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**Title: Community seed banks: Instruments for food security or unsustainable endeavour? A case study of Mkombezi Community Seed Bank in Malawi**

**Authors:** Viviana Meixner Vásquez, Researcher, Fridtjof Nansen Institute, Lysaker, Norway.  
Regine Andersen, Research Director, Biodiversity and Natural Resources; and Research Professor,  
Fridtjof Nansen Institute, Lysaker, Norway

**Address correspondence to:** Viviana Meixner Vásquez Email: [vmvasquez@fni.no](mailto:vmvasquez@fni.no) with copy to [randersen@fni.no](mailto:randersen@fni.no) **Postal Address:** Fridtjof Nansen Institute, P.O. Box 326, N-1326 Lysaker, Norway

**ORCID:** 0000-0002-5603-6518

**Abstract**

Community Seed Banks (CSBs) have been established in many developing countries to improve small-scale farmers' access to crop genetic resources and thereby their food security. However, empirical evidence of the effects on farmers' food security remains scarce. This study focuses on Malawi, where the NGO Biodiversity Conservation Initiative has facilitated the operation of four CSBs. Among these, Mkombezi CSB was selected for in-depth analysis, as a case of a well-established CSB carrying out typical activities of a CSB, such as conserving a rich diversity of crop varieties, enhancing the performance of selected varieties, enabling access to relatively high-quality seed of the varieties, arranging seed and food fairs, capacity building in agricultural practices responding to the effects of climate change, as well as trainings in group dynamics and gender relations relevant to food production and the operation of the CSB. Three questions guide this study: (1) Does Mkombezi CSB contribute to food security? (2) If so, how? (3) Under what conditions may the findings be relevant for other CSBs in Malawi and elsewhere? The analysis builds on qualitative information from 43 semi-structured in-depth interviews, two focus-group discussions and 24 key informant interviews. We find that Mkombezi CSB contributes decisively to improving food security among its members as well as helping them to cope with lean seasons and unexpected shocks. Overall, this study indicates that under certain conditions, CSBs may contribute considerably to food security.

**Key words:** Community seed banks. Farmers' seed systems. Crop genetic resources. Local varieties. Food security. Malawi.

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40 Mkombezi Community Seed Bank in Malawi

41

## 42 **1. Introduction**

43 Despite noteworthy efforts to reduce hunger worldwide, food insecurity and malnutrition are on the rise, and  
44 COVID-19 has worsened those problems (FAO et al., 2021; Ceres2030, 2020). Of the total number of  
45 undernourished persons worldwide in 2020, more than one third (282 million) lived in Africa (FAO et al., 2021).  
46 Paradoxically, those whose livelihoods depend on food and agriculture are especially likely to experience food  
47 insecurity (Ceres2030, 2020). Solutions to food-insecurity problems often focus on improving productivity to  
48 produce sufficient amounts of nutritious food for consumption as well as income generation (Mausch et al., 2021;  
49 WB, 2019; Ivanic and Martin, 2018; Ligon and Sadoulet, 2018; Sibhatu and Qaim, 2018; Jayne et al., 2018).  
50 Community Seed Banks (CSBs) have been established in many developing countries to improve small-scale  
51 farmers' access to crop genetic resources and thereby their food security. This article is focused on the role of  
52 CSBs with regard to food security.

53

### 54 *Limited responsiveness of the formal seed system to small-scale farmers' needs*

55 Climate change has affected food production, and small-scale farmers in many developing countries experience  
56 greater food insecurity (IPPC, 2018). The role of seeds and seed systems is recognized as a potential contributor  
57 to increasing food production and adapting it to the effects of climate change (Mulesa et al., 2021; IPBES, 2019;  
58 FAO, 2015; IPCC, 2014; Fujisaka et al., 2010; Andersen, 2008). In sub-Saharan Africa, most funding for seed-  
59 system development has been directed to improving the formal seed systems (Westengen et al., 2019; Sheahan  
60 and Barret, 2017; McGuire and Sperling, 2016). A 'formal seed system' can be described as a system that is guided  
61 by scientific methodologies of plant breeding and controlled multiplication operated by specialists from the public  
62 and private sectors (Louwaars and de Boef, 2012). It uses a strict quality-control system and delivers certified  
63 seeds of improved varieties – but not of local varieties (McGuire and Sperling, 2016; Almekinders et al., 1994;  
64 2007). With the formal seed system, production has focused on improved varieties of a few crops that guarantee  
65 profitability under favourable conditions – not on crops that the farmers themselves use and prefer (van Niekerk  
66 and Wynberg, 2017; Louwaars and de Boef, 2012; Almekinders et al., 2007). Tellingly, 'the formal seed system  
67 has followed a heavily top-down modernization approach which has neglected the roles of smallholder farmers  
68 and their traditional practices' (Song et al., 2021, p.2). Moreover, the formal seed system is often not readily  
69 accessible to small-scale farmers, in terms of distance or cost (Coomes et al., 2015).

70

71 Formal seed systems have been heavily promoted, but studies in developing countries show that farmers' own  
72 seed systems remain the main source from which most small-scale farmers obtain seeds (McGuire and Sperling,  
73 2016; Haug et al., (2016); Louwaars et al., 2013; de Boef et al., 2010; Almekinders and Louwaars, 2002). A study  
74 conducted by McGuire and Sperling (2016), based on 9660 observations in six countries (five of them in Africa),  
75 and covering 40 crops, showed that farmers access some 90% of their seeds through farmers' seed systems.  
76 Similarly, Almekinders and Louwaars (2002) had found that, depending on the crop and the country, from 60% to  
77 100% of the seeds sown by farmers came from their own seed production or through exchange. The World Bank  
78 (2008) has estimated that 80% of all seeds used by farmers in Africa were produced within their own seed systems.

79

### 80 *Importance of farmers' seed systems for local seed security*

81 Farmers' seed systems include methods of seed selection, production, and dissemination (Louwaars and de Boef,  
82 2012): seeds are largely obtained from own production, gifts and exchanges among friends, neighbours, and family  
83 (ibid); and from local markets (Sperling et al., 2020). Such systems may provide farmers with quantities of seeds  
84 of many crop varieties (McGuire and Sperling, 2016; Coomes et al., 2015), including traditional farmers' varieties  
85 and land races as well as improved varieties previously released from the formal seed system and later integrated  
86 into farmers' seed systems (Bishaw et al., 2010). Recognizing the importance of farmers' seed systems, several  
87 experts and academics have concluded that improving them can be an effective strategy for improving local seed  
88 supply among small-scale farmers (Katunga et al., 2021; McEwan et al., 2021; Sperling et al., 2020; Andersen  
89 2019a and 2019b; McGuire and Sperling, 2016; Coomes et al., 2015; Almekinders and Louwaars, 2002;

90 Almekinders et al., 1994), thus promoting seed security. According to a frequently-cited FAO seed security  
91 assessment guide, seed security exists when men and women within the household have sufficient access to  
92 quantities of available good quality seed and planting materials of preferred crop varieties at all times, in good as  
93 well as bad cropping seasons (FAO, 2016). Integrated Seed Sector Development is one approach towards that end,  
94 seeking to link informal and formal seed systems, balance public and private sector involvement and making seed  
95 programmes and policies more coherent with farmers' practices (Louwaars et al., 2013; Louwaars et al., 2012).

#### 96 *Community Seed Banks as promoters of farmers' seed systems and seed security*

97 Well-functioning CSBs are recognized as trusted institutions that support farmers' seed systems (Vernooy et al.,  
98 2014). CSBs vary widely in size, governance structures, management, seed-storage methods, and activities; there  
99 is as yet no authoritative, all-encompassing definition for the concept (Andersen et al., 2018). At the simplest level,  
100 CSBs can be defined as informal or formal local institutions whose core function is to maintain seeds collectively,  
101 for local use (Andersen et al., 2018; Vernooy et al., 2017; Development Fund, 2011). Vernooy et al. (2014; 2015)  
102 identified three core functions of CSBs: conserving local agrobiodiversity; enhancing seed access and availability;  
103 and ensuring seed and food sovereignty (for the contribution of CSBs to food sovereignty, see also Porcuna-Ferrer  
104 et al., 2020). Andersen (2019a, 2019b) adds the function of enhancing local crop varieties through participatory  
105 methods. A recent study of CSBs in China (Song et al., 2021) identifies two further functions of general relevance:  
106 adding value to seed and produce through innovative marketing strategies (see also Poudel et al., 2010); and  
107 building regional and national seed-system linkages, fostering collaboration.  
108

109  
110 Generally, CSBs in the Global South have focused on improving seed and food security while building small-scale  
111 farmers' resilience to climate change (Nyantakyi-Frimpong, 2019; Andersen et al., 2018; Vernooy et al., 2014).  
112 The term 'community seed bank' dates back to a 1986 publication from the Rural Advancement Foundation  
113 (RAFI), 'Community Seed Bank Resource Kit', which pioneered the use of the term (Vernooy et al., 2015). CSBs  
114 are also referred to as 'gene banks', as they maintain genetic diversity, or as 'community seed huts' (or 'houses'),  
115 indicating the ways in which seeds are stored (ibid). CSBs often also distribute seeds to farmers through a loan/  
116 repayment system whereby farmers can pay with seeds from the next harvest (Maharjan and Maharjan, 2018).

#### 117 *Research on community seed banks*

118 CSBs have contributed to seed security as regards availability, affordability, and quality (Mulesa et al., 2021;  
119 Andersen, 2019a, 2019b; Vernooy et al., 2014). Andersen (2019a, 2019b) found that members of well-functioning  
120 CSBs and farmers in these communities in Ethiopia and Nepal were satisfied with the quality of the seeds obtained  
121 from the CSBs, and that CSBs have played an important role by making a range of locally adapted and some  
122 locally enhanced varieties available to farmers through low-interest seed loans (for members) and exchange and  
123 sale (from members to other farmers in Ethiopia and Nepal, and sale from CSBs in Nepal). Mulesa et al. (2021)  
124 confirmed these findings for Ethiopia. Further, Maharjan and Maharjan (2018) and Vernooy et al. (2014) showed  
125 how CSBs have been an effective platform for enhancing farmers' access to high-quality seeds.  
126

127  
128 Studies have also demonstrated the potential of CSBs to create synergies between formal and farmers' seed  
129 systems, as they involve CSB members in participatory plant breeding (Vernooy et al., 2020; Westengen et al.,  
130 2018; Vernooy et al., 2014). Evaluations of CSBs in Ethiopia and Nepal (Andersen, 2019a; 2019b) show that such  
131 farmer-breeder collaboration has resulted in greatly enhanced local varieties in terms of traits preferred among  
132 farmers, including yield increase. Vernooy et al., (2017) found that CSBs in Nepal have become important local  
133 centres for accessing quality seed of drought-tolerant crop varieties that require less water than other varieties. In  
134 Guatemala, Porcuna-Ferrer et al. (2020) found a positive correlation between CSB membership and access to  
135 maize and bean varieties enhanced through participatory methods. Generally, crop varieties selected through  
136 participatory processes are likely to be better suited to local conditions and farmers' preferences (Almekinders et  
137 al., 2007).

