintained with proper local storage techniques, resulting in less availability of various types of seeds for following planting seasons.

Another problem mentioned by refugees in terms of saving seeds is that, although they try to conserve as much seed as necessary for the following planting seasons after DSD, when the food ration is reduced or delayed, the entire harvest goes to consumption instead of seed savings. Refugees stated that although they tried to implement long-term strategies, volatile circumstances force them to implement coping mechanisms instead. Using the harvest to guarantee food for themselves and their families becomes the main concern in the short term.

Moreover, the type of seeds in terms of varieties and crops distributed in the DSDs is likely to have both positive and negative impacts on the availability of seeds for the upcoming planting

seasons. For most refugees and host community farmers, cereal seeds such as maize and legumes such as beans are strategically important as they are easy to preserve because farmers are familiar with proper techniques of selection, cleaning and drying. Consequently, when the seeds provided are OPVs, farmers can use those techniques to ensure the availability of seeds from those crops. However, when the seeds provided are hybrids, farmers are advised not to save seeds due to the low germination rate on their second use. Hence, despite farmers' general knowledge about seed saving, long term seed availability tends to be jeopardized as hybrids cannot be conserved (Figure 8).

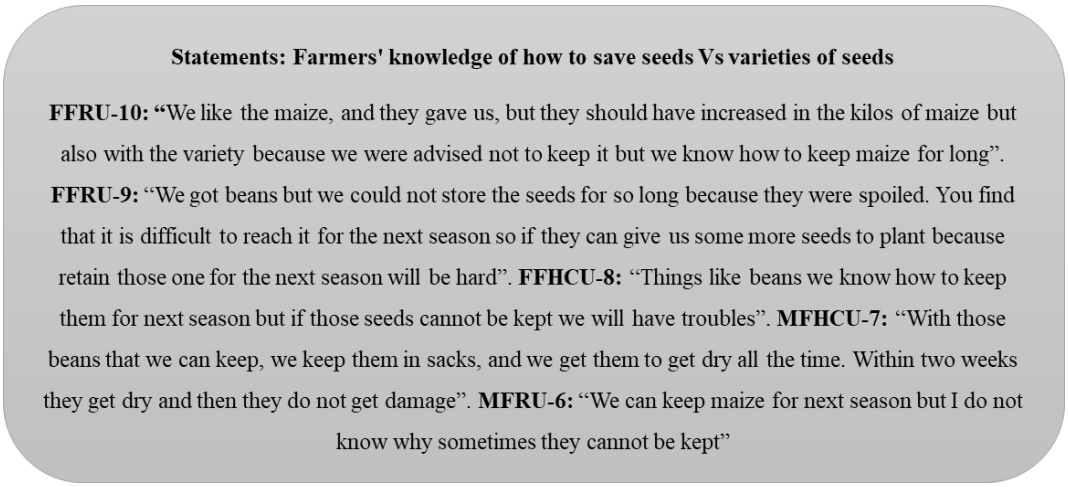

Figure 8: Farmers' knowledge about seed saving

Source: Ugandan farmers

Refugee stories also revealed that they did not arrive in Uganda with seeds from South Sudan as they suddenly escaped the conflict and lost everything. Additionally, some refugees were not farmers and had limited knowledge of how seed activities worked. Refugees started farming from scratch and although DSDs initially provided seeds; the continuation of seed availability for following seasons is in doubt. In contrast, host community farmers had saved seeds before being part of DSDs. So, following DSD, host community farmers increased the volume of saved seeds, especially cereal and legume seeds.

Additionally, vegetable seeds are part of the seed portfolio that farmers receive during DSDs. However, the lack of knowledge on how to select, clean and dry those seeds, especially tomatoes and onions, makes it difficult for farmers to preserve those seeds for following seasons. This difficulty was expressed by both refugees and host community farmers alike

(Figure 9). Thus, farmers tend to use the entire harvest for consumption and sales, as those crops have a high market value.

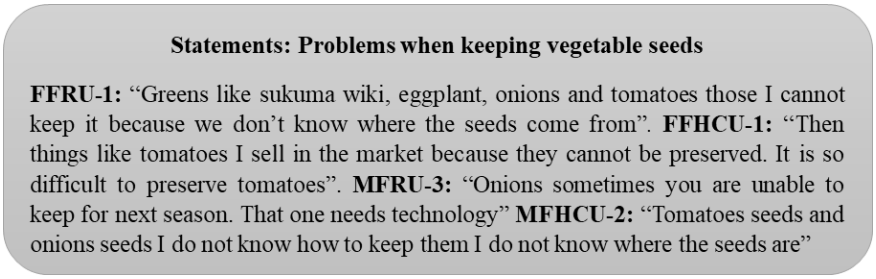

Figure 9: Problems when keeping vegetable seeds

Source: Ugandan farmers

Lastly, although DSDs did not aim to create a link between farmers and seed traders, NRC has through those responses promoted the establishment of outlets around the refugee camp. Unfortunately, despite the large number of DSDs, where NRC attempts to promote the use and sale of certified seeds, NGO-promoted seed traders have not established certified seed sale outlets close to the refugee settlement yet. So, farmers must go to Yumbe district to acquire certified seeds, a remote location that increases the seed cost due to transportation.

6.5.2 Effects of SSRs on seed access

For most refugees and host community farmers, the lack of money to buy the seeds they use and prefer is a major constraint that they mentioned having both before and after SSRs. From the NGO perspective, the certified seeds provided are intended to be sown and then harvested for consumption as well as for sale in the local market. Sale that should generate income to buy the next batch of certified seeds to sustain farming activities. However, it does not appear that sufficient income is being generated neither that the generated income is prioritized to buy seeds (Figure 10). Consequently, there is no evidence of positive effects on the seed access component in terms of generating assets for purchase of certified seeds after DSDs. It is worth noting that the season in which the interviews were conducted may have influenced the responses on income prioritization, as it was a harvest season and not a planting one (Figure 11).

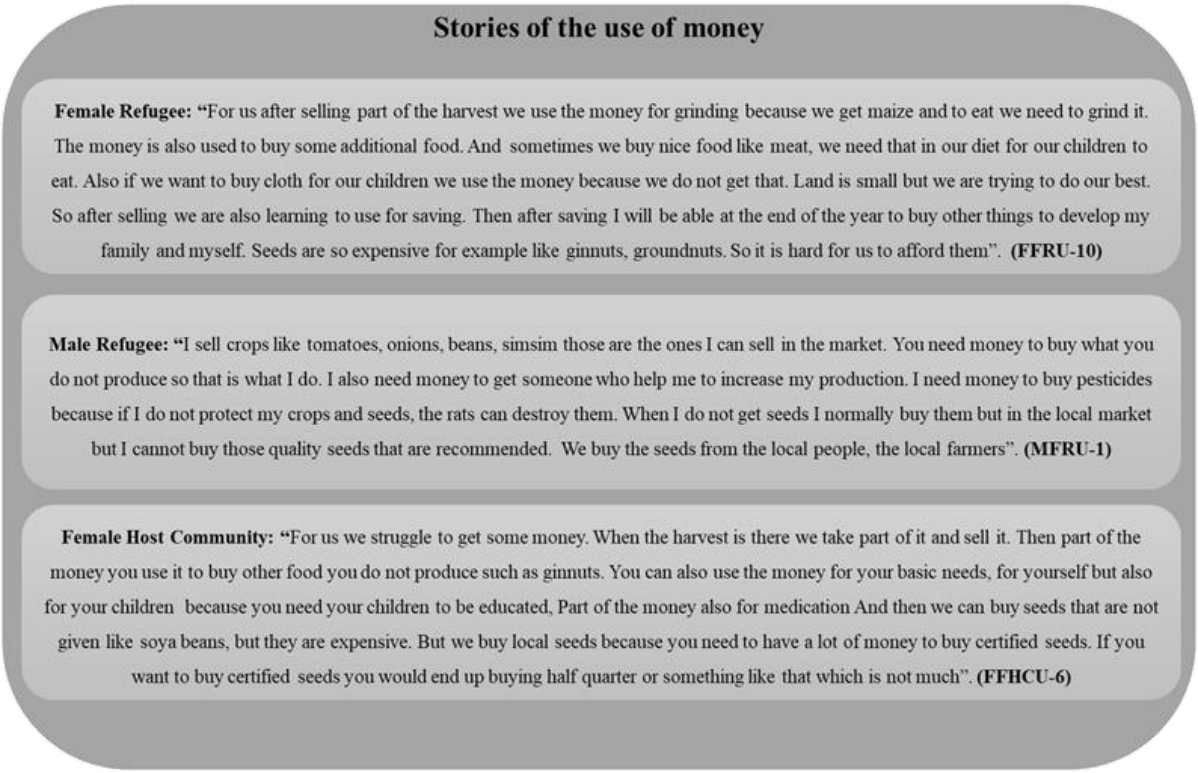

Figure 10: The use of money

Source: Ugandan farmers

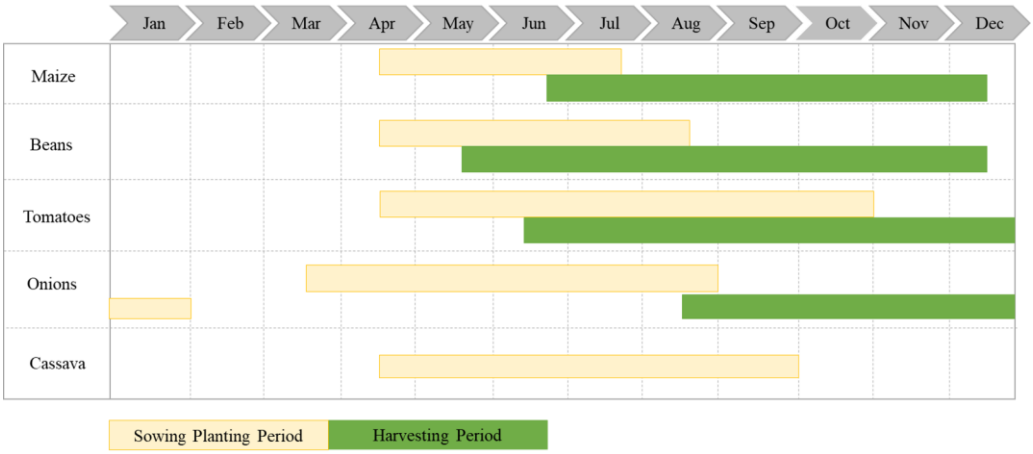

Figure 11: Farming calendar

Source : http://www.fao.org/agriculture/seed/cropcalendar/cropcalendar.do

To begin with, refugees have struggled to produce enough harvest for both food consumption and income generation due to small land size. However, they said that they have tried to sell something on the market, but the purchase of seeds has not been the main priority as other more urgent needs tend to arise. Some female refugees stated that they learned more about the local market and peoples' needs and thus decided to prioritize the investment in seeds of crops that they do not obtain in DSDs. However, this practice was not found a trend. In some cases, female

refugees have also tried to implement male strategies of acquiring more land from the host community to receive more seeds from DSDs. In this way they hope to increase productivity by increasing area and thus obtain higher income to be self-sufficient in terms of farming. Although a larger land size is considered a good strategy to increase harvest volume and thus income, male refugees mentioned that higher income as a result of a larger harvest has not translated into more seed purchases. Once again seeds are not seen as the main priority, especially because the prices of improved seeds are out of reach.

Host community farmers, on the other hand, did not express any concerns in terms of land size. In their case, part of the harvest of some crops has been used to generate income. Nonetheless, concerns such as low productivity with the seeds provided, strong changes in weather patterns and low market prices, do not allow them to obtain suitable income to prioritize the purchase of certified seeds, as those seeds are very expensive. Instead, farmers mentioned that with the income generated they buy OPVs from the local market that they consider to be of good quality. However, income is sometimes not enough to buy the quantity of seeds needed. In all the conversations, host community farmers requested more support in both farming activities and off-farm employment.

It is worth mentioning that DSDs are conducted together with the provision of extension services. NRC's extension services include training sessions in groups of farmers to improve farming activities. Consequently, those trainings promote integration among refugees and host community farmers. Integration that was mentioned as a positive contributor to the seed access component, as refugees can expand their networks and then barter seeds, especially reused seeds from local varieties and OPVs. However, this impact does not necessarily end up being positive when the entire community experience the same problem of seed shortage.

Moreover, due to the creation of networks through training participation, some host community farmers reported improved cooperation aiming to generate more harvest and thus more assets to continuously access seeds. Though, it remains unknown if this type of integration contributes positively to a long-term improvement that will enhance the access component and if it has been the exclusive result of DSD or if other external factors have had more influence. Finally, as mentioned in section 6.5.1, part of the seeds provided through DSDs are conserved for future sowing seasons. A conservation process that faces quality and quantity challenges as described, but that becomes a source of seed access. However due to few positive impacts of SSRs on the

access component, refugees in particular, have relied on DSD, as obtaining additional income has also been a challenge.

6.5.3 Effects of SSRs on seed quality and suitability

To supply seeds, NRC only makes agreements with certified seed traders who produce seeds (hybrids and OPVs) with a guaranteed germination rate ratified by MAAIF. Female and male refugees as well as male host community farmers reported that they did not experience any problem in terms of germination rate on the first use of the seeds. On the contrary, most female host community farmers reported germination failures, predominantly happening with vegetable seeds, resulting in the inability to produce sufficient harvest. For example, one woman said that "Sukuma wiki did not germinate, and people could not transplant them. Soil should not be a factor as we have different land. So the problem we believe is the seed. Maybe the storage place was not good before distributing us" (FFHCU-5). Another farmer expressed that "certified seeds should not have problems as we have been told, so we do not understand why the sukuma wiki did not germinate" (FFHCU-3). And FFHCU-7 said that "greens did not germinate as the other seeds did, do not why".

Additionally, NRC promotes certified seeds to guarantee harvest in times of climate change. Despite this, all farmers reported quality problems with tomato and onion seeds. Among the main problems were the high rate of insects around their crops and the low resistance of those seeds to the strong heat the area experiences. One female farmer mentioned: "Insects disturb my tomatoes and onions. I used homemade pesticides to try to kill the insects, but the insects did not die" (FFUH-1). Another male farmer expressed: "Let me say the seeds are different, like tomatoes that NRC gives us, those tomatoes are not weather resistant, there is a lot of sun in the field and the tomatoes, they have poor yield" (MFHCU-8). Another expressed concern was "Tomatoes get pests, and get destroy, the same with onions and sometimes with pigeon peas. So now I do not know how to get quality seeds for the next season" (MFHCU-3).

Potential longevity of the seeds depends on the initial quality. Some concerns were expressed that those quality problems will intensify with preserved seeds. However, more in-depth monitoring and quantitative analysis are needed to evaluate the effects regarding the quality of seeds in their second and third use, specifically of OPVs as hybrids are not suitable for reuse.

The findings in terms of supplying farmers with seeds they prefer and need, are mixed. The qualitative interviews with all farmers showed that they were satisfied with the seeds they received. Farmers especially highlighted the diversity of seeds from a wide range of crops and the varieties that did not have any restrictions to be saved, in this case OPVs. On the contrary, complaints arose about seeds that could not be conserved as they did not contribute to change farmers' condition of vulnerability. Several farmers reported problems with long maturation time of some varieties, as with the short rainy season they needed shorter-lasting varieties. Additionally, claims were made about the need of supplying both additional seed varieties and larger quantities.

Women and men had different perspectives of the types of crops required to escape the cycle of dependency (Figure 12). This claim was based on the following aspects: preferred seeds for dietary use were not supplied. Some crops with high market demand were not supplied. And finally, the quantities of seeds delivered were not enough for the family or land size. This last complaint was critical as most farmers (25 out of 34) expressed that medium-term improvements are limited due to insufficient quantity.

