SAIRLA

Sustainable Agricultural Intensification Research and Learning in Africa

# Smallholder Risk Management Solutions (SRMS) in Malawi and Ethiopia

## Replicable Business Model (RBM), Malawi:

## Seed Supply Survey, 2017

30 November 2018

Prepared by Oxford Policy Management on behalf of SAIRLA

Funded by: UKaid from the British people

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# Abstract

This report analyses experience drawn from applying the Replicable Business Model (RBM) introduced by Smallholder Risk Management Solutions (SRMS) in Temani Economic Planning Area, Phalombe District, southern Malawi, during the 2017/18 crop season. The RBM in Malawi addresses systemic risks in the value chain for pigeonpea, and uses a Seed Revolving Fund (SRF) to increase smallholder access to improved pigeonpea seed and output markets. A survey was made of 249 households selected to receive the improved seed varieties Mwaiwathualimi and Chitedze 1 through the Sukhamphete Pigeonpea Farmers' Cooperative. The results showed a high level of social inclusion, with 49% of the recipient households falling below the national poverty line, compared to 66% of households below the poverty line in Phalombe district. Both the utilisation and agronomic performance of the improved seed were neutral with regard to poverty score. Of the selected households, nine out of 10 actually received seed, virtually all of which received the seed on time. Nine out of 10 recipients had already repaid the required amount of grain to the cooperative, ensuring that the cooperative's target of 1,600 kg to be repaid was met. As expected, farmer-to farmer diffusion of improved pigeonpea seed was low in 2017/18, but six out of 10 farmers reported planning to share or sell seed to family and non-family members in the 2018/19 season. Yields from the improved varieties in farmers' fields were poor, reflecting drought and erratic rain during the second half of the growing season, although most households reported that yields were higher than from local varieties. The report concludes with three recommendations for the SRMS project to improve the effectiveness of the RBM in the coming crop season.

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# Acronyms

| Acronym | |
|---|---|
| DFID | Department for International Development |
| IHS | Integrated Household Survey |
| MWK | Malawian Kwacha |
| NSO | National Statistical Office |
| OPM | Oxford Policy Management |
| RBM | Replicable Business Model |
| SAIRLA | Sustainable Agricultural Intensification Research and Learning in Africa |
| SRF | Seed Revolving Fund |
| SRMS | Smallholder Risk Management Solutions |

In August 2018, 1 US Dollar (US $) = 731 Malawian Kwacha (MWK) (Source: Reserve Bank of Malawi)

# Acknowledgements

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# 1 Introduction

Sustainable Agricultural Intensification Research and Learning in Africa (SAIRLA) is a five-year programme (2016–19) funded by the UK Department for International Development (DFID). SRMS is one of eight projects funded by this programme and implemented in Malawi and Ethiopia by a consortium led by Oxford Policy Management (OPM).

The general objective of the SRMS project is to explore the potential for smallholder commercialisation in the face of systemic investment risks. Specifically, the project focuses on four systemic risks: risks from natural shocks (e.g., rainfall); economic coordination risks (input and output markets); price risks (volatility); and opportunism risks (quality of inputs) (Orr *et al.*, 2017).

A key objective of the SRMS project is to develop an RBM that addresses these systemic risks. The SRMS Scoping Study identified pigeonpea as an entry point for smallholder commercialisation in Malawi (Orr *et al.*, 2017). A stakeholder workshop that included agricultural extension, agricultural researchers, and smallholders identified a market failure in the supply of improved pigeonpea varieties (Weber and Tiba, 2017). Three features belonging to these varieties reduce systemic risks in the value chain for pigeonpea: they are medium-maturing, which reduces the risk of drought; they are resistant to fusarium wilt, a major disease affecting pigeonpea; and they have large, cream-coloured grains, which are attractive to exporters (Orr *et al.*, 2017). Despite these advantages, the seed system in Malawi is unable to meet smallholder demand for improved pigeonpea varieties. Consequently, availability and access remain limited.

To overcome this supply constraint, the stakeholder workshop developed an RBM based on an SRF (Weber and Tiba, 2017). In Year 1, farmers would receive 2 kg of certified improved pigeonpea seed, of which 1 kg would be the improved variety Mwaiwathualimi and 1 kg would be the improved variety Chitedze 1. Following the harvest, each farmer would deliver 4 kg of pigeonpea back to the SRF for each kilogramme of certified seed received (a total of 8 kg). At least 400 kg of pure C1 seed from the returned pigeonpea would subsequently be included in the SRF, while the rest would be sold as grain and the income used to buy more certified seed for distribution in Year 2.

This RBM has three advantages. First, it increases the availability of improved seed by using an existing institution—the Sukhamphete cooperative—rather than by introducing new institutions that may not survive the life of the SRMS project. Second, it increases access to improved seed for smallholders who already grow pigeonpea and have experience with collective sales. Third, in this model, the demand for improved seed is driven by smallholders themselves and not by centralised state institutions that focus primarily on supply rather than on smallholder preferences.

The general objective of this report is to monitor this risk management strategy in the 2017 season and to provide feedback to improve the design of the strategy in the 2018 season. Specifically, the report provides:

1) the socioeconomic profile of the smallholders who received the improved pigeonpea seed varieties;
2) an assessment of how farmers used the improved pigeonpea seed varieties; and
3) an assessment of the performance of these improved seed varieties in the farmers' fields.

The monitoring survey was conducted in September 2018 after harvesting the pigeonpea planted during the 2017 crop year, but before the majority of growers had sold their crop. Consequently, we were not able to measure the share of pigeonpea sold or the income received from pigeonpea in the 2017/18 crop season.

# 2 Data and methods

The SRF is managed by the Sukamphete Pigeonpea Farmers' Cooperative. The cooperative is based in the village of Chitekesa, Phalombe District, within Temani Environmental Planning Area, Jenala Traditional Authority and Blantyre Agricultural Development Division. Cooperative members belong to the Bona Village group, which comprises of 13 villages: Chitekesa, Bona, Bona 2, Mulima, Dzuwa, Chikopa, Ligola, Ligomeka, Chitungo, Ntikwa, Chilombo, Nayuma, and Nankhonya.