138  
139 Empirical studies of the overall contribution of CSBs to food security are scarce. However, two evaluations  
140 (Andersen, 2019a; 2019b) provide comprehensive assessments of such impacts in Ethiopia and Nepal: they found

141 that well-functioning CSBs contribute significantly to local food and nutrition security and to income generation  
142 among CSB members. A study of CSBs in Uganda (Vernooy et al., 2017) showed that CSB members had more  
143 food available at the household level, as they could access several local varieties of beans offering high yield  
144 stability, pest/ disease tolerance and marketability. Another study in Uganda (Otieno and Nzuki, 2020) noted that  
145 CSBs offer several high-yielding local varieties that mature at different times, providing household-level food for  
146 longer periods. Andersen (2019a) found that members of the Sigeda CSB in Ethiopia began to rely on varieties  
147 from this CSB, as these proved far more resistant to pest/disease attacks and to the effects of climate change. In a  
148 study in Guatemala, Porcuna-Ferrer et al. (2020) observed that CSB members benefited from greater yields due to  
149 the use of quality seed of local varieties, improving food self-sufficiency. In India, studies on the use of local minor  
150 millets among very poor farmers showed multiple beneficial impacts in terms of yield, income, and nutrition  
151 (Padulosi et al., 2015). In a study conducted in Malawi by Bezner Kerr (2013), local maize out-performed maize  
152 from hybrid seeds under poor conditions, thanks to its diverse genetic portfolio, also shown to resist stress better  
153 in various agro-ecological climates (see McGuire and Sperling, 2016).

154  
155 Moreover, as CSBs conserve crop diversity, they often maintain a range of neglected crops and make these  
156 available (Joshi et al., 2020; Vernooy et al., 2020; Otieno and Nzuki, 2020). As a result, CSB members have access  
157 to a greater diversity of crops. Many studies have noted the positive relation between crop diversification and  
158 improvements in food availability, as well as access to a more nutritious diet (Madsen et al., 2021; Herforth et al.,  
159 2020; Rawal et al., 2019; Andersen, 2019a, 2019b; Bezner Kerr et al., 2019, Mango et al., 2018; Kahane et al.,  
160 2013). In Bangladesh, crop diversification has ensured a supply of nutritious and diverse food for CSB members  
161 and their families (Vernooy et al., 2020). In a study conducted by Madsen et al. (2021), farmers reported that crop  
162 diversification had resulted in better food security through direct consumption and agricultural income. Andersen  
163 (2019a) showed that Ethiopian farmers with access to a diversity of crops were able to spread the risks of crop  
164 failure by choosing drought-tolerant local varieties, including participatorily enhanced local varieties, thereby  
165 improving their food security. A study in Malawi showed that households with higher crop diversification tended  
166 to be more secure in terms of food supplies, and to have a more diverse diet (Mango et al., 2018). Crop  
167 diversification has also been found to improve household income, in turn enabling the purchase of other food  
168 products and household items (Madsen et al., 2021; Rawal et al., 2019; Mango et al., 2018).

169  
170 Crop diversification serves as an adaptation strategy that may boost household income, strengthening farmers'  
171 purchasing power (Madsen et al., 2021; Andersen, 2019a and 2019b), as well as improving the capacity to cope  
172 with market pressures and providing commercial opportunities in local markets (McCord et al., 2015). Bellon et  
173 al. (2020) found that crop diversity helped small-scale farmers in Ghana to access market opportunities and  
174 generate income, while also contributing to own consumption. Kasem and Thapa (2011) noted that farmers in  
175 Thailand who practise diversification could have a continuous stream of income from crop sales, as they harvested  
176 various types of crops at different times of the year. Crop diversity can then be a direct source of food as well as  
177 income (Rawal et al., 2019). CSBs are an important means in this regard.

#### 178 179 *Research needs*

180 Thus, we find clear indications of the contribution of CSBs to seed security and to the adaptation of crop production  
181 to the effects of climate change. However, many cases focus on only one or sometimes multiple dimensions of  
182 food security but lack systematic approach to all the dimensions of the food security concept. Several studies  
183 address the contribution of CSBs to food security, but there are still very few in-depth empirical studies that  
184 systematically address the impacts of CSBs on food security according to the dimensions of the food security  
185 concept as defined by the United Nations. This article aims to break new ground, presenting the results of an in-  
186 depth case study of the effects of a typical CSB in Malawi on local food security, thereby systematically addressing  
187 the central dimensions of the UN concept (see below) and deriving conditions under which these results may have  
188 relevance for other CSBs in Malawi as well as in other countries.

189

190 **2. Research questions and conceptual framework**

191 We ask: (1) Does the CSB selected for this case study contribute to food security? (2) If so, how? (3) Under what  
192 conditions may the findings be relevant for other CSBs in Malawi and elsewhere?

193

194 Here we analyse the impacts of a CSB in Northern Malawi, using the lens of the food security framework (FAO,  
195 2016). ‘Food security’ has gradually evolved as a term (see Westengen and Banik, 2016); the present study draws  
196 on the definition established at the 1996 World Food Summit on Food Security: ‘Food security exists when all  
197 people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their  
198 dietary needs and food preferences for an active and healthy life’ (FAO, 2006, p. 1). Four dimensions central to  
199 the concept of food security are widely recognized: *availability*, *access*, *utilization*, and *stability* (HLPE, 2020). In  
200 2020, two more dimensions were added to provide guidance for the transformation of food systems needed to  
201 achieve food security: *agency* and *sustainability* (HLPE, 2020, p. 2).

202

203 ‘Food availability’ is understood as having food in sufficient quantity and quality to meet people’s dietary needs  
204 (HLPE, 2020). This dimension refers to the supply side and is determined by the level of national food production,  
205 imports, stock levels and net trade (FAO, 2008). Here, we examine food availability at the local level, asking  
206 whether and how Mkombezi CSB has contributed to the availability of food among its members.

207

208 ‘Food access’ is determined by how well people can convert their assets into food, whether produced or purchased  
209 (Ericksen, 2008). The HLPE report defines access to food as ‘having personal or household financial means to  
210 acquire food for an adequate diet at a level to ensure that satisfaction of other basic needs are not threatened or  
211 compromised; and that adequate food is accessible to everyone, including vulnerable individuals and groups’  
212 (HLPE, 2020, p.10, see also Sen, 1981). We examine whether Mkombezi CSB has contributed to its members’  
213 access to, and use of the food produced for home consumption, and/or whether the CSB has fostered increased  
214 income generation that is used for purchasing necessary food.

215

216 ‘Food utilization’ is commonly understood as how the body makes the most of various nutrients in food (FAO,  
217 2008). Adequate food utilization requires a diet that can provide sufficient energy and essential nutrients (FAO,  
218 2006). Food utilization may be affected by additional factors, such as age, hygiene, and health (Ericksen, 2008),  
219 but we focus on whether and how Mkombezi CSB has contributed to improved nutrition among its members.

220

221 ‘Food stability’ concerns the conditions under which people have access to food at all times (FAO, 2006). It is  
222 important to ensure food security in the event of sudden crises or cyclical events (FAO, 2021). Here we focus on  
223 the sudden crisis that emerged due to the effects of COVID-19 and related restrictions, and whether/how  
224 Mkombezi CSB contributed to food stability this period. We also examine the cyclical events of the lean periods  
225 before the next harvest, in which food scarcity used to be prevalent, and ask whether Mkombezi CSB has  
226 contributed to food stability during these periods.

227

228 ‘Agency’ is, in relation to food security, described as a form of empowerment that enables people to make  
229 decisions about the food they produce and consume, as well as to participate in relevant political decision-making  
230 (HLPE, 2020). This understanding also addresses power imbalances and inequalities in current food systems  
231 (Clapp et al., 2022; FAO et al., 2021; HLPE, 2020). It would be interesting to address agency in a study like this,  
232 as CSBs can be considered to stimulate agency among their members, and closer examination of such dynamics  
233 might shed light on important aspects of the contribution of CSBs to food security. However, such a focus would  
234 require data collection beyond the limitations of this study and has therefore not been prioritized here. We touch  
235 briefly on this food security dimension in the concluding section.

236

237 ‘Sustainability’ refers to protection of the agroecological systems to ensure that this basis for food security remains  
238 available for future generations (HLPE, 2020). In our context, sustainability may also refer to the prospects for the  
239 CSB to continue contributing to food security in the future, while ensuring that this basis for food security – the

240 diversity of crops and knowledge of production methods – remains available for future generations. We will  
241 address this in the discussion and in the concluding section.

242

243 *Food production* is the starting point that determines food availability (Swaminathan, 2011). Seeds are the first  
244 link in the food value-chain (Galiè, 2013). Limited access to genetic diversity of crops may affect farmers' food  
245 security, particularly those dependent on agriculture for own consumption and livelihood: seed security is directly  
246 linked to food security – the access dimension not least (McGuire and Sperling, 2011). High-yielding varieties and  
247 quality seeds are investments that can have wide-ranging impacts on agricultural production, also in challenging  
248 contexts (Sperling et al., 2021), making seed security an important determinant of food security. 'Seed security'  
249 appeared as a concept in the 1990s in connection with evaluations of seed aid in humanitarian relief efforts (Dalle  
250 and Westengen, 2020). Initially, three dimensions were noted: availability, access, and quality. In 2016, the UN  
251 Food and Agriculture Organization (FAO) issued a revised version of the seed-security framework and added two  
252 dimensions: varietal suitability, and resilience (FAO, 2016, p.6). This new version is the one used in the present  
253 study, based on the assumptions that seed security is a central measure of the success of a CSB and a core  
254 determinant for food security among farmers.

255

256 Our analysis focuses on how the operations of Mkombezi CSB affect the food security of its members by targeting  
257 their seed security. We also note the effects of various non-seed related CSB-activities, such as capacity building  
258 in agricultural methods, training in group dynamics and gender relations, and farmer-to-farmer exchanges.

259

### 260 **3. Methodology**

#### 261 **3.1 Research design**

262 We opted for a case-study approach, as case studies enable in-depth explanations of complex causal relations, such  
263 as the effects of CSB activities on local food security. Although they do not fulfil the requirements of statistical  
264 representativeness as a basis for generalization (Yin, 2018; Bryman, 2016), they enable qualitative generalizations,  
265 depending on case selection, quality (construct validity and reliability) and the specification of conditions under  
266 which generalizations are likely to be valid (Yin, 2018).