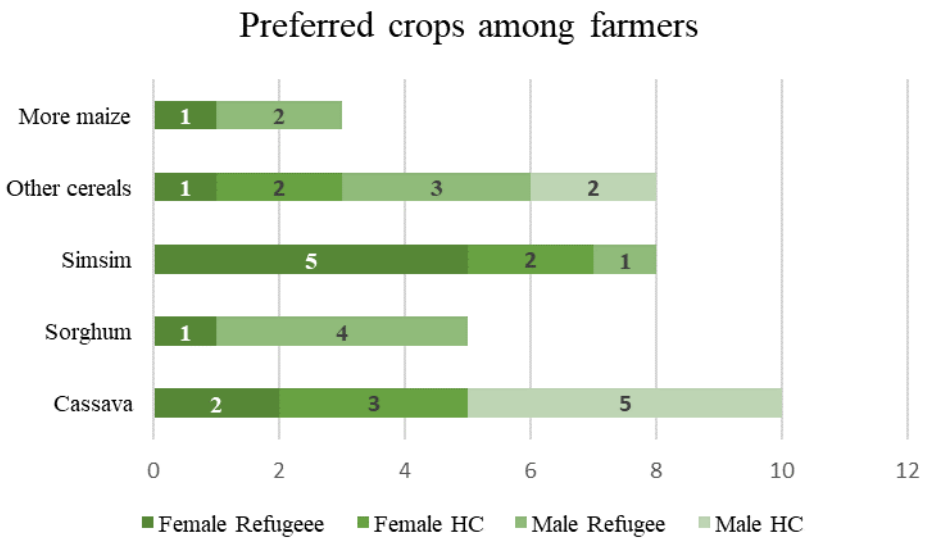

Figure 12: Preferred crops

Source: Ugandan farmers

Figure 13 summarizes the impacts of DSDs implemented in humanitarian action by NRC on farmers' long-term seed security.

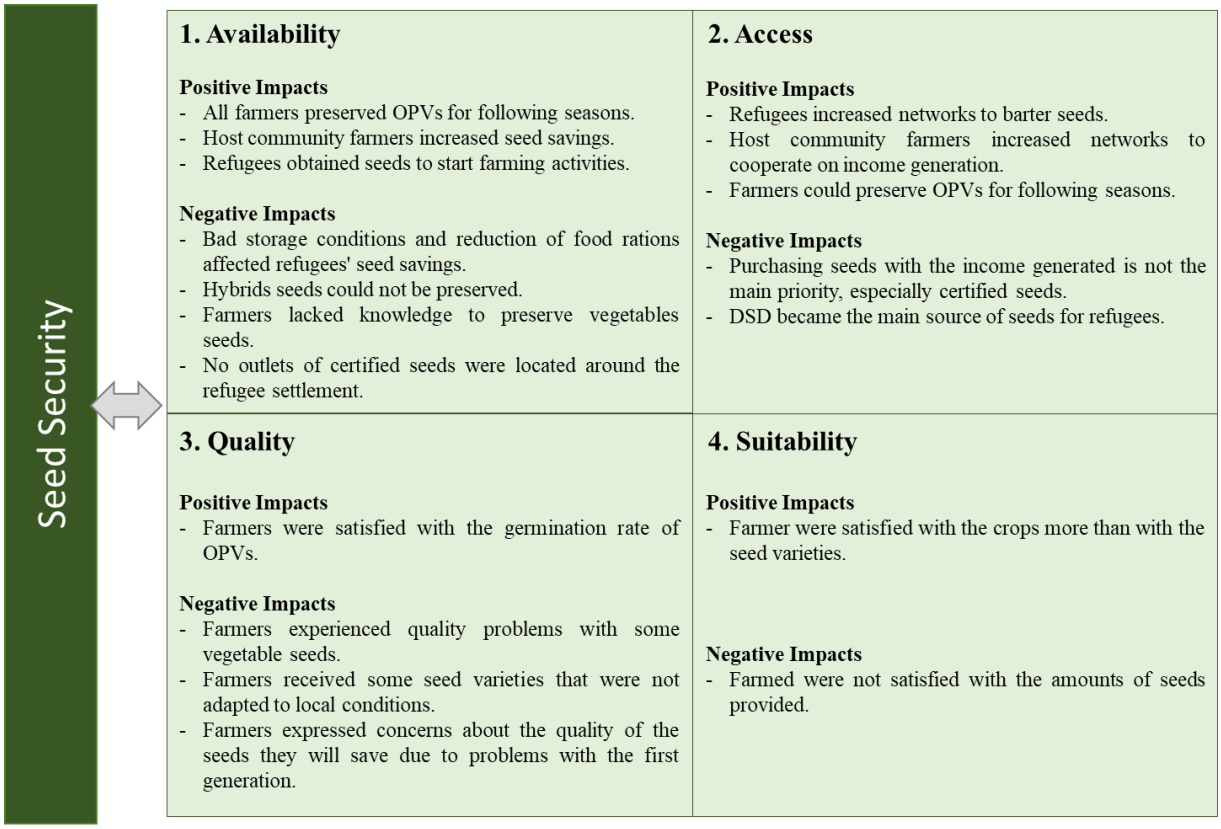

Figure 13: DSD impacts on farmers' long-term seed security

Source: Author

6.6 Effects of SSRs on food security

As a result of DSD participation, most farmers expressed that their food availability increased with more food available for consumption. Refugees stated that they have supplemented their household diet in both quantity and variety. Vegetables, other cereals and legumes were mentioned as new options. Host community farmers also mentioned that they have improved crop diversity as previously un-affordable crops were made accessible. However, despite the increase in food availability, this improvement has not had a lasting effect. Vegetables are complex products and cannot be kept fresh for a longer shelf life, as farmers mentioned not having access to adequate storage facilities. In general, after harvest, farmers reported having more food available for two to four months (Figure 14). Although this short period does not guarantee long-term stability, it tends to influence the safety net of people in vulnerable conditions to access basic needs.

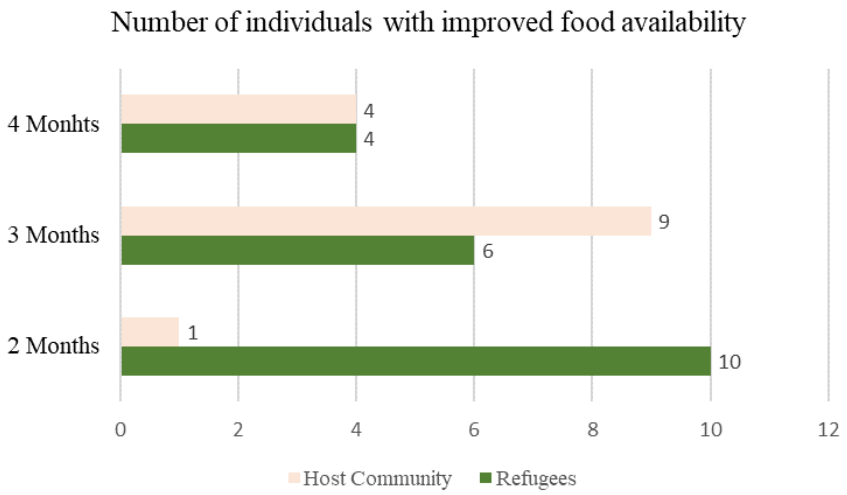

Figure 14: Food availability improvement

Source: Ugandan farmers

In terms of food access, besides their own production with the provided seeds, farmers have struggled to obtain income to buy additional food. Refugees experienced great challenges to get surplus to sell, as mentioned, their area is small. However, some have tried to sell part of their harvest and claim that at least having a low income is better to start over than having no income at all. Buying additional food is one a main spending priority for refugees (Figure 10). For host community farmers, new crops generated some extra income. Nonetheless, farmers expressed that the income was not as high as expected due to low yield of some seeds of crops with high market value. That limits farmers' access to other food groups such as meat, dairy products, and in general, products that they do not produce themselves.

Food utilization has potentially improved by promoting seeds of other types of crops that farmers did not have access to before. Those seeds, together with provided training, have encouraged the consumption of a variety of foods giving farmers access to more nutritious diets. Crop diversification has allowed the harvest of multiple crops, some of which can be consumed together, as expressed by farmers. Additionally, most farmers mentioned that after harvest the number of meals per day increases from two to three, although this has not been sustainable over longer periods, as farmers lack storage facilities and knowledge to preserve vegetables seeds. Finally, through trainings sessions linked to DSDs, farmers stated having received information about compositions of nutritious diets.

Unfortunately, stability has not particularly improved through DSDs and the complementary activities because farmers are still unable to themselves obtain seeds of all the crops and varieties they need and prefer to maintain their food intake during a longer period of time. Although farmers have tried to make effective use of the provided seeds and generate income from the sale of the surplus, many factors have affected the effectiveness of this strategy. Overall, farmers cannot reuse some of the provided seeds as some are hybrids, while others they do not have knowledge or facilities to preserve. Finally, some of the seeds that can be reused also have an effective use period, and consequently, over re-use for a longer period tends to make seeds lose their potential, creating unstable food environments. Figure 15 summarizes the impacts of DSD implemented in humanitarian action by NRC on farmers' food security.

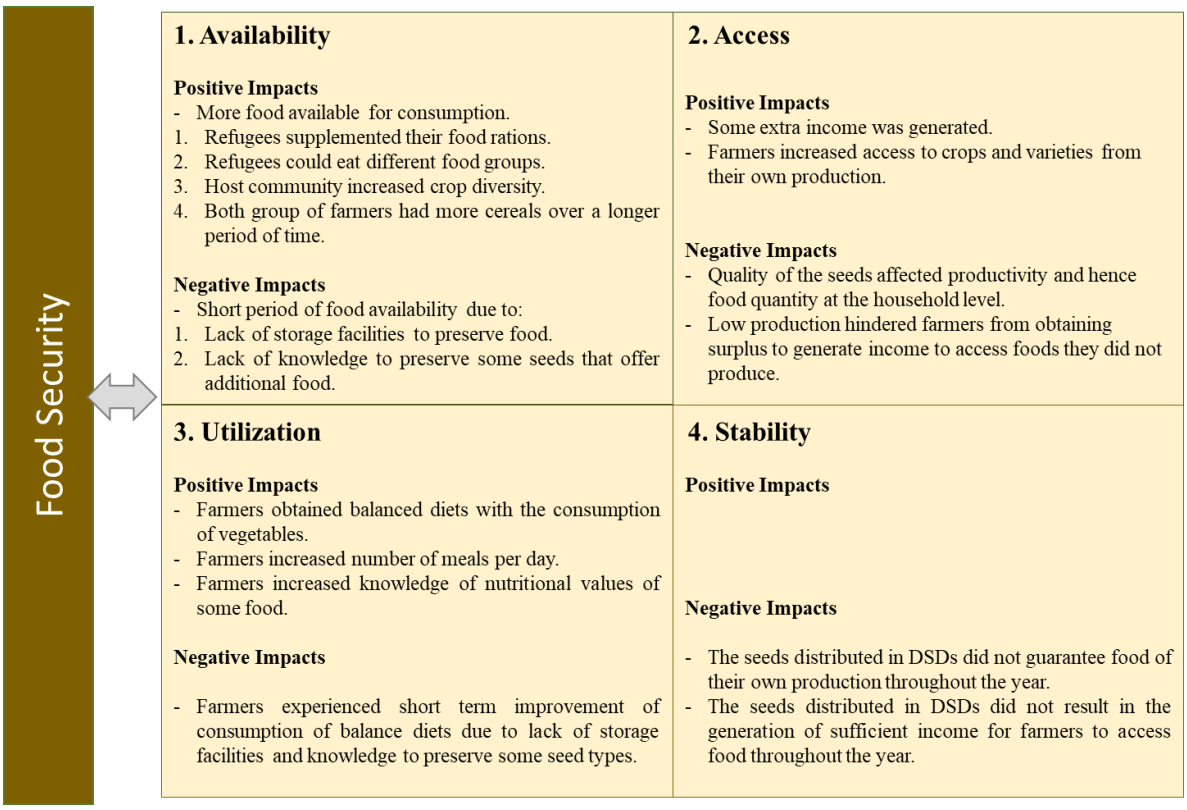

Figure 15: DSD impacts on farmers' food security

Source: Author

6.7 Effects of SSRs on income generation

Most farmers expressed that their participation in DSD helped them earn money immediately after harvest (Figure 16). Though they stated that the generated income was not significantly high. Refugees expressed that they had access to income that they did not have before while host community farmers mentioned that there was a small increase in income at the household

level. The introduction of a wide variety of seeds of different crops contributed to the initiation of commercialization of products in the local market. All farmers who generated income confirmed the importance of vegetables seeds (especially tomatoes and onions) because beyond the nutritional benefits, those crops have high market values (Figure 17). Cassava, one important cash crop as mentioned by NRC staff, was part of the seeds that primarily host community farmers benefited from after harvest. Few refugees received cassava seeds as most refugees have insufficient land size to establish this crop. Additionally, it was found that when refugees rented land, they lacked secure rental contracts. Verbal agreements give landowners the right to take the land back together with the cassava crop. Overall, findings about income generation are based on farmers' perspectives (Figure 18), so more quantitative data is required to analyse the impact in terms of percentage of generated income both before and after their participation in SSRs.

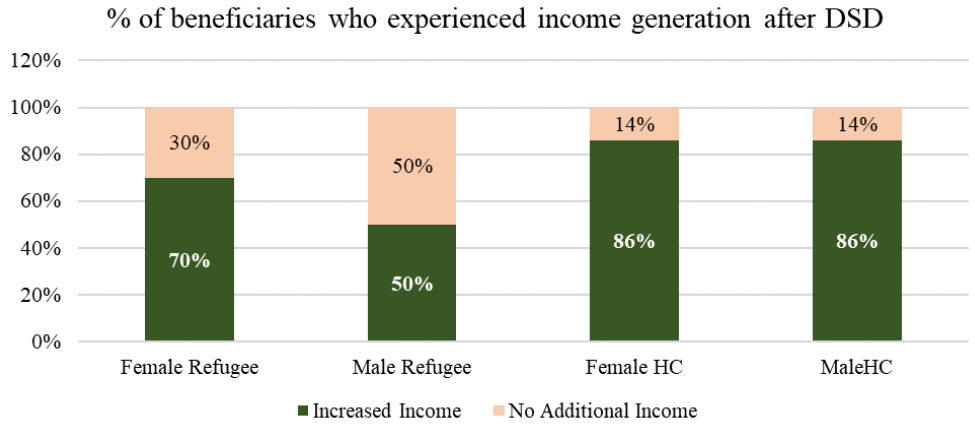

Figure 16: Income increase after DSD.

Female refugees = 10; Male Refugees= 10; Female HC = 7; Male HC = 7

Source: Ugandan farmers

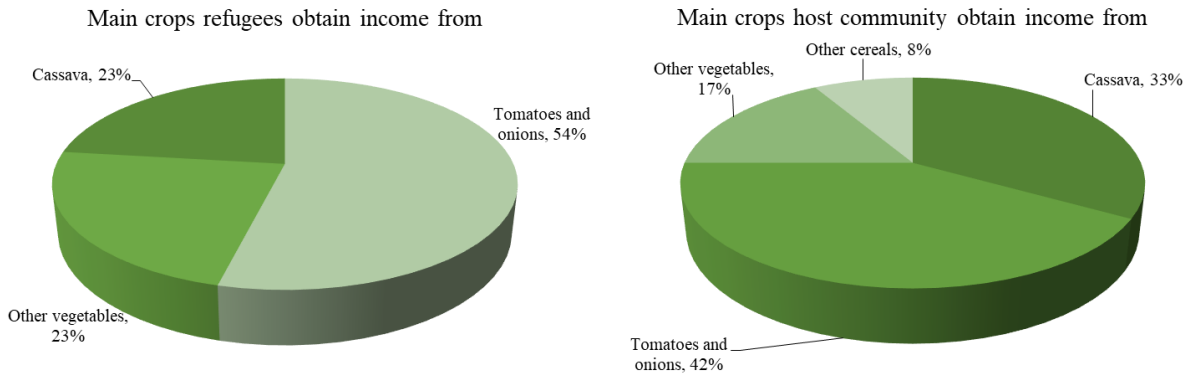

Figure 17: Main cash crops

Source: Ugandan farmers

Furthermore, all participants who obtained income mentioned that despite having access to seeds, market constrains hindered them for being more profitable when selling their harvest. Low prices in the local market, lack of networks and high transportation cost to access larger markets, as well as high competition by offering the same products were some of the limitations that farmers pointed out. For those farmers who could not open market opportunities, the main constraints mentioned were poor seed germination of the most marketable crops, and low production volumes due to small amounts of seeds received or small land size. Other factors which could affect production were not mentioned and require further analysis.