The seed supply survey was administered to all the growers who received pigeonpea seed from the cooperative in the 2017/18 season. The original RBM proposed that the cooperative should distribute improved pigeonpea seed to 200 households, including all cooperative members (which at that time comprised of 72 households) and 128 additional households who were non-members.

Table 1 shows, however, that 253 households were selected to receive improve seed, all of which were members of the cooperative. The management informed us that membership was increased to 253 households in November 2017 when the improved seed was distributed. This increase reflected the pressure from the local government, the non-member households, and their relatives to share the improved seed. Of the 253 households selected to receive the improved seed, we identified and interviewed 249 (98%) for the seed supply survey. The four missing households may represent recipients who were members of the same household. Consequently, the sample size for the 2017/18 seed supply survey was 249 households. Of the 249 households interviewed, 83 reported that they were not members of the cooperative, for reasons which are discussed in Section 3.

**Table 1. Sample households, 2017/18 season**

| | Cooperative members | Non-members | Total |
|---|---|---|---|
| Number of households selected to receive improved seed in Oct 2017 | 72 | 128 | 200 |
| Number of households selected to receive improved seed in Nov 2017 | 253 | 0 | 253 |
| Number of households interviewed | 166 | 83 | 249 |

Source: SRMS Seed Supply Survey, 2018

## 2.1 Data collection and processing

The data were collected using a structured household questionnaire. The questionnaire was designed by the lead author in consultation with other members of the SRMS project, including Joachim Weber, who facilitated the design of the RBM. The lead author pre-tested the questionnaire in the survey area in early September 2018. The survey was administered in early October 2018 under the supervision of OPM. The enumerators were selected MSc. students with previous experience of household surveys from our project partner (Lilongwe University of Agriculture and Natural Resources). Enumerators received both classroom and field training, after which the questionnaire was further revised. The data were collected on hand-held tablets. The dataset was cleaned, stored, and analysed by OPM using the Statistical Package for the Social Sciences.

## 2.2 Poverty score

To measure social inclusion in the RBM, we used a Poverty Scorecard to estimate the share of the sample households that lay below the poverty line. The Poverty Scorecard uses 10 indicators from Malawi's Second Integrated Household Survey (IHS) of 2004/5 to estimate the likelihood that a household has a consumption

below a given poverty line (Schreiner, 2015). The 2004/5 IHS was conducted by the National Statistical Office of Malawi (NSO) from March 2004 to March 2005. The scorecard thus allows us to relate poverty levels in the sample households to the national poverty line. Unfortunately, a Poverty Scorecard based on the IHS for 2010/11 is not available; however, the share of households in Malawi below the national poverty line showed no significant change between 2004/5 and 2010/11.[1] Thus, our use of a Poverty Scorecard based on the 2004/05 IHS should not distort the results.

All points in the Poverty Scorecard are non-negative integers, and total scores range from 0 (most likely below a poverty line) to 100 (least likely below a poverty line). To get absolute units, scores must be converted to poverty likelihoods, or the probability of being below a poverty line. This is done via look-up tables. In the case of the national poverty line, for example, scores of 35–39 have a poverty likelihood of 47.8%, and scores of 40–44 have a poverty likelihood of 36.1%.

[1] The share of households in Malawi below the national poverty line in 2010/11 was estimated at 50.7%, which was not significantly different (at the 95% confidence level) from the estimate of 55.9% in 2004/05 (Government of Malawi, [2012], p. 206, Table 13.2. The national poverty line based on the 2016/17 IHS has not yet been published (Government of Malawi, 2017).

# 3 Survey results

## 3.1 Social inclusion

The objective of this section is to provide socioeconomic information about the farmers selected to receive improved pigeonpea seed. We need this information to judge whether the RBM is socially inclusive or whether it only reaches better-off farmers. Ideally, we should compare the treatment group of those selected to receive improved pigeonpea seed with those who were not selected. A rigorous comparison of treatment and control groups will be made in our study of social inclusion planned in Year 3 of the project (OPM, 2016). For the time being, we only have information for the treatment group.

Table 2 shows that the likelihood of the sample households having expenditure falling between the national poverty line in 2004/5 (44 MWK/day) and the international poverty line of US $1.25/day (64 MWK/day) was 30%. The likelihood of expenditure falling between the two international poverty lines (US $1.25–2.50/day) was 21%. The likelihood of expenditure falling above the poverty line of US $2.50 was only 1.3%. Since the figures measure the probability of falling between cumulative, mutually exclusive poverty lines, we can estimate the aggregate probability of households falling below a specified poverty line. Thus, for the sample households, there was a likelihood of 47.8% that expenditure lay below the national poverty line (12% + 2.8% + 33.0%) and a likelihood of 77.6% (12% + 2.8% + 33.0% + 29.8%) that expenditure lay below the US $1.25/day international poverty line. This figure may be compared with the corresponding shares at the national level.[2] In 2004/05, the share of households living below the national poverty line was 61.9% for Phalombe District, 64.4% for the rural southern region, and 55.9% for rural Malawi (NSO, 2012). On average, therefore, the households selected to receive improved pigeonpea were less poor than if they had been randomly selected from the rural population at district, regional, or national level. This is to be expected, since access to land was a criterion for receiving improved pigeonpea seed.

Figure 1 shows that the Poverty Scorecard follows the normal distribution. To capture the range of poverty within the sample, we divided the households into terciles. Table 2 shows that the poorest households (Tercile 3) had a mean poverty score of 52 (compared to 25 for the households that were best off). Within this group, the likelihood of consumption falling below the food poverty line was 31%, while the likelihood of falling between the national poverty line and the international poverty line of US $1.25/day was 21% (compared to 28% for the households that were best off).