267

#### 268 *External validity*

269 We wished to study a case that is typical of CSBs engaged in *agrobiodiversity-related crop management* in  
270 Malawi. This is an important distinction, as there are many initiatives in Malawi called 'CSBs' but which focus  
271 on only one or two crops, maintaining seeds of only very few improved varieties of each, from the formal seed  
272 system (Andersen et al., 2022). Agrobiodiversity-focused CSBs focus on conserving agricultural biodiversity,  
273 reviving local varieties and providing farmers with access to high-quality seed of local crops. Such CSBs may also  
274 enhance local varieties through participatory varietal selection and may offer training to build capacity in climate-  
275 resilient agriculture and other topics among their members. In Malawi, there are 16 CSBs within this category  
276 (Andersen et al., 2022); they share these features along with largely similar socio-economic conditions, thus  
277 providing a firm basis for qualitative generalizations based on the conditions under which the findings from the  
278 case may be valid for other CSBs.

279

280 We applied the following criteria in case selection: The CSB should (1) work on the conservation of  
281 agrobiodiversity; (2) offer farmers a portfolio of diverse local varieties from various crops, including local varieties  
282 of maize, the main staple crop in Malawi; (3) have implemented participatory approaches to enhance local  
283 varieties; (4) have offered capacity building in agricultural methods and other relevant topics; and (5) have a well-  
284 established membership base where both women and men are included. Mkombezi CSB, a well-established CSB  
285 featuring all these characteristics, was therefore selected as a case that would allow for qualitative generalizations  
286 to other similar CSBs in Malawi. The case selection criteria also form the point of departure for identifying the  
287 conditions under which our findings may be relevant to other CSBs in Malawi.

288

289 As Malawi's agrobiodiversity-focused CSBs in general, and Mkombezi CSB in particular, represent the classical  
290 CSB-model found in many other countries in Africa, Asia and Latin America (Vernooy et al., 2014; Vernooy et

291 al., 2015; Andersen et al., 2018), it would also be possible to derive conditions under which the findings from the  
 292 case study may be valid also for CSBs outside Malawi. Mkombezi CSB is thus a typical case of agrobiodiversity-  
 293 focused CSBs in Malawi which may also have relevance for similar CSBs in other countries in Africa, in Asia and  
 294 in Latin America. This makes it a strong case for the external validity of our single-case study.

295

296 *Construct validity, internal validity, and reliability*

297 The quality of any case study depends on how well the method measures what it is to be measured (construct  
 298 validity) – here, the causal relationship between CSB and food security (internal validity), and how consistently  
 299 this is measured – whether the same findings would be achieved if replicating the study (reliability). Our study is  
 300 based on a document review, supplemented by in-depth interviews with a representative selection of CSB members  
 301 (40 out of 100 members) and central informants relevant to the CSB and/or seed-related issues in Malawi (24  
 302 informants). The interviews were semi-structured, following an interview guide addressing all topics in focus,  
 303 based on the conceptual framework. As data collection was carried out from September 2020 until January 2022,  
 304 i.e., during the COVID 19 pandemic with its travel restrictions, all interviews were conducted online by the first  
 305 author of this study, using Zoom, Skype, Teams, and WhatsApp. Both authors were able to visit Mkombezi CSB  
 306 and many of the key informants in March 2022, to validate the findings from the on-line interviews. Thus, the  
 307 construct validity, internal validity and reliability of this case study are considered strong.

308

309 Focusing on the experiences, views and perceptions of farmers who belong to the CSB, this study acknowledges  
 310 farmers’ specific knowledge of agrobiodiversity, local varieties, farming systems, social norms, and cultural  
 311 practices, drawing on their experiences so as to understand the drivers and constraints that underlie food security  
 312 for farmers belonging to a CSB.

313

314 **3.2 Data collection and analysis**

315 The qualitative approach of this case study combines several data-collection methods. We began with a  
 316 comprehensive literature review of CSBs and related initiatives, to document the impacts found in other settings  
 317 worldwide in terms of food security as context. Furthermore, we conducted a review of documents about  
 318 Mkombezi CSB, mainly produced by Biodiversity Conservation Initiative (BCI) – a non-profit, locally registered  
 319 organization based in Mzuzu, Malawi, that facilitates the CSB’s activities. These documents provided the history  
 320 of the CSB as well as central facts, contexts, and issues. In-depth semi-structured online individual interviews  
 321 were conducted with 11 staff members of BCI and the Development Fund of Norway (DF) – the NGO that finances  
 322 CSB operations through BCI. Further, in-depth semi-structured interviews with 14 male and 18 female farmers  
 323 who are CSB members (out of a total of 100) were undertaken. Participating farmers were selected on the basis of  
 324 gender, age, family status, household size and access to land. All participants had agriculture as their main  
 325 livelihood. Two focus group discussions were conducted: one with five members of the CSB management  
 326 committee (three female, two male) and the other with two female and one male CSB members. In addition, 24  
 327 key informant interviews were conducted with staff from international research institutions, and international and  
 328 Malawian NGOs involved in research and work on seed-related issues in Malawi. These key informant interviews  
 329 complemented and triangulated the collected data. (See details in Tables 1 and 2.)

330

331

**Table 1: Study participants**

Group	Description	Female	Male	Total
Farmers	Mkombezi CSB members	23	17	40
DF	Norwegian NGO that finances CSB operation	0	2	2
BCI	Malawi NGO that facilitates CSB operation	0	6	6
DF partners	DF partners who have worked with the CSB and its programmes	1	2	3
Malawian NGOs	NGOs that work on seed security programmes in Malawi	3	9	12
International NGOs	International NGOs that support seed programmes in Malawi	2	4	6
Research Institutes	Institutes that conduct research and work on seed systems in Malawi	0	6	6
<b>Total</b>		<b>29</b>	<b>46</b>	<b>75</b>

332

333 **Table 2:** Profile of interviewed farmers who participated in semi-structured interviews and focus group  
 334 discussions

Profile of interviewed farmers	Female	Male
<b>Total respondents</b>	<b>23</b>	<b>17</b>
Married	16	14
Single/divorced/widowed	7	3
<b>Land size</b>		
0.3 ha	5	0
0.8 ha	8	4
1.0 ha	6	5
1.6 ha	4	3
1.8 ha	0	4
5.0 ha	0	1
<b>Average household size</b>	<b>7</b>	<b>5.5</b>

335 All interviews were conducted on the basis of prior informed consent; participant anonymity was ensured. Data  
 336 collection was conducted online, as explained above. Most data collection was undertaken between September and  
 337 December 2020, supplemented by additional interviews with key informants, CSB members of the management  
 338 committee and analysis of reports between November 2021 and January 2022. Content analysis was used to  
 339 analyse the data. Coding categories were developed deductively, based on the conceptual framework for this study.  
 340 The data gathered through the interviews were also contextualized in light of the findings from the literature review  
 341 on CSBs in Malawi and worldwide, to indicate the conditions upon which our findings may be relevant for CSBs  
 342 in Malawi and in other countries of the Global South.  
 343

344  
 345 **4. Mkombezi CSB and effects on farmers’ food security**

346 **4.1 Mkombezi CSB and its context**

347 Mkombezi CSB is situated in Malawi, where national agricultural policies have for decades promoted the adoption  
 348 of modern maize varieties and non-organic inputs to improve production and alleviate hunger (Haug & Westengen,  
 349 2020). The Government of Malawi (GoM) has used subsidy programmes to favour the distribution of certified  
 350 seed of improved varieties from the formal seed sector to increase yields – thereby neglecting farmers’ seed  
 351 systems in official policies and regulations (Andersen et al., 2022; GoM, 2018; Chinsinga, 2011). In terms of  
 352 funding, the distribution of certified seed of improved varieties has dominated Malawi’s agricultural development  
 353 strategy. Approximately 75% of the agriculture budget is used for subsidies (WB, 2020). Also, the members of  
 354 Mkombezi CSB are exposed to this overall agricultural development strategy, mainly through the extension  
 355 services, even though their capacity and presence is limited.

356  
 357 However, several food security indicators in Malawi have remained low during those subsidy programmes. The  
 358 Global Food Security Index ranked Malawi 91, 110, 104 and 107 out of 113 countries in 2021, 2020, 2019, 2018  
 359 respectively, in terms of food affordability, availability and quality. At the country level, the Integrated Food  
 360 Security Phase Classification Analysis from 2022 (IPC, 2022) showed that the southern region of Malawi have the  
 361 highest proportion of the population classified as ‘severely food insecure’,<sup>1</sup> whereas most districts in the central  
 362 and northern regions have populations classified as ‘moderately food insecure’.<sup>2</sup> Mkombezi CSB is thus located  
 363 in an area classified as ‘moderately food insecure’, as are also most other CSBs focused on agrobiodiversity.

364  
 365 Mkombezi CSB is located in Rumphi District, a major agricultural area in Northern Malawi. The district has an  
 366 altitude of around 1000 meters above sea level, a tropical wet and dry climate, and an annual average temperature

<sup>1</sup> ‘Severely food insecure’: In a common year, households have seasonal deficits in quantity of food for more than 4 months of the year and consistently do not consume a diet of adequate quality. household livelihoods are very marginal and are not resilient. Households are likely to have severely stunted children. (IPC, 2021)

<sup>2</sup> In an average year, households experience mild deficits in food quantity and or seasonal food quantity deficits for 2 to 4 months of the year. Household livelihoods are marginally sustainable, and their resilience to shock is very limited. (IPC, 2021).



367 of about 23.54°C- Rumph District experiences extreme seasonal variation in monthly rainfall (Snapp et al., 2019).  
368 Most farmers in the area are small-scale farmers who practice rain-fed agriculture (mainly maize) and hold an  
369 average of 1–2 hectares of land (Chinsinga 2009).

370  
371 Mkombezi CSB, together with 13 more, were established in 2010 by the NGO ‘Find Your Feet’ (FyF), under the  
372 Rumph Food Security Project. In 2013, FyF lost the financial support for their engagement in CSBs, but were  
373 able to transfer the operation of Mkombezi CSB along with three other seed banks (Chikwawa, Baliro and Kahaza)  
374 to BCI. BCI was recognized as an institution with in-depth knowledge of agrobiodiversity conservation and  
375 management; however, limited resources prevented BCI from offering to follow up all the 14 CSBs. Mkombezi  
376 CSB was the first CSB in Malawi to be facilitated by BCI; it has continually grown, in activities as well as  
377 membership. According to data provided by BCI, in the 2019/2020 season, the number of direct members was 79  
378 (59% women and 41% men), whereas in the 2020/2021 season around 100 direct members were registered (62%  
379 women and 38% men). Each member represents one household. Although the bylaws allow more than one person  
380 from the same household to join, only one person per household is normally registered as a member. Those  
381 registered as members must have land or the ability to rent land to sow the seeds obtained through the CSB. Of  
382 the 100 members, BCI reports show that 8 members represent 4 households (2 per household) and 92 represent 92  
383 households. The average size of members’ land is 1.3 hectares.