Income Generation statements – Refugees	Income Generation statements – Host Community
"I get a little money but it is better that nothing. I sell in the market to buy other things like soap". (FFRU-1)	"I sell greens in the market, they have normal prices and they cannot be preserved at home". (FFHCU-2)
"Seeds has helped because changes my life. I can sell and get money. I use the money to buy something at home". (FFRU-3)	"My situation has improved because before I did not earn money from farming now I can sell some green in the market". (FFHCU-5)
"I sell because I need part of the money to grind, they give us maize and you cannot eat maize without grinding it". (FFRU-10)	"We are selling but still is not enough money. We got involved in those programmes when the refugees came not before". (FFHCU-7)
"I have been able to sell in the market and buy what we do not produce. Those are the business I have started doing after NRC". (MFRU-1)	"We planted what they gave us and multiply and part of it we sell to others". (MFHCU-12)
"Being a refugee is hard so with that help I can sell in the market to keep my standards of living". (MFRU-3)	"We get some extra money by selling but I need to do extra jobs to earn more". (MFHCU-5)

Figure 18: Income generation stories

Source: Ugandan farmers

7. Seed security responses and long-term development interventions

7.1 Participant characteristics

7.1.1 Farmers

Female and male farmers contributed to the primary data for the qualitative study in the Malawi case. Of the female participants, 56% were married, 22% were widowed and 22% were single. Only widows reported that they were heads of households. Three out of nine women reported working alone in agricultural activities, while the rest stated that together with their partners they were in charge of their farms. All female participants stated having children and the average household size was 7. Two women mentioned to access two meals per day, while the rest mentioned three meals a day. Their reported land size was between 0.3 and 1.6 hectares (Table 7). Interviewed female farmers were primarily subsistence farmers, but they reported selling some surplus through middlemen. The main products women mentioned selling were groundnuts, bambara nuts, beans, and tobacco, while maize was mentioned as the main crop for food consumption.

Among male farmers 100% were married and stated that together with their partners they were in charge of farming activities. Only one man stated not to be the head of the household and all participants reported having children, the average size of the household was 5.6. Maize was mentioned as the main food consumption crop, while tobacco and groundnuts were the most reported crops for sale. Only one man mentioned maize as the main market crop. As female farmers, men reported that they made some money selling surpluses through middlemen. Male farmers reported land size was between 1 to 5 hectares (Table 7).

Land size	Female	Male	Total
0.3 ha	1	0	1
0.8 ha	2	0	2
1.0 ha	4	0	4
1.6 ha	2	3	5
1.8 ha	0	4	4
5.0 ha	0	1	1
Total	**9**	**8**	**17**

Table 7: Land size

Source: Malawian farmers

7.1.2 NGO staff

DF field employees and implementing partners contributed to build the primary data for the Malawi case study. DF interviewees belonged to the agricultural programme in Malawi. All participants were involved in the development of SSRs at DF and BCI or worked to advocate for farmers' rights and their local varieties, which are the seed varieties promoted in the Malawian case. DF has been developing SSRs since around 2010. The interviewed staff held positions such as managers and coordinators. All NGO participants had been part of several seed fairs and had been involved in the development and/or maintenance of the CSB.

7.2 Reasons to implement SSRs

To better understand the reasons why long-term development programmes include SSRs, the interviews began by questioning why SSRs are included within the programmes developed in Malawi by DF and its partners. Understanding those reasons could provide in-depth insights of how SSRs developed under long-term development interventions are designed, and how they influence farmers' long term seed security, food security and income generation. The findings showed that the main reasons are classified around the following themes: (1) Seed security is needed for the food security of subsistence farmers (2) Seed security enhances diversity and thus, stimulates to nutritional diets and (3) Seed security contributes to economic empowerment. The first two reasons were mentioned as the most important, while the last one was referred to as an important goal to be pursued, provided that farmers could ensure enough food at the household level.

7.2.1 Food security through seed security

> "In Malawi we are most dependent on agriculture and the many foods we drive on. Farmers produce their own food" NGOMI-1

The need to support farmers with inputs that ensure sustainable agriculture, as they depend on it to access food, emerged as a noticeable theme in most of the discussions with the SSR implementers (Figure 19). The interviewees emphasized that most Malawian farmers are subsistence farmers and do not have enough income to buy inputs each season, especially certified seeds, despite the subsidy programmes some of them were part of. As a result, farmers experienced a lack of food and therefore food insecurity. A problem that led DF and its implementing partners to include SSRs within their programmes to provide seeds, one of the most important inputs for farming.

Expressed needs to provide farmers with seeds

NGOMI-2: "Smallholder farmers did not have access to seeds so how they could ensure food security at the household level. Well we needed then to mobilize seeds to ensure food security".

KI-5: Poor access to seed was one of the major challenges that NGOs saw to contribute to the food insecurity situation among subsistence farmers, so seed security responses were needed".

NGOMI-4: "We work with seeds because we believe that for us to achieve food security in Malawi, we must have seed security".

Figure 19: Reasons for SSRs**.**

Source: Malawian interviewees

Additionally, lack of seed access was preventing farmers from achieving high productivity and therefore it became necessary to implement strategies for seed supply. During the interviews, NGO staff mentioned the need to develop SSRs to ensure farmers' access to seeds to improve productivity and thus the amount of harvest to guarantee food security. With more harvest, farmers would be able to feed their families and that could only be guaranteed with the use of good quality seeds. Here it is important to mention the characteristics under which good quality seeds were framed: (1) Seeds have to be selected carefully and separated from grain during harvest (2) Seeds need to be stored in a good quality environment (3) Seeds should be tailored to farmers' needs and (4) Seeds should be adaptable to local conditions. It is worth noting that the above-mentioned quality characteristics are meant to be found in local seeds obtained from the farmers' seed system, which is the system promoted by the CSB of the Malawi case study. The CSB does not promote seeds from the formal seed system.

Lastly, the findings indicated the importance of having access to more types of seeds from a wide range of crops to ensure food security. NGO staff pointed out that to enhance food security among subsistence farmers, the production of various foods was important because producing and consuming only maize could not improve the food security of farmers and their families. Intercropping was mentioned as a good strategy through which farmers could manage to produce a wide range of foods, considering the small lands to which most of them have access. This was voiced by NGOMI-1 who said: "We had big problems in terms of malnutrition and food insecurity because farmers were producing only one crop, so we needed to have a broader concept in terms of seeds of different types of crops". Emphasized by NGOMI-3 who said: "Our food security project emerged so that each farmer could produce through intercropping

enough food of different crops that they wanted". And also by NGOMI-5 who said: "Farmers need crop diversification to be food secure and that is why we are encouraging intercropping".

7.2.2 Seed security and nutrition

All NGO participants explicitly described diversity as key to have access to nutritious food. Subsistence farmers who depend mainly on their own production need to have a variety of foods to avoid problems of malnutrition. As a result DF and its partners include wider selections of seeds in their long-term development interventions. The following is how participant NGOMI-1 phrased it: "Seeds are important to guarantee food security but also to guarantee nutrition and crop diversification improves nutrition. So our SSRs were needed to provide farmers with more diversification not just only maize". NGOMI-2 further explained how dependency on one crop has restricted farmers' access to a nutritious diet and why SSRs were key to approach that concern: "The GoM has been focused on commercial seed and it is mostly maize because it is a political crop. So if you hear that we do not have enough food in Malawi, it is not because we do not have enough food. It is because the absence of maize. Now some companies have started to produce groundnuts but those companies work only with few crops so that does not guarantee nutritious food by only using one crop. So we needed to include diversity in our responses" .

Concerns were found among all NGO staff and key informants about the need to provide farmers with not only seeds, but also with knowledge about types of food to ensure a balanced diet. SSRs and especially forums where farmers could get knowledge were needed. Participant NGOMI-3 explained what was important to promote: "We always thought about teaching farmers that they should eat six groups of food, carbohydrates, protein, vitamins, all these different types. So if they could get seeds of the various groups, they will be able to have diversified diet, which would be a balanced diet. In certain areas, they only eat maize and beans, so they are only eating carbohydrate and a little protein, but no vitamins, not these other things. We needed a space to teach farmers that knowledge". While participant KI-5 described the need for knowledge sharing by saying: "Some NGOs were given seeds but still food insecurity did not improve, so some NGOs realized that most of the farmers had lost the knowledge of how to cook those foods. So to tackle food insecurity and malnutrition SSRs needed to be done together with spaces for discussion and knowledge sharing"

7.2.3 Economic empowerment

All informants mentioned two key benefits of local seeds which are of great importance for subsistence farmers and their economic empowerment: (1) Local seeds are cheaper than hybrid seeds and (2) Harvest from local seeds and derived products have a higher market price than hybrid seed derived products. Low cost and high market price of local seeds have led long-term development programmes to promote SSRs with local seeds to contribute to farmers' economic empowerment. It is worth mentioning that economic empowerment has not been the main reason for implementing SSRs, however farmers have been encouraged (after having enough nutritious food at the household level, as well as enough seeds for conservation) to try to open market opportunities and thus generate income.

The reasons why economic empowerment is not highly promoted and farmers' access to income remains weak is outlined in the following two main limitations. First, some farmers have not been able to produce enough surplus to sell, because the size of their land is too small. Second, market opportunities are very weak, and profit margins are small because of many intermediaries. Relevant statements made by interviewees were:

> **NGOMI-2:** "We are promoting everything, focusing primarily on food security and nutritious, but we also make farmers to try to sell and make a bit more income, but their land is also too small"
>
> **NGOMI-3:** " In our programmes farmers are encouraged to use part of their harvest to sell in the market, even though the quantity is small. But if they produce enough grain or seed, there is a problem of market. So at the end if you do not have a reliable market is also a problem"

7.3 Justifications for selection of CSB and seed fairs

NGO participants revealed several reasons why CSB and seed fairs are conducted in long-term development programmes. The reasons are categorized around the following themes: (1) biodiversity conservation, (2) farmers' empowerment and (3) improvement of access and means to quality seeds. The findings showed that all the reasons are considered when selecting and implementing both SSRs. It is worth noting that in this case study, the CSB members receive mainly non-monetary benefits, such as capacity building, technology transfer and seed access. Farmers from the community where the CSB is located can apply to become CSB

members. Their application is reviewed by a committee conformed by senior farmers who originally were selected by the NGO for their extensive knowledge. When someone becomes a member, annual and monthly fees must be paid to support a part of the CSB's maintenance, as the rest of the CSB's maintenance is funded by DF and other NGOs. Additionally, seed fairs are activities linked to the CSB and emerged with the aim of promoting local seeds. Also agro-dealers and private companies are invited to those events. CSB members do not obtain any financial support to purchase seeds but are given the opportunity to barter their seeds and use their income to buy any types of seeds.

7.3.1 Biodiversity conservation

All the informants mentioned that through years, the GoM has promoted and subsidized improved maize, especially hybrid seeds produced by private companies, to address food insecurity and move towards commercialized agriculture. Simultaneously, many other varieties of maize and other crops have been ignored, leading them to a high risk of extinction which motivated the establishment of the CSB as part of long-term development programmes, as expressed by DF and its partners (Figure 20). CSBs have been considered of great importance in preserving biodiversity because they are appropriate environments to store and maintain neglected quality seeds, while guaranteeing farmers' seed access at the right time.

Statements: CSBs as a tool to ensure the biodiversity conservation

NGOMI-2: " The government has focused on commercial seeds, mainly hybrid maize. So generally speaking they have promoted only one crop and one varieties and other crops are in extinction. We needed to implement a place where to preserve other varieties of seeds and crops. That is how community seed bank emerged, and it deals with all sorts of group of crops, specially those that we refer to as the neglected and underutilized specie". **NGOMI-3:** "We promote biodiversity conversation. We have a broader concept in terms of seeds or a broader types of crops, which are indigenous that have been for long, but now with the emphasis on one crop, which is maize, we can see that our indigenous seeds are getting lost and if we are not careful, it means they will go completely extinct" **NGOMI-4:** "In Malawi we are slowly losing the kind of crops and plants that farmers used to consume in the past because of the increase in the narrow based of crop varieties, specifically maize crop. So other crops are gradually getting eroded and we are losing them because we are replacing those indigenous crops with the improved crop varieties that come from the commercial sector. So community seed banks are made to converse biodiversity".

Figure 20: CSB and biodiversity conservation

Source: DF participants

Since biodiversity conservation was a prominent topic throughout the discussions, seed fairs were also highlighted as part of the strategy to raise awareness about the importance of conserving and rescuing different species. Seed fairs were introduced as platforms to promote and introduce seeds farmers within and outside the community were not familiar with. Informants especially emphasized that farmers needed a space to promote their seeds and exchange knowledge because they are the real experts of biodiversity conservation as they have preserved seeds for generations. For instance NGOMI-1 said "Seed fairs helped to improve awareness because before farmers did not have an idea of some type of seeds. So initially we did not have promotion of biodiversity and farmers did not have access to seeds, but now it is improving that is why seed fairs emerged". A statement that was also supported by NGOMI-2 who said, "to promote farmers saved seed and hence biodiversity conservation we use what we call seed fairs".

7.3.2 Farmers' empowerment

Farmers can use their traditional knowledge to preserve good quality seeds, and simultaneously their skills and knowledge can be enhanced through field visits and trainings. Through enhancing their capacities, empowerment can be achieved and that has been a main aim for which the CSB has been conducted, as mentioned by NGO staff and key informants (Figure 21). Additionally, when farmers manage CSBs, they reduce their dependence on other sources. Seed self-sufficiency tends to increase self-confidence, as farmers themselves produce quality seeds to maintain their farming activities. This self-confidence tends to promote empowerment, making farmers raise their voices to defend their rights and show their seed developments.

Statements: CSBs as a tool to farmer's empowerment

NGOM-3: "When farmers are allowed to decide what to plant, they become empowered. Farmers are the ones who can choose which group varieties should be multiplied". **NGOMI2:** "We work together with farmers so they select the specific characteristics that they want to retain, that is how you create empowerment". **NGOMI-1:** "To create empowerment farmers use their traditional knowledge. So we provide training and field visits to enhance their knowledge but they are the ones who do the work. Sharing their knowledge is key to create empowerment". **KI-5:** "When farmers themselves run the seed banks they are being empowered. They are a whole community and they run the activities at the seed bank and all seed fairs" **KI4:** " Farmers knowledge is valuable, and with more training they can improve more"

Figure 21: CSB and farmers' empowerment

Source: DF participants

During the discussions, seed fairs linked to CSBs were highlighted as spaces where farmers can show their developments and promote the good quality of their varieties. Farmers use the seed fairs to break the myth of hybrid seed superiority over farmers saved seeds. Participant NGOMI-6 expressed that "seed fairs help farmers to show what they produce because the government through the private sector have been providing hybrid seeds as being superior to the farmers saved seeds. So they kind of indoctrinated the mind of people". And participant NGOMI-4 agreed when saying that "it is like we have been brain-washed to think that everything has to be modern agriculture and we have to use improved seeds because other varieties will not work. So, we needed through different platforms and work with other partners empower farmers so that they could show that their seeds are of good quality".