**Table 2. Likelihood of household expenditure in range demarcated by poverty lines (%)**

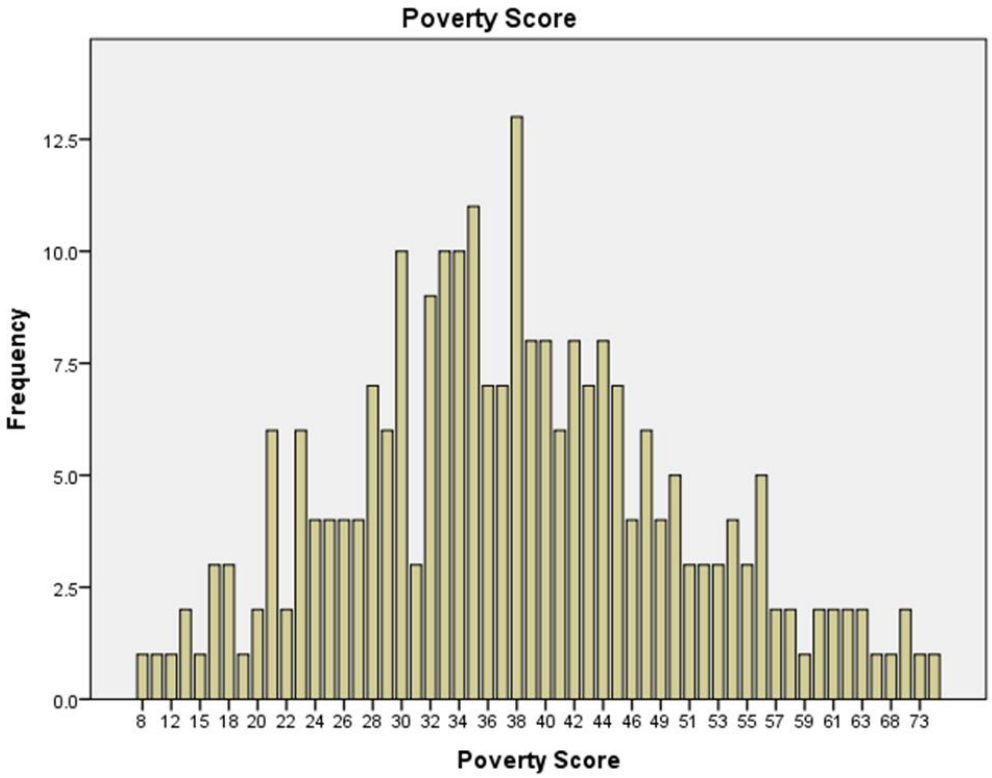
| | Poverty tercile | | | All sample (n=249) |
|---|---|---|---|---|
| | High (n=83) | Medium (n=83) | Low (n=83) | |
| Poverty Scorecard[a] | 25.33 | 37.24 | 51.95 | 38.17 |
| Poverty Lines[b] | Likelihood (%) | | | |
| Below Food Poverty Line (below MWK 27) | 30.8 | 12.0 | 2.0 | 12.0 |
| Food Poverty Line and USAID poverty line (MWK 27–30) | 5.0 | 2.8 | 0.7 | 2.8 |
| USAID and National Poverty Line (MWK 30–44) | 34.2 | 33.0 | 10.6 | 33.0 |

[2] The national figures show the percentage share of households lying below the poverty line. However, if the probability is 47.8% that the sample households lie below the national poverty line, this is equivalent to saying that for every 100 sample households, 47.8% lie below that poverty line.

| | | | | |
|---|---|---|---|---|
| National Poverty Line and US $1.25/day (MWK 44–64) | 21.2 | 29.8 | 28.1 | 29.8 |
| US $1.25–2.50/day (MWK 64–127) | 8.2 | 21.2 | 48.6 | 21.2 |
| Above US $2.50/day (above MWK 127) | 0.6 | 1.3 | 10.0 | 1.3 |

Sources: [a] Table 3 below; [b] Schreiner (2015), p. 86, Figure 6

**Figure 1. Distribution of poverty scores from the seed supply survey, 2017/18**




Other indicators provide further insights into the poverty status of the sample households. Table 3 shows statistically significant differences among the sample households. The poorest households (households with a high poverty status) had:

- a higher share of households headed by women (36%);
- fewer years of education for the household head (4.3 years);
- larger households (5.4 members);
- higher dependency ratios (1.82);
- a lower share of income from agriculture (55%) and higher share of income from casual labour (*ganyu*) (29%);
- a lower share of households hiring in *ganyu* (20%);
- lower household food security in a normal year, running out of maize in September; and
- lower household security in a poor year (2017/18), running out of maize in August.

Other studies of social inclusion and poverty in Malawi give similar results (Devereux *et al.*, 2011), which confirms the reliability of our findings.

In contrast, several indicators that were expected to relate to poverty were not statistically significant. These included receipt of a voucher for seed and fertiliser under the national Farm Input Subsidy Programme targeted at poorer households,[3] which suggests considerable leakage from the programme. Other non-significant indicators included the ownership of oxen, cows, and goats, the number of livestock units, the value of the livestock, and the total income from the sale of crops. This reflected high variation in mean values. Interestingly, there was no significant relationship between poverty and membership of the Sukamphete cooperative. This suggests that membership is socially inclusive.

**Table 3. Socioeconomic indicators for households selected to receive improved pigeonpea seed**

| | Poverty status | | | | *P*-value |
|---|---|---|---|---|---|
| | High | Medium | Low | All | |
| Poverty Scorecard | 25.33 | 37.24 | 51.95 | 38.17 | .000 |
| Number of households | 83 | 83 | 83 | 249 | |
| Number of male headed households | 53 | 66 | 68 | 187 | .014 |
| Number of female headed households | 30 | 17 | 15 | 62 | |
| Number of female headed households *de jure* | 20 | 15 | 12 | 47 | .230 |
| Number of female headed households *de facto* | 10 | 2 | 3 | 15 | |
| Age of household head (years) | 46.3 | 45.9 | 48.1 | 46.8 | .594 |
| Education (years) | 4.3 | 5.8 | 5.3 | 5.1 | .012 |
| Number of children under 15 | 2.9 | 2.7 | 1.7 | 2.5 | .000 |
| Number of adults over 60 | 0.3 | 0.3 | 0.3 | 0.3 | .965 |
| Number of females aged 15–60 | .99 | 1.13 | 1.17 | 1.10 | .376 |
| Number of males aged 15–60 | .99 | 1.13 | 1.17 | 1.10 | .376 |
| Total household size | 5.37 | 5.34 | 4.42 | 5.04 | .002 |
| Dependency ratio[1] | 1.82 | 1.68 | 1.09 | 1.53 | .000 |
| Number of households owning cows | 1 | 7 | 13 | 21 | .198 |
| Number of households owning oxen | 1 | 2 | 2 | 5 | .643 |
| Number of households owning goats | 28 | 32 | 31 | 91 | .561 |
| Number of households owning sprayer | 2 | 9 | 4 | 15 | .063 |
| Total livestock units[2] | 0.101 | 0.518 | 0.521 | 0.380 | .190 |
| Income from agriculture (%) | 54.7 | 60.5 | 64.8 | 60.0 | .063 |
| Income from *ganyu* (%) | 29.4 | 22.9 | 17.8 | 23.4 | .014 |
| Income from business (%) | 12.1 | 15.5 | 11.0 | 12.9 | .268 |