384  
385 Both female and male farmers from the community can apply to become CSB members. Applications are reviewed  
386 by a committee of senior members (6 women, 4 men). To support part of the CSB’s maintenance, members must  
387 pay annual fees ranging from MK1,500 and MK2,500. However, most of the funding for the CSB is channelled  
388 via BCI from the DF and other NGOs, and is largely project-based.

389  
390 Core activities of Mkombezi CSB are the multiplication of seed of the varieties held by the CSB, participatory  
391 variety selection (PVS), coordination of field day demonstrations, characterization of genetic material, collection,  
392 and conservation of seed of local varieties, trainings focused on agronomic practices<sup>3</sup> and group dynamics as well  
393 as gender relations and arranging seed and food fairs. At these fairs, CSB members can barter and exchange their  
394 seeds, expand their networks, show their crop developments, and use their own income to buy seeds of the varieties  
395 they prefer. Agro-dealers and private companies are also invited to sell seeds at these fairs, providing members  
396 and other participating farmers with ample possibilities.

397  
398 Mkombezi CSB produces annually around 3.5 tons of seeds of more than 51 local crop varieties (see Table 3), of  
399 which four maize varieties have been improved through PVS. Members of Mkombezi CSB can borrow local  
400 varieties of seeds and return them after the harvest. This seed loan includes a 50% interest rate, to be paid in kind.  
401 By returning more seeds, farmers contribute to increasing the CSB’s seed stock. If, due to natural disasters, a  
402 farmer lacks enough seeds to pay, he or she is exempted from paying. If lack of seeds is due to poor crop  
403 management, the farmer is encouraged to pay in the next growing seasons, as the payback system is based on trust.  
404 According to data from BCI and the CSB management committee, the default rate in normal seasons tends to vary  
405 between 1% and 2%; however, with climatic conditions changing drastically, the default rate has gone up to 20%  
406 and 25%. The last time it reached 20% was in the 2017/2018 season, when Malawi was hard-hit by droughts.

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<sup>3</sup> Agronomic practices: manure preparation and application, soil and water conservation, conservation of agriculture, agroforestry, good weed control, pest and disease management and leadership training.

**Table 3:** List of crops, varieties and volumes of seeds produced in 2021

Name	No	Variety	Volumes of seeds produced in 2021 (Kg)
<b>Cereals</b>			
Maize	1	Bingo	27.0
	2	Kafula	35.2
	3	Kampalapati	4.0
	4	Kafula wa Yellow	1.0
	5	Lokolo	15.0
Sorghum	6	Mapemba Yatuwa	17.0
Pearl millet	7	Nyauti wa minga	5.0
Finger millet	8	Malezi Yatuwa	20.0
	9	Malezi Yaswesi	27.0
Sweet sorghum	10	Njiho Ziswesi	2.0
<b>Total cereals</b>			<b>153.2</b>
<b>Legumes</b>			
Beans	11	Nyauzembe	163.0
	12	Sugar beans	270.0
	13	Ntchunga Zituwa	6.0
	14	Katolica	7.5
	15	Saba	5.0
	16	Mzaza	393.0
Cowpeas	17	Nkhunde Zakutawa Zichoko zichoko	8.2
	18	Nkhunde Zakutawa Zichoko zichoko	9.0
Pigeon peas	19	Mbange Zakhuni	15.3
Groundnuts	20	Chalimbana	500.0
	21	Chaholi	35.0
	22	Kaswaya Mtuwa	100.0
	23	Kaswaya Mfipa	21.0
	24	CG7	1200.0
	25	Chalimbana wa Khaki	17.5
Chick pea	26	Tchana	5.8
Green gram	27	Kankhoma wa green	10.1
Bambara nuts	28	Zgama mixed	111.0
	29	Zgama Ziswesi	200.0
	30	Zgama Zayellow	15.0
	31	Zgama Zamadowa	23.7
	32	Zgama za Yellow	120.0
	33	Zgama Chikope cha Nyani	20.0
	34	Zgama Zifipa	30.0
	35	Zgama Makata	6.0
	36	Zgama za Yellow Zifipa pa mlomo	30.0
	Lima beans	37	Mambamba Yachaholi
38		Mambamba Yaswesi	3.0
39		Mambamba Yamadowela	1.0
<b>Total legumes</b>			<b>3330.1</b>
<b>Fruits</b>			
Water melon	40	Vihaba Vituma	0.1
<b>Total fruits</b>			<b>0.1</b>
<b>Roots and tubers</b>			
Air yams	41	Air yams	5.0
Ground yams	42	Ground yams	20.0
Sweet potato	43	Kenya variety	10.0
<b>Total roots and tubers</b>			<b>35.0</b>
<b>Oil crops</b>			
Sesame	44	One local variety	7.3
<b>Total oil crops</b>			<b>7.3</b>
<b>Vegetables</b>			
Kamganje Mtuwa	45	Kamganje Mtuwa	0.1
Kamgange Mswesi	46	Kamgange Mswesi	0.03
Amaranth	47	Amaranth	0.05
Pumpkin	48	Chitangalala	0.6
Hebicuss	49	Hebicuss	0.7
Okra	50	Okra	0.13
Cat whisker	51	Cat whisker	0.02
<b>Total vegetables</b>			<b>1.6</b>
<b>Total annually production (Kg)</b>			<b>3527.3</b>
<b>Total annually production (Tonnes)</b>			<b>3.5</b>

#### 416 4.2 Contribution of Mkombezi CSB to food availability

417 All interviewed CSB members reported that the use of local varieties of crops had ensured food supply even during  
418 dry seasons. These local varieties are more robust to climatic conditions and thus help farmers to obtain food from  
419 their own production even under difficult periods. All study participants noted that increased and more frequent  
420 drought periods presented a critical environmental challenge in Malawi, lowering productivity. They regarded  
421 increased food supply as a positive effect of being CSB members: using hybrid seeds available through government  
422 subsidy programmes had failed to produce sufficient yields in periods of low rainfall. All interviewed CSB  
423 members reported their preference for growing local varieties, which were seen as providing more food for  
424 household use. These local varieties were considered more drought-tolerant and having more of the desired  
425 characteristics in taste and use. As one female farmer explained: 'Local varieties are much better adapted to climate  
426 change than hybrids. These hybrids are not produced here, so it's hard for them to adapt.' Another female farmer  
427 added: 'When there is no rain, hybrids don't do well. But with seed of local crop varieties you're certain to get  
428 some food in the end.' BCI key informants emphasized that the use of local varieties is essential: it contributes to  
429 farmers' food security and strengthens farmers' seed systems in times of recurrent drought and genetic erosion.

430  
431 In an interview, BCI director, Dr Godwin Mkamanga, presented a report on maize variety trials in Malawi that  
432 showed that in the first experiment, certified open-pollinated varieties (OPVs) and improved hybrids produced  
433 slightly higher yields than local varieties, although in the second experiment all yields from all the varieties were  
434 comparable. According to Dr Mkamanga, the OPVs and hybrids were cultivated with sufficient water and chemical  
435 fertilizers, which is why in some experiments they presented slightly higher yields than local varieties. However,  
436 'local varieties also performed well and needed far less water and no chemical fertilizers'. He added that, in dry  
437 seasons, local varieties are likely to produce higher yields, as they are adapted to local conditions, while hybrids  
438 require large amounts of water, and most farmers in Malawi do not have artificial irrigation systems. Similarly,  
439 key informants from Malawian NGOs and research institutes noted that when hybrids were not used with the right  
440 technology package, there could be germination problems and even poorer harvests. A male key informant from a  
441 Malawian NGO explained: 'Local varieties still do better than the hybrids, because they are adaptable to local  
442 environmental conditions, while the hybrids need chemical fertilizers and water – a lot of water – otherwise they  
443 just don't give such good yields.'

444  
445 Interviewed female and male farmers said that they were now able to have more food for consumption, due to the  
446 wide range of local varieties of various crops accessed through Mkombezi CSB. Greater food availability at the  
447 household level was associated with crop diversity. Female farmers in particular mentioned this as a positive  
448 outcome of being CSB members: they could now grow and consume a range of crops previously unaffordable. A  
449 female farmer said: 'I have in some months *nsima*<sup>4</sup> with beans and in others *nsima* with vegetables, for example.  
450 This is great, because I have some variation in food and it's healthy for my kids.' The 2015 BCI report presented  
451 by Dr. Mkamanga provided information on crops that are multiplied, preserved, and distributed to CSB members:  
452 these include groundnuts, beans, sesame, finger millet and sorghum. Key informants from Malawian NGOs  
453 stressed that the crop diversity provided by Mkombezi CSB has improved food availability: different crops are  
454 grown at different times of the seasons which ensures that farmers and their families have different types of foods  
455 available throughout the year. A female key informant from a Malawian NGO stated: 'When farmers have access  
456 to many crops that they grow on their own, they definitely reduce the risks of food shortages and deficiencies, as  
457 they have various types of food available all year around.'

458  
459 Another characteristic that had improved food availability at the household level, according to the CSB members,  
460 was that the harvest and products derived from local varieties exhibit better and longer storability. Farmers find  
461 local maize cobs less susceptible to pests due to their hardness and the protective way they are covered with husk,  
462 which makes them storable for a longer period than hybrid maize. Female farmers in particular associated food  
463 availability with the number of months that flour, particularly maize flour, lasted for household consumption. A  
464 female farmer mentioned: 'The flour I make with the local maize lasts longer. When I made flour with hybrid

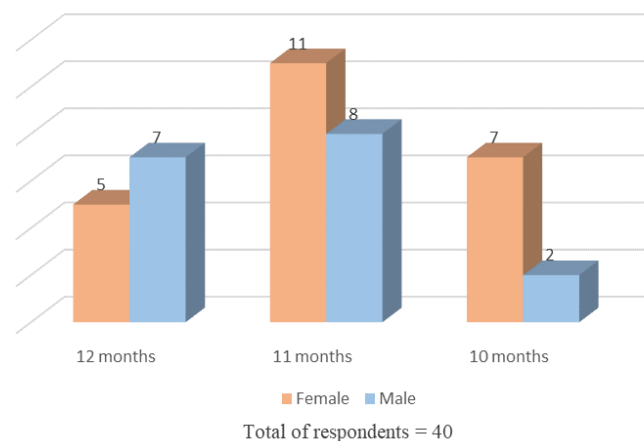
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<sup>4</sup> *Nsima*: staple carbohydrate dish of the region: a thick porridge made from cassava, corn, or other starchy flour.