Lastly, the findings showed that women's empowerment has been considered when implementing CSBs and seed fairs as women in Malawi have been seed custodians for generations. Therefore inclusion of women in SSRs provide them with empowerment opportunities by increasing their recognition as seed keepers, highlighting their contribution to seed security, and thus impacting their decision-making power. Moreover, through more active participation in spaces such as seed fairs where stakeholders from several organizations are invited, women can show their work and demonstrate leadership in the conservation of seeds and genetic resources. The following quotes illustrate the importance of women's empowerment:

NGOMI-2: "In Malawi, the custodians of seeds are women. So women are the seed keepers. Over 60% of the participants at the community seed bank are women. By including women they are taking a leading role in the conservation and sustainable use of planting genetic resources"

KI-4: " Women are so into agriculture. They do almost all the agricultural activities by themselves including the conversation of seeds. So their active participation in those seed security responses such as seed bank and seed fairs can encouraged them and show the work they do"

KI-8: "Approx. 70% of the women are in agriculture. Women are mainly the ones who grow the local varieties. So they need to start getting the benefits, so they need to be empowered"

7.3.3 Improvement of sources and means of seed access

The CSB as a source of seed supply where subsistence farmers could access to a variety of quality seeds under an affordable scheme emerged as an important pattern among NGO participants and key informants (Figure 22). Farmers needed other seed sources because the formal seed system promoted by the GoM for years did not guarantee access to seeds, at least in a sustainable manner and for all subsistence farmers. First, certified seeds, such as hybrid maize, have high prices and farmers do not have the assets to purchase them, especially considering that those seeds could not be reused and have to be purchased every season. Second, farmers do not have the additional resources to acquire additional agricultural inputs like chemical fertilizers and pesticides that are necessary to use with hybrid seeds to ensure high yields. And finally, the seeds are not easily available when farmers need to plant, particularly improved varieties promoted by the GoM.

Furthermore, as the data showed, CSBs aimed to provide farmers with seeds regardless of good or bad growing seasons. The strategy was created not based on exclusive seed sales but on farmers being able to borrow seeds and return them back after harvest. So, despite limited income farmers could guarantee access to seeds to maintain their farming activities and hence their food security at the household level. Finally, the CSBs as a seed source were developed to provide farmers with seeds based on their preferences and also in terms of family and land size, so enough food could be produced to meet family needs.

Statements on community seed banks as a source of seeds

NGOMI3: "Few farmers in Malawi I would say can afford to buy seeds every season such as hybrid seeds. Those seeds are also you know difficult, storage is a big problem, and the seed is expensive". **NGOMI1:** "The biggest benefits that seed banks will give to farmers is that farmers are able to produce their own quality seeds and those are available at any time, it is not like the ones that the seed company will bring in". **NGOMI2:** "The seeds that farmers can obtain from the seed bank, they can use it for two to three or four seasons, unlike the commercial seed, which you can only use for a single season". **NGOMI4:** "Farmers rely on the seeds they produce because they are readily available. On the contrary the commercial seeds come with a cost. Farmers do not get sufficient income to buy those seed varieties and planted every planting season, unlike the local varieties which can be recycled". **KI4:** Seeds in the seed banks are available for the planting season and are adaptable whether there is a drought or erratic rainfall". **KI5:** "Farmers sometimes get subsidies, but they are not sustainable neither for the government nor for the farmers. And in the absence of any subsidy. The prices of those hybrid seeds are very prohibited. The smallholder farmers cannot afford them"

Figure 22: CSB and seed access
Source: DF and KI participants

7.4 Main convictions governing SSRs in DF

7.4.1 The potential of local varieties

Interviews with key informants and NGO staff showed that local seeds produced and collected by farmers are of good quality. First, farmers' knowledge and the guidance provided by the NGO were considered essential to conserve good quality seeds. Second, having a storage place such as the CSB has been of great importance in maintaining high quality standards. All participants emphasized how the farmers' seed system has enormous potential to benefit small-scale farmers by improving their access to high-yielding varieties of various crops and guaranteeing low costs of agricultural production. The following quotes were used to describe local seeds, CSBs and their benefits: “Selection done by farmers ensure that only high-quality seeds are stored at the CSB” (NGOMI-1), “Seeds are multiplied by farmers, and they know the process to guarantee good quality (NGOMI-3)”, “Local seeds can be used for 2 to 3 seasons unlike the commercial seeds” and “Local seeds can create low cost of production, unlike hybrids that are imported”(NGOMI-).

An important constraint mentioned during the discussions was that the GoM and private companies that dominate the certified seed market have undermined the recognition of local seeds, especially maize. This has slowed down the process of recognizing local seeds even though efforts over the years have resulted in some progress (Figure 23). However, interviewees suggested more attempts to promote local seeds are needed through a more participatory approach among NGOs and the GoM.

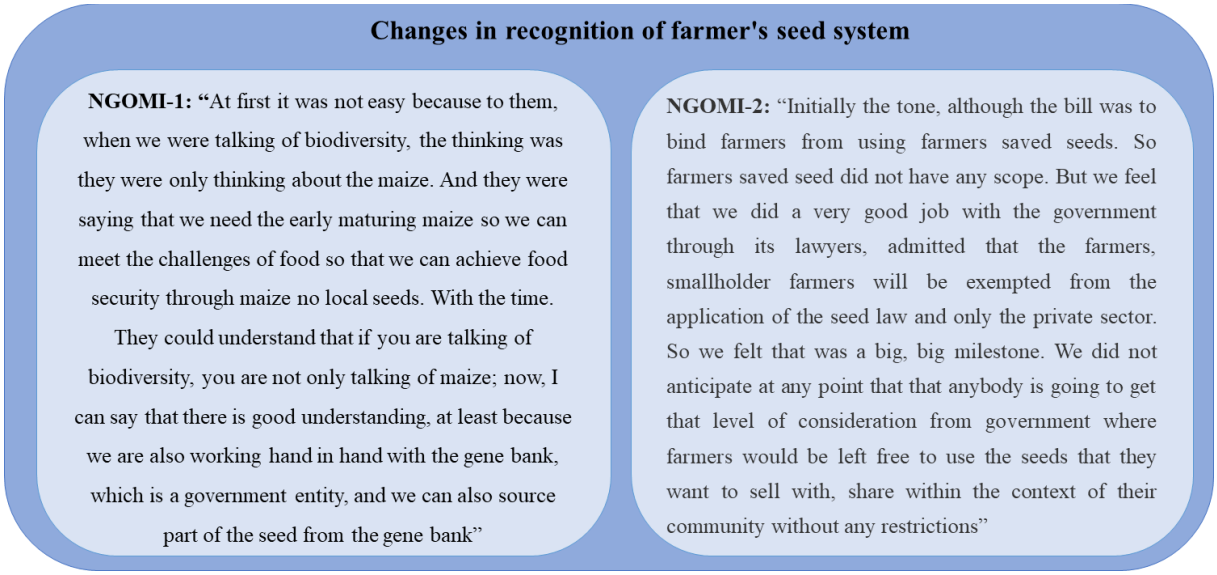

Figure 23: Recognition of farmers' seed system

Source: DF participants

7.4.2 Crop diversification is a long-term food security strategy

The shift from monoculture to more diversified agriculture has been one of the goals of long-term development interventions by DF and its partners in Malawi. However, more joint efforts are needed to achieve this goal, as stated by many study participants. First, the GoM has focused primarily on promoting hybrid maize as a strategy to address food insecurity. Prioritization that has generated dependence on a single crop and that according to the study participants does not guarantee food security and nutrition for those who mainly depend on their production to access food. Monoculture is seen as a short-term strategy promoted in a political approach rather than a development approach. Second, with the promotion of hybrid maize, the private sector has benefited the most, especially multinational companies. It was mentioned that the private sector uses the subsidy programmes to promote certified seeds, especially hybrid maize. Little room has been given not only to other types of crops but also to other types of local seeds. And third, few NGOs promote crop diversification. So efforts rely only on few organizations. It was mentioned that several organizations promote hybrids because they are linked to donors aiming to address food insecurity through these seeds.

7.5 Seed security

The following section presents the findings from the interviews and the focus group discussion regarding the impacts that the CSB and seed fairs have had on farmers' long-term seed security. Several positive impacts were reported along with additional needs to achieve self-sustainability. It is worth mentioning that even though the participants highlighted local seed varieties as the best solutions due to their promotion in the SSRs, many farmers reported to continue using hybrid seeds in part of their plots, mainly maize.

7.5.1 Effects of SSRs on seed availability

"Adequate seed processing facilities in strategic locations should always be available so that farmers can obtain seeds easily when the planting season begins" (NGOMI-3). The above statement was made by one SSR implementer in Malawi regarding aims of implementing CSBs. A statement that directly correlates with the findings on the effects of SSRs on farmers' long-term seed availability. All participants reported that having CSBs within walking distance has made it possible to have a wide range of local seeds available when needed. First, most farmers mentioned the CSB vicinity as an advantage. Short distances make seeds available at short notice which due to the climatic conditions is an important factor, as planting takes place when the rainy season just begins. Farmers explained: “I am so happy that the seed bank is

there because I can pick seeds up when I need to start planting, with this weather you never know when you need but you go, and you get seeds" (FFM-2). "If you only rely on the market and starts raining, you could go and they may not have what you need, so then it will take time before those seeds come and rains will be gone" (FFM-1)

Second, farmers expressed that the CSB started as an alternative to exclusive dependency on subsidies offered by GoM. Those subsidies covered mainly certified seeds (hybrid and OPV maize), did not reach all farmers and did not provide sufficient amounts of seeds, thus affecting the seed availability component. It is though important to highlight that GoM representatives were not available for interviews, hence their version of the subsidy programmes cannot be presented. Third, farmers indicated that the availability dimension has been impacted positively because they no longer need to travel to acquire local seeds safeguarded by the elderly. Old people were the traditional custodians of local seeds; but in addition to living in remote villages, they sometimes did not have the required quantities.

During the focus group interview, farmer FFM-1 was forthcoming about the obstacles she encountered with respect to obtaining seeds from the elderly: "We needed to walk too far to find the old people who were the custodians and when we found them, we did not get the quantities we needed". A statement that was further expanded by MFM-1 who said, "… things became worse because some of the custodians started dying so where else, we could find those varieties, but now we have the seed bank and that means more seeds and more diversity at any time and close to us".

Another positive change mentioned by female and male farmers was that having a place to store seeds like CSBs helps prevent the use of seeds for consumption when coping mechanisms are required. Additionally, the findings showed that farmers continued to rely on their traditional methods to preserve seeds while gaining guidance through field visits and trainings to improve their skills and knowledge. Above all farmers stated to have ensured that the best seeds are available and properly separated from grain.

Social networks were mentioned as an important seed source that has been strengthened after farmers participation in seed fairs and the CSB. Women especially highlighted that through seed fairs, they gained contacts inside and outside the community, helping them to know what kind of seeds farmers have available and thus being able to contact them when needed. Overall,

participants indicated that they considered their own saved seeds and the CSB to be the most reliable seed sources. However, farmers emphasized the need to maintain and strengthen the CSB (Figure 24), as well as to increase local maize varieties as part of the portfolio due to the continued lack of adequate and timely supply of improved maize seeds.

Statements: Importance of maintaining CSB for seed availability

FFM-3: "It is necessary to be able to have the seed bank otherwise our availability of seeds can be in high risk". **FFM-4:** "We need to continue to have even more seed banks to cover more member". **MFM-5:** "We need to continue keeping seed at the banks so that we can obtain seeds even in time of drought". **MFM-2:** "We need to continue conserving seeds after harvesting and store them in the seed bank even if acquire them without seed loan". **MFM-3:** "We need to continue storing enough seeds at the seed banks to reach being long-term seed secure". **MFM-4:** "We need more support towards seed multiplication to meet the increasing demand for seed".

Figure 24: CSB and seed availability
Source: Malawian farmers

7.5.2 Effects of SSRs on seed access

Farmers belonging to the CSB can borrow the seeds they need and return them after harvest. This scheme was by study participants named a *seed loan*. As interest on their seed loan, farmers should return more seeds than they initially received, helping to increase banks' seed stocks. If farmers do not have enough seeds to pay due to natural disasters, they are debt free. If the lack of seeds is due to poor crop management, they are encouraged to pay in coming seasons. Data on how often members default on their loans was not available. The system is based on trust.

Seed loans were by the study participants emphasized as a positive change after joining the CSB. Previously, those farmers depended on their own seeds and recycled them more than 3 times. They also relied on government subsidies with certified seeds, but lacked the additional income required, as the subsidies did not cover 100% of the seed cost. A situation that was worse when inclusion in the subsidy programme was limited. Farmer MFM-6 phrased it like this when reflecting on his past and current situation:

> "Now I can access good seeds, before it was very hard for me. I did not always get help from the government. For example, in a village of 20 households, 17 were left out of the programme so only 3 households had the option to acquire seeds and I was not part of those 3 households".

Participant FFM-4 had a similar reflection, after talking about her situation:

> "I did not have money not just to add to the subsidies but also to then buy seeds on my own. So I mainly relied on the seeds I saved at home. Now, the seed bank gave me credit and that is how I got seeds. I could not access credits before"

So, farmers can access seeds even when there is insufficient income. Seed loans have been seen as an improvement in the access dimension of seed security at the household level. Additionally, seeds are provided based on farmers' needs such as land or family size, aiming to ensure sufficient harvest to feed the family. However, farmers mentioned that it is necessary to expand the seed bank capacity, as well as to increase promotion of local seeds by the GoM and other NGOs. Otherwise, a greater number of members in one CSB could affect the access component in terms of sufficient quantity for all.

With respect to the seed fairs, a significant pattern emerged that indicated how those responses have become platforms that allow farmers to expand their networks. Most farmers mentioned that during seed fairs, farmers from different localities are invited, and everyone gets the opportunity to interact and exchange seeds while also introducing new varieties.

The study revealed that in terms of purchasing power to access certified maize seeds, there have been no significant changes after SSRs. Although farmers began to sell some surplus in the market with the use of a greater varieties of local seeds, income remains low and the purchase of certified seeds is not prioritized, instead other household needs are covered. Due to the high prices of certified seeds and the lack of local stores, participants have requested the promotion of more local maize varieties through the CSB. However, isolation requirements to produce high-quality maize could hinder farmers from accessing large quantities of quality maize from local varieties (Figure 25). The CSB has created strategies to produce local quality

maize seeds such as: (1) the use of early mature varieties to collect before or after the normal maize harvest season and (2) the collection of maize at the field's centre to avoid cross pollination with other crops.

Limitations in terms of access to maize

Interviewer: What are the main crops the CSB has?

Interviewed: The CSB is focused on food security. Therefore our food security project is for each farmers to produce enough of seed of the crop that they want. Most of these crops are groundnuts, cassava, beans but different varieties. Farmers want maize but maize production is difficult because of isolation. Almost everyone grows maize and we do not find an area which does not have maize. The other crops are easy because the isolation is very short distance.

Interviewer: What are the isolation requirements for maize?

Interviewed: Maize is cross pollinated so pollen is carried in the air. So to multiply a maize variety it should be grow about 800 meters away from any other crops or maize. So some farmers use then hybrid maize but the proportion is still small. Hybrids are so expensive for them.

Figure 25: Limitations to access maize

Source : DF participants

7.5.3 Effects of SSRs on seed quality and suitability

Farmers who have had access to seeds through the CSB mentioned being satisfied with the quality in terms of germination. The germination rate has been high under normal conditions, and it was mentioned that those seeds germinated satisfactory when the climate varied drastically. According to farmers, this has not been the case for hybrids that did not perform well in high temperatures.

Farmers rated the quality of the seeds stored in the CSB as the highest. First, participants explained how they can rely on farmers' knowledge to collect and preserve seeds, especially because they followed the NGO guidelines. All reported that knowing that other farmers are going to use those seeds themselves is a proof of quality. Farmers made statements such as: MFM-6: “I really trust local seeds that were collected by other farmers, I know where those seeds come from and that they were selected carefully to guarantee the quality”. MFM-4: “Good germination will happen because those seeds were well managed in the field by other farmers”. FFM-5: “In the seeds that farmers produce we find good quality because those seeds have not additional mixtures”.

Second, field visits during pre-harvest handling, visual inspection and trainings focused on improving practices to preserve and multiply seeds were highlighted as positive activities carried out during SSRs that have made farmers trust the quality of seeds supplied by the CSB (Figure 26). Lastly, farmers mentioned having confidence in the physical storage facilities and the skills of those who handle the seeds in the CSB as important factors that strengthen the seed quality.