[3] According to households in the sample that received vouchers in 2017/18, the vouchers entitled them to receive one 50 kg bag of basal fertiliser (diammonium phosphate), one 50 kg bag of top-dressing (calcium ammonium nitrate), and seed (maize, pigeonpea, and sorghum). The total value of the voucher was MWK 21,000, including MWK 10,000 for each bag of fertiliser and MWK 1,000 for seed.

| | | | | | |
|---|---|---|---|---|---|
| Income from other (%) | 3.5 | 0.7 | 5.1 | 3.1 | .076 |
| Does anyone in your household normally perform *ganyu* for others? (Yes) | 63 | 55 | 44 | 162 | .073 |
| Does your household usually employ *ganyu* to work on your farm? (Yes) | 17 | 25 | 35 | 77 | .010 |
| Did your household receive a voucher for seed/fertiliser last season (2017)? (Yes) | 27 | 15 | 36 | 78 | .002 |
| Which month do you normally run out of maize? | Sep | Oct | Oct | Oct | .240 |
| Which month did you run out of maize this season (2017/18)? | Aug | Sep | Oct | Sep | .280 |
| Member of Sukhamphete cooperative? (Yes) | 55 | 59 | 52 | 166 | .512 |
| Total value of livestock (MWK)[3] | 20,481 | 110,000 | 111,084 | 80,522 | .190 |
| Total income from sale of crops (MWK/year) | 38,370 | 61,092 | 427,591 | 175,684 | .288 |

Notes:

[1] Children under 15 + adults over 60 / males + females aged 15–60.

[2] Ox, 0.7 units; improved cow, 0.6 units; local cow, 0.5 units; goat, 0.1 units.

[3] Ox, MWK 150,000; cow, MWK 110,000; goat, MWK 20,000.

Source: SRMS Seed Supply Survey, 2018

## 3.2 Use of improved pigeonpea seed

The rest of this report focuses on the utilisation and performance of improved pigeonpea seed. Of the 249 farmers interviewed for the survey, 230 (92%) actually received improved seed, while 19 farmers (8%) did not (Table 4). We did not ask these 19 farmers why they failed to receive seed, on the assumption that the reasons for exclusion were outside their control. Indeed, they may not even have known that they had been selected. However, this information will be collected in future, since it may be relevant for managing the RBM. The results and discussion on the use of improved seed (Table 4) relate to the 230 farmers who received improved seed; it excludes non-recipients.

Results were cross-tabulated by membership of the Sukhamphete cooperative, on the assumption that members were more likely than non-members to have received preferential treatment or to have repaid seed. As discussed in Section 2, following the introduction of the SRF in November 2017, the number of cooperative members grew from 72 to 253. Thus, all the households that received improved seed were supposed to be cooperative members. However, 83 of the households interviewed for the survey stated that they were not members of the cooperative. Joining the cooperative requires registration, paying a membership fee, and being approved by an annual general meeting. It seems likely that these households were unsure about their status because they had not yet been confirmed as full members. We have treated these 83 households as non-members, but in practice the results showed almost no statistically significant differences between the two groups. Consequently, the discussion below does not differentiate between members and non-members.

Results were cross-tabulated by sex of household head. This is not meaningful for gender analysis, because it confounds gender and household structure and renders women in male headed households invisible (Doss

and Kieran, 2016). However, Table 3 shows that, on average, households headed by women are poorer.[4] Thus, treating them as a separate analytical category can be justified on the grounds that they are a subset of the poor. The results show few statistically significance differences in the utilisation and performance of improved pigeonpea seed (Appendix 1). Results were also cross-tabulated by poverty score. Once again, few statistically significant differences were found (Tables 4 and 5). Since the utilisation and performance of improved pigeonpea seed is neutral with regard to poverty status, the discussion that follows is based on the average values for the sample households.

Table 4 shows that the RBM has improved awareness, availability, and access for improved pigeonpea seed. The evidence is summarised below.

1. Of the recipients, 60% had never heard of the improved variety Mwaiwathualimi, while 61% had never heard of the improved variety Chitedze 1. Thus, the RBM has significantly increased the awareness of improved pigeonpea varieties among farmers.
2. Less than 15% of those who received improved seed had planted these varieties before. Thus, the RBM has significantly increased the access of farmers to improved pigeonpea varieties.
3. Of the recipients, 87% planted all the seed they received. Thus, there is significant unmet demand among smallholders for improved pigeonpea seed.
4. Of those who received Chitedze 1, 89% planned to replant this variety in their own fields next season. The corresponding figure for Mwaiwathualimi was 80%. Thus, improved varieties have at least some of the traits that farmers want.

As expected, diffusion of improved seed through farmer-to-farmer exchange was minimal in Year 1. Of the 230 households that received improved seed, only four (2%) shared any seed with family members or with neighbours and non-family members. However, we can expect an increase in diffusion through farmer-to-farmer exchange of saved seed (C1 seed) in Year 2. Of the households that received improved seed in 2017, 65% planned to share some harvested grain (C1 seed) with other family members, while 60% planned to share with neighbours or non-family members. Harvested grain given as seed to family members will be given as a gift or repaid in grain, while harvested grain given as seed to neighbours or non-family members will also be sold. These numbers suggest that we can expect to see the rapid diffusion of improved pigeonpea seed through informal channels in Year 2.