465 maize and stored it in my kitchen, then after two or three months, I wanted to use it, and it was already ruined by  
 466 insects. If you produce hybrids, I recommend selling as soon as the harvest comes, don't store them.' Another  
 467 characteristic of local varieties mentioned by both female and male farmers was poundability, which results in  
 468 larger quantities of flour per unit of grain. Interviewees, particularly female farmers, indicated that hybrid maize  
 469 had poor poundability and provided less flour than could be obtained from local maize. Both female and male  
 470 farmers associated improvements in terms of household-level food availability with accessing local maize for food  
 471 purposes. One female farmer reported: 'With 20 kg of maize from local varieties I got more flour than when I used  
 472 the same amount of hybrid maize.' Some key informants from research institutes noted that a household is more  
 473 food secure over time when using local maize than when using hybrid maize.

474

475 Improvements in farmers' food availability were associated with an increase in the quantity and diversity of crops  
 476 harvested. All interviewed female and male farmers reported improved food availability for longer periods than  
 477 before joining the CSB, including more food during lean periods. However, not all farmers could ensure year-  
 478 round food availability: the lack of food storage facilities and small size of their land-holdings were mentioned as  
 479 two main constraints. All key informants agreed that the latter limited their capacity to produce more food, even  
 480 with the use of quality seed of local varieties from the CSB. Figure 1 shows how CSB members considered their  
 481 food sufficiency. Twelve respondents reported to have sufficient amounts of food throughout the year, whereas 19  
 482 had sufficient amounts of food 11 months and 14 only 10 months of the year. Figure 1 also shows that female  
 483 farmers experience less food sufficiency than male farmers.



484

485 **Figure 1:** Number of months of the year in which the households of interviewed farmers have experienced sufficient amounts of food

486

487 All in all, food availability has improved considerably among the CSB members due to their access to seed of  
 488 diverse local varieties in time for the planting season, due to the specific characteristics of preferred local varieties  
 489 in terms of drought tolerance, tolerance to other environmental stresses, storability, poundability (of maize), and  
 490 due to accompanying trainings and farmer to farmer exchanges on suitable agricultural methods. Growing a diverse  
 491 range of crops that mature at different times throughout the year is a measure for safeguarding food availability  
 492 also in lean periods. Although the majority of the members still experience food shortages to some extent during  
 493 such periods, the situation has improved considerably as a result of the CSB.

494

### 495 **4.3 Contribution of Mkombezi CSB to food access**

496 Concerning the food access dimension, first, we assessed the extent to which farmers access the food they produce  
 497 for own consumption, including strategies used by the CSB to promote food self-sufficiency among members.  
 498 Second, we assessed the extent to which income-generation increased or decreased among members as an effect  
 499 of their membership in the CSB, and whether income generated as an effect of the CSB was used by members and  
 500 their households to purchase food they did not produce themselves.

501

502

503 *Food access through own production*

504 Farmers' own production plays a key role regarding household access to food. As a point of departure all members  
505 utilize the food they produce for own consumption: only excess food is sold. However, this depends on household  
506 needs and whether the family has debts to pay. Female and male interviewees reported that improvements in food  
507 access had become possible by having a stable and affordable source of seeds since joining the CSB, enabling  
508 them to produce the food preferred for own consumption. Male farmers explained that they grew both improved,  
509 often hybrid, and local varieties of maize: improved varieties were normally aimed for sale, whereas local varieties  
510 were preferred for home consumption. However, they stressed the prohibitive cost of hybrid seeds and chemical  
511 fertilizers. Female and male farmers agreed that the CSB had been central: first in providing seeds to ensure better  
512 access to the local varieties preferred for home consumption, and second, in making it possible to avoid reliance  
513 on the agro-dealers who primarily sell hybrid seeds. As Dr Mkamanga of BCI put it: 'Farmers prefer local varieties,  
514 as hybrid seeds are expensive, but also due to cultural preferences and taste. Through the CSB, farmers can ensure  
515 that they have seeds to produce foods preferred for home consumption.'

516  
517 Most interviewed female and male farmers described the CSB as providing an alternative to the seeds offered  
518 through government subsidy programmes. A male farmer said, reflecting on his past and current situation: 'Now  
519 I can access good seeds – before, that was very hard for me. I didn't always get help from the government. For  
520 example, in a village of 20 households, 17 were left out of the programme. Only three households had the option  
521 of getting seeds from the government, and my household wasn't among those three.' Moreover, government  
522 subsidies cover only part of the cost, and farmers cannot afford to buy hybrid seeds every season. All study  
523 participants emphasized that government programmes do not reach all farmers, enough seeds are not provided,  
524 and the seeds are often not distributed when the planting season begins. In the focus group, one male farmer stated:  
525 'Not having seeds in time for planting puts our food at risk, because, to guarantee the harvest, we need to plant  
526 when the rain starts – not later.' According to most interviewees, before joining the CSB, some farmers had started  
527 to recycle hybrids due to the delays of government programmes for seed distribution. They did so even though  
528 germination rates and productivity decline with the second use, because it was a way of guaranteeing at least some  
529 food. Thus, joining the CSB meant a significant improvement for them.

530  
531 Maize, the main staple in Malawi, has long been promoted to address food insecurity. All interviewed female and  
532 male farmers associated 'food access' with access to quality local maize. Saving seeds from the previous harvest  
533 of local maize varieties was a common practice, both before and after joining the CSB; farmers used these seeds  
534 for their own land holdings as well as for exchange with family and community members. However, limited yields  
535 were a challenge. Today, according to female and male farmers interviewed for this study, all CSB members have  
536 access to local varieties of maize that have been enhanced through participatory variety selection (PVS), thereby  
537 producing higher yields, and that have been preserved with high quality standards in the CSB building. BCI key  
538 informants mentioned that 4 varieties of maize have been enhanced since the establishment of the CSB: *kafula*,  
539 *lokolo*, *bingo* and *kamparapati*. Moreover, as female farmers explained, these enhanced local varieties of maize  
540 obtained from the CSB mature at different times, offering a longer period of household food security.<sup>5</sup> *Kafula* is  
541 appreciated for being early maturing, which is important in times of drought.

542  
543 All in all, Mkombezi CSB has greatly contributed to its members' access to food by stimulating their production  
544 of preferred local crop varieties for home consumption. As a result, dependence on improved varieties of cash  
545 crops, and the agro-dealers representing them, has been reduced. Farmers consider this an important achievement:  
546 they find those varieties more risky to grow, due to the effects of climate change, being less easy to store, and  
547 because the agro-dealers have the power to determine grain prices, which are often too low.

548  
549 *Income generation through crop productivity*

550 All farmers mentioned that, by sowing seeds of local varieties and implementing agricultural practices acquired  
551 through CSB trainings, productivity has increased, and some surplus has been generated for sale. This increased

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<sup>5</sup> Interviews with BCI staff confirmed that the four enhanced maize varieties were *kafula*, *lokolo*, *kampalapati* and *bingo*.

552 productivity has improved their access to food, while also generating additional income, which has helped to  
553 improve the household economic situation. Having access to income which could make it possible to buy  
554 additional food and meet some household needs was mentioned as a positive effect of CSB membership.

555

556 However, experiences differed. One female farmer explained: ‘Local maize produces higher yields than hybrid  
557 maize, especially in times of frequent drought. After meeting my family’s food needs, I can sell some surplus and  
558 get some cash.’ Another female farmer added: ‘By growing those drought-tolerant local varieties, I can get surplus  
559 and income from selling the surplus. Now I can buy salt, soap, and some clothes.’ A female farmer from the  
560 management committee noted: “Productivity is high when I use local varieties: there is enough to consume and  
561 sometimes to sell. Yields stay high every year: it’s not like with hybrids, where yields decrease after a few years.’

562

563 However, some interviewees mentioned that their surpluses have remained limited, for various reasons: most of  
564 the food produced is used for home consumption; the small size of farmers’ holdings precludes additional  
565 production; and in some cases, yields have declined due to lack of access to other agricultural inputs. Indeed, some  
566 farmers said they had limited access to other foods that they themselves do not produce, as most of the income  
567 gained must cover other household needs. However, they found that, after becoming CSB members, the situation  
568 improved somewhat. Some male farmers reported having to use food originally intended for sale to pay for labour  
569 or to share with neighbours during lean periods: they could not use this surplus for generating income. Also, some  
570 female farmers reported problems in accessing other types of food with the income generated: unexpected needs  
571 often arose, and the money had to be used for other purposes, such as medicines for their children. They would  
572 rely on their own production the most urgent problems were solved: only then would they be able to purchase  
573 additional food.

574

575 Only two male farmers out of forty CSB members interviewed for this study reported buying additional food due  
576 to increased productivity after joining the CSB. These two farmers reported planting approximately 60% of local  
577 maize and 40% of hybrid maize on their land. Both thus affirmed that using local varieties for consumption and  
578 hybrids for income generation has been a strategy that helps them to generate enough surplus and additional income  
579 to buy other types of food and meet family needs.

580

581 Thus, for most farmers who are members of Mkombezi CSB, increased productivity has enabled them to sell  
582 surplus produce. The achieved income is generally limited; it is largely used for meeting other household needs  
583 than food and only to a very limited extent for types of food that they do not produce themselves. Only two of the  
584 interviewed farmers produced larger amounts of excess food (mainly from hybrid maize production), and could  
585 use the income from selling this surplus to purchase additional food throughout the year.

586

#### 587 *Income generation through crop diversification*

588 In addition to increased yields, farmers mentioned crop diversification through the introduction of local varieties  
589 of a wide range of crops as essential for generating income. Female farmers particularly highlighted the diversity  
590 of crops, enabling them to ensure food for themselves and their families, while also having additional crops to sell  
591 in the market. BCI and DF key informants emphasized that CSBs offering a larger product portfolio helped farmers  
592 to reduce the risk of selling a single product and being dependent on fluctuating market price. Female members of  
593 Mkombezi CSB mentioned groundnuts, bambara nuts and beans obtained through the CSB as key income  
594 generators, and other crops as secondary income generators, explaining that these crops had not been grown by  
595 CSB members previously, or only in small quantities by a few. After joining the CSB, crop diversification enabled  
596 them to obtain certain incomes. As one female member put it: ‘Before, we could not get groundnuts or other crops.  
597 We couldn’t sell anything in the market, because the maize we had was for food. But now we have many crops  
598 and varieties in the CSB, and can earn some income from selling – in my case, especially groundnuts.’. Another  
599 female farmer said ‘Thanks to the CSB, I now have access to many local varieties of many crops. The income is  
600 not high, but something is better than nothing. Before, I had no income and was totally dependent on my husband  
601 – now I sell some beans’. Figure 2 shows the situation as of 2021 regarding crops that female farmers sell, which  
602 indicates a substantial improvement from barely having access to these crops, as reported above.