The CSB and quality seeds

MFM-4: "We have got good germination percentage because seeds are well managed in the field and during storage". **FFM-4:** I trust the seeds because they are stored in a good environment and seeds are also inspected in the field". **MFM-3:** "Those seeds that we get in the seed bank are inspected through growing period and that guarantees quality". **MFM-5:** "I am satisfied with the quality of the seeds because they are well-managed in the filed and during the storage, I trust those who take care of the seeds" **MFM-6:** "The seeds are managed well and we know all seed we get from the seed bank will germinate"

Figure 26: CSB and seed quality
Source: Malawian farmers

Despite being satisfied with the seed quality, some farmers during the focus group and individual interviews mentioned that local seeds should also be used together with organic fertilizers to get good germination rates. Farmers explained that DF and its partners have supported them with new techniques and knowledge but that other NGOs and the GoM itself still focus on hybrids and their chemical fertilizers. For instance MFM-1 said: "Local seeds are not magic, they also need nutrients and even if we get help from DF and its partners, more support is needed to have high yield". FFM-1 asserted by saying "We do not need chemical fertilizers, but we still need manure, otherwise the use of only local seeds will not be translated into increased production". So, more support to access organic fertilizers to guarantee the high germination rate was mentioned as very relevant.

Local and indigenous seeds of a wide range of crops have been of great importance to small-scale farmers. The CSB and seed fairs have contributed to promote those varieties making farmers satisfied because they had the possibility of enjoying food that they preferred, wanted and were more familiar with in terms of taste, colour and poundability, especially when referring to local maize. Farmers have made a transition from depending only on hybrid maize

promoted by the GoM to use local varieties of other types of crops. Some farmers reported that they continued to use hybrid maize simultaneously with local maize and other crops. However, farmers highlighted that the harvest of their local seeds in terms of maize is prioritized for consumption due to food preferences, while hybrid maize is used mainly for commercial purposes. Some statements made during the discussions were:

MFM-6: "Since we are part of the programme, we have no longer problems in accessing seed of our own choice, we are able to get what we need and want".

FFM-7: "Now we have access to every seed and crop we need, and we want. Local seeds taste very good".

FFM-8: "We have access to crops and seeds we did not have access before. So we can obtain different food that we like how it tastes".

Figure 27 summarizes the impacts of the CSB and seed fairs implemented in long-term development programmes by DF and its partners on farmers' long-term seed security.

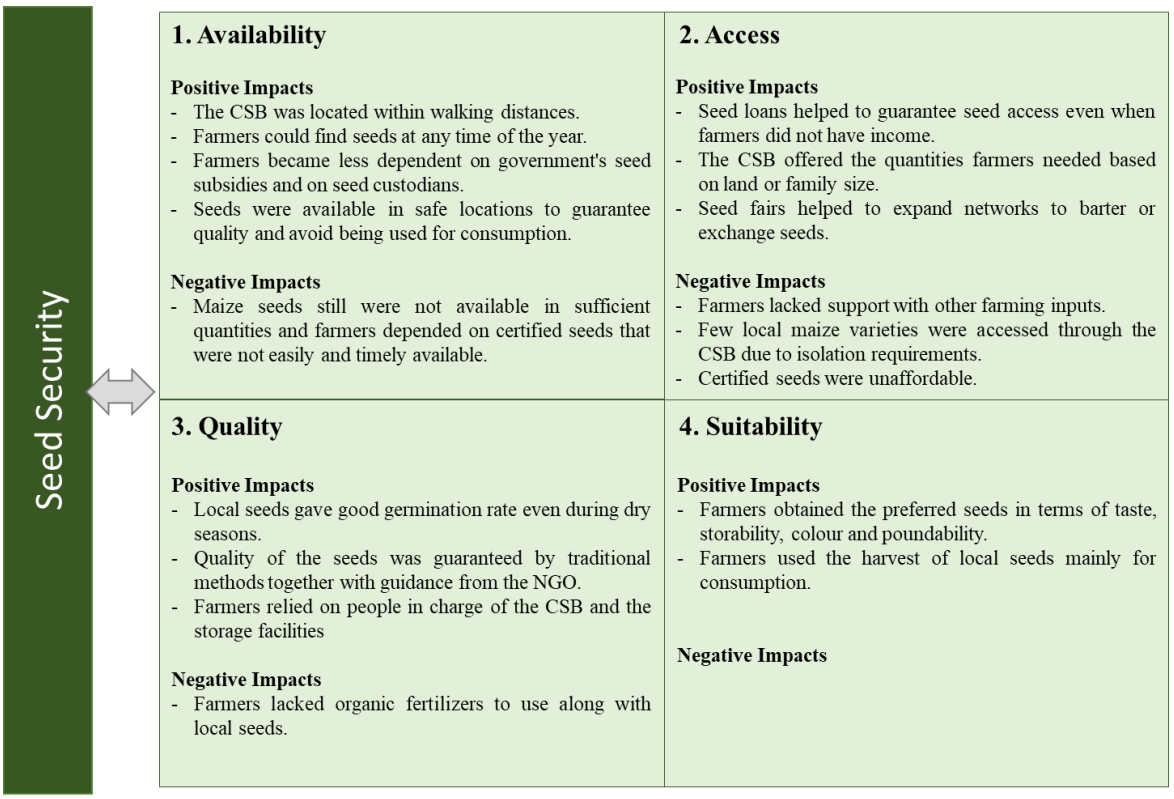

Figure 27: CSB and seed fair impacts on farmers' long-term seed security

Source: Author

7.6 Effects of SSRs on food security

Dry weather was a main challenge of crop production mentioned by the study participants in Malawi. Most farmers mentioned that the use of local seeds have ensured food supply even during dry seasons, which was a positive effect of CSB membership. In response to the question "has food availability been affected by your participation in the SSRs", most farmers stated that local varieties promoted through SSRs have different levels of maturity that helps to get sufficient harvest in less rainy seasons. Below are selected quotes that highlight the participants' views:

> **FFM-2:** "Some seeds have shortcoming season hence mature early, and I can obtain food even during periods where there is not enough water".
>
> **MFM-1:** "When I used to have only hybrids, I lacked food during dry seasons, now those local varieties give me harvest when times are good and not also, those varieties have different levels of maturity. The amount of food is not high, but it is better than before when I sometimes lost my entire production".
>
> **MFM-6:** "Before I joined the project, I was having a lot of problems because I only used some hybrid seeds, and they did not give me enough food during dry seasons. But now I am having more food which I feed my family all year"

A larger quantity of food available for consumption than before being part of SSRs is the result of the CSB promotion of local seeds of a wide range of crops. Farmers emphasized that it has been a transition from relying only on maize to having other food types available. Additionally, local varieties and products derived from those varieties have shown better and longer storability. As a result, all farmers reported improved food availability for longer periods following SSRs (Figure 28), although not all farmers assured food availability throughout the year and mentioned lack of food storage facilities and small land size as two main constraints. All farmers emphasized the importance of local seeds for food availability because products made from hybrids expire faster than products made from local seeds. Another underlined characteristic in terms of food availability following SSRs was productivity growth with the use of local seeds. As one farmer stated: "With 20 kg of maize from local seeds I obtained more flour than when I used 20 kg of hybrid maize" (FFM-2).

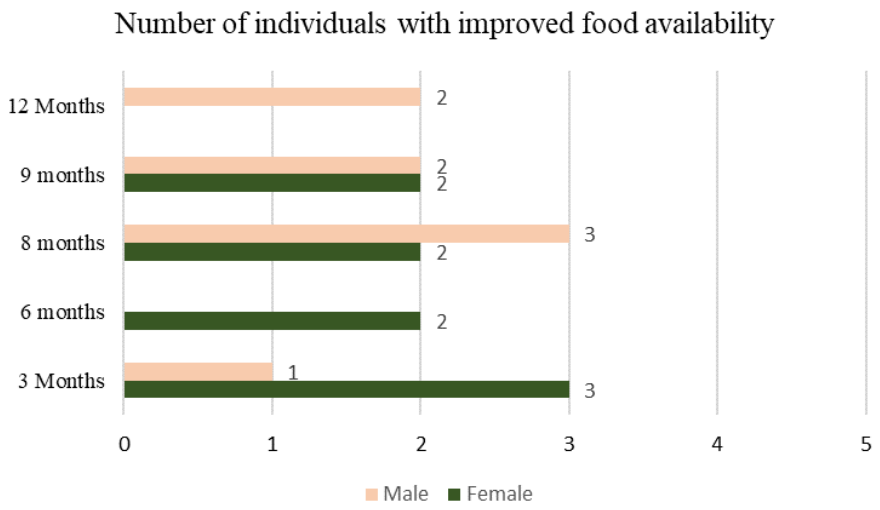

Figure 28: Food availability improvement

Source: Malawian farmers

Despite increased food quantities from their own production for longer periods than before, farmers have not had enough surplus to sell, which affected food access. Due to lack of income farmers have been unable to buy foods they do not produce themselves. Low surplus and limited income were mainly due to (1) small land size, (2) declining yields when not having access to other agricultural inputs and (3) extreme weather conditions, even though local varieties produce yield still surplus can be limited. Consequently, the assets to access foods not produced by the farmers themselves have not been positively affected following SSRs. Furthermore, male farmers reported that selling parts of their surplus to generate income has also been affected because food meant to be sold was used to pay for labour when needed or shared with relatives during lean periods.

Women also reported problems accessing other types of food by using income generated from selling surplus. When unexpected needs arise, women usually decided to use the money for other purposes, such as medicine for their children. Women mentioned sacrificing purchase of additional food and relying on their own production until the most urgent problems were solved.

Interestingly, the two farmers who reported year around food availability after joining the CSB, introduced a division between food crops and cash crops on their lands. Both asserted that they use local varieties for consumption and hybrid seeds for income generation, a strategy that helped them to access additional food and other needs when required. However, a more in-

depth study should be conducted to assess whether the division of crops alone renders significant differences in the dimension of food security or if additional factors could have been in play.

Regarding effects of a wider range of crops from local seeds on utilization, several farmers stated that switching from consuming only maize and its derivatives to a more varied range of foods generated a balanced diet. Nutritional information on the different types of food to be consumed along with lessons on how to cook different dishes has improved farmers' knowledge of nutritional issues (Figure 29). Awareness of benefits of balanced diets was underlined as a positive change.

Some dishes farmers learned to make	Some statements about nutrition farmers learned
• "I have learned to prepare pap from finger millet" **(MFM-5)**	•"Bambara nuts provides oil and proteins. I know there are six food groups and their sources" **(FFM-7).**
• "I have learned how to prepare pastes from cowpeas (vilanda)" **(MFM-4)**	•"Beans are a source of protein, maize is a source of carbohydrates and nuts are a source of oil" **(FFM-6)**
• "I know how to prepare doughnuts from potatoes flower" **(FFM-1)**	•"Maize is an important type of carbohydrates but we need the other food groups" **(MFM-3)**
• "Peanut butter we learned how to prepare in the seed fairs**" (FFM-2)**	•"We can replace meat by eating beans which are a source of protein" **(MFM-4)**

Figure 29: Quotations on nutrition

Source: Malawian farmers

CSBs and seed fairs have improved access to local varieties of seeds which has resulted in improved access to various foods for longer periods than before. Additionally, farmers are more aware of preparation of varied foods for a balanced diet. However, the positive effects are still not stable for longer periods (Figure 28), and year-round family maintenance remains a challenge, affecting the stability dimension of food security.

Climatic conditions were mentioned as a main challenge of food security when farmers mainly depend on their own crops. The pre-harvest period January - March are the months in which the greatest food shortage occurs. DF and its partners mentioned the implementation of additional programmes to address food shortages in their long-term development interventions.

More access to organic fertilizers and water as well as soil improvements were mentioned as new technologies implemented under the Climate-Smart Agriculture initiative.

Figure 30 summarizes the impacts of the CSB and seed fairs implemented in long-term development interventions conducted by DF and its implementing partners on farmers' food security.

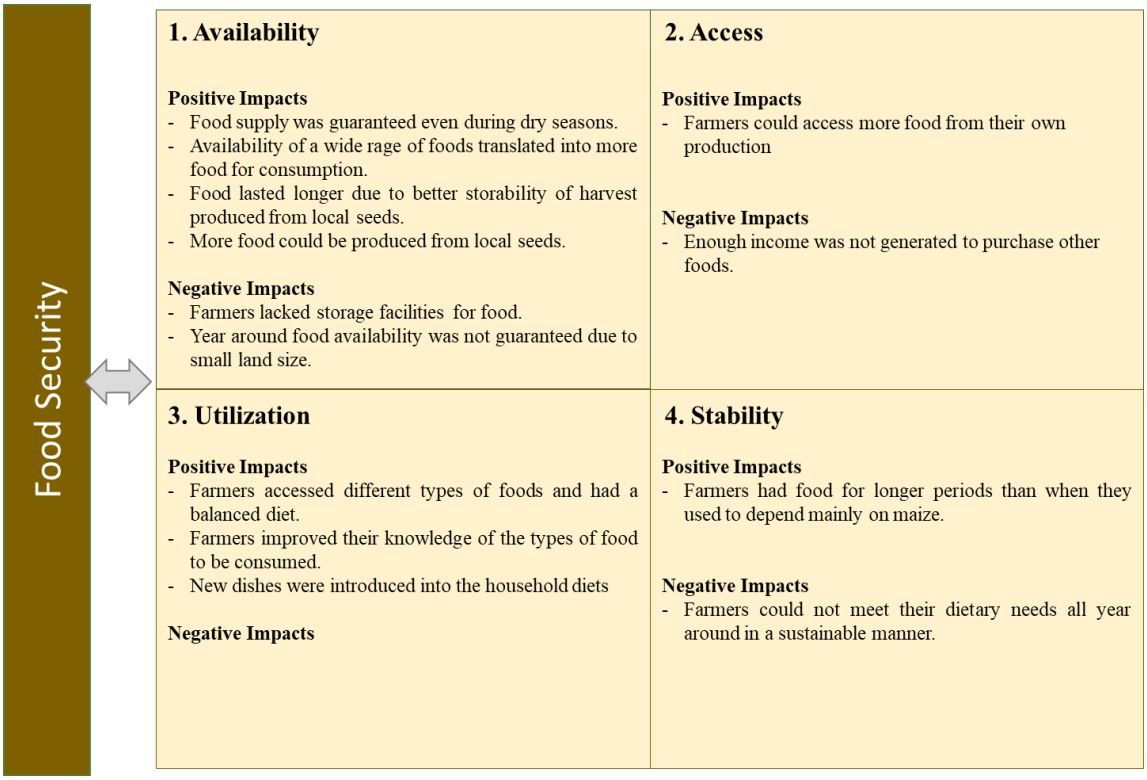

Figure 30: CSB and seed fairs impacts on farmers' food security

Source: Author

7.7 Effects of SSRs on income generation

All farmers reported income increases after joining the SSRs conducted by DF and its partner BCI (Figure 31). However, the income generated was by farmers described as low and not sustainable in the long term. The increased income resulted from minor surpluses generated by higher yields of the local seed varieties. With the surplus, farmers have been able to sell fresh products and sub-products in local markets. Sub products that for being derived from local seeds, have a higher commercial price. Women in particular expressed their satisfaction as they have become more independent from their husbands due to the income generated. For instance FFM-1 said that "I used to depend on what my husband gave to me, but now I grow my own local seeds and obtain some income, it may not be a high income, but it helps me to cover some

basic needs sometimes". A statement that was emphasized by FFM-2 who said that "Nothing is better than being economically independent, then you can buy your own things and also for example you can pay school fees for your children. The income is not so high, but I had something".

In addition to increase yields, crop diversification through introduction of local seeds from a wide variety of crops increased income by offering a larger product portfolio. This helped to diminish the risk of selling a single product and depending on whether the prices were high or low at a current moment. Groundnuts, bambara groundnuts and beans were some additional crops that farmers mentioned as key income generators. However, some informants mentioned that the market still is strongly focused on maize and few buyers commercialize other crops.