The success of the SRF depends on the willingness of farmers to repay harvested grain. The original design for the RBM was for recipients to receive 2 kg of improved seed for each variety, and to return 4 kg of grain of each variety after harvest, thus returning a total of 8 kg (Weber and Tiba, 2017). However, this plan was not followed. The decision to expand the number of households receiving improved seed from 200 to 253 reduced the average quantity of seed available for each household. According to the management of the cooperative, the additional 53 households received half a kilogramme of Mwaiwathualimi and half a kilogramme of Chitedze 1 seed, while the quantity of certified seeds given to the 200 initially selected households was reduced from 2 kg to 1.5 kg. Table 4 shows that, on average, each household received just over 1 kg of improved seed for each variety, and on average repaid 2 kg. In general, therefore, recipients honoured the agreement to return twice the quantity of seed that they received.

Of the 230 households that received improved seed, so far 215 (93%) have returned grain to the cooperative. Of those who have not yet repaid, seven (3%) gave low yields as the reason for non-repayment. The average quantity returned was 2 kg of grain for each of the two improved varieties. As we have seen, the original RBM proposed that recipients repay 4 kg. The cooperative management had to reduce this rate because of pressure from local authorities and farmers who were not cooperative members. To enable the RBM to function, the

[4] The value of assets owned by male headed households is double that of female headed households. Male headed households are more likely to own productive agricultural assets, while households with young, female, or divorced heads are more vulnerable to loss of assets (Devereux *et al.*, 2006).

cooperative management collected 1,600 kg of pigeonpea. Thus, both the rate of repayment and the average quantity repaid have been satisfactory, and will allow the RBM to continue to operate in 2018/19.

**Table 4. Farmers' use of improved pigeonpea seed, 2017/18 season, by poverty tercile**

| | High | Medium | Low | All | *P*-value |
|---|---|---|---|---|---|
| Poverty Scorecard | 25.33 | 37.24 | 51.95 | 38.17 | .000 |
| Number of households | 83 | 83 | 83 | 249 | |
| **Households that received seed:** | | | | | |
| Yes | 73 | 78 | 79 | 230 | .171 |
| No | 5 | 10 | 4 | 83 | |
| **All figures below relate to households that received seed** | | | | | |
| Received Mwaiwathualimi (Yes) | 75 | 69 | 74 | 218 | .777 |
| Received Chitedze 1 (Yes) | 75 | 71 | 76 | 222 | .917 |
| ***Have you heard about these varieties before?*** | | | | | |
| Mwaiwathualimi (No) | 51 | 40 | 48 | 139 | .412 |
| Chitedze 1 (No) | 42 | 41 | 47 | 140 | .398 |
| ***Have you planted these varieties before?*** | | | | | |
| Mwaiwathualimi (Yes) | 8 | 12 | 10 | 30 | .885 |
| Chitedze 1 (Yes) | 6 | 9 | 7 | 22 | .841 |
| ***How much seed did you receive?*** | | | | | |
| Mwaiwathualimi (kg) | 1.08 | 1.04 | 1.13 | 1.09 | .183 |
| Chitedze 1 (kg) | 1.08 | 1.04 | 1.11 | 1.08 | .440 |
| ***Did you receive it on time?*** | | | | | |
| Mwaiwathualimi (Yes) | 71 | 68 | 72 | 211 | .632 |
| Chitedze 1 (Yes) | 71 | 68 | 74 | 213 | .869 |
| ***Did you plant all the seed?*** | | | | | |
| Mwaiwathualimi (Yes) | 71 | 68 | 72 | 199 | .632 |
| Chitedze 1 (Yes) | 71 | 68 | 74 | 201 | .322 |
| ***If not:*** | | | | | |
| Shared seed with relatives | 1 | 1 | 1 | 3 | .915 |
| Shared seed with neighbour/other farmers | 0 | 1 | 0 | 1 | .466 |
| Kept seed for next season | 2 | 3 | 1 | 6 | .465 |
| Sold as seed | 0 | 0 | 1 | 1 | .336 |
| Ate as grain | 0 | 0 | 0 | 0 | |
| Other (specify) | 2 | 1 | 2 | 2 | .627 |
| Did you repay the seed? | 73 | 68 | 74 | 215 | .990 |
| ***How much seed did you repay?*** | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Mwaiwathualimi (kg) | 2.31 | 2.08 | 2.16 | 2.19 | .646 |
| Chitedze 1 (kg) | 1.97 | 1.97 | 2.04 | 2.00 | .666 |
| ***If not, what was the reason?*** | | | | | |
| **Mwaiwathualimi** | | | | | |
| Not yet finished harvesting | 0 | 1 | 0 | 1 | .379 |
| Yield was too low | 1 | 4 | 2 | 7 | .223 |
| Other (specify) | 2 | 1 | 2 | 5 | .627 |
| **Chitedze 1** | | | | | |
| Not yet finished harvesting | 0 | 1 | 0 | 1 | .294 |
| Yield was too low | 1 | 2 | 1 | 4 | .598 |
| Other (specify) | 2 | 0 | 4 | 6 | .056 |
| ***Will you plant next season?*** | | | | | |
| Mwaiwathualimi (Yes) | 68 | 61 | 63 | 192 | .456 |
| Chitedze 1 (Yes) | 71 | 65 | 76 | 204 | .233 |
| Will you supply seed to family members? (Yes) | 56 | 46 | 48 | 150 | .311 |
| Gift | 46 | 27 | 30 | 103 | .008 |
| Repaid in grain | 44 | 37 | 36 | 117 | .397 |
| Will you supply seed to non-family members? | 50 | 42 | 45 | 137 | .602 |
| Gift | 31 | 21 | 22 | 74 | .211 |
| Sale | 38 | 31 | 37 | 106 | .733 |
| Repaid in grain | 41 | 34 | 28 | 103 | .091 |

Source: SRMS Seed Supply Survey, 2018

# 4 Performance of improved pigeonpea varieties

The viability of the RBM also depends on the performance of improved pigeonpea varieties taking into account the condition of the farmers' fields. In this section, we review some key indicators of crop performance, focusing on some agronomic determinants of crop yield.

Of the 230 farmers that received improved seed, 222 (97%) actually planted the seed (Table 5). The results and discussion on the performance of improved seed (Table 5) relate to the 222 farmers who planted improved seed, and exclude those who received the seed but did not plant it.