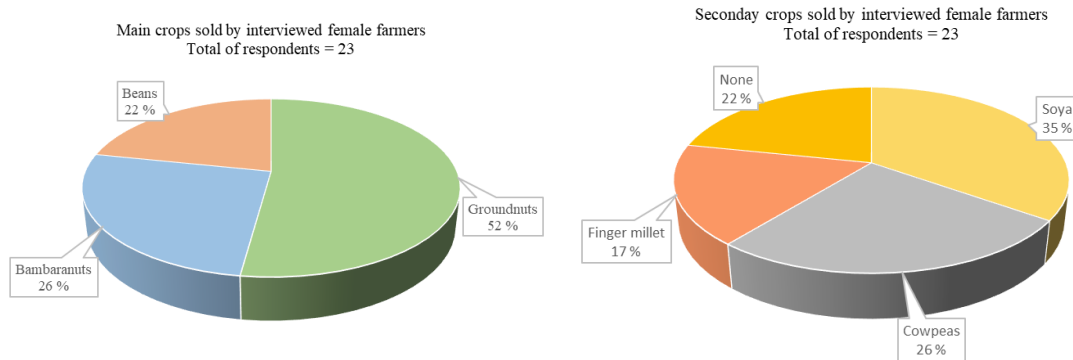


Figure 2: Main crops and secondary crops sold by interviewed female farmers

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Interviewed female and male farmers and BCI key informants explained that farmers use seed and food fairs linked to the CSB as platforms to build networks for selling seed and food surpluses, to increase their incomes so as to be able to buy both food and other household items. Female farmers also mentioned that at these seed and food fairs, they could display their products and deal with national-level customers, instead of relying solely on traders from the local market. This was seen as a positive outcome of belonging to the CSB – since, as some farmers explained, without the CSB, smallholder farmers do not normally have opportunities to reach other markets than the local ones. Female and male farmers noted that, by creating alliances with other traders, they aimed to become independent from the middlemen who run the local market. A claim made by female and male farmers alike, which was confirmed by BCI, DF and Malawian NGOs, was that local middlemen introduce price ceilings that limit farmers’ income. One female farmer added: ‘It makes no difference if you are a woman or a man, the middlemen are the ones who establish the prices in the market, and if we want money, we have to toe the line.’

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Key informants from research institutes and international NGOs also noted how the need for income immediately after the harvest is an important factor here, leading the middlemen to control the market price. Many farmers have informal loans<sup>6</sup> to pay, and will sell even at low prices, as they have no other sources of income, and their storage facilities cannot guarantee long-lasting quality – which could lead to even lower income over time. The Government of Malawi has formally introduced floor prices, but as key informants from Malawian NGOs and DF explained, there is not enough capacity to monitor what happens in the field. Even for the heavily promoted maize, middlemen do not adhere to the minimum price set by the government. Some interviewed male farmers added that the price paid by middlemen for maize, including hybrid maize, is very low, and farmers generally lack bargaining power. DF key informants mentioned work on establishing connections between farmers and traders in various projects. However, the heavy promotion of maize has reduced the market demand for other crops, resulting in low prices. A few farmers said they felt sceptical to crop diversification as a long-term strategy for income generation, as demand is uncertain and there is no guarantee of fair market prices.

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All in all, crop diversification is an important source of income generation. In particular, groundnuts, bambara nuts and beans are sold at the market, and the CSB facilitates market access by organizing seed and food fairs. This is considered an important achievement; women in particular appreciate this opportunity to generate income for themselves and their families and reduce their economic dependence on their husbands. Nevertheless, the income is limited and is largely used for other household and family needs, including reducing debts, and only to a limited extent for purchasing food that is not produced on-farm.

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*Income generation through cost reduction*

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As market prices in Malawi are generally low, another strategy for increasing farmers’ incomes has been to reduce production costs. Key informants from BCI and DF as well as interviewed female and male farmers explained how CSB members in general have had the possibility to access seeds under a seed loan scheme, whereby they obtain

<sup>6</sup> Loans were for buying food during the lean season, medical care, and school items for children.

642 quality seed of local varieties, and re-pay in kind when the next harvest comes. However, this seed-lending  
643 arrangement is not possible when farmers want to access hybrid seeds. Farmers pay a membership fee to the CSB,  
644 but interviewed farmers, particularly male farmers, said that their costs have decreased, helping them to generate  
645 more income. They noted that, to buy seeds, they do not need to spend a lot of money, which they would often  
646 have to borrow. Moreover, although they continue to access hybrid maize, they do so in smaller quantities than  
647 before because they can obtain local maize from Mkombezi CSB, helping them to save money. Although those  
648 wishing to join the Mkombezi CSB must pay a membership fee, interviewed female and male farmers noted that  
649 the membership fee covers access to quality seed of local varieties, as well as participation in other activities,  
650 including agricultural trainings. These additional activities and trainings, which are generally not offered by the  
651 government or other organizations, were seen as highly important, keeping the farmers up to date while also  
652 helping them to improve their farming practices. When asked why she preferred to pay a membership fee instead  
653 of buying certified seeds, one farmer answered: 'Hybrid seeds are too expensive. Instead, we can pay a membership  
654 fee in the CSB and get not only seed of local varieties that are at least 50% cheaper than hybrid seeds, but also get  
655 agricultural trainings where we learn how to prepare good manure, how to select our seeds, and many other things.'

656  
657 Moreover, 35 out of 40 interviewed farmers recognized that using quality seed of local varieties reduces  
658 dependency on chemical fertilizers that must be purchased if hybrid seeds are used. With local varieties of crops,  
659 all interviewed farmers noted that they could use organic fertilizers they produce themselves, lowering overall  
660 production costs. Key informants from BCI explained that in some years CBS members have received  
661 comprehensive training in compost preparation, including manure compost. By using local varieties obtained  
662 through the CSB, farmers do not have to purchase chemical fertilizers for these crops. They have been able to earn  
663 more income, as they spend less on production costs. One farmer said: 'I do not need to buy fertilizers because I  
664 use local varieties, so I have more money for other needs.' Another farmer added, 'I used to borrow money to buy  
665 chemical fertilizers, but now I do not need to, because I can use organic fertilizers for my local varieties'.

666  
667 All interviewed farmers see fertilizers as essential inputs to guarantee good harvests, enrich the seed germination  
668 rate and boost productivity. However, they all added, they cannot afford to purchase expensive chemical fertilizers  
669 every season. They saw the CSB as an important platform for obtaining training in the production of organic  
670 fertilizers, central to ensuring plant growth. However, male farmers in particular felt that more support from the  
671 Government of Malawi was needed to access organic fertilizers, as the main focus of the government has been on  
672 hybrid seeds and chemical fertilizers.

673  
674 All in all, Mkombezi CSB has contributed to cost reduction in agricultural production, as farmers do not have to  
675 spend money to buy seed, fertilizers and pesticides, or they do so to a substantially less extent than before. This  
676 improves the family economy, because it reduces the need to borrow money.

677  
678 *Income generation through seed sales*

679 Seed marketing was mentioned as another sales channel that farmers with CSB support are exploring to increase  
680 their incomes. Farmers interviewed for this study mentioned that they sometimes sell seed of local varieties in  
681 small quantities to farmers in other areas, as their seeds are recognized as being of good quality. Key informants  
682 from BCI and DF emphasized that seeds produced by CSB members are of good quality as members receive  
683 training in seed multiplication and selection. Furthermore, key informants from BCI explained that both BCI  
684 supervisors and members of the Mkombezi CSB management committee conduct follow-up visits to farmers'  
685 fields to guide the seed-selection processes, in turn helping to increase quality controls in seed production.  
686 Interviewed farmers who have managed to sell some seeds explained that part of the income earned had been used  
687 to buy food and school supplies for their children and/or buy medicines when necessary. However, despite the  
688 quality of the seeds produced, most interviewed farmers, especially males, stated that seed sales have not been a  
689 stable source of income, as these seeds cannot be sold openly in various markets in Malawi. Key informants from  
690 BCI, DF and Malawian NGOs mentioned that many CSB members have tried to sell seeds to create another income  
691 source, both for themselves to meet food and family needs, as well as for the financial maintenance of the  
692 Mkombezi CSB, but that this has largely failed.



693 *Summarizing the contribution of Mkombezi CSB to food access*

694 Mkombezi CSB has greatly contributed to its members' access to food through their own food production,  
695 stimulating the production of local varieties of crops which are preferred and used for home consumption.  
696 Dependence on cash crops has been reduced, and members can to a greater extent than before rely on their own  
697 food production for food access and consumption.

698  
699 Moreover, increased income through higher productivity has helped to boost income generation among members,  
700 but rarely as a substantial contribution. Crop diversification has been the most important source of income  
701 generation for most members, women in particular. By organizing seed and food fairs, Mkombezi CSB has created  
702 market opportunities for selling crops such as ground nuts, bambara nuts and beans. Cost reduction in agricultural  
703 production is a further strategy, and Mkombezi CSB has contributed to this as well. Marketing seed has been seen  
704 as a potential strategy for income generation, but without clear results as yet.

705  
706 On the whole, members of Mkombezi CSB have achieved increased income through various approaches.  
707 However, this income is to a very limited extent used for purchasing food not produced on-farm: the income is  
708 used for other household and family needs and for reducing debts.

709

#### 710 **4.4 Contribution of Mkombezi CSB to food utilization**

711 In the conceptual framework for this study, we defined 'food utilization' as the intake of a wide range of foods,  
712 which together provide the essential needed nutrients: *nutrition security*. To ascertain whether and how the CSB  
713 members have achieved greater nutrition security by joining the CSB, we asked them first about the characteristics  
714 of their diets before and after becoming CSB members. Ten out of 30 interviewed farmers stated that maize used  
715 to be the main food and that they rarely had access to other types of food, as income had always been limited and  
716 food that they did not produce themselves had been expensive. Those who mentioned having had access to food  
717 other than maize before, stressed that it was because they worked on other people's land (a practice known as  
718 *ganyu*), which made it possible to earn some small extra income to purchase food.

719  
720 Although incomes have remained limited even after joining the CSB, our interviewees, female farmers in  
721 particular, emphasized that by being CSB members and accessing seeds of a wide range of crops, they have become  
722 self-sufficient in cereals, legumes, and some vegetables. They have diversified their diets: instead of consuming  
723 only maize and its derivatives, they now enjoy a more varied range of foods. Crop diversity has resulted in more  
724 balanced, more nutritious diets at the household level, through the increase in the production and consumption of  
725 products other than maize. In a focus group interview, one female farmer explained: 'We used to eat only maize,  
726 sometimes only twice a day, as it was hard to get seeds of other types of crops. But now that I'm a member of  
727 Mkombezi CSB, I can get the seeds I want, and can prepare more different types of food as side dishes.' A male  
728 farmer added: 'In my family we had some other food, but mainly because I worked in my neighbour's garden and  
729 got some cash. Now I don't need to work there because we produce what we want and prefer: seeds are available  
730 at the CSB for us.'