Income Generation statements – Females	**Income Generation statements – Males**
"I have got more income that before because I could make some contacts to sell my products, so participation in seed fairs gave me access to more buyers" (FFM3)	"We have been able to grow more food and sell excess that income helps us obtain our basic need" (MFM3)
"Have the option to sell other products made mi life easier, I did not need to depend only on my own production, I got income too" (FFM4)	"I have sell some surplus and the income help us to obtain some basic needs" (MFM4)
"Now I am able to sell multiple products in the market, I get some income I did not have before" (FFM6)	"After obtaining more quality seeds I have increased yield and hence I increased sale and income" (MFM5)
" We now grow more crops so we have more sale and then income" (FFM7)	" I am selling and get a little money. A little money for other purposes in my family" (MFM8)

Figure 31: Income generation stories
Source: Malawian farmers

Seed fairs formed platforms for farmers to build networks to sell surplus. Farmers had the opportunity to display their products and deal with customers (buyers from Lilongwe, hospitals and schools) other than relying on buyers from the local market. Establishment of connections aiming to increase trade income was still ongoing during the study. Farmers mentioned ambitions to become independent from middlemen running the local market through creation of alliances with other buyers. A claim made by female and male farmers alike, which was

confirmed by NGO participants and key informants, is that local middlemen introduce price ceilings that limit farmers' income.

According to participants, the need for income as soon as farmers get their harvest is an important factor leading middlemen to control the market price. Farmers prefer to sell despite the low prices because they have no other sources of income and their storage facilities cannot guarantee long-lasting quality, which could lead to even lower incomes over time. The GoM formally introduced price regulations, but as the informants mentioned, the regulations have not been controlled and implemented in reality. Even for the highly promoted maize it was found that buyers do not adhere to the minimum price set by the GoM. DF and its partners mentioned work on establishment of connections between farmers and buyers in various projects. However, the strong promotion of maize in the country has diminished the demand for other crops that farmers produce resulting in low selling prices. Farmers therefore mentioned being sceptical to crop diversification as demand is uncertain.

Seed marketing was another sales channel that farmers mentioned trying to open to create another source of income. In the case of seeds of other crops than maize, CSB members were very confident with the seed quality. However, the commercialization process was found to be slow and income generation is still unstable. In the case of maize, commercialization is restricted by lack of recognition at the policy level of local maize as seed, as stated by all participants in the case study. It was mentioned that several NGOs in Malawi work on protecting farmers' rights with respect to commercialization and the right to reuse, recycle and share seeds of local maize. As a result of the advocacy, participants mentioned that the ban on farmers' traditions was removed from the seed policy. Nonetheless, it is still unknown whether there will be room in the seed law for a more flexible quality scheme to market local seeds. Today the seed law has not yet been enacted.

Some key informants mentioned a successful case of small-scale farmers who have been able to sell groundnut seeds following SSRs, especially CSB (Figure 32). Nevertheless, informants highlighted that those farmers established connection with buyers who have financial muscles to guarantee the inspections and thus the quality certifications. Without certification those seeds could not have been commercialized. Farmers themselves lack means to fund the certification process.

Farmers selling seeds…

KI-5: "Farmer who claim to be growing seeds, their seeds have to go through a certification process from the Ministry of Agriculture. This is a high cost for individual farmers. There is a case of a contract with a buyer named […….] .That client covers the cost of the seed certification so then the inspectors come to the field of the farmers and those seeds are certified. Those farmers are able now of selling seeds of good quality, get a certification and earn income from selling seeds. But there are not many cases. On the contrary the policies in Malawi, especially they seed law, whereby the farmer concerned is not allowed to sell whatever is produced to sell as package seed. There are a lot of restrictions and lots of certifications which the farmer cannot afford"

Figure 32: Seed sales story

Source: Key informant

8. Discussion

The following chapter discusses the key findings in light of existing theory. A summary of key findings from each case study is provided, followed by a discussion to assess the extent to which the aims of SSRs are met.

8.1 Summary

Figure 33 and Figure 34 summarize the key findings of the Uganda and Malawi case study respectively. Each figure illustrates the origin of SSRs in both humanitarian action and long-term development interventions and how the SSRs selected by the NGOs influence farmers' long-term seed security, food security and income generation. These findings are organized based on the study framework described in the theoretical framework chapter. It is worth noting that the figures present a flow chart including evaluated parameters and that other factors that may affect farmers' strategies in the long-term are not included.

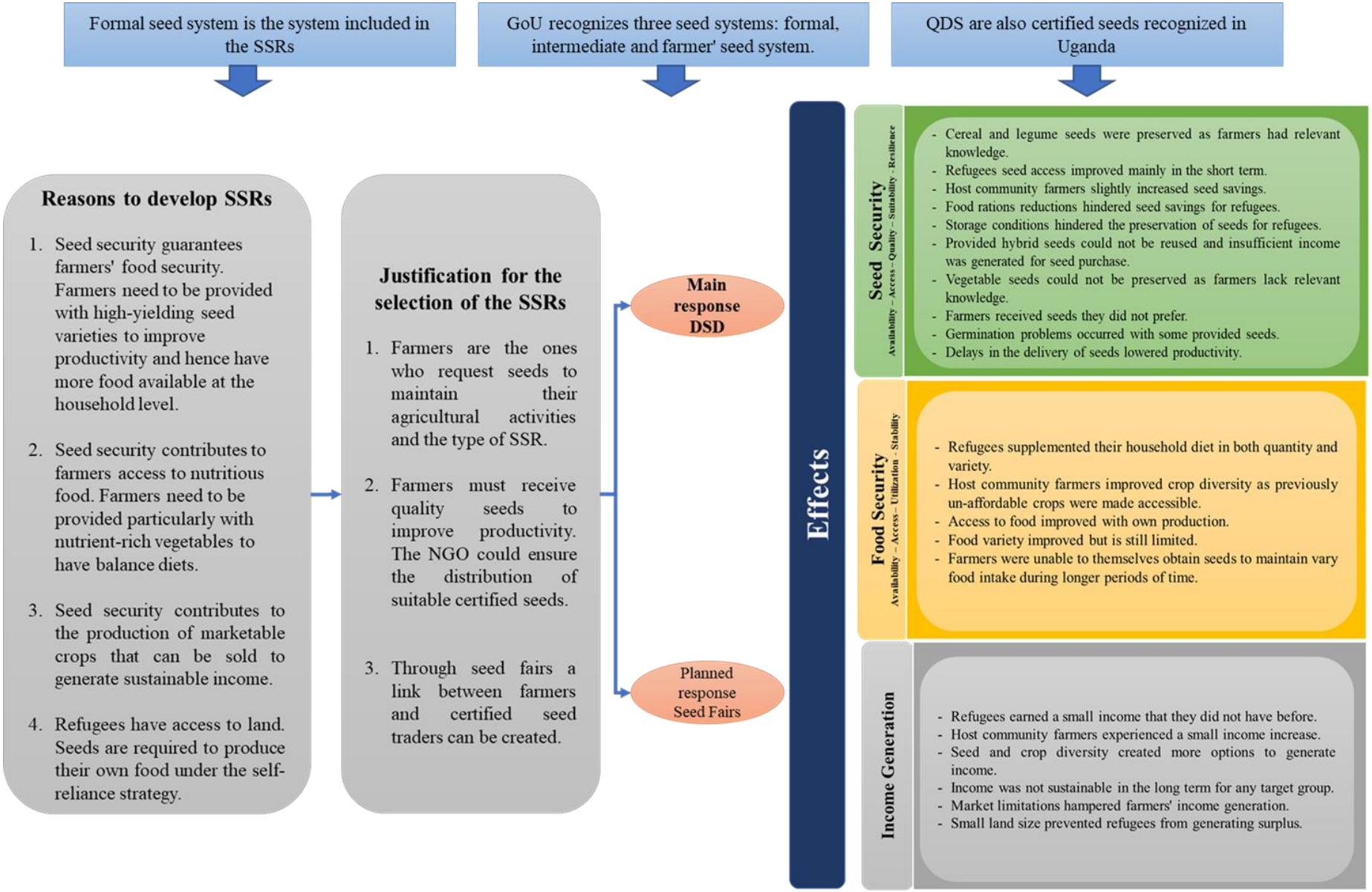

Figure 33: SSRs and humanitarian action

Source: Author

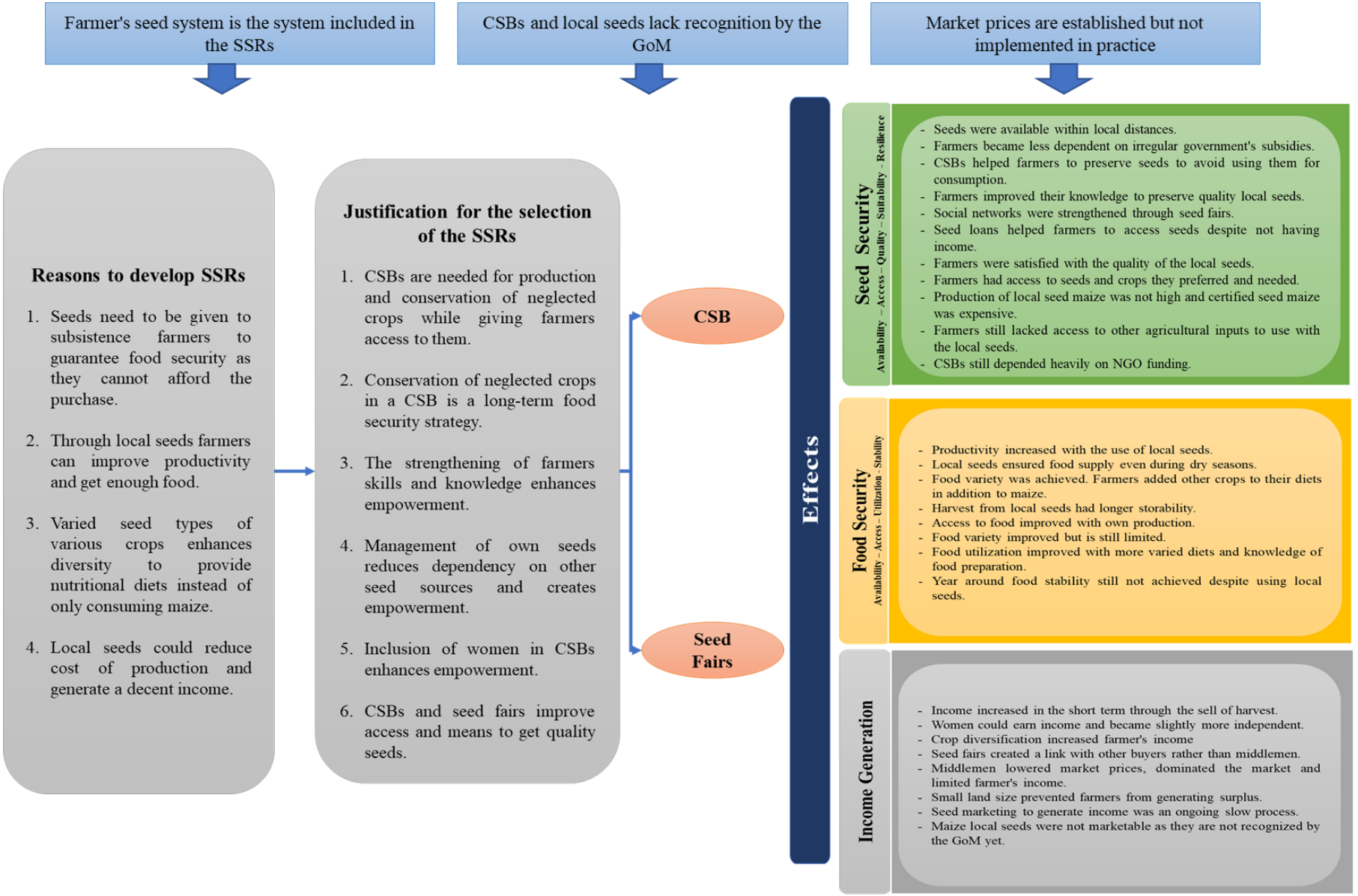

Figure 34: SSRs and long-term development interventions

Source: Author

8.2 Formal seed system and farmers' needs in humanitarian action

The Uganda case study showed that the interventions developed in humanitarian action leave out the intermediate and farmers' seed systems, regardless of the SSR, whether implemented or planned. Instead, NRC considers the formal seed system key to provide farmers with certified quality seeds due to, in particular, expected high germination rate. Hybrid seeds normally dominate NRC's SSRs. In contrast, refugees and host community farmers showed that they prefer seeds that can be stored for upcoming seasons, as those seeds produce preferred foods in terms of taste and the harvest is in high demand in local markets.

This finding indicates that NRC's approach is part of the agricultural development agenda that considers technology, especially the adoption of hybrid seeds, vital to transform food production among small-scale farmers. The agricultural development agenda with the use of technology aims to increase production, especially in Africa, with the use of hybrid seeds and chemical fertilizers, as promoted in the first green revolution during the 1960s (Evenson & Gollin, 2003; Borlaug, 2007; Pingali, 2012; and AGRA, 2019). NRC's development agenda, as shown in the case study, disregards the quality of local seeds produced by farmers themselves under the farmers' seed system and excludes seeds produced by farmer cooperatives under the QDS scheme. Indeed, NRC leaves out of its agricultural programmes the agricultural development approach that aims to use low-cost inputs, particularly local seeds and organic fertilizers, to maintain agricultural activities among small-scale farmers. An approach promoted by various NGOs worldwide as well as by agroecology activists (Holt- Giménez et al., 2013; GreenPeace, 2015; Shiva, 2016; and Via Campesina, 2018).

One problem to highlight with the use of the agricultural green revolution-based development approach, as practiced by NRC in its SSRs, is that it does not offer empowerment to farmers. A rigid equation of supremacy in terms of knowledge is what sustains this approach. Farmers, even when asked about their general needs prior the implementation of SSRs, are seen by NRC staff as end-users rather than agents of their own change. Instead, seed traders with their limited portfolio, as shown in the study, tend to be prioritized, as those traders are prequalified suppliers and are in line with NRC's development agenda. As a result, the livelihood of refugees and host community farmers trapped in cycles of poverty remains in the hands of the NGO that decides which technology to promote. This insight calls for more attention to verify the bottom-up approach in terms of farmers' needs that NRC promotes to avoid implementing an isolated top-down approach instead, as the study findings showed. One such bottom-up approach is the

Participatory Rural Appraisal which emphasizes the empowerment of local communities and leads them to take an active role in analysing their own living conditions and limitations to seek change in their situations (Chambers, 1994).

Moreover, although studies have shown that NGOs provide only a moderate proportion of the seeds that farmers sow (McGuire & Sperling, 2016; Mulesa et al., 2021), the Uganda case study findings indicate that NRC has become, particularly for refugees, an important seed source that in some cases provides the total seed amount used. Many refugees do not have established networks or sufficient income to initiate and maintain farming activities although the GoU provides them with a land plot. This suggests that refugees' social networks are weak and, consequently, refugees are at a higher risk of disruption to seed access, as early studies by Poudel et al., (2015), Coomes et al., (2015) and Bezner Kerr, (2013) showed. A particular problem involving NRC as the main seed supplier for some refugees is the great influence that can be exerted on farmers to make them believe in the superiority of certain seed technologies. Indeed, farmers can be misled when information is provided about the advantages of certain technologies, while disadvantages and additional input requirements are not sufficiently highlighted. As a consequence, farmers could be led to a debt trap rather than a recovery stage, as they could be persuaded to use technologies they cannot afford in the long-term, as the findings showed.

8.3 Income generation constraints following SSRs

As discussed in the findings sections of both case studies, farmers in general and female farmers in particular, are eager to seek income by selling part of the harvest in local markets. Without being able to say anything about causality, the findings of both case studies show a pattern in which regardless of the seed type farmers access and use (hybrids, OPVs, and local seeds), a decent and sustainable income remains a challenge. The market in each context presents barriers such as higher supply over demand generating supply-side price pressure, influence of middlemen and low acceptance of diversified crops, especially in Malawi where maize dominates the market. Additionally, refugees in Uganda and subsistence farmers in Malawi cannot obtain surpluses to sell in the market due to their small land size.