The results were cross-tabulated by membership of the Sukhamphete cooperative, on the assumption that members had more experience in the cultivation of the improved varieties; however, the results showed almost no statistically significant differences between the two groups. Consequently, the discussion below does not differentiate between members and non-members.

In general, the performance of improved pigeonpea seed was below expectations. The evidence for this poor performance is summarised below (Table 5). The figures relate to farmers who both received and planted improved seed.

1) Of the farmers who planted Mwaiwathualimi, 73% reported that germination was 'good' (as did 78% of the farmers who planted Chitedze 1).
2) Less than 15% of farmers reported replanting seed following poor germination.
3) The majority of farmers (64%) intercropped pigeonpea with maize.
4) Yields of Mwaiwathualimi averaged 2.67 50 kg bags/acre planted in pure stand, and 1.52 50 kg bags/0.88 acres when intercropped. This is equivalent to 330 kg $ha^{-1}$ in pure stand and 212 kg $ha^{-1}$ intercropped.
5) Yields of Chitedze 1 averaged 2.21 50 kg bags/0.93 acres planted in pure stand, and 1.50 50 kg bags/0.88 acres planted when intercropped. This is equivalent to 294 kg $ha^{-1}$ in pure stand and 211 kg $ha^{-1}$ intercropped.
6) Only 41% of growers reported that the yield of Mwaiwathualimi was 'good', and only 48% of growers reported 'good' yields for Chitedze 1.
7) The main reason reported by farmers for poor yields was drought and erratic rainfall.
8) Despite this, 52% of growers reported that Mwaiwathualimi gave higher yields than local varieties, while 57% of growers reported the same for Chitedze 1.

**Table 5. Performance of improved pigeonpea varieties, 2017/18 season, by poverty tercile**

| | High | Medium | Low | All | *P*-value |
|---|---|---|---|---|---|
| Poverty Scorecard | 25.33 | 37.24 | 51.95 | 38.17 | .000 |
| Number of households that received seed | 73 | 78 | 79 | 230 | |
| Number of households planting seed | 73 | 72 | 77 | 222 | .632 |
| **All figures below relate to households that planted seed** | | | | | |
| ***Was the seed germination good?*** | | | | | |
| Mwaiwathualimi (Yes) | 52 | 58 | 51 | 161 | .172 |
| Chitedze 1 (Yes) | 60 | 60 | 52 | 172 | .064 |
| ***Did you plant as intercrop?*** | | | | | |
| Mwaiwathualimi (Yes) | 46 | 48 | 45 | 139 | .584 |

| | | | | | |
|---|---|---|---|---|---|
| Chitedze 1 (Yes) | 46 | 48 | 49 | 143 | .751 |
| ***How much land did you plant?*** | | | | | |
| Mwaiwathualimi (acres) | 1.04 | 0.89 | 0.82 | 0.92 | .345 |
| Pure stand (acres) | 0.96 | 1.02 | 1.02 | 1.00 | .966 |
| Intercropped (acres) | 1.08 | 0.84 | 0.70 | 0.88 | .142 |
| Chitedze 1 (acres) | 1.04 | 0.80 | 0.79 | 0.88 | .150 |
| Pure stand (aces) | 0.98 | 1.0 | 0.83 | 0.93 | .726 |
| Intercropped (acres) | 1.07 | 0.72 | 0.77 | 0.85 | .116 |
| ***What was the grain yield? (50 kg bags/area planted)*** | | | | | |
| Mwaiwathualimi | 2.27 | 2.01 | 1.65 | 1.98 | .759 |
| Pure stand | 3.16 | 3.70 | 1.44 | 2.67 | .511 |
| Intercropped | 1.78 | 1.31 | 1.78 | 1.62 | .664 |
| Chitedze 1 | 2.23 | 1.60 | 1.39 | 1.74 | .485 |
| Pure stand | 3.12 | 2.50 | 1.08 | 2.21 | .531 |
| Intercropped | 1.74 | 1.23 | 1.55 | 1.50 | .645 |
| ***How was the grain yield?*** | | | | | |
| **Mwaiwathualimi:** | | | | | |
| Good | 27 | 25 | 40 | 92 | .139 |
| Average | 20 | 17 | 12 | 49 | |
| Poor | 24 | 26 | 20 | 70 | |
| **Chitedze 1:** | | | | | |
| Good | 39 | 34 | 34 | 107 | .206 |
| Average | 12 | 8 | 19 | 47 | |
| Poor | 20 | 26 | 21 | 67 | |
| ***If the yield was poor, what was the reason?*** | | | | | |
| **Mwaiwathualimi:** | | | | | |
| Drought/low rainfall | 20 | 16 | 13 | 49 | .233 |
| Insect pests | 4 | 4 | 4 | 12 | .927 |
| Plant diseases (e.g. *kunyala*) | 2 | 1 | 2 | 5 | .713 |
| Weeds | 1 | 1 | 1 | 3 | .984 |
| Other (specify) | 2 | 7 | 4 | 13 | .208 |
| **Chitedze 1:** | | | | | |
| Drought/low rainfall | 15 | 19 | 18 | 52 | .452 |
| Insect pests | 5 | 5 | 3 | 13 | .732 |

| | | | | | |
|---|---|---|---|---|---|
| Plant diseases (e.g. *kunyala*) | 1 | 1 | 3 | 5 | .350 |
| Weeds | 0 | 0 | 2 | 2 | .103 |
| Other (specify) | 2 | 1 | 2 | 5 | .702 |
| ***Was grain yield higher than local varieties?*** | | | | | |
| Mwaiwathualimi (Yes) | 39 | 40 | 36 | 115 | .248 |
| Chitedze 1 (Yes) | 41 | 41 | 44 | 126 | .904 |

Source: SRMS Seed Supply Survey, 2018

Yields of improved varieties of pigeonpea were lower than expected. Intercropped yields averaged 212 kg ha$^{-1}$ for Mwaiwathualimi and 211 kg ha$^{-1}$ for Chitedze 1.[5] These reported yields are not based on crop cuts but on farmer recall, so they give only an approximate estimate of the true yields. Nevertheless, the majority of farmers reported 'average' or 'poor' yields. This is likely to reflect a poor growing season in the 2017/18 crop year. According to farmers in the study area, the rains arrived on time and crops performed well in the first half of the season, but the rains stopped prematurely and were erratic for the rest of the season.[6] Pigeonpea yields in Malawi are sensitive to rainfall. On-farm trials of improved pigeonpea intercropped with maize at two sites in Malawi show that in a good season yields of pigeonpea may reach 1 t ha$^{-1}$, but in a drought year yields may sink as low as 0.33 t ha$^{-1}$. Over a three-year period, the mean yield was 370 kg ha$^{-1}$ and the median was 202 kg ha$^{-1}$ (Høgh-Jensen *et al.*, 2007). Thus, farmers' reported yields of pigeonpea are consistent with quantitative measures of yield from on-farm trials.