731  
732 Additionally, interviewed farmers stated that since they joined the CSB they have obtained nutritional training on  
733 the types of food necessary for a healthy diet and life. They highlighted this as an important benefit, adding that  
734 had not known what types of food were good to eat for different health problems. The nutritional trainings have  
735 been accompanied by lessons on how to cook various dishes, so, according to BCI key informants, farmers now  
736 know how to prepare different types of food with the additional crops to which they now have access. Female  
737 farmers highlighted that learning to prepare other types of food has been a positive outcome of being a CSB  
738 member. For instance: 'My kids are happy because I can make them doughnuts that I learned to prepare from  
739 potato flour'. 'I can prepare a delicious peanut butter thanks to my training at the CSB, and I have taken it with  
740 me to several seed and food fairs.' The positive change in terms of knowledge gained on how to prepare some  
741 foods was also highlighted by key informants from Malawian and international NGOs as well as from research  
742 institutes. They pointed out that it should not be assumed that, simply because farmers grow different crops, they

743 all know the nutritional values of each crop, or they use them as food themselves. Key informants from Malawian  
744 NGOs emphasized that farmers in Malawi need to know more about how to prepares various types of food to  
745 ensure a balanced diet; otherwise, what is produced may simply be sold instead. A male key informant from a  
746 Malawian NGO explained: ‘Seeds were distributed to some NGOs, but food insecurity continued, until some  
747 NGOs realized that most of the farmers were unaware of how to prepare those foods. To tackle food insecurity  
748 and malnutrition, seed security responses should include spaces for discussion and knowledge sharing.’

749  
750 The Mkombezi CSB’s approach of providing members with access to a range of crop varieties and at the same  
751 time implementing training programs to maximize the incentive to consume nutritious foods from self-production  
752 has, according to our findings, improved members’ nutritional security and thus food utilization.

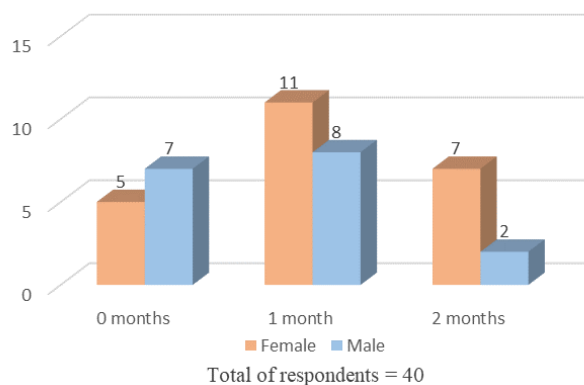
#### 753 754 **4.5 Contribution of Mkombezi CSB to food stability**

755 Have farmers been able to maintain food stability during periods of stress after becoming CSB members? We  
756 assessed the effects of COVID-19 and related restrictions on farmers’ seed and food security. All interviewed  
757 farmers (female and male) stated that being CSB members has meant better access to seeds during the pandemic.  
758 – Despite the lockdown, the CSB guaranteed continuity in the supply and distribution of seeds of local varieties;  
759 – Through the CSB, farmers could access seeds of the varieties they preferred through the loan repayment system;  
760 – The CSB is located close to the community, enabling seed access without requiring additional transport, made  
761 difficult due to COVID restrictions.

762  
763 Although farmers’ already-low incomes were even lower during COVID-19, as some markets were closed or  
764 restricted, access to local varieties of crops through the Mkombezi CSB was not affected. Interviewed farmers  
765 stated that they themselves, and members of the CSB in general, had not faced food shortages during COVID-19  
766 restrictions: they were able to be self-sufficient and ensure good nutrition. BCI key informants noted that members  
767 had access to crops from the CSB that are easy to store, such as finger millet, maize, pumpkins, and traditional  
768 legumes, enabling them to have sufficient food during the lockdown.

769  
770 The pre-harvest period, January/March, are the months with the greatest food shortages in some regions of Malawi  
771 (IPC, 2021), also in the region where Mkombezi CSB is located. All interviewed confirmed that their lean period  
772 has been shortened to less than two months a year after joining the Mkombezi CSB, although not all reported the  
773 same time reduction (see Fig. 3). Two reasons were often mentioned: 1) farmers have been able to produce and  
774 store quality flour (produced from local varieties) that lasts until part of the lean season is over; 2) one of the maize  
775 varieties (*kafula*) is an early-maturing local variety which they can start harvesting in mid-March, for food from  
776 their own production during part of the lean period. Thus, although all interviewed farmers mentioned the need for  
777 income to buy other foods that they do not produce during the lean season, and that they to some extent seek to  
778 sell parts of their assets as a coping mechanism to get food during parts of this period, the local crop varieties from  
779 the CSB have helped them reduce the need for cash. However, interviewed farmers, while agreeing on the  
780 importance of income-generating activities through the CSB, also highlighted the need to create more diverse  
781 income-generating activities that can provide additional income sources not necessarily dependent on the sale of  
782 seeds and/or grain. This was particularly important among female farmers, who pointed out that they did not have  
783 access to other types of income-generating activities beside those generated from farming.

784



**Figure 3:** Number of months of food shortage at the household level of the interviewed female and male members of the CSB

785  
786  
787

788 An important aspect of food availability here is equal access to seeds among CSB members. During interviews  
789 with female and male farmers, they all stated that all CSB members have the right to obtain seeds under the same  
790 conditions. BCI key informants reported that when seed supply is less than demand, seeds are distributed  
791 proportionally to cover *all* members. In an interview, a male key informant from BCI explained: ‘If both a woman  
792 and a man ask for 20 kg of maize and we do not have enough maize seeds, both get the same quantities – for  
793 example, 15 kg. There is no difference because the person is a woman or a man.’ Although the seeds provided do  
794 not always satisfy the total demand per farmer, both female and male famers confirmed that the distribution has  
795 been fair. Female farmers in particular mentioned equal access to seeds as a positive effect of CSB membership:  
796 they explained that before joining the CSB they did not have regular access to seeds from governmental  
797 programmes and therefore experienced serious problems of food insecurity at the household level. One female  
798 farmer explained: ‘Before, I had to struggle to find seeds to plant and get food; now, I don't need to stress because  
799 I know I can get seeds from the CSB’. However, we did not have access to records from the management committee  
800 of Mkombezi CSB or BCI showing how much each farmer had asked for and obtained over the years, quantitative  
801 information in terms of equal access to seeds could not be analysed.

802

803 All in all, Mkombezi CSB has contributed considerably to food stability during the COVID-19 pandemic as well  
804 as in the lean periods. This contribution is equally distributed among the CSB members as regards access to seed.

805

## 806 **5. Discussion – with focus on relevance of the findings and sustainability of community seed banks**

807 We find that Mkombezi CSB has contributed greatly to increasing food security among its members in terms of  
808 availability, accessibility, utilization as well as stability. We now consider the relevance of these findings for  
809 community seed banks in other parts of Malawi and the Global South, before addressing the question of long-term  
810 sustainability of such development endeavours.

### 811 **5.1 Contribution to food security: Mkombezi CSB as a case and conditions for generalizations**

812 We have studied the Mkombezi CSB as a case of agrobiodiversity-focused CSBs in Malawi in particular, and the  
813 Global South in general. In this section, we discuss whether and how key findings from this case study are relevant  
814 for other CSBs and under what conditions they may be valid in other settings. Thereby we compare our findings  
815 with results from other studies.

816

817 Our findings on the positive relationship between crop diversity and food security for small-scale farmers who  
818 depend primarily on agriculture for food consumption are supported by a range of other studies (Madsen et al.,  
819 2021; Herforth et al., 2020; Rawal et al., 2019; Bezner Kerr et al., 2019; Mango et al., 2018; Kahane et al., 2013).  
820 We also found that local varieties of crops provided through the CSB performed well, as has been shown in studies  
821 on CSBs in other parts of the world (Mulesa et al., 2021; Porcuna-Ferrer et al., 2020; Andersen 2019a and 2019b,  
822 Maharjan and Maharjan, 2018; Vernooy et al., 2014 and 2017). As these studies have also shown, a specific

823 contribution of many CSBs to food security is their use of participatory approaches to enhance preferred local  
824 varieties according to traits selected by farmers, enabling the CSBs to provide farmers with access to quality seed  
825 of local varieties that perform better according to farmers' preferences, and are adapted and adaptable to local  
826 conditions. This supports our findings on the four maize varieties that had been enhanced at Mkombezi CSB, and  
827 which greatly contributed to food security.

828

829 We may thus infer that smallholder farmers who largely rely on subsistence farming for availability of, access to,  
830 and utilization of food, benefit substantially from crop diversification and access to sufficient quality seed of  
831 preferred varieties at the right times of the year, including of enhanced local varieties. The CSBs offering these  
832 possibilities to members who are mainly subsistence farmers contribute to their food security in terms of increased  
833 availability and access to food.

834

835 Our findings show that CSBs are an effective platform for enhancing farmer access to genetic diversity of crops,  
836 as studies by Vernooij et al. (2014); Maharjan and Maharjan (2018); and Andersen (2019a; 2019b) confirm. We  
837 may infer that when such a development includes access to sufficient amounts of quality seed of nutritious crops  
838 that mature at different times of the year, then this contributes to food stability as well as utilization.

839

840 Our findings of limited possibilities to generate substantial income from crop genetic diversity are consistent with  
841 those of Kell et al. (2017): commercial markets tend to favour uniformity, which discourages local crop diversity.  
842 Studies also support the observation that agro-dealers tend to keep prices for agricultural produce below the  
843 minimum prices announced by Malawi's Ministry of Agriculture and Food Security (MoAFS): A report from  
844 IFPRI (2020) showed that 90% of 1265 soybean farmers did not obtain the minimum field price announced by  
845 MoAFS in 2020. Additionally, a report of the 2019 harvesting season showed that pigeon peas and chickpeas in  
846 southern Malawi were sold below the minimum farmgate prices as announced by MoAFS: 'The two legumes are  
847 mostly sold below the minimum farm gate prices of MWK330/kg for pigeon peas and MWK310/kg for chickpeas.  
848 Less than 8 percent of reporting farmers sold their pigeon peas and chickpeas at prices equal to or higher than the  
849 minimum farm gate prices' (Ochieng 2019, p.13).

850

851 Thus, income generation from the marketing of farm produce is not an efficient way to acquire other types of food  
852 when prices are kept below established minimums. In such situations, it is more efficient to seek to produce as  
853 much of the food items needed as possible on-farm or in the local community. Self-sufficiency in food, as promoted  
854 by many CSBs, including Mkombezi CSB, is a logical response to such situations.