Despite accessing and using different seed technologies to increase production, this finding reveals that for seed security to contribute to food security and income generation, much more is needed than access to seeds. The evidence from the case studies has shown that the

agricultural development approach, especially with the use of local improved seeds, indeed contributes to slightly improved productivity. This is in line with Bezner Kerr (2013) who found that local maize performs better than hybrids in poor conditions. However, the increase in production is insufficient to increase economic growth, reduce poverty and address food insecurity among small-scale farmers as agricultural development approach supporters have promoted (Borlaug, 2007; WB, 2008; Pingali, 2012 and WB, 2019a). Consequently, the findings indicate that food insecurity and poverty-related problems among small-scale farmers should not be addressed only from an agricultural development approach. Instead, stronger integration between the political economy of agrarian change and the agriculture development approach for addressing food insecurity and poverty related-problems will likely be more beneficial in the short and long-term.

Indeed, this study has shown that proper SSRs should be established to ensure long-term availability and access to quality seeds, as seeds are key inputs in agriculture that contribute to increase productivity. And there is evidence that increased productivity is effective in creating structural transformation (Ivanic & Martin, 2018; Ligon & Sadoulet, 2018 and Jayne et al., 2018). But the findings highlight that it is critical to consider two additional factors to address food insecurity. First, high productivity is not exclusively about seeds, as access to other inputs and a larger land size are also needed. As Agarwal (2018) found, access to land can significantly improve the ability to produce and acquire food, especially women's access to land. Limited access to land and other resources will make it difficult to escape poverty directly through agricultural productivity (Jayne et al., 2003). Second, despite producing enough food through access to quality seeds and a larger land size, if farmers cannot have a secure market environment to earn a fair and sustainable income, food insecurity and poverty will not be tackled successfully. As Sibhatu & Qaim (2018) stated, market integration can efficiently contribute to income gains. But “without increased demand for agricultural products and/or more efficient markets to distribute them, growth in agricultural productivity could quickly run into declining prices that counteract the benefits of productivity growth for producers and discourage investment” (Poulton et al., 2006 p.244).

As land scarcity was mentioned as a challenge to productivity increase in both case studies, the findings suggest it must be acknowledge before implementing SSRs. This insight calls for the conduction of proper land assessments to identify what can actually be produced on particular land plots and what kinds of seeds and crops can be efficiently grown in current soil

conditions. Although such assessments may be outside the NGOs scope, especially during sudden emergencies, integration of the right stakeholders to develop the assessments could help NGOs create more sustainable solutions tailored to real individual needs inside or outside the agricultural business. Indeed, the findings showed how some farmers asked for alternative forms of income generation, as they had low productivity due to the small land size. A finding in line with Haug & Westengen (2020) that stated that when low profitability occurs in agriculture, other measures such as alternative job creation, both within and outside the agricultural sector, can become more sustainable solutions.

Another challenge experienced by farmers in both case studies was market constraints. This finding indicates that farmers could limit the use of any types of seeds and crops they are unfamiliar with, as they require modification of farming practices without any safety net. So, simultaneously with the creation of sustainable SSRs, the findings suggest that to guarantee the use of new seed varieties and crops, market analysis, the promotion of new crops domestically and effective implementation of market price regulations need to take place. As Haug et al., (2016) found "to encourage the adoption of new technology, it is necessary to provide a conducive and predictable environment for such investment to take place". Otherwise, farmers will be strict about what is safe for them to produce and all promotion, production and distribution of new seeds and crops through the SSRs in emergency and long-term development interventions will be wasted as they will be unsustainable endeavours. Especially considering that farmers of both case studies are at a survival threshold and cannot risk being on a wider learning curve and diversifying their production systems without securing short- and long-term benefits. Given the importance of market constraints emerging from the findings, more research is needed to address how to link SSRs with more marketable approaches, especially if the goal of the selected NGOs is to promote agriculture, crop diversification and the use of new seed varieties as an economic engine.

8.4 Food and seed aid dependency in humanitarian action

Although SSRs in NRC are designed to help farmers to stop relying on food aid and start producing their own food under a self-sufficiency strategy, refugees and host community farmers who have participated in various SSRs developed by NRC, particularly DSD, continue receiving food rations and expressed the need for more support in terms of seeds and tools to maintain their agricultural activities. Although farmers have supplemented their food rations,

that supplement does not normally last for more than four months, and despite efforts made to earn a decent income, just low income, if any, is generated with obtained surplus.

This finding indicates that following various SSRs developed by NRC, farmers have not recovered as expected when the responses were established and instead of helping them avoid relying on food aid, seed aid has become necessary. This finding acquires greater importance as previous studies have correlated repetitive SSRs, especially DSDs, with farmers' seed dependency, as seeds are delivered free of charge (Sperling et al., 2008 and Sperling, 2020). However, based on the findings and despite great diversity in the experiences of those who have been part of DSDs, it is valid to say that farmers have not necessarily become seed aid dependent, but rather that SSRs developed by NRC have not effectively addressed the problems refugees and host community farmers experience.

To start with, the SSRs implemented by NRC aim to address a problem of seed availability when the problem faced by farmers, according to the findings, is an access problem. Access to seeds as the main problem faced by farmers is a finding that accords with research conducted by Remington et al., (2002); Longley (2003); and McGuire (2007). When the problems are interpreted based on previous experiences, and the solutions are implemented unilaterally, with a minimum prior background study, it is likely that the solutions proposed will not lead to any satisfactory outcome. Therefore, the findings suggest that SSRs developed by NRC within the framework of humanitarian action consider the specific limitations of each target group to develop programmes focused on addressing the problems and thus implementing successful agricultural interventions.

Furthermore, the findings also reveal that some farmers have created different strategies to maintain their livelihoods with the seeds and training provided through SSRs because food and seed aid are usually not delivered on time and farmers cannot rely on such an unstable support. Those results fit with previous studies conducted in Ethiopia and Nepal indicating that few farmers willingly rely on food aid, as its delivery is not on time and the quantities are insufficient (Little, 2008 and Gautam, 2019). Similarly to what happens in the delivery of seeds during emergencies, as studies have shown (Sperling & McGuire, 2010a). What this finding demonstrates is that SSRs developed by NRC do not effectively help refugees reach the survival threshold and consequently farmers seek help despite delays, but it is not necessarily because they would like to. In fact, as the findings indicate, some seeds delivered are not

adjusted to agroecological conditions, to farmers' needs, nor can the seeds be conserved. A significant problem with the supply of those seeds is that they do not offer short or long-term benefits. Food and seeds continue to be insufficient to meet family' needs, and as a result, farmers need to ask for help.

To address the seed access dimension around the refugee settlement in Uganda, the findings suggest that there are opportunities for the development of emergency seed approaches to avoid that NRC continues to reimplement the same SSRs, and instead implement SSRs that can address seed access while providing farmers with seeds adapted to local conditions. Uganda's laws recognize QDS as important to supplement the demand the formal seed system cannot cover. As a result, supporting CSBs or farmers cooperatives represents a promising strategy to enhance farmers' access to quality seeds while integrating refugees and host community farmers. Especially considering that CSBs in Uganda were also recognized in the national policy in 2017 (Vernooy et al., 2020). For instance, a CSB in Zimbabwe has committed to the provision of seeds to non-members in need, indicating the potential of CSBs as local solutions to emergencies (ibid). So, NRC could play a key role in supporting community seed initiatives to address immediate needs and also help to alleviate longer-term problems, as in Uganda refugees from a protracted crisis in South Sudan continue to arrive. Additionally, the findings suggest that local organizations can be included in SSRs implemented by NRC to enable beneficiaries to connect to local structures, as especially refugees need to increase their networks to support their livelihoods. Integration into existing community support structures could generate more long-term benefits than simply implementing short-term support (Hammond, 2018) such as seed delivery.

Lastly, it is worth noting that the lack of implementation of instruments, both to measure the real problem that farmers experience and the impact of SSRs, has led NRC to continuously implement the same responses. Indeed, the findings showed that the main cause of food insecurity is highly associated with lack of seeds and other causes are not considered as Remington et al., (2002) also found. Although studies by Longley (2003), and Remington et al., (2002) on the lack of evaluation were published almost two decades ago, the findings of this study showed that today the same challenges remain. The reimplementation of responses found in the case study indicates that farmers ask for more seeds not necessarily because those are their real priorities, but because farmers ask for what they are sure can be obtained and do

not want to be excluded from the programmes. A finding similar to what McGuire & Sperling (2008) found where farmers learned what they need to be concerned about to obtain support.

8.5 CSB sustainability and long-term development

The CSB in the Malawi case study has been in operation with the support of DF for approximately 10 years while increasing recognition among community farmers and local and international stakeholders. The production and distribution of local quality seeds and crops known as neglected, the provision of agricultural services, the improvement of farmers' access to seeds, the membership fee and the financial support channelled through international donors that support the farmers' seed system have contributed to the CSB maintenance.

In line with studies showing that CSBs may be at risk due to limited financial capacity and high dependency on NGO funds (Nyantakyi-Frimpong, 2019), the findings from the Malawi case study indicated that the use of multiple internal and external sources to generate income have contributed to the CSB operations but not yet guaranteed sustainability. This finding suggests that more advocacy is needed at the national and international levels, as CSBs and local seeds still lack recognition within Malawi's national policies. Lack of recognition of CSBs could hinder CSB operations, as reported in early studies (Vernooy et al., 2020).

One source that the CSB relies on to maintain part of its operation is the membership fee. Although this fee does not cover all CSB expenses, the findings indicate that it serves to create a bond between CSB members and a sense of ownership while generating social pressure on farmers to repay their seed loans. Such a finding is contrary to what Reisman (2017) found where, due to the collective environment in which the CSBs are managed, farmers do not feel much pressure to pay their loans back. Instead, the Malawi case study shows that farmers work in a trustworthiness environment and, although their willingness to pay should not be romanticized, farmers are encouraged to pay as they obtain quality seeds, a flexible payment scheme to access them, and additional services that could boost their farming activities. This finding is in line with studies showing how farmers are willing to invest in quality seeds (McGuire & Sperling, 2016). And this finding also provides a new perspective on the willingness of farmers to pay for agricultural services in general and not just for seeds in particular. Especially when the services provided are of high quality such as those offered by the CSB and that cannot be easily substituted in the area.

In the Malawi case study, after becoming a CSB member, farmers have accessed crops and varieties that were previously unavailable or too expensive for them. Particularly, farmers' seed access dimension has improved positively over longer periods through the seed loan scheme. This finding can be highlighted as it indicates that CSBs are an effective platform for enhancing farmers' access to good quality seeds, as previous studies by Vernooy et al., (2014) and Maharjan & Maharjan (2018) have shown. So, although farmers' assets have not increased significantly after becoming CSB members, the seed loan scheme improves farmers' opportunities to obtain seeds and avoid reliance on unequal subsidies and other farmers. Indeed, the findings indicate that asset differences or status in the community do not influence access to seeds among CSB members, as all members are entitled to obtain seeds on the same conditions. Contrary to the study by Reisman (2017) and Nyantakyi-Frimpong (2019) which showed that people take advantage of their influential positions to access seeds, in the Malawi case study there was no evidence of inequalities, especially gender inequalities, that could limit women's seed access. However, a separate quantitative analysis is required to further analyse the gender access dimension, as the study result generalizability is limited by not having had access to all CSB members.

Agronomic training and field inspection visits are part of the services that the studied CSB offers. Those services, based on the findings, match farmers' needs, as the GoM lacks staff to provide that type of assistance. Information that is in line with other studies that have shown that most of the budget in Malawi goes to subsidy programmes, while the provision of information and training is inadequate (Ragasa & Mazunda, 2018). One such service where CSB expertise is needed, as the findings indicated, is support and guidance in production of organic fertilizers. Consequently, the CSB could play a key role in becoming an expert in providing those services and being an intermediate provider of the GoM to other farmers, while contributing to CSB sustainability.

The Malawi case study findings also revealed that thanks to the quality seeds produced at the CSB, efforts have been made to become a relevant actor in the production and commercialization of improved local varieties to create another source of income to assure sustainability. However, the findings showed that the CSB has not succeeded yet, as the GoM continues to favour improved certified seeds produced under the formal seed system. This finding is in line with conclusions of Matita et al., (2021) that the GoM through the new subsidy programme continues to promote certified seeds. Today, with the new seed policy, there is

legal space for the commercialization of QDS. Thus, the CSB could play a central role in the production of QDS, especially of seeds and crops that have been neglected and that the formal seed system does not produce, as the findings indicate. Vernooy et al., (2020) showed how a CSB in Zimbabwe has started producing and marketing seeds to generate income for members and support the seed bank sustainability. Indeed, as the findings indicate, the production and commercialization of QDS by the CSB could make feasible for the GoM and non-members of the CSB to access cheaper quality seeds. Although such a strategy could contribute to CSB sustainability while giving farmers opportunities for diversification of seed sources, further advocacy is needed to broaden the approach to food security promoted in Malawi and thus become a recognized seed provider to the GoM subsidy programmes, NGOs and other clients.

Furthermore, the Malawi case study findings showed that CSB members used to grow only maize, as in Malawi farmers have strong preferences for this crop (Westengen et al., 2019). However, being a CSB member has resulted in a greater diversity of foods to improve household nutrition. This finding indicates that farmers are willing to adopt new varieties and crops to have a more varied and nutritious diet, as long as they are also given knowledge on how to cook new dishes. This suggests a positive development in the nutritional dimension of CSB members, the importance of the provision of knowledge together with the means and the strong bond CSB members have created with the CSB to continue supporting its maintenance.

Lastly, despite the benefits that local seeds and CSBs could offer and that are shown in the Malawi case study findings, more support to farmers is needed from the GoM and other NGOs, as local seeds also need other agricultural inputs to perform well. Indeed, in line with existing literature, more efforts are needed to support the farmers' seed system (McGuire & Sperling, 2016) and other farming needs. DF and BCI in addition to seed conservation, offer a range of auxiliary services such as training in the production of organic fertilizers and the improvement of water facilities. However, those efforts need to be strengthened by the GoM, whose agricultural budget is mainly allocated to subsidies while other areas are neglected as early studies have shown (Ragasa & Mazunda, 2018 and Matita et al., 2021).

8.6 M&E in humanitarian action

While NRC staff mentioned conducting field visits to measure quantities of seeds delivered rather than in-depth assessments of DSDs to assess their effects on beneficiaries, as well as whether or not their aims were met, further analysis with refugees and host community farmers

revealed positive and negative contributions of SSRs on farmers' seed and food security in different dimensions, albeit the positive contributions were short-lived. Although there are many critical outcomes after DSDs that have been presented frequently in different studies and may not lead to long-term food and seed security, the findings from this study also showed some positive results among different target groups.

This finding indicates that although DSDs developed by NRC were designed to enhance farmers' seed and food security, as well as income generation, their results did not entirely live up to these aims. Although NRC staff conducts M&E at various SSR stages, information is typically collected in terms of seed quantities rather than the real changes the responses made in farmers' food and seed security status. This finding is in line with studies conducted by Sperling et al., (2008) and Sperling & McGuire (2010), showing that M&E conducted during humanitarian responses does not measure the real SSR impacts on the direct beneficiaries. Previous research has also shown that resources are not allocated to M&E of the SSRs (Sperling & McGuire, 2010a), however, the Uganda case study results contradict that, as indeed resources for M&E are set up during the SSR planning phase. But, despite allocation of resources for M&E, what this study indicates is that delays in the implementation makes it unfeasible to measure the real SSR impacts.