[5] The analysis of variance (ANOVA) showed no statistically significant difference between the mean yields of pure stand and intercropped pigeonpea for Mwaiwathualimi ($p$=0.146 ns.) or Chitedze 1 ($p$=0.259 ns.)
[6] This can be confirmed by the rainfall data collected by the agricultural extension office in Temani Economic Planning Area. Unfortunately, this was not available at the time of writing.

# 5 Conclusions and recommendations

The SRMS project identified several systemic risks in the value chain for pigeonpea in southern Malawi. One major systemic risk is the lack of economic coordination in the supply of certified pigeonpea seed. To address this risk, the project developed an RBM based on an SRF, which was piloted in the 2017 crop season.

The objective of this report was to analyse experiences drawn from applying the SRF during its first year of operation. The analysis focused on three aspects of performance: social inclusion, the use of certified seed, and its performance. These are not the only criteria that can be used to evaluate the performance of this SRF and the RBM. Ultimately, the success of the RBM depends on the sustainability of the SRF, which must be able to function independently after the end of the SRMS project. This report does not address the issue of sustainability, which requires evidence from more than one crop season.

Our findings are based on a structured questionnaire survey of 249 of the 253 households that were selected to receive certified seed. Based on this survey, we conclude the following.

1. In terms of social inclusion, the criteria used by the cooperatives to select farmers to receive improved pigeonpea seed did not exclude poorer farmers. A Poverty Scorecard based on the IHS for 2004/05 found that 47.8% of the sample households lay below the national poverty line, compared to 61.9% for Phalombe District, 64.4% for the rural southern region, and 55.9% for rural Malawi (NSO, 2012). Moreover, bivariate analysis showed that the household's Poverty Scorecard was not significantly related to membership of the Sukhamphete cooperative. We thus conclude that, while the level of poverty among the sample households was above the national average, the RBM is socially inclusive, with a high proportion of households falling below the national poverty line.

2. We found no significant differences in the utilisation and performance of improved seed between poverty terciles. In terms of farmers' use of the improved pigeonpea seed, a high proportion (91%) of the 253 households selected by the cooperative received and planted the improved seed. Similarly, a high proportion of the farmers reported plans to share improved teff grain with family members (67%) and non-family members (58%), which suggests that next season will see a rapid diffusion of improved seed through farmer-to-farmer exchange. Finally, 93% of those who received the improved seed returned pigeonpea grain to the cooperative, returning 2 kg for each 1 kg of seed they received of the two improved varieties. We thus conclude that, despite a poor season that resulted in low average yields, the SRF performed well and will be sustainable in Year 2.

3. In terms of crop performance, the improved pigeonpea seed did not meet the expectations of farmers. Yields averaged just 267 kg ha $^{-1}$ for Mwaiwathualimi and 250 kg ha$^{-1}$ for Chitedze 1. Of the farmers who planted Chitedze 1, less than half (48%) reported 'good' yields, while the corresponding figure for Mwaiwathualimi was 41%. These low yields were outside the control of the farmers and reflected erratic rainfall during the second half of the growing season, which also reduced the average yield of maize and household food security.

Based on these results, we have identified three action points to improve the performance of the RBM in Year 2.

1. The availability of improved seed led to a rapid expansion in the membership of the cooperative, which more than tripled in size (from 72 to 253 members). The reasons for this are unclear. The original plan was for seed to be distributed to both members and non-members. Did the cooperative management view seed as a lever to increase their membership (and thus their membership fees)? Obviously, the performance of the SRF does not depend on all recipients of improved seed being members of the cooperative; however this rapid growth in the cooperative's membership has been an unintended consequence of the RBM.

2. The seed supply survey did not find a proper list for identifying households for interview. The available listing did not specify whether the names represented separate households or members of the same household. Some names were missing from the list, which also did not specify the number of kilogrammes of each variety received by each household. To avoid the same problem next season, the SRMS project should prepare an accurate listing of the households that will receive improved seed in 2018/19.

3. In general, farmers reported a better performance with Chitedze 1 than with Mwaiwathualimi. Although there was no significant difference in yields, germination was higher and slightly more farmers reported that they planned to replant Chitedze 1 in 2018/19. We cannot compare performance based on just one year, but it would be useful to explore the preferences of farmers through an informal discussion or through the seed supply survey at the end of next season.

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# Appendix 1. Cross-tabulations by sex of household head

**Table A1. Farmers' use of improved pigeonpea seed, 2017/18 season, by sex of household head**

| | Male headed | Female headed | Total | *P*-value |
|---|---|---|---|---|
| Number | 187 | 62 | 249 | |
| **Received improved seed?** | | | | |
| Yes | 173 | 57 | 230 | 1.00 |
| No | 14 | 5 | 19 | |
| **All figures below relate to households that received seed** | | | | |
| Received Mwaiwathualimi (Yes) | 164 | 54 | 218 | .608 |
| Received Chitedze 1 (Yes) | 165 | 57 | 222 | .205 |
| ***Have you heard about these varieties before?*** | | | | |
| Mwaiwathualimi (No) | 103 | 36 | 139 | .644 |
| Chitedze 1 (No) | 103 | 37 | 140 | .533 |
| ***Have you planted these varieties before?*** | | | | |
| Mwaiwathualimi (Yes) | 24 | 6 | 30 | .794 |
| Chitedze 1 (Yes) | 19 | 3 | 22 | .382 |
| ***How much seed did you receive?*** | | | | |
| Mwaiwathualimi (kg) | 1.10 | 1.06 | 1.09 | .382 |
| Chitedze 1 (kg) | 1.08 | 1.05 | 1.08 | .484 |
| ***Did you receive the seed on time?*** | | | | |
| Mwaiwathualimi (Yes) | 157 | 54 | 211 | .205 |
| Chitedze 1 (Yes) | 149 | 52 | 213 | .519 |
| ***Did you plant all the seed?*** | | | | |
| Mwaiwathualimi (Yes) | 149 | 50 | 199 | .508 |
| Chitedze 1 (Yes) | 149 | 52 | 201 | .519 |
| ***If not:*** | | | | |
| Shared seed with relatives | 1 | 2 | 3 | .236 |
| Shared seed with neighbour/other farmers | 0 | 1 | 1 | .333 |
| Kept seed for next season | 5 | 1 | 6 | .545 |
| Sold as seed | 1 | 0 | 1 | 1.00 |
| Ate as grain | 0 | 0 | 0 | |
| Other (specify) | 1 | 1 | 2 | .369 |
| Did you repay the seed? | 160 | 55 | 208 | .369 |