855

856 Our findings on the positive effect of capacity building among CSB members for food and nutrition security are  
857 in line with other studies highlighting that CSB members often have had access to a wide range of trainings they  
858 recognize as valuable for building knowledge, social capital, and improving their agricultural, nutritional and  
859 income-generating skills (Porcuna-Ferrer et al., 2020; Vernooij et al., 2020; Andersen, 2019a, 2019b; Andersen et  
860 al., 2018). Thus, we may infer that relevant capacity building facilitated through CSBs is a useful measure for  
861 increasing food and nutrition security.

862

863 Thus, our key findings from Mkombezi CSB are largely supported by studies from other CSBs, suggesting that  
864 they – under the conditions highlighted – are relevant also to other CSBs in Malawi as well as elsewhere in the  
865 Global South where smallholder farmers rely on mainly subsistence farming.

866

## 867 **5.2 Community Seed Banks as development endeavours – the question of sustainability**

868 Studies on the effectiveness of CSBs have noted limited financial capacity and heavy dependence on NGO funds  
869 as risks for long-term sustainability (Nyantakyi-Frimpong, 2019; Thornton et al., 2018). According to Pitambar et  
870 al. (2015, p.56), 'past experience has shown that community seed bank initiatives are usually quite effective during  
871 their initial years, but with the withdrawal of external support, many cut back on activities or stop altogether'.

872 Economic sustainability is a challenge to Mkombezi CSB, as its operations depend heavily on the support received  
873 from DF through BCI. This support covers BCI facilitation and trainings as well as some equipment. The key  
874 question is whether Mkombezi CSB will survive when this support ends. The CSB has a highly committed and  
875 well-skilled management committee consisting of elected CSB members who take care of day-to-day  
876 commitments. There is also a membership fee, which is a necessary (albeit not sufficient), measure for building  
877 economic sustainability. Although this fee does not cover all CSB expenses, it serves to create a bond between  
878 CSB members and a sense of ownership, while generating social pressure on farmers to repay their seed loans.  
879 This contrasts with what Reisman (2017) found: due to the collective environment in which the CSBs are managed,  
880 farmers did not feel much pressure to repay their loans. The Mkombezi case study shows that farmers work in an  
881 environment of trust; although this point should not be romanticized, members are in fact willing to pay, as they  
882 can obtain quality seed of local varieties from a wide range of preferred crops, with a flexible payment scheme,  
883 and can participate in additional activities, including agricultural trainings, that help to boost their farming  
884 activities and are not readily available otherwise. This finding is in line with studies showing how farmers are  
885 willing to invest in quality seeds (McGuire and Sperling, 2016). Further, it offers a new perspective on the farmers’  
886 willingness to pay for participating in agriculture-related activities in general, not only for obtaining seeds. Central  
887 questions here are how this environment of trust is developed in a CSB and how awareness of joint responsibility  
888 for the CSB is promoted. Capacity building and good leadership are probably central. Local socio-cultural norms  
889 may also be relevant. A strong sense of joint responsibility for the CSB among members is probably key to long-  
890 term sustainability. More research is needed to explore these aspects.

891  
892 Membership fees are not sufficient to maintain operations at the same level. If no other financial sources are  
893 available, then the CSB will – given the commitment of its members and the well-functioning management  
894 committee – most likely continue those activities that do not depend on substantial financial support, whereas other  
895 activities will cease. To maintain operations at the same level as today, sustainable sources of income for the CSB  
896 must be identified. Another way of increasing CSBs incomes is to expand their roles beyond conservation and  
897 utilization to commercialization of seeds and/or agricultural produce. This might boost their long-term financial  
898 sustainability, while enabling non-member farmers to obtain quality seeds and other farm produce at acceptable  
899 prices. Studies reported by Thornton et al. (2018), Andersen (2019a; 2019b) and Vernoooy et al. (2020) showed  
900 that CSBs in Costa Rica, Nepal and Zimbabwe finance their operations and maintenance through sales of seeds at  
901 low prices, which also helps non-members in need. In Côte d'Ivoire, a farmer-led organization supplies rice seeds  
902 on demand for the national rice programme and for private buyers, aiming to sustain its operations in the longer  
903 term (Vernoooy et al., 2020). However, most of these examples concern the sales of seed of varieties already  
904 registered in the official lists of plant varieties in the respective countries, following also other legal preconditions  
905 for seed sales in those countries. As the Malawi Seed Act of 2022 does not explicitly address the sale of seed of  
906 unregistered varieties by organizations like CSBs, it is currently uncertain whether this is allowed according to the  
907 law. Should it not be allowed, then it will be important to get the varieties that have been enhanced through the  
908 CSB registered and fulfil the legal requirements for marketing them. Another option is to find market opportunities  
909 for the produce of surplus harvest (e.g., from the experimental field), to generate income for the CSB.

910  
911 All our study participants agreed on the importance of developing a sustainable source of income for the CSB to  
912 secure long-term sustainability. Interviewed farmers recognized that although members pay membership fees, and  
913 the DF supports the operations of the CSB through BCI, a long-term income-generating strategy is necessary. One  
914 male farmer said: ‘We are committed to work together and produce and sell seeds in bulk, because that will be a  
915 way to maintain the building and other needs of the CSB when the DF is not with us.’ A female farmer added:  
916 ‘We are waiting to see if there is a way to sell the seed of local varieties. That will help us to continue for many  
917 years even when we don’t have an NGO helping us.’

## 918 919 **6. Conclusions**

920 This study has documented that Mkombezi CSB has contributed substantially to improving food security among  
921 its members. It has also detailed how this effect has been achieved with regard to four dimensions of food security:  
922 food availability, access, utilization, and stability. Further, a literature review of findings from CSBs in other parts

923 of Malawi as well as in other countries in the Global South, indicated that our findings may have relevance also  
924 for other CSBs under certain conditions. The food security effect identified in Mkombezi CSB is particularly  
925 relevant for CSBs whose members are mainly subsistence farmers – provided there is good governance in the  
926 CSBs with regard to equitable access to seed and activities, and concerning the development of joint responsibility  
927 for the CSB among its members. These findings show that the development of various complementary activities  
928 in CSBs is more effective in improving food security among CSB members than is the implementation of one or  
929 few isolated tasks.

930  
931 Agency is another dimension of food security. It has not been analysed systematically in this study, but we have  
932 found clear traces of empowerment among the farmers interviewed, as they have been able to make decisions on  
933 what food to produce on the basis of a much broader choice of crops than previously. This effect is likely to be  
934 found also in other CSBs offering a broad choice of crops responding to farmers’ preferences. Also training in  
935 group dynamics and gender relations, as experienced in Mkombezi CSB, may improve social cohesion (Andersen  
936 et al., 2022) and the sense of ownership and joint responsibility for the CSB – important for developing the  
937 potentials for improving food security and finding solutions to the challenges of economic sustainability. All this  
938 is related to agency among the members. More research is needed on the development and function of agency at  
939 CSB level, and its effects for the operation and sustainability of CSBs as well as on the contributions to the four  
940 food security dimensions emphasized in this study.

941  
942 A challenge related to the long-term sustainability of Mkombezi CSB and many other CSBs operating in semi-  
943 arid areas is the risk of losing seed and thus crop varieties due to natural disasters or other major shocks affecting  
944 agricultural production, which may reduce seed payback ability among members. As Wasswa et al. (2015) found:  
945 in dryland environments, seed-bank failures can be the result of extreme climate variability, in turn leading to  
946 decreased yields and non-payment of seed loans. One way to reduce this risk could be to establish a *genetic*  
947 *resource backup mechanism* at the national level, for instance, at the national gene bank. Various avenues could  
948 be followed here: (1) the CSB could offer accessions of each variety to the national gene bank; (2) the CSB could  
949 deposit a ‘black box’ with its own material at the national gene bank, in line with the system implemented for  
950 Svalbard Global Seed Vault. Such a black box would then be the property of the CSB, and accessions would have  
951 to be replenished by the CSB to ensure sufficient germination levels. Another option could involve a combination  
952 of these two approaches.

953  
954 The greatest challenge for Mkombezi CSB, as for so many other CSBs, is financial sustainability. Members of  
955 Mkombezi CSB are committed to work and maintain the CSB. They willingly pay the CSB membership fee and  
956 have discussed creating a more stable long-term source of income through the sale of self-produced quality seed  
957 of the CSB crop varieties. This could enable Mkombezi CSB to generate income over time and thus become  
958 financially self-sufficient. However, national policies in Malawi have restricted this possibility, as only certified  
959 seed of registered varieties are recognized by the Government of Malawi and are thus covered by the subsidy  
960 programme.

961  
962 The lack of a supportive political and legal framework recognizing CSBs and their seed could hinder CSB  
963 operations and sustainability (Vernooy et al., 2020). However, some countries have seed policies and laws that  
964 support farmer-led efforts to produce and sell seed of local varieties: Rwanda, for instance, established a law to  
965 support farmers in their local seed production and sales, aimed at reducing imports and sustaining productivity and  
966 food security (Vernooy et al., 2015). Three states in Brazil have established legal frameworks to support the  
967 implementation of CSBs (Santilli, 2015). In Uganda, CSBs gained legal recognition in 2017, and are now  
968 registered as community-based organizations (Vernooy et al., 2020). A political environment conducive to farmer-  
969 led organizations could promote greater financial sustainability among CSBs (Nyantakyi-Frimpong, 2019). Legal  
970 recognition of the CSBs, their crop varieties and seeds, and inclusion of these initiatives in relevant national  
971 policies and strategies, is at the core of such a conducive environment, which should also include marketing  
972 opportunities for CSBs.

973

974 All in all, smoothly-functioning CSBs with a combination of several activities related to the promotion of crop  
975 genetic diversity, agricultural productivity and food utilization may contribute substantially to food security among  
976 smallholder farmers who rely mainly on subsistence production, as the case of Mkombezi CSB has shown.  
977 However, legal recognition and political support, *inter alia* to improve market access for seed and produce from  
978 CSBs, are required to ensure long-term sustainability and continued contributions to food security of such farmer-  
979 managed initiatives. An enabling legal and political environment would probably also provide a conducive basis  
980 for scaling up the CSB model to enable more farmers to benefit from this bottom-up approach to achieving food  
981 and nutrition security.

982

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993

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999

## 1000 **9. Availability of data and material (data transparency)**

1001 All interviews have been transcribed; the records are stored with the FNI in accordance with the Institute's data  
1002 management procedures.

1003

## 1004 **10. Conflict of Interest**

1005 The authors have no conflicts of interest to declare.

1006

## 1007 **11. Informed consent statement**

1008 Informed consent was obtained from all participants involved the study.

1009

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