NRC's current M&E approach points to Ragasa and Mazunda's (2018) critique of biases in project and programme monitoring. When M&E is conducted solely in the sense of gathering quantities and with minimal impact analysis, it is likely that SSRs will continue to be misinterpreted internally and externally in terms of their outcomes, especially the negative ones. Significant impacts of the lack of adequate development of M&E of SSRs are that: First, the same responses could continue to be implemented even though they do not meet the initial established goals. Second, positive effects on different target groups are not sufficiently analysed to be used for improvements of ongoing responses and future interventions. Third, no negative outcomes are identified, especially in individual target groups, and future interventions will continue to be implemented similarly to the previous ones, leading to further deterioration of farmers' living conditions. And fourth, funds that can be used for farmers' recovery end up being misused in the development of non-impact responses. The use of a single approach for all interventions is not necessarily effective in reducing the vulnerability of farmers, and may even have inequitable results (McGuire & Sperling, 2008). Consequently,

the findings suggest the improvement of M&E guidelines at NRC to assure its timely execution to gather quality evidence of the real SSR impacts.

8.7 Farmers' seed preferences

Farmers in both case studies showed a clear interest in the use of improved seeds. However, what stands out from the findings from the Malawi case study is that local seeds, that have undergone a quality selection process, were preferred, as those seeds could offer more than high germination rate, especially in terms of maize. While in the Uganda case study, refugees and host community farmers expressed both their desire to use OPV certified improved seeds, particularly maize and beans, and their inability to access those seeds due to unaffordable prices.

Although farmers in each case study lean towards different types of seeds, especially in terms of maize, what this finding indicates is that hybrid seeds are not part of farmers' preferences despite their high promotion. Hybrid seeds, as the findings showed, are used because different programmes promote them, particularly NRC and the GoM in the case studies. In similar ways the Alliance for a Green Revolution in Africa promotes the adoption of improved seeds, especially hybrids, and chemical inputs (AGRA, 2019). However, economic barriers, intensive farming management practices, low market value, undesirable food taste, cultural preferences and low adaptability to agroecological zones make hybrids unattractive to farmers. Those findings build on existing evidence for why farmers remain loyal to non-hybrid seeds. Louwaars & De Boef (2012) found that the formal seed system focuses its production on hybrids while neglecting farmers' needs and preferences. While van Niekerk & Wynberg (2017) found that farmers in South Sudan attach multiple values to traditional crops and, thus, they prefer to grow local seeds over commercial varieties, particularly over hybrids.

Moreover, in line with other studies, this study showed that refugees in particular in Uganda expressed their satisfaction and interest in using OPVs, as they can be reused for various seasons. Similarly, in the Malawi case study, farmers highlighted the importance of local seeds, as those seeds can also be used for several seasons, are part of a more sustainable long-term strategy and produce yield during periods of stress. Indeed, Lipper et al., (2010) found that "farmers can make a higher return by recycling the seeds of improved varieties over several seasons" (p. 219). Similarly, van Niekerk & Wynberg (2017) concluded that traditional crops have more value, as those seeds contribute to save cash reserves while increasing self-

sufficiency. Consequently, farmers' preferences for OPVs and local seeds in the case studies, indicate that hybrid seeds do not contribute to farmers' long-term food and seed security, as farmers cannot afford the cost of purchasing seeds each season due to low market prices for the harvest in general and for the hybrid harvest in particular. As Wise (2019) found, most farmers in Malawi are too poor to risk their low income on purchase of hybrids.

The broader implications of the lack of correlation between the justified preferences for what farmers want and what programmes offer are significant because resources end up being misused and solutions are not created to address seed and food insecurity, neither poverty. As Nyantakyi-Fripong (2019) found, programmes tend to fail when farmers' needs in terms of types of crops and seeds are not considered, as farmers will not adopt those technologies, as it happened in a CSB in Northern Ghana that focused on the distribution of bean and hybrid maize while farmers asked for locally-adapted maize varieties. Furthermore, the findings indicates that continuous offering of seeds that do not meet farmers' needs, and preferences would probably not make a difference in relation to increased adoption of hybrid seeds.

There is no doubt that farmers want improved and quality seeds to sustain their farming activities. But as Sperling et al., (2008) and Remington et al., (2002) found, quality assessments from the perspective of farmers can vary significantly from the quality parameters promoted by the formal seed sector. Similarly, this study shows that farmers assess the seed quality according to their germination rate, but also according to how those seeds can be recycled, adapted to local conditions and in line with their preferences in terms of taste, colour, poundability and storability. Consequently, the findings suggest that when developing SSRs, those responses need to be based on a demand-driven bottom-up approach rather than a supply-side top-down approach. However, the bottom-up approach must go beyond asking farmers whether they need seeds or not. Instead, more in-depth analysis of the varieties and crops need to be prioritized. As Sperling et al., (2008) found, lack of assessments could contribute to the development of poorly designed responses, as “there are cases where farmers' seed of crops may be judged ‘low' by anyone's standards” (Remington et al., 2002 p. 320).

9. Conclusions

Access to seeds is a serious problem small-scale farmers face. For farmers to improve access to seeds, NGOs working in humanitarian action and long-term development interventions have for decades implemented seed security responses. The theory of change is that through seeds, farmers are expected to improve productivity and thereby become food secure and generate sustainable income. However, while the need for access to quality seeds to maintain farming activities is undeniable, the questions addressed in this study are *how* seed security responses can effectively ensure farmers' long-term seed security, and how by being seed secure farmers can become food secure and earn sustainable income. The study findings in both contexts (humanitarian action and long-term development interventions) indicate that despite the type of seeds (OPVs, hybrids and local seeds) farmers have access to through seed security responses, their long-term food security remains a challenge, and a decent and sustainable income to satisfy household needs has not been achieved. Indeed, the findings reveal that seeds contribute to increased productivity, particularly local seeds, but increased production alone is not a sufficient solution to improve farmers' food security and income generation. Instead, the study suggests that to address food insecurity and improve income among small-scale farmers, an integrated approach between agriculture, particularly one that promotes use of local improved seeds, and other agrarian change measures should be implemented.

Moreover, it appears that in general seed security responses in humanitarian action, as the findings from the Uganda case study show, focused on solving seed availability while the main problem faced by farmers is access to seeds. Then, following seed security responses, farmers only have access to certain types of seeds in the short term, while their long-term access remains uncertain. The seed security responses, while effective in short-term seed provision, seem ineffective in addressing the long-term seed and food security problems. What is perhaps more surprising is that despite years of calls for assessments prior to seed security responses implementation, those assessments are still absent today and therefore the problem goes unidentified, hence unresolved. Additionally, monitoring and evaluation of seed security responses in humanitarian action continues to focus on the amounts distributed rather than on the effects of the responses, so the lack of in-depth evaluations prevents the inclusion of constructive outcomes and the exclusion of ineffective ones in future responses.

On the other hand, the findings from the Malawi case study reveal that the community seed bank has managed to subsist using a hybrid approach between community work and NGO support. However, its long-term sustainability remains a challenge, particularly due to the lack of recognition community seed banks and local seeds have at the national level. Lack of recognition limits community seed banks from marketing local improved seeds to generate a more reliable source of income to operate without NGO support. Farmers' needs in terms of preferred seeds and crops have been the main priority since the establishment of the community seed bank and that has positively contributed to improve farmers' access to seeds, despite not having had a significant increase in their income, as well as to create a strong bond among members to maintain the seed bank operation. Indeed, the findings suggest that all community seed bank members have equal access to seeds, and that no elite capture has created unequal access to services. While it is confirmed that through community seed banks, farmers seed security and food security have improved, the improvements do not last all year around and food insecurity especially during lean seasons remains a challenge. Consequently, the findings suggest increased collaboration between the government and the community seed bank to provide small-scale farmers with other agricultural inputs, such as organic fertilizers, that are also needed to improve productivity. Simultaneously, the government could provide more legal space for the commercialization of local improved seeds of a wide range of crops, as that would help the community seed bank to become self-sufficient and avoid relying on NGO support in the long-term.

Lastly, it is often more feasible for NGOs to keep applying the same responses and focus on a single development approach as the preferred solution to address food insecurity and income generation, especially when working with rural communities whose main source of livelihood is agriculture. Perhaps mastering one approach can sometimes be helpful and even necessary to optimize the use of resources to support people living in poor conditions, but in doing so the root causes of the problem may remain unsolved. Therefore, if agriculture continues to be the main development approach to address food insecurity and income generation constraints among NGOs, the way in which seed security responses are conducted should be revised. To begin with, the seed technologies promoted in seed security responses should be those that farmers prefer, need, and that can be obtained without NGO support in the long term. Additionally, the responses should focus not only on providing seeds, but also address market constraints for different crops as well as farmers' access to land, as together these are key factors in enhancing food security and income generation. Future studies would do well to explore

market constraints and how to integrate seed security responses with more marketable crops, especially considering the increasing promotion of crop diversification. Finally, NGOs should consider that the lack of access to land is a major limitation to obtain enough harvest for both food and income generation. As severe land shortages persist among small-scale farmers, NGOs could also improve off-farm employment to supplement farm incomes, rather than involving all small-scale farmers in the same seed security response.

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11.Appendixes

11.1 Interview Guides

11.1.1 Topics for semi-structured interviews and focus groups with farmers

- Life situation before joining the seed security responses developed by the selected NGOs
- Seed security situation before and after joining the seed security responses
- Food security situation before and after joining the seed security responses
- Source and use of income before and after joining the seed security responses
- Measures needed to improve the seed security responses, as well as farmer's living conditions

11.1.2 Topics for semi-structured interviews with NGO staff

- Reasons for implementing seed security responses
- Reasons for selecting a seed security response approach
- Instruments to assess the need for a seed security response
- Planning and development of seed security responses
- M&E of the effects of the seed security responses on the beneficiaries
- Measures needed to improve seed security responses
- Impacts of the seed country frameworks on the developed seed security responses

11.1.3 Topics for semi-structured interviews with seed traders

- Seed portfolio, main clients, business location and mode of operation
- Experiences of their participation on seed security responses
- Requirements to be invited to participate in different seed security responses
- Benefits for participating in seed security responses
- Outcomes after participating in seed security responses in terms of clients and new business opportunities

11.1.4 Topics for semi-structured interviews with key informants

- Advantages and disadvantages of DSDs, CSBs and seed fairs
- Seed security responses and seed laws in Malawi and Uganda
- Effects of seed security responses on farmers long-term seed and food security
- Effects of seed security responses on farmers long-term income generation

- Seed security responses operation and advantages and disadvantages of the types of seeds delivered

11.1.5 Interview guide for structured interviews with farmers

General Information

Location:

Sex: Male ( ) Female ( )

Married or living conjointly as if married ( ) Not married ( ) Widow/Widower ( )

Are you the head of the household? Yes ( ) No ( )

Number of Adults in your family including you: Male ( ) Female ( )

Number of children in your family: Male ( ) Female ( )

Who does agricultural activities at home? You ( ) Your Partner ( ) Both ( ) Other, who

Who makes the decision about what to plant? You ( ) Your Partner ( ) Both ( ) Other who

Who decides the use of the harvest at home? You ( ) Your Partner ( ) Both ( ) Other who

How many meals your family eat per day?

Farming

Do you have access to land? Yes ( ) No ( ). If yes, what is the size of your land?

What are the main crops you plant?

What are the main seed varieties you use for those crops?

Where do you obtain those seeds?

What is the major problem you have faced to access seeds?

What is the main crop you use for food consumption at the household level?

What are the main crops you sell in the market?

Seed Security

From where did you obtain you seeds before you were part of the SSRs?

What are the SSRs that the NGO has developed, and you have participated?

For how long has the NGO provided you with seeds through the SSRs?

Besides the NGO and the SSRs from where do you obtain other seeds?

What kind of additional assistance does the NGO use and how it works?

How has the seed availability improve after your participation in the SSR?

How has the participation in the SSRs changed your possibilities to access seeds of different crops and varieties?

How were your preferences and needs met in the SSRs?

Are you satisfied with the quality of the seeds you have during the SSRs? Yes ( ) No ( )

Explain why.

Could you explained me the quality of the seeds and your experiences with those seeds?

What are the benefits of the SSRs you have been to?

What would you like to improve of the SSRs?

During your participation in the SSR, have you been able to establish contacts to buy seeds or exchange seeds later? If yes, with who you have established contact? How it works?

If not, why not? What is missing?

With the seeds you are given during the SSR, can you obtain seeds for more than one season? Yes ( ) No ( )

If yes, for how many seasons and how it works?

If not, why not? What is missing?

How have those seeds helped you in terms of having nutritious food?

How have those seeds helped you to build resilience agricultural systems?

Besides seeds, what other support you obtained and what are the benefits you could tell?

Seed Security Responses Impact

Have the seeds helped you to improve productivity? Yes ( ) No ( )

Could you explained how it was before and after the SSR in terms of productivity?

Do you use the harvest for food consumption? Yes ( ) No ( )

If yes, with the seeds you obtain from the SSRs, for how long can you get food for your home?

What are the benefits in terms of consumption of the harvest produced with the provided seeds?

Is that food enough until the next harvest season? Yes ( ) No ( )

If not, why not? What is missing?

What are the nutritional benefits of the food produced with the provided seeds?

Have you received information on nutrition that guides they type of crops and seeds to use and consume? Yes ( ) No ( )

Tell me what kind of information?

Are you able to sell part of the harvest in the local markets? Yes ( ) No ( )

If yes, how long do you have enough product from the harvest to sell on the market? (months)

What are the benefits of selling part of the harvest?

If not, why can you not sell part of the harvest?

Do you consider that by after being part the SSR you have earned more money than before? Yes ( ) No ( )

If yes, mention three ways in which your income has increased?

If not, explain why not?

Additional Comments

How do you think you could become more sustainable in terms of having enough seeds in the long term?

How do you think you can become more sustainable in terms of having enough food all year around from your agricultural activities?

How could you generate more stable income?

How has COVID-19 affect food, seed and market access as well as the support from the NGO?

How do you think your participation in the SSR has changed your life and your family's lives?

How do you think your participation in the SSR has changed your life?

11.1.6 Informed Consent

Purpose: My name is Viviana Gualdrón[4], and I am a master student at the Norwegian University of Life Sciences. For my master thesis, I am interested in learning more about how seed security modalities are decided and plan as well as how those seed security modalities can influence smallholder farmers' access to quality seeds that could improve their seed security and livelihoods. The aim of the study is to map how seed security activities function and analyse their strengths and what should be done differently to better be able to help those in need to be seed and food secure.

Procedures: You will be asked to answer questions about your role in the development of seed security modalities, as well as how seed security activities function in different phases such as assessment, planning, development, monitoring and evaluation. In addition, you will be asked how those seed security activities help farmers to access seeds according to their needs, preferences, and adaptability to local conditions. And what are the effects of those seed security activities on farmers' seed and food security. Information will be recorded by video and voice recording and writing it down. The interview will last approximately 1 hour.

[4] My name changed to Viviana Meixner Vásquez during the development of the thesis.

Risks and Benefits: There are no known risks to you for participating in this study. Although participating in this activity will not personally benefit you in any material way, sharing your information and views will help to identify the strengthens of the seed security modalities and also what things could be done differently to influence the seed security of the beneficiaries.

Confidentiality: All information will be kept confidential. Any identifying information such as your name or location will be removed when sharing the findings of this activity. Your words may be quoted in the thesis document, publications, reports, web pages and other research outputs, especially to emphasize the findings, however it should be noted that no names will be used. The data collection process is planned to finalize in January 2021 and the thesis will be submitted around May 2021.

Voluntary Participation: Participation in this master's thesis research project focuses on how seed security modalities function is voluntary. You have the right to decline participation, or not answer particular questions. If you start and then do not wish to continue, you have the right to stop participation without penalty at any time. Your decision to participate will not affect your relationship with the organization you work in or involvement in projects the organization will develop. You also have the right to send a complaint to The Norwegian Data Protection Authority.

Questions: If you have further questions or clarification, please contact Viviana Gualdrón with email address vivianagualdron@hotmail.com or yerlith.viviana.gualdron.vasquez@nmbu.no or phone number +4797303118 in Oslo, Norway.

Agreement to Participate: All of my questions and concerns about this study have been addressed. I choose, voluntarily, to participate and agree to share my information. I have been given adequate time to consider my decision. I certify that I am at least 18 years of age.

_____
Print name of participant

_____ _____
Signature of participant Date

Viviana Gualdrón
Print name of data collector

_____ _____
Signature of data collector Date

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