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| | | | | |
|---|---|---|---|---|
| How much seed did you repay? | | | | |
| Mwaiwathualimi (kg) | 2.20 | 2.15 | 2.19 | .846 |
| Chitedze 1 (kg) | 1.99 | 2.02 | 2.00 | .809 |
| ***If not, what was the reason?*** | | | | |
| **Mwaiwathualimi** | | | | |
| Not yet finished harvesting | 1 | 0 | 1 | 1.00 |
| Yield was too low | 5 | 2 | 7 | .462 |
| Other (specify) | 6 | 0 | 6 | .462 |
| **Chitedze 1** | | | | |
| Not yet finished harvesting | 1 | 0 | 1 | 1.00 |
| Yield was too low | 5 | 2 | 4 | .077 |
| Other (specify) | 6 | 0 | 6 | .462 |
| ***Will you plant next season?*** | | | | |
| Mwaiwathualimi (Yes) | 144 | 48 | 184 | 1.00 |
| Chitedze 1 (Yes) | 161 | 51 | 212 | .398 |
| Will you supply seed to family members? (Yes) | 108 | 42 | 150 | .149 |
| Gift | 71 | 32 | 103 | .065 |
| Repaid in grain | 86 | 31 | 117 | .546 |
| Will you supply seed to non-family members? | 104 | 33 | 137 | .876 |
| Gift | 53 | 21 | 74 | .416 |
| Sale | 78 | 28 | 106 | .647 |
| Repaid in grain | 76 | 27 | 103 | .759 |

Source: SRMS Seed Supply Survey, 2018

**Table A2. Performance of improved pigeonpea varieties, 2017/18 season, by sex of household head**

| | Male headed | Female headed | Total | *P*-value |
|---|---|---|---|---|
| Number of households that received seed | 173 | 57 | 230 | |
| Number of households planting seed | 165 | 57 | 222 | .174 |
| **All figures below relate to households that planted seed** | | | | |
| ***Was the seed germination good?*** | | | | |
| Mwaiwathualimi (Yes) | 119 | 42 | 161 | .917 |
| Chitedze 1 (Yes) | 122 | 50 | 172 | .141 |
| ***Did you plant as intercrop?*** | | | | |
| Mwaiwathualimi (Yes) | 102 | 37 | 139 | .740 |
| Chitedze 1 (Yes) | 104 | 39 | 143 | .741 |
| ***How much land did you plant?*** | | | | |
| Mwaiwathualimi (acres) | 0.95 | 0.82 | 0.92 | .335 |
| Pure stand (acres) | 1.08 | 0.74 | 1.00 | .155 |
| Intercropped (acres) | 0.89 | 0.85 | 0.88 | 0.88 |
| Chitedze 1 (acres) | 0.92 | 0.75 | 0.88 | .216 |
| Pure stand (aces) | 1.01 | 0.71 | 0.93 | .174 |
| Intercropped (acres) | 0.87 | 0.77 | 0.85 | 0.85 |
| ***What was the grain yield? (50 kg bags/area planted)*** | | | | |
| Mwaiwathualimi (50 kg bags) | 1.97 | 1.58 | 1.98 | .968 |
| Pure stand (50 kg bags) | 2.42 | 3.47 | 2.67 | .615 |
| Intercropped (50 kg bags) | 1.73 | 1.32 | 1.62 | .470 |
| Chitedze 1 (50 kg bags) | 1.58 | 2.18 | 1.74 | .798 |
| Pure stand (50 kg bags) | 1.53 | 4.35 | 2.21 | .119 |
| Intercropped (50 kg bags) | 1.61 | 1.23 | 1.50 | .454 |
| ***How was the grain yield?*** | | | | |
| **Mwaiwathualimi (no):** | | | | |
| Good | 66 | 26 | 92 | .246 |
| Average | 34 | 15 | 49 | |
| Poor | 57 | 13 | 70 | |
| **Chitedze 1 (no):** | | | | |
| Good | 67 | 40 | 107 | .001 |
| Average | 35 | 4 | 47 | |
| Poor | 55 | 12 | 67 | |

| | | | | |
|---|---|---|---|---|
| ***If the yield was poor, what was the reason?*** | | | | |
| **Mwaiwathualimi:** | | | | |
| Drought/low rainfall | 41 | 8 | 49 | .489 |
| Insect pests | 10 | 2 | 12 | 1.00 |
| Plant diseases (e.g. *kunyala*) | 5 | 0 | 5 | .575 |
| Weeds | 3 | 0 | 3 | 1.00 |
| Other (specify) | 9 | 4 | 13 | .232 |
| **Chitedze 1:** | | | | |
| Drought/low rainfall | 43 | 9 | 52 | 1.00 |
| Insect pests | 10 | 3 | 13 | .681 |
| Plant diseases (e.g. *kunyala*) | 4 | 1 | 5 | 1.00 |
| Weeds | 2 | 0 | 2 | 1.00 |
| Other (specify) | 5 | 0 | 5 | .578 |
| ***Was grain yield higher than local varieties?*** | | | | |
| Mwaiwathualimi (Yes) | 85 | 30 | 115 | .387 |
| Chitedze 1 (Yes) | 91 | 35 | 126 | .074 |

Source: SRMS Seed Supply Survey, 